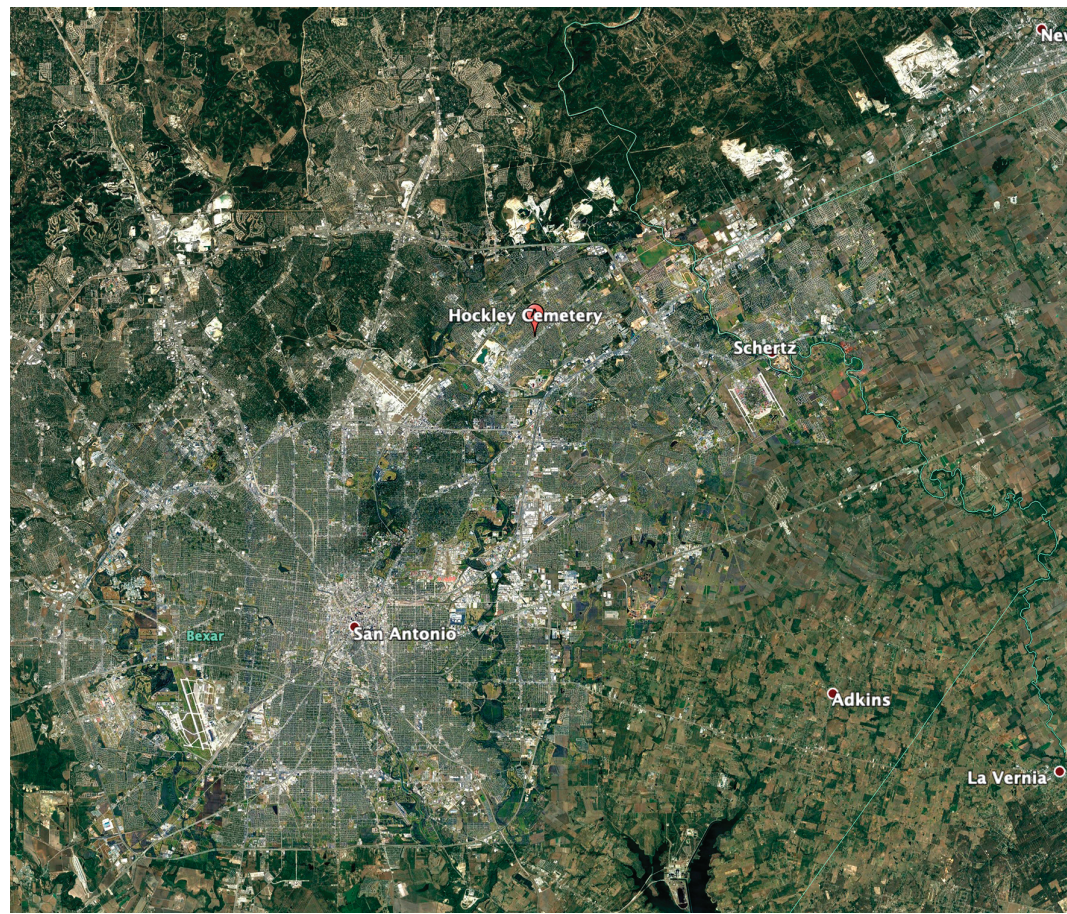


INTRODUCTION

The following is a report on the terrestrial laser scanning survey of the Hockley Cemetery in San Antonio, Texas, conducted by the Center for Heritage Conservation at Texas A&M University on March 15th, 2019, for Everett Fly Associates.

The primary objectives were

- 1) to document the current condition of the historic cemetery;
- 2) to create a detailed plan and digital model of the surface terrain that might be useful in identifying mounds or depressions representing below ground features, such as burials;
- 3) to prepare a detailed plan and digital model that could be combined with data from future geophysical survey work, such as ground penetrating radar.



