Surveys at the Sydney Cricket Ground 1999-2013

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ABSTRACT

Many people are surprised when told that the author does survey work at the Sydney Cricket Ground (SCG). A common response is "What do they need you for? Isn't it just a piece of grass that people play sport on?" It seems to be a common misconception that the hallowed field of the SCG is something set in stone, never to be altered. However, during the author's involvement with the ground it has been modified a number of times. Between times, there is survey input into various maintenance tasks. A comprehensive as-built survey of buried services is of increasing value. This paper outlines several surveys undertaken over the years, including determination of the horizontal and vertical geometry of the SCG field, its reconstruction in 2000, sporting field set-outs, the building of the Trumper Stand in 2008, the field renovation in 2010 and the current Stage 2 development.

KEYWORDS: *Sporting fields, cricket, construction, machine control, design, as-built surveys.*

1 INTRODUCTION

Sporting fields were traditionally built using local soil formed into a domed cross-section intended to allow rainwater to drain across the surface to the sides of the field. The gradient was necessarily slight and the soil retained moisture. When a match was held after heavy rain the combination of saturated material and many sprigged boots typically resulted in one of the 'mud baths' of fond memory (Figure 1).

Figure 1: Mud-caked footballers of the Australian and English national rugby league teams walking off the Sydney Cricket Ground after a test match on 12 June 1950.

The Sydney Cricket Ground (SCG) originally opened in 1886. For many decades, it has been famous for cricket and being the home ground of the Sydney Swans AFL team. However, it has also hosted other sports in the past. Around 1900, it included a concrete cycling track on which Australia's first motor race was held in 1901. In 1914, the New York Giants played the Chicago White Sox – the only U.S. Major League Baseball (MLB) game ever to be played in Australia. In 1938, the Empire Games were held at the SCG. Tennis matches have also been staged, as well as many concerts.

On 25 January 1998, a one-day international cricket match between Australia and South Africa at the SCG was washed out when heavy rain fell overnight and in the morning. Initially it was thought that conditions would improve and the gates were opened. The crowd, including the author, waited several hours in the stands and watched as the ground staff attempted to dry out the ground. This was unsuccessful and the patient fans were sent home and told to come back the next day.

Subsequently, it was decided to rebuild the playing field and incorporate a modern sub-surface drainage system under the outfield (Figure 2). Water now falls onto the surface and works down through porous sand and gravel layers to an impervious subgrade. This subgrade is designed to direct water across it towards the fence. It is transected by a herring-bone network of trenches filled with gravel and slotted pipes. Water flows across the subgrade and into the trenches where it is picked up by the pipes and directed into the main drainage network. The sand and gravel dry out the surface quickly and the subgrade and piping take the water away. At the SCG, the outlet from the field is below the drainage system outside the ground. Water is directed into a holding tank under the Churchill Stand concourse and then pumped out to the street.

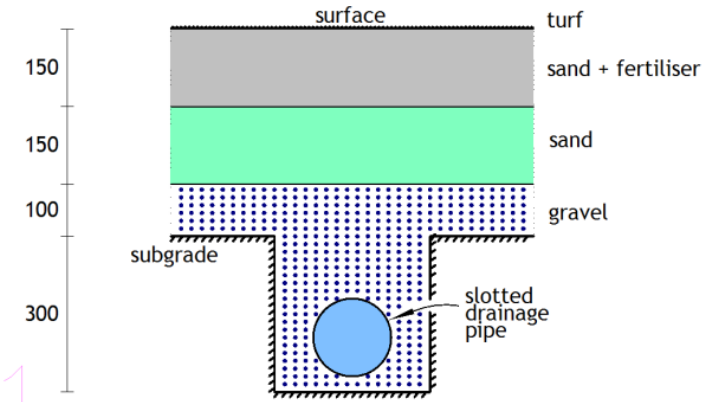


Figure 2: Typical cross-section of the rebuilt outfield (dimensions in millimetres).

