

University of Southern Queensland
FACULTY OF ENGINEERING AND SURVEYING

Defining Non-Tidal Riparian Boundaries

A dissertation submitted by

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ABSTRACT

The boundary between land and water is one of the most difficult of all boundaries to re-define. The changing nature of watercourse systems poses major problems and surveyors currently have limited guidelines to assist in the process of selecting an appropriate natural feature to use for a boundary alignment.

This project has been undertaken to address uncertainty in Queensland legislation with regard to non-tidal riparian boundaries. The current approach regarding the boundary between land and non-tidal water is defined by the term - *bed and banks*. The methods adopted by surveyors in determining a natural feature are drawn upon using their experience alone rather than a combination of experience and theoretical knowledge in solving this problem

Addressing short falls in bed and bank descriptions has allowed a greater understanding of these types of boundaries.

The formulation of principals and standards of the definition process has enabled thorough guidelines to be developed. The project addresses key topics of riparian boundary reinstatement by:

- Identification of the needs of society for riparian boundaries and the key principles essential to meeting those needs
- Develop a set of standards to address these key principals, and
- Develop a guideline to aid surveyors in an appropriate definition process.

These developments have enabled a transparent approach to be achieved with the relationship between the surveyor and regulation.

The current system of reporting outlined in the *Cadastral Survey Requirements*, compromises the ability of the system to cater for society's needs. A guideline for the surveyor to refer to when determining an appropriate natural feature to locate would be an invaluable resource. This reference tool would potentially address a deficiency in the current system thereby satisfying the greater community.

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CERTIFICATION

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I further certify that the work is original and has not been previously submitted for assessment in any other course or institution, except where specifically stated.

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Chapter 1

1.0 Introduction

1.1 Project Aim

The aim of this report is to develop a guideline to aid the field surveyor in determining the appropriate natural feature to adopt when defining a non-tidal riparian boundary.

1.2 Background

There is uncertainty in the current Queensland legislation with regard to non-tidal riparian boundaries. The present approach regarding the boundary between land and non-tidal water is defined by the term - bed and banks. The method adopted by surveyors when determining a natural feature is to use their practical experience alone rather than a combination of experience and theoretical knowledge. There is a long history behind the lack of information available to surveyors.

Australian law was introduced by the English upon settlement and thus reflected the situation in England. Over time the extreme Australian climate became apparent, which differed greatly from England and it was realized that some legislation was no longer appropriate.

In 1910 parliament introduced changes to legislation involving the alignment of riparian boundaries. The lack of insight by the parliament to acknowledge future dealings of property development and the value of land has created uncertainty in the direction given to surveyors by governing authorities.

This project seeks to provide society with more detailed information on non-tidal riparian boundary definition. The separation of tidal and non-tidal boundaries is important, as the definition processes are somewhat different. It is not the intention of this project to address tidal riparian boundary definition as that has been previously documented.

1.3 Critical Objectives

Addressing short falls in bed and bank descriptions will allow better understanding of non-tidal riparian boundaries. Research into legislation, legislation from other jurisdictions, existing issues in Queensland, and physical characteristics of riparian zones will achieve the best results.

1.3.1 Analysis of Legislation

Critical analysis of current and repealed legislation on non-tidal riparian boundary definition is required to determine where the deficiency lies prior to guidelines being developed. The current legislation is described in the Water Act 2000 (Qld), defines the bed and bank but fails to advise on an appropriate natural feature to adopt. Instead the act defines normal flow as to that which is contained within the bed and bank to constitute the boundary between land and water. The definition of bed and bank, and normal flow are detailed in Chapter 4. Other relevant acts of parliament which affect non-tidal riparian boundaries are the Survey and Mapping Infrastructure Act 2003 (Qld), Integrated Planning Act 1997 (Qld) and to a lesser extent the Vegetation Management Act 1999 (Qld). Although this act doesn't directly regulate surveyors it does provide a definition of bed, banks and watercourses and the terminology is quite similar to those Acts which relate directly to surveying. The Rights in Water and Water Conservation and Utilization Act 1910 (Qld), is the original act to alter the boundary from the *ad medium filum* (center thread of watercourses) to the landward edge of the bed and banks. These acts will be further addressed in chapter 2.

1.3.2 Analysis of Other Jurisdictions

By making comparisons of current Queensland legislation with legislation from other jurisdictions enables distinctions to be noted. The problems faced by surveyors in Queensland are not uncommon and analysis of other jurisdictions and their ability to overcome physical barriers will strengthen our own regulations. Comparisons of jurisdictions with similar geographical characteristics as well as similar legal systems such as the other Australian states, USA, England, Canada, New Zealand and South Africa will provide the best results.

1.3.3 Analysis of Existing Problems in Queensland

The reporting processes, as required by the NRM&W plan registrations, demonstrates the extent of difficulties faced by surveyors.

Currently the reporting process must address the following criteria:

- *Location as determined by original surveyor and any subsequent surveys.*
- *Extant evidence of determination by previous surveyor(s).*
- *Description, stability and permanency of the feature(s).*
- *Application of statute to the new determination.*
- *Relevant photographs demonstrating case.*
- *A specific statement regarding the extent of any movement and whether that movement is significant or not significant.*
- *Evidence that the new boundary does not affect or encroach onto the property on the opposite side.*
- *If an encroachment is apparent, the requirements as per s.18 and s.19 of the Survey and Mapping Infrastructure Regulation 2004 apply.*
- *Copy of subject plan showing, plotted on the face, the boundary position as determined by previous surveyors;*
- *For cases of significant movement or difference, a report on the investigation undertaken to establish that such movement has satisfied the doctrine of accretion (or erosion). If this doctrine cannot be satisfied, then on what basis is the additional land claimed; and such other evidence considered appropriate must be included in the report.*

The report, as required by Department of Natural Resources Mines and Water (NRM&W), has the expectation that surveyors make certain assumptions. Certain assumptions are outside their level of expertise and in particular the use of the word ‘significant’ (outlined by the legal authority) in determining movement is rather subjective. In the following chapters the legal repercussions imposed on surveyors by complying with this report will be addressed.

1.3.4 Analysis of Physical Characteristics of Riparian Zones

The physical characteristics of riparian zones are largely dependent on the theory behind the doctrine of accretion and erosion. The rights people have with the attachment to riparian land, or land in general, is slowly diminishing over time. Much

of this has come in the form of changes to environmental management laws. Just as riparian boundaries change over time by accretion and erosion, so to have the rights people hold in the land they occupy. These changes have historically been difficult for surveyors to deal with and at present the same issues remain apparent.

The application of the doctrine is difficult to apply in Queensland. Its roots began in Roman Law (Tronc, 1999) where measurements of the land have been taken over many thousands of years whereas in Queensland, due to the recent white settlement, land has been surveyed less frequently. The impact of this is that the ever-changing environmental features have not been documented as frequently as necessary to substantiate the doctrine. To assume that accretion and erosion has taken place is irrelevant if the boundary of the watercourse has been misidentified on prior occasions.

To enable informed decisions in this process, the characteristics of riparian zones need to be taken into account. For a riparian boundary alignment to be determined there are a number of natural features, which could be used in this process. Vegetation, actions of water, soil, and bank profile, must be considered when determining the extents of these areas.

As limited direction has been given through regulation and legislation this project seeks to investigate how these natural features can best aid a surveyor in the determination of a non-tidal riparian boundary.

1.4 Summary: Chapter 1

Limited direction has been given to surveyors to define an appropriate natural feature to be adopted. In all forms of the above documentation, no distinction is made between non-tidal and tidal watercourses, which differ significantly in their impact on the natural environmental features. There is sufficient evidence to substantiate that non-tidal riparian boundaries have characteristics that warrant them being considered separately from tidal watercourses and to the extent that individual non-tidal areas are segregated to meet specific regional needs. This would allow a fluent process to be adopted to best suit the individual characteristics of the land in question.

Chapter 2

2.0 Literature Review

2.1 Introduction

This chapter outlines the available literature for surveyors to determine a non-tidal riparian boundary. It covers the area of current and repealed legislation and other published documentation. Upon delving into this topic it was apparent that the available literature on defining these types of boundaries was scarce. Determining a non-tidal riparian boundary should be classified in the same, clear manner as a straight-lined boundary. The rules of reinstatement should apply to all boundaries being surveyed.

2.2 Current Legislation

There are a number of different types of legislation that control and regulate the surveying industry in Queensland. Many do not direct surveyors in the procedures of defining non-tidal riparian boundaries but the following are available and require investigation.

The Surveying and Mapping Infrastructure Act 2003 (Qld) does not address the issue of non-tidal riparian boundaries but gives powers to the NRM&W using regulatory means, in other words it implies the directions for surveyors will be contained in the NR&M *‘Cadastral Survey Requirements’*.

The NRM&W’s definition of a feature to use as the boundary is stated as - the landward edge. As far as aiding the surveyor in the correct determination of the boundary alignment this definition is limited and the onus is left to the ability and knowledge of the surveyor in its interpretation. The definition also requires the user to have knowledge of the Water Act 2000 (Qld) to ascertain it’s version of the ‘bed and bank’ and how it relates to boundary definition. The Water Act 2000 (Qld) also provides a limited definition. The normal flow of water in a watercourse is required to be known, and at present retrospect information from landholders is the main source as documented information is generally non-existent. For a factual basis to be

determined by a surveyor in the true determination of a water boundary, monitoring of water levels and the resultant changes to the bed and banks over a period of time is required. This procedure is not feasible as subsequent surveys may not be required for tens of years and actual duration of a field survey may only be days to weeks on site, depending on the survey.

The current legislation as listed above adequately defines the bed and the bank from a departmental viewpoint though they are considered as separate elements. It is the relationship between the two elements (the bed and the bank) and how they interact is where the legislation is deficient.

Variations of the definition are found in the Vegetation Management Act 1999 (Qld). Whilst this act does not direct/control surveyors, they should be aware of this Act as it has implications on the land use of riparian zones.

The terminology used in this Act in relation to riparian boundaries is similar to that of the Water Act 2000 (Qld). However, the association between this legislative document and others on this topic is not made apparent to the reader.

2.3 Statutory Definitions

In the following section the definitions from all relevant acts of parliament and regulations from governing authorities on riparian boundary definition have been grouped into one section. The process of defining a riparian boundary is at present complex. The information pertaining to the definition is apparent throughout many texts and a thorough understanding of the terms is required to understand the difficulties currently faced by surveyors.

2.3.1 Sections of the Acts

The NRM&W's Cadastral Survey Regulations is as follows:

The NRM&W's Cadastral Survey Regulations addresses the bed and bank as:

If a boundary abuts a non-tidal watercourse or lake as defined in the Water Act 2000, the landward edge of the bed and banks (as defined in the Water Act 2000) of the watercourse or lake must be adopted as the boundary.

And

Section 6 of the Rights in Water and Water Conservation and Utilization Act 1910 changed boundaries from the centre thread of a stream (ad medium filum) to its banks. When locating the position of the bank of a watercourse, surveyors should consider the definitions contained in the Water Act 2000 for "Bed" and "Bank".

The Vegetation Management Act 1999 defines the bed and bank as follows:

The section relating to the bed and bank contained in the this act is found in the schedule dictionary and the following is it's description.

1 Bed and banks, of a watercourse or lake, means land over which the water of the watercourse or lake normally flows or that is normally covered by the water, whether permanently or intermittently.

2 Bed and banks, does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater.

The Rights in Water and Water Conservation and Utilization Act 1910 defines a bank of a watercourse as:

The bank, which on either side, limits the main or principal watercourse under normal conditions as indicated by the normal water level, or the water mark, or any bed of shingle, sand, or mud, as the case may be.

The Water Act 2000 (Qld) defines the bed and bank as follows:

The Water Act 2000 lists the bed and bank in schedule 4: Bed and banks, for a watercourse or lake, means land over which the water of the watercourse or lake normally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater.

The act also goes on to define other relevant terms such as:

The meaning of the word "floodwater" as:

"Floodwater means the water overflowing, or that has overflowed, from a watercourse or lake onto or over riparian land that is not submerged when the watercourse or lake flows between or is contained within the bed and banks".

The meaning of the word "water" is as:

Water in a watercourse, lake or spring, or underground water, or overland flow, or water that has been collected in a dam.

The expression of the term “*overland flow water*” is as:

“Overland flow water means water, including floodwater, flowing over land, otherwise than in a watercourse or lake - after having fallen as rain or in any other way, or after rising to the surface naturally from underground”.

2.3.2 Other Relevant Definitions

Geomorphology (fluvial): *the physical structures, processes and patterns associated with waterway systems – including landforms, soils, geology and the factors that influence them.* (Bennett et al., 2002)

2.4 Repealed Legislation

This report will specifically concentrate on one repealed act of legislation – The Rights in Water and Water Conservation and Utilization Act 1910. This Act of parliament is the first Act in Queensland to change the location of the boundary of a watercourse (creek or river) from the centre of the stream (*ad medium filum*) to the landward edge of the bed and banks. All legislation from 1910 to current has been based on similar wording and no major alterations have taken place to warrant inclusion. The changing of the location of the boundary at this point in time came about from forward thinking of the government and other governments within Australia and the world. The emphasis was to regulate water usage and the means of transportation throughout Queensland. The government sort control of its water to assess the influence public settlement had and in doing so to recognise and regulate its limited supply. The parliamentary discussions pertaining to the bill were lengthy and the relevant sections (5 and 6) of the Act directly relates to the change in location of the riparian boundary. One notable point to make is the inability of the government at the time not to fully develop the Act to reflect its ability to withstand the processes of time. Not only did the opposition to the government realize the short sightedness of the wording of the bill but also the time frame allocated by the government to pass it. On numerous occasions the government conceded the short falls in the wording and anticipated changes would be made in the future.

2.5 Available Literature

Literature on non-tidal riparian boundaries in Queensland is limited. A.G. Browns Law Relating to Land Boundaries & Surveying raises the issue of non-tidal riparian boundaries but falls short in defining a natural feature to be adopted. Brown is more concerned with the discussion of the old rule of ad medium filum (ownership of the bed to the centre stream) and how it relates to other jurisdictions (United States of America). Brown discusses the repealed Water Act (at the time of printing, 1980) and once again the natural feature of a non-tidal riparian boundary is left up to the surveyors discretion.

C.M. Brown (American print) Boundary Control and Legal Principles and V. Powell-Smith (English print), The Law of Boundaries and Fences delve into the movement of riparian boundaries detailing natural and manmade occurrences such as erosion, accretion and avulsion. These phenomena are all relevant to actions, which occur in Queensland and the processes will be addressed later in the report.

