APPENDIX A – CONCEPT PLAN INTENDED OUTCOME

Dennis partners	Concept Layout Plan, Building Envelopes & OSWW (Oct 2016)

FOR COMMENT ONLY
NOT FOR CONSTRUCTION

LEGEND

- SLOPE <25% (14.04°)
- BUSHFIRE CONSTRAINT
- WATERCOURSE BUFFER
- APPROX PROPOSED LAND RELEASE BOUNDARY
- TREE TO REMAIN
- 1% AEP FLOOD LEVEL RL 15.88m AHD
- POSSIBLE DISPOSAL AREAS WITH 100% RESERVE
- POSSIBLE 20x30m BUILDING ENVELOPE (B.E.)

LOT 100 DP778496

LOT 101 DP778496

EXISTING DAM

EXISTING SHED

EXISTING DWELLING

1% AEP Flood level RL 15.88m AHD

ACID SOIL LINE

MACLEAY RIVER

MARYS BAY ROAD

2.1	Add BE and Wastewater Constraints	20/10/16
1	Prelim constraints plan	23/05/16
Issue	Desc.	Date

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civil | structural | planning

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project	PROPOSED RURAL RESIDENTIAL SUBDIVISION AT LOT 101 DP778496 MARYS BAY RD, EUROKA
client	IRVING
title	CONSTRAINTS PLAN

scale	original	issue	
1:2000 @ A2	A2	2.1	0816-DP
approved	drawn		
	TJW		
total sheets	sheet no.		
[01]	C01		

PRELIMINARY LAYOUT FOR DISCUSSION ONLY

APPENDIX B – SITE ENVIRONMENTAL ASSESSMENTS

Terrence James Evans:

- Koala Habitat Assessment (Sept 2015)

Midcoast Building and Environmental:

- Bushfire Hazard Assessment (Oct 2016)
- Onsite Sewage Management Assessment (Oct 2016)
- Acid Sulphate Soil Testing (Oct 2016)

KOALA HABITAT ASSESSMENT

Applicant: This study has been carried out on behalf of Alex Irving Solicitors.

Property Location : 262 Marys Bay Road Euroka.

Property Identification: Lot 101 D.P. 778496.

Property Size: 30.15 hectares.

Introduction.

In accordance with the applicant's instructions a report has been prepared in regard to:-

(a) the existence of **preferred koala habitat** upon the allotment .

(b) the **presence or absence** of a koala population upon the allotment and as a consequence, the possible presence of **core koala habitat.**

The information contained within this report has been gathered from field surveys undertaken over two days (14 June & 10 Sep 2015), aerial photography and personal experience with all feasible care being taken in reaching the resulting conclusions.

Location.

Lot 101 (the study area) is located at Euroka which is a small rural locality within the Kempsey Shire Council Local Government Area. It is situated approximately six kilometres south – west of the town of Kempsey and is bounded by Marys Bay Road in the east and the Macleay River in the west. It is bracketed by Gowings Hill Road in the south.

Landform.

The study area covers an area of about 30 hectares and is characterised by a low rounded ridge line and lateral re-entrant system. The ridge line extends from the public road (Marys Bay Road), in a generally west to north - west direction terminating in a steep scarp descending to the southern bank of a looping bend in the Macleay River. At the base of the scarp there is a narrow fringing river terrace. Both north and south of the of the ridge line the slopes are moderate to gentle and are periodically laterally dissected by dry but often significant gullies extending (north and south) down the slopes to discharge onto the flood plain below.

Vegetation Description.

The study area has been substantially disturbed having been subjected to significant clearing for agriculture, probably post the settlement of the township of Kempsey. As a consequence only remnants of the wet and dry open forest types that once existed here, are evident today. There is evidence of rainforest elements once occupying the deeper gullies, however as most of the gullies that presently exist have at least been

partially modified and perhaps enlarged as a result of accelerated erosion following post settlement clearing, some of these brush elements may have a more contemporary origin. As a further consequence of the early clearing activity, the bulk of the study area is covered by an extensive "grassy community" of mixed composition which is primarily used for the grazing of cattle. This "rough pasture" appears to consist of a reasonably diverse mixture of both native and introduced grasses, herbs and occasional ferns and shrubs.

Areas of remnant (heavily modified) and regrowth open forest vegetation occur within the study area, the most significant being an area of heavily modified tall open forest which loosely occupies the east to west running ridge line and its southern slopes. A considerable number of large mature ("old growth") eucalypts occur here in small clumps or as individual paddock trees forming almost a "woodland formation" (canopies frequently not intermeshing). These significant mature trees appear to have been retained in the past due to either their shelter or ascetic values or possibly both. This "community" is obviously dominated by Tallowwood *(Eucalyptus microcorys)* however several associate species do occur but generally at an unnatural subdominant to occasional level. The original/normal structured understorey has been completely replaced by grassy pasture and as a consequence eucalypt regeneration is very limited across the allotment as a whole, however is locally dense downhill of the mature open forest elements on the ridgeline.

An area of presumed regrowth forest vegetation extends in a narrow band from north to south upon and along the western escarpment which falls steeply to the Macleay River. This band of forest is of relatively low stature occupying fairly dry shallow soils with the result that structure and floristics vary considerably from the taller forest remnant on the ridge and southern slopes which appears to occupy deeper and richer soils. At the base of the escarpment adjacent to the Macleay River there is a narrow, poorly defined alluvial terrace. The terrace is sparsely vegetated but is generally dominated by riparian species particularly River Oak *(Casuarina cunninghamiana)* however occasional pioneer rainforest species sometimes also occur.

While not of any particular significance due to the lack of suitable koala food tree species, there are a number of effectively heterogeneous patches of regrowth vegetation which have become established in protected sites, particularly at the heads of many of the dry watercourses. These patches generally contain a diverse range of invasive weed species, a number of dry rainforest pioneers as well as occasional introduced native species e.g. Silky Oak *(Grevillea robusta).*

Floristic Composition of Nominated Communities.

(A) Tall to Medium Open Forest Elements - (Heavily disturbed). Occupies main ridgeline and southern slopes. (25 – 32 metres in height). Occurs as a remnant, virtually artificial "woodland" formation consisting of small clumps of large trees and individual paddock trees:-

- **Dominant Canopy Trees**

Tallowwood (*Eucalyptus microcorys)* - Dominant in excess of 50% of stand.

- **Associate Canopy Trees**

White Mahogany *(Eucalyptus carnea)* – *E. acmenoides* may also be present . (Disc of fruit capsule varies from extremely narrow to wide in different trees).
Grey Ironbark *(Eucalyptus siderophloia)* – *E. placita* may also be present.
Small – fruited Grey Gum *(Eucalyptus propinqua)* – scarce. (Only three specimens were located).
Pink Bloodwood *(Corymbia intermedia)*
Brush Box *(Lophostemon confertus)* – occasional only.

- **Understorey** – (Gassy ground layer with occasional shrubs).

Mixed "rough pasture" – refer "community" (C) for floristic content.

(B) <u>Low to Medium Dry Open Forest</u> - (Presumed regrowth**).** Occupies steep escarpment to Macleay River (15 – 25 metres in height). Includes adjacent narrow riparian terrace elements.

- **Dominant Canopy Trees**

Grey Ironbark *(Eucalyptus siderophloia)*
White Mahogany *(Eucalyptus carnea)*

- **Associate Canopy Trees**

Pink Bloodwood *(Corymbia intermedia)*
Small – fruited Grey Gum *(Eucalyptus propinqua)* . occasional.
Tallowwood *(Eucalyptus microcorys).* occasional. (Virtually confined to southern slopes)
Brush Box *(Lophostemon confertus).*

- **Understorey**

Black She – oak *(Allocasuarina littoralis).* Dominant.
Elderberry Panax *(Polyscias sambucifolia)*
Narrow-leaved Orangebark *(Maytenus silvestris).*
Corkwood *(Duboisia myoporoides)*
Hard Quandong *(Elaeocarpus obovatus).*
Forest Oak *(Allocasuarina torulosa).*
Foambark Tree *(Jagera pseudorhus* var. *pseudorhus)*
Cheese Tree *(Glochidion ferdinandi)*
Tree- Heath *(Trochocarpa laurina)* – Small leaved variety.
Prickly Beard Heath *(Leucopogon juniperinus)*
Banana Bush *(Tabernaemontana pandacaqui)*
Bush Lawyer *(Smilax australis).*

- **Riparian Elements**

River Oak *(Casuarina cunninghamiana)*
Foambark Tree *(Jagera pseudorhus* var. *pseudorhus)*
Hard Quandong *(Elaeocarpus obovatus)*
Small-leaved Tuckeroo *(Cupaniopsis parvifolia)*

(C) <u>Mixed Grassland</u> – "rough pasture" – Includes a mixture of native and introduced grasses with ferns and occasional invading shrubs. It extends across in excess of 80% of the allotment,

- **Common Pasture Species**

Carpet Grass *(Axinopus affinis)* *
Broad – leaved Paspalum *(Paspalum wettsteinii)* *
Blady Grass *(Imperata cylindrica* var. *major)*
Giant Parramatta Grass *(Sporobolus fertilis)* *
Red Natal Grass *(Melinus repens)* *
Kangaroo Grass *(Themeda australis)*
Pigeon Grass *(Setaria* sp.) *
Kikuyu *(Pennisetum clandestinum)* *
Feathertop Rhodes Grass *(Chloris virgata)* *
Whisky Grass *(Andropogon virginicus)* *

* Introduced species.

- **Shrubs, Climbers, Ferns and Herbs.**

Hickory *(Acacia implexa)*
Green Wattle *(Acacia irrorata* subsp. *velutinella)*
Cheese Tree *(Glochidion ferdinandi)*
Corkwood *(Duboisea myoporoides)*
Small-leaved Tuckeroo *(Cupaniopsis parvifolia)*
Black She-oak *(Allocasuarina littoralis)*
Cockspur Thorn *(Maclura cochinchinensis)*
Lomandra *(Lomandra longifolia)*
Yellow Pittosporum *(Pittosporum revolutum)*
Hairy Clerodendrum *(Clerodendrum tomentosum)*
Red Lantana *(Lantana camara)* * *
Fireweed *(Senecio madagascariensis)* **
Tall Fleabane *(Conyza albida)* *
Spear Thistle *(Cirsium vulgare)* *
Bracken Fern *(Pteridium esculentum)*
Rasp Fern *(Doodia aspera).*
Climbing Guinea Flower *(Hibbertia scandens)*
Dusky Coral-pea *(Kennedia rubicunda)*
Purple Twining – pea *(Hardenbergia violacea)*
Red Kamala *(Mallotus philippensis)*
Banana Bush *(Tabernaemontana pandacaqui)*
Blackberry *(Rubus* sp.). **

* Introduced species.
** Invasive weed species

(D) <u>Small Discrete Patches of Seral Regrowth</u> – Numerous small heterogeneous patches of regrowth vegetation generally consisting of mainly pioneer species both native and introduced occur in dry gully heads and other protected locations across the allotment.

- **Common Regrowth Species**

Camphor Laurel *(Cinnamomum camphora)* **
Large-leaved Privet *(Ligustrum lucidum)* **
Rusty Fig *(Ficus rubiginosa)*
Small-leaved Fig *(Ficus obliqua)*
Silky Oak *(Grevillea robusta)* ***.
Cockspur Thorn *(Maclura cochinchinensis)*
Turpentine *(Syncarpia glomulifera* subsp. *glomulifera).*
Brush Box *(Lophostemon confertus).*
Large Mock-olive *(Notelaea longifolia)*
Foambark Tree *(Jagera pseudorhus)*
Cheese Tree *(Glochidion ferdinandi)*
Green Wattle *(Acacia irrorata* subsp. *velutinella)*
Hairy - Clerodendrum *(Clerodendrum tomentosum).*
Tea - Tree *(Leptospermum* sp.)
Red Ash *(Alphitonia excelsa)*
Small-leaved Tuckeroo *(Cupaniopsis parvifolia)*
Wild Tobacco *(Solanum mauritianum)* *
Red Kamala *(Mallotus philippensis)*

* Introduced species.
* * Introduced invasive weed.
*** Introduced native species.

<u>Assessment of Presence of Preferred Koala Habitat</u>

The presence of **preferred koala habitat** has been assessed in accordance with SEPP 44 and more specifically with Kempsey Shire Council Comprehensive Koala Plan of Management Vol. 1. The two documents vary in accordance with the eucalypt species nominated as koala food tree species, this being principally a result of limited empirical scientific data being available for inclusion in the original SEPP document which is now somewhat dated. The only significant variation in this case is the substitution of the Small-fruited Grey Gum (*Eucalyptus propinqua*) for the otherwise absent Sydney sandstone specialist Grey Gum (*Eucalyptus punctata).*

As previously described the vegetation of allotment has historically been significantly modified with the greater part of the land area having been cleared for cattle grazing with the consequence that the principal vegetation type is now "rough pasture" (mixed grassland) interspersed with a patchwork of heavily modified remnant forest elements

along the ridge and southern slopes bounded by a narrow band of intact open forest along the western boundary with the Macleay River. That would appear to be regrowth however could at least be partially remnant in origin.

Primary koala food tees have been identified in accordance with the table provided in the Comprehensive Koala Plan of Management Vol 1, (pp.8.). **Primary koala food tree species** present on the allotment accordingly are limited to **Tallowwood** (*Eucalyptus microcorys*). Similarly the only **secondary/supplementary koala food tree species** found to occur on the allotment was **Small-fruited Grey Gum** (*Eucalyptus propinqua)* and this was found to be so poorly represented as to be statistically, virtually absent (Only 3 specimens located during the survey).

Considering the disjunct nature of the vegetation the **preferred koala habitat** has been assessed as follows in accordance with the vegetation "community" groupings as detailed previously:-

- **Tall to Medium Open Forest Elements** (Ridge line and southern slopes).

This formation consists of clumps of mature ('old growth") modified open forest dominated by large specimens of **Tallowwood** (*E.microcorys)* with occasional but rarely occurring specimens of **Small – fruited Grey Gum** (*E.propinqua).* In this stand, in excess of 50% of the canopy trees present, comprise of Tallowwood. Accordingly this highly disturbed "community" satisfies the definition of **primary preferred koala habitat.** In making this assessment no consideration has been given to the impact that the past destruction of many of the structural components that would normally exist within a natural forest and that are important factors in the well being of a healthy koala population would have.

- **Low to Medium Dry Open Forest.** (Narrow band occupying escarpment to Macleay River).

This formation consists of low to medium open forest generally being dominated by eucalypt species not considered to be **preferred koala food trees**. Both Tallowwood (E. microcorys) and Small-fruited Grey Gum (*E. propinqua)* occur at very low densities in the bulk of this band such they could be considered statistically absent in most of it. This however is not the case for a small section of the band that occupies the slope falling from the ridge line to the southern boundary. Floristically this patch resembles the previously described forest elements of the ridgeline and eastern slopes rather than the rest of the band.

Accordingly this "community" is problematic in that it neither satisfies the definition of **preferred koala habitat** nor the alternative of **other vegetation**. Intuitively it lies somewhere between secondary B and other vegetation. While such a "community" may provide limited transitory protection, it's general low density and poor distribution of preferred koala food trees would effectively place this "community" in a low level of koala preference.

- **Grassland**. (Rough Pasture.)

The bulk of the allotment is covered by this essentially artificial "community" which falls into the category of **other vegetation**.

- **Seral Regrowth.**

Small generally isolated patches of regrowth vegetation occur in the heads of gullies and other protected areas. These patches generally consist of native and introduced pioneer species rarely if ever containing **preferred koala food trees** and thus generally fall within the classification of **other vegetation.** Below the mature open forest elements on the south facing slopes, there is limited but significant colonisation of the grassland by "eucalypt" seedling progeny. It would appear that the bulk of the invading eucalypts include White Mahogany, Tallowwood and Brush Box. There appear to be several cohorts which range from 1 – 4 metres in height. It is known that koalas will graze such regeneration however due to its early stage of development, it could be seen only to be a supplement to the adjacent forest elements.

