

Bathurst: A City in a Special Landscape

Chris Marshall, April 2016



Landscape is an inescapable physical reality that underpins our community, culture and economy.

Seeing and understanding landscape is a surprisingly personal experience influenced by a diversity of views of the wider world, including cultural background, knowledge, perceptions, attitudes and values.

There are many powerful and valid ways of reading and valuing the landscape. There are also contested views as to how the landscape was formed, how long it took, what processes were involved and in particular, how the landscape should be used and managed. Many people through their attitudes and actions seem to be blind to landscape, ignoring its constraints, overexploiting its resources and destroying its special qualities. Others celebrate landscape, striving to understand it and to find answers for the many riddles that daily confront us in our lives in that landscape.

There is little doubt that the early European explorers, road builders, administrators and settlers saw the landscape quite differently from the world view of Aboriginal people of that time. Even today, artists, writers, poets, farmers, engineers, scientists and many others from varied backgrounds, see and experience landscape in different ways.

The perspective of the Bathurst landscape presented here is based on the work of contemporary geologists, geomorphologists and other earth scientists. It is rounded out with personal insights from having lived and worked within this landscape for 30 years, as well as information gleaned from astute locals who have generously shared their knowledge and perspectives.

The story presented here is one person's contemporary view of an extraordinary but very complex landscape.

The Wider Landscape Setting

The city of Bathurst sits within a special and beautiful landscape. Viewed from afar the setting



Figure 1. The granite erosion basin at Bathurst is rimmed to the east by the dramatic Winburndale Range (photo: Wes Schulstad).

comprises a massive granite erosion basin carved out of a plateau that was gently raised during the formation of the Great Divide some eighty million years ago. Much of the rim of the basin is dominated by older and harder rocks that have been folded into a distinctive north south structure. Of particular note is the distinctive steep timbered ridges of the Winburndale Range on the skyline to the east of Bathurst (Figure 1, 5 & 23). To the north the basin has a softer edge where the rounded granite woodland country rises to the crest of the Mount Rankin ridge.

The sculpting of this basin has been achieved with the forces of running water. The Wambuul/Macquarie River and its tributaries continue the process today. There is abundant and clear evidence of older and different forms of this river system and its landscape shaping work scattered across the basin that will be discussed later in this paper. Understanding these ancient river systems is often a key to understanding the wider landscape.

Rivers and creeks enter the basin through narrow steep valleys dropping from the higher dissected plateau country. Their paths across the basin are characterized by wider flatter valleys with distinctive areas of floodplain. The Wambuul/Macquarie River again narrows and steepens as it exits the granite country downstream of Bathurst between the Evans Plains Creek junction and Pine Ridge. From here it does not have the capacity to form substantial floodplains until it flattens again far down stream near Wellington.

A rain shadowed valley. The open rounded character of the granite hills within the wide erosion basin is quite distinctive and a contrast to the steeper tighter valleys outside the bounds of the granite. Also distinctive is the difference in the natural vegetation structures between these contrasting landscapes. The steeper hill country tends to be covered in forest while the valleys have a mosaic of open woodland and grassland.

The basin is in a natural rain shadow (Figure 2). Travelers marvel at the frequency with which steady rain can fade at the edge of the high rim of the basin as they begin to descend to Bathurst. The valley is noted for its less frequent and more erratic rainfall.



Figure 2. The rain shadowed Bathurst valley landscape (photo: Wes Schulstad).

It seems all access to Bathurst involves a descent from higher wetter country. Much of the dependable flow in the valley's streams is sourced beyond the steep rims on the better watered remnants of the surrounding dissected plateau country.

The community's relationship with the landscape. Bathurst is a modern city with a vibrant community showing many features of prosperity and wellbeing. It is testimony to the gumption of the early European explorers, surveyors, road builders and administrators who found their way to this special place early in the nineteenth century but also the landscape wisdom of the Wiradyuri people who long lived in this valley before the Europeans.

While foresight, endeavour and creativity have been key elements to the success of our modern community, we need also to reflect on and celebrate the special values within the landscape that allowed that community to establish and flourish. The landscape has been shaped by our community to meet its needs and the landscape in turn has shaped the community, demanding that we not only appreciate it as an asset but that we understand it and work within its constraints.

The story of this ongoing relationship includes the effects of long term Aboriginal presence and land management as well as the development and exploitation of soil, water and mineral wealth by the later arriving Europeans. It also explores the wonder we feel and the beauty we see in the landscape, our spiritual connections to it as so often expressed through artistic endeavours, nature appreciation and the simple joy of being in the landscape.