The New South Wales (NSW) Cadastral Management Unit of the Land Information Centre (LPI) compiled a paper titled ‘Water As A Boundary’. This paper covers topics in relation to the bed and banks of river and creek systems and the legal aspects of riparian boundary definition in relation to systems in NSW. The main point to consider from this paper includes limited knowledge based information on case law from NSW. Many of the cases came from the United States of America (USA) and the United Kingdom (UK), although the author states *‘I am not sure what weight these cases carry at law in New South Wales but they have been quoted as giving some guidance to appeal courts...’* The definitions of bed and bank in this paper have very similar wording to which Queensland legislation and direction currently adhere too. The other significant point is that the author makes reference to natural features, which could be considered as being adopted as a riparian boundary or at a minimum standard, aid the surveyor in his determination. This section of the paper is important to this report as the author makes an attempt to address the issue of which natural feature to adopt for a riparian boundary by a regulatory authority, though the information is derived from other jurisdictions.

G. Tronc's 'Water Boundaries' details relevant documentation in relation to non-tidal riparian boundaries. Tronc addresses issues directly relating to the definition of water boundaries and associated difficulties faced by surveyors.

The main points of interest include:

- Relevance of watercourses,
- Addressing current and historical legislation.

Definitions include:

- Bed and Banks,
- Accretion, erosion, avulsion and reliction,
- Associated problems of water boundary definitions,
- Methods of definition.

The definition to describe a water boundary is limited to five points. All of which provide worthy information to surveyors and will be discussed later in the report.

2.6 Summary: Chapter 2

Research into non-tidal riparian boundaries has uncovered a limited number of texts available and the definition of where a riparian boundary is situated is somewhat unclear. All information contained within the texts refers to similar natural and manmade processes which control riparian areas. The definition of a particular natural feature to be adopted for non-tidal riparian boundaries currently has no direction from text and authority, although some suggestions have been made to address the issue. It is disturbing that governing authorities have known of the limited degree of information on this topic and yet made insufficient attempts to publish relevant documentation to justify or warrant particular processes being adopted. Surveying as an industry has stood clearly on the grounds of it being a profession using practical applications to solve problems in a logical order. This process over time has allowed its members to be viewed by society as highly community orientated. To note the limited information available to surveyors with regard to defining a non-tidal riparian boundary, society as a whole should see surveyor's role as practical. In referencing the term watercourse, society will appreciate the practical approach required to be undertaken by surveyors to deal with regulations.

In conclusion, research into the topic of non-tidal riparian boundaries is warranted and this report highlights the limited published documentation on the topic.

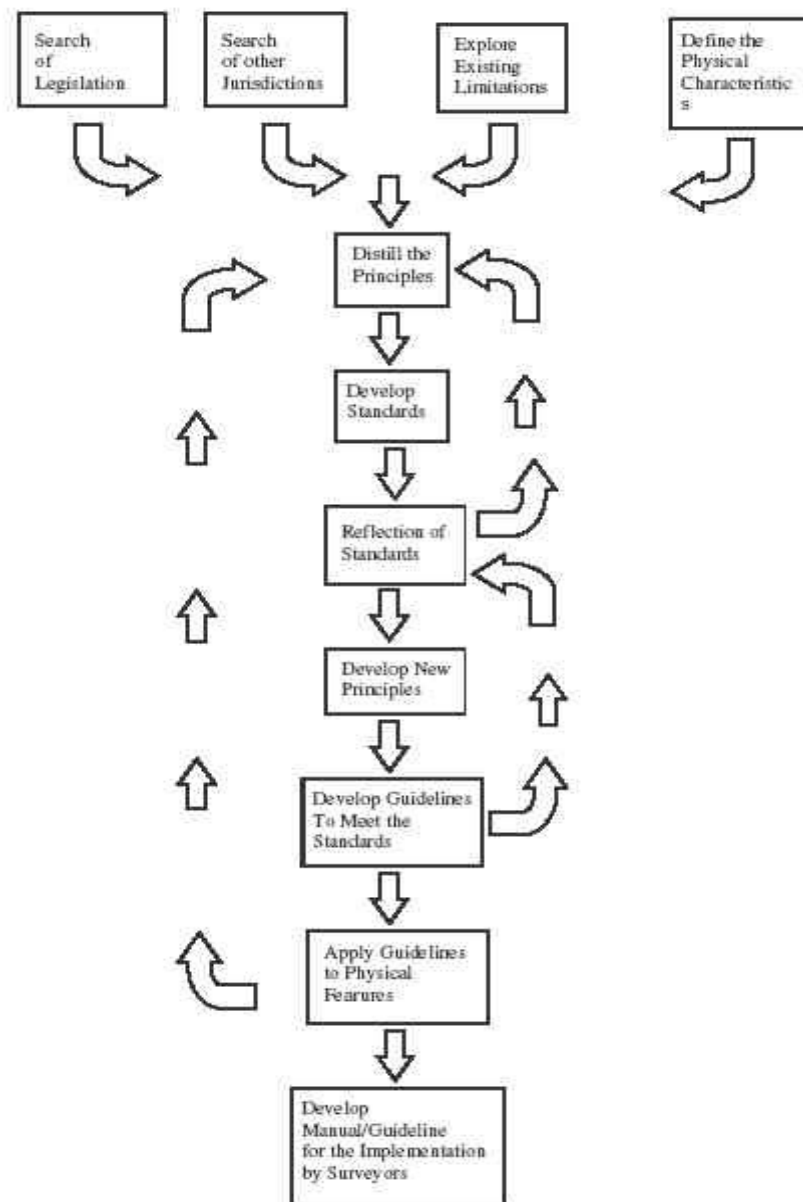
Chapter 3

3.0 Methodology

3.1 Introduction

At present the principals and standards of riparian boundary definition are limited and the therefore as is ability for society to gain the full potential of its need. The process of developing a new workable structure is represented in the following flow chart.

Figure 1 - Flow Chart to Develop Standards



Using the flow chart, a clear process can be achieved in the development of guidelines to clarify current practices. Incorporating checks and refinements in the development of principles and standards is paramount to its success. The chart also allows the end product, A Guideline for the Implementation by Surveyors, to be viewed and referred to at all stages through out the project.

3.2 Identification of the Need

To identify the need for alterations in current processes to meet the needs of society requires critical analysis of the current situation to be undertaken. There are a number of issues to be raised with regard to the system currently in place. These include:

- Society's need for riparian boundary definition,
- The needs of society today may not be the same as in 1910 when the 'bed and bank' became the boundary,
- Landholder's rights in riparian land have changed since 1910.

Currently there are a number of definitions located in various legislation and regulation, which ultimately lead to a very limited conclusion. There are a number of questions, which need to be asked in this respect, which include,

- Why is this process the way it is?
- Has the legal perspective taken over what should be a practical application?
- Is this the type of information that society expects governing bodies to be delivering?
- Can one broad definition cover a range of applications?

The principles behind non-tidal riparian boundary definition, while attempting to deliver an outcome, fail to address the needs by the definitions themselves. The wording used in current definition, simply confuses and distorts the required outcomes. The issues faced by surveyors when defining riparian boundaries range from natural processes of creek/river bank movement (accretion and erosion) to incorrect determination in original surveys. These factors in themselves are complex and complying with the current directions/regulations, make the process that much more involved and difficult to conclude.

There are a number of ways to determine how appropriately society's needs are being met which include:

- Gathering information from cadastral surveyors, who in the past had riparian boundary alignment issues, and developed techniques to overcome limitations,
- Analyzing procedural documentation, which cadastral surveyors must adhere to, will enable a measurement of performance of processes currently undertaken.

3.3 Standards Development

At present, the standards being used in defining non-tidal riparian boundaries has deficiencies. The development of a standard protocol has implication such as:

- Addressing society's requirements for riparian boundaries,
- Addressing the limited information available to surveyors in the definition process and,
- Introducing a guideline to standardize the procedure of adopting a natural feature of a non-tidal riparian boundary in the surveying industry.

3.4 Reflection of the Standards

The Reflection of Standards Flow Chart (Figure 3.1) illustrates the process of formulating, adopting and continually reviewing the guideline to ensure it meets the necessary requirements.

The development of appropriate standards of principles has a two-fold effect. Firstly, it will remove the uncertainty of the definition process which currently exists and secondly, appropriate standards will enable a transparent method of definition to be developed for surveyors to access.

3.5 Development of New Principles

The current reporting process outlined in the NRM&W's Cadastral Survey Requirements requires surveyors to report on the principles deemed appropriate by the NRM&W. It is arguable that this process implies surveyors are required to submit information to meet the NRM&W requirements and not necessarily meet the needs of society. The proposed guideline developed in this report has an emphasis on

standardizing requirements for the benefit of the NRM&W also encompassing to a high degree the needs of society.

3.6 New Guideline Development

The development of a clear and consistent guideline, which can be applied in any situation in question, will serve as a reference tool for the surveyor. This will also serve to standardize practices and produce consistent outcomes. For the guidelines to withstand the processes of industry they must meet the principle need of the definition process. The incorporation of the flow chart allows for rigorous checking to take place.

3.7 Summary: Chapter 3

With the development of new principles and standards the current system can be standardized and the effectiveness of the process be critically analyzed. The major point to be drawn from this is if the system does not meet the needs of society, and the needs society form the basis of the system, would imply the entire process is flawed and meaningless.

The guidelines must be:

- Theoretically clear and concise and be achievable on a practical level,
- Address the needs of the society,
- Comply with the ethics of the industry.

Chapter 4

4.0 Principles and Standards

4.1 Introduction

Historically, riparian boundaries have been of great importance to society in that these boundaries form a natural division between land and water. In more recent times, environmental legislation has been placed over the top of riparian boundaries and has seen people's rights eroded in what once was a relatively free use of land. This is not to understate the requirements of environmental protection. It is however necessary to ensure overlapping forms of legislation work in unison and serve the purpose they were formulated to achieve.

This concept and others such as the costs on society, management of spatial information and environmental considerations, all of which reflect the requirements of society as a whole, forms the basis of this project.

4.2.1 Riparian Costs on Society

At present, applying the current system for defining a riparian boundary, uncertainty in regulation and a lack of definite guidelines limits a surveyor's ability to effectively allocate the correct amount of time associated with field survey. In the current working environment and competitive nature of this industry, individual survey firms are vying for new and existing clients. To provide clients with optimal service, industry requires information from governing bodies to support the needs of society not only the administrative requirements of the governing body. At present a surveyor can only approximately determine a charge out rate using normal subdivision figures (without riparian boundaries). The time allocated to the riparian boundary definition portion of the survey can only be taken from previous surveys or blindly determining an amount her/she feels will cover the costs of survey. This process to a degree is fair, abiding with the laws of free trade. It is however unfair for society to, by law, be constrained to using a regulation, which in itself limits the

usefulness of the purpose for whom it should serve. As this approach is the only one available to surveyors any of the following situations are likely to unfold:

- The client will be forced to pay higher fees for surveys to ensure the costs associated with the survey are met,
- The surveyor will be forced to complete work at fees lower than the cost of survey in circumstances where difficulties in the field become apparent after the survey has commenced,
- Due to difficulties faced when fulfilling the administrative requirement, extra work will be required at lower or no fee than the initial quote.

The regulation defining a non-tidal riparian boundary is limited by the fact that it encompasses all riparian boundaries in Queensland under one definition. In doing so, has limited the ability of regulation to serve individual requirements of these boundaries. For example; a landholder in South Western Queensland should not have to adhere to the same stringent regulations as those in much higher developed areas of our state. The needs of riparian boundaries in rural areas are less stringent due to the nature of industry. Rural landholders need boundaries of their land defined just as much as residential or commercial landholders in higher developed communities. The accuracy of the location of riparian boundaries in these areas is not. The boundaries of land in rural Queensland and Australia for that matter are required to contain (or exclude) livestock. These boundaries are not used for building of expensive dwellings to the boundary line or have the land valued to the nearest square metre or limit the effects on downstream landholders by building a structure which will affect the normal flow of water in the watercourse.

A watercourse, which contains water, is a suitable natural division between two adjoining properties and serves to segregate livestock. Systems where no water or reduced water volume is contained in the watercourse, landholders, for the containment of livestock, fence these systems off regardless. This is often referred to as 'give and take fencing'. It must be noted that this is not a formally documented term rather a term used in rural communities. In these situations the exact location of the boundary is irrelevant and the description of the boundary alignment will remain the same on the landholders title.

In conventional rural cadastral surveys occupation takes preference to plan dimensions in circumstances where the need arises, so the existence of riparian boundaries need to be recognized for what they are – a natural system, which change from time to time (Water Act 2000, Qld) and should be recognized as such. The NRM&W insists that the alignment of riparian boundaries be fixed as to the initial survey which fixed the alignment not the alignment in time and space where the watercourse maybe today.

As regulation becomes more complex so too does the cost of adherence. In saying this, the accuracy and the ability of a regulation to obtain a minimum standard of acknowledgment and workability within the current administration needs to be achieved.

In all circumstances the issues relating to riparian boundary disputes arise between the landholder and the state. Changes in the alignment of the boundary of a watercourse are related to natural processes. There are a couple of points to raise:

- The issue of fairness to all parties in the case that the department claims ownership of the bed and banks in question,
- The rights of the department and its limitations in making such a claim need to be assessed.

These issues have been brought to the forefront in the case of Cornerstone Properties Ltd v. Caloundra City Council and State of Queensland. In this case the courts stated that the boundary location was not a state government or council decision rather a court ruling. To a lesser degree the cases of Douglas McLeod Beames v. Loren Leader also Randel and Reinicke v. Brisbane City Council and The Commissioner of Water Resources also had similar outcomes in that the courts defined the boundaries not the State.

The Surveying and Mapping Infrastructure Act 2003 (Qld) recognizes that these systems are not static and varying degrees of movement are apparent. The fact that the Surveying and Mapping Infrastructure Act 2003 (Qld) expects surveyors to acknowledge the term '*significant in movement (if any) of an alignment of a riparian boundary*' confirms this. The movement of these boundaries poses the problem of overlapping riparian boundary lines. From an administrative point of view:

- For a watercourse to exist, the channel width must be significant in itself to allow water to flow between its banks. In reality, the banks of a watercourse cannot ever overlap because the channel would cease to exist,
- Another reason is that it would be extremely difficult to have a database to reflect an ever-changing alignment. For practical purposes, changes to the database are not necessary for minor deviations and would only be required in circumstances where significant changes have taken place.

The loss of area contained within the banks of a watercourse can be viewed as a greater risk to the State (as it has automatic custodianship to these areas), than the loss of land to the adjoining riparian landholder. The risk associated with purchasing riparian land is the uncertainty with regard to the loss of area due to accretion and erosion and is a consideration to all.