Assessment of Available Koala Habitat Corridors.

Koalas have a complex social structure often with interlocking home ranges or territories usually centred on areas of preferred habitat. Females generally have smaller home ranges centred on high quality food trees while males tend to range more widely and are less fussy about food tree quality. The larger home ranges of male koalas tend to overlap those of several or more females.

Juveniles, particularly males, tend to remain in their mother's territory until they are about two years old, after which they become nomadic until and if they can establish their own territory. Mortality at this stage is very high. (Smith 1987).

While koalas can and do move from tree to tree where canopies are close or interlocking , movement throughout their home range and at times further afield is often on the ground . While the koala is well adapted for arboreal movement it is far less agile on the ground and is particularly effected by obstructions which act to cause the animal confusion thus acting to slow its progress, channel it and consequently increase the possibility of predation. Obstructions may be both natural and artificial and are exemplified by road cuttings, roads, water bodies including farm dams and swimming pools, fence lines, steep slopes, buildings, vegetation thickets etc.

Koalas while on the ground are thus subject to predation and interference by a number of native and feral predators such as raptors, dingos, foxes and wild dogs. When their territory coincides with urban and rural development, they face a major problem of predation by domestic dogs, singly or in packs, and often deadly interference by livestock .Koalas are particularly vulnerable when their home ranges include areas of cleared land especially when a koala is forced to cross these areas in search of new territory or potential mates.

While ever a koala is forced to travel over open country it is always at extreme risk. While this risk diminishes where suitable refuge trees are available e.g. when in danger, koalas do not discriminate in that they will climb whatever is at hand whether

it be a domestic fruit tree, an ornamental conifer or even a power pole to seek refuge during a predator attack. Such temporary refuges are however poor substitutes if there is a determined predator at the bottom of the temporary refuge. The presence or absence of vegetation corridors and associated linked nodes of appropriate vegetation therefore, are of critical importance to the safe interaction of koala communities within the landscape.

Although the allotment under study contains a patchwork of **preferred koala habitat**, it is poorly served by recognisable koala habitat corridors, its surroundings being generally dominated extensively by cleared land with almost no significant forest structure being present. Much of the surrounding land has also been subject to rural residential development with the result that passage of the landscape by koalas is inevitably likely to be subject to significant interference and likely obstruction leading to increased predation.

To the west, movement is virtually prevented by the Macleay River and though there is a narrow band of forest that extends laterally along the southern bank of the river, it is discontinuous and often of unsuitable floristic composition, not particularly containing a desired density of **preferred koala food tree species**. Terrain is also problematic and likely to be disruptive to koala movement. In the south, adjoining allotments have been substantially cleared and subsequently developed for rural residential subdivision. The bulk of this land consists of grazed pasture with only occasional trees and small clumps of trees. Roads and fenced areas associated with the rural residential development are a particular impediment to safe koala movement as they tend to channel koala movement thus exacerbating predation and interference by domestic dogs and livestock. Domestic dogs in particular are a major predator particularly when they group to operate in packs. Similarly domestic cattle are well known for their aggressive behaviour towards koalas on the ground and do cause significant injury as a consequence of head butting and trampling. A further obstruction which would tend to channel movement is a large farm dam.

Similarly in the north, natural forest vegetation is sparse. Though not as obstructed by residential subdivision, much of the north has been converted to exotic tree plantation that provides little or no sustenance or cover. The absence of any nodal habitat areas makes this a dead end. In the east, Marys Bay Road and the associated rural residential development would again tend to channel koala movement into areas of conflict. While there is more disturbed forest vegetation on the eastern side of this road, this in itself becomes a potential trap in that koalas are likely to be enticed to cross this relatively busy road in conflict with vehicular traffic. All the other hazards that apply to rural residential development also exist.

The viability of the **preferred koala habitat** on Lot 101 to support a viable koala population is thus likely to be compromised due to its small size, highly disturbed nature and its isolation, i.e. "like an island in a sea of development". Koalas exiting the remnant will be at great risk and consequently stress while koalas entering would be drawn into what is a potentially dangerous dead end or at least a "bottleneck". Accordingly the viability of **preferred koala habitat** to support a stable koala population is unlikely. This assessment however is indicative only and would need to be confirmed, or not, by ground survey to establish actual usage.

Assessment of Presence or Absence of Koalas .

Field surveys were carried out on 14th June, 2015 and again on 10th September 2015 and included the following survey techniques:-

- Visual search for koalas likely to be present and observable during daytime supplemented by spotlighting searches at night if considered necessary.

- Visual search of suitable koala food trees displaying typical koala scratch marks indicative of a koala presence.

- Application of Spot Assessment Technique for Determining Koala Habitat Significance (Phillips & Callaghan, 1995.) where applicable.

(A.) Visual Search.

An opportunistic search of the allotment was undertaken on 14th June 2015. The search was concentrated upon the area identified as **primary preferred koala habitat** but it was not confined to these areas. Considering koala community dynamics it was considered inappropriate to only consider the areas of demonstratively high habitat/food value. Canopies, sub-canopies forks and branches were thoroughly searched by the unaided eye or where necessary with binoculars.

Results:-

Following an extensive random search no koalas were found to be obviously present on the allotment at the time of the search. As a consequence of a lack of any evidence being obtained as to the presence of koalas on the allotment, it was decided not to proceed with a nocturnal spotlight search at this time.

(B.) Search for Preferred Koala Food Trees Displaying Koala Scratch Marks,

Typical scratch marks can be a useful indicator of koala activity however while useful when smooth bark tree species are present, they are of little use where trees have fibrous bark. Due to the dearth of smooth – barked food trees, only three trees could be examined that contained visible scratch marks i.e. Small - fruited Grey Gum (*E. propinqua).* Koala scratch marks generally consist of three parallel deeply scored lines between 25mm & 75 mm in length and between 15mm and 25mm apart.

Results:-

Three smooth- barked Grey Gums within the area designated as **primary preferred koala habitat** were examined however no diagnostic koala scratch marks were observed. Relatively recent scratch marks indicating the presence of other fauna were present, particularly the scratch marks of a large tree goanna (lace monitor lizard) (*Varanus varius),* and that of a phalanger, probably a brush-tailed possum (*Trichosurus vulpecula).* As a precaution however, since there are similarities between the scratch marks of a tree goanna and a koala, a search was undertaken for koala scats (dung pellets) at the base of each tree, generally in accordance with the

"Spot Assessment Technique". No scats were found thus tending to confirm the original assessment.

(C) Search Utilising Spot Assessment Technique.

Application of the "Spot Assessment Technique" as prescribed by the Council in its Comprehensive Koala Plan of Management Vol.1. is problematic on this site. The Spot Assessment Technique combines what is a very effective koala detection system together with a statistical model to "determine the significance of habitat utilisation by koalas" (Phillips & Callaghan 1995). As such it is designed to be applied in open forest which is structurally intact. As a statistical model it has a number of constraining parameters that must be adhered to for it to retain its validity. In this case as the bulk of the identified **primary preferred koala habitat** has been substantially modified with most of the understorey, and the associate and subordinate tree component having been removed some time in the past, the only area where the technique can easily be applied is a very small area of regrowth forest on the southern slopes of the ridge line, in the far south eastern corner of the allotment.

The Spot Assessment Technique - SAT (Phillips & Callaghan 1995) requires that a circle of minimum 10 metres radius of the basal circumference of an identified "important" tree, be effectively inscribed around that tree and that for statistical purposes that at least twenty trees occupying that circle be subject to a koala scat search undertaken in accordance with the prescribed search technique. While this is generally easily achieved in a structurally intact forest, it is extremely difficult to achieve where the "community" has been converted into a series of nodal clumps of big trees and individual paddock trees. Although the SAT allows for an increase in the radius of the circle, the value of the technique becomes questionable as the radius increases and the survey process becomes more impractical and unwieldy. In line with the SAT the 10 metre radius of the circle was extended to 30 metres and in almost all cases the minimum required associate/subordinate trees present within the circle could still not be achieved. After this point the technique becomes confused, as you break out of the clump and effectively chase ground and in effect interfere with trees in the next nodal clump which would be searched in turn anyway.

Considering however, that the principal objective of the study, as defined by the applicant, was to determine the presence or absence of koalas on the site, rather than at this early stage, to attempt to attribute significance of habitat utilisation by a notional unconfirmed population of koalas, it was decided to utilise the scat (dung pellet) search technique to basically search all trees within each identified clump generally within a radius of 30 metres of a selected nodal tree. This would concentrate the search and would result in a greater search aggregate than if a random sampling process was specifically adopted. The tree identified as the nodal tree was generally a large Tallowwood located in the centre of the clump. Seven distinct clumps of **primary preferred koala habitat (PPKH)** were identified and nominated nodal trees were marked for identification by placing a non - degrading pink ribbon around the girth to allow them to be positioned by GPS by others at a later date.

While the number of trees to be searched within each 30 metre circle was generally less than the minimum specified in the SAT, i.e. generally less than 14, **every** one of the clumps were searched which would not have been the case with a random grid

selection. The only location where the SAT technique utilising a 10 metre radius could be achieved was in a patch of **PPKH** (previously mentioned) to be located on slopes in the far south –western corner of the allotment where there is a relatively undisturbed forest structure.

Due to the large size of most of the trees, many with a D.B.H in excess of 1 metre, the larger search radius of 1200 mm around the base of each tree within the clump captured by the 30 metre radius circle, were examined for koala scats (faecal pellets) in accordance with the SAT. It should be noted that searches were undertaken in early June and early September 2015 in a period of restricted rainfall with only six rain days being recorded over the period with commensurate very light falls of rain having been recorded in the district at that time. As a result of the dry conditions it could be expected that any recent koala scats present would be in an un-degraded state and therefore would be a valid indicator if found within the clump.

Results.

During the survey in excess of seventy trees were examined in accordance with the above methodology and the SAT, however no Koala scats were at any time located, this effectively agreeing with previous findings that indicated the apparent absence of koalas from the allotment, in particular, the area previously identified as **primary preferred koala habitat**

Summary of Findings.

In accordance with the applicant's instructions, the assessment that has been undertaken has provided the following results:-

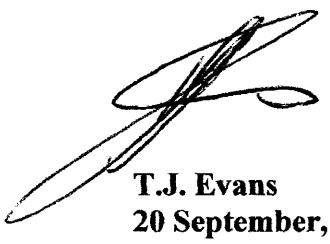
(a) The allotment contains a relatively small area of **primary preferred koala habitat (PPKH)** which is indicated by the red line on the attached aerial photograph. The area making up the **PPKH** generally consists of heavily disturbed mature forest elements but also includes a small area of structurally intact "regrowth" forest on slopes in the far south west corner of the allotment.

(b) The area indicated as **primary preferred koala habitat"** has been thoroughly searched for the presence of koalas using a number of standard survey techniques however at the time of the survey there was no evidence found of the presence of koalas on the site. Considering the past history of the site and the degree of development around it, this is likely to be a permanent situation.

Recommendations:

While the remaining forest elements upon the site were found to not support a viable koala population, the remaining forest elements have their own intrinsic nature conservation values and accordingly it is suggested that consideration should be given to their preservation where possible, by careful positioning of subdivision boundaries, access roads and consequent building envelopes within the new allotments . The narrow band of forest on the steep western boundary has a critical soil conservation role while the clumps of large mature Tallowwoods and associated

species on the ridgeline and southern slopes is an increasingly rare example of the grandeur of mature or "old growth" forest trees. Because of their mature state and accordingly the likely presence of hollows etc., they also possess critically important intrinsic habitat values for other important wildlife.



T.J. Evans
20 September, 2015.

Marys Bay Rd, Eurobodalla NSW 2440

Traffic, cycling

Imagery ©2015 CNES / Astrium, Cnes/Spot Image, DigitalGlobe, Map data ©2015 Google 200 m

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Phillips S. & Callaghan J.	1995	*The Spot Assessment Technique for Determining The Significance of Habitat Utilisation by Koalas.* AKF. Brisbane, Qld.
Smith M.	1987	*Behaviour and Ecology.* In Cronin L. (ed.) *Koala.* Reed Books. Frenchs Forest, NSW.

This report compiled by Terrence John Evans of "Wyuna" 183 Killabakh Creek Killabakh. 2429. Phone 02- 65 505876.

Qualifications:

- **Master of Letters - H Dist. (Geoecology) – University of New England (Armidale).**

- **Batchelor of Arts (Biogeography and Botany) – University of New England (Armidale).**
- **Diploma of Environmental Control - Dist. (Wildlife Survey and Analysis) – Charles Sturt University (Bathurst & Orange).**
- **Diploma of Applied Science – Sydney Institute of Technology.**

Experience:

- **Senior Environmental Scientist and subsequently Manager Natural Environment Greater Taree City Council. 1989 – 1999.**
- **Area Manager Hunter Region (Barrington Tops) – New South Wales National Parks and Wildlife Service. 1999 - 2012**
- **Member of Management Committee of Koalas in Care Inc. Taree.**

Relevant Publications.

(Evans & Fitzpatrick 1996) *Taree and Environs Koala Habitat Study* – A resource study of the natural vegetation within the Taree Koala Management Area. (Greater Taree City Council).

BUSHFIRE HAZARD ASSESSMENT

Proposed Rezoning and Subdivision

Lot 101 No 262
Marys Bay Road
Euroka

Alex Irving

October 2016

41 Belgrave Street, Kempsey NSW 2440 – PO Box 353 Kempsey NSW 2440 – phone 0265631292 – mecham@bigpond.com – ABN 32098436812

TABLE OF CONTENTS

1.0 INTRODUCTION

As requested a Bushfire Risk Assessment has been carried out for the proposed subdivision of Lot 101 No 262 Marys Bay Road, Euroka.

This report is based on a site assessment carried out on the May, July and October 2016. Discussions were held in May with the Coffs Harbour RFS to discuss the access which will be detailed in the report. The report is to demonstrate that bushfire risk is manageable.

The development would be an integrated development and has a requirement for a Bushfire Safety Authority under Section 100B of the *Rural Fires Act 1997*.

NOTE

The report has been prepared with all reasonable skill, care and diligence.

The information contained in this report has been gathered from field survey, experience and has been completed in consideration of the following legislation.

1. Rural Fires Act 1997.
2. Environmental Planning and Assessment Act 1979.
3. Building Code of Australia.
4. Council Local Environment Plans and Development Control Plans where applicable.
5. NSW Rural Fire Services, Planning for Bushfire Protection, 2006. (PfBP, 2006)
6. AS 3959-2009 Construction of Buildings in Bushfire Prone Areas.

The report recognizes the fact that no property and lives can be guaranteed to survive a bushfire attack. The report examines ways the risk of bushfire attack can be reduced where the subdivision site falls within the scope of the legislation.

The report is confidential and the writer accepts no responsibility of whatsoever nature, to third parties who use this report or part thereof is made known. Any such party relies on this report at their own risk.

1.1 Objectives

The objectives of this report are to:

- Ensure that the proposed subdivision meets the aims and objectives of NSW Rural Fire Services, *Planning for Bushfire Protection*, 2006 and has measures sufficient to minimize the impact of bushfires; and
- Reduce the risk to property and the community from bushfire; and
- Comply where applicable with AS3959 – 2009.

1.2 Legislative Framework

In NSW, the bushfire protection provisions of the BCA are applied to Class 1, 2, 3, Class 4 parts of buildings, some Class 10 and Class 9 buildings that are Special Fire Protection Purposes (SFPPs).

The BCA references AS3959 – 2009 as the deemed-to-satisfy (DTS) solution for construction requirements in bushfire prone areas for NSW.

All development on bushfire prone land in NSW should comply with the requirements of Addendum Appendix 3 and other bushfire protection measures identified within PfBP, 2006.

