Appendix: GIS Process for Bedrock Surface Creation

1. The "Extract by Mask" tool (ArcToolbox/Spatial Analyst Tools/Extraction/Extract by Mask) was used to create a land surface elevation raster of the shallow bedrock feature class.
2. The "Minus" tool (ArcToolbox/Spatial Analyst Tools/Math/Minus) in Spatial Analyst to subtract 10 feet from the extracted land surface elevation raster.
3. The "Contour" tool (ArcToolbox/3D Analyst Tools/Raster Surface/Contour) was used to create elevation contours of the shallow bedrock that are 10 feet below land surface.
4. The "Buffer" tool (ArcToolbox/Analysis Tools/Proximity/Buffer) was used iteratively in ArcGIS Model Builder to generate buffers of the "shallow bedrock" polygons at an incremental distance (every 10 meters). A field was added to the feature class for "depth". The appropriate depth value for each buffer polygon feature class was calculated so that the difference in depth between the buffers was equivalent to a 40 degree slope. A 40-degree slope was chosen in order to simulate the observed angle of repose for the eroded bedrock material being modelled, in this case sandstone.
5. The incremental buffer polygons were converted to Z-enabled polylines (ArcToolbox/Data Management/Features/Feature to Line), and the appropriate depth of each increment was inherited from each polygon feature class.
6. The "Add Z Information" tool (ArcToolbox/3D Analyst Tools/3D Features/Add Z Information) was used to add the mean land surface elevation to each polyline. A "bedrock elevation" field was added to the feature class, and the values in that field were calculated by subtracting the values in the "depth to bedrock field" from the values in the "mean land surface elevation" field.
7. Using the "Topo to Raster" tool (ArcToolbox/3D Analyst Tools/Raster Interpolation/Topo to Raster), the elevation values of the shallow bedrock land surface contours and the elevation values of the polyline buffer contours were chosen as the inputs to generate a bedrock elevation raster.
8. The "Extract by Mask" tool (ArcToolbox/Spatial Analyst Tools/Extraction/Extract by Mask) was used to extract the areas of the shallow bedrock raster within the boundary of the outermost polygon of the incremental bedrock elevation-buffers.

Integration of Components 1 and 2

1. The "Greater Than Equal" tool (ArcToolbox/Spatial Analyst/Math/Logical/ Greater Than Equal) was used to create a Boolean raster that indicates where the shallow bedrock raster was equal to or greater than the bedrock elevation raster created from the borehole data.
2. The Raster to Polygon tool (ArcToolbox/Conversion Tools/From Raster/Raster to Polygon) was used to convert the Greater Than or Equal raster in to polygons. The resultant polygons were edited to delete all of the polygons where the shallow bedrock data was less than the bedrock elevation raster created from the borehole data.
3. The Clip tool (ArcToolbox/Analysis Tools/Extract/Clip) was used to clip the shallow bedrock land surface contours and the polyline buffer contours depth-buffer contours to the area where the shallow bedrock elevation raster was greater than, or equal to, the bedrock elevation raster interpolated from bedrock point data.
4. Finally, the "Topo to Raster" tool (ArcToolbox/3D Analyst Tools/Raster Interpolation/Topo to Raster) was used to interpolate a bedrock elevation raster from the

bedrock points data, the clipped shallow bedrock land surface contours, and the clipped polyline buffer contours.