

# Initial Explorations in Reconstructing the Original Beacons and Boundaries in the Constantia Valley in Cape Town

Daniel THOMAS, South Africa  
Jennifer WHITTAL, South Africa

**Keywords:** property law, land law, history, cadastre, reconstruction

Relevance: **Permanent Institution** for the History of Surveying and Measurement

## SUMMARY

This paper reports on the relocation of the original farm Constantia in the southern suburbs of Cape Town and explores the development of early farm boundaries in the Constantia Valley so as to provide a spatial context to pair with the book *Constantia and its Neighbours* by Dr Helen Robinson. Early farms in the Cape were granted by the Dutch East India Company (VOC or DEIC) from 1657. The southwards expansion of farming and hence grants reached this historic valley in 1865 with the granting of “Constantia”.<sup>1</sup> The subsequent early grants and subdivisions in the area are represented on a plan of the entire valley compiled in 1887.<sup>2</sup> Using geographic information systems as a tool for exploring multiple sources of spatial evidence (old maps and diagrams, aerial photographs, surveyor-general’s compilation sheets (noting sheets) and employing cadastral techniques assists the researcher in identifying beacons and boundaries that are still evident in the modern cadastre. This contribution is significant in adding to the body of work on early settlement at the Cape and its spatial effects on the current city-scape in the valley of Constantia. The addition of geo-spatial evidence and processing using land surveying methods of property relocation and later mathematical beacon and boundary reconstruction has the potential bring geo-spatial rigor to locational information of historic farms at the Cape in the early Dutch period. This is a key contribution to pair with the genealogical and social historical work produced in a text such as *Constantia and its Neighbours*. This paper reports on the early outcomes of this research project while extension of the project to cadastral fieldwork and to the rigorous relocation of the other farms in the valley will be undertaken over some years to come.

---

<sup>1</sup> Diagram 6 of 1685

<sup>2</sup> Diagram 1113 of 1887

*'If you're going to have a complicated story, Tolkien once explained, 'you must work to a map; otherwise you can never make a map of it afterwards.'*<sup>3</sup>

## 1. INTRODUCTION AND BACKGROUND TO THE CONSTANTIA VALLEY

The origins of the first European settlement at the Cape, South Africa, are of interest to historians and descendants of the early settlers. The spatial pattern of the metropolitan City of Cape Town can trace its form back to the early farm boundaries the fabric of those grants forms the framework of the urban city-scape today. The subject of this paper is the relocation of the farms in the Constantia Valley, surveyed more than 330 years ago, using a range of methods and historical data. The aim is to located beacons and boundaries that survive in the cadastre.

*Constantia and its neighbours* by historian, Dr Helen Robinson, sets the scene for the investigation. This text is compiled from a social-anthropology point of view and concentrates on families, marriages, deaths, and the transfer of land in the valley. It is aligned with natural, political and economic events of the times. The principle frustration for the land surveyor in reading such an interesting text is the lack of a map and hence geographical context. The task of exploring the creation of a map to accompany the book framed the research.

The Constantia Valley is bounded on the North by Wynberg Hill, on the West by the Table Mountain Chain, and on the East by the Diep River and the Main Road to Simons Town. The Valley is principally drained by the Kasteelspoort River flowing into the Diep River and thence to the sea of False Bay at Muizenberg.

The original *Constantia* farm was surveyed, and a diagram framed in 1685 (SGO Diagram 6 of 1685 also called Old Cape Farm (O.C.F.) 1/141 and shown in Figure 3). It is this farm that is today an historic estate called *Groot Constantia*. The farm was subdivided in 1716 into two portions and again in 1716 into three portions.

---

<sup>3</sup> 1965 BBC Interview is a recorded interview with J.R.R. Tolkien on January 20, 1965, to be placed in the BBC's Recorded Programmes Permanent Library.[1]. The interview comprises a detailed discussion about The Lord of the Rings and whether Tolkien will be remembered for his fiction or his academic career.