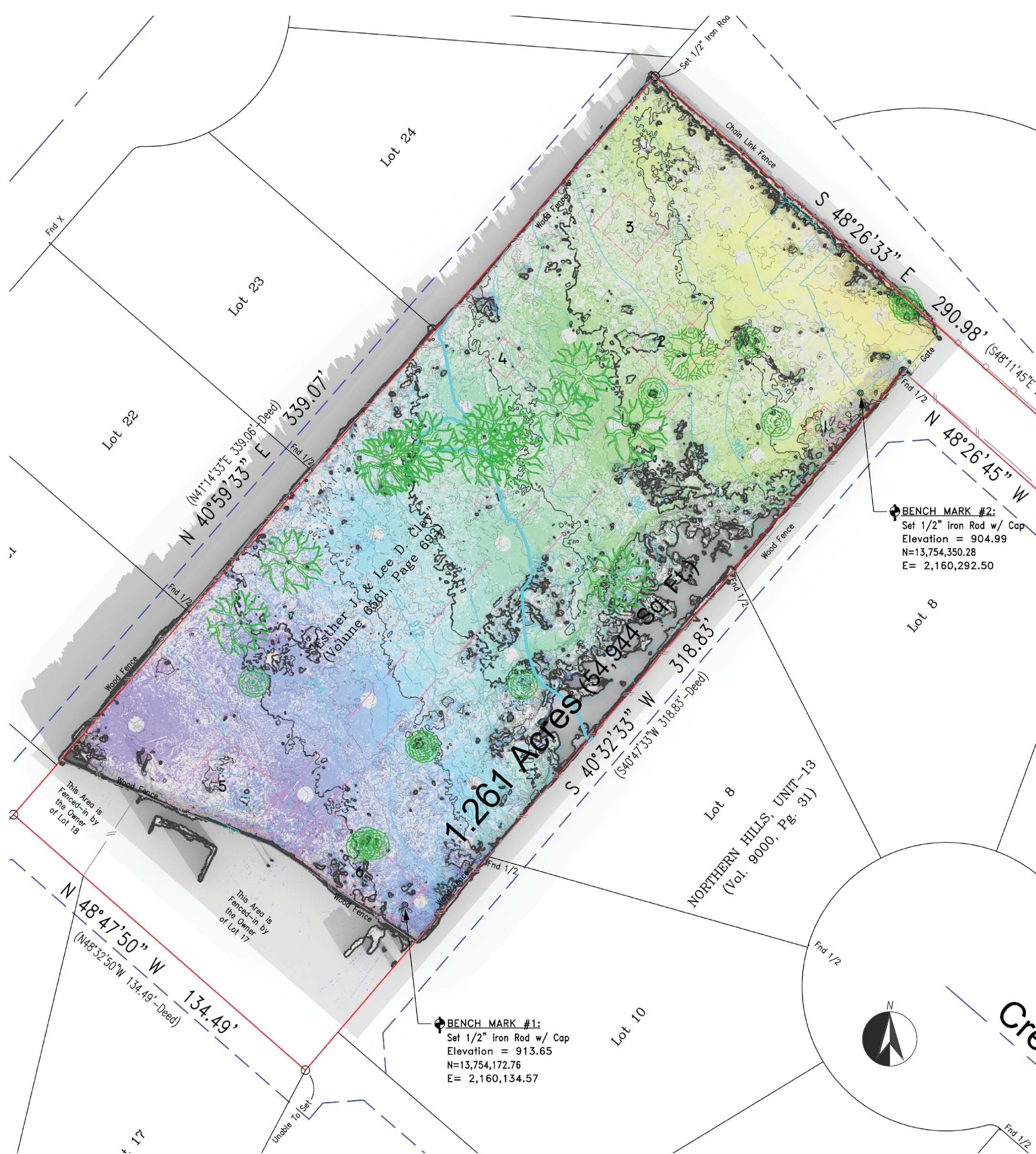
Aerial view showing location of Hockley Cemetery in northeast San Antonio, Bexar County, Texas. Google Earth (imagery date January 11, 2019).



Aerial view of Hockley Cemetery. Google Earth (imagery date January 11, 2019).