The proposed subdivision is required to obtain a bushfire safety authority from the NSW Rural Fire Service.

1.3 Location

The site is located at Lot 101 No 262 Marys Bay Road, Euroka.

Locality – Euroka
Local Government Area – Kempsey Shire Council
Closest Rural Fire Service – Aldavilla
Closest Fire Control Centre – Kempsey

The site location of the proposed subdivision can be seen in **Figure 1** and **Figure 2** below:

Figure 1 – Topographic Map

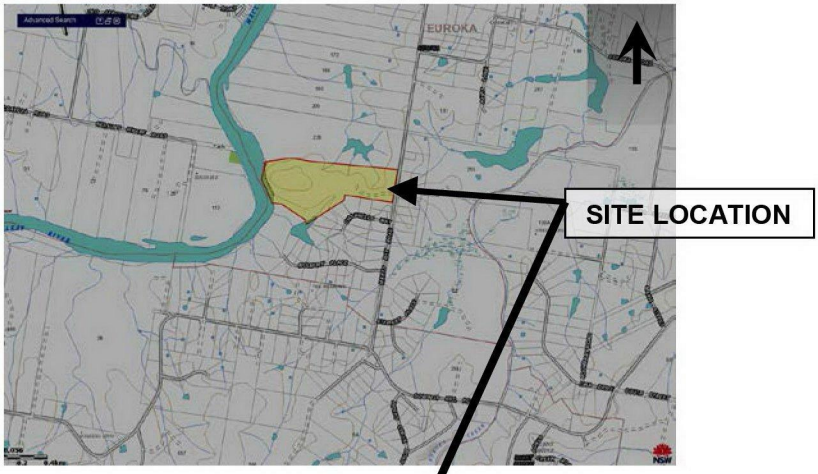


Figure 2 – Aerial View

1.4 Development Proposal and History

It is proposed to subdivide Lot 101 into 23 lots.

The subdivision and constraints layout can be seen in **Appendix 1**.

2.0 BUSHFIRE HAZARD ASSESSMENT

2.1 Assessment Methodology

Several factors need to be considered in determining the bushfire hazard.

These factors are slope, vegetation type, and distance from hazard, access/egress and fire weather.

Each of these factors has been reviewed in determining the bushfire protection measures.

The assessment of slope and vegetation being carried out in accordance with Appendix 2 and Appendix 3 of NSW Rural Fire Service, *Planning for Bushfire Protection*, 2006 and Section 2 of AS 3959 - 2009.

2.2 Slope Assessment

Slope is a major factor to consider when assessing the bushfire risk.

A slope assessment has been completed as part of the subdivision planning.

It is noted that there is some 10-15° slopes that are present on the existing lots principally from the centre to the western end of the lot.

To ensure a conservative approach a 10-15° downslope for all grassland has been adopted.

The following table shows the results of the slopes:

Table 1 – Adjoining Lot Hazard Vegetation Slopes

Hazard Aspect	Slope	Upslope/Downslope or Flat
North	0-5°	Downslope
East	0-5°	Downslope
South	0-5°	Downslope

It should be noted that to the west there is the river.

Table 1 – Internal Lot Hazard Vegetation Slopes

Hazard Aspect	Slope	Upslope/Downslope or Flat
North	10-15°	Downslope
East	10-15°	Downslope
South	10-15°	Downslope
West	15-20°	Downslope

A 15-20° downslope to the west has been adopted. It is noted that the area is very steep and cliff like in nature.

This slope will be examined further in the report.

2.3 Vegetation Assessment

The vegetation on and surrounding the subject site was assessed over a distance of 140m. The vegetation formations were classified using the system adopted as per Keith (2004) initially for the Asset Protection Zone calculation and then converting Keith to AUSLIG using Table A3.5.1 of Appendix 3 (2010) for assessment of the Bushfire Attack Level.

2.3.1 Vegetation on and Adjoining/Adjacent to the Subject Lot

The majority of the hazard vegetation on the subject lot has been considered as grassland, however it is noted that there is active grazing taking place currently.

The adjoining lands are either grazing land or rural residential subdivision and therefore again for the purposes of the report this has been considered as a grassland hazard.

There is remnant unmanaged vegetation to the west of the lot.

As discussed previously the majority of this vegetation is positioned on very steep land that extends to the river.

It should also be noted that there is grazing land positioned on the western side of the river.

As can be seen from the following photos this unmanaged vegetation because of the slope and the on-going erosion is very sparse and for the purposes of the report has been considered as woodland.
It is also noted that there are a number of rocky outcrops in this slope which also adds a factor of safety to the slope assessment.

The following table details the hazards for the proposed lots:

Table 2 – Hazard Vegetation

Hazard Aspect	Vegetation
North	Grassland
East	Grassland
South	Grassland
West	Woodland

Photos 1 and 2 showing examples of vegetation on the western slope

Photos 3 and 4 - showing the vegetation from the opposite bank of the river

Note: the extent of the rocky outcrops present

Photo 5 – Showing the photo of the grassland vegetation (currently managed by cattle grazing) from Marys Bay Road

Photos 6 and 7 showing other examples of the grassland vegetation (currently managed by cattle grazing)

2.4 Hazard

The hazards are located to the north, south, east and west.

The hazard vegetation can be seen in ***Figure 4*** below:

Figure 4: Hazards

Table 3 – Summary of Hazard Characteristics

Hazard Aspect	Hazard	Slope	Upslope/Downslope or Flat
North	Grassland	10-15°	Downslope
East	Grassland	10-15°	Downslope
South	Grassland	10-15°	Downslope
West	Woodland	15-20°	Downslope

It is noted that the slope in the unmanaged vegetation to the the west is greater than a 15-20° downslope of a cliff like in nature.

There are significant areas on this slope that have no vegetation due to the rocky outcrop nature of the slope.

The vegetation that extends beyond the steep slope is less than 15-20° downslope therefore this builds a factor of safety into the report.

2.5 Fire Danger Index

The fire weather for the site is assumed on the worst-case scenario. In accordance with NSW Rural Fire Services, PfBP, 2006 and Table 2.1 of AS3959 - 2009, the fire weather for the site is based upon the 1:50 year fire weather scenario and has a Fire Danger Index (FDI) of 80.

3.0 BUSHFIRE THREAT REDUCTION MEASURES

3.1 NSW Rural Fire Services, *Planning for Bushfire Protection*, 2006

The following provisions of PfBP 2006 have been identified:

3.1.1 Defendable Space/Asset Protection Zone (APZ)

To ensure that the aims and objectives of NSW Rural Fire Services, PfBP, 2006, a defendable space between the asset and the hazard should be provided. The defendable space provides for, minimal separation for safe fire fighting, reduced radiant heat, reduced influence of convection driven winds, reduced ember viability and dispersal of smoke.

The proposed development is not considered to be subject to the Special Fire Protection Purpose requirements which are applicable to schools, (the proposed development is not a school).

It is recommended that the defendable space for the proposed development be based upon the minimum requirements for Asset Protection Zones as set out in NSW Rural Fire Services, *Planning for Bushfire Protection*, 2006.

Table 4 - APZ Requirements (PfBP 2006) for the Proposed Lots of the Subdivision

Hazard Aspect	Vegetation Type	Slope	IPA	OPA	Total APZ Required (IPA + OPA)	Total APZ Proposed
North	Grassland	10-15°	12m		12m	12m
East	Grassland	10-15°	12m		12m	12m
South	Grassland	10-15°	12m		12m	12m
West	Woodland	15-20°	37m		37m	37m

The above table considers APZs for hazards within the subject lot and external to the subject lot.

Appendix 1 shows possible dwelling positions in consideration.

The possible dwelling locations have been positioned a minimum 12m from the side boundaries and a minimum 37m from the hazard to the west.

3.1.2 Operational Access and Egress

Access to and egress from each of the proposed lots will be via public roads to be completed as part of the subdivision. The access and egress was part of a Fire Design Brief meeting with the Rural Fire Service. The public road will comply with the below requirements for the access/egress length and have a roll back kerb.

Performance criteria	Acceptable solution	Comment
The intent may be achieved where:		
• Access to properties is provided in recognition of the risk to fire fighters and/or evacuating occupants	• At least one alternative property access road is provided for individual dwellings (or groups of dwellings) that are located more than 200 metres from a public through road	The subject lot is adjoined by rural residential to the south and east and grazing land to the north. The main hazard is to the west of the lot and therefore exiting will be away from the hazard.
• The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles • All weather access is provided	• Bridges clearly indicate load rating and pavements and bridges are capable of carrying a load of 15 tonnes • Roads do not traverse a wetland or other land potentially subject to periodic inundation (other than a flood or storm surge)	Can Comply Can Comply

• Road widths and design enable safe access for vehicles	• A minimum carriageway width of four metres for rural residential areas, rural landholdings or urban areas with a distance of greater than 70 metres from the nearest hydrant point to the most external part of a proposed building (or footprint)	Can Comply
	• In forest, woodland and heath situations, rural property access roads have passing bays every 200 metres that are 20 metres long by two metres wide, making a minimum trafficable width of six meters at the passing bay.	N/A
	• A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches.	N/A
	• Internal roads for rural properties provide a loop road around any dwelling or incorporate a turning circle with a minimum 12 metre outer radius.	A reversing bay may be provided in lieu of a loop road around the dwelling or a turning circle. Where a reversing bay is provided it shall be not less than 6m wide and 8m deep with an inner minimum turning radius of 6m and an outer radius of 12m.
	• Curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress.	Can Comply
	• The minimum distance between inner and outer curves is six metres.	Can Comply
	• The crossfall is not more than 10 degrees.	Can Comply
	• Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads.	Can Comply

It is considered that the relevant acceptable solutions as provided for by 4.1.3 of NSW Rural Fire Service, PfBP, 2006 are capable of being complied with and as such the intent for the provisions of services can be achieved.

3.1.3 Services - Water, Gas and Electricity

As set out in Section 4.1.3 of NSW Rural Fire Services**,** *Planning for Bushfire Protection*, 2006, developments in bushfire prone areas must maintain a water supply for fire fighting purposes.

Electricity supply is available and will be connected to the subdivision site.

Reticulated water supply is available and will be connected to the site. If Council cannot guarantee a water supply then a Water Supply for Fire Fighting of 20,000 litres in accordance with Fast Fact 3/08 and Planning for Bushfire Protection, 2006 is to be provided for the dwelling (See **Appendix 2).**

Any tanks will require the following at a minimum.

- A suitable connection for firefighting purposes is made available and located within the IPA and away from the structure. A 65mm Storz outlet with a Gate or Ball valve is provided.
- Gate or Ball valve and pipes are adequate for water flow and are metal rather than plastic.
- Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank. A hardened ground surface for truck access is supplied within 4 metres of the access hole.
- Above ground tanks are manufactured of concrete or metal and raised tanks have their stands protected. Plastic tanks are not used. Tanks on the hazard side of a building are provided with adequate shielding for the protection of fire fighters.
- All above ground water pipes external to the building are metal including and up to any taps.
- Pumps are shielded.

The use of heavy-duty hoses with wide spray nozzles is recommended with hoses able to reach all parts of any dwelling.

Bottled gas supplies are to be installed and maintained in accordance AS 1596. Metal piping is to be used. All fixed gas cylinders are to be kept clear of all flammable materials to a distance of 10m and shielded on the hazard side of the installation. If gas cylinders need to be located close to the building, the release valves are to be directed away from the building and at least 2 metres away from any combustible material so they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal.

It is considered that the relevant acceptable solutions as provided for by 4.1.3 of NSW Rural Fire Services, PfBP, 2006 are capable of being complied with and as such the intent for the provision of services can be achieved.

3.1.4 Landscaping

Landscaping is a major cause of fire spreading to buildings, and therefore any landscaping proposed in conjunction with the proposed development will need consideration when planning, to produce gardens that do not contribute to the spread of a bushfire.

When planning any future landscaping surrounding any proposed building or subdivision, consideration should be given to the following:

- The choice of vegetation – consideration should be given to the flammability of the plant and the relation of their location to their flammability and on going maintenance to remove flammable fuels.
- Trees as windbreaks/firebreaks – Trees in the landscaping can be used as windbreaks and also firebreaks by trapping embers and flying debris.
- Vegetation management – Maintain a garden that does not contribute to the spread of bushfire.
- Maintenance of property – Maintenance of the property is an important factor in the prevention of losses from bushfire.

Appendix 5 of NSW Rural Fire Services, *Planning for Bushfire Protection*, 2006, contains standards that are applicable to the provision and maintenance of landscaping. Any landscaping proposed to be undertaken in conjunction with the proposed development is to comply with the principles contained in Appendix 5 of NSW Rural Fire Services, PfBP, 2006.

Compliance with Appendix 5 of NSW Rural Fire Services, PfBP, 2006, will satisfy the intent of the bush fire protection measures that are applicable to the provision of landscaping.

3.2 Construction of Buildings

3.2.1 General

The deemed-to-satisfy provisions for construction requirements are detailed in AS 3953-2009. The relevant Bushfire Attack Level and Construction Requirements have been determined in accordance with Appendix 3 (2010) of PfBP, 2006 and Section 2 of AS 3959-2009. The additional construction requirements with respect to A3.7 of Appendix 3 (2010) of PfBP (2006) are required to be added to the standards for each Bushfire Attack Level.

3.2.2 Vegetation

To complete the assessment under AS 3959-2009 the vegetation, as originally assessed in accordance with Keith, has to be converted to AUSLIG.

The following table shows the conversion:

Table 4 – Summary of Vegetation Characteristics

Vegetation Classification – (Keith, 2004)	Vegetation Classification – (AUSLIG 1990)
Grassland	Grassland
Woodland	Woodland

3.2.3 AS3959 – 2009 Construction of Buildings in Bushfire Prone Areas

The following construction requirements in accordance with AS 3959 – 2009 Construction of Buildings in Bushfire Prone Areas is required for the bushfire attack categories.

Bushfire Attack Level (BAL)
BAL - LOW No construction requirements under AS 3959-2009
BAL - 12.5

BAL - 19
BAL - 29
BAL - 40
BAL - FZ

The possible dwelling locations have been positioned a minimum 12m from the side boundaries and a minimum 37m from the hazard at the west. These distances will ensure all dwellings can be built to the requirements of BAL 29.

Compliance with these requirements will ensure that any new dwelling complies with the requirements of AS3959-2009 Construction of Buildings in Bushfire Prone Areas, for the siting, design and construction.

4.0 REQUIREMENTS

The following requirements are considered to be integral to this bushfire risk assessment:

1. An Asset Protection Zones as detailed in Section 3.1.1 of this report are to be provided.
2. The proposed subdivision is to comply with the relevant performance criteria/acceptable solutions as provided for by Section 4.1.3 of NSW Rural Fire Services**,** PfBP, 2006.
3. Adopt landscaping principals in accordance with Section 3.1.4 of the NSW Rural Fire Services, PfBP, 2006.

5.0 CLAUSE 44 CONSIDERATIONS

Table 5

Environmental/Heritage Feature	Comment
Riparian Corridor	Not considered in this report
SEPP 14 – Coastal Wetland	Not considered in this report
SEPP 26 – Littoral	Not considered in this report
SEPP 44 – Koala Habitat	Not considered in this report
Areas of geological interest	Not considered in this report
Environment protection zones	Not considered in this report
Land slip	Not considered in this report
Flood prone land	Not considered in this report
National Park Estate or other reserves	Not considered in this report
Threatened Species, populations, endangered ecological communities and critical habitat	Not considered in this report
Aboriginal Heritage	Not considered in this report

6.0 CONCLUSION

It is suggested that with the implementation of this report, and its recommendations, that the bushfire risk is manageable and will be consistent with the acceptable bushfire protection measure solutions, provided for in Section 4.3.5 of NSW Rural Fire Services, PfBP, 2006.

The report provides that the required APZ's can be achieved and that any proposed new dwelling can be constructed so as to comply with the requirements of AS 3959-2009 and Appendix 3 of PfBP, 2006, Construction of Buildings in Bushfire Prone Areas.