Figure 1. Location of the Constantia area

## 2. SOURCES OF DATA

Sources of data in historical cadastral research spanning many centuries are multiple. They include:

### 2.1. Historic texts

- Principally the book by Dr Helen Robinson: *Constantia and its neighbours*.<sup>4</sup>
- Reprint of the *Constantia* farm diagram in the VOC Atlas.<sup>5</sup>
- *Constantia and Wynberg: a bibliography* created by Wilhelm Wolfgang Wendland.<sup>6</sup> This contains only a time-line documentation of the social changes of the area through newspaper and magazine articles.

### 2.2. The National Dutch Archives

- Web portal provides an interface for searching.
- P.A. Leupe collection maps were sourced but their quality was too poor for use.

<sup>4</sup> Dr Helen Robinson: *Constantia and its neighbours*, Wynberg, South Africa: Houghton House, 2014

<sup>5</sup> Comprehensive Atlas of the Dutch United East India Company, Vol. V: Africa, by Brommer, 2009, accessed through the University of Cape Town library

<sup>6</sup>Published by Cape Town : University of Cape Town, School of Librarianship, 1957, OCLC : (OCOLC)869935854

Initial Explorations in Reconstructing the Original Beacons and Boundaries in the Constantia Valley in Cape Town (10033)

Daniel Thomas and Jennifer Whittal (South Africa)

FIG Working Week 2019

Geospatial information for a smarter life and environmental resilience

Hanoi, Vietnam, April 22–26, 2019

- High-quality scan of the *Constantia* farm diagram was acquired from this source.

### 2.3. The United Kingdom of Great Britain and Northern Ireland National Archives

- Diagrams and maps of relevance had not yet been digitized.
- There was no easily-accessible information about which maps had been returned to the countries formerly colonized and which maps were still held in their archives.

### 2.4. The Deeds Office (DO):

- Old diagrams with title deeds combined.
- The Erf Register books which are used to trace a property lineage back to the original grant.

### 2.5. The Surveyor-General's Office: Cape (SGO)

- Noting sheets or compilation sheets are a printed typology of erven sometimes with O.C.F. lines added, old Cape Farms (C.F. ) often noted, as well as other important cadastral surveying information. The O.C.F. lines often end mid-sheet without explanation. About 145 noting were downloaded and put together in a mosaic form. Excel was used to note the typology of the noting sheets. This allows the researcher to find the correct noting sheet number adjacent to the one currently used.

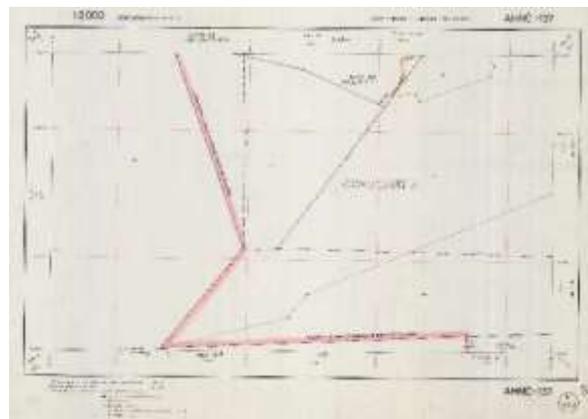


Figure 2. an example of a noting sheet

- Copies of original diagrams.
- Surveyor's E-Records and correspondence from more modern surveys. Online electronic retrieval system is invaluable.
- The component farms noted on SGO Diagram 11113/1887 Plan 32AY (7477) were obtained from this source. Each diagram was retrieved, inspected for its original diagram number, then that was retrieved, and so on until the original grant diagram for the farms was acquired.
- A framed compilation sheet hanging on the wall in the SGO showed the historical farm boundaries of Constantia. This sheet confirmed that there was no farm or erf number for the principle farm called *Constantia*.

