

# Geomorphology Report

## Proposed New Berrima Brickworks Facility at 416-524 Berrima Road, Moss Vale

Author: Dr David N. Outhet BSc MSc PhD

Fluvial Geomorphologist

HPG Pty Ltd

Level 3, 75 Elizabeth Street, Sydney, NSW, 2000

For Brickworks Limited

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### 1. Abstract

All landforms at the site and adjacent areas are currently stable.

There are no defined natural streams at the site of the proposed pad for the brick factory nor at the site of the proposed runoff diversion channel.

Runoff across the site is by shallow overland flow.

The proposed runoff diversion channel is well designed to prevent erosion of the structure.

A flow spreading structure is recommended for the downstream end of the proposed diversion channel. Vegetation should be planted along the Stony Creek flood plain downstream from the spreading structure. These measures should reduce flow concentration and erosion potential.

The diversion channel, flow spreading structure and vegetation planting should be monitored after each high flow and any problems rectified immediately.

### 2. Introduction

I have inspected the site of the proposed brick factory, the proposed diversion channel and the surrounding area. This inspection included Stony Creek and all surface runoff flow lines at the site plus areas upstream and downstream. I have also reviewed the design of the proposed diversion channel and reports from other consultants where relevant to the geomorphology of the site.

I have produced a geomorphology map (Figure 1) from my inspection observations and from the site flood report (SMEC, 2020).

### 3. Geomorphic Setting

The site is located amid the upper rolling hills of the valley of the Wingecarribee River in the Southern Highlands of New South Wales. The valley has been carved by the river over millions of years into Triassic sandstone and shale formations. The site is located on the Ashfield shale formation, part of the Wianamatta Group (AT&L, 2020). Accordingly, the hill slopes have fine grained topsoils derived from the shale bedrock. The foot slopes and the terrace landforms have deposits of eroded hill slope soils. The flood plain landform has deposits of clay, silt and sand transported from upstream sources by stream flows.

There are no previous geomorphology reports on the site or the surrounding area.

### 4. Geomorphic Activity

All landforms shown on my map (Figure 1) are presently “stable” in terms of the human time scale. That is, a person would not notice any significant changes in their lifetime. All landforms have a dense cover of grasses, including Stony Creek. There is no sign of any significant recent erosion or deposition. All hill slopes and soils are stable. Apart from Stony Creek, runoff is by way of shallow overland flow. One short section of Stony Creek has stock trampling damage to the banks.

### 5. Streams

The only natural “defined” (definite bed and banks) stream I found on the site is Stony Creek. This 5<sup>th</sup> order stream (AT&L, 2020) flows from south to north along the west side of the site. It is quite small considering its order. Bed width is less than 2m and bank height is less than 0.5m high (Photo 1, Site A Figure 1). It flows into the Wingecarribee River 1 km north of the area. I found no “stones” in the creek bed where it flows through the site, only silt and sand. There was no flow at the time of my inspection. The farm dam contained a large pond of water and there are two small ponds of water in Stony Creek upstream of the northern property boundary. The River Style® (Brierley and Fryirs, 2005) is “Low Sinuosity Fine Grained”.

It appears that the streams in the area have been stabilised by human intervention:

- The former 1<sup>st</sup> and 2<sup>nd</sup> order streams flowing out from the hills to the east of the site have been filled to form broad swales (Photo 2, Site B Figure 1).
- Remnants of spoil heaps beside the channel indicate that Stony Creek has been straightened and the banks have been battered (Photo 1). It is possible that the channel was dug to drain a swamp when the property was first settled.

- Stony Creek has been diverted into a large farm dam with flow exiting the dam by way of breach in its south west corner (Photo 3, Site C Figure 1). The dam backwater reduces flood velocities upstream.
- A small earth-and-culvert weir has been built on Stony Creek near the northern property boundary (Photo 4, Site D Figure 1). Although it is partially breached, the weir is still backing up a small pond and reducing flood flow velocities upstream.

There is a short constructed drainage channel at site E on Figure 1 in the north west corner of the site. This appears to be intercepting the overland flow and diverting it into a very small pond. The overflow from the pond goes down another small artificial channel (Photo 5) along the northern property boundary and into Stony Creek. These artificial channels are stable with a good cover of grasses. They will not be affected by the proposed construction except for a reduction in flow when the fill for the pad is put in place, cutting off the overland flow. This will make the channels more stable.