The current process of reporting on these types of surveys is lengthy when a change to the location of a riparian boundary is required. The requirements of the department to legislate the reporting process, makes it difficult for surveyors to estimate the true value of undertaking such surveys. Estimating on any type of survey is totally dependant on the availability of existing survey information being found on the ground. The difference between defining a straight-line boundary and a curvilinear boundary (as in the case of a riparian boundary) is that surveyors depend on factors outside their control. Straight-line boundaries, being the most common type to survey, have fixed end points and are relatively simple to define, whereas curvilinear boundaries do not and as their name suggests may include a multitude of directions and distances requiring extensive time to measure. Other factors, which also would be included in the consideration of undertaking such surveys include:

- Previous definitions by surveyors using different regulations, which apply to riparian boundaries,
- Natural processes of accretion and erosion,
- Limited reference information along riparian boundaries,
- The changing fascist of natural features common in riparian zones and,
- Cost of survey exceeding the value of the land to survey.

All of which would not be known until ground survey is being carried out and as a result may cause conflict between the surveyor, landholder and the department.

4.2 Management of Spatial Information

The management of all survey and survey related information is controlled by the NRM&W by a number of Acts, but principally the Surveying and Mapping Infrastructure Act 2003 (Qld). The following is an extract from sections 1 and 2 (part 1 section 3 - Purposes of Act), which lists the authority and the type of information managed by that authority.

(1) The main purposes of this Act are to provide for the following -

Developing, maintaining and improving the State survey and mapping infrastructure;
Maintaining and improving cadastral boundaries throughout the State and
information held by the department about the boundaries;

- *Coordinating and integrating survey and mapping information;*
- *Improving public access to survey and mapping information;*
- *Defining administrative areas, and describing and working out administrative area boundaries.*

(2) The purposes are to be achieved mainly by providing for the following -

The making of standards and guidelines for achieving an acceptable level of survey quality;

The obligations and powers of persons carrying out surveys;

The establishment and maintenance of recognized permanent survey marks;

The recording of survey and mapping information, including the establishment of the following State datasets -

- (i) the administrative area boundary dataset;*
- (ii) the State remotely sensed image library;*
- (iii) the State digital cadastral dataset;*
- (iv) the survey control register.*

The information referred to in the Surveying and Mapping Infrastructure Act 2003 (Qld) relates to all information produced in the day-to-day operations of the surveying and mapping industry. This information among other things includes non-tidal riparian boundaries.

The following sub-sections relate to this process adopted by the NRM&W.

4.2.1 Riparian Boundary Holdings

The legislation pertaining to the management of riparian land differs throughout the states and territories in Australia. In Queensland, the Water Resources Act 1989 (repealed) terms ‘riparian land’ to be all land within the high banks of a stream or lake. This wording is confusing as it directly references the high bank as the natural feature to adopt though the high bank does not reflect the normal conditions of a watercourse. The more recent legislation being the Water Act 2000 (Qld) has altered the description in that the reference to a high bank has been replaced with the wording, ‘the normal conditions’ of a watercourse. Referencing normal conditions has somewhat improved the description though still no clear information is given as to exactly what natural feature should be adopted.

The legislation has been introduced to protect riparian vegetation and for efficient management of these areas. Queensland and Victoria at present are the only two states in Australia to seek protection of the streambed. The Queensland legislation which refers to this is the Rights in Water and Water Conservation and Utilization Act 1910 (repealed). The following table is a summary of the way in which Australian states and territories legislate the management of streambeds.

Table 1 - State Protection of Stream Beds

State	Action
Queensland	The crown remains ownership of the bed and banks up to the top of the low bank.
New South Wales	Streambed and banks are usually freehold land (ownership is center thread of the stream where the stream forms the boundary).
Western Australia	Bed and bank ownership travels with the ownership of the land surrounding the stream except in proclaimed areas (rights in water and irrigation Act) where the bed of the stream is owned by the crown.
Victoria	Bed and banks are usually property of the crown (some private: Western districts) On larger streams 20-60m from top of each bank is crown land frontage = 25000km frontage ‘reserves’ and 38000km of river frontage

	privately owned.
South Australia	Ownership travels with the ownership of the surrounding land; in rural areas river frontages have ‘reserve status’ and are managed by local government.
Tasmania	Most non-tidal frontages are in private ownership.

(Nichol et al., 2000)

4.2.2 Complying with Current Requirements

The current system of reporting changes to a riparian boundary by field surveyors is located in the NRM&W’s - *Cadastral Survey Requirements* document. The following points need to be raised when conforming to this convention:

- The appropriateness of such a reporting system for cadastral surveyors needs to be reassessed,
- Clear, consistent and stringent criteria for analysis of the information contained in the report must be available for reference,
- Such information contained in reports needs to be analyzed subjectively.

The information contained in such reports for all boundary definitions along with general lodgment of reinstatements, are reported using the NRM&W’s - Form10 – Version 1 – Plan Registration Compliance Checklist (refer to Appendix H). This checklist is used by plan auditors in all Queensland Departments and follows the Surveying and Mapping Infrastructure Act 2003 (Qld). The section specifically related to ambulatory boundaries is deficient, however this is not indicative of the remaining information in this document. The uncertainty in the definition of a riparian boundary must raise similar issues for the NRM&W’s auditors as it does for cadastral surveyors.

4.2.3 Compliance Checklist

Section 10 of Form 10 - Plan Registration Compliance Checklist deals with auditing of ambulatory boundaries at departmental level. This section of the checklist addresses five points, only two relate to defining riparian boundaries whilst the other three points relate to administration of the reporting process. The information paramount to defining a riparian boundary is the adoption of a natural feature and it is evident that this information is not investigated and assessed by well-defined criteria.

It does question whether the surveyor, in his/her report has supplied the information, deemed appropriate by the auditor.

Item 10.1 addresses whether or not the survey plan is compiled using existing field note information held by the NRM&W. Item 10.2 questions whether the survey plan re-defines a riparian boundary, and as such, alter existing database information.

Section 10 of the form makes references to the NRM&W's Cadastral Survey Requirements and Register of Titles Directions for The Preparation of Plans. The relevant sections will not be reproduced in this document however are an integral part of the reporting process which need to be consulted.

4.2.4 Addressing the Report

The NRM&W's Cadastral Survey Requirements states that – *'The onus of proof lies with the claimant'*. This statement indicates to surveyors lodging a report in which the location of a riparian boundary has been altered, requires the inclusion of all necessary information to substantiate the alteration to the original survey. This process differs from straight-line surveys due to the complexities of riparian boundaries. The NRM&W recognizes that there is a need for justification and has developed guidelines for surveyors to further clarify their position in this process. The following seven points, taken from the NRM&W's Cadastral Survey Requirements section 4.5.1 and are discussed in terms of their level of significance:

1) *Location as determined by original surveyor and any subsequent surveys;*

This is a straightforward process requiring a plot (on the same datum) using essentially two sets of information:

- A plot from original field note information and
- A plot of the new alignment being proposed by the current cadastral surveyor.

This is considered an appropriate course of action.

2) *Extant evidence of determination by previous surveyor(s);*

This also is a straightforward process requiring additional information and any subsequent information of the original survey. The following list indicates the information normally present on the face of survey plans, within registered field notes and requirements of legislation at the time of survey.

- Descriptions of the feature adopted by the original surveyor,
- Labels of what feature was located at the time of survey or,
- Recommended procedural regulations at the time of survey.

This is considered an appropriate course of action.

3) *Description, stability and permanency of the feature(s);*

This is a subjective part of the report. The department expects surveyors to make professional judgments outside the realm of knowledge of most in the industry. To address this section requires a thorough knowledge on the following:

- The criteria which determine the stability and permanency of a feature,
- Appropriate and sufficient information to determine accretion and erosion,
- The department must be proficient in its judgment of the accuracy of the reported information.

It is my opinion that this information be accurately ascertained by seeking technical advice from engineers, specializing in these particular environments rather than risking the integrity of the cadastral endorsement surveyors hold.

4) *Application of statute to the new determination;*

This is to ensure that surveyors are acting under current legislation which the department advocates. However, it must be noted that there are documented legal proceedings where courts decide on the alignment of boundaries rather than the department as in the previously mentioned case of 'Cornerstone Properties Ltd vs. Caloundra City Council and State of Queensland.

The subjectiveness of this section is apparent in that the department ensures compliance with the legislation however the courts may over-rule any decision.

5) *Relevant photographs demonstrating case;*

Supplying photographic evidence of the associated alignment in question and is an appropriate and realistic requirement.

6) *A specific statement regarding the extent of any movement and whether that movement is significant or not significant;*

This statement from the department is highly subjective. To monitor riparian areas requires a number of surveys over time to determine the amount of movement thus decide whether the movement observed is significant or not. This is an unrealistic approach, as many areas would not have surveys undertaken at set intervals over extended time periods. In many instances in rural communities in particular, an original survey would be the only other information at hand.

7) *Evidence that the new boundary does not affect or encroach onto the property on the opposite side;*

This is in most circumstances an unrealistic consideration, excluding an un-natural event. In all situations, except major manmade encroachments, there must be a formed channel to allow the movement of water through a watercourse system. If in the case of a natural flowing system, a change to one bank of a river/creek occurs, through the movement of water, it would only be natural to assume a similar degree of change to the bank on the opposite side. The rules of accretion and erosion will not allow overlapping boundaries to occur, as a result, the NRM&W should apply these rules to its regulation and make the distinction between a natural process and a manmade occurrence.

4.3 Riparian Zones

To date the report has focused on the processes associated with riparian boundary definition, but it is important to consider how these processes fit the environment. A riparian boundary is situated between land and the normal conditions within a watercourse as defined in the Water Act 2000 (Qld). In environmental terms, the riparian zone is not referred to as an alignment but a strip or zone immediately alongside creeks and rivers, including the riverbank itself. This zone includes the land, gullies, which sometimes run water, the areas surrounding lakes and wetlands and river flood plains, which interact with the river in times of flood (Rutherford et al. Vol 1,1998).

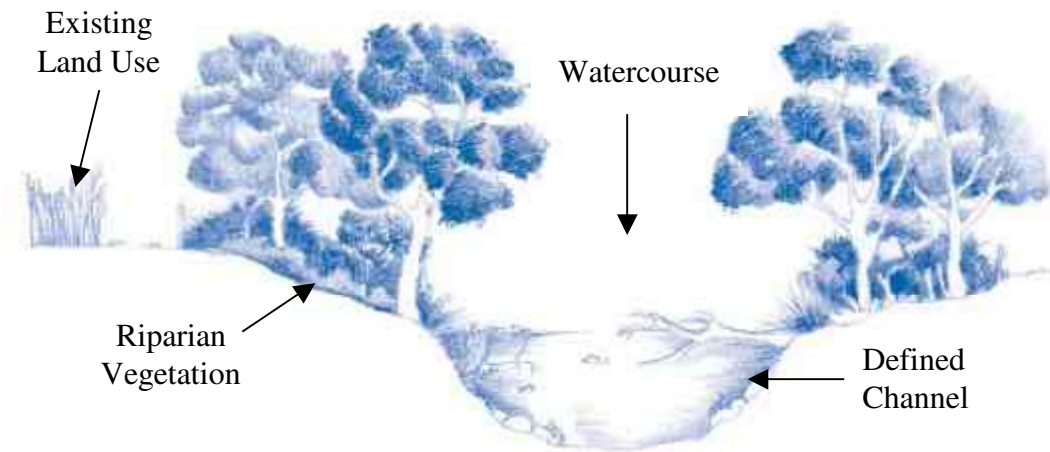


Figure 2- Illustrates a standard cross-section of a watercourse

4.3.1 Human Impacts

Over the past 200yrs, (since white settlement) poor management of riparian zones has led to substantial degradation and alteration of watercourses. The removal of vegetation cover combined with changed flow regimes has increased the incidence of bank erosion resulting in a loss of agricultural land during floods, changes to river shape and decreased water quality (Australian Government, 2005). As a result, the alignment of riparian boundaries, due to erosion, has changed.

The environmental management of these zones is sometimes overlooked. Riparian land is some of the most productive land available to us. Yet, these areas in the past have been cleared to make way for intensive cropping, intensive grazing, intensive irrigation and urban/commercial development (Rutherford et al. Vol. 1,1998). The reasons for this is that riparian land usually contains higher quality soils and greater moisture levels than areas of land farther away from the water source along with the aesthetics associated with these areas. The advantage of superior soil and moisture content in these areas is that they provide an ecosystem for many native plants and animals.

There is one other very important aspect to riparian land. These areas or zones have become corridors connecting plants and animals to those in other areas and as a result are fragile and prone to destruction from human activities.

It is therefore important to think of riparian zones as land with benefits not only in monetary terms to landholders but also to the environment. The nature of adjoining land (land use) is also important. The width of the riparian zone needs to reflect this land use to enable protection from possible factors such as:

- Erosion of creek and riverbanks,
- Benefits of filtration of pollution entering watercourses.

The major cause of erosion in riparian zones is flooding and is likely that clearing of riparian vegetation plays a major role in weakening the banks of the creeks and rivers. The effect can be dramatic and if no action is taken the streams will remain unstable (Rutherford et al. Vol. 2,1998).

4.3.2 Australian Rivers

The river systems in Queensland have highly variable flows ranging from no flow, associated with low rainfall to floods in areas with high rainfall. The water contained within these systems terminates in two locations; either in large wetlands or lagoons and alternatively at sea. The function of inland rivers is determined by a number of factors influenced by the surrounding terrain, which include;

- Geography
- Time
- Distance
- The extensive nature of flood events and
- The size of rural properties

(Thoms, 2001).

Extensive mapping of the inland river systems within Australia has yielded information of 3127 million kilometers of lowland rivers in Australia, which make up 97% of the total length of Australian rivers. Of this, the majority, 83%, are inland systems and have semi-arid to arid (dry land) climatic regimes, which many cease to flow for periods of time. Traditional geomorphologic models of river systems assumed that an alluvial river channel maintains a relatively uniform change in morphology along its length whereby its dimensions follow the rules of hydraulic geometry and its gradient and pattern reflect the type of sediment load and the valley characteristics. However, these assumptions are often erroneous for Australian inland rivers as they generally display a great deal of variability in their longitudinal structure and function also vary between different systems. This is due to the influences of tributaries, tectonics, bedrock outcrops and valley slope. In general, relatively lower channel gradients and smaller particle sizes of sediment load and bed material distinguish inland reaches from higher energy upland areas. Long-term

sediment storage commonly occurs in inland regions because flows are insufficient to carry the sediment load from the high-energy headwater reaches (Thoms, 2001).

4.3.3 Hydrological Variability

This term is used to describe the highly variable effective rainfall with low rainfall – runoff ratios (Puckridge et al. 1998). Analysis of the hydrographs of 52 rivers with similar catchments character, showed Australia's dry land rivers to be among the most hydrologically variable in the world. The average coefficient of variation for annual run-off for dry land regions is 0.99 - much higher than for the humid regions of North America (0.3), Europe (0.2) and Asia (0.2) (Finlayson and McMahon, 1988). Key hydrological features of Dry Land Rivers include a nonlinear temporal response of run-off to rainfall and basin size, and highly variable seasonal flow (McMahon, 1979). This variability may be further amplified by climatic conditions such as El Nino - Southern Oscillation events, because the discharges of rivers in southeastern Australia correlate significantly with the Southern Oscillation Index (Simpson et al., 1993).