### 2.6. South African National Archives and Record Service (NARS)

- online National Automated Archival Information Retrieval System (NAAIRS)
- a list of maps of greater cape town in the cape archives compiled in 1979 by Christopher

---

Initial Explorations in Reconstructing the Original Beacons and Boundaries in the Constantia Valley in Cape Town (10033)

Daniel Thomas and Jennifer Whittal (South Africa)

FIG Working Week 2019

Geospatial information for a smarter life and environmental resilience

Hanoi, Vietnam, April 22–26, 2019

Merret and held by the second author, provides a useful resource

- very large compilation map housed in the archive that was about 2m by 1.5m
- two copies of title deed diagrams for the farms, *Baas Hermans Kraal* and *Witteboomen* but better copies were later sourced from the SGO.

### **2.7. South African National Library (NLSA) Cape Town**

- No useful maps were found.

### **2.8. Department of Rural Development and Land Reform- Chief Directorate: National Geo-spatial Information (CD:NGI)**

- Old undigitized aerial photography could provide a useful resource if sorted and digitized so that it can easily be accessed and used
- Old topographical maps may show original farm boundaries.

## **3. RESEARCH METHODOLOGY**

### **3.1. Data Gathering**

Initial data acquisition focused on searching through web-accessible databases. Some of these were only accessible to the authors online (such as the British National Archives) while others were searched online and visited (such as the UCT Library). All archives and offices listed that have branches in the Cape Town area were visited. Further data was obtained from Dr Helen Robinson using her book, *Constantia and its Neighbours*. Lastly, field recognisance was done to search for specific historical beacons.

### **3.2. Digitization**

ArcMap, an Esri ArcGIS package, was the principle tool used in the research. The modern cadastre (2015 AD), road boundaries, water bodies, watercourses, suburban boundaries and City of Cape Town municipal aerial photography (dated January 2017 AD) were imported to create a geographical information system (GIS) compilation of all data. Historical compilation sheets covering the areas of SGO Diagram 11113/1887 were then imported and georeferenced. The challenge of georeferencing a diagram was initially solved using beacons that were identified as the same on both the compilation sheets and the modern cadastral layer. More tie points were then identified and a suitable set was used in the georeferencing so as to minimize the distortions that result from georeferencing old data (higher order transformations are needed). The same technique was used when georeferencing modern noting sheets and old farm diagrams.

### **3.3. Comparison**

Comparisons were made between the modern cadastre (2015 AD), the reconstructed former boundary lines and beacons by overlaying them in ArcMap. From this process, the beacons and



The noting sheets contain important information as to whether corner beacons have been recently surveyed on the Cape Datum or Hartebeesthoek94 Datums (the current and former datums of South Africa). For some beacons, multiple sources of locational data existed. A cadastral surveyor usually uses the most recently surveyed coordinates, but this type of historical relocation demands that all data be identified and compared for consistency; sometimes survey errors have taken place historically. This research process is generally known as data triangulation and if consistency is high, internal validity of the results is good.

#### 4. CONSTANTIA FARM RELOCATION

Since the task of establishing the location of all the boundaries in the Constantia Valley cannot be tackled at once, a strategy of relocating the *Constantia* farm as a first step was adopted. This farm also occupied a large part of the valley and so was a sensible and pragmatic approach. The initial location of the *Constantia* boundaries was not easily accomplished.

A portion of the farm, *Hoop op Constantia* was found to have a subdivided portion that contained a portion of the *Constantia* farm. This facilitated the georeferencing of SGO Diagram 1113/1887 (Figure 4) and thereafter the other subdivided portions of *Constantia* to make up the original whole farm. The georeferencing process was conducted using ArcMAP – an ESRI geographical information science (GIS) package – licenced for teaching and research use at the University of Cape Town.

The process involves higher-order affine transformations (called ‘rubber-sheeting’) as there are considerable distortions in the scans of early plans and maps. These are fitted to the modern cadastral layer imported into the GIS.