POST PROCESSING & MODELING

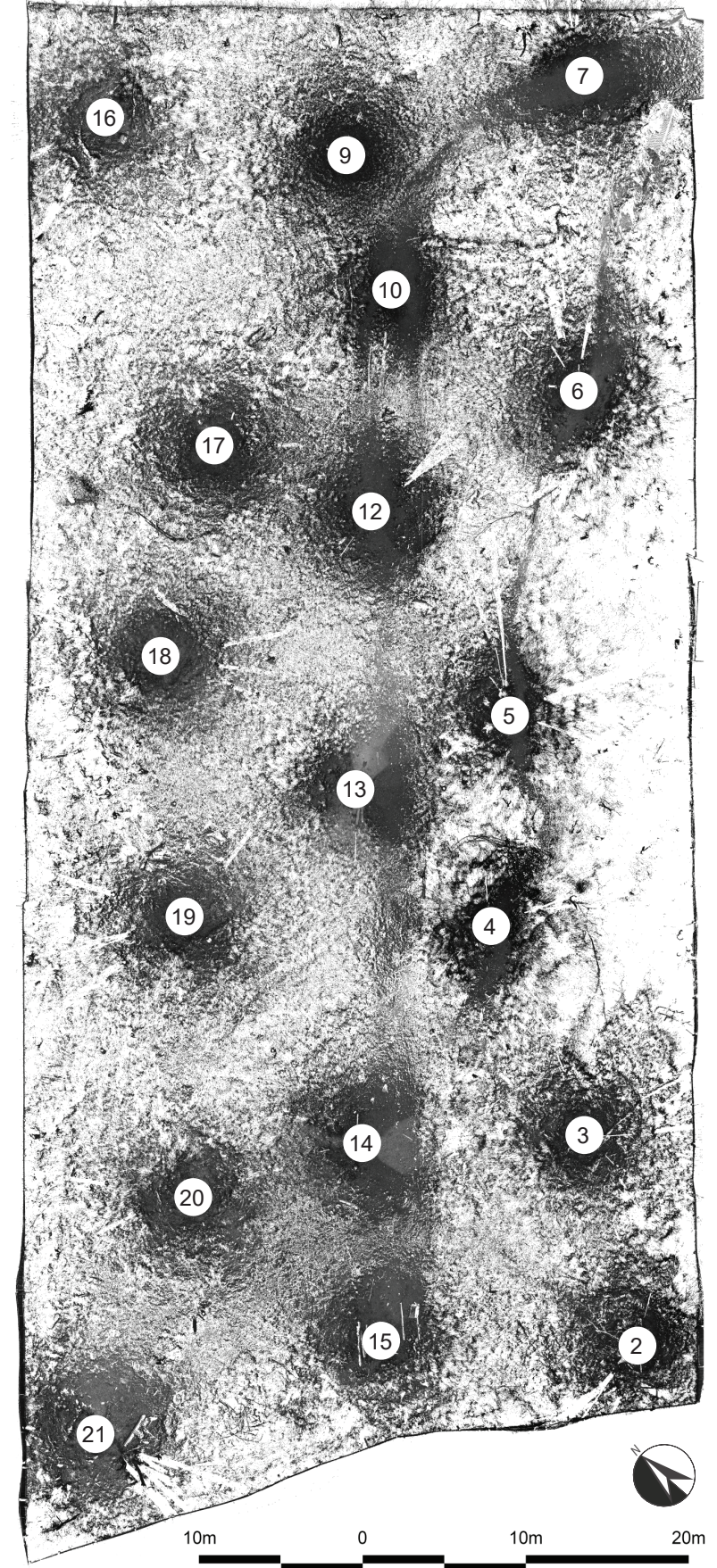
Once sufficiently registered, the data was exported to various general formats and brought into secondary software for editing. The project point cloud was exported to E57 and PTS file formats, since either of these formats can be brought into a variety of useful secondary software (e.g., Autodesk ReCap Pro, CloudCompare, Rhinoceros 6, etc.). In the context of this project, the E57 file was imported into Autodesk ReCap Pro in order to take advantage of that software's "heat map" filter and preset isometric view settings (for image export).