That landscape story documents our ongoing inquisitiveness, our striving to understand the landscape and our quest to live in harmony in it. All is not agreed. The recent controversy over a proposal to extract treated effluent from the river and change its low flow character has showcased the concern, passion and love the community has for the river and the wider landscape.

We have little in the way of direct evidence of the detail how the Wiradyuri people lived within this landscape. We can certainly imagine them valuing, managing and utilising the waters, grasslands, wetlands and woodlands at and near the site of modern Bathurst. We do know that they continue to attach much significance to the Wambuul/Macquarie River as well as nearby Wahluu/Mount Panorama and Mount Pleasant.

In acknowledging this important connection to landscape we should reflect on the fact that the Wiradyuri people recognised, valued and creatively utilised this landscape for tens of thousands of years. They were here long before the arrival of the first European settlers. Indeed they were most likely here 20,000 years ago during the last worldwide glacial climate extreme. They would have witnessed the wide, braided, and shallow, bed load dominated stream form of the Wambuul/Macquarie River at that bleak time. They must have celebrated the gradual waning of the extreme weather over multiples of generations. Such long residence surely imparted much knowledge, deep wisdom and strong landscape connection.

It would be presumptuous to assume further detail of the Wiradyuri connection to and knowledge of the Bathurst landscape. This is a story that should be left to these first people of the valley to decide if, when and how it is told.

A Closer Look at the Landscape Setting of Bathurst.

The Historic Town Square and the old town of Bathurst. Governor Macquarie, with the guidance of Evans and Cox, was drawn to the pleasant camp site at the junction of the Wambuul/Macquarie River and Vale Creek in May 1815 (Fig 3 & 11). The character of the site is still largely defined by the proximity to these water courses as well as to the long, low slopes that rise from here towards Wahluu/Mount Panorama as a catchment dividing ridge between the lower ends of the Vale and Jordan Creeks (Fig 4).



Figure 3. The original site of the Vale Creek junction with the Wambuul/Macquarie River below Peace Park.

We can't be sure of why this exact spot was chosen ahead of others that the travelers had passed in the previous days, and would see in days to come. But with reflection it's clear that the site is special in its suitability for a secure temporary camp for the governor's party at that time, a small colonial outpost after the Governor's formal proclamation and eventually a growing town that has developed into a substantial and still expanding city.

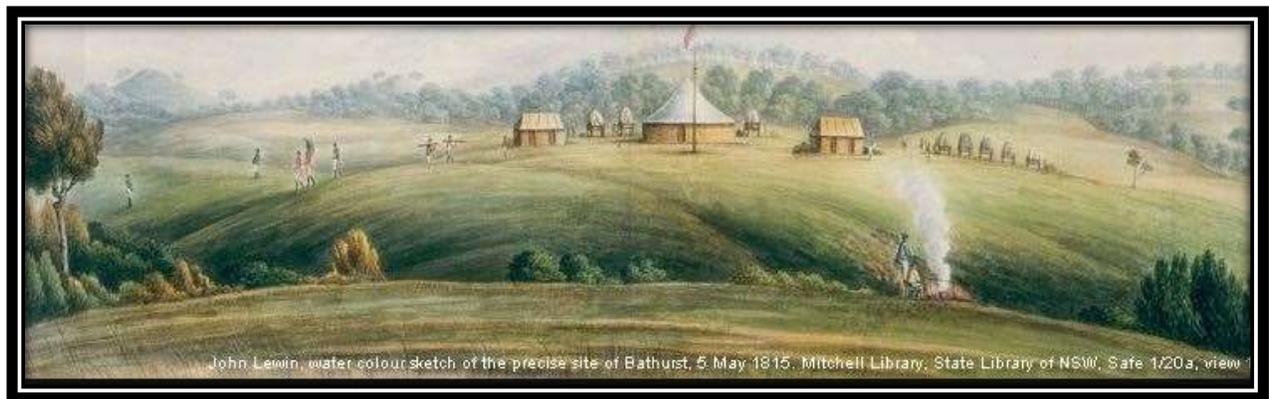


Figure 4. Lewin's 1815 painting clearly shows grassed low sloped remnants of ancient flood terraces rising to higher granite hills. The catchment dividing ridge between the Vale and Jordan Creeks extends up slope from Macquarie's camp and now forms the spine of today's grid patterned city layout.

While other sites in the valley have many elements of suitability it appears that none have the same expanse of landscape qualities evident here.

It's not possible to know the scale of Macquarie's vision for the future settlement. It's likely that he at least had a keen eye for what lay immediately around him as is so well displayed in the paintings of the site by Lewin made at that time (Fig 4). It's not hard to imagine Macquarie seeing enough suitable land to support a substantial town embracing a significant central area of public and civic land uses on the flattest of the grassed catchment divide upslope from his camp beside the river.