Figure 4. SGO Diagram 1113 of 1887 showing the properties of the Constantia Valley as thick black outlines with aerial photography dated January 2017

Once the spatial location of *Constantia* had been identified, the cadastral layer was then used to identify the surrounding farms and to search for data on the farm beacons. Such data consists of beacon descriptions and projected coordinates for each beacon as last surveyed, but also historic notes of beacon descriptions and mathematical data going back in time. The earliest diagram has no such data and only shows a scale bar in Rhyndland roods – an old unit of measure at the Cape. The farm area is also given.

## 5. COMMON BEACONS AND BOUNDARIES IN THE VALLEY

Forty-five farm diagrams were sourced in digital format. The outlines of these farms were digitized to create a layer of farm shapes (Figure 5). These were then fitted to the cadastral layer in GIS where the beacons and boundaries were identifiable in the current cadastre. These beacons were noted with red circles. Thus a mosaic of different shapes was created on GIS to indicate the different farms that existed in the valley. Some corner points are lost in the current cadastre and in such cases the boundary lines were visually extended to create intersections to allow the positioning of the farm shape. In some cases even this strategy was impossible – here the farm shapes were georeferenced using SGO Diagram 1113/1887 to roughly identify the location of these remaining beacons. These are highlighted with blue circles to distinguish them from those that were more rigorously located (Figure 6).

The results of this process were checked by sourcing modern diagrams along the boundaries to check for gross inconsistencies in the boundary lengths. This was a difficult task as the sourcing of the lineage of diagrams was not straightforward since some surveyors had not noted the original diagram numbers when preparing subdivisional diagrams. It may also be possible that some subdivisional diagrams were compiled from the surrounding diagrams and were not in fact surveyed! Some compounding problems are that some SGO diagrams have not yet been scanned and this causes delays in retrieval, some of the scans are of poor quality, some original diagram references are incorrect, the SGO has daily server outages, and there is no ability to search online for ‘Crown Land’ (state land) diagrams, should these exist, since they do not have the required reference numbers used in online diagram retrieval forms.

The identification of boundaries that existed in the early layout of the Constantia Valley farms was conducted by visually comparing the mosaic of farms to the current cadastral layer. This is easily conducted in GIS since layers can be made transparent. Original boundaries for which more than half the original length is still in existence today are indicated with red bold lines, while those indicated with yellow bold lines are now extinct (Figure 7).

