Determination of Headloss in a Piping System in Rural Africa

<div align="right">**Garrett Kehoe**</div>

Background

The goal of this project is to determine the headloss for a piping system which is installed in Ntisaw, Cameroon. As part of an Engineers Without Borders (EWB) project, PVC piping was installed in the village a few years ago. As an expansion onto this project, a filter is planned to be installed into the piping system. However, the system operates under very tight head constraints and there has been discussion as to whether or not the system could even sustain the loss in head contributed from a filter. Creating a headloss curve would aid in determining if and how long big a filter the system could sustain.

The original plan was to get elevation data of the terrain from the USGS server and plot the latitude and longitude of the pipeline with the elevations. The elevations which were originally collected are suspicious as to their accuracy.

Update

Thus far a map has been created in which all the relevant parts of the water system has been added. To this map a basemap of the wold imagery has been added to confirm the locations of the system. The coordinates have been separated into the two relevant pipelines using different feature classes with the coordinates connected with polylines as to easily distinguish the system parts. DEM of the area has been retrieved from USGS for SRTM at 3 arc seconds as well as the ASTER Global DEM at 3 arc seconds. Using these two separate DEM maps coordinates were attached to the pipeline coordinates using the Extract Multi Values to Points tool from the spatial analyst toolbox. Calculation of the total distance of the pipeline has been done using the haversine formula for distance between two points. Exporting all this information from GIS into excel the following plot has been created.

From these preliminary results we can see a couple very interesting results. First that the calculation of the distance of the pipeline varies a great deal from the USGS data with the haversine formula and the survey results. Secondly, that the method of using USGS DEM is not very accurate. Just looking at the DEM profiles you can see that the pipelines would not even be operational as a gravity based system. The DEM method is not very accurate compared to the surveyed pipeline. While the surveyed pipeline is not believed to be very accurate it is substantially better than the DEM results. However, there is another pipeline which the headloss is needed for which no survey was done.

Future Work

To continue with the work done thus far on this project a profile/headloss plot will be done for the pipeline which there is no survey results for. We can see from the baseline comparison of the known pipeline that this method may not be very accurate. The baseline analysis was done on the pipeline in purple in the following image. The red pipeline is the one in question for getting a profile in the future. If this plan does not work out then the next step may be to try and delineate the watershed in this area or to try and do statistical analysis on the differences between the DEM and survey results.