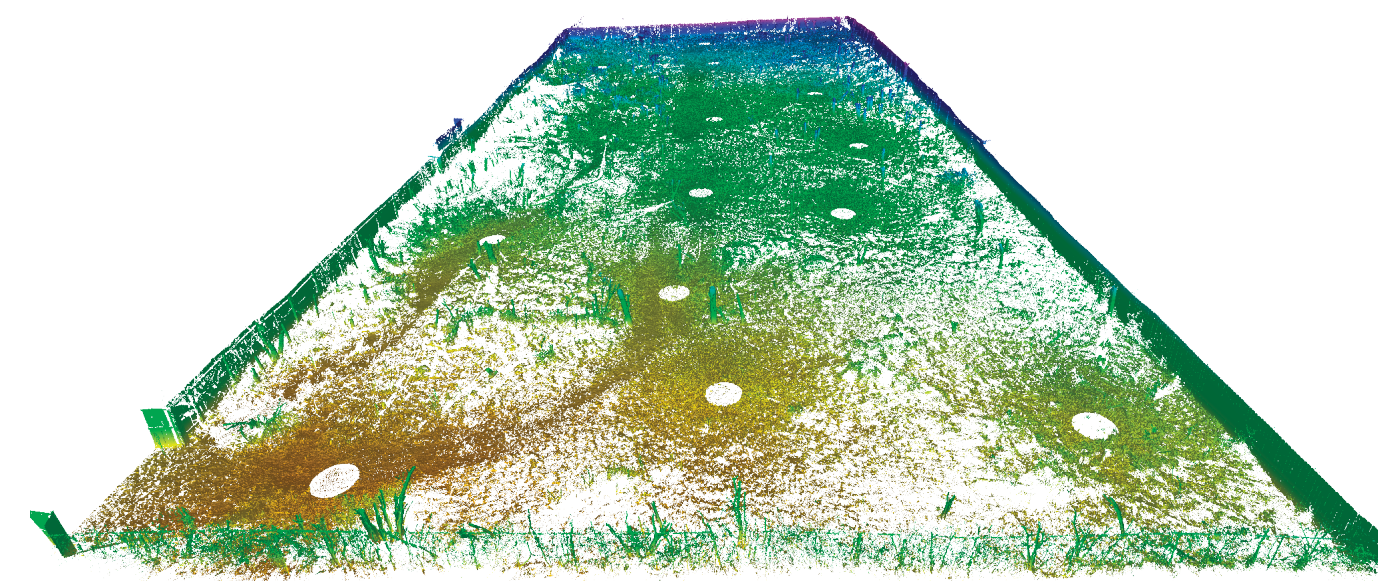
Site plan combining detail of previously surveyed site plan (Gibbons Surveying & Mapping, Inc., January 30, 2019) with underlay: mesh created in FARO Scene, rendering & contour lines (1 meter, .50 meter, and .10 meter intervals) from Rhino (with ReCap "heat map" filter showing topographic elevations: high [violet/blue] to low [yellow/red] elevations).

TERRESTRIAL LASER SCANNING SURVEY

The scan project resulted in 18 usable scan positions, with each scan duration being around 8 minutes. A scan resolution of 1/4 was set; this results in an average point spacing of 6mm at a distance of 10m. The scan quality was set to 3x; this number pertains to the number of measurements of a collected data point. A full 360-degree capture was obtained at each scan position, with a vertical declination range of -60-degree to 90-degrees. Light metering was set to even-weighted and the high dynamic range (HDR) setting was not used for images.