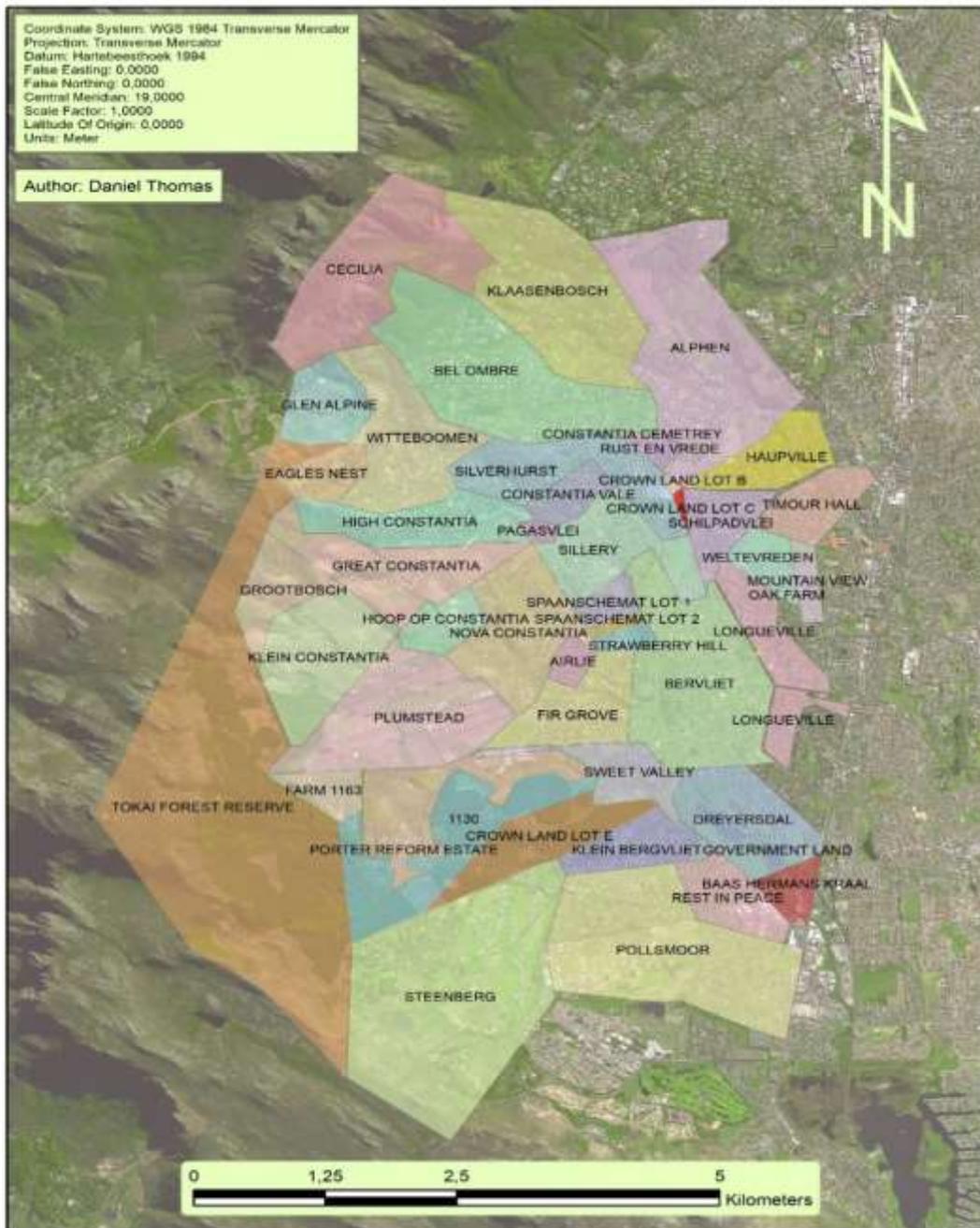


Figure 5. Farm shape mosaic in GIS

Initial Explorations in Reconstructing the Original Beacons and Boundaries in the Constantia Valley in Cape Town (10033)

Daniel Thomas and Jennifer Whittal (South Africa)