The author commenced his professional connection with the SCG during the reconstruction project in 2000 and has continued work at the ground since. This paper describes the SCG field and some of the surveys undertaken.

2 SCG PLAYING FIELD GEOMETRY

2.1 Horizontal Geometry

The SCG started life in the 1850s as the Garrison Ground, built for English troops based at Victoria Barracks. The field is an irregular shape, neither circular nor elliptical. It has been

created over a long period by numerous local re-alignments of the fence. Residuals from best-fit solutions show the deviations as long shallow slivers (Figure 3). The wicket square consists of 9 pitches and is the focus of the centre of the field. It is oriented towards Magnetic North.

Harvey (2010) has used 36 points around the drain as a student least squares ellipse-fitting exercise. His best-fit north-south aligned ellipse has a semi-major length of about 80.8 m and a semi-minor length of about 72.6 m. Offsets from the calculated ellipse are up to about 2 m.

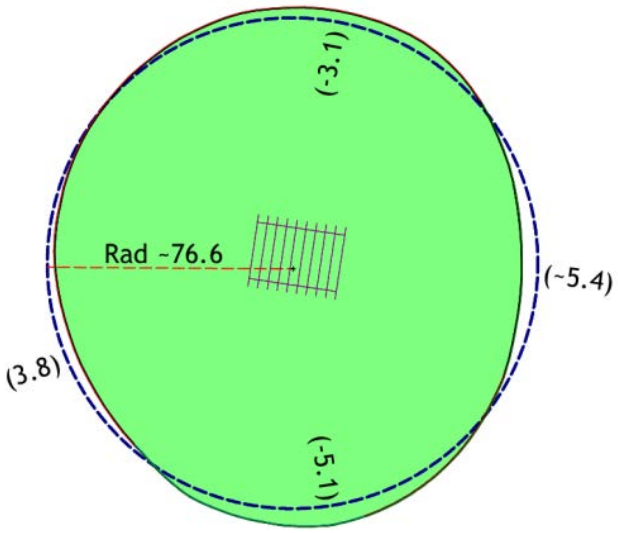


Figure 3: Residuals from a typical best-fit circle. Field shown is post construction of the Trumper Stand in 2008.

2.2 Vertical Geometry

A concrete drain at the edge of the field (Figure 4) is intended to capture water from the concourse seating immediately behind the fence. The grassed area inside the drain is 1.84 ha, or a little over 4½ acres. A long section along the drain shows that the vertical alignment of the field boundary is also far from regular (Figure 5).

Figure 4: concrete edge drain.

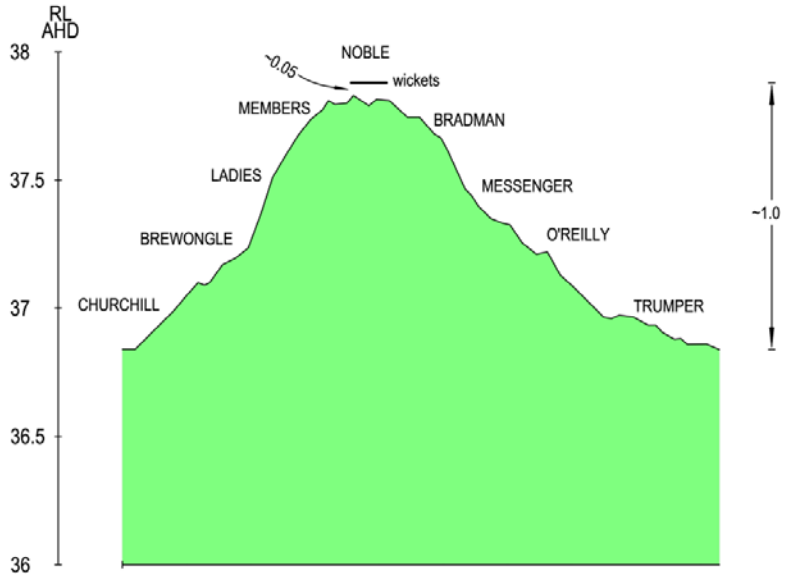


Figure 5: long section along edge drain (all values in metres).