Figure 5. Joseph Backler's painting of Bathurst from about 1850 with the distinctive Winburndale Range to the east. Compare this with Figure 23.

The gentle broad slopes close to reliable water but above apparent flood levels and with clear views all around for security purposes offered obvious advantages for Macquarie's camp. As it did for the early settlement that followed. It's tempting to think that Macquarie sensed the beauty of the views to the east across the floodplain and grassland hills to the timbered and mysterious Winburndale Range in the distance. It's notable that the view to east features prominently in a number of historic artworks from those and later times. (Fig 5).

Perhaps Macquarie was also aware of the shelter and warmth offered by these east and north facing slopes backed by the higher timber hills to the south and west.

Macquarie and his party must surely have also been aware of the distinctive narrow gallery forest of dark Casuarina trees that edged the river and contrasted so markedly with the broad treeless character of the floodplain to the east.



Figure 6. Macquarie's Flag Staff site still clearly exhibits the flat character of its flood terrace locality.

The grassy treeless slopes rising from the knoll above the river where Macquarie pitched his pavilion and set his flag staff (Fig 6) are distinctly different to the steeper rounded woodland covered slopes of the surrounding granite hills. These locally unique features are in fact reshaped and eroded remnants of ancient flood plain terraces of the Wambuul/Macquarie River. They are draped over the underlying granite base as deposits of alluvium of various depths having been left stranded as the river continued its downward cutting of the landscape through the ages. With knowledge of the general rate of ongoing landscape evolution, the terraces may be in the order of 1 to 2 million years old.



Figure 7. Views along George Street reveals the low sloped and benched character of the ancient flood terraces.

Given the surrounding hillier woodland country and the obvious flood risks on the lower wetter land, the expanse of remarkably flat grassy land on the lower end of the flat ridge rising from the camp site must have caught Macquarie's eye. Even today, looking up and down William and George Streets (Fig 7) it's possible to see the gentle long grades and especially the flatter benched section that has been developed as the Bathurst Town Square. The Square exploits the flatter bench to support substantial historic civic buildings (Fig 8) and public open spaces (Fig 9). Machattie Park and the Catholic

Cathedral and associated school beyond, while not part of the Town Square, also occupy the flatter benched section of this ridge as major feature in the Central Business District.

The exact reason for the attractive mix of treeless grass on the benches and grassy woodland on the steeper hills beyond (Fig 4) remains to be explored and explained with certainty. It undoubtedly involves a mix of long employed Aboriginal burning regimes, regolith and soil character as well as aspect and drainage.

It's surely no coincidence that the historic surveyed alignment of Macquarie's Flag Staff and the centre line of the iconic Bathurst Town Square closely follows the catchment divide between the Vale and Jordon Creeks. The catchment divide creates the spine for the city's historic grid patterned layout with William and George Streets aligned parallel but to the side and slightly downslope of the spine. The cross streets are perpendicular to the catchment divide and set out at measured distances to create the characteristic grid pattern of the inner city area.



Figure 8. The scale and grandeur of the Bathurst Courthouse is only possible because of the flatness of the catchment dividing ridge at this locality.



A view down any of the cross streets reveals the clear roll of the landscape across the catchment divide.

Anyone who has run the iconic Edgell Jog will be familiar with the slight downhill start from the ridge crest in front of the Bathurst Court House to the dip of the now buried and channeled Jordon Creek. The last two and a half blocks of that challenging run are renowned for the discomfort of running uphill from the floodplain of the Vale Creek to the finish line on the catchment divide in front of the Court House.

The alignment of Macquarie's survey and the catchment divide provides a plausible explanation for why Bathurst's formal street grid is laid out at very close to, but not exactly, forty five degrees off north.



Fig 9. Low sloped ancient flood terraces proved attractive for civic, commercial and residential development at Bathurst.

It's clear that from its very symbolic but humble beginning the town has been intimately linked to the landscape. The historic Bathurst Town Square with its major civic buildings, cathedrals and parks are located on the flattest area of the ancient terraces straddling the divide (Figs 8, 9 & 10).

Drastic Changes to the defining creeks. It's wise to remember that the Vale and Jordon Creeks in these earlier times were not the tightly defined flow lines evident today. They were broad, flat and swampy expanses with chains of deep ponds posing obvious barriers to easy access and crossing as well as limiting the possibilities for stable, flood free buildings. The original broad form of Jordon Creek can still be seen when looking up and down Rankin Street.