FIG Working Week 2019

Geospatial information for a smarter life and environmental resilience

Hanoi, Vietnam, April 22–26, 2019

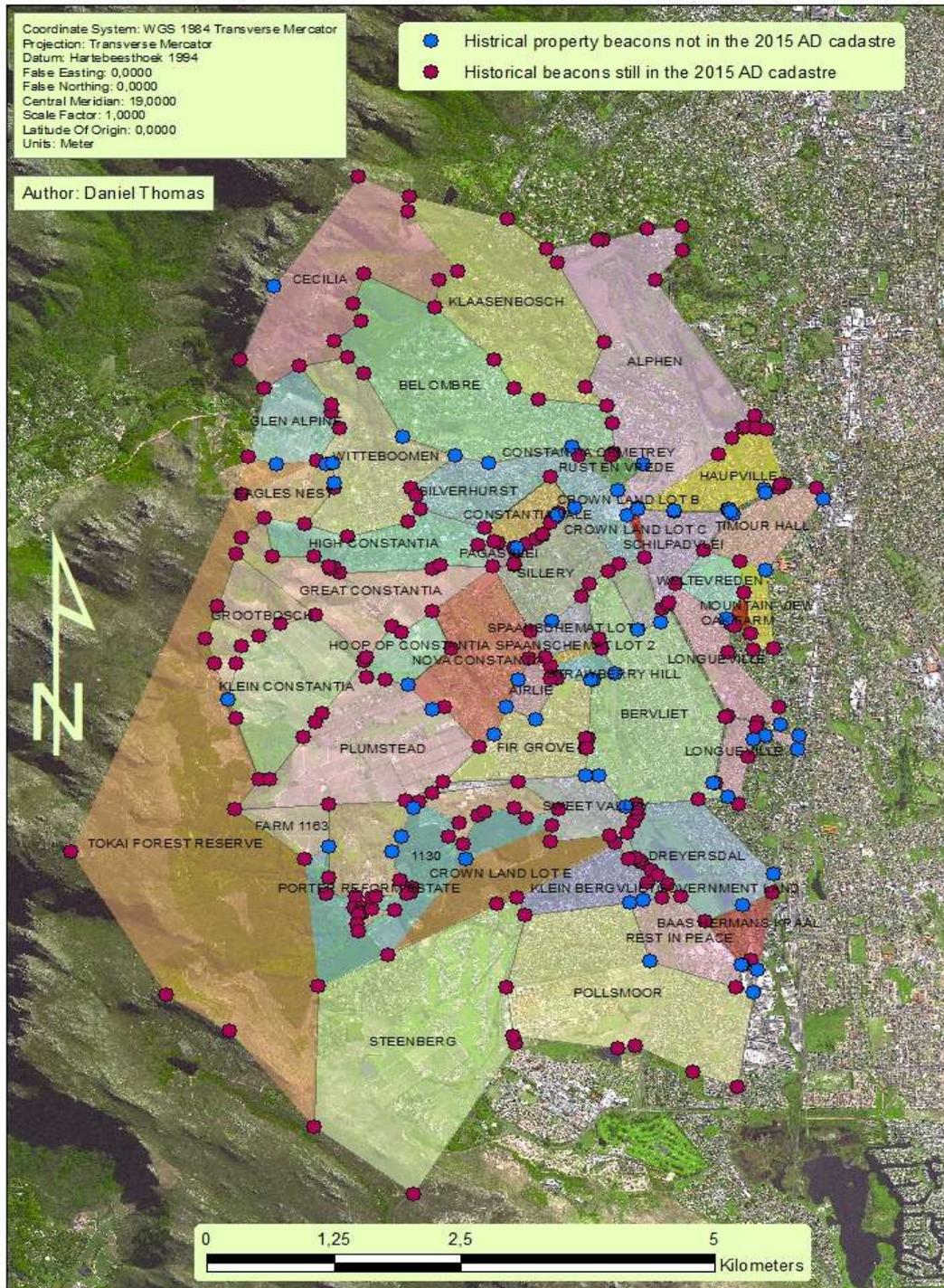


Figure 6. A farm mozaic with blue beacons not used in the current cadastre and red beacons still existing in the current cadastre

Initial Explorations in Reconstructing the Original Beacons and Boundaries in the Constantia Valley in Cape Town (10033)  
 Daniel Thomas and Jennifer Whittal (South Africa)

FIG Working Week 2019  
 Geospatial information for a smarter life and environmental resilience  
 Hanoi, Vietnam, April 22–26, 2019