4.3.4 Riparian Zone Widths

All states and territories in Australia currently have legislation or regulation in support of riparian zones. The width of the zones varies between each state and territory and range between 20-200m depending on the stream size, location and land use.

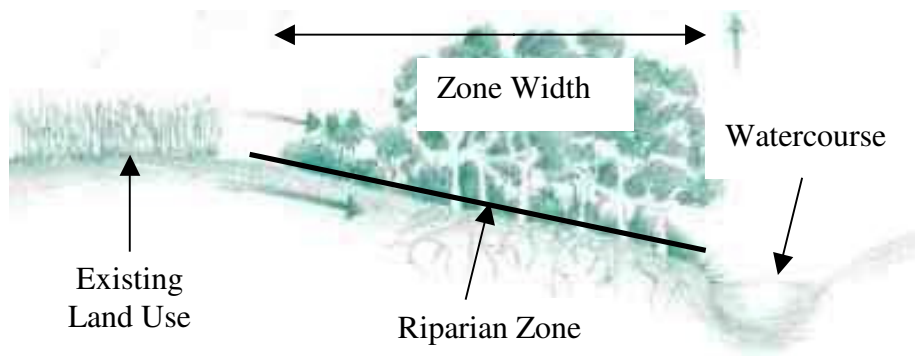


Figure 3 - Illustrates the use of Riparian Zone Width

The following is an extract of the states and territories riparian zone widths.

Queensland: The Queensland State Policy for Vegetation Management on Freehold Land 2000 (Department of Natural Resources and Mines) requires that 50 metres each side of first and second order streams (gullies and small streams) be left

uncleared, 100 metres each side of third and fourth order (mid-sized) streams, and 200 metres each side of fifth order and larger streams (rivers).

South Australia: Under the SA Water Resources Act 1997, Watercourses Section 9 Permits, (Fact Sheet 27); a permit is required to alter a waterway in any way. Staff from the local natural resources management agency can provide advice about the width of riparian area that should be protected and the appropriate plant species to be used in the process. Where possible, the riparian zone should be fenced off if stock are on the property. Riparian vegetation is recommended to:

- slow overland movement of water allowing the settling of soil before water enters a watercourse, thereby reducing sediment deposits into the watercourse;*
- slow flood waters;*
- stabilise watercourse banks, reducing erosion;*
- provide shade to watercourse to reduce water temperature and algal blooms;*
and
- provide habitat for animals living on land and in the water.*

Tasmania: The Tasmania Land Use Planning and Approvals Act 1993, (Wetlands and Waterway Schedule) has variable widths, depending on the particular Planning Scheme, which, in turn, has to be consistent with State Policies. However, removing vegetation within 30 metres of the outer boundary of permanent wetlands, waterway or shoreline or estuary is generally prohibited. Local government Planning Schemes must be consistent with Tasmania's Resource Management and Planning System.

Victoria: Under the Victoria Planning and Environment Act 1987, a permit is required where proposed activity is within 30 metres of a watercourse.

Western Australia: The Western Australia Public Open Spaces in Residential Areas 2002, Policy No. DC 2.3, in general does not permit clearing within 30 metres of a recognised watercourse or foreshore. Width varies according to size of watercourse or body of water and condition of the banks (Nichol et al. Vol. 2,1998).

4.4 Determination of a Watercourse

A watercourse essentially means, ‘a stream of water, a river or brook, also an artificial channel for the conveyance of water’. The legislation in Queensland defines the bed and banks of a watercourse ‘*are and always have been the property of the crown*’.

The most appropriate description of a watercourse is set out by Tronc. Tronc lists three elements, when summated the elements of a watercourse to comprise of a bed, a bank and water. He also recognizes that the law distinguishes between a regular flowing stream of water and freshets from seasonal discharge. A notable fact in Tronc’s work is that the definitions are not from Australian case history but have been sourced from England, Scotland and New Zealand. In essence, the bed can be simplified as ‘that portion of its soil which is alternately covered and left bare’. In M. Brown’s book – *Boundary Control And Legal Principles*, the bed is described as ‘*the bed of a lake or river is normally that land which is covered by water sufficiently long to keep it bare of vegetation and destroy its value for agriculture*’.

Vegetation along a watercourse provides a limit to the productive land that supports plant life. Not only is vegetation important ecologically, but also the type and age of vegetation allows estimation to the duration of normal flows to be determined within a watercourse system.

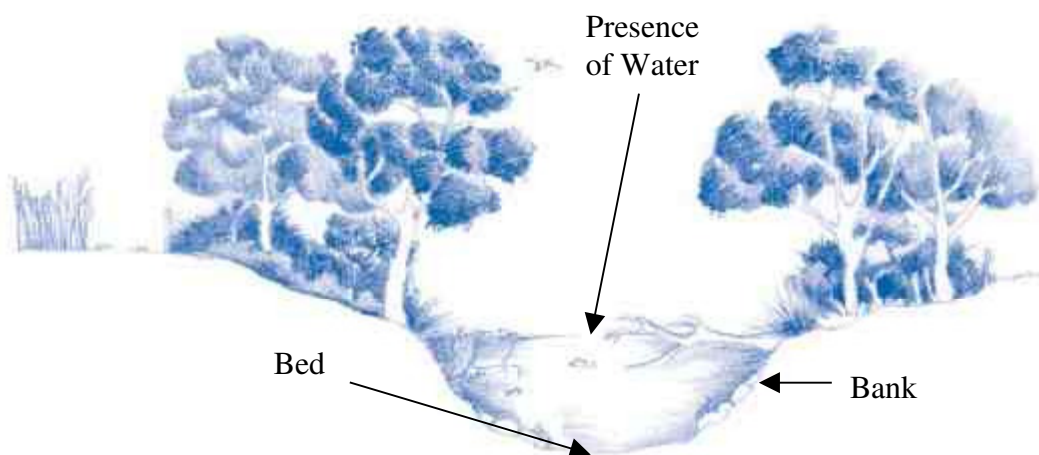


Figure 4 - Illustration of the elements of a watercourse

The bank can be described as ‘*those elevations of land, which confine the waters when they rise out of the bed*’ (Tronc, 1999). The water is ‘*incapable of private ownership*’ (Tronc, 1999).

In saying this, the water can be used but only under regulation. Water contained within watercourses is important due to its ability to physically shape riparian zones. The lack of water in a watercourse holds just as much importance as its presence in determining a true boundary alignment.

4.4.2 Normal Flow

Normal flow (of water) is best described to be '*regular, annual, predictable behavior of the creek/river*' (Tronc 1999). He also describes the term, normal, to be the areas that are covered whenever a usual or normal flow occurs, but not over time. At this point the interpretation of the legislation becomes limited in direction. In the case of *Cornerstone Properties Ltd v Caloundra City Council*, the judge gave preference to the individual characteristics of the subject watercourse, and not the description of a normal flow detailed in the Water Act 2000 (Qld). Water, which was found to exceed that level (height of normal flow) was found to be floodwater and not normal flow.

4.4.3 Frequency of Flow

In watercourses that form a riparian boundary, at times may not contain water for long periods of time. Within these systems the frequency of the flow of water is therefore difficult to ascertain. To determine the boundary of a watercourse ascertainment of the presence, the frequency and the regularity of the flow of water is essential. It maybe argued that the presence of a bed and bank of a watercourse was created by the frequency (the rate) of the flow of water over time. The actual frequency of water in Australia depends upon the points outlined in section 4.3.2 of this report. Tronc refers to cases to define what frequency of flow constitutes. Although, the examples are from outside Australia and it is therefore possibly irrelevant to apply this in Queensland should the conditions be significantly different.

4.4.4 Gradual and Imperceptible

The term 'gradual and imperceptible' is based on the movement or change in the location of a riparian boundary through the actions of accretion and erosion. The Oxford dictionary term for gradual is '*taking place by degrees, slowly progressive, not rapid, steep, or abrupt*', while the definition for imperceptible is '*that cannot be perceived, very slightly, gradual, or subtle*'. Current regulation in Queensland

concedes that riparian boundaries are prone to movement. In section 4.6 – ‘Title Amendment for Riparian Boundaries’ of the *NR&M Cadastral Survey Requirements*, the degree of movement is determined by the use of the word ‘significant’. The term refers to the degree of total movement and also the measure of the amount of movement over time. The degree of movement between the prior and current survey can be measured though the interim variations are unknown. The regulation also does not indicate what value differentiates between the term significant and not significant (Tronc, 1999).

4.4.5 The Doctrine of Accretion and Erosion

It is a known fact that riparian boundaries have potential to move and when movement does take place so to do the rights attached to it. M. Brown describes a changing riparian boundary, as ‘*that line, no matter how it shifts, remains the boundary*’. The movement of this boundary is a fundamental right attached to these boundaries. The doctrine has its roots in Roman law and as a result is complex and difficult to apply. The basic concept though is relatively simple. Riparian boundaries have actions applied to them by the withdrawal and intrusion of water at varying times.

Accretion is the process by which waterborne material is deposited over time to the banks of a watercourse, gradually building up and expanding the area of riparian land. Erosion is the reverse of accretion and is the process through the actions of water; the soil is removed from the banks of a watercourse to reduce the area of riparian land. Avulsion has the same actions as erosion but the process is sudden rather than gradual. This process is the exception to the Doctrine and the rights of the change to not apply in these circumstances. The concept of avulsion is outside the realms of this project.

4.4.5.1 Support of the Doctrine

There are a number of terms to support the doctrine. They include:

Historical justification - the ancient term of ‘*de minimis non curat lex*’ meaning – ‘the law is not concerned with small or petty things’.

Productivity and Efficiency Theory – making the best use of the land available (Tronc, 1999).

Justification for the doctrine relates to the compensation or equity theory. The United States Supreme Court as best describes this;

‘Since a riparian owner is subject to losing land by erosion beyond his control, he should benefit from any additions to his lands by the accretions there to which are equal beyond his control’ (Tronc, 1999).

4.4.5.2 Application of the Doctrine

The doctrine can be applied using one of two scenarios.

A rule construction – Fixed as per the original survey alignment and would ignore the processes of accretion and erosion.

A rule of law – The boundary was adopted as a riparian boundary and not a fixed boundary, the nature that the boundary is not fixed and subject to change (accretion and erosion) allows the boundary to move within the riparian zone (Tronc, 1999).

4.4.5.3 Methods of Change

There are four methods of change, which will affect a riparian boundary at some point in time. They include;

Accretion – as described previously.

Erosion – as described previously.

Reliction – The gradual erosion of soil from upstream areas with that soil being deposited within the bed and banks of a watercourse downstream. This process vertically raises the bed of the watercourse resulting in changes to the boundary.

Avulsion – the rapid removal of soil caused by the catastrophic actions of water where the soil is placed elsewhere and the benefits of ownership of the soil are moved to another riparian landholder.



Figure 5 - Illustrating a natural bank profile

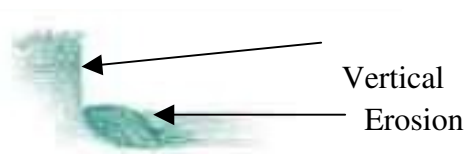


Figure 6 - Illustrating erosion causing a vertical bank profile

4.4.5.4 Applying the Doctrine

To aptly apply the doctrine of accretion and erosion there are a number factors, all of which need special consideration on individual merit. The relationship between natural actions within watercourses in Australia differs from region to region largely due to the diverse nature of our climate. They include;

Rate of Movement – the rate of riparian boundary change over time.

Contiguity – the actions of accretion and erosion can only affect land that bounds a watercourse.

Permanence – acceptance that riparian boundaries are ambulatory and the actions of accretion and erosion apply.

Methods of Proof – complex and involving factual evidence supporting the movement of a watercourse boundary (Tronc, 1999).

4.4.5.5 Difficulties in Applying The Doctrine

There are a number of causes which may effect the application of the doctrine. They include;

Unnatural Actions – caused by the interference by man with the natural flow of a watercourse.

Misdescription of a riparian boundary – the feature adopted by the previous surveyor may not have been an appropriate feature to use as the extent of a watercourse. This may be attributed to the limited nature of current legislation at the time of survey (Tronc, 1999).

4.5 Case Studies

The case studies used in this report ranged in location and time. The reasons for this are:

- To determine the subsequent ranges in the application of the reporting process and,

- To attempt to monitor the development of the reporting process over time

The following case studies refer to survey plans shown in the appendixes at the end of the report. Also included in Appendix G is a typical original survey which displays in detail the conditions on the ground at the time of survey, though due to the age of the plan is rather difficult to read.

4.5.1 Survey Plan RP813705

Original Survey Plan – G476 (1864)

New Survey Plan – RP813705 (1990) Appendix B

Description of Report

No original marks were found on G476 on river. Clouding the reinstatement is a levee bank and was constructed by council (1985) for flood protection. Construction of the levee bank was 5 yrs after the original survey. The levee is described to be located on or at the high bank. The surveyor makes reference between the different banks in the area and also describes the limits of the boundary as '*natural ebb and flow of the river*'. Reference is made to the extent and age of the vegetation. The shape of the cross-sectional layout of the river and the relationship between it and the vegetation and abnormal flows in the channel (floodwater) are referenced. The changing conditions within the watercourse are noted and in particular the construction of a weir in 1940, which was well after the survey of G476.

Evidence to support the report:

- Change of vegetation from trees to grasses to water tolerant plants,
- Evidence of water inundation, staining mud on vegetation,
- A definite bank from sloping and capable of walking on to a vertical drop, in many cases to the water line,
- Aided with supporting photographs

In conclusion, the report was rejected initially on the basis of opinion from within the NRM&W and the fact that recent surveys either side of the subject lot had not shown discrepancies with the alignment of the original surveyed riparian boundary. The rejection was contested and overturned some months later. The report was then

accepted with the subsequent registration of the survey plan in the Toowoomba NRM&W office.

4.5.2 Survey Plan RP864194

Original Survey Plan – RP93341 (1959) and RP97922 (1961)

New Survey Plan – RP864194 (1993) Appendix C

Description of Report

Comparisons were made between the original survey and subsequent surveys. RP864194 definition identified the boundary in a similar position to the original survey plan G473 (1861). Subsequent surveys plans; MH15 (1901) and RP93341 (1959) changed the alignment of the riparian boundary to include swampland, which at the time contradicted legislation. Reference is made to the extent and age of the vegetation. The shape of the cross-sectional layout of the river and the relationship between it and the vegetation and abnormal flows in the channel (floodwater) are referenced.

Evidence to support the report:

- Change of vegetation from trees to grasses to water tolerant plants,
- Evidence of water inundation, staining mud on vegetation,
- Aided with supporting photographs.

In conclusion, the report was accepted with the subsequent registration of the survey plan in the Toowoomba NRM&W office.