The surface of the field is also highly irregular. In the 1990s it was graded in 8 segments with a laser level. The 2000 reconstruction adopted smoothed contours that roughly approximated the pre-existing shape (Figure 6). The 2010 renovation will be dealt with in section 5.

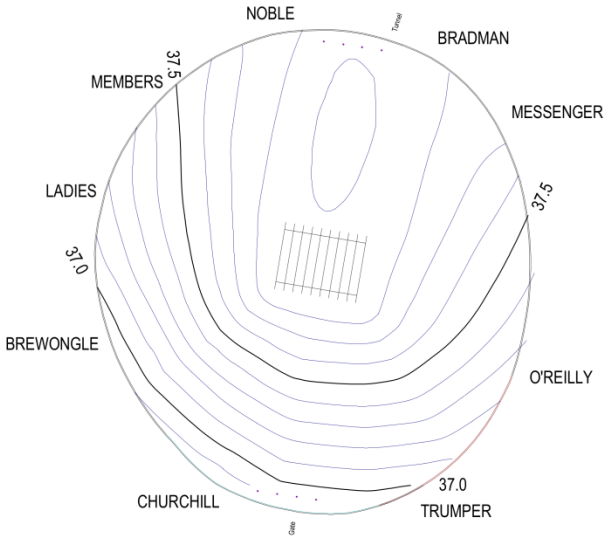


Figure 6: 2000 reconstruction design contours with post 2008 field.

3 THE 2000 RECONSTRUCTION

3.1 Description

The 2000 reconstruction of the SCG was a $2M project, which is unimpressive compared to the almost $200M currently being spent on the new Northern Stand. About 400 mm of material was removed and later replaced in layers after trimming of subgrade and installation of complete new drainage and irrigation systems and other services.

Two Leica robotic total stations were used. Grading of the layers by machine control methods was considered but the final trimming was done manually. Backpacker labourers were trained

to set up the instrument and operate the 'DTM Setout' program, which gives a cut or fill to design level.

3.2 As-Built Survey

The two instruments were also used for the set-out and as-built surveys. Files were reduced daily and integrated into the main Liscad file. The as-built survey of underground services can be a stressful operation – contractors are not happy waiting. The surveyor must be available as work is completed. It is very helpful if the surveyor is on-site full time, observing progress and pre-planning windows of opportunity for survey work. The final plan fitted onto a B1 sheet at 1:250 scale (Figure 7). The survey has been updated since as services are altered or added and has proven its usefulness on many occasions. The sprinklers form a very useful network of on-field control points, and it is often possible to mark locations by simply intersecting calculated distances from them.

