Technical Insights

by Nancy Graham, QCoherent Business Development Manager

Interview with Dr. Al Karlin, January 24 2013

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Southwest Florida Water Management District

Could you give us an overview of the Southwest Florida Water Management District (SWFWMD) and your role in the organization?

The SWFWMD is one of five water management districts in Florida; we serve ~ 5,000,000 people in our 10,000 sq. mile service area. Our four-part mission is to ensure an adequate and safe water supply, provide flood protection and protect natural water systems.

I work in the "Watershed Management Program (Flood protection)" section of the District. We construct Hydrological and Hydraulic (H&H) models to assist in Floodplain mapping (FEMA), Environmental Resource Permit approval, and Watershed water quality and environmental protection.

How does LIDAR fit into your analysis process?

We think of the Watershed Management Program as a cyclical workflow that begins and ends with topographic information. We start with surface topography to determine natural water flow paths, augment the surface flow with man-made systems (storm water pipes, etc.) and then construct a model. However, with building permits and other land alterations such as putting pipes into the ground to re-route water, surface changes occur. This requires new topographic data and updated models to be constructed. LIDAR is now the preferred means to obtain topographic data. We are also finding new uses for LIDAR such as roof drip line extraction to estimate non-connected impervious area, that were not available with "traditional" topographic surveys.

We have also found other uses for LIDAR including, (1) assisting the Regulatory engineers in determining potential issues, (2) assisting Enforcement Officers in finding unauthorized activities, and (3) aiding ecologists in identifying land patterns, historical/archaeological sites, and natural fire breaks. LIDAR data serves as the source for our downstream modeling analysis. These software tools require gridded data and the fact that LP360 rapidly exports ERSI Grids was our primary reason for purchasing it. LP360 is also used by our Regulatory engineers for visualization to determine what would happen if something was built in a particular area with respect to water flow. It is also useful for interpreting hillshaded DEMs. The ecologists use it, for example, to detect historical mounds created by native Floridians without having to go into the field.

We know from working with your organization that you have a rigorous and well documented Quality Control process for LIDAR. Can you tell us some of the anomalies you encounter?

We have found all types of abnormalities in delivered LIDAR. Of course, the birds in the air (very high points) and deep pits (low point noise) are common. In Florida, things such as delivery wells on the sides of buildings are difficult to determine, as well as vegetation, such as saw grass and palmettos. The other place that we see anomalies is with breaklines. (A whole other story!)

For us, what we find is that a vendor may not be familiar with our particular environment. As mentioned above two problem areas in Florida that make classification challenging are palmettos and saw grass. They can easily be misclassified as ground if an operator is not familiar with the terrain.

Based on your experience would you recommend that everyone who receives LIDAR data have a similar process?

My experience is that the more that I show our vendors what we are seeing, the better they are at helping to QC their own data, but, yes, the end-user really needs to be diligent about accepting LIDAR products. There is a lot that can be misinterpreted even by diligent vendors.

We use a lot of different tools as part of our Quality Acceptance (QA) process, LP360 being one of our primary tools used for several different checks. We have found that we need to designate anywhere from 15% - 30% for QA in the acquisition budget.

Not implying that you are "long in the tooth" but how has LIDAR changed hydrological modeling as compared to the pre-LIDAR “old Days"?

Thanks, but I am long in the tooth. Back in the day (and still to some extent), the goal is to use “best available". Typically, years ago we derived TINS from 5' or 10' contours from USGS or we would send surveyors out and spend millions of dollars to acquire the data. Then we would take that derived product and use it to derive a TIN (another level of abstraction) and then finally extract a DEM from the TIN. LIDAR has replaced the data collection side. We still have to use the LIDAR to construct and interpolate the TIN but it is now a much more direct process.

LIDAR has really changed that process for the better due to its very high point density and vertical accuracy.

You are one of our most technical users of LP360. Could you discuss some of the features of the software that impress you as well as some of the ones we need to work on?

LP360 is a high end consumer product that is extremely usable and customizable and does about everything that I could ask of it! The cost relative to the time that is saved is so small!