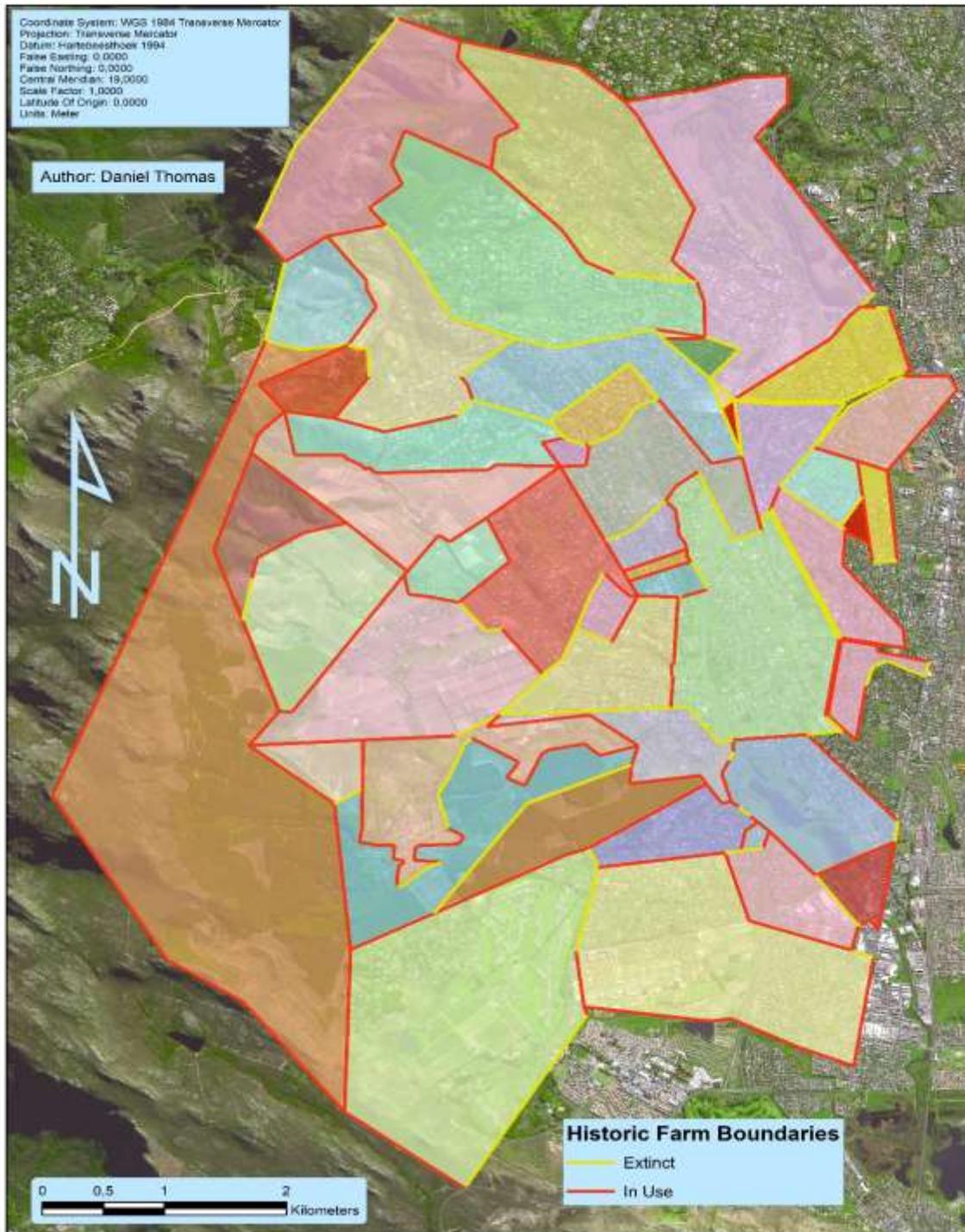


Figure 7. Boundaries in the modern cadastre (red) and extinct boundaries (yellow)

---

Initial Explorations in Reconstructing the Original Beacons and Boundaries in the Constantia Valley in Cape Town (10033)  
 Daniel Thomas and Jennifer Whittal (South Africa)

FIG Working Week 2019  
 Geospatial information for a smarter life and environmental resilience  
 Hanoi, Vietnam, April 22–26, 2019

## 6. CONCLUSIONS

The conclusions concentrate on the original farm of *Constantia*, after which the valley is named, and also on the largest piece of land in the area being state land in Tokai.