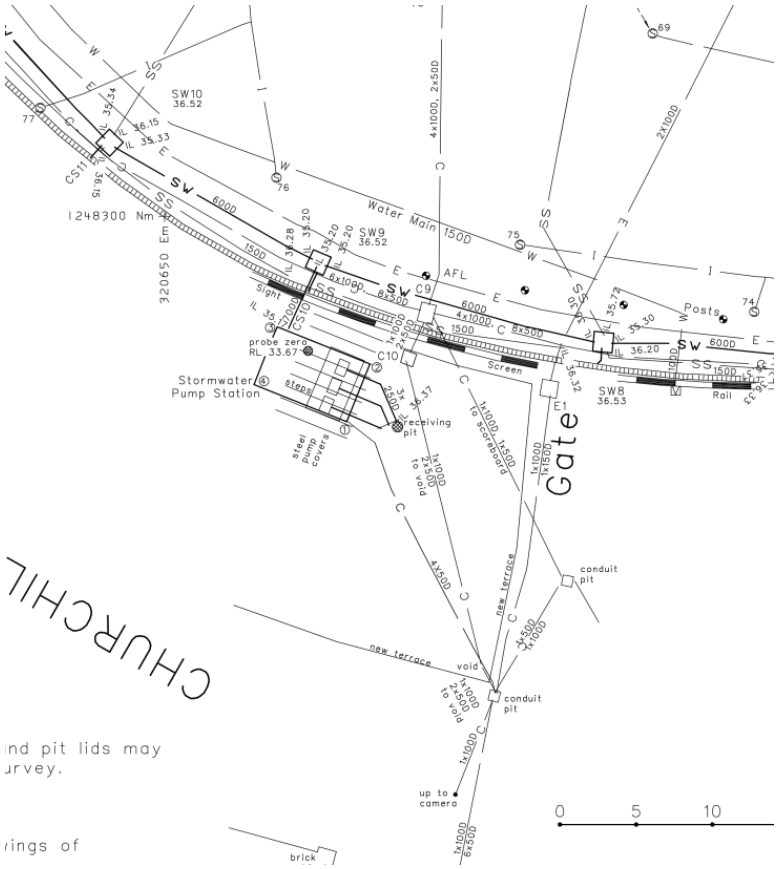


Figure 7: 2001 as-built plan, detail showing drainage to storage tank for pump out to street system.

4 SPORTING FIELD SET-OUTS

4.1 Description

Apart from cricket in the summer, the SCG is the home ground of the Sydney Swans AFL team during the winter. 'Heritage' rugby matches are also played every season but a soccer field sees little use (Figure 8). Sleeves buried in concrete allow rapid installation of goal posts. The positioning of these sleeves to avoid existing services is an example of the use of

the as-built survey. An interesting feature of the Trumper Stand development in 2008 was the lengthening of the field by about 2 metres. An important reason for this was to ensure that the 50 m arcs of the AFL field would not touch the centre square.

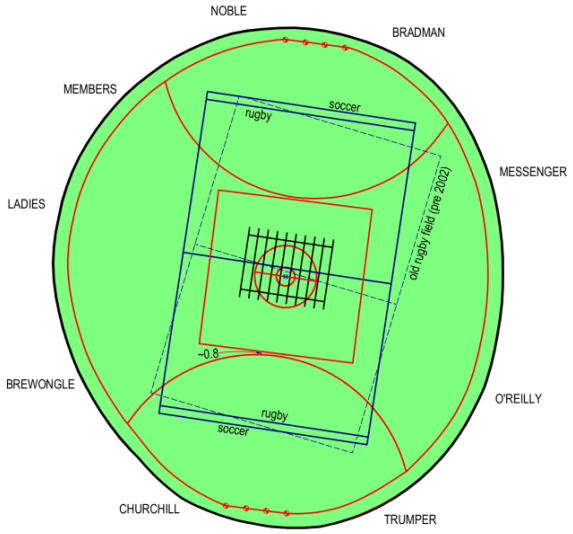
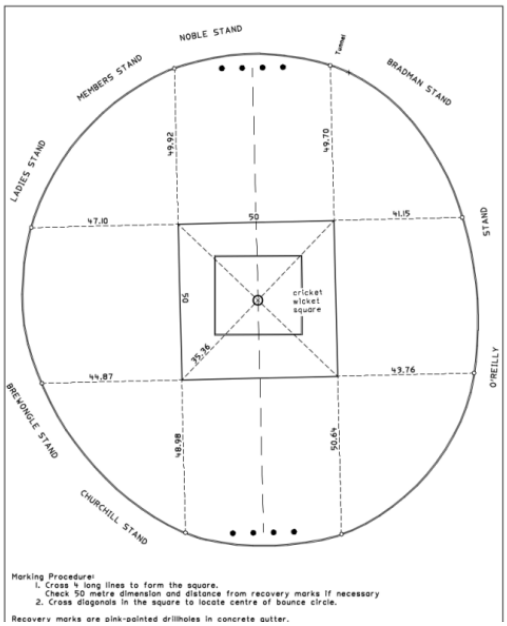


Figure 8: SCG sports field layouts – post 2008 field shown.