4.5.3 Survey Plan DP174420

Original Survey Plan – RP31848 (un-known) and CP866850 (1994)

New Survey Plan – SP174420 (2004) Appendix D

Description of Report

The surveyor identifies that the landward edge of the bed and bank describes the higher part of the low bank. The surveyor makes reference to current regulation and case law and the application of this wording of the definition process and how it

applies to his survey. The surveyor disputes the original survey and makes reference to natural features and their location within the watercourse. In contradiction to his own earlier survey (1992) he concedes a misidentification has been made in the definition of the alignment of the riparian boundary. Reference is made to the extent and age of the vegetation along with any significant movement, which may or may not have taken place. The surveyor makes reference to the width of the channel (Balonne River) and the reason for not measuring it.

Evidence to support the report;

- Change of vegetation from trees to grasses to water tolerant plants,
- Citing to current legislation,
- Supporting diagram of the original and current riparian boundary alignments.

In conclusion, the report was accepted with the subsequent registrations of the survey plan in the Toowoomba NRM&W office.

4.5.4 Survey Plan SP190245

Original Survey Plan – CSH233 (1903)

New Survey Plan – SP190245 (2006) Appendix E

Description of Report

The report details the countryside and the condition of the watercourse in the subject area. Within the watercourse the surveyor describes high cliffs with granite outcrops on both banks in certain locations. The conditions are best described as being ambulatory in nature. The original description outlines features as being stable and permanent in nature. References are made to accretion and erosion and due to the conditions described above would not be apparent in certain location.

Evidence to support the report:

- Misrepresentation of the alignment due to low accuracy of the previous survey,
- Minimum movement of the streambed due to accretion and erosion,

- Adoption of different natural features for the definition of the alignment of the riparian boundary.

In conclusion, the report was accepted with the subsequent registration of the survey plan in the Toowoomba NRM&W office.

4.5.5 Survey Plan DP190240

Original Survey Plan – D3410 (1865), RP21670 (1895) and SP149667 (2002)

New Survey Plan – SP190240 (2006) Appendix F

Description of Report

The original survey (D3410) surveyed the creek and has been called original in both RP21670 and SP149667. There are no original field notes for plan D3410 registered. The watercourse contained steep banks on the outsides of the channel on the bends, which may be possibly caused by erosion and landslides. The inside bank of the channel on the bends contained gentle slopes to the bank of the watercourse. These actions could result in the movement of the bank alignment over time and would apply the doctrine of accretion and erosion.

Evidence to support the report:

- Misrepresentation of the alignment of the riparian boundary due to the misidentification of the normal condition within the watercourse,
- Movement of the streambed due to accretion and erosion,
- Adoption of different natural features for the definition of the alignment of the riparian boundary.

In conclusion, the report was accepted with the subsequent registration of the survey plan in the Toowoomba NRM&W office.

4.6 Summary: Chapter 4

It is important to gain a through understanding of the natural processes and how these affect society when dealing with riparian boundaries. Environmental factors once would have been a part of decision processes of early surveyors and in more recent years these considerations form the basis of some legislation. As stated earlier, major changes to creek and riverbank formation have occurred in Australia, post white

settlement. It is these events, which cause difficulties in the definition process and one that will remain into the future.

The measurement of non-tidal riparian boundaries over the entire state is few. Compared to other countries where settlement has taken place over thousands of years the theory behind accretion and erosion has been developed by continual measurement. This is one important factor yet to be fully incorporated into Queensland definition.

Chapter 5

5.0 Results

5.1 Introduction

To date the manner in which riparian boundaries have been managed has been a complex issue. For surveyors to be seen as professional the rules and regulation must also apply in a similar manner. The successful application detailing a change in the alignment of a riparian boundary is measured on the performance of the report submitted with a survey plan to the NRM&W by the surveyor. For this report to be successful the surveyor must have the ability to not only perform the necessary field calculations but also to have the knowledge in the administration system of the NRM&W. For the process to meet the needs of society as well as meeting the needs of the administration system, change must take place not only at an administration level but also at a ground level.

The following chapter details the results of the information studied from the preceding chapter.

5.2 Societies Needs

The needs of society today are not being met on two fronts. Firstly, the legislation currently used is essentially the same legislation as that drafted in 1910. The needs of society at that time were different in the fact that Australia was relatively undeveloped as compared to modern times. Parliamentary discussions in 1910 could not agree on the wording of the act (The Rights In Water and Water Utilization Act 1910, Qld) at the time of implementation, which is a major issue. The reasons behind the change of the boundary alignment from the Ad Medium Filum (center thread of the stream) to the landward edge of the 'bed and banks' is of far greater importance to society as a whole than the individual occupiers of riparian land. The process of acknowledging the whole of society rather than the occupiers of riparian land is of utmost importance.

The important factor for the change of the boundary alignment is for the protection of the water contained in Queensland watercourses, not the need for the change in the location of the riparian boundary.

The second reason is current legislation such as the Environmental Management Act 1999 (Qld), the Water Act 2000 (Qld), Surveying and Mapping Infrastructure Act 2003 (Qld) and NRM&W's Cadastral Survey Requirements, have difficulty in providing a clear guideline in the process of defining a non-tidal riparian boundary. These forms of legislation will only serve society when a better alliance between the relevant legislation can be formed to improve their application. Each Act serves an important role in providing society with rules and regulations. The difficulty in accessing the information becomes apparent when one Act references another to define certain aspects of the parent act, as in the case of the definition of the 'bed and banks' of a watercourse. The necessity to consult multiple Acts to describe the legal process, results in a loss of detail thus creating legislation that is limited in nature. It would deliver a clearer message to surveyors (and society) if the description of reinstatement of a riparian boundary could be found in one form of legislation, directly relating to the industry.

5.3 The Rights of Individuals

As stated in earlier sections the rights people have in riparian land has changed over time. There is a strong possibility that in the future these rights will again be lessened as environmental issues become even more apparent. In all situations, not only on riparian land, environmental issues are changing the way land use is being managed. Therefore, the rights people have in riparian land are becoming more of an issue than determining the correct alignment of a riparian boundary. This is so as the usable area (development area) of land is reduced to accommodate for the protection or rehabilitation of riparian zones. The area under this protection has anonymity status and to a degree is a liability to the landholder. In all situations the limit of the rights people hold in riparian land is less than the total land area and as a result the demarcation between the usable and protected land requires demarcation.

5.4 Dealing With Riparian Boundaries

The methods adopted by the other states in Australia when dealing with riparian boundaries are vastly different. Each state has adopted a method to best suit the conditions and legislation for their individual needs. Queensland is no exception. The current Queensland legislation is deficient as it attempts to combine tidal and non-tidal riparian boundaries along with the varying conditions found within these complex watercourse systems, into one form of legislation. One of the major differences between tidal and non-tidal riparian boundaries is the presence of water. Tidal systems in certain areas have one high tide and one low tide whereas in other areas there are two high tides and two low tides all of which range at varying degrees over varying times. The major link between these two forms of riparian boundaries is the presence of water however this factor is where the two natural systems differ greatly. In most non-tidal watercourse systems in Queensland there is a definite lack of the presence of water and some systems it may take years to obtain a sufficient volume of water to allow the current approach to be used.

Many of the problems associated with the adoption of an alignment has stemmed from insufficient wording of regulation and legislation. These shortfalls were noted in parliamentary discussions prior to the introduction of the 1910 Act. The government of the day insisted the new legislation be passed and any shortfall in the wording would be rectified in the future. Almost 100 years into the future and little rectification has taken place.

The administration of property boundaries using the Acts is sufficient in most situations, however when a situation arises outside these guidelines the courts are consulted to provide a decision.

5.5 The Reporting Process

The reporting process has two distinct steps. The first is to conform to the form 10-compliance checklist –Appendix H. This is used by the NRM&W to check the validity of survey plans. The second is written report, which is submitted in conjunction with the survey plan for assessment by the NRM&W. This report provides the department with a means to assess the appropriateness of a riparian boundary alteration. To provide information explaining why such a decision was reached and allows the surveyor to justify the reasons for the alteration. The concept

of providing a report is appropriate however, certain sections of the report are open to subjective interpretation. These shortfalls are detailed in Section 4.2.4 of this paper Addressing the Report.

The most critical of the seven points, which is required to be addressed, is the use of the word 'significant'. The Cadastral Survey Requirements give a detailed description of the term and how to apply it. For a surveyor to correctly address this issue he/she must be able to measure over time the changes, which may or may not have taken place. This process is difficult, if not impossible, to accurately portray. Many surveys are original in nature and as a result have not been measured for 100 years or more. In these situations hear say from unqualified points of view may be taken into consideration in lieu of what could be considered to be a measurable entity. This is fraught with uncertainty and considerable error and may result in a misrepresentation of the boundary.

5.6 Environmental Considerations

To date, from a legal perspective, little has been documented in regard to the environmental considerations in surveying literature relating to riparian boundaries, other than the importance of measuring an apparent change.

It has been stated that major environmental considerations lie in the removal of vegetation in the form of trees and grasses. This removal of vegetation has lead to the natural actions of accretion and erosion being applied to the land at rates much higher than would be expected in a pristine environment. It is now up to surveyors discretion to nominate the process and declare whether it is accretion, erosion or more dramatically avulsion.

The reasons behind the destruction of riparian land needs considering because if riparian areas are not seen for what they are, natural, the process of accretion and erosion will continue to pose problems into the future. For the current system in place in Queensland to be effective the watercourses being measured must all have the same natural conditions being applied both internally and externally. As this is not the case the current system cannot effectively administer these boundaries.

5.7 Applying the Doctrine

The application of the 'Doctrine of Accretion and Erosion' can be considered one of the more complex issues in the determination process. The main reason for it being complex is we have great difficulty in measuring the significance of the type and duration of the movement. As stated previously, the movement is subject to natural forces over long periods of time. Much of the information documented is either sparse in time, that is the last survey may have been in excess of 100 years or more, or the feature that was originally adopted is no longer present. Tronc lists five considerations in applying the doctrine which include:

- *Differences from an older survey may not indicate physical changes to the watercourse.*
- *When determining the edge of a watercourse, consider the physical attributes of the watercourse,*
- *Accreted land is generally of low elevation compared to the parent parcel,*
- *Vegetation of equal age to that existing on the parent parcel or large trees or stumps existing on the 'new' area indicates avulsion has occurred,*
- *Soil borings that indicate alluvial soil at a greater depth than the adjoining land indicates that accretion is the probable source of the soil.*

These results indicate great consideration is needed before decisions can be made as to what natural feature should be adopted as the boundary.

5.8 Adoption of Thought

The current process of gathering information for surveyors is through the consultation of legislation and regulation pertaining to the particular type of survey to be undertaken. At present, for a non-tidal riparian boundary to be surveyed, inexperienced individuals will find it difficult and time-consuming to gather all the relevant information. Not only is current information limited in content but also the information is spread throughout multiple forms of legislation and to some extent not referenced at all. The NR&M's Cadastral Survey Requirements refers to the definition of the 'bed and banks' to be located in the Water Act 2000 (Qld), apart from this no mention is made to any other documented forms.

Surveyors experienced in performing and reporting on riparian boundary surveys appears to be the most reliable information source in the industry. Consulting their reports and basing practices on those principles can be an invaluable tool.

Though, clear guidelines which can be applied in the field and reporting process by a surveyor is necessary to standardize the process of redefining riparian boundaries.

5.9 Summary: Chapter 5

Comparing the results of this chapter with the current available literature in the form of regulation and legislation enables a clearer view to the problems associated with defining a non-tidal riparian boundary. Having identified the sections of the reporting process that are deficient allows each of these to be addressed such that the alignment of these boundaries can be more appropriately considered and determined.

The following chapter is one such method I have adopted to rectify these matters.

Chapter 6

6.0 Development of Guidelines

6.1 Introduction

This chapter provides a guideline to aid a surveyor which is more transparent than the approach currently available when attempting to define a non-tidal riparian boundary. Throughout the research for this topic (defining non-tidal riparian boundaries) an apparent lack of information was found not only in the limited nature of feature definition but also a much broader way regulation and legislation currently operate. In section 7.3 Possible Solutions, a number of changes have been proposed to alter the way current practices take place. The alteration to regulation and legislation has in effect been a by-product of this project and will serve as future research topics.

6.2 Guideline Development

Current regulation and legislation has been shown in this project to be limited in definition. Surveyors themselves through history have proven the best source of information delivering reliable content in the appraisal of natural features detailed in the form of lodged field notes. From this source there are a number of principles to be identified and the following points illustrate a simple yet practical solution to overcoming limitations.

6.2.1 The Three Elements

For a watercourse to be classified a watercourse it must contain 3 elements – water, a bed and a bank. At various times non-tidal watercourses contain only 2 elements, a bed and a bank. The water component of a watercourse is the most difficult of the 3 elements to assess, due to the variability of its supply and subsequent volume. At the time of survey the presence of water found in these systems can vary greatly which is directly related to the climate of the location of the watercourse. Therefore, when assessing non-tidal watercourse systems, there must be the potential for water to be present as opposed to the actual water present for the identification to be complete.

6.2.2 Evidence of Vegetation

The evidence of vegetation will indicate the limit of the extent of the normal conditions within a watercourse. The type of vegetation found along riparian land will vary greatly depending on the locality of the watercourse system. The different types of vegetation will include grasses, shrubs and small to large trees. The best indicator as to the edge of the normal conditions of a watercourse is the age of vegetation. The older the vegetation the more likely the conditions within the watercourse have not altered for some time. Trees and stumps located along side watercourses are indicators as to the permanency of the watercourse; large diameter tree trunks are accepted as being a more permanent feature. Grasses, shrubs and small trees generally indicate their presence to be much shorter in existence when compared to larger trees. The latter types of vegetation are more susceptible to varying climatic conditions such as long droughts or the effects of El’Nino and the processes of accretion and erosion.

6.2.3 Cross-sectional Area

The shape of the cross-sectional area of a watercourse will provide an indication of the normal conditions within the channel. The actions of water, whether it be a fast or slow moving body will over time shape the channel. The soil type in the surrounding channel profile will also be under the effect of the movement of water to shape the cross-section. In lighter sandier soils the channel walls will be prone to slump and erosion, resulting in a wider sloping profile, whilst in heavier clay type soils the walls will generally hold together and produce a more vertical profile. The heavier clay soil areas will usually contain a small platform at the base of the wall due to small amounts of erosion from the vertical face. This platform has led to confusion as to what feature to adopt. In this particular circumstance the presence of a platform is to be ignored as these conditions will be altered in times of flood.

6.2.4 Evidence of Accretion and Erosion

Accretion and erosion is a very difficult process to measure. To correctly apply the ‘Doctrine of Accretion and Erosion’, the watercourse system requires measurements to have been taken over time. As indicated previously in this report, this process

cannot be correctly applied due to the insufficient background information available. This is not to say this process does not take place it just makes proving more difficult. Indicators to aid in determining the existence of accretion and erosion are in the form of:

- Step walls on the outside of bends of watercourses (indicate erosion) and,
- Shallow sloping walls on the inside of the bends of watercourses (indicate accretion).