## **6. Proposed Diversion Channel**

I have reviewed the design drawings (AT&L, 2020: C032, C590, SKC005) for the proposed runoff diversion channel and I find that it is well designed to prevent erosion of the bed and banks and to prevent meanders developing within it. The longitudinal slope and the side slopes are gentle. The low flow portion will be protected with rock fill. The side slopes will be protected with vegetation.

## **7. Flow Exiting the Proposed Diversion Channel**

The drawings for the proposed diversion channel show that its downstream end is approximately 60m from Stony Creek and located on the creek's flood plain. I inspected this site and found the presence of 4 flood chutes (Figure 1). They are very shallow (less than 30cm deep), up to 1.5m wide at the bed and up to 3m wide at the top of the banks. Photo 6 is taken looking downstream along one such chute from site F on Figure 1. Flood chutes are linear depressions in a flood plain that run parallel to the stream channel and convey flood flow. They can be formed by scour or they may be prior stream channels that have been partially filled with sediment (Brierley and Fryirs, 2005).

If the flow exiting the proposed diversion channel travels down just one of the flood chutes, the flow may be concentrated enough to cause significant erosion. This could be prevented by spreading out the exiting flow to at least 20m in width so that it flows down at least 2 of the flood chutes. Figure 2 is a concept drawing of a flow spreader at the downstream end of the proposed diversion channel. A dense growth

of low-growing native plants such as *Lomandra longifolia* (spiny-head mat-rush) in the flood chutes and on the flood plain would also help to prevent erosion.

## **8. Review of Reports and Design Drawings**

I have reviewed the following reports and design drawings:

AT&L. 2020. New Berrima Brickworks Facility, 416-524 Berrima Rd, Moss Vale: Soil and Water Management Plan & Civil Servicing Report. REP001-01-19-681. 52 pp.

AT&L. 2020. C032. Typical Cross Sections

AT&L. 2020. C590. Drainage Channel Longitudinal Sections

AT&L. 2020. SKC005. Proposed Brick Factory Revised Layout Plan

AT&L. 2020. C200. Bulk Earthworks Cut/Fill Plan

SMEC. 9 March 2020. Flood Impact Assessment: New Berrima Brickworks Facility, 416-524 Berrima Rd, Moss Vale. Reference No. 30012599. 25 pp.

Aside from the diversion channel exit problem mentioned above, I have found no other problems with any of the reports or design drawings from a geomorphology point of view.

## **9. Conclusion**

From a geomorphology point of view, there is only one potential problem with the proposals for the site: the flow exiting the proposed diversion channel.

## **10. Recommendations**

1. A flow spreading structure at least 20m wide should be constructed at the downstream end of the proposed diversion channel. This should be designed to reduce the exiting flow concentration, making the flow wide and shallow so that it flows overland down the slope of the flood plain and down at least 2 of the existing flood chutes.
2. The east bank flood plain overland flow area downstream from the diversion channel exit should be planted with closely-spaced low-growing native plants such as *Lomandra longifolia* (spiny-head mat-rush).
3. The diversion channel and the area downstream from its end should be monitored by inspection for erosion and sedimentation after each high flow event. Any problems should be rectified immediately.

## 11. References

AT&L. 2020. New Berrima Brickworks Facility, 416-524 Berrima Rd, Moss Vale: Soil and Water Management Plan & Civil Servicing Report. REP001-01-19-681. 52 pp.

Brierley, Gary J. and Fryirs, Kirstie A. 2005. Geomorphology and River Management: Applications of the River Styles Framework. Blackwell. 398 pp.

SMEC. 9 March 2020. Flood Impact Assessment: New Berrima Brickworks Facility, 416-524 Berrima Rd, Moss Vale. Reference No. 30012599. 25 pp.