4.2 Field Marking

Drillhole recovery marks are placed in the concrete edge drain for each field. By mutual agreement these are colour coded for easy identification, e.g. the AFL marks are painted red and white in honour of the Swans. Ground staff have very long ‘stringlines’ that are actually light cord, and a 100 m nylon-coated steel tape. A plan for each field explains how to mark it using these tools (Figure 9). Another drawing shows the position of the wickets and a table of distances from the centre of each pitch to the boundaries (Figure 10).



Marking Procedure:
1. Cross 4 long lines to form the square.
Check 50 metre dimension and distance from recovery marks if necessary
2. Cross diagonals in the square to locate centre of bounce circle.

Figure 9: AFL field set-out plan 2006 and detail of set-out instructions.

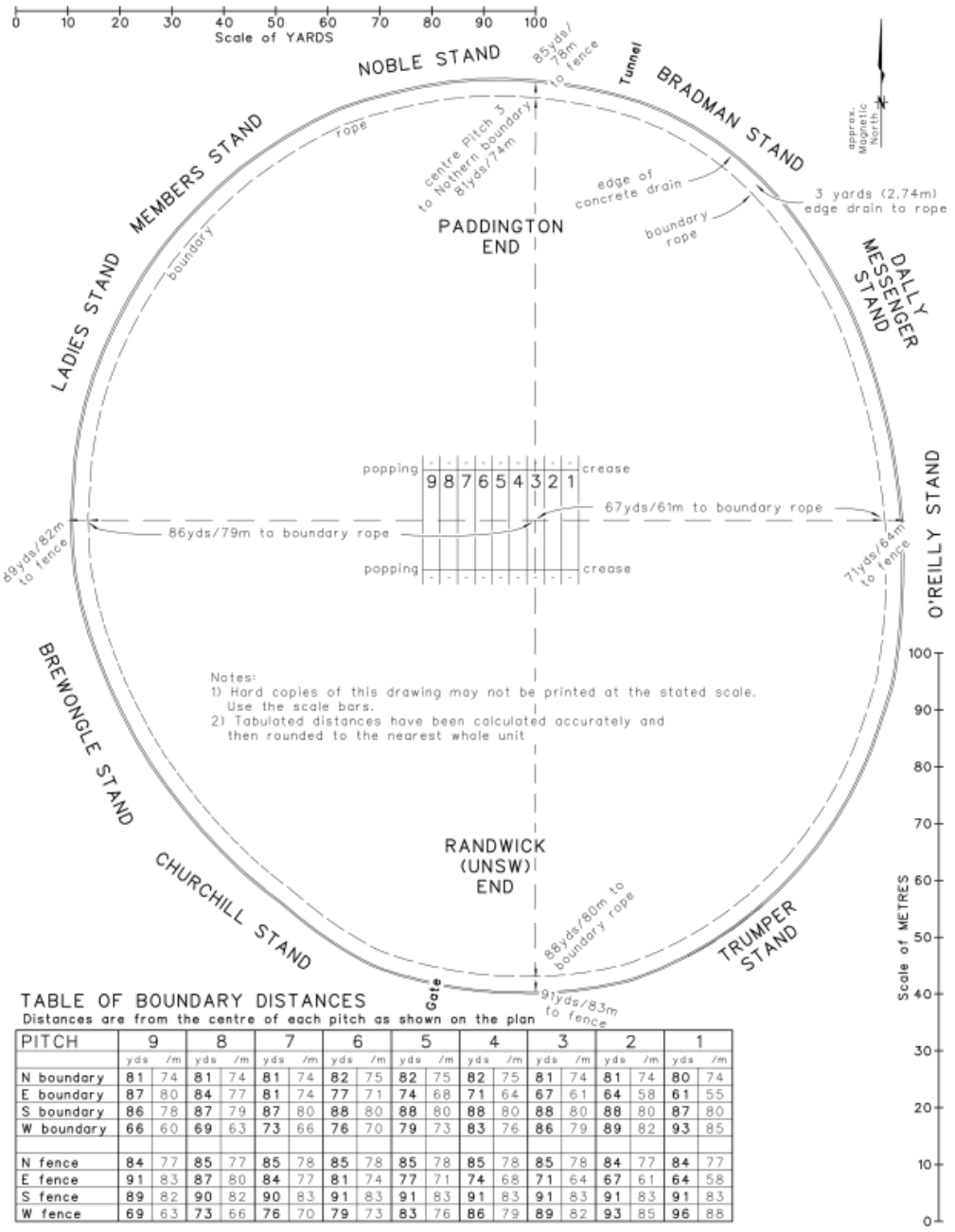


TABLE OF BOUNDARY DISTANCES
Distances are from the centre of each pitch as shown on the plan

PITCH	9		8		7		6		5		4		3		2		1	
	yds	/m	yds	/m	yds	/m	yds	/m	yds	/m	yds	/m	yds	/m	yds	/m	yds	/m
N boundary	81	74	81	74	81	74	82	75	82	75	82	75	81	74	81	74	80	74
E boundary	87	80	84	77	81	74	77	71	74	68	71	64	67	61	64	58	61	55
S boundary	86	78	87	79	87	80	88	80	88	80	88	80	88	80	88	80	87	80
W boundary	66	60	69	63	73	66	76	70	79	73	83	76	86	79	89	82	93	85
N fence	84	77	85	77	85	78	85	78	85	78	85	78	85	78	84	77	84	77
E fence	91	83	87	80	84	77	81	74	77	71	74	68	71	64	67	61	64	58
S fence	89	82	90	82	90	83	91	83	91	83	91	83	91	83	91	83	91	83