The soil is eroded from the walls through the actions of water gradually removing the soil to leave a step face remaining. The reason for this action is the forces of inertia of the water. This is where the water has difficulty in changing direction and it wants to travel in a straight line and when it comes to a bend it slams into the outside wall of the watercourse resulting in the effect of friction causing erosion. The soil is then carried in the water and deposited downstream.

The shallow sloping walls of a watercourse effectively are formed in the reverse process to that of erosion. The soil is removed upstream and deposited on the inside of the bends downstream. The depositing process of the soil is due to the slowing down of the movement of water in these areas.

The process of accretion and erosion has been developed over a long time period and as a result clarifies the very slow sideways movement of watercourses. The acceptance of the term cannot be used lightly. The actions of accretion and erosion that take place in a relatively short time period cannot be classified under the rules of the doctrine but must be termed avulsion. Avulsion does not alter a non-tidal riparian boundary and is very difficult to substantiate its inclusion in this report. Defining this process in any great length is outside the limits of this project.

6.2.5 Alterations to Conditions

The conditions found within watercourses vary depending on their location and the surrounding land use. Human intervention within these areas is the major cause of impact. The alterations of the normal condition within watercourses are in the form of weirs and large block dams. These human assets raise or lower the normal conditions about the structures to fasciate the storage of water. These changing conditions generally only apply in circumstances where the structure has been built

after the initial survey and as a result offer sound evidence to alter the alignment of the boundary.

6.3 Guideline for the Adoption of a Natural Feature

Table 2 - Guideline for Non-Tidal Riparian Definition

Feature	Indicator
Three Elements	Note the elements within the watercourse. Does the watercourse contain a bed, a bank and the presence of water, or has the potential to contain water?
Evidence of Vegetation	Note the vegetation around the watercourse. If so, what type of vegetation is present? - Old, large diameter trees and stumps or small trees and shrubs - Is the alignment of vegetation consistent with the alignment of the watercourse? - Are there water tolerant grasses present or a division between native plain grasses and the water tolerant grass?
Cross-Sectional Shape	Note the general layout of the sloping walls of the watercourse. - Does the cross-section exhibit a feature that would contain the normal conditions within the watercourse? - Is the soil in the walls of the watercourse consistent with the surrounding landscape? - Do the walls of the watercourse exhibit a vertical or sloping face?
Accretion and Erosion	Note the general layout of the sloping walls of the watercourse. - Is it possible to initially determine whether the watercourse position has moved prior to the preceding survey? - Do the outside walls at the bends in the watercourse contain a vertical face? - Do the inside walls at the bends in the watercourse contain gradual sloping face?
Alterations to Conditions	Note if there have been manmade changes within the watercourse. - Is there a weir or block dam structure, which may alter the normal conditions within the watercourse? - If so can the extent of change be determined and the difference between original and present conditions be measured?

Chapter 7

7.0 Conclusions, Limitations and Recommendations

7.1 Introduction

The project was not intended to solve shortfalls in non-tidal riparian boundary legislation. The guidelines, which have been developed during the course of this project, will serve as an aid to inexperienced surveyors. As stated earlier, throughout the course of the project it became apparent that the current regulation pertaining to guidelines for feature definition was not the only limited factor in this process. It is therefore fitting that a number of points of interest be drawn to attention.

7.2 More Information

There are a number of important points to make in relation to defining a non-tidal riparian boundary. They include:

- Little has been achieved in almost 100 years in the way of simplifying the definition process,
- A lack of information available to surveyors on non-tidal riparian boundaries,
- Great emphasis has been placed on original determination of a riparian boundary by the NRM&W,
- The reluctance of the NRM&W to allow the alteration of the alignments of riparian boundaries,

Limited information and education of surveyors has been the driving force behind this project. By overcoming limitations in current regulation, at the very least, some of the inherent problems associated with the definition of a non-tidal riparian boundary will be overcome.

7.3 Further Investigations

This report has outlined three areas which may benefit the system in the management of riparian boundaries: covenants, trigger mechanism and consolidation of legislation.

7.3.1 Covenants

The use of a covenant combined with environmental considerations is applied by using a minimum width (zone) to extend from the riparian boundary to the limit of the usable rights people have in land. The width would be set at a minimum of 20-30m to protect/rejuvenate riparian areas (river banks) and range at a perpendicular distance from the riparian boundary to include an area sensitive to protect under environmental legislation. Defining the limits of where people's rights start and end is more of a consideration to society than the process of defining riparian boundaries. The application of this principle would offer society a preventative approach to land management and reassure landholders in these areas the security of their land.

An alteration to this process would be to enforce a covenant survey over riparian land upon subdivision of an existing lot. This process essentially would lock up a strip of land (the riparian zone) parallel to the watercourse and form demarcations between the right people have in land, environmental legislation and the riparian boundary.

A covenant under legislation is described in the Land Title Act 1994 (Qld), division 4a covenants. The covenant must:

(b) Be aimed directly at preserving:

(i) A native animal or plant; or

(ii) A natural or physical feature of the lot that is of cultural or scientific significance;

A covenant under these circumstances would be an existing process familiar to industry simply being applied in a different manner. The same processes of plan registration would apply and be handled by the NRM&W at a state level. New regulation/legislation would be required and an introduction period with educational guidelines would be required to be allocated.

7.3.2 Trigger Mechanism

Under current processes one method is available to define a non-tidal riparian boundary. This method assumes all boundaries are subject to similar natural processes with similar features.

The third method of handling non-tidal riparian boundaries would be to apply a trigger mechanism, which would involve a series of steps to be invoked at varying land development stages. This process would exclude existing residential developed allotments (inside town/city boundaries). The reason for the exclusion of these areas (residential allotments) is the impacts on native vegetation would be at a premium and any further exclusion of area would impact greatly on the lifestyles of its occupants not to mention the cost of land. Furthermore, the land use in these areas will have been modified to an extent the natural control mechanism would require a great financial burden in the reconstruction costs to the landholders to overcome. The depth of existing allotments in residential areas is already minimal and any further reduction in allotment size due to environmental zoning would be beyond any benefit to society as a whole. Un-natural protection (man-made) would be better suited in these circumstances.

A trigger mechanism would include the direct relationship between the needs of society for riparian boundaries and the administration requirements of the NRM&W.

This proposal includes:

- Trigger mechanism to be enforced upon subdivision,
- A varying degree of accuracy required by the needs of society:
 - Rural boundaries require less accuracy due to the scale of rural allotments,
 - Residential, commercial and industrial land require greater levels of accuracy due to the need for costly development, increased land value and the limited availability of space in higher developed areas,
- The severity of the trigger mechanism would be controlled by:
 - The name of parish.

The proposed changes to the definition of a non-tidal riparian boundary using a trigger mechanism would require alterations to the reporting process. The report would be required to address the points in the proposal, although the reporting system would proceed as per the normal plan registration requirements and would be controlled by the NRM&W under normal auditing arrangements and the process still be handled at a state level. New regulation/legislation would be required and an introduction period with educational guidelines would be required to be allocated.

7.3.3 Consolidation of Legislation

The difficulties faced when undertaking this project were due to the limited information on the topic but also from the variety of locations where regulation and legislation were found. This proposal originates from the order of longevity. The legislation in place today originated from England, and as a result, laws which best-suited English life were adopted in Queensland. All forms of legislation from that time have been altered to a degree but essentially each version reflected life of the day. In more recent times environmental legislation has been developed and placed over the top of surveying legislation. The layering of legislation increases the chance for error due to high volume of information required to be sorted before related topics are found. These forms of layered legislation are becoming more common as times goes by and this proposal is aimed at consolidating relevant forms of legislation relating to title boundaries. The proposal would be similar to current land management practices allowing strong environmental issues currently dealt with at a local government level to continue but allow the management of riparian land boundaries to be included. At present these semi-related topics bear no connection but are closely related due to dealing with similar natural process. One of the desired features of this form of management techniques is the ability of local government to apply a foundation structure of definition to best suit local conditions. By allowing these changes in the management of non-tidal riparian land, title boundaries are still dealt with by the state and land management issues will be unchanged and dealt with by local government. This process would also have the advantage of being less stringent in the wording or direction overcoming current limitations in legislation direction.

7.4 Achievement of the Topic

The aim of the project was to develop a guideline to aid a surveyor in the determination of a feature to adopt as a non-tidal riparian boundary. Appendix A – Project Specification, illustrates the aim in depth and I believe for the time constraints involved the topic has been met. Not only was the aim achieved but also future direction for others wishing to undertake research into the topic of non-tidal riparian boundaries. Future direction leans towards improving legislation and developing practical applications to meet shortfalls in areas currently in need.



The project did have shortfalls with time, much of which could be overcome for future dissertations if directed at developments in the field of climate, an in-depth review of morphology within Australian creeks and rivers and research into overseas legislation.

7.6 Conclusion

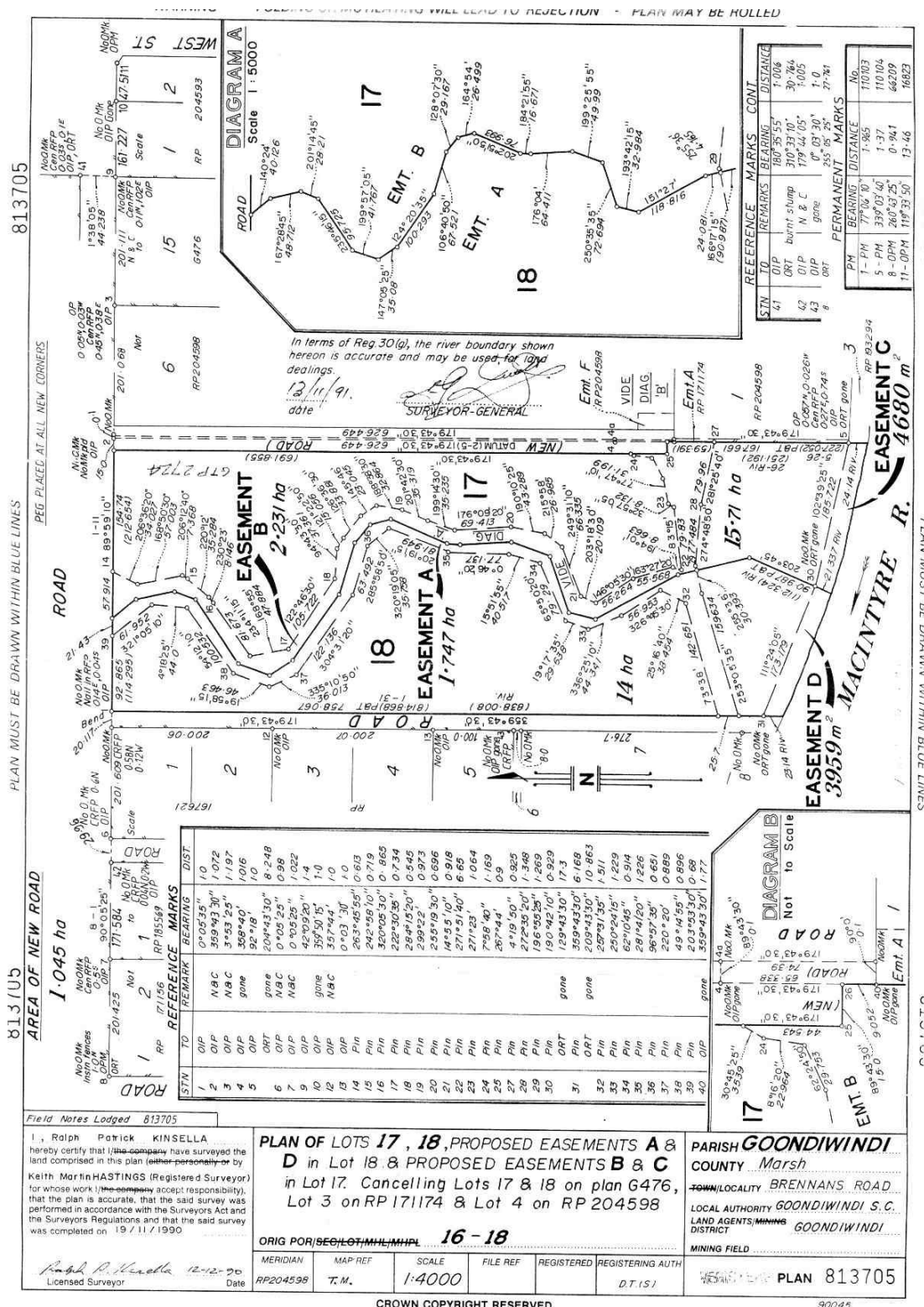
The guideline developed in this project is aimed at providing an educational supplement for surveyors. It is hoped the guideline will play an integral part for a field surveyor who has found themselves in a similar situation to other surveyors, having to overcome confusion and isolation in the field.