This report is however contingent upon the following assumptions and limitations:

Assumptions

1. For a satisfactory level of bushfire safety to be achieved, regular inspection and testing of proposed measures, building elements and methods of construction, specifically nominated in this report, is essential and is assumed in the conclusion of this assessment.

2. There are no re-vegetation plans in respect to hazard vegetation and therefore the assumed fuel loading will not alter.

3. It is assumed that the building works will comply with the DTS provisions of the BCA including the relevant requirements of Australian Standard 3959 – 2009.

4. The proposed development is constructed and maintained in accordance with the risk reduction strategy in this report.

5. The vegetation characteristics of the subject site and surrounding land remains unchanged from that observed at the time of inspection.

Limitations

1. The data, methodologies, calculations and conclusions documented within this report specifically relate to the proposed subdivision and must not be used for any other purpose.

2. A reassessment will be required to verify consistency with this assessment if there is any alterations and/or additions, or changes to the risk reduction strategy contained in this report.

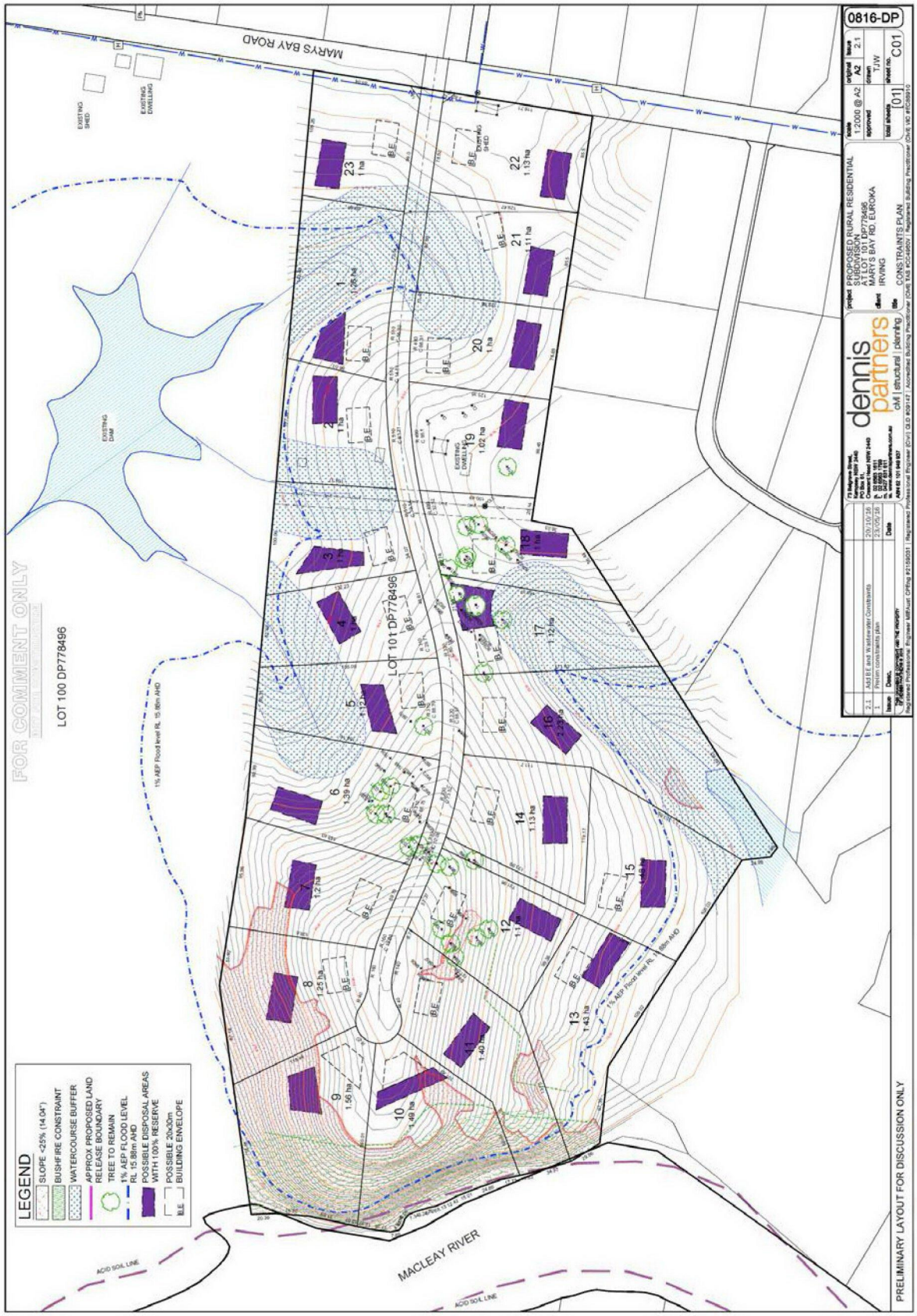
Regards

Tim Mecham
Midcoast Building and Environmental

7.0 REFERENCES

NSW Rural Fire Services, ***Planning for Bushfire Protection***, 2001
NSW Rural Fire Services, ***Planning for Bushfire Protection***, 2006
AS 3959-2009 ***Construction of Buildings in Bushfire Prone Areas***
Keith David 2004, Ocean ***Shores to Desert Dunes, The Native Vegetation of New South Wales and the ACT***, Department of Environment and Conservation
NSW State Government (1997) Rural Fires Act 1997
NSW Rural Fire Service – ***Guideline for Bushfire Prone Land Mapping 2002***

APPENDIX 1: Subdivision Layout



APPENDIX 2

NSW RURAL FIRE SERVICE

COMMUNITY RESILIENCE FAST FACTS 3/08

Water Supply for Fire Fighting Purposes

This Fast Fact clarifies the NSW Rural Fire Service (RFS) position on the requirement for water supplies for development in bush fire prone areas.

Adequate water supply is critical for effective fire fighting. Where a non reticulated water supply is provided or the reticulated water supply is deemed inadequate, an additional onsite stored supply of water for fire fighting will be required. Non reticulated water is a supply that is not piped by council or a water authority and includes rainwater, ground water or surface water.

In the past, additional water sources could take the form of a static water supply (SWS) or a dedicated water supply. The RFS has traditionally required that an alternate supply of water be 'dedicated' for fire fighting purposes in line with the provisions of *Planning for Bush Fire Protection* 2006 (PBP). Dedicated water implies that the supply shall be in the form of a tank of water and has traditionally not included swimming pools or dams. The term also implies that the supply must be isolated from other domestic water supplies and used solely for fire fighting purposes.

From a practical fire fighting point of view, any source of available water will be utilised during a bush fire event and dedicated tanks are not always the most practical option.

In light of the above and the increasing demand for sustainable and efficient use of our water resources, the RFS will no longer require water to be solely 'dedicated' for fire fighting purposes and will allow more flexibility in satisfying the water requirements of PBP. As such, water holding structures such as tanks, swimming pools and dams can be considered.

Therefore, the RFS conditions addressing water supply will no longer refer to a 'dedicated' water supply and will simply state that a supply of water shall be provided for 'fire fighting purposes'. This position will also apply to previously issued conditions referring to dedicated supplies. As such, the water source can be used for other purposes and allow for the circulation of fresh water. The onus will be on the property owner to provide suitable water supply arrangements for fire fighting that meet the RFS requirements and ensure that any water sources are maintained at the appropriate capacity (see Table 4. of PBP).

Water capacities, access (tanker or pedestrian) for fire fighters and the provision of appropriate connections should also be considered when determining if a proposed water source is suitable. Furthermore, the property owner is encouraged to place a 'SWS' sign in a visible location on the street front.

PREPARE. ACT. SURVIVE. | www.rfs.nsw.gov.au

ONSITE SEWAGE MANAGEMENT ASSESSMENT

PROPOSED REZONING THEN SUBDDIVISION INTO 23 LOTS

No 262 Lot 101 DP778496
Marys Bay Road
Euroka NSW 2440

Alex Irving

October 2016

41 Belgrave Street, Kempsey NSW 2440 – PO Box 353 Kempsey NSW 2440 – phone 0265631292 – fax 0265624851 – ABN 32098436812

1.0 INTRODUCTION

This report has been prepared on behalf of the owners on the subject site for a proposed subdivision on land known No 262 Lot 101 DP778496 Marys Bay Road, Euroka.

The report contains an assessment of soil and site conditions and provides recommendations for the most suitable types of on-site sewage management systems that could be utilized.

Site investigations were carried out on the 9th June 2016 to determine site and soil conditions.

The site and soil assessments, design details and calculations have been carried out in accordance with the following technical and regulatory documents:

- AS/NZS 1547-2012 On-site domestic-wastewater management.
- NSW Government Environment and Health Protection Guidelines - On-site Sewage Management for Single Households.

NOTE

This report has been prepared with all reasonable skill, care and diligence.

The information contained in this report has been gathered from the field survey and experience.

The report recognizes the importance of the correct installation of onsite sewage management systems, coupled with ongoing appropriate and regular maintenance in ensuring that satisfactory environmental health outcomes are obtained and maintained into the future.

The report is confidential and the writer accepts no responsibility of whatsoever nature, to third parties who use this report, or part thereof is made known.

Any such party relies on this report at their own risk.

2.0 Site Description

The site is located at No 262 Lot 101 DP778496 Marys Bay Road Euroka and is situated within the Kempsey Shire Local Government Area.

The site is positioned approximately 9.9 km west of Kempsey. Head west on Savages Lane towards Clyde Street. Take the first right onto Clyde Street and then take the first right onto Forth Street. Take the first right onto Macleay Valley Way and follow for approximately 2.4 km. Turn right onto Middleton Street following for approximately 1.5 km and then continue onto Gowings Hill Road and follow for approximately 3.3 km. Take a right onto Marys Bay Road and the subject site will be 1.5 km on the left.

These roads are all public sealed roads.

Figure 1 and **Figure 2** below show the site location.

Figure 1 –Topographical Map

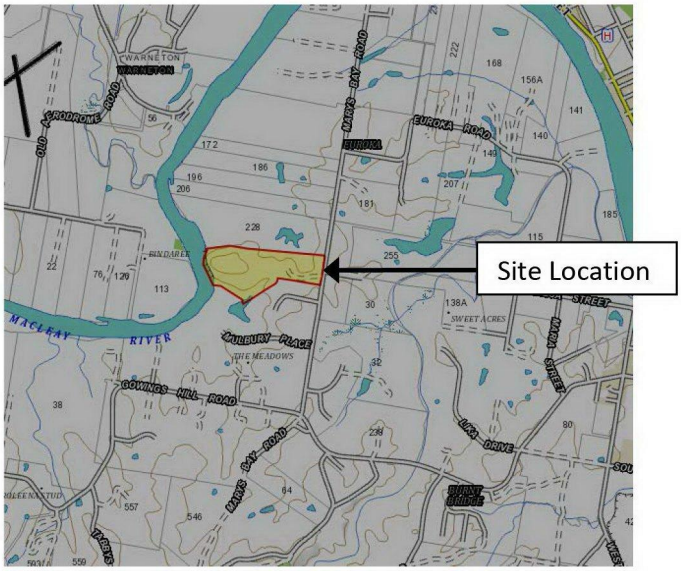


Figure 2 – Aerial Photograph

3.0 History and Proposed Development

It is proposed to subdivide the subject site into twenty one (23) separate lots.

The subject site is approximately 30 hectares in size.

The subdivision and constraints plan can be seen in **Appendix 1**.

The site has one (1) dwelling currently being occupied and it is assumed this dwelling has a Council approval to operate the on-site sewage management system.

4.0 Site Assessment

The following table outlines the major site features relevant to on-site sewage management.

Table 1: Site Assessment Results

SITE FEATURE	DESCRIPTION	LIMITATION
Climate	Annual rainfall – 1122.6mm (Kempsey BOM) Annual pan evaporation – 1597mm (BOM)	Moderate
Flood/inundation potential	Given the proposed subdivision it is not anticipated that there will be any flooding or localized storm water inundation issues for the site. The 1 in 100 year flood level can be seen in the constraints map.	Minor
Exposure	The aspect of the site provides for high levels of wind and sun exposure	Minor
Slope	The site slopes as shown as possible disposal areas on the constraints map range from 0% to 30%	Moderate
Landform	Sloping rolling hills which crest down to flood plain and the river. To the west there is a steep fall to the river.	Minor
Run-on & Seepage	Given the nature of the soil and the slopes there is a chance of runoff	Moderate
Erosion Potential	No signs of erosion potential present	Minor
Drainage	Sloping site and well drained. No pooling	Minor
Fill	There is no evidence of fill in the area assessed for onsite sewage management	Minor
Buffer Distances	Buffer distances are achievable, refer to ***Table 2***	Minor
Land Area	As indicated previously the lot size is approximately 30 hectares	Minor
% Rocks and /or Outcrops	There were no rocks or rock outcrops viewed with respect to the likely position of the disposal areas	Minor

The relationship of rainfall to evaporation, slope and the management of overland storm water run-on and seepage from the disposal area have been identified as moderate limitations.

The above limitations will require attention in the design of the onsite sewage management system.

5.0 Soil Assessment

Soil samples were taken at the site, in locations determined to represent the soil profiles that could exist on the subject property in the area identified as being suitable for onsite sewage management systems.

The location of the test pits were determined based upon lot layout and landform.

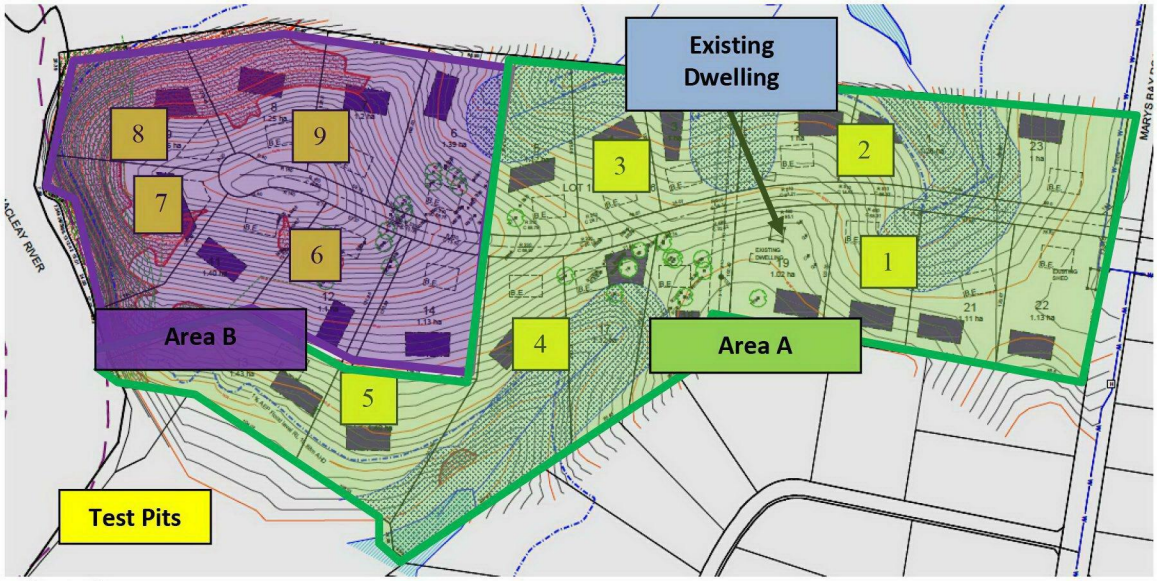
Due to the varying site landforms, nine (9) test pits were dug on the subdivision site and the soils was tested.

These pits were considered representative of the expected location of the onsite sewage management system and were excavated to a depth of approximately 1200mm when possible.

Observations of soil characteristics were made and noted with soil samples being taken from the following test pits.

The test pits can be seen labelled 1 to 9 below.