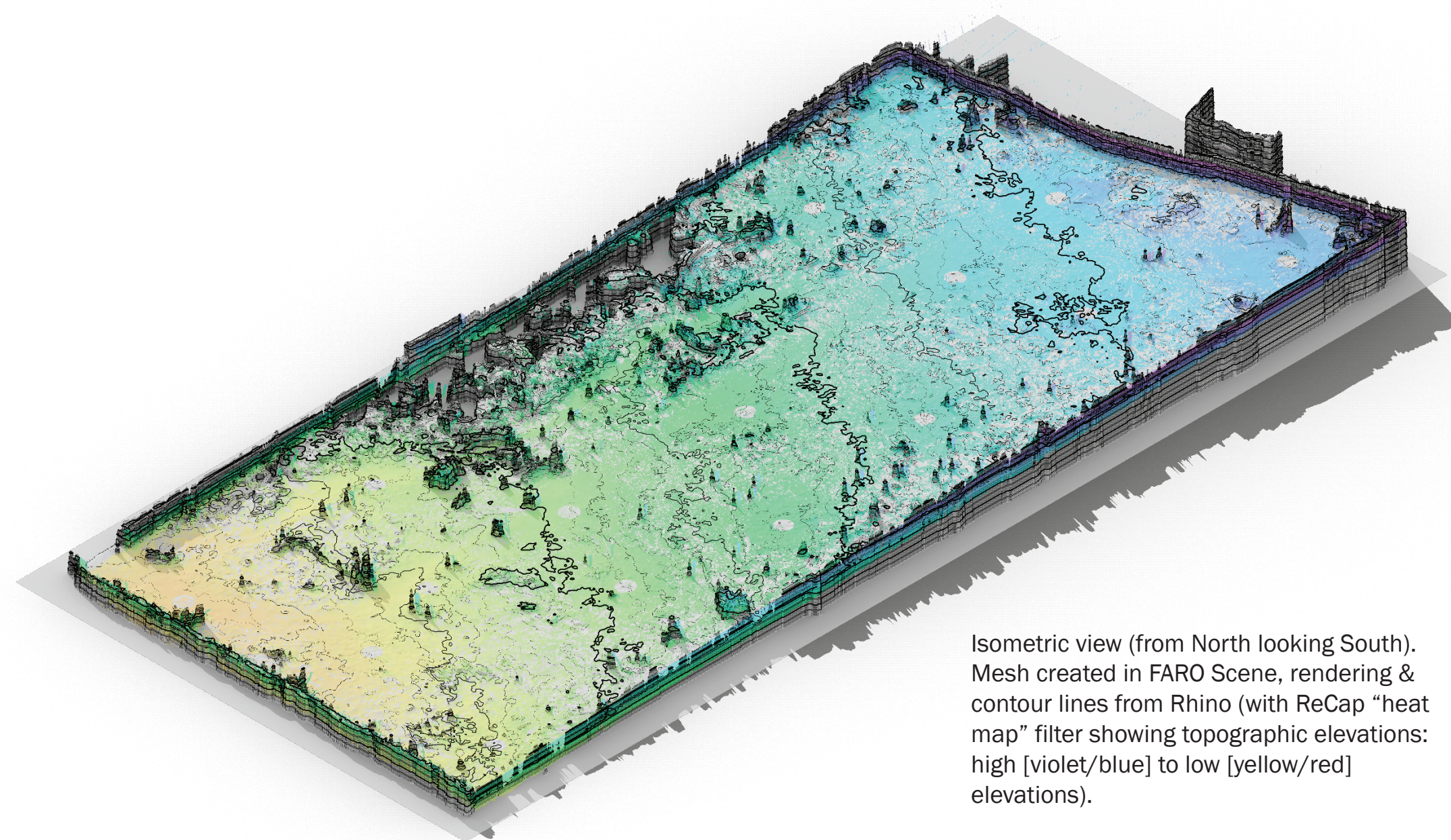
Site Plan. Orthophoto of point cloud export from FARO Scene showing scan positions.



Perspective View (from Northeast looking Southwest). Color point cloud image export from Autodesk ReCap ("heat map" filter showing topographic elevations: high [violet/blue] to low [yellow/red] elevations).

ANALYSIS & PROSPECTUS FOR FUTURE WORK

The terrestrial laser scanning (TLS) of Hockley Cemetery successfully produced a high resolution digital survey of the property as it existed on March 15, 2019. The project recorded over 190,000,000 data points with a mean point error of 6.8 mm and a maximum point error of 10.1 mm over an area of ca. 54,944 square feet (or 1.26 acres).



Isometric view (from North looking South). Mesh created in FARO Scene, rendering & contour lines from Rhino (with ReCap "heat map" filter showing topographic elevations: high [violet/blue] to low [yellow/red] elevations).

The logical next step in the analysis would be to incorporate data from the ground penetrating radar (GPR) survey conducted by Prof. Mark Everett and his students from Texas A&M on April 19, 2019, with the terrestrial laser scanning (TLS) survey conducted by the Center for Heritage Conservation. In particular, it would be instructive to see how subsurface anomalies and features recorded by GPR relate to the detailed surface contours both in their two-dimensional and three-dimensional aspects. The combination of the results from the TLS and GPR surveys at Hockley Cemetery may help to refine the methodologies used analyze such digital data in the search for lost burials at other neglected cemeteries in San Antonio and elsewhere.