The intervening flat ridge between the creeks would have been distinctly obvious as a relatively well drained, accessible, expanse of open developable land.

Today the Vale Creek has been diverted in an excavated channel to a new junction with the Wambuul/Macquarie River



Figure 11. The much altered and degraded remnant of the original channel of the Vale Creek just above its junction with the Wambuul/Macquarie River below Peace Park.



Figure 10. Perhaps the first map of Bathurst that indicates the significance of the catchment dividing ridge to the Town Square and the grid pattern of the streets in old Bathurst. The original 1841 faint map hatching has been emphasise here (Map copy provided by R. McLaughlin)

near the railway bridge. The cut off remnant of the natural course of the creek has been converted into a system of open and piped urban storm water drains. Its floodplain, the location of the new settlements first agriculture, is intensively developed for housing, streets, playing fields and the Bathurst Show Ground. All is contained within the protection of an engineered flood levee.

Unfortunately the significance and natural beauty of the original junction of the Vale Creek with the river below Macquarie's camp (Fig 3) has been lost. It now presents as an ugly, eroded, weedy and litter strewn eyesore within the manicured area below Peace Park and Macquarie's Flag Staff site (Fig 11). Surely as a site of such landscape and historical significance it deserve recognition and care?

Jordon Creek is now also a generally sorry sight. Much of its lower reaches are confined to engineered channels (Fig 12) allowing streets to be built over it in many places. Houses have been built across its broad flat floodplain. Rankin Street generally follows its natural alignment in its lower reaches. Some sections in

the upper reaches are currently being rehabilitated and the section through Hector Park is an excellent example of a reconstructed



Figure 12. The chanelised, straightened and deepened course of today's Jordon Creek. Note the broad flat form of the original floodplain to the side of the drain.



Figure 13. Reconstructed ponds in the upper section of Jordon Creek at Hector Park gives an idea of what the creek looked like at the time of settlement.

chain of ponds with associated water plants and animals (Fig 13). Much remains to be done to recognize and better manage this historic waterway.

Some Practical Connections to Landscape. The soils of the older part of the city carry evidence of the old flood plain terraces, the underlying and surrounding decomposing granite as well as the clays developed from the ancient basalts on nearby Wahluu /Mount Panorama and the wider catchment of the Wambuul/Macquarie River. While very attractive for agriculture, the tendency for these deep, clay dominated soils to shrink and swell with wetting and drying has proved problematic and destructive for many of the heritage buildings in old Bathurst. Cracking of foundations and walls as well as rising damp and salinity is common (Fig 14).

Local architect, Henry Bialowis, freely quotes his experiences to confirm at least some aspects of this part of the cities intimate connection to landscape. In constructing the foundations for the bell tower of the Anglican Cathedral in recent years, Henry describes excavations through approximately thirteen meters of alluvial clays. At that point he encountered river sands and gravels. He also describes earlier attempts by others to drain groundwater from the foundations of the Cathedral leading to accelerated drying of the clays. The result was severe cracking of that building leading to its tragic partial demolition.



Figure 14. Cracking brickwork and rising damp is common in many older buildings on the old alluvial flood terraces.

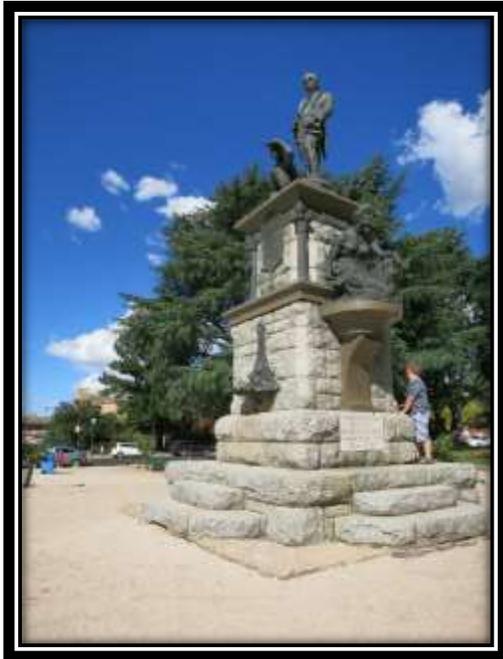


Figure 15. Solid granodiorite used in the Evans Memorial. In its decomposing form it has been used as the distinctive pale gravel on the surrounding paths.

Henry also recognised the significance of the ridgeline location of the Cathedral. It allowed him to incorporate low profile wheelchair access to the front door of the Cathedral without the danger of storm water from the street draining into the Cathedral. The water naturally flows away from the prominent ridge crest to Jordon and Vale Creeks.