After inspection of the test pits the report identified two areas defined by soil type **Area A** and **Area B.**



Area A

Test pits (1), (2), (3), (4) and (5) representative of 13 lots being **Lots 1, 2, 3, 4, 5, 13, 15, 16, 17, 18, 19, 20, 21, 22 and 23.**

Area B

Test pit (6), (7), (8) and (9) representative of Eight (8) lots being **Lots 6**, **7, 8, 9, 10, 11, 12 and 14**.

Area B has steeper topography than Area A.

5.1 Soil and Wastewater Assessment for Area A

Test pits (1), (2), (3), (4) and (5).

Soil permeability was established using field textural classification techniques.

The five (5) test pits were very similar soil types with little variations in the (3) profile depths.

The soils from the five (5) test pits were tested and test pit 1 was considered representative for **Area – A** which contains the Lots 1, 2, 3, 4, 5, 13, 15, 16, 17, 18, 19, 20, 21, 22 and 23.

As stated above, field observations by Midcoast Building and Environmental indicated soil conditions in Test Pit 1 generally consisted of three (3) horizons being:

Test Pit 1

- Profile A – 0mm to 350mm
- Profile B – 350mm to 600mm
- Profile C – 600mm plus

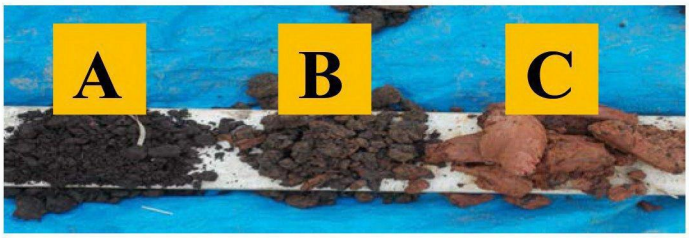
Field observation and soil analysis information is presented in **Appendix 2**.

Generally the top soil, (Profile A), was a very dark greyish clay loam. Profile A had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content being 25-35%.

Profile B was underlain by dark reddish grey light clay. Profile B had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content being 35-45%.

Profile C was a yellowish red medium to heavy clay. Profile C had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content of more than 50%.

Photograph 1: Showing the 3 Soil Profiles from Test Pit 1



The following table outlines the major soil features relevant to on-site sewage management at the site.

Table 2 – Soil Assessment Results Area A

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	Bedrock/hardpan was not encountered in any test pits	Minor
Depth to water table	No water was encountered in the test pits	Minor
Soil permeability (Category)	Profile A – (clay loam) Profile B – (light clay) Profile C – (medium to heavy clay)	Minor Minor Moderate
Soil structure	Profile A – Sub angular Blocky Profile B – Sub angular Blocky Profile C – Sub angular Blocky	Minor Minor Minor
Course fragments%	Profile A – less than 20% Profile B – less than 20% Profile C – less than 20%	Minor Minor Minor
pH	Profile A – 6.6 Profile B – 6.5 Profile C – 6.4	Minor Minor Minor

Electrical conductivity	Profile A – 0.01 Profile B – 0.00 Profile C – 0.00	Minor Minor Minor
Dispersability (Emerson Class)	Profile A – 3 Profile B – 2 Profile C – 2	Minor Moderate Moderate

Soil permeability and dispersability was identified as moderate limitations to the wastewater system.

The above limitations will require attention in the detailed design of onsite sewage management systems to service the subject site.

5.2 Soil and Wastewater Assessment for Area B

Test pits (6), (7), (8) and (9).

Soil permeability was established using field textural classification techniques.

The four test pits were very similar soil types with very little variations in the (3) profile depths.

The soil from Test Pit 8 was tested and considered representative for Area A which contains Lots 6, 7, 8, 9, 10, 11, 12 and 14. Field observation and soil analysis information is presented in **Appendix 2**.

As stated above, field observations by Midcoast Building and Environmental indicated soil conditions in Test Pit 8 generally consisted of three (3) horizons being:

Test Pit 8

- Profile A – 0mm to 300mm
- Profile B – 300mm to 500mm
- Profile C – 500mm to refusal at 1000 mm

Generally the top soil, (Profile A), was a very dark greyish clay loam. Profile A had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content being 25-35%.

Profile B was underlain by dark reddish grey light clay. Profile B had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content being 35-45%.

Profile C was a yellowish red medium to heavy clay. Profile C had a smooth texture with few, (<20%), small course fragments with a sub angular blocky ped structure and an estimated clay content of more than 50%.

Photograph 2: Showing the 3 Soil Profiles from Test Pit 8

The following table outlines the major soil features relevant to on-site sewage management at the site.

Table 3 – Soil Assessment Results Area B

SOIL FEATURE	DESCRIPTION	LIMITATION
Depth to bedrock/hardpan	Bedrock/hardpan was encountered in test pits at approximately 1m	Moderate
Depth to water table	No water was encountered in the test pits	Minor
Soil permeability (Category)	Profile A – (clay loam) Profile B – (light clay) Profile C – (medium to heavy clay)	Minor Moderate Moderate
Soil structure	Profile A – Sub angular Blocky Profile B – Sub angular Blocky Profile C – Sub angular Blocky	Minor Minor Minor
Course fragments%	Profile A – less than 20% Profile B – less than 20% Profile C – less than 20%	Minor Minor Minor
pH	Profile A – 5.4 Profile B – 5.4 Profile C – 5.3	Minor Minor Minor
Electrical conductivity	Profile A – 0.01 Profile B – 0.00 Profile C – 0.00	Minor Minor Minor
Dispersability (Emerson Class)	Profile A – 3 Profile B – 2 Profile C – 2	Minor Moderate Moderate

Soil permeability, depth to bedrock/hardpan and dispersability was identified as a moderate limitation to the wastewater system.

The above limitations will require attention in the detailed design of onsite sewage management systems to service the subject site.

6.0 Waste Water Characteristics and Generation

Having regards to the domestic nature of the occupation of the proposed subdivision it is considered that low strength effluent will be generated following treatment.

Assumed characteristics of effluent which requires disposal would therefore be as follows:

Table 3: Effluent Characteristics

PARAMETER	STRENGTH
Total Nitrogen	<50mg/L
Total Phosphorus	<10mg/L
BOD	<40mg/L
TDS	<500mg/L

For the purposes of this report the volume of wastewater which is predicted to be produced is provided for in ***Table 4*** below.

Effluent loading is based on two persons for a master bedroom, two persons for a guest room

and one person per additional bedroom. A study or any other room that has the potential to be used as a bedroom will be considered as an additional bedroom.

It has been assumed that standard water reduction measures will be installed as a result of compliance with the BASIX requirements.

Table 4: Estimation of Effluent Generation

USAGE	OCCUPANCY RATE	EFFLUENT – LITRES PER PERSON PER DAY	PREDICTED EFFLUENT GENERATION - LITRES/DAY
3	5	150 L	750 L
5	7		1050 L

It is therefore considered that a total daily effluent production rate from the above table should be applied to the determination of the minimum onsite effluent disposal requirements for any new dwelling on the proposed lots dependant on the number of bedrooms.

7.0 System Design Assumptions

The following design assumptions have been adopted for the purposes of investigating system design options.

Table 5: Design Parameters

DESIGN PARAMETER	DESIGN ASSUMPTION
Soil Permeability	0.5 m/d-0.06 m/d
Hydraulic Loading - Number of persons	5 persons (3 Bedroom Dwelling) 7 persons (5 Bedroom Dwelling)
Hydraulic Loading - Expected Wastewater Quantity	150 L/p/d
Crop Factor	0.75
Rainfall	1126.4mm BOM Kempsey
Design Irrigation Rate (DIR)	18mm/week
Design Loading Rate (DLR)	9mm/day

For the purposes of this report a system with secondary treatment has been considered as the soil and slope are the constraining issues. A design irrigation rate (DIR) of 18mm/week and a design loading rate (DLR) of 9mm/day was adopted in consideration of soil improvement before and during installation.

The soil samples above indicated that the soils across the two (2) areas tested, although being similar in structure, the depth to hardpan and the slope make **Area B** unsuitable for evapotranspiration beds and surface irrigation**.**

Therefore, it is recommended that:

1. The proposed lots in Area **A** with slopes less than 10% can have the effluent disposed by subsurface/surface irrigation or evapotranspiration beds**.** Where the slopes are

greater than 10% then sub-surface irrigation should be used for disposal of effluent.

2. That the effluent from the proposed lots in Area **B** be disposed by subsurface irrigation.

It is noted that the maximum slope for sub-surface irrigation is 30%. This maximum slope has been considered when the effluent disposal envelopes were nominated by Dennis Partners (**Appendix 1**). These envelopes as shown are between 800m² and 900m² in area.

8.0 On-site Sewage Management System

Based on the above site assessment and constraints, the type of treatment proposed for the effluent, and the likely quantity and quality of wastewater to be generated it is considered that the site is suitable for disposal of effluent by the following.

8.1 Primary and Secondary Treatments

Area A

Option 1

An Aerated Wastewater Treatment System then to subsurface irrigation, evapotranspiration beds or surface irrigation on slopes less than 10%. With slopes greater than 10%, effluent is to be disposed of by sub-surface irrigation.

Option 2

Primary treatment by 3000 litre septic tank approved by the NSW Department of Health to an approved reed bed system then to subsurface irrigation or to evapotranspiration beds in accordance with the Department of Health requirements and AS 2047. With slopes greater than 10%, effluent is to be disposed of by sub-surface irrigation.

Area B

Option 1

An Aerated Wastewater Treatment System then to subsurface irrigation.

Option 2

Primary treatment by 3000 litre septic tank approved by the NSW Department of Health to an approved reed bed system then to subsurface irrigation in accordance with the Department of Health requirements and AS 2047.

8.2 Disposal Area

8.2.1 ***Subsurface Systems (Secondary Treatment)***

(i) Subsurface Irrigation Area Required

- **For 5 persons (3 bedroom dwelling) a minimum irrigation of 267m² is required for subsurface irrigation. Design calculations are presented in** Appendix 3 **of this report.**
- **For 7 persons (5 bedroom dwelling) a minimum irrigation of 373m² is required for**

subsurface irrigation. **Design calculations are presented in** Appendix 3 **of this report.**

These areas are based on a DIR of 18mm per week.

A below the ground system would need to be constructed.

The irrigation area is to be planted with suitable vegetation (shrubs or lawns) to assist in nutrient uptake and improve effluent disposal through evapotranspiration.

All storm water is to be directed away from the disposal area. This includes the stormwater from any proposed dwelling and any ground water run-off.

The irrigation area sizing is based on hydraulic loading without consideration of a nutrient balance calculation.

It is considered nutrient build up in soil within the effluent disposal area will be minimised due to the natural filtration process that occurs in clay soils. Plantings in the irrigation area will also help with the nutrient uptake.

Subsurface Irrigation Area

Sub surface irrigation will require the necessary measures to ensure there is no loss of top soil.

Sub-surface systems include:

a. Shallow subsurface drip irrigation

Shallow subsurface drip irrigation shall be installed at 100-150 depth into 150 to 250mm of top soil in grassed or other suitably vegetated areas. Secondary treated effluent shall be distributed from a system of pressure compensating drip emitters into the topsoil layer.

b. Covered subsurface drip irrigation

In systems using subsurface drip irrigation, effluent shall be applied directly to the surface of the soil under a cover of mulch or other approved cover material, which shall be held in place by durable bird resistant mesh netting pinned securely to the ground surface. Secondary treated effluent shall be distributed from pressure compensating drip emitters to achieve effective coverage of the design area.

Components of a sub-surface system would include:

- A designated subsurface irrigation area.
- Irrigation area to contain suitable vegetation to assist effluent disposal through evapotranspiration.
- The positioning of the disposal area is to comply with the requirements of Kempsey Shire Council.
- The installation of the irrigation area is to comply with the Kempsey Shire councils technical standards.
- The design and construction of subsurface irrigation areas is to comply with Appendix M of Australian Standard 1547 – 2012.

An example of layout components subsurface irrigation is shown in **Appendix 4**.

All irrigation systems shall be designed to ensure that effluent is not applied at rates which exceed the absorption capacity of the soil. Care shall be taken to ensure that the application rate does not lead to:

a) Adverse effects on soil properties and plant growth through excess salt accumulation in the root zone during extended dry periods;
b) Harmful long term environmental effects to the soil of the land application system or

the adjacent surface water and ground water; or

c) Increased risk to public health from surface ponding in the land application area or channelling or seepage beyond the land application area.

All irrigation systems shall be designed to promote evapotranspiration. The irrigation area is to be planted with suitable vegetation (shrubs or lawns) to assist in nutrient uptake and improve effluent disposal through evapotranspiration. Care shall be taken to ensure that the irrigation is well planted with plant species that are:

- Water tolerant;
- Appropriate for site conditions; and
- Planted at an appropriate density for evapotranspiration.

All stormwater is to be directed away from the disposal area. This includes the stormwater from any proposed dwelling and any ground water run-off.

8.2.2 ***Surface Irrigation Systems (Secondary Treatment)***

(ii) Surface Irrigation Area Required

- **For 5 persons (3 bedroom dwelling) a minimum irrigation of 267m² is required for surface irrigation. Design calculations are presented in** Appendix 3 **of this report.**
- **For 7 persons (5 bedroom dwelling) a minimum irrigation of 373m² is required for surface irrigation. Design calculations are presented in** Appendix 3 **of this report.**

These areas are based on a DIR of 18mm per week.

An above the ground system would need to be constructed.

The irrigation area is to be planted with suitable vegetation (shrubs or lawns) to assist in nutrient uptake and improve effluent disposal through evapotranspiration.

All storm water is to be directed away from the disposal area. This includes the stormwater from any proposed dwelling and any ground water run-off.

The irrigation area sizing is based on hydraulic loading without consideration of a nutrient balance calculation.

It is considered nutrient build up in soil within the effluent disposal area will be minimised due to the natural filtration process that occurs in clay soils. Plantings in the irrigation area will also help with the nutrient uptake.

Surface Irrigation Area

Components of this system would include:

- A designated surface irrigation area.
- Irrigation area to contain suitable vegetation to assist effluent disposal through evapotranspiration.
- The positioning of the disposal area is to comply with the requirements of Kempsey Shire Council.
- The installation of the irrigation area is to comply with the Kempsey Shire Councils technical standards.

- The design and construction of surface irrigation areas is to comply with Appendix M of Australian Standard 1547 – 2012.
- The proposed irrigation area is to be benched to ensure a slope of less than 10%. A stormwater diversion system needs to be installed to divert stormwater from irrigation area.
- Sprinklers are to be evenly distributed throughout the irrigation area.
- The main irrigation line is to be buried.
- Irrigation area to have boundaries clearly delineated by appropriate vegetation or other types of borders.
- Storm water is to be diverted away from the irrigation area.
- The positioning of the irrigation area is to be determined on site.

An example of layout components surface irrigation is shown in **Appendix 5**.

Spray-irrigation systems shall:

a) Distribute the effluent evenly in the designated area;

b) Control the droplet size, throw and plum height of the sprinkler system so that the risk of aerosol dispersion and likelihood of wind drift distributing any effluent beyond the designated area is negligible.

c) Have warnings, complying with AS 1319 or NZS/AS 1319, at the boundaries of the designated area in at least two places, clearly visible to property users, with wording such as 'Recycled Water - Avoid Contact - DOT NOT DRINK';

d) Meet the application disinfection criteria, see 5.4.2.5.1; and

e) Be provided with buffer area to ensure that any potential spray drift is absorbed within the appropriate setback distances.

f) The main irrigation line is to be buried.

Improvement of the soil within the irrigation area is to be carried out to ensure no run-off. The soil should be rotary hoed or ripped and lime or gypsum added, (at a rate of 200g/m^2).

This will also raise the pH and improve the emersion class rating. The provision of garden beds, benched areas and importing absorbent soils may to be required to ensure that any run-off is in accordance with Appendix M of Australian Standard 1547 – 2012.