Appendices

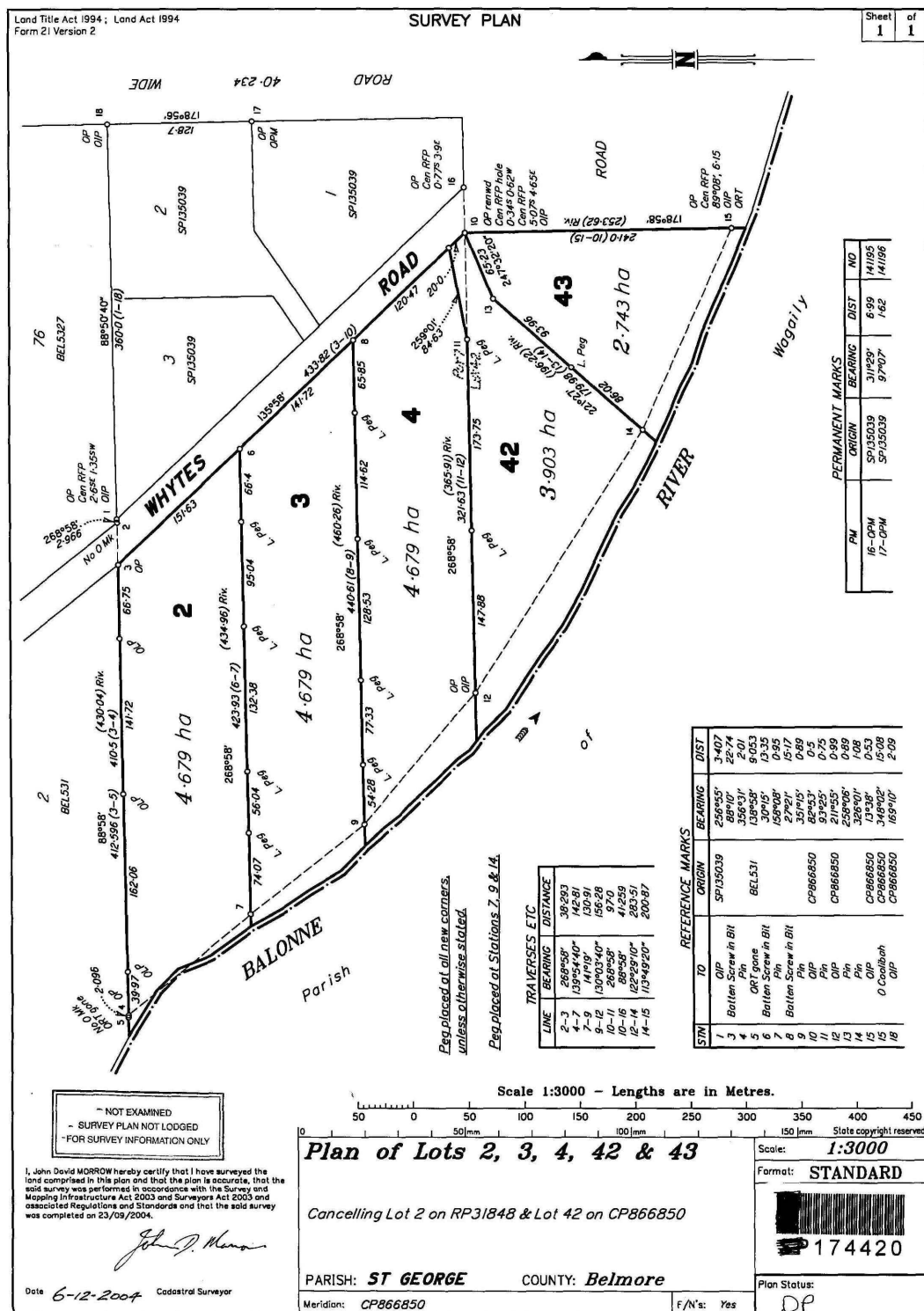
Appendix A – Project Specification

University of Southern Queensland Faculty of Engineering and Surveying	
ENG 4111/4112 Research Project PROJECT SPECIFICATION	
FOR:	Daniel Lawless
TOPIC:	DEFINING NON-TIDAL RIPARIAN BOUNDARIES
SUPERVISOR:	Mr Glenn Campbell
PROJECT AIM:	This project seeks to develop a guideline to aid the cadastral surveyor when faced with the task of defining non-tidal riparian boundaries.
PROGRAMME:	Issue A, 15 March, 2006
<ol style="list-style-type: none">1) Research historical and current legislative and administrative requirements in Queensland.2) Research survey standards with respect to riparian boundaries in other jurisdictions.3) Search for historical cases of non-tidal riparian boundary redefinition problems.4) Research non-tidal watercourse morphology for a representative system.5) Formulate appropriate principles for the reinstatement of non-tidal riparian boundaries.6) Formulate standards for the conforming to the principles of the reinstatement of non-tidal riparian boundaries.7) Develop guidelines to meet the standards.	
<i>As time permits:</i>	
<ol style="list-style-type: none">8) Validate the guidelines with representative case studies.9) Assess the performance of the guidelines with respect to existing requirements.	
AGREED:	
 (Student)	 (Supervisor)
<u>24/3/06</u> (Date)	<u>10/4/06</u> (Date)

Appendix B – RP813705

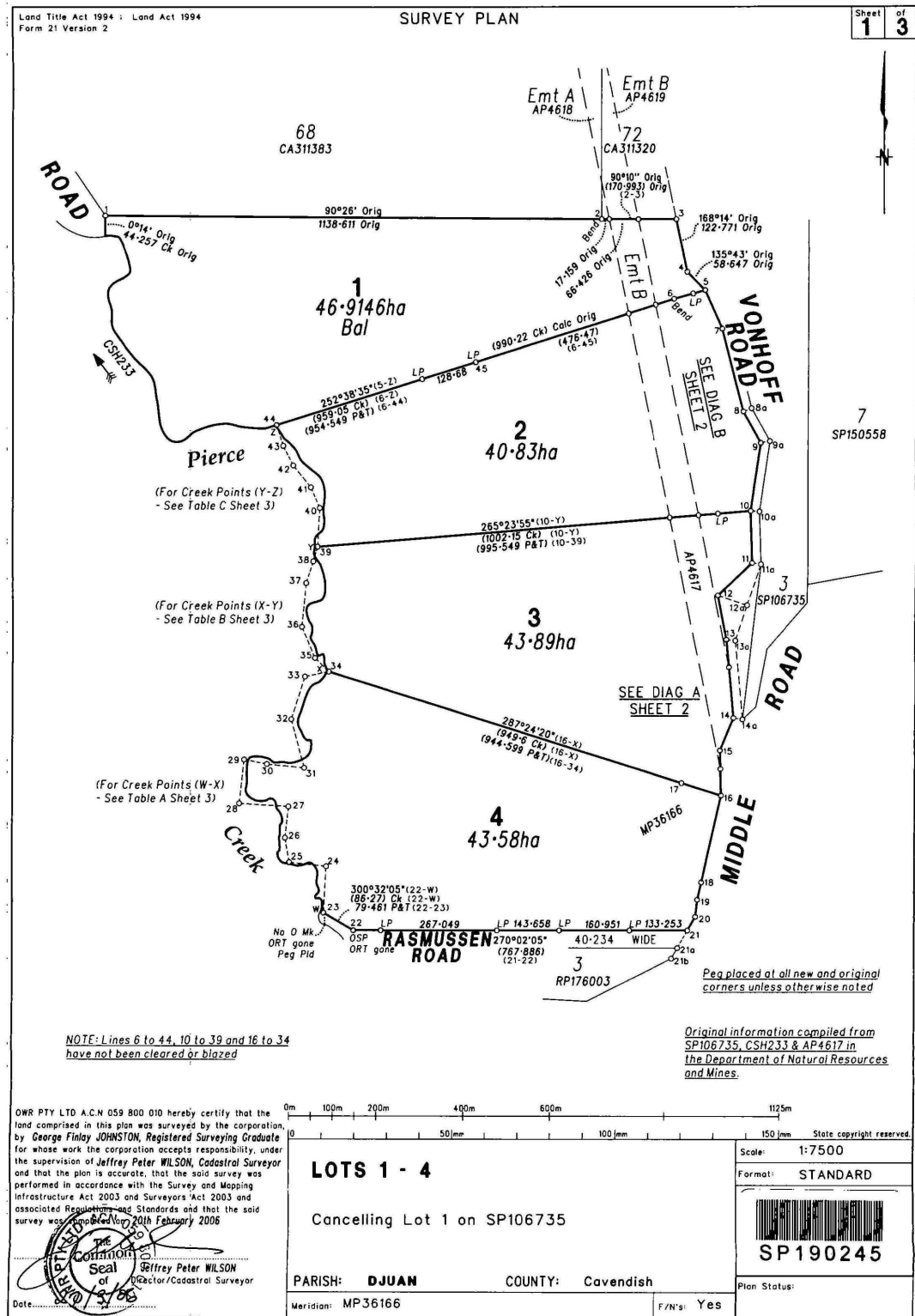


Appendix D – DP174420



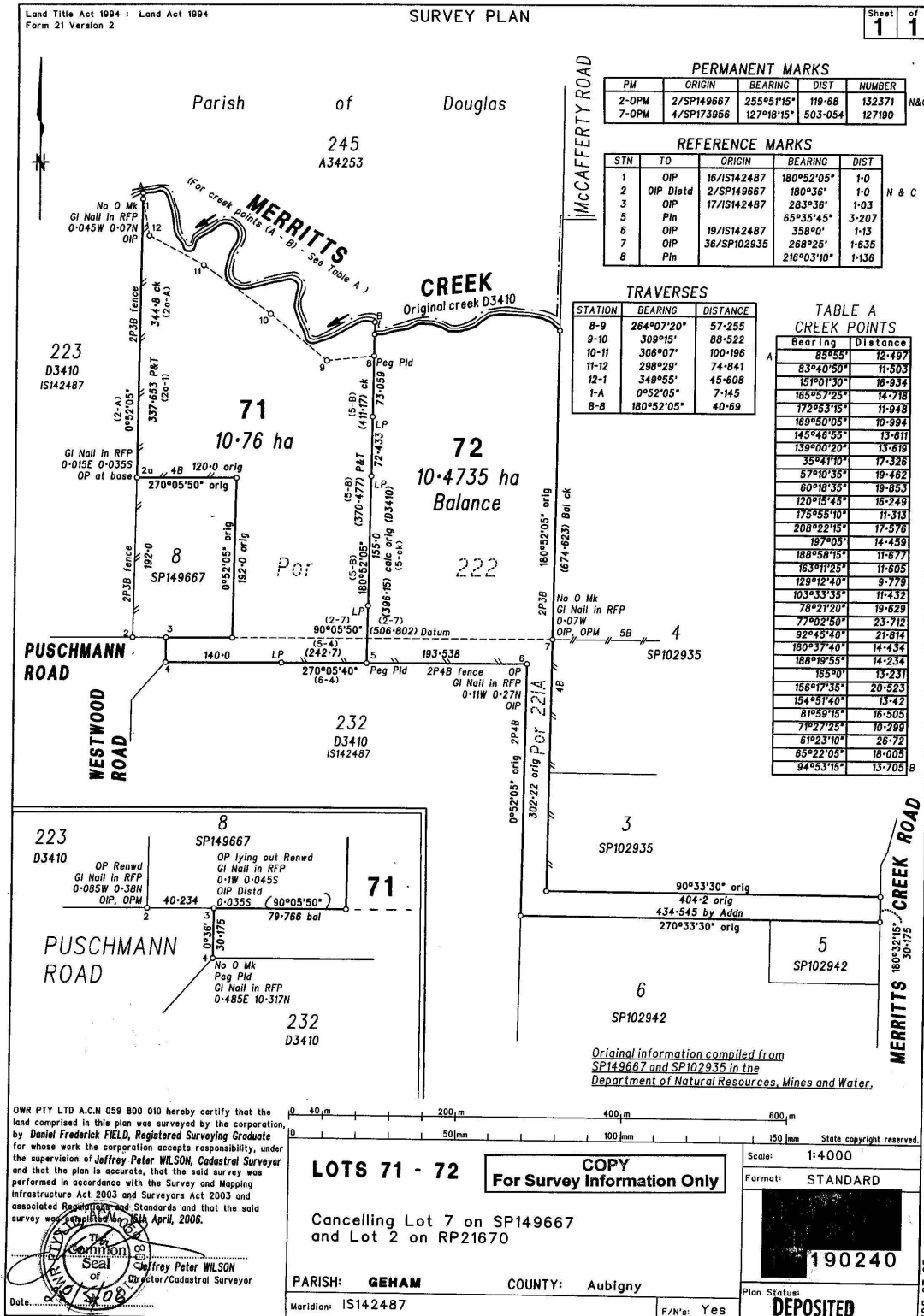
Appendices

Appendix E – SP190245



Appendices

Appendix F – DP190240



Appendices

Appendix H – Form 10 Plan Registration Compliance Checklist

Form 10 – Version 1

Survey and Mapping Infrastructure Act 2003

Plan Registration Compliance Checklist

In accordance with s20(1)(c) of the *Survey and Mapping Infrastructure Regulation 2004*, this form must be completed and lodged with each cadastral plan that is not endorsed by an accredited surveyor at Item 11 of Form 21 Version 2 under the *Land Act 1994* and the *Land Title Act 1994*. This requirement applies to all plans signed on or after 1 July 2005.

Plan Number	Surveyor	Assessor	Date Checked
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ITEM (Rule through where not applicable)	INIT.	AUDIT COMMENT	REFERENCE
CERTIFICATION			
1.1 Which certificate has been used to certify the plan is accurate?			NRMSR 3.9
1.2 Is the certificate correct, complete and dated?			
1.3 Is the signature current? (NRM Internal Use Only)			s.76A SA77
1.4 Has the ACN/ABN Number been shown if a Corporation?			
1.5 Have any amendments been made to the plan by strikeout?			
1.5.1 If so, has an amendment certificate been added to the plan?			RDPP 23
1.6 Has any amendment certificate been completed correctly?			RDPP 23
1.7 If amendment certificate uses s.32 (6) SMI, does it declare that plan is endorsed under that section?			NRMSR 3.7
1.7.1 Is a certified copy of authorisation lodged?			
1.8 Does the plan contain any original information?			
1.8.1 If so, is a compilation certificate shown?			NRMSR 9.39
1.9 If an explanatory plan:			
1.9.1 Is the correct certificate used?			RDPP 20.10
1.9.2 Has the format of the plan been modified correctly?			RDPP 20.7
1.9.3 Has the Registrar of Titles approval been provided?			RDPP 20.2
2 DESCRIPTION			
2.1 Are all the lots and secondary interests on the face included in the description of the plan?			RDPP 4.9
2.2 Does the cancelling clause contain all lots being cancelled?			NRMSR 3.8 RDPP 4.9, 4.10
2.3 Are secondary interest descriptors duplicated on the plan or title?			RDPP 4.8.2
2.4 Is the title restricted in depth?			
2.4.1 If so, does the description of the lots reflect the restriction as shown in the title and the previous plan?			RDPP 8.7
2.4.2 Is the restriction clearly stated on the face of the plan?			RDPP 8.7
2.5 Does the title and/or subject plan show any exclusion?			
2.5.1 If so have they been addressed (eg reservations in title – allocated or purchased)?			NRMSR 2.9
2.6 Is there a Reservation allocation shown on the plan?			
2.6.1 If so, does it agree with the Department's Reservation allocation?			NRMSR 2.9
2.6.2 Is the allocation certification signed?			NRMSR 2.9
2.7 Is the title partially cancelled?			
2.7.1 Has Registrar of Titles consent been given to continue this status?			RDPP 4.17
2.8 Are new undescribed balances created?			
2.8.1 If so – was consent of registrar provided?			RDPP 4.17
2.9 Do the Parish and County agree with the title and previous plan/s?			
2.10 Does the Orig Portion/s agree with the title and are plotted on face?			NRMSR 9.40
2.11 Does the Local Government and locality agree with SmartMap?			NRMSR 9.31