A major connection to landscape is showcased in the dominance of red brick (Fig 14) as a building material in the older part of the city. The early bricks were fired from the richly organic black and grey clays dug from the contemporary floodplain of the Wambuul/Macquarie River at Bathurst. Upon firing the organics were burnt off bringing out the underlying red colouring of the iron stained alluvial clays.



Figure 16. Bathurst granodiorite in the George St gates into Machattie Park.

Other landscape connections take the form of the light grey coloured feldspar gravels widely used at Bathurst. These gravels have been traditionally quarried from hill sides at Boundary Road and used to cover the paths of Kings Parade and Machattie Park (Fig 15). This material is the decomposed underlying granodiorite that forms the geological foundation to Bathurst. In its undecomposed state the granodiorite, probably quarried from near Abercrombie House near Mount Pleasant, has been used to much effect in the bases of the Evans and Boar War memorials in Kings Parade (Fig 15). It is also the material used in the impressive George Street gates into Machattie Park (Fig 16).

Basalt from the top of Wahluu/Mt Panorama was used in old Bathurst to form building foundations (Fig 18) and curb and guttering for the streets. Unfortunately most of the street stone work has been pulled up (Fig 17) and replaced with concrete, destroying these intriguing and beautiful historic features.



Figure 17. Wahluu/Mt Panorama basalt, originally used to form street guttering in old Bathurst has been reused to form retaining walls at Bathurst High School.



Figure 18. Basalt used to form the foundations and walls of the cellar in an historic inn at Bathurst.

The modern Bathurst spills beyond the initial catchment ridge of ancient floodplain terraces identified and surveyed by Governor Macquarie. It now spreads, many would say, sprawls, across the hills either side of the Wambuul/Macquarie River and its associated broad expanse of contemporary floodplain. The flood prone nature of that plain has constrained its urban development leaving its expanse to be retained largely for agriculture, playing fields, and hopefully in the future, wetland management (Fig 32). It is of great significance that the smell, sight and feel of agriculture and nature can still be experienced right in the heart of the modern city.

Some of the newer urban areas that adjoin the contemporary floodplain are located on ancient river terraces similar to those in Bathurst Town Square and the older parts of the city. Although lacking the black, organic richness of the contemporary floodplain soils, these areas have red clay loam soils and in some cases there are significant sand and gravel deposits that challenge the urban gardeners. In general the spreading city is now developing on the rolling woodland hills of granite that forms the underlying geological foundation to the city.

Ancient rivers. Having a grasp of the character and pattern of the ancient Wambuul/Macquarie River, as widely evidenced around Bathurst, gives us an insight into the forces at play that formed the local landscape that supports the city.

An ancient river filled with basalt. The oldest obvious evidence of an earlier river system at Bathurst can



Figure 19. 19 million year old river bed material on Wahluu/Mt Panorama. Note the scale of erosion needed to create the modern Bathurst valley in the background

be found on Wahluu/Mount Panorama and other nearby hills. This prominent feature dominates the skyline to the south west of the city. The presence and form of these high points is linked to the forces associated with the raising of the Great Divide and the creation of a number of volcanic provinces in the

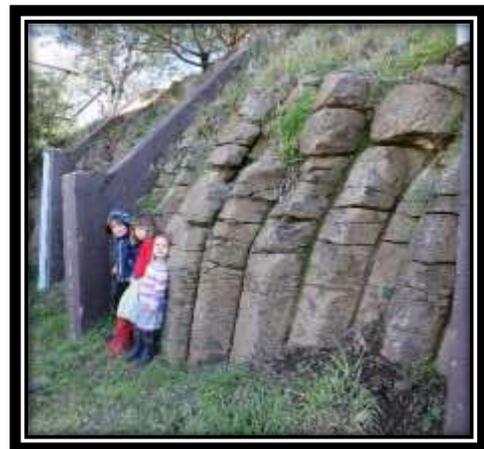


Figure 20. Basalt columns form part of the intriguing volcanic capping to Wahluu/Mt Panorama in the Wahluu Gamara Reserve..

region. Of great importance for Bathurst is the 19 million year old Abercrombie Volcanic Province to the south. It comprised lava fields with multiple outlets that delivered molten basalt in vast flows down the ancient Wambuul/Macquarie River bed, and possibly an old alignment of the Vale Creek, filling their channels and capping their sediments.

Today, remnants can be found of both the ancient river bed in the form of sand and rounded river pebbles (Fig 19), and the basalt capping (Fig 20), outcropping on Wahluu /Mount Panorama and other nearby hills.