That said I would like to see LP360 take better advantage of multiple cores. Even so, the current speed of LP360 in displaying and analyzing data is to me the single most impressive facet. The work that used to take us weeks, we now do in minutes. Another big draw is that it functions in the ESRI ArcGIS environment that is familiar to so many people. Lastly, the advantage of LP360 is that it handles a massive amount of data (6.8 billion points for our entire watershed).

Can you give us an example of how you used LP360 for some of your projects?

We recently did a project for Hernando County Florida. They needed estimated mature building heights of the City of Brookfield to construct a 3-D model.

The original LIDAR data did not have the buildings classified as our specification only required the following classifications:

1	Unclassified
2	Ground
9	Water
12	Overlap

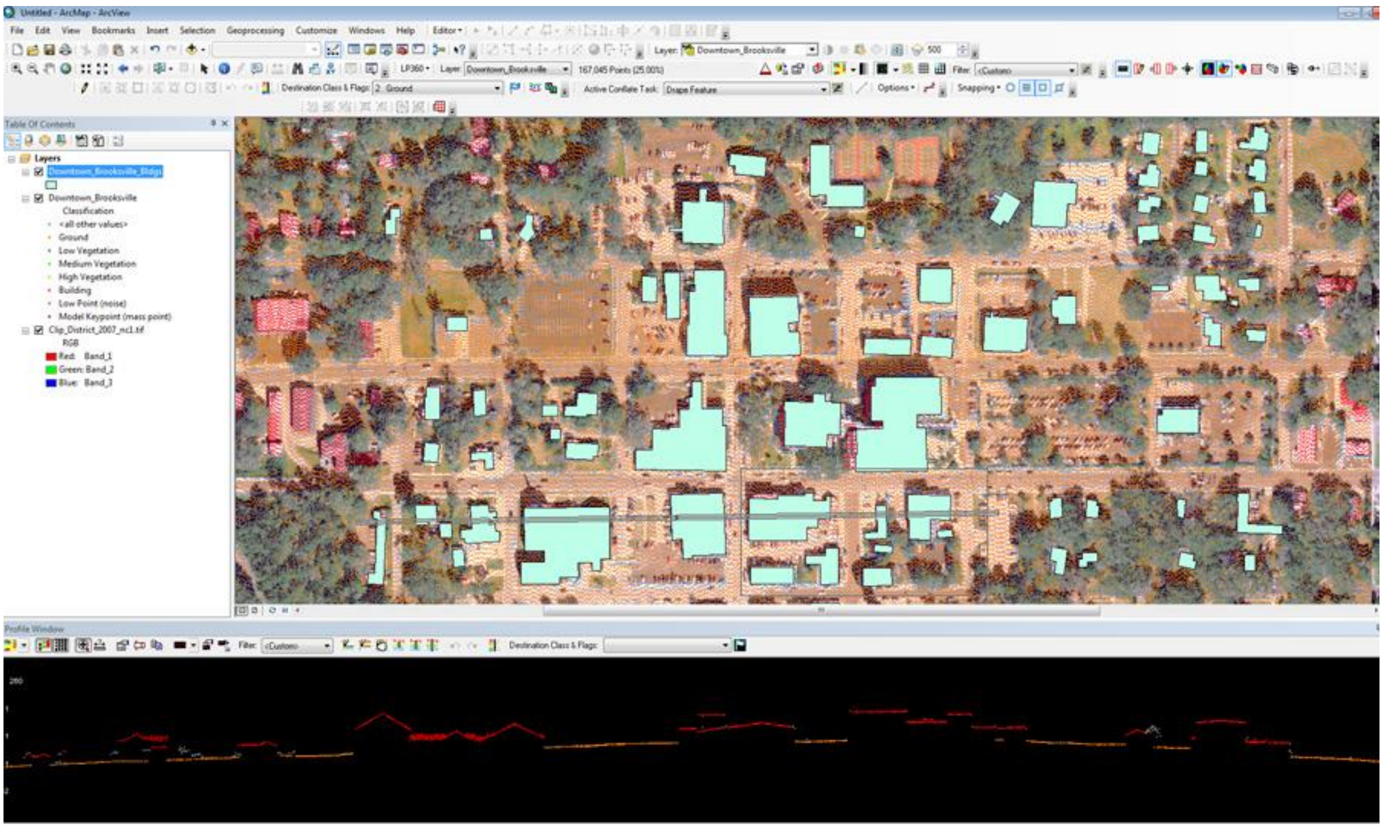
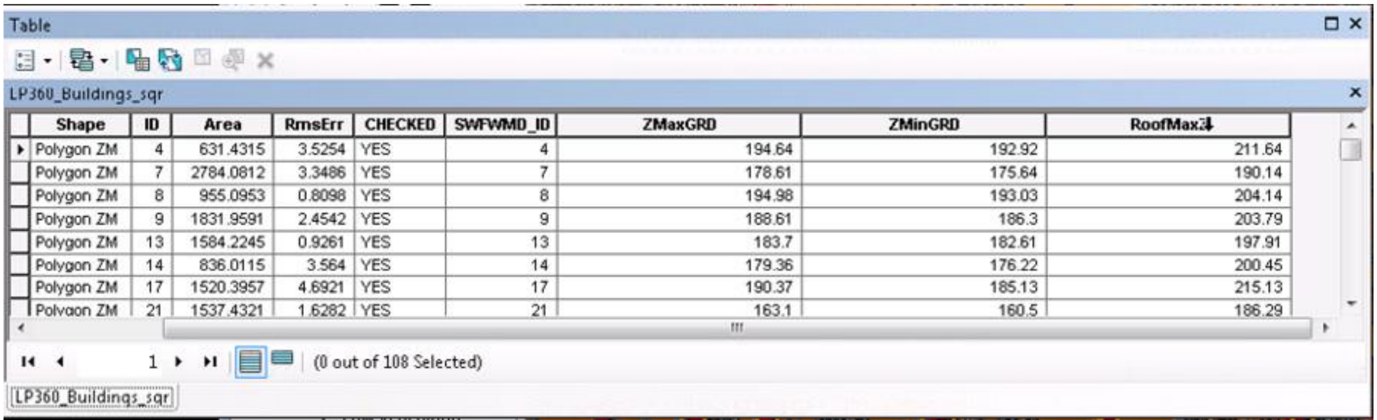