W fence	69	63	73	66	76	70	79	73	83	76	86	79	89	82	93	85	96	88

Figure 10: Cricket boundary distances.

5 THE 2010 RENOVATION

5.1 Description

After a few years, the new drainage system was not working as well as it first had, especially in the flatter area in front of the Noble Stand. After heavy rain, water was pooling on the surface and only slowly escaping down to the subgrade. The cause was the build-up of a skin of grass clippings ('thatching') and other material. The solution is occasional renovation of the playing surface. There had also been some uneven settlement over the field and the surface was becoming somewhat bumpy.

It was decided to remove about 50 mm of grass and sand, regrade the surface and lay new turf. This time the grading was to be done by machine control methods and the surface was to be redesigned. The very simple brief was to produce a smooth, even fall from the wicket to the boundary. Any irregularities were to be adjusted out near the fence.

An initial Digital Terrain Model (DTM) was created by fixing only the wicket and the edge drain (Figure 11, left graph). It was immediately apparent that some finessing was required. The cricket field boundary rope was surveyed. It is about 3 m from the edge drain. Design levels along the rope were determined by manual, graphical methods (Figure 11, right graph). Contours were updated automatically as these levels were entered into the Liscad model. The slight rise north of the wickets was retained, producing a final DTM design (Figure 12).