At the contact between the basalt and the river materials at some localities is a layer of the river bed material chemically fused into a distinctive matrix of silcrete and ferricrete. Large fragments of these unusual and incredibly hard rocks can be found scattered down slope of their original outcrop (Fig 21).



Figure 21. Distinctive silcrete bedding formed from ancient river bed materials under the basalt on the hills near Bathurst.

Below the river bed material at some sites, are profiles of pale kaolinite clay. This material provides evidence of deeply decomposed granite formed in a very humid and perhaps warm climate. Some of the kaolinite may have been concentrated in localised lake deposits associated with the ancestral Wambuul/Macquarie River. This river most probably flowed on a broad flat plain supporting subsidiary lakes in which this very fine material was deposited. Given the 19Ma age of that landscape it's likely that the river and lakes were surrounded by an open structured rain forest grading to more dry tolerant vegetation types on higher ground.

prominent high point near Bathurst (Fig 22). Intriguingly its basalt to river bed contact point is located about one hundred meters lower in the landscape than the contact point on Wahluu/Mount Panorama. Dating of Mount Pleasants basalt at approximately twelve million years differentiates it from the older basalt flows on nearby Wahluu/Mount Panorama. It links it to the basalts flows from the younger Mount Canobolis volcanic complex to the west. The orientation of the basalt here indicates it may have flowed as a molten stream down an ancient alignment of today's Evans Plains Creek. It's intriguing to contemplate if there was sufficient basalt to block the Wambuul/Macquarie creating a lake. No evidence for this is currently known but may be worth pursuing.

The basalt capped Mount Pleasant is another



Figure 22. 12 million year old basalt capping dramatically exposed by quarrying at Mount Pleasant.

The basalt hills near Bathurst all have distinctly flat tops and are utilised for that practical reason at the popular camping area at Reid Park on Wahluu/Mount Panorama and the Aboriginal Bora Rings on Mount Pleasant. The flatness of the hill tops is a remarkable contrast to the steeper side slopes of these high landscape features. Despite the great age of the basalt flows, it's likely that an approximation of the original flat top of the flows has been preserved due to the resistance to erosion of the hard basalt. If this is the case then these landscape features are some of the oldest in the region.

The modern valley of the Wambuul/Macquarie River. The dating of the volcanics is the key to grasping the scale of change that has created our contemporary landscape. It's sobering to stand beside the exposed

river bed materials in the road cuttings on Wahluu/Mount Panorama (Fig 19) that were overwhelmed by the molten basalt flow (Fig 20). The challenge is to understand that 19 Ma ago this was the river bed in the bottom of the valley cut by the ancient Wambuul/Macquarie River. The depth of relatively resistant basalt emplaced in the river valley was sufficient to see the river diverted to the side. Here it could continue its erosive work in the more erodible granite materials. The result is remnants of the ancient river bed and associated basalt capping now standing as the high point in the modern landscape.



Figure 23. The modern valley of the Wambuul/Macquarie River looking east to the Winburndale Range from Wahluu/Mount Panorama. Compare with Figure 5.

Today, looking east across the broad rolling valley, the modern version of that river is located some 200 meters lower (Fig 23). It and its tributary streams has carved the vast volume of material from the valley that stretches from that point to the Winburndale Range. Its work has proceeded at a rate in the order of 10 meters per million years.

The eroded material was first transported north east into the developing Sydney Basin and then to the north into the Coonamble Embayment section of what was to become the Great Artesian Basin. In more recent times the sediments from the Bathurst region have contributed to the riverine plain that includes the iconic Macquarie Marshes down river of Warren.

Mount Pleasant represents an interim point in the down cutting process with its younger 12 Ma flow of basalt located about one hundred meters lower in the landscape than Wahluu/Mount Panorama but still one hundred meters above the modern Wahluu/Macquarie River.



Figure 24. Ancient river stones from a Bathurst garden.

This is a story of prodigious ongoing geological work on a grand scale.

Remnants of ancient river beds. In descending the slopes of Wahluu/Mount Panorama one passes over soils carrying the mixed erosion products of that prominent landmark. Granite derived sands of quartz and feldspar, black basalt rock fragments and intriguingly, small rounded quartz pebbles in a variety of subtle colours (Fig 24). They are spread across the hills and are continually making their way down slope under the ongoing forces of landscape erosion. At the base of the mountain can be found deep deposits of these mixed materials in the gullied foot slopes and valley fills.