PLAN REGISTRATION COMPLIANCE CHECKLIST

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Appendices

ITEM (Rule through where not applicable)	INIT.	AUDIT COMMENT	REFERENCE
2.12 If cancelling common property, is the common property correctly stated in the cancelling clause – Common Property<scheme name> CTS<number>(plan that created Common Property) ?			RDPP 11.3
3 PLAN PRESENTATION			
3.1 Is the correct format of the plan identified?			RDPP 4.7
3.2 Is the plan capable of reproduction at a reduced scale without loss of clarity?			RDPP 3.1
3.2.1 Are the subject parcels correctly identified (line styles & fonts)?			NRMSR 9.30 & 9.55
3.3 Is an original Barcode label attached to the plan?			RDPP 4.2
3.4 Is the current plan number identified on the reverse of sheet 1 and all additional sheets?			RDPP 4.2
3.5 For multiple sheet plans, is the sheet number identified correctly?			RDPP 4.2
3.6 Have field notes/survey records been provided & plan noted?			NRMSR 3.35
3.7 Does the scale of the plan comply with the standard scales?			RDPP 4.14 NRMSR 9.48
3.7.1 Is the scale bar correct?			RDPP 4.14
3.8 Is a north point necessary and if so, shown?			RDPP 4.12
3.9 Does every lot have a total area?			RDPP 8.2 NRMSR 3.6
3.9.1 If a lot is shown in parts, does each part have a separate area?			RDPP 8.4.1
3.9.2 Is a Vinculum used? If so, do severances have no areas?			RDPP 8.4.2
3.10 Is a multiple line area shown?			
3.10.1 If so, does the plan show an allocation of the reservation certified by SLAM?			NRMSR 2.9
3.11 Is public use land created on the plan?			
3.11.1 Are all Public Use Land lots identified prominently with an approved term and clearly shown on the first sheet?			RDPP 4.8.1
3.11.2 Is access to the Public Use Land addressed correctly?			NRMSR 3.2.1
3.12 Are calculated intersections of new lot boundaries with registered secondary interests shown correctly?			RDPP 4.21
3.13 Are any of the new secondary interests restricted?			
3.13.1 If so, is the restriction clearly stated on the face of the plan?			RDPP 8.5, 8.7
3.13.2 Has the PM No, Datum and Height been shown on the plan?			RDPP 6.5
3.13.3 Is the information for this PM correct?			SCDB
3.14 If part of Common Property is included in lot/s within scheme, is Common Property limits included in each lot identified on face?			RDPP 11.8.1
3.15 Has the meridian box been completed correctly?			NRMSR 3.23 NRMSR 9.34
4 ACCURACY			
4.1 Does each lot and secondary interest have complete dimensions and area?			NRMSR 3.18
4.2 Does each lot (and part lot), severance, secondary interest and new road close within acceptable limits?			NRMSR 3.4.2
4.2.1 Is the area of each parcel correct?			NRMSR 3.6.1
4.3 Are all the severances fully dimensioned, including unsurveyed sides of roads?			NRMSR 3.18
5 ADJOINING INFORMATION			
5.1 Does the adjoining description agree with Smart Map? Should be correct at day of lodgement.			NRMSR 3.5
6 ALLOCATIONS			
6.1 Have all previous titles been stated?			RDPP 22
6.2 Has every new lot, new road and secondary interest been correctly allocated against the previous title/s, with a separate line for each previous lot?			RDPP 22.4
6.3 Are there any registered secondary interests or admin advice on the title?			
6.3.1 Have they been fully dealt with, if required, on the plan?			RDPP 22.6
6.3.2 Are the dealing numbers for the registered secondary interests in agreement with those shown on the title/s?			RDPP 22.6

Appendices

ITEM (Rule through where not applicable)	INIT.	AUDIT COMMENT	REFERENCE
6.4 Has every new lot been correctly allocated against the Original Portion/s, with each new lot mentioned once only?			RDPP 22.5
6.5 Are the Original Portions in agreement with the Title and the previous plan/s?			RDPP 22.5
6.6 If any lot is in more than one Local Government, have Local Govt area allocations been shown?			RDPP 22.7
7 REINSTATEMENT			
7.1 Is the reinstatement logical?			
7.2 If the reinstatement is complex, or requires explanation, has a report and/or an annotated copy of the plan been lodged as Survey Records?			NRMSR 3.35
7.3 Have the interests of all adjoining owners including the State been complied with?			SMI Reg s11
8 ENCROACHMENT			
8.1 Are there any encroachments shown?			SMI Reg 18-19
8.1.1 Is the size, nature and location shown appropriately?			NRMSR 3.20
8.1.2 Is there either: (a) a noting on the plan that SMI Reg s 19 has been complied with; or (b) evidence of a letter being forwarded to owner and a copy lodged with NRM as Survey Records?			SMI Reg 19
9 MARKING			
9.1 Does the plan show connections to two (2) PMs?			NRMSR 3.26
9.1.1 If yes, have the sketch plans for new PMs been lodged with the plan?			NRMSR 3.26 SMIA s15(2)
9.1.2 If no, has an explanation been provided?			
9.2 Have the corners of all new lots and new secondary interests been shown as marked?			NRMSR 3.22.5
9.3 Have sufficient and suitable reference marks been placed?			NRMSR 3.22.2
9.4 Is occupation referenced?			NRMSR 3.22.5
10 AMBULATORY BOUNDARIES			
10.1 Has the ambulatory boundary been compiled?			
10.1.1 If so, does the survey plan agree with the previous field survey for this boundary?			NRMSR 3.11
10.1.2 If so, has this plan number of the most recent survey of the boundary been shown on the face of the plan for this boundary?			NRMSR 3.18
10.2 Does the survey redetermine the ambulatory boundary, in part or in full?			
10.2.1 If so, have Survey Records been lodged clearly explaining the determination, differences etc?			NRMSR 4.0
10.3 Is the report acceptable?			NRMSR 4.5
10.4 Does the plan indicate that Survey Records have been lodged, if applicable?			NRMSR 3.35
10.5 Have correct terms been used for tidal boundaries (eg HWM, not Bay, not Ocean etc)?			NRMSR 4.4
11 STATE LAND PLANS			
11.1 Is a letter of offer/approval available?			NRMSR 5.15
11.2 Does the plan fully comply with the letter of offer from the NRM?			NRMSR 5.15
11.3 Have the parcels been correctly described, lot<alpha>, lot<number>?			NRMSR 3.17
11.4 Have the correct action statements been shown on the plan?			NRMSR 9.2
11.5 Is the plan suitable for the action intended?			
12 STANDARD FORMAT WITH COMMON PROPERTY (SCHEME - STANDARD FORMAT)			
12.1 Does the description of the plan include "common property"?			RDPP 11.3
12.2 Does the plan show the area of common property?			RDPP 11.5
12.3 Is the lot numbering acceptable?			RDPP 8.3
12.3.1 If not, is there a letter of explanation for the numbering pattern adopted?			
12.4 Does the plan show CMS Name and/or Number in Item 3?			RDPP 4.15
12.5 Does the plan show the Development Approval Date above item 12?			RDPP 4.20

Appendices

ITEM (Rule through where not applicable)	INIT.	AUDIT COMMENT	REFERENCE
13 BUILDING FORMAT PLAN (SCHEME - BUILDING FORMAT)			
13.1 Is base parcel fully dimensioned?			RDPP 9.7
13.2 Does the plan show the base parcel area?			RDPP 9.7
13.3 If new CTS, does plan have 2 lots (min) and Common Property?			RDPP 9.3.1
13.4 Is the building layout correctly shown and plotted, and "Common Property" not shown within the base parcel?			RDPP 9.8
13.5 Does the plan show two direct or indirect connections to the corners of the base parcel for each building?			RDPP 9.8
13.6 Is there ONLY ONE "remainder" Standard Format Lot?			RDPP 9.3.2
13.6.1 Have the dimensions and area for this lot been shown?			RDPP 9.3.2
13.6.2 Has a statement added to the face of the plan indicating which lot is a Standard Format lot?			RDPP 9.3.2
13.7 Are there multiple buildings?			
13.7.1 If so, are they correctly identified by an alpha?			RDPP 9.10
13.7.2 Is this identification also reflected in the level diagrams for each building?			RDPP 9.15.2
13.8 Are there multiple towers?			RDPP 9.15
13.8.1 If so, is the footprint the podium/basement and towers plotted?			RDPP 9.15.1
13.8.2 Are the level diagrams correct?			RDPP 9.15.2
13.8.3 Is a lateral aspect diagram shown?			RDPP 9.15.3
13.9 If consecutive lot numbering is not used, is the lot numbering template acceptable?			RDPP 9.4
13.9.1 Is the lot numbering template applied across the whole of the CTS?			RDPP 9.4
13.10 Are all lots and parts of the same lot readily identified by appropriate line weights?			RDPP 9.5.2
13.11 Are all lots bounded by structural elements?			RDPP 9.6
13.11.1 If not and for a boundary within a building, are the corners marked, boundaries dimensioned and referenced to structural elements or base parcel?			RDPP 9.6.2
13.12 Has a standard scale been used for each of the level diagrams and are they all drawn to the same scale and orientation?			RDPP 9.12
13.13 Have the total areas been shown for every lot that is in parts?			RDPP 9.5.1
13.14 Have all part lots been described with an approved purpose?			RDPP 9.5.4
13.15 Are all building format lots represented on level diagrams?			RDPP 9.12
13.15.1 If applicable, is the outline of the lower level shown on level diagrams?			RDPP 9.13
13.16 Are the level diagrams correctly identified, eg Level A (and building/tower)?			RDPP 9.15.2
13.17 Is a north point shown for the level diagrams, if necessary?			RDPP 9.12
13.18 Is every closed figure on every level diagram identified with "ownership", eg common property, lot<number>?			RDPP 9.12
13.19 Is adjoining information shown and correct for every lot on every level diagram?			NRMSR 9.3.4
13.20 Are all encumbrances, eg easements, correctly plotted on every level diagram?			RDPP 4.22
13.21 Are voids shown correctly?			RDPP 9.5.5
13.22 Are there private yards on the plan?			
13.22.1 Has the principle of a low-rise building been satisfied?			RDPP 9.17
13.22.2 Does the private yard abut parts of other lots?			RDPP 9.17
13.23 Has the CMS Name or Number been shown in Item 3?			RDPP 4.15
13.24 Has item 12 been fully completed?			RDPP 9.20.7
13.25 Are there any encroachments by the buildings onto adjoining land or road?			RDPP 9.20.3
13.25.1 If so, has the encroachment been addressed correctly?			RDPP 9.20.3
13.26 If an encroachment is shown, is there a statement about "the lots being wholly contained within the base parcel"?			RDPP 9.20.7
13.27 Does the encroachment relate to an "existing building"?			RDPP 9.20.7
13.27.1 If so, is the appropriate noting made?			RDPP 9.20.7
13.28 Does the plan show the Development Approval Date above item 12?			RDPP 4.20
13.29 Are existing volumetric lots or existing volumetric or restricted secondary interests in the base lot affected?			

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Appendices

ITEM (Rule through where not applicable)	INIT.	AUDIT COMMENT	REFERENCE
13.29.1 Has a lateral aspect diagram been shown for affected volumetric lots?			RDPP 9.16.3
13.29.2 Have the other special requirements for affected volumetric lots been met, eg. footprints, level diagrams?			RDPP 9.16
13.29.3 Has a lateral aspect diagram been shown for volumetric secondary interest or restricted secondary interest registered against base parcel?			RDPP 9.23
14 VOLUMETRIC PLANS			
14.1 Is the lot numbering acceptable?			RDPP 10.3
14.1.1 If not, is there a letter of explanation for the numbering pattern adopted?			
14.2 If part lots are used, are they correctly described?			RDPP 10.4
14.3 Has the area of the footprint been shown?			RDPP 10.5.3
14.4 Has the area for the overall footprint been shown?			RDPP 10.5.3
14.5 Have sufficient references to the ground RL been shown?			RDPP 10.12.5
14.6 Has the volume for each lot and secondary interest been shown? (easements may be excluded)			RDPP 10.5.4, 10.6
14.7 Has the PM No, Datum and Height been shown?			RTDP 10.10.2
14.8 Does the plan contain a statement regarding Vertical Planes?			RDPP 10.10.5
14.9 If plan notes that the parcels are bounded by vertical planes, are all the bounding edges on the footprint fully dimensioned?			RDPP 10.10.5
14.10 If plan does not use vertical planes for bounding surfaces, have the bearings & slope distances for bounding edges been shown?			RDPP 10.10.1
14.11 If co-ordinates are shown, are they in addition to polar dimensions for the bounding edges?			RDPP 10.10.1
14.12 Does the plan contain a definition of bounding surfaces?			RDPP 10.10.5
14.13 Are the corners marked or referenced to physical structures?			RDPP 10.11
14.14 Are the isometric diagrams ISOMETRIC?			RDPP 10.12.1
14.15 Does the plan indicate the direction from which the isometric diagram is viewed?			RDPP 10.12.1
14.16 Have the Isometric Diagrams been drawn to a standard scale?			RDPP 10.12.6
14.17 Do all vertices have an RL?			RDPP 10.10.1
14.17.1 If not, is there a statement for a single horizontal plane?			RDPP 10.10.1
14.18 Is there ONLY ONE remainder Standard Format Lot?			RDPP 10.2.4
14.18.1 If so, has the area for this lot been shown and a statement added to the face of the plan indicating which lot is a Standard Format lot?			RDPP 10.2.4
15 VOLUMETRIC FORMAT WITH COMMON PROPERTY (SCHEME – VOLUMETRIC FORMAT)			
In addition to 14 VOLUMETRIC PLANS:			
15.1 Does the description of the plan include "common property"?			RDPP 11.1
15.2 Does the plan show the area of common property?			RDPP 11.6
15.3 Does the plan show CMS Name and/or Number in Item 3?			RDPP 4.15
15.4 Does the plan show the Development Approval Date above item 12?			RDPP 4.20

Certification

I, _____¹

hereby certify that this checklist accurately represents an audit of _____²

_____³ Date : _____

Cadastral Surveyor

1. Full name of Cadastral Surveyor (Individual) identified on Form 13 or Form 18 on the plan
2. Plan number
3. Signature of Cadastral Surveyor whose name appears at Item 1

Appendices

Abbreviations

CMS	Community Management Statement
CTS	Community Titles Scheme
NRMSR	Department of Natural Resources and Mines Cadastral Survey Requirements see www.nrm.qld.gov.au/property/surveying/technical_standards.html
RDPP	Registrar of Titles Directions for the Preparation of Plans see www.nrm.qld.gov.au/property/titles/rdpp/index.html
RL	Reduced level
SA77	<i>Surveyors Act 1977</i> (now repealed)
SCDB	Survey Control Data Base
SLAM	State Land Asset Management, in the Department of Natural Resources and Mines
SMIA	<i>Survey and Mapping Infrastructure Act 2003</i>
SMI Reg	<i>Survey and Mapping Infrastructure Regulation 2004</i>

Instructions for completing the form

- (1) Complete the general information at the top of the form
- (2) All relevant items in the checklist must be completed. Completion involves:
 - a. initialling the box in the “INIT.” Column to certify that the item has been checked and is correct; and
 - b. answering the question in the “Audit Comment” column
- (3) Items that are not applicable (e.g. Sections 13 –1 5 for a Standard Format Plan) should be ruled through, and the ruling through should be initialled.

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