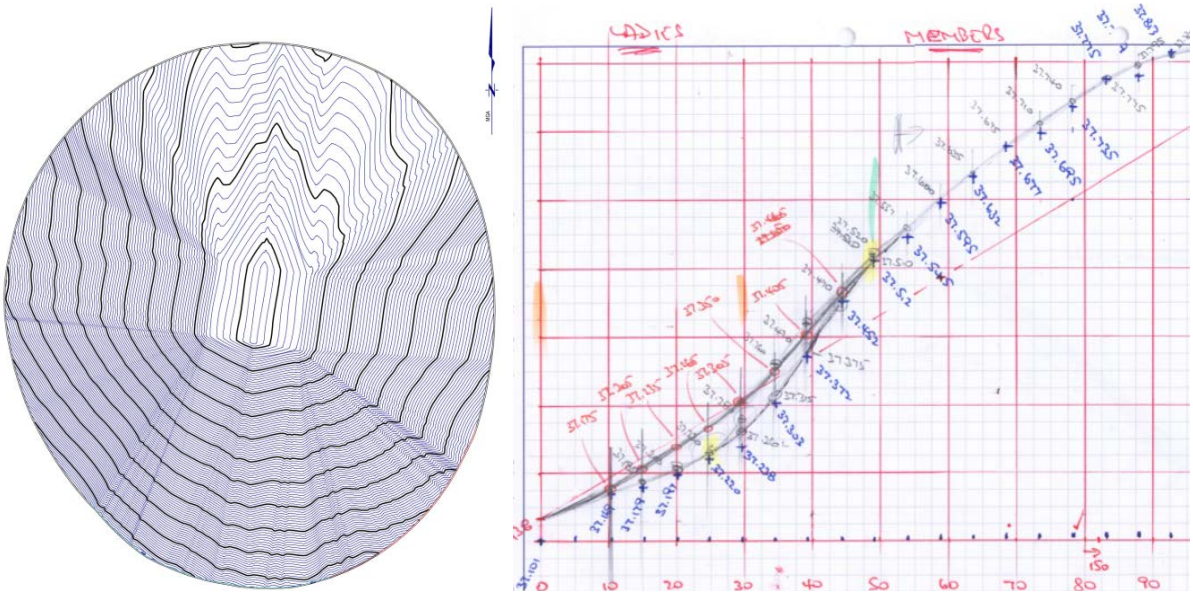


Figure 11: Initial DTM design (left) and manual working sheet (right).

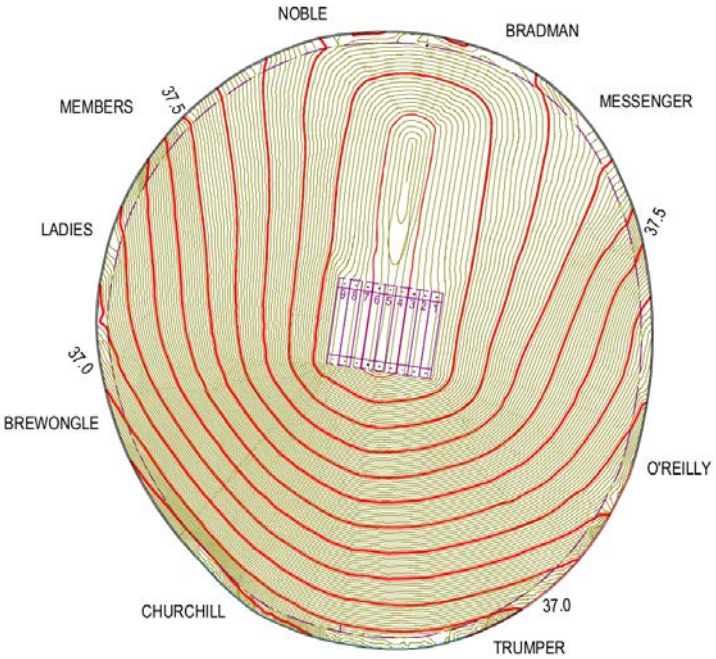


Figure 12: Final DTM design (August 2010).

The entire grading process, both bulk and final trim, was completed in 2 or 3 days. Random check surveys gave results generally within 5 mm. The finished product was much smoother than the 2000 manual grading, and the process was many times faster. In addition, it will be possible to restore future renovations, whether complete or partial, to this design profile.

6 CONCLUDING REMARKS

This paper has described the SCG field and some of the surveys undertaken. Topics not covered in this paper include work at the Sydney Football Stadium (SFS), the AFL and Rugby League practice pitches in Moore Park and the cricket practice nets. Cadastral surveys have also not been mentioned.

At the time of writing (January 2013) the Noble, Bradman and Messenger Stands have been demolished, and work on the vast new Northern Stand is at basement level. The first major event after construction will be the Ashes Test in January 2014. The main impact of the development on the playing field will be a further lengthening, this time by about 7 m.

New and not-so-new uses for the ground can be expected in the future. For instance, published reports state that MLB games may be played at the SCG in 2014.

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