At various localities and altitudes around the city of Bathurst can be found concentrated deposits of very similar quartz gravels together with river sands cemented by iron and silica (Fig 25). Prominent examples seem to outcrop at about the 720m contour 100 meters above the modern river, indicating an age of approximately 10Ma. Some may well be the remnants of river beds long left stranded as the Wambuul/Macquarie River pursued its relentless down cutting of the valley. Other more dispersed examples may be remnants of materials from higher river positions being spread downslope in the manner observed on the higher slopes of the mountain. Gardeners in the city are often puzzled and frustrated by these seemingly strange rounded stones mixed throughout the soils of their gardens (Fig 24).



Figure 25. Remnants of an ancient river bed in the road cutting near the 720 meter contour in Bradwardine Road.

There are other observable traces of the ancient Wambuul/Macquarie around Bathurst. Road cuttings at Gorman's Hill, Eglinton and the industrial area at Kelso reveal quite remarkable deposits of river rubbles and gravels 10 to 20 meters or higher above the modern river, indicating ages in the order of 1 to 2 Ma (Fig 26).



Figure 26. Ancient river bed gravels exposed high above the modern river in a road cutting at Gorman's Hill

Floodplains and wetlands. There is evidence around Bathurst of the vastly different landscape that prevailed during the various glacial periods of the last two million years.

Approximately 20,000 years ago, at the climatic extreme of that worldwide glacial, the Bathurst region was more seasonally dry, cold and windy than it is today. In responding to these conditions the vegetation across the catchment would have been sparse with less transpiration leading to increased surface runoff and groundwater discharge. The result was accelerated rates of catchment erosion and spasmodically energetic, shallow braided rivers. There was a dominance of coarse bed loads in the rivers. The evidence for this lies in the extensive deposits of sands and gravels that underlie the clays and loams on the modern flood plains.

Similar beds of gravel are found on surrounding higher slopes. They hint at similar situations with a high energy river system carrying a large coarse bed load during other multiple glacial extremes going back beyond 2 Ma (Fig 26).

With the moderating of the climate after the last glacial extreme about 15 thousand years ago, vegetation cover on the catchment increased. The streams transitioned to a sediment load dominated by finer clay and loam



Figure 27. The meandering course of the Raglan Creek on the flood plain at Bathurst. This is a likely remnant of the ancient Wambuul/Macquarie River before it took on its modern form.



Figure 28. Ancient meander patterns indicated by soil colour changes on the floodplain at Bathurst

earlier widespread catchment erosion and commencement of soil forming processes that began creating the valuable organic component of the modern floodplain and hill soils of the region. These processes operated across the catchment with clear evidence of deep valley fill sands and gravels topped by organic dark soils in the numerous swampy meadows. It's notable that early travelers in the region recorded sighting of these features in the many creeks and flow line swales along their route.

Much of the extensive riverine floodplains encountered by early travelers to the region would have comprised ephemerally or permanently wet meadows, billabongs and back

materials which built the upper layers of the modern floodplains. There is clear evidence that the river that built these organic clay loams was of a shallow and complexly meandering nature. Modern air photos reveal channel remnants and soil patterns related to this system (Fig 27 & 28). It remains a mystery as to when and why that meandering shallow system converted to the more entrenched rather straighter river channel that remains evident today. The modern river is a likely misfit for the floodplain that is an artifact of older and different catchment conditions.

The modern climate patterns emerged about 8 thousand years ago. With this came the steadying of the



Figure 29. A wetland remnant beside the Kelso cycleway/footpath is here confined to a narrow drain with the occasional flood out onto mown playing fields occurring after heavy rain.

plain lagoons. They were no doubt frustrated by the waterlogged nature of the floodplains with their extensive beds of reeds that constrained their travel.



Figure 30. The Edgell Lane Brick Pit section of the Raglan Creek Wetland Complex. The channel of Raglan Creek is in the top right corner

Modern remnants of these extensive wetlands are now largely confined to a small percentage of their original extent. Vast areas have been subject to drainage, grazing, cultivation for crops and development as parklands and playing fields (Fig 29).

An outstanding wetland remnant example is the series of wet meadows, meanders, manmade channels and brick pit excavations that make up the Raglan Creek Wetland Complex on the floodplain at Bathurst (Fig 27, 28, 29 & 30). It supports an impressive populations of water birds and remain valuable as wetlands to this day.

Why is there a floodplain at Bathurst? A major element of the landscape that drew the

early Europeans and no doubt the Aboriginal people before them, to the locality of Bathurst, was the presence of the broad areas of organic rich, dark soiled floodplain. They may well have pondered the geomorphic forces at play that created these regionally significant features.

The highly erodible nature of the Bathurst granite compared to the surrounding harder rocks has already been mentioned. This significant imbalance led to the scouring of a massive landscape scale erosion basin. It created an expanse of gently rounded hill country that now forms the familiar Bathurst valley. The basin is largely edged by steep, sharp ridged and harder rock escarpments. Streams drop over and carve through them into the granite valley from the surrounding more resistant higher plateaus.