8.2.3 *ETA Beds (Secondary Treatment)*

(iii) Evapo-Transpiration Bed Area Required

- **For 5 persons (3 bedroom dwelling) a minimum evapo-transpiration bed of 53m long by 1m wide is required (3 beds x 18m); design calculations are presented in** Appendix 6 **of this report.**
- **For 7 persons (5 bedroom dwelling) a minimum evapo-transpiration bed of 74m long by 1m wide is required (3 beds x 25m); design calculations are presented in** Appendix 6 **of this report.**

These areas are based on a DLR of 9mm per week.

The evapo-transpiration beds are required to be constructed in accordance with Appendix L of AS/NZS 1547 – 2012 (Figure L6 see **Appendix 7**). It is noted that an individual evapo-transpiration bed is not to exceed 25m in length and the beds are to be positioned 90 degrees

to the slope of the land.

The trenches are to be evenly dosed and this is normally completed by way of a distribution box.

All storm water is to be directed away from the disposal area. This includes the stormwater from any proposed dwellings, subdivision and existing dwelling and any ground water run-off.

Construction Techniques

The following techniques shall be observed so as to minimise the risk of damage to the soil:

a. Plan to excavate only when the weather is fine;

b. Avoid excavation when the soil has moisture content above the plastic limit. This can be tested by seeing if the soil forms a wire when rolled between the palms;

c. During wet seasons or when construction cannot be delayed until the weather becomes fine ,smeared soil surfaces may be raked to reinstate a more natural soil surface, taking care to use fine tines and only at the surface.

d. When excavating by machine, fit the bucket with ‘’raker teeth ‘if possible, and excavate in small ‘bites’ to minimise compaction; and

e. Avoid compaction by keeping people off the finished trench or bed floor.

In particular for beds:

a) If rain is forecast then cover any open trenches, to protect them from rain damage;

b) Excavate perpendicular to the line of fall or parallel to the contour of sloping ground; and

c) Ensure that the inverts are horizontal.

d) During construction gypsum shall be applied at 1 kg/m2 to the base of the trench or bed to prevent the clay dispersing. The trench shall be closed in, as soon as possible to protect the gypsum from raindrop impact.

8.3 Buffer Distances

It is recommended that the buffer distances be provided in accordance with the following table:

The irrigation area is to be kept at a minimum distance of 6m up gradient and 3m down gradient from the property boundaries, and 15m away from the dwelling with the spray irrigation.

Evapotranspiration beds are to be kept at a minimum distance of 12m up gradient and 6m down gradient from the property boundaries.

The disposal area is to be located at least 40m from any dams and drainage channels.

Table 6: Recommended Buffer Distances for Onsite Sewage Management

SYSTEM	BUFFER DISTANCES
All Systems	• 100m to permanent surface waters (rivers, creeks, lakes etc.). • 250m to domestic ground water supplies • 40m to other waters (farm dams, intermittent creeks/drainage depressions, drainage channels etc.)
Surface Spray Irrigation Systems	• 6m between irrigation area and property boundaries/driveways if area up gradient and 3m if down gradient • 15m to dwellings or other buildings • 3m to paths and walkways • 6m to swimming pools
Surface Drip/Trickle Irrigation Systems Shallow Subsurface Irrigation Systems	• 6m between irrigation area and property boundaries/driveways, swimming pools, dwellings and buildings if area up gradient and 3m if down gradient
Absorption Trenches and Evapotranspiration/ Absorption Systems	• 12m if the disposal area is upslope of property boundaries • 6m if the disposal area is down slope of property boundaries • 6m between disposal area and swimming pools, sheds dwellings driveways if disposal area is upslope • 3m between disposal area and swimming pools, sheds dwellings driveways if disposal area is down slope

The attached subdivision and constraints layout (**Appendix 1**) considers the setbacks from gullies, from boundaries and building envelopes.

8.4 Reserve Area

Over time the operation and performance of disposal area can become compromised by the effects of wastewater on the soil characteristics within the disposal area.
In accordance with AS 1547-2012 a reserve area of 100% of the design area shall be available on site. As stated above the effluent envelopes are between 800m² and 900m².

8.5 Mitigation Measures

The following mitigation measure is necessary to ensure the sustainability of the recommended onsite sewage management system:

- Installation of up-slope surface water (and subsurface) drainage to divert run-on and seepage water from the land application area. The diversion system is to be designed and constructed in accordance with the technical requirements of Kempsey Shire Council.
- Irrigation areas are to be planted with suitable vegetation to assist in nutrient uptake and improve effluent disposal through evapo-transpiration.
- The soils within the effluent disposal area are to be rotary hoed or ripped to a depth of 200mm to improve moisture retention.

- During construction of ETA beds gypsum shall be applied at 1 kg/m2 to the base of the trench or bed to prevent the clay dispersing. The trench shall be closed in, as soon as possible to protect the gypsum from raindrop impact.
- Where ETA beds are to be placed on slopes over 10% a careful assessment of the lot, soil conditions and contaminant pathways is to be completed.
- The positioning of the disposal area is to comply with the requirements of Kempsey Shire Council.

9.0 Flooding

The 1 in 100 year flood line is shown on the subdivision layout (**Appendix 1**).

10.0 Recommendations

With the introduction of the new system the following recommendations should be implemented:

- Be water wise.
- Use low sodium washing detergents.
- Use 'septic friendly' cleaning agents.

11.0 Conclusion

The site and soil characteristics of the allotment are suitable for the use of the onsite sewage management systems identified in this report.

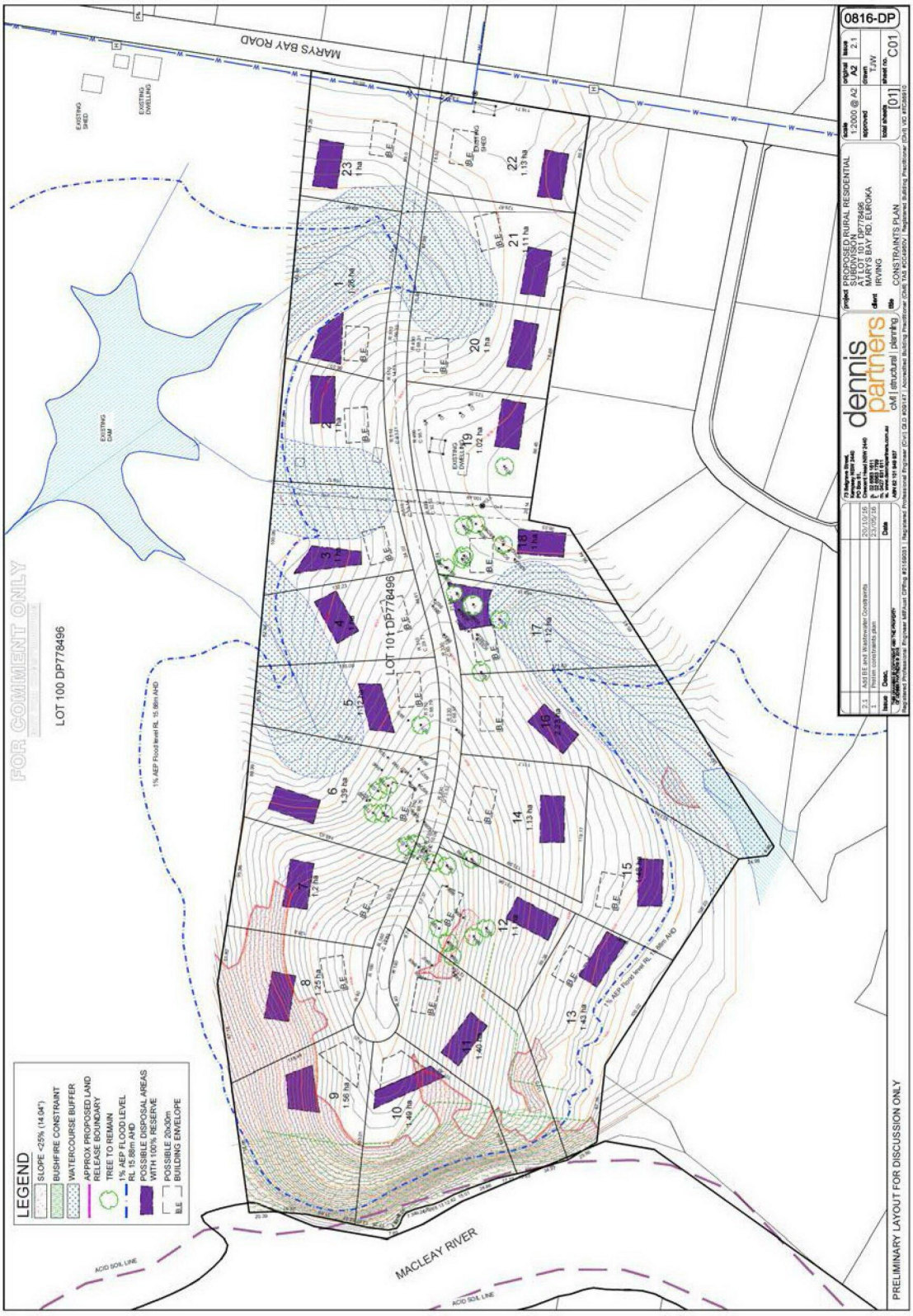
In this regard the mitigation measures outlined in Section 8.5 of this report must be implemented in respect of the system utilized.

It must however be recognized that the sustainable disposal of effluent is heavily reliant upon the correct installation of onsite sewage management systems coupled with ongoing appropriate and regular maintenance if satisfactory environmental health outcomes are obtained and maintained into the future.

Regards

Tim Mecham
Midcoast Building and Environmental

APPENDIX 1 – Subdivision plan



APPENDIX 2 - Soil Profile Descriptions

Test Pit 1 – Representative of Area A

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	ECe	Salinity
A	0mm-350mm	sub-angular blocky	6.6	3	0.01	Low
B	350mm-600mm	sub-angular blocky	6.5	2	0.00	Low
C	600mm-1200mm	sub-angular blocky	6.4	2	0.00	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Clay Loam	25-35%	<20%	Very dark grey	5yr 3/1
B	Light clay	35-45%	<20%	Dark reddish grey	5yr 4/2
C	Medium/heavy clay	+50%	<20%	Yellowish red	5yr 5/6

Test Pit 8 - Representative of Area B

Sample	Test hole layer	Ped Structure	pH (1:5) soil/water	Emerson Class	ECe	Salinity
A	0mm-300mm	sub-angular blocky	5.4	3	0.01	Low
B	300mm-500mm	sub-angular blocky	5.4	2	0.00	Low
C	500mm-1000mm Refusal	sub-angular blocky	5.3	2	0.00	Low

Sample	Texture class	Approximate % of clay	Course Fragments %	Soil Colour	Munsel Colour
A	Clay Loam	25-35%	<20%	Very dark grey	5yr 3/1
B	Light clay	35-45%	<20%	Dark reddish grey	5yr 4/2
C	Medium/heavy clay	+50%	<20%	Yellowish red	5yr 5/6

APPENDIX 3 – Subsurface/surface irrigation areas

3 Bedrooms Calculations

Minimum Area Method Water Balance and Wet Weather Storage Calculations (Kempsey)

Design Wastewater Flow (Q):	l/day	750
Design Percolation Rate (R):	mm/wk	18

Sub-Surface Irrigation Area from a Secondary Treatment System
Design Irrigation Rate 18

Parameters					Outputs			Inputs					
Month	Days (D)	Precipitation (P)	Evaporation (E)	Crop factor (C)	Evapotranspiration (ET)	Percolation (B)	Total Outputs (ET+B)	Retained Precipitation P=1	Possible Effluent Irrigation (W)	Actual Effluent Production (I)	Inputs	Storage (S)	Cumulative Storage (M)
	days	mm/month	mm/month	-	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm
Jan	31	128.9	189.0	0.75	141.75	79.71	221.46	128.9	92.56	84.48	213.38	-8.09	0.00
Feb	28	170.7	154.0	0.75	115.5	72.00	187.50	170.7	16.80	84.48	255.18	67.68	67.68
Mar	31	145.1	147.0	0.75	110.25	79.71	189.96	145.1	44.86	84.48	229.58	39.61	107.29
Apr	30	79.2	111.0	0.75	83.25	77.14	160.39	79.2	81.19	84.48	163.68	3.28	110.57
May	31	75.3	98.0	0.75	73.5	79.71	153.21	75.3	77.91	84.48	159.78	6.56	117.14
Jun	30	106.0	70.0	0.75	52.5	77.14	129.64	106	23.64	84.48	190.48	60.83	177.97
Jul	31	23.1	73.0	0.75	54.75	79.71	134.46	23.1	111.36	84.48	107.58	-26.89	151.08
Aug	31	52.5	98.0	0.75	73.5	79.71	153.21	52.5	100.71	84.48	136.98	-16.24	134.84
Sep	30	45.0	129.0	0.75	96.75	77.14	173.89	45	128.89	84.48	129.48	-44.42	90.43
Oct	31	75.0	160.0	0.75	120	79.71	199.71	75	124.71	84.48	159.48	-40.24	50.19
Nov	30	115.3	173.0	0.75	129.75	77.14	206.89	115.3	91.59	84.48	199.78	-7.12	43.07
Dec	31	106.5	195.0	0.75	146.25	79.71	225.96	106.5	119.46	84.48	190.98	-34.99	8.09
Total	365	1122.6	1597		1197.75	938.57	2136.32	1122.6	1013.72	1013.72	2136.32	-	-

Irrigation Area (L) m2 **266.35**

Storage (V) **largest M mm** **177.97**
(VxL)/1000 m3 **47.40**

RAINFALL BOM Kempsey
EVAPORATION BOM

C=0.75
P (r) = 1.0

5 Bedrooms Calculations

Minimum Area Method Water Balance and Wet Weather Storage Calculations (Kempsey)

Design Wastewater Flow (Q):	l/day	1050
Design Percolation Rate (R):	mm/wk	18

Sub-Surface Irrigation Area from a Secondary Treatment System
Design Irrigation Rate 18

Parameters					Outputs			Inputs					
Month	Days (D)	Precipitation (P)	Evaporation (E)	Crop factor (C)	Evapotranspiration (ET)	Percolation (B)	Total Outputs (ET+B)	Retained Precipitation P=1	Possible Effluent Irrigation (W)	Actual Effluent Production (I)	Inputs	Storage (S)	Cumulative Storage (M)
	days	mm/month	mm/month	-	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm/month	mm
Jan	31	128.9	189.0	0.75	141.75	79.71	221.46	128.9	92.56	84.48	213.38	-8.09	0.00
Feb	28	170.7	154.0	0.75	115.5	72.00	187.50	170.7	16.80	84.48	255.18	67.68	67.68
Mar	31	145.1	147.0	0.75	110.25	79.71	189.96	145.1	44.86	84.48	229.58	39.61	107.29
Apr	30	79.2	111.0	0.75	83.25	77.14	160.39	79.2	81.19	84.48	163.68	3.28	110.57
May	31	75.3	98.0	0.75	73.5	79.71	153.21	75.3	77.91	84.48	159.78	6.56	117.14
Jun	30	106.0	70.0	0.75	52.5	77.14	129.64	106	23.64	84.48	190.48	60.83	177.97
Jul	31	23.1	73.0	0.75	54.75	79.71	134.46	23.1	111.36	84.48	107.58	-26.89	151.08
Aug	31	52.5	98.0	0.75	73.5	79.71	153.21	52.5	100.71	84.48	136.98	-16.24	134.84
Sep	30	45.0	129.0	0.75	96.75	77.14	173.89	45	128.89	84.48	129.48	-44.42	90.43
Oct	31	75.0	160.0	0.75	120	79.71	199.71	75	124.71	84.48	159.48	-40.24	50.19
Nov	30	115.3	173.0	0.75	129.75	77.14	206.89	115.3	91.59	84.48	199.78	-7.12	43.07
Dec	31	106.5	195.0	0.75	146.25	79.71	225.96	106.5	119.46	84.48	190.98	-34.99	8.09
Total	365	1122.6	1597		1197.75	938.57	2136.32	1122.6	1013.72	1013.72	2136.32	-	-