*David Outhet*

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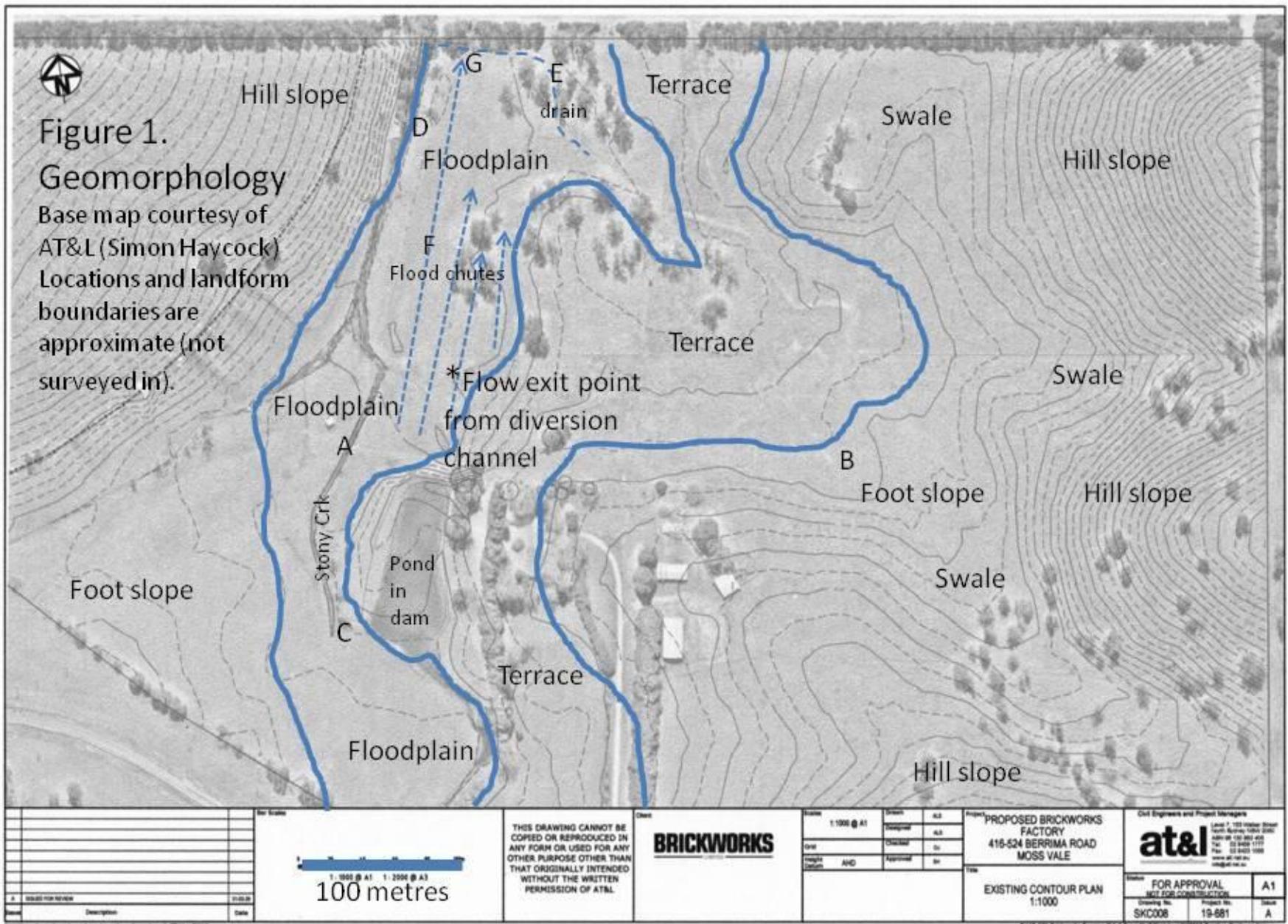




Figure 2. Concept drawing of a flow spreader at the downstream end of the proposed diversion channel (courtesy of Simon Haycock, AT&L).

## Photographs



Photo 1. Stony Creek looking upstream. Site A on Figure 1. The scale pole is 1.5m long with 15cm divisions.



Photo 2. Looking upslope at the swale at site B on Figure 1.



Photo 3. The breach at the upstream end of the farm dam where Stony Creek flows out of the dam pond. Site C on Figure 1. The scale pole is 1.5m long with 15cm divisions.



Photo 4. Partially breached soil-and-culvert weir on Stony Creek at site D on Figure 1. The scale pole is 1.5m long with 15cm divisions.



Photo 5. A drainage channel dug parallel to the fence, looking downstream toward Stony Creek (just beyond the blackberry bush). The western-most flood chute ends at the scale pole. Under the pole is flood debris that has been floated down the flood chute. Site G on Figure 1. The scale pole is 1.5m long with 15cm divisions



Photo 6. Looking north and downstream along a flood chute from site F on Figure 1. The scale pole is 1.5m long with 15cm divisions