### 6.1. Constantia

Locating beacons *b*, *c*, *d* and *e* of SGO Diagram 6/1685 of the farm Constantia (Figure 3) proved simple. They were all reflected on the modern noting sheets and could be identified on SGO Diagram 1113/1887. The comparison of locations on the noting sheets and farm diagrams were also in fair agreement. The noting sheets were always used in preference to the farm diagrams since the quality of the scans of the latter is poor in comparison to those of the noting sheets which were scanned at a higher resolution and in colour. Any disagreements the author found between the beacon locations on the noting sheets and the farm diagrams were less than 30cm indicating that the determination of the location is of good quality for such old data.

This was not the case with beacon *a*. There are numerous diagrams that depict the location of beacon *a*. Determining positions of this beacon using multiple diagram data sources yields a spread of position in the order of 20m! The location according to the noting sheet is not consistent with that of SGO Diagram 1113/1887 but is consistent with the position obtained from other diagrams. For this reason, the location as per SGO Diagram 1113/1887 is rejected in favour of that derived from the noting sheet.

Since beacon locations had been decided, consistency checks were carried out using the rough coordinates determined from the desktop study. It was found that the lengths and area agree with original Constantia farm SGO Diagram 6/1885 values.

It is unfortunate that the original beacons did not have any coordinates on any of the diagrams, as a least-squares based transformation of coordinates would have yielded a more accurate position for the beacons than the method employed.

### 6.2. State land

The largest piece of Crown Land (also called Government Land and which is now called state land) on compilation SGO Diagram 1113/1887 is that of Tokai Forest Reserve. It is still state land today. Crown Land Lot E has been consolidated into Tokai Forest Reserve. All other tracts of Crown Land within the study area no longer appear to be state land. This was determined by visually comparing aerial photography of the area against land formerly described as Crown Land. Comparison of these areas to the modern cadaster reveals that all trace of them has disappeared. Interestingly, it was found that the farm *Groot Constantia* (labelled *Great Constantia* on SGO Diagram 1113/1887) has no survey diagram. This is due the farm being owned by the Crown and then the state between 1885 and 1993 - no survey diagram has ever been produced.

## 7. RECOMMENDATIONS

The main hindrance to further research is the inaccessibility of diagrams. The British National Archives did not appear to hold diagrams as seemed likely from the many results from querying the web portal. A researcher based in the United Kingdom or with connections in the British National Archives could possibly find more diagrams of interest. The archives held on the historical farm premises in the area may also yield interesting material such as original maps or historical diagrams. A second stage of cadastral fieldwork is required to verify the largely desktop study thus far undertaken.

## ACKNOWLEDGEMENTS AND THANKS

The authors would like to acknowledge the ongoing contribution of historian and author, Dr Helen Robinson and her work *Constantia and her Neighbours* as an inspiration for this project. The authors acknowledge the University of Cape Town, the National Research Foundation of South Africa, and the South African Geomatics Institute for their ongoing support of research and presentation at conferences.

## BIOGRAPHIES

### DANIEL THOMAS

Daniel Thomas is a graduate from the University of Cape Town in the BSc Geomatics in Surveying programme. He is currently undertaking his period of articles training for professional registration. The investigative work for this paper was undertaken by him for his final year project under the supervision of the second author.

### JENNIFER WHITTAL

Jennifer Whittal is an Associate Professor in the Geomatics Division at the University of Cape Town. She obtained a B.Sc. (Surveying) and a M.Sc. (Engineering) specializing in global navigation satellite systems from the University of Cape Town. In 2008, Jenny obtained her Ph.D from the University of Calgary applying critical realism, systems theory and mixed methods to a case of fiscal cadastral systems reform. She is a Professional Land Surveyor and lectures advanced surveying and land law. Research interests are land tenure and cadastral systems with specific interest in sustainable development and resilience in land holding for the poor, historical property holding, and cadastral issues in the coastal zone.

Contact:

Address: Geomatics: School of Architecture, Planning and Geomatics, University of Cape Town, Western Cape, South Africa, 7700.

Tel: 021 650 3575 email: [Jennifer.whittal@uct.ac.za](mailto:Jennifer.whittal@uct.ac.za)