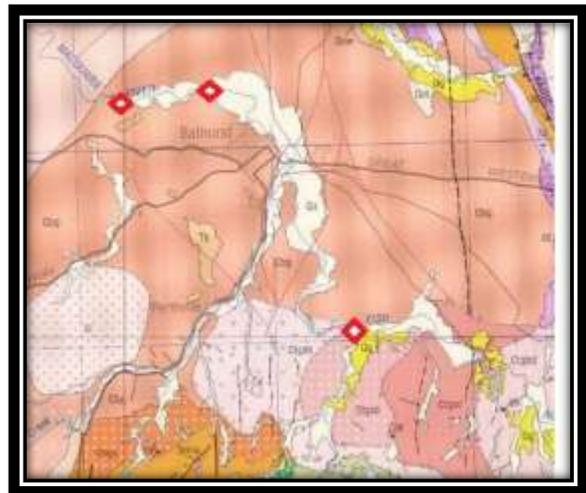


Fig 31. Floodplain Qa with examples of key nick points marked with red diamonds (base map: Geological Survey of NSW).

While the granite valley was being rapidly scoured across its area, its overall downward erosion was being delayed at a number of key geomorphic nick points by harder rock structures (Fig 31, 32 & 33). These nick points include localities where the river exits and reenters the harder surrounding rocks. They also occur at points at which there are more erosion resistant granitic materials.

The result is a river system with steep narrow valleys at the entry and exit points from the granite. There is a broad valley and much flatter grade through the granite reaches. There also appears to be a steepening of grade and a narrowing of the valley at each internal granite based nick point. Upstream of each of these, significant areas of alluvial deposits have developed in the sections of flatter, broader valleys (Fig 31, 32 & 33).



Figure 32. This major landscape nick point is highlighted by the Ranken's Bridge and adjoining suburbs that take advantage of the flood free land. Irrigated agriculture spreads out and dominates the deposited sediments on the floodplain upstream of the nick point.

Downstream of Bathurst are two of the most important nick points in the valley. One at the site of the Ranken's Bridge near Eglinton (Fig 32). The other near the Evans Plains Creek junction with the



Figure 33. Landscape nick point near the junction of Evans Plains Creek and Wambuul/Macquarie River with extensive area of deposited sediments on the flood plain upstream.

Wambuul/Macquarie River where the boundary between the Bathurst and Dunkeld granites crosses the river (Fig 33). These are clearly visible from local roads which also provide a wide views of the broad expanses of floodplain banked up behind the nick points.

At Pine Ridge the valley narrows and steepens into a distinct gorge. From here the river once again begins its descent through the rugged terrain of hard rocks with very limited instances of floodplain development.



Figure 34. Pleistocene aged deflation basins east of the village of Raglan (photo: NSW Land & Property Information).

The legacy of a periglacial climate. Evidence suggests that we are currently in an interglacial period. This has been preceded by a series of glacial and interglacial events over at least two million years or more. The extreme of the last worldwide glacial is estimated to have occurred approximately 20 thousand years ago. A waning from the extraordinary cold occurred from about 15 thousand years to conditions somewhat similar to today at about 8 thousand years. While there were no actual glaciers in the Bathurst region, there is evidence of periglacial conditions with a seasonally dryer, colder, windier climate. Temperatures were on average about six degrees colder than today. There was a lack of groundcover and reduced transpiration induced by the cold constrained vegetation. Despite the dryer climate its likely there was more groundwater and rainfall runoff and rivers had spasmodically higher energy because of those hydrological

changes.

Evidence of this trying environment can be seen in the small regionally significant deflation basins scoured by strong winds out of the upland plain just east of Raglan

at this time (Fig 34). While often dry, they occasionally have enough water in them to support nesting swans and other water birds. They are unusual and special spots in our landscape.

There is also evidence in the form of the deep coarse valley fill deposits now exposed in many of the gullied swampy meadows around Bathurst (Fig 35) and the fact that the floodplains are underlain with coarse gravels and sands.



Figure 35. Deep coarse valley fill material exposed in the gullied Hawthorndon Creek in Boundary Road Reserve

Much remains to be learnt about the Bathurst landscape.

This paper has presented a brief outline of what we currently know about the landscape and how it influenced the established and growth of the city of Bathurst. Questions remain about how best to manage that landscape as the population of the city grows and the demand for landscape resources intensifies into the future. It is hoped that with a wider awareness, interest and concern for the landscapes history, values and limitations that there will be a heightened motivation and passion by our community to care for this special place.