Figure 1

We used LP360 to first automatically classify the building rooftops (Class 6) and extract building polygons. (Figure 1) We then conflated the polygons to get the z value for the buildings. Then by taking the difference between the minimum and maximum height relative to Class 2 (ground) and the maximum height of Class 6 (buildings) we were able to determine the heights of the buildings above ground (Figure 2).



Table

LP360_Buildings_sqr

Shape	ID	Area	RmsErr	CHECKED	SWFWMD_ID	ZMaxGRD	ZMinGRD	RoofMax
Polygon ZM	4	631.4315	3.5254	YES	4	194.64	192.92	211.64
Polygon ZM	7	2784.0812	3.3486	YES	7	178.61	175.64	190.14
Polygon ZM	8	955.0953	0.8098	YES	8	194.98	193.03	204.14
Polygon ZM	9	1831.9591	2.4542	YES	9	188.61	186.3	203.79
Polygon ZM	13	1584.2245	0.9261	YES	13	183.7	182.61	197.91
Polygon ZM	14	836.0115	3.564	YES	14	179.36	176.22	200.45
Polygon ZM	17	1520.3957	4.6921	YES	17	190.37	185.13	215.13
Polygon ZM	21	1537.4321	1.6282	YES	21	163.1	160.5	186.29

1 (0 out of 108 Selected)

LP360_Buildings_sqr

Figure 2

Another way we use LP360 as part of our flood plain analysis is that we established that the relationship between the roof drip line and the finished floor height was highly correlated. Therefore, we are able to infer the finished floor heights using the LP360's building filter extractor. Using it as the best estimator for finished floor elevation we can now add another level of detail to our flood plain analysis to say not only if a property is located in the flood plain but also if the finished floor of a building, located on that property, is in the flood plain.

We are convinced that LP360 is a tool we have to use to provide our desired level of analysis services.