Irrigation Area (L) m2 **372.88**

Storage (V) **largest M mm** **177.97**
(VxL)/1000 m3 **66.36**

RAINFALL BOM Kempsey
EVAPORATION BOM

C=0.75
P (r) = 1.0

APPENDIX 4 - Subsurface Irrigation Example of Layout Components

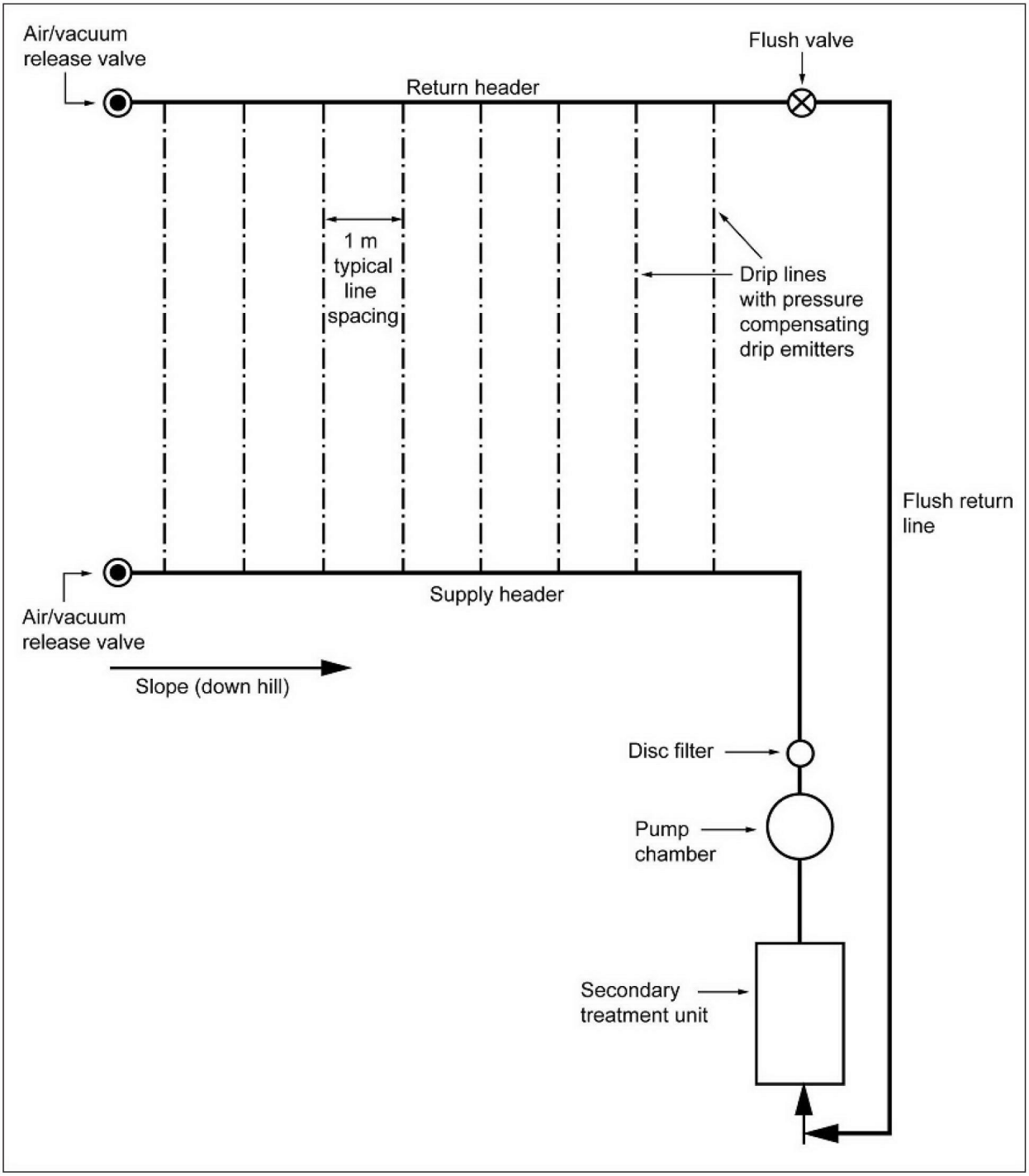


FIGURE M1 DRIP IRRIGATION SYSTEM – EXAMPLE LAYOUT OF COMPONENTS

APPENDIX 5 - Surface Irrigation Example of Layout Components

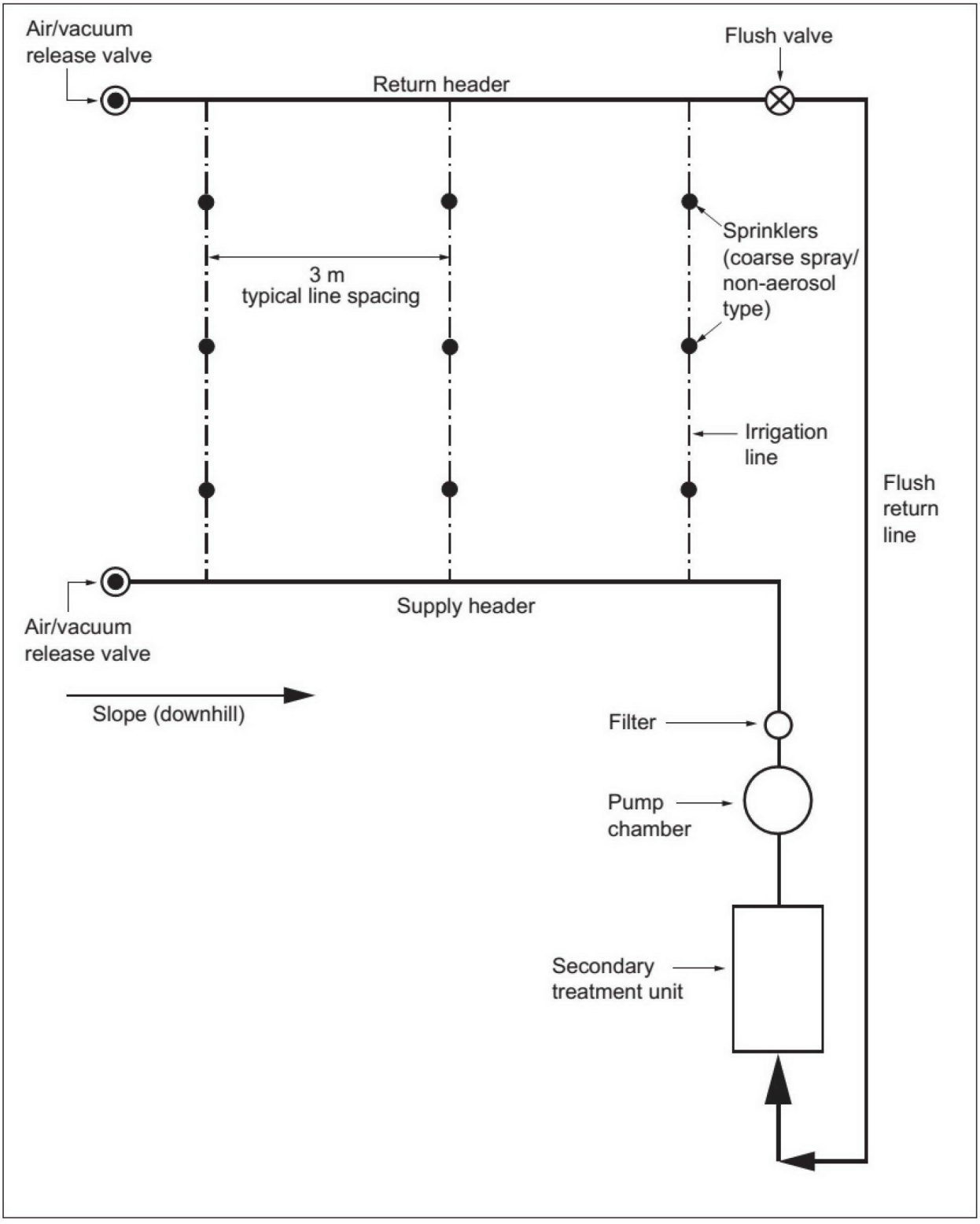


FIGURE M2 SPRAY IRRIGATION SYSTEM – EXAMPLE LAYOUT OF COMPONENTS

APPENDIX 6 - Evapo-Transpiration Bed/Trench System Calculation

3 Bedrooms Calculations

Evapotranspiration-absorption Area Calculation

Daily Flow	750	Enter daily vol and calc appears in (8)	DLR	9		
Size of Area for Each Month			Enter daily vol and calc appears in (4)			

(1) Month	(2) Pan Evaporation E mm	(3) Evapotranspiration ET (ET=0.75 E) mm	(4) Rainfall R mm	(5) Retained Rainfall Rr (Rr=0.75 R) mm	(6) LTAR per Month mm	(7) Disposal Rate per Month (3)-(5)+(6) mm	(8) Effluent Applied per month L	(9) Size of Area (8)/(7) m2	
January	189.0	141.75	128.9	96.675	279	324.075	23250	71.74265	
February	154.0	115.5	170.7	128.025	252	239.475	21000	87.69183	
March	147.0	110.25	145.1	108.825	279	280.425	23250	82.90987	
April	111.0	83.25	79.2	59.4	270	293.85	22500	76.56968	
May	98.0	73.5	75.3	56.475	279	296.025	23250	78.54066	
June	70.0	52.5	106	79.5	270	243	22500	92.59259	76.02643
July	73.0	54.75	23.1	17.325	279	316.425	23250	73.47713	
August	98.0	73.5	52.5	39.375	279	313.125	23250	74.2515	
September	129.0	96.75	45	33.75	270	333	22500	67.56757	
October	160.0	120	75	56.25	279	342.75	23250	67.8337	
November	173.0	129.75	115.3	86.475	270	313.275	22500	71.82188	
December	195.0	146.25	106.5	79.875	279	345.375	23250	67.31813	

Depth of Stored Effluent

(1) Month	(2) Trial Area m2	(3) Application Rate (8)*/(2) mm	(4) Disposal Rate per Month mm	(5) (3)-(4) mm	(6) Increase in Depth of Stored Effluent (5)/n (n=0.3) mm	(7) Depth of Effluent for Month (x-1) mm	(7) Increase in Depth of Effluent + 6 mm	(7) Computed Depth of Effluent for Month (x) mm
December	76.02643							
	76.02643							
January	76.02643	305.8147	324.075	-18.2603	-60.8677	0	-60.8677	-60.8677
February	76.02643	276.2197	239.475	36.74472	122.4824	-60.8677	122.4824	61.61472
March	76.02643	305.8147	280.425	25.38969	84.63231	61.61472	84.63231	146.247
April	76.02643	295.9497	293.85	2.099703	6.999009	146.247	6.999009	153.246
May	76.02643	305.8147	296.025	9.789693	32.63231	153.246	32.63231	185.8783
June	76.02643	295.9497	243	52.9497	176.499	185.8783	176.499	362.3774
July	76.02643	305.8147	316.425	-10.6103	-35.3677	362.3774	-35.3677	327.0097
August	76.02643	305.8147	313.125	-7.31031	-24.3677	327.0097	-24.3677	302.642
September	76.02643	295.9497	333	-37.0503	-123.501	302.642	-123.501	179.141
October	76.02643	305.8147	342.75	-36.9353	-123.118	179.141	-123.118	56.02329
November	76.02643	295.9497	313.275	-17.3253	-57.751	56.02329	-57.751	-1.7277
December	76.02643	305.8147	345.375	-39.5603	-131.868	-1.7277	-131.868	-133.595
								362.3774

Trench length	L= A/B					
	A=	76.02643				
	B =	1.45		**Rainfall BOM**	Kempsey	
				Evaporation BOM		
Trench Length	=	**52.43**	**m**			
Trench Width	=	**1m**				
Trench Depth	=	**500mm**				
Depth of Aggregate	=	**450mm**				

5 Bedrooms Calculations

Evapotranspiration-absorption Area Calculation

	Daily Flow	1050	Enter daily vol and calc appears in (8)			DLR	9		
Size of Area for Each Month						Enter daily vol and calc appears in (4)			
(1) Month	**(2) Pan Evaporation E mm**	**(3) Evapotranspiration ET (ET=0.75 E) mm**	**(4) Rainfall R mm**	**(5) Retained Rainfall Rr (Rr=0.75 R) mm**	**(6) LTAR per Month mm**	**(7) Disposal Rate per Month (3)-(5)+(6) mm**	**(8) Effluent Applied per month L**	**(9) Size of Area (8)/(7) m2**	
January	189.0	141.75	128.9	96.675	279	324.075	32550	100.4397	
February	154.0	115.5	170.7	128.025	252	239.475	29400	122.7686	
March	147.0	110.25	145.1	108.825	279	280.425	32550	116.0738	
April	111.0	83.25	79.2	59.4	270	293.85	31500	107.1975	
May	98.0	73.5	75.3	56.475	279	296.025	32550	109.9569	
June	70.0	52.5	106	79.5	270	243	31500	129.6296	106.437
July	73.0	54.75	23.1	17.325	279	316.425	32550	102.868	
August	98.0	73.5	52.5	39.375	279	313.125	32550	103.9521	
September	129.0	96.75	45	33.75	270	333	31500	94.59459	
October	160.0	120	75	56.25	279	342.75	32550	94.96718	
November	173.0	129.75	115.3	86.475	270	313.275	31500	100.5506	
December	195.0	146.25	106.5	79.875	279	345.375	32550	94.24539	

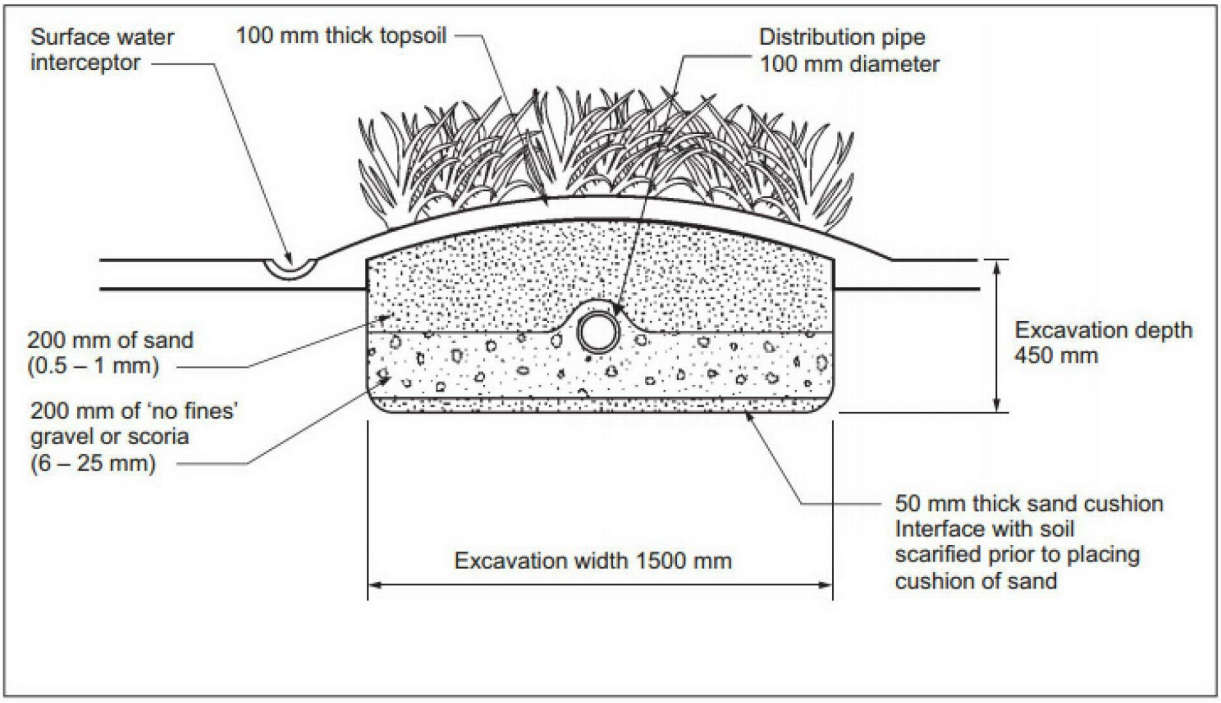
Depth of Stored Effluent

(1) Month	**(2) Trial Area m2**	**(3) Application Rate (8)*/(2) mm**	**(4) Disposal Rate per Month mm**	**(5) (3)-(4) mm**	**(6) Increase in Depth of Stored Effluent (5)/n (n=0.3) mm**	**(7) Depth of Effluent for Month (x-1) mm**	**(7) Increase in Depth of Effluent + 6 mm**	**(7) Computed Depth of Effluent for Month (x) mm**
December	106.437							
	106.437							
January	106.437	305.8147	324.075	-18.2603	-60.8677	0	-60.8677	-60.8677
February	106.437	276.2197	239.475	36.74472	122.4824	-60.8677	122.4824	61.61472
March	106.437	305.8147	280.425	25.38969	84.63231	61.61472	84.63231	146.247
April	106.437	295.9497	293.85	2.099703	6.999009	146.247	6.999009	153.246
May	106.437	305.8147	296.025	9.789693	32.63231	153.246	32.63231	185.8783
June	106.437	295.9497	243	52.9497	176.499	185.8783	176.499	362.3774
July	106.437	305.8147	316.425	-10.6103	-35.3677	362.3774	-35.3677	327.0097
August	106.437	305.8147	313.125	-7.31031	-24.3677	327.0097	-24.3677	302.642
September	106.437	295.9497	333	-37.0503	-123.501	302.642	-123.501	179.141
October	106.437	305.8147	342.75	-36.9353	-123.118	179.141	-123.118	56.02329
November	106.437	295.9497	313.275	-17.3253	-57.751	56.02329	-57.751	-1.7277
December	106.437	305.8147	345.375	-39.5603	-131.868	-1.7277	-131.868	-133.595
								362.3774

Trench length	L= A/B				
	A=	106.437			
	B =	1.45	**Rainfall BOM**	Kempsey	
			Evaporation BOM		
Trench Length	=	**73.40**	**m**		
Trench Width	=	**1m**			
Trench Depth	=	**500mm**			
Depth of Aggregate	=	**450mm**			

APPENDIX 7 - Evapo-Transpiration Bed Specifications

AS/NZS 1547:2012 154



NOTE: An LPED line can be used to dose load the ETA/ETS bed.

FIGURE L6 ETA/ETS BED DETAILS

20th October 2016

General Manager
Kempsey Shire Council
PO Box 78
West Kempsey NSW 2440

Attention: Bill Larkin

Dear Bill

Re: Acid Sulphate Soil Testing
262 Marys Bay Road Euroka

I refer to the above and to the application for the proposed rezoning and subdivision at the above lot.

A copy of the most recent constraints plan can be seen in **Appendix 1**.

An investigation into the risk of exposing acid sulphate soils was completed for the lot with samples being submitted to the Environmental Analysis Laboratory (Division of Southern Cross University) for analysis.

In consideration of the Local Environmental Plan, the Development Control Plans, specifically DCP30, it was ascertained that the site was found to be located in accordance with the Class nominated below:

Nominated Class	Details
Class 5	Works where the water table is likely to be lowered to below 1m AHD in adjacent Class 1, 2 and 3 or 4

The soil samples were taken in the lower areas of the lot as detailed in the attached plan showing locations (**Appendix 2**). The samples were also taken at the depth of 300mm.

As can be seen in the attached lot layout (**Appendix 1**) the proposed dwelling site is significantly higher than the sampling areas.

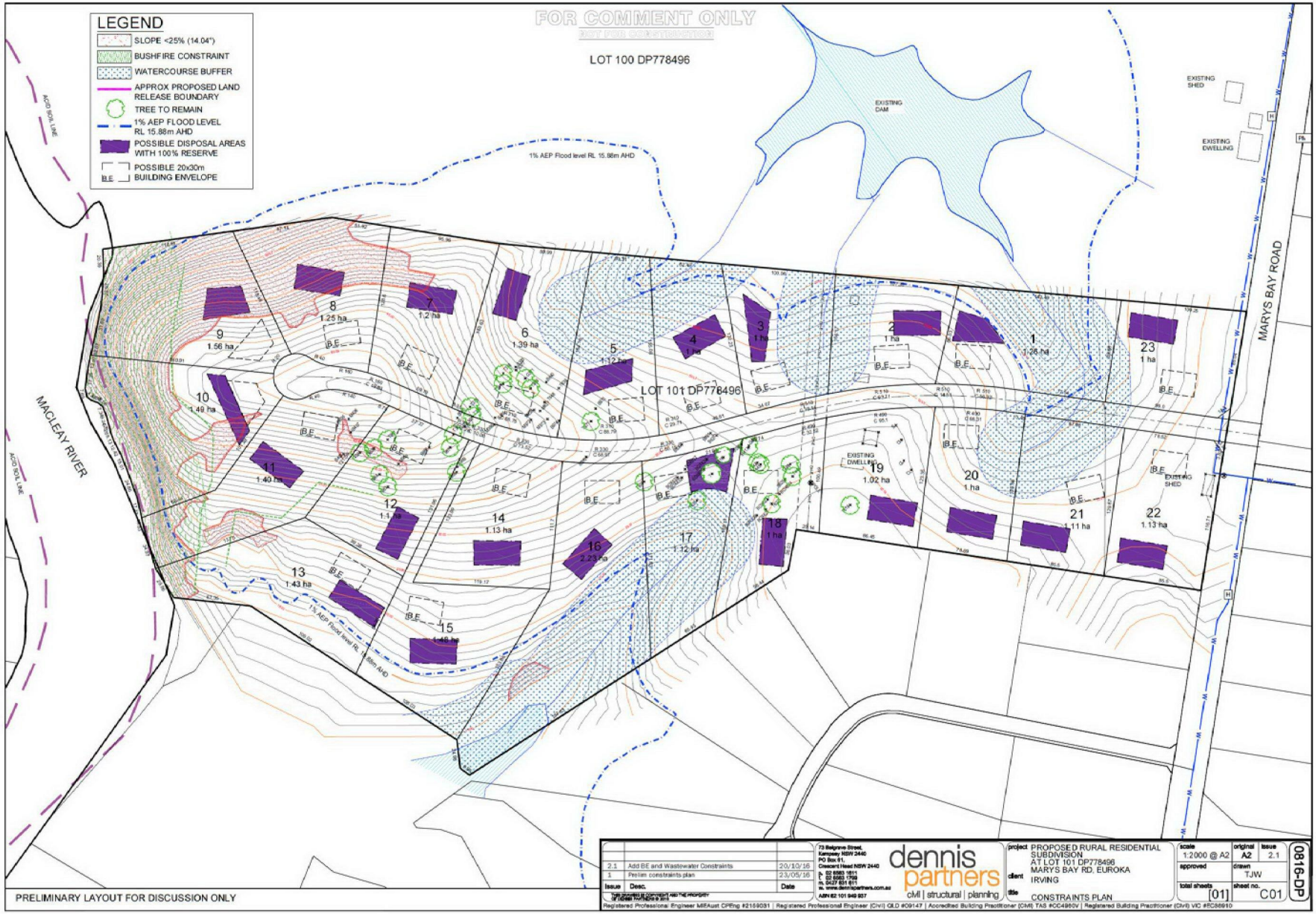
The results of the samples are attached in **Appendix 3** and if any further information is required you are requested to contact the writer.

Yours faithfully

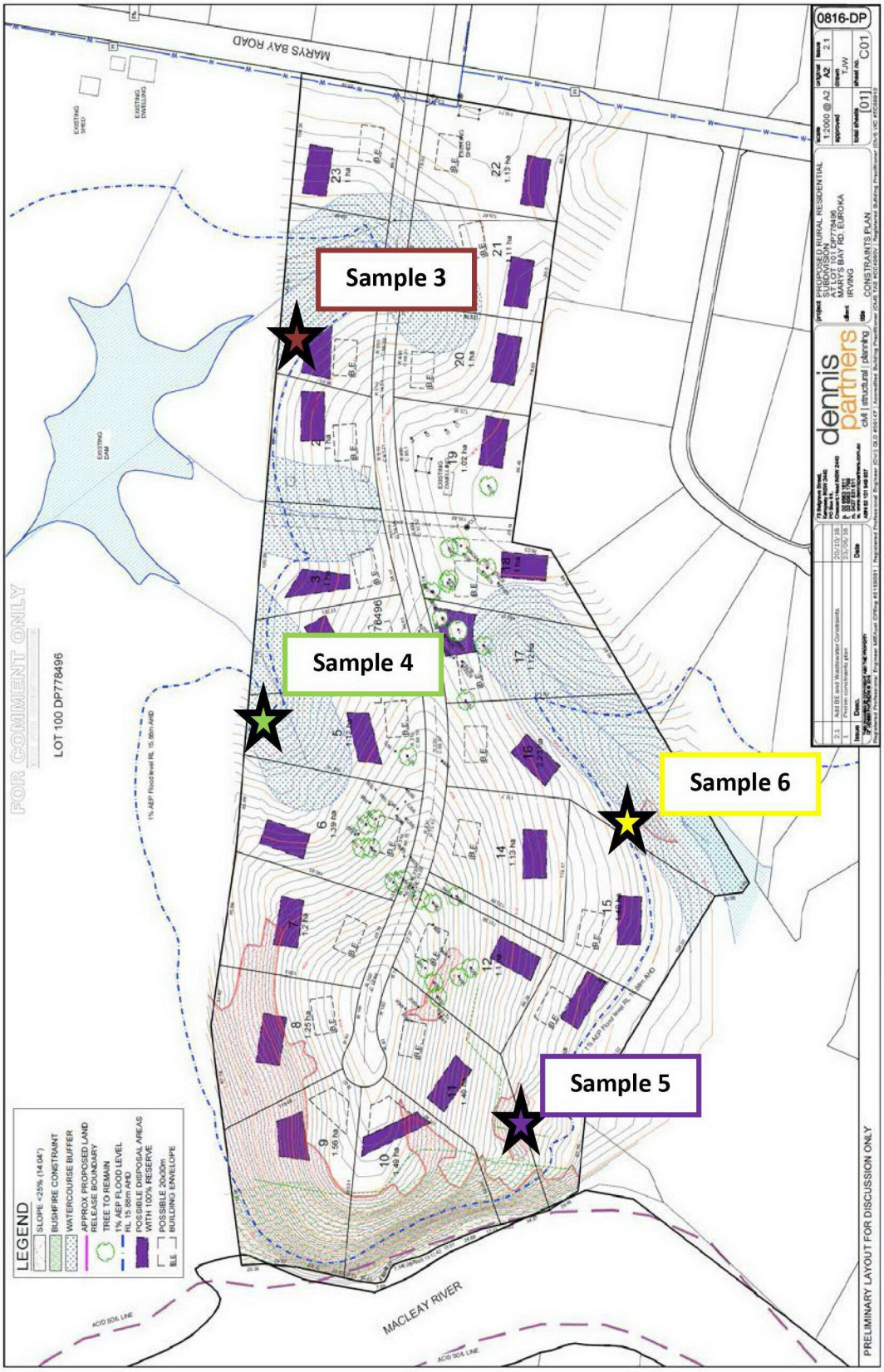
Tim Mecham MAIBS MAIEH
Midcoast Building and Environmental

41 Belgrave Street, Kempsey NSW 2440 – PO Box 353 Kempsey NSW 2440 – phone 0265631292 – fax 0265624851 – ABN 32098436812

Appendix 1 – Constraints Plan



Appendix 2 – Soil Samples



RESULTS OF ACID SULFATE SOIL ANALYSIS

6 samples supplied by Midcoast Building and Environmental on 7th July, 2016 - Lab. Job No. F1604
Analysis requested by Tim Mecham. **Your Project: Acid Sulfate**

(PO Box 353 KEMPSEY NSW 2440)

Required if pH_{KCL} <4.5

Sample Site	EAL lab code	MOISTURE CONTENT (% moisture of total wet weight)	MOISTURE CONTENT (g moisture / g of oven dry soil)	TITRATABLE ACTUAL ACIDITY (TAA) pH_{KCl}	TITRATABLE ACTUAL ACIDITY (TAA) (To pH 6.5) (mole H^+/tonne)	Extractable sulfate sulfur $\%S_{KCl}$	Extractable sulfate sulfur (equivalent mole H+/tonne)	REDUCED INORGANIC SULFUR (% chromium reducible S) (%Scr)	REDUCED INORGANIC SULFUR (% chromium reducible S) (mole H^+/tonne)	RETAINED ACIDITY (HCL extract) (as $\%S_{HCL}$ - $\%S_{KCl}$) ($\%S_{NAS}$)	RETAINED ACIDITY S_{NAS} (mole H^+/tonne)	NET ACIDITY Chromium Suite mole H^+/tonne (based on %Scrs)	LIME CALCULATION Chromium Suite kg $CaCO_3$/tonne DW (includes 1.5 safety Factor when liming rate is +ve)
Method Info.		**		*(ACTUAL ACIDITY-Method 23)*				*(POTENTIAL ACIDITY-Method 22B)*		*(RETAINED ACIDITY)*		** *& note 5*	** *& note 4 and 6*
Sample 1	*F1604/1*	26.3	0.36	5.00	33	0.000	..	0.005	3	..	..	36	3
Sample 2	*F1604/2*	35.4	0.55	5.14	37	0.000	..	0.007	4	..	..	41	3
Sample 3	*F1604/3*	26.5	0.36	4.30	93	0.002	1	0.007	4	0.004	2	99	7
Sample 4	*F1604/4*	24.2	0.32	4.42	58	0.001	1	0.007	4	0.003	1	64	5
Sample 5	*F1604/5*	24.9	0.33	4.36	103	0.001	0	0.006	4	0.005	2	109	8
Sample 6	*F1604/6*	27.8	0.39	4.35	98	0.002	1	0.006	4	0.003	2	103	8

NOTE:

1 - All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)
2 - Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)
3 - Methods from Ahern, CR, McElnea AE , Sullivan LA (2004). ***Acid Sulfate Soils Laboratory Methods Guidelines*** . QLD DNRME.
4 - Bulk Density is required for liming rate calculations per soil volume. Lab. Bulk Density is no longer applicable - field bulk density rings can be used and dried/ weighed in the laboratory.
5 - **ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF (with FF currently defaulted to 1.5)**
6 - The neutralising requirement, lime calculation, includes a 1.5 safety margin for acid neutralisation (an increased safety factor may be required in some cases)
7 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
8 - .. denotes not requested or required. '0' is used for ANC and Snag calcs if TAA pH <6.5 or >4.5
9 - SCREENING, CRS, TAA and ANC are NATA accredited but other SPOCAS segments are currently not NATA accredited
10- Results at or below detection limits are replaced with '0' for calculation purposes.
11 - Projects that disturb >1000 tonnes of soil, the ≥0.03% S classification guideline would apply (refer to acid sulfate management guidelines).
12 - Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
13 ** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available

(NOTE: negative Net Acidity indicate excess acid neutralising capacity)

NATA
Accreditation No. 14960.
Accredited for compliance with ISO/IEC 17025.

(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H^+/t; medium Scr≥0.06%S or 37mole H^+/t; fine Scr≥0.1%S or 62mole H^+/t) - as per QUASSIT Guidelines

checked: .....
Graham Lancaster
Laboratory Manager

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal