

KML EXPORT & 3D CONSTRUCTION POINT TIP SHEET FOR *iWitness*TM V2

Working with GPS Coordinates

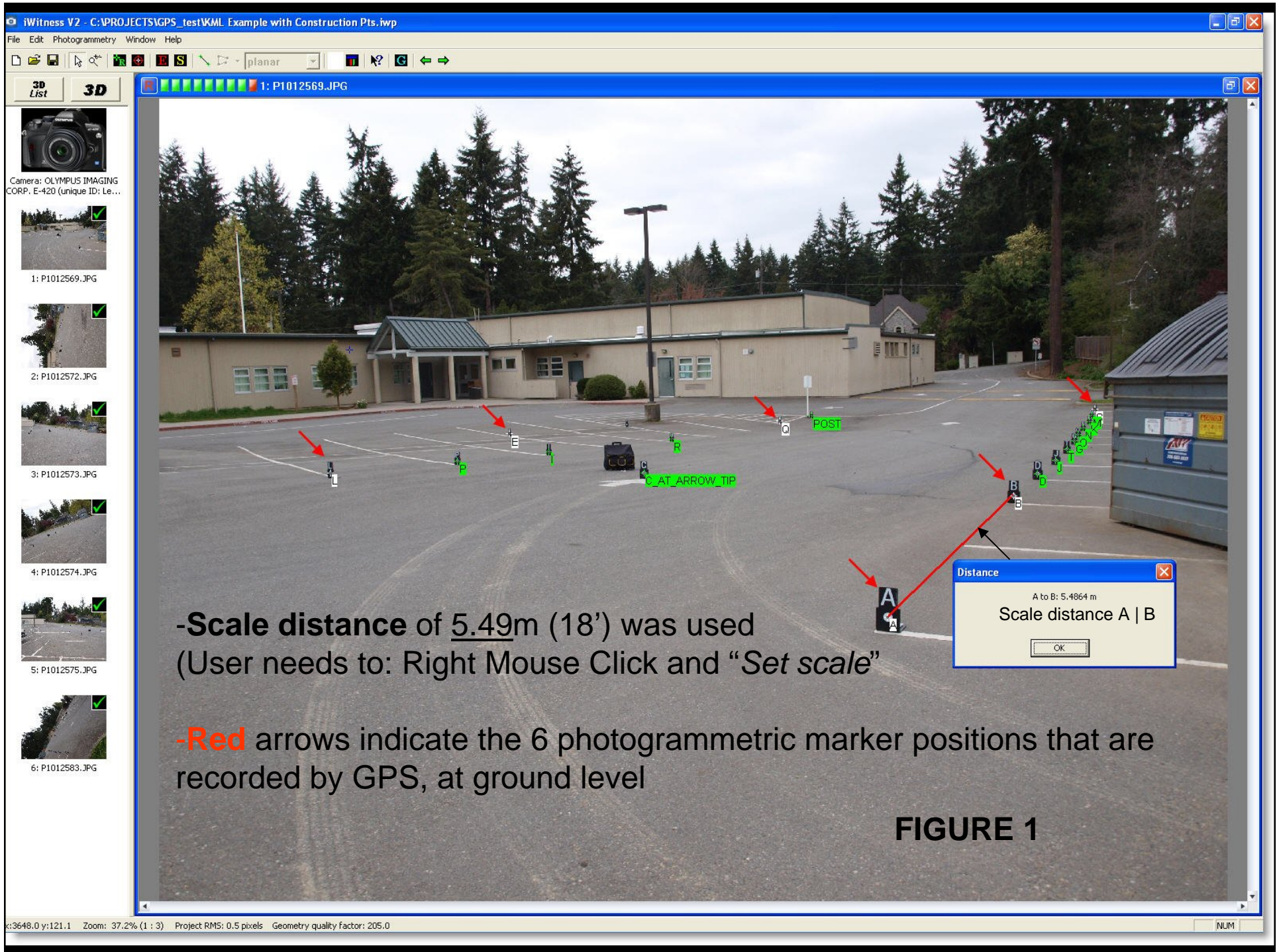
STEP 1. Conduct the *iWitness* project and assure the scale distance used is set in Meters (Metres).
NOTE: there is no need to apply the “3-2-1”.

NOTE: It is important that one uses GPS Control Points (CPs) with good two-dimensional spatial separation. In this project example, we used six CPs (identified as white labels, in FIGURE 1). We recommend use of at least 6 CP's for the KML export – more CPs are better than less.

STEP 2. Use the GPS instrument and record the CPs - (in this example, we used a hand-held Garmin EtrexTM GPS, and set the GPS device on the ground, at the same location as the six *iWitness* measured photogrammetric markers A,B,S, Q, E, L). The horizontal coordinate readout of the GPS device must be in Degrees & Decimal Minutes, whereas the height must be in Meters.

STEP 3. Create a text file (using Microsoft Notepad) of the Step 2, GPS recorded readings. See FIGURE 2.

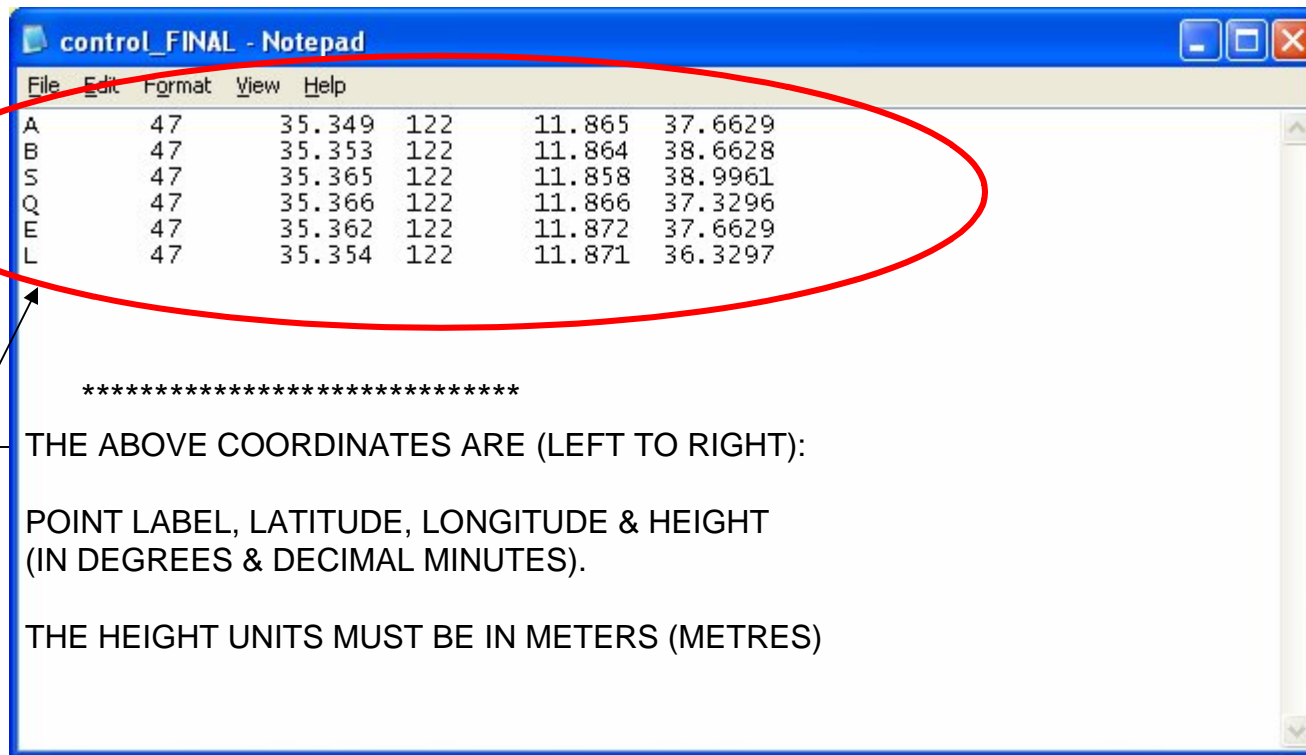
STEP 4. Use the *iWitness* “Transformation to Control” dialog box (*pull-down menu of Photogrammetry + Transformation to control*), using the Step 3 text file. **Mark the CPs in an open image, or the 3D View.** See FIGURE 5.



-Scale distance of 5.49m (18') was used
(User needs to: Right Mouse Click and "Set scale")

-Red arrows indicate the 6 photogrammetric marker positions that are recorded by GPS, at ground level

FIGURE 1



NOTE: *Only enter the Point Label, Latitude, Longitude & Height in the "Notepad" Text file. Values must be space or tab delimited.*

FIGURE 2

Control Label	X	Y	Z	Z-Offset	Closest Point	DX	DY	DZ	Total
A	560317.6694	5270949.3870	37.6629	0.0000	N/A	N/A	N/A	N/A	N/A
B	560318.8458	5270956.8091	38.6628	0.0000	N/A	N/A	N/A	N/A	N/A
S	560326.1345	5270979.1142	38.9961	0.0000	N/A	N/A	N/A	N/A	N/A
Q	560316.0907	5270980.8629	37.3296	0.0000	N/A	N/A	N/A	N/A	N/A
E	560308.6488	5270973.3760	37.6629	0.0000	N/A	N/A	N/A	N/A	N/A
L	560310.0551	5270958.5707	36.3297	0.0000	N/A	N/A	N/A	N/A	N/A

Transformation Options: 3D 2D 1D

Scale set and held
Quality: N/A

STEP 5. Click the “Import Control Points”

Figure 3

Select Hemisphere

North-West
South-West
North-East
South-East

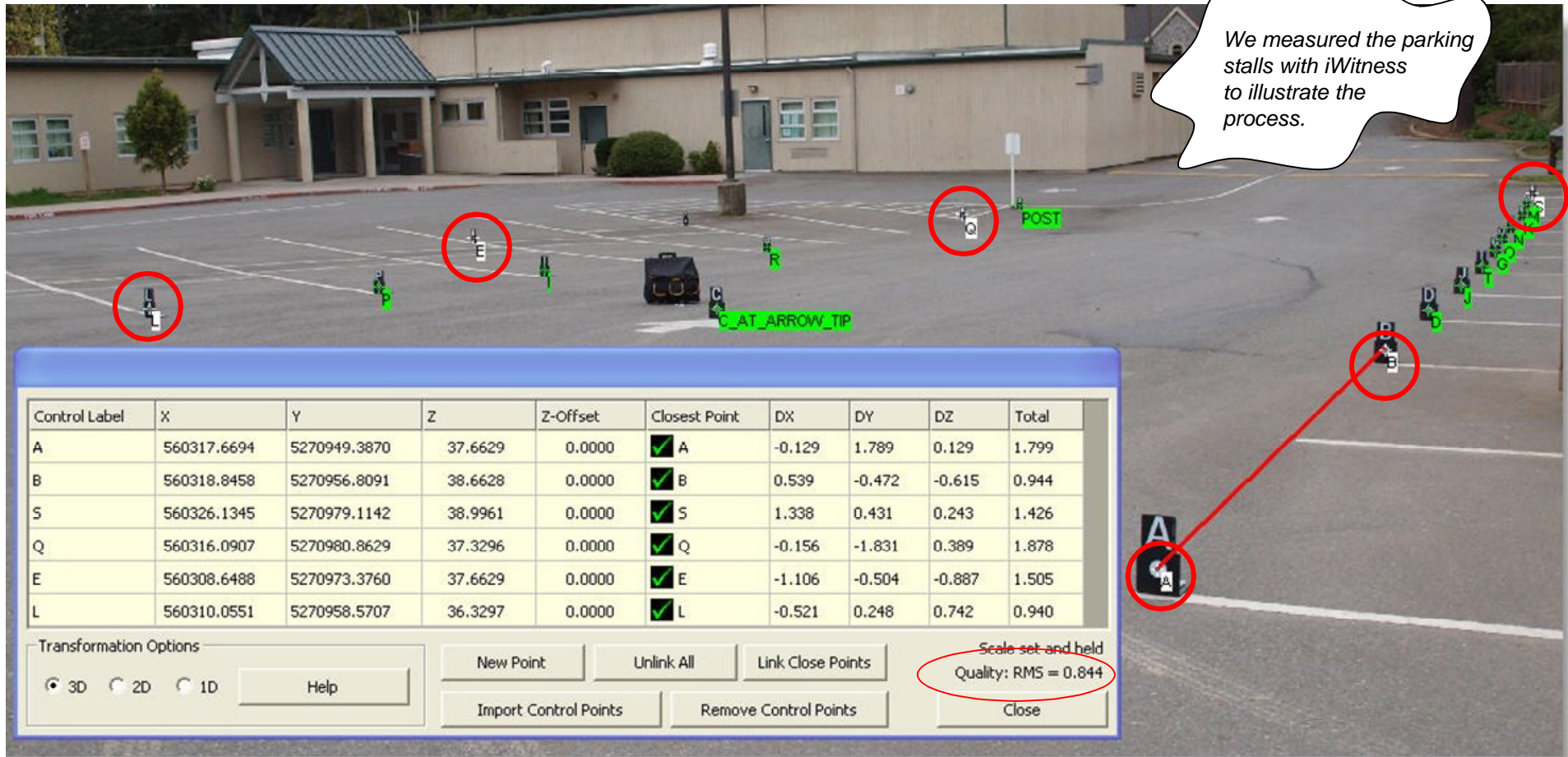
Select Hemisphere

North-West (USA, Canada) North-East (Europe, North Africa, Asia)
 South-West (South America) South-East (Australia, South Africa)

STEP 6. Click the radio button for the proper hemisphere.

Figure 4

3D Transformation to control dialog box presented with Six Control Points Marked



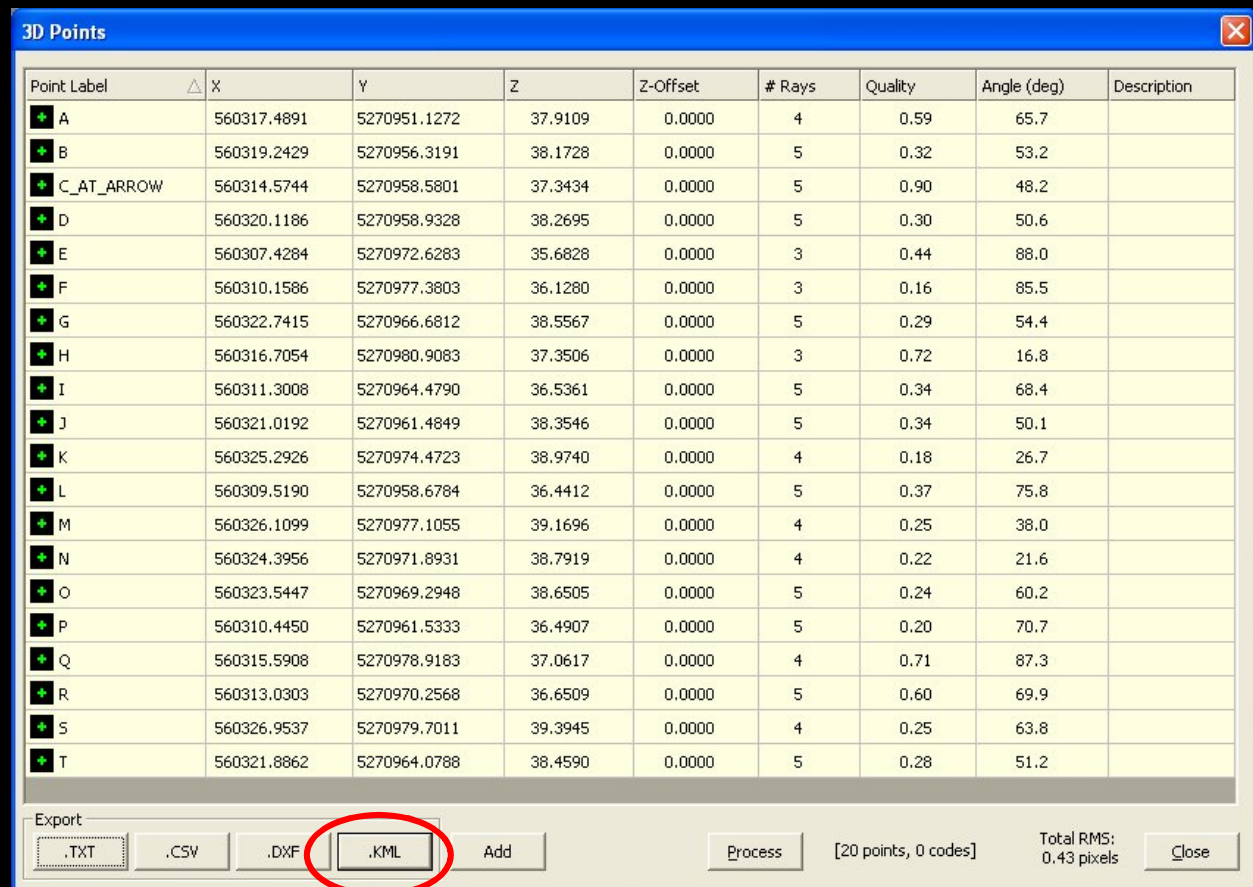
*Note: the RMS fit is about eight-tenths of a meter; this is due to the measurement uncertainty of the hand-held GPS. The generally much higher relative accuracy of 3D points within the iWitness network, scaled using the **A/B scale distance**, is not affected by the transformation into the GPS coordinate system.*

FIGURE 5

STEP 6. Open the 3D View (3D Button). *NOTE: within the 3D view, you may have to depress the ALT key + Left Mouse Drag around the network of points to “zoom to full extent”.*

The iWitness coordinates in the 3D Points (FIGURE 6) are now in the WGS84 Global Coordinate System and can be exported as a **KML file** to an ‘earth viewer’ e.g., Google Earth.

However, before exporting, we will now discuss the KML Export “Shift Parameters” and the “3D CONSTRUCTION POINT” procedures.

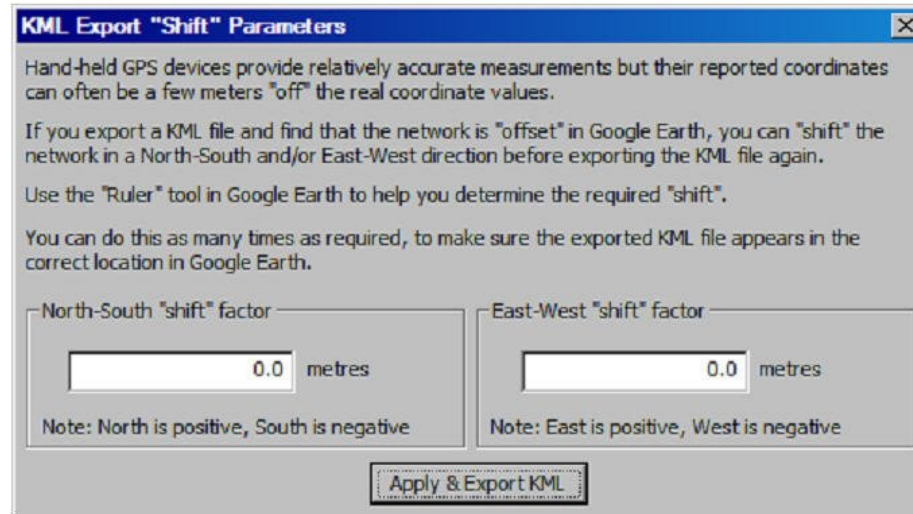
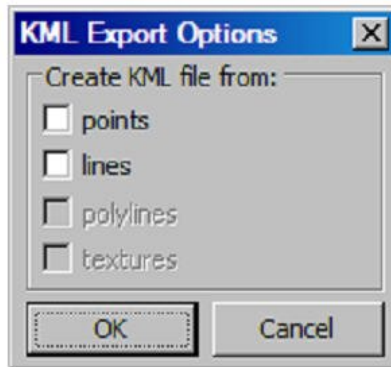


The screenshot shows a window titled "3D Points" with a table of data and an export menu at the bottom. The table has columns for Point Label, X, Y, Z, Z-Offset, # Rays, Quality, Angle (deg), and Description. The export menu includes options for .TXT, .CSV, .DXF, and .KML, with the .KML option circled in red. The status bar at the bottom right shows "Total RMS: 0.43 pixels" and a "Close" button.

Point Label	X	Y	Z	Z-Offset	# Rays	Quality	Angle (deg)	Description
A	560317.4891	5270951.1272	37.9109	0.0000	4	0.59	65.7	
B	560319.2429	5270956.3191	38.1728	0.0000	5	0.32	53.2	
C_AT_ARROW	560314.5744	5270958.5801	37.3434	0.0000	5	0.90	48.2	
D	560320.1186	5270958.9328	38.2695	0.0000	5	0.30	50.6	
E	560307.4284	5270972.6283	35.6828	0.0000	3	0.44	88.0	
F	560310.1586	5270977.3803	36.1280	0.0000	3	0.16	85.5	
G	560322.7415	5270966.6812	38.5567	0.0000	5	0.29	54.4	
H	560316.7054	5270980.9083	37.3506	0.0000	3	0.72	16.8	
I	560311.3008	5270964.4790	36.5361	0.0000	5	0.34	68.4	
J	560321.0192	5270961.4849	38.3546	0.0000	5	0.34	50.1	
K	560325.2926	5270974.4723	38.9740	0.0000	4	0.18	26.7	
L	560309.5190	5270958.6784	36.4412	0.0000	5	0.37	75.8	
M	560326.1099	5270977.1055	39.1696	0.0000	4	0.25	38.0	
N	560324.3956	5270971.8931	38.7919	0.0000	4	0.22	21.6	
O	560323.5447	5270969.2948	38.6505	0.0000	5	0.24	60.2	
P	560310.4450	5270961.5333	36.4907	0.0000	5	0.20	70.7	
Q	560315.5908	5270978.9183	37.0617	0.0000	4	0.71	87.3	
R	560313.0303	5270970.2568	36.6509	0.0000	5	0.60	69.9	
S	560326.9537	5270979.7011	39.3945	0.0000	4	0.25	63.8	
T	560321.8862	5270964.0788	38.4590	0.0000	5	0.28	51.2	

FIGURE 6

KML Export “Shift Parameters”



OVERVIEW:

The positioning accuracy of both hand-held GPS devices and the imagery in virtual globe viewers is such that measured GPS positions are often a few meters removed from their ‘correct’ positions as depicted in Google Earth. In order to compensate for this offset, the user can specify a ‘shift’ factor, to position the *iWitness* points closer to the positions shown in the imagery. The amount of shift required is entered in meters via the KML Export ‘shift’ parameters window after the KML Export operation. For the initial export of the KML file, the shift factor should be left at 0.0 meters. Once the saved KML file is opened directly into Google Earth, or other compatible software for viewing, the user can employ a distance measuring tool to determine the required shift of the point array. The shifts can be in both the North/South and/or East/West directions, the signs being positive for North and East, and negative for South and West.

The next slide presents an example: **FIGURE 7**

In **FIGURE 7**, the point labeled **GPSPoint 2**, is incorrectly positioned in Google Earth. The point should in fact be placed at a location 5m North and 2m East of its current position. In this case, a shift factor of +5m in the North/South direction and +2m in the East/West direction would move the point to the position indicated in the underlying image, as well as moving all other points in the network by the same amount. This is an iterative process where the user can export and view the KML file as many times as required to make sure the exported coordinates appear in the correct location.



FIGURE 7

ADDING 3D CONSTRUCTION POINTS

Goal:

This tip sheet will discuss entering **Hand Held GPS coordinates** into the project discussed so far. The example will be **adding a quantity of three Garmin Etrex (GPS) measurements into the *iWitness* project**. In this example, the user wishes to measure three additional points (tens of meters from the *iWitness* network), where the GPS accuracy is not as 'critical' as the *iWitness* measurements. The relative accuracy of the GPS coordinates will typically agree to the *iWitness* measurements to an uncertainty of about 1 meter or so.

NOTE: this process is accomplished *before* doing the KML export.

Background:

3D Constructed Points are 3D points which can be manually added to an oriented *iWitness* network, and displayed within the 3D View. 3D constructed points are not measured photogrammetric points and are therefore not included in the bundle adjustment. 3D Constructed Points can be added to the *iWitness* network using the **Add** button at the base of the 3D Points List. The user can manually input 3D points either in Cartesian coordinates or, where GPS control points are present, in degrees & decimal minutes for horizontal position and in meters for height.

- STEP i) Click the “ADD” button in the 3D Points List.
- STEP ii) Click the “Enter GPS-style coordinates” (radio button).
- STEP iii) Click the “From File...” button

The screenshot shows the '3D Points' window with a table of points and an 'Add a constructed 3D point' dialog box. The table contains 20 points (A-T) with columns for Point Label, X, Y, Z, Z-Offset, # Rays, Quality, Angle (deg), and Description. The dialog box has fields for Label, Latitude (degrees and decimal minutes), Longitude (degrees and decimal minutes), and Height (metres). It also has a radio button for 'Enter GPS-style coordinates' and buttons for 'Clear', 'Close', 'Add', and 'From File...'. At the bottom of the main window, there is an 'Export' section with buttons for '.TXT', '.CSV', '.DXF', and '.KML', followed by an 'Add' button, a 'Process' button, a status indicator '[20 points, 0 codes]', 'Total RMS: 0.43 pixels', and a 'Close' button.

Point Label	X	Y	Z	Z-Offset	# Rays	Quality	Angle (deg)	Description
A	560317.4891	5270951.1272	37.9109	0.0000	4	0.59	65.7	
B	560319.2429	5270956.3191	38.1728	0.0000	5	0.32	53.2	
C_AT_ARROW	560314.5744	5270958.5801	37.3434	0.0000	5	0.90	48.2	
D	560320.1186	5270958.9328	38.2695	0.0000	5	0.30	50.6	
E	560307.4284	5270972.6283	35.6828	0.0000	3	0.44	88.0	
F	560310.1586	5270977.3803	36.1280	0.0000	3	0.16	85.5	
G	560322.7415	5270966.6812	38.5567	0.0000	5	0.29	54.4	
H	560316.7054	5270980.9083	37.3506	0.0000	3	0.72	16.8	
I	560311.3008	5270964.4790	36.5361					
J	560321.0192	5270961.4849	38.3546					
K	560325.2926	5270974.4723	38.9740					
L	560309.5190	5270958.6784	36.4412					
M	560326.1099	5270977.1055	39.1696					
N	560324.3956	5270971.8931	38.7919					
O	560323.5447	5270969.2948	38.6505					
P	560310.4450	5270961.5333	36.4907					
Q	560315.5908	5270978.9183	37.0617					
R	560313.0303	5270970.2568	36.6509					
S	560326.9537	5270979.7011	39.3945	0.0000	4	0.25	63.8	
T	560321.8862	5270964.0788	38.4590	0.0000	5	0.28	51.2	

FIGURE 8

STEP iv) Click the name of the control file (in this example we named it “construction GPS points”), and then click **Open**. The Figure 4 dialog is now displayed; click the proper “hemisphere” radio button.

NOTE: these “3D construction points” were recorded on scene and then put into a Microsoft Notepad (txt file) from the Hand Held GPS device. The “txt file” is formatted exactly the same as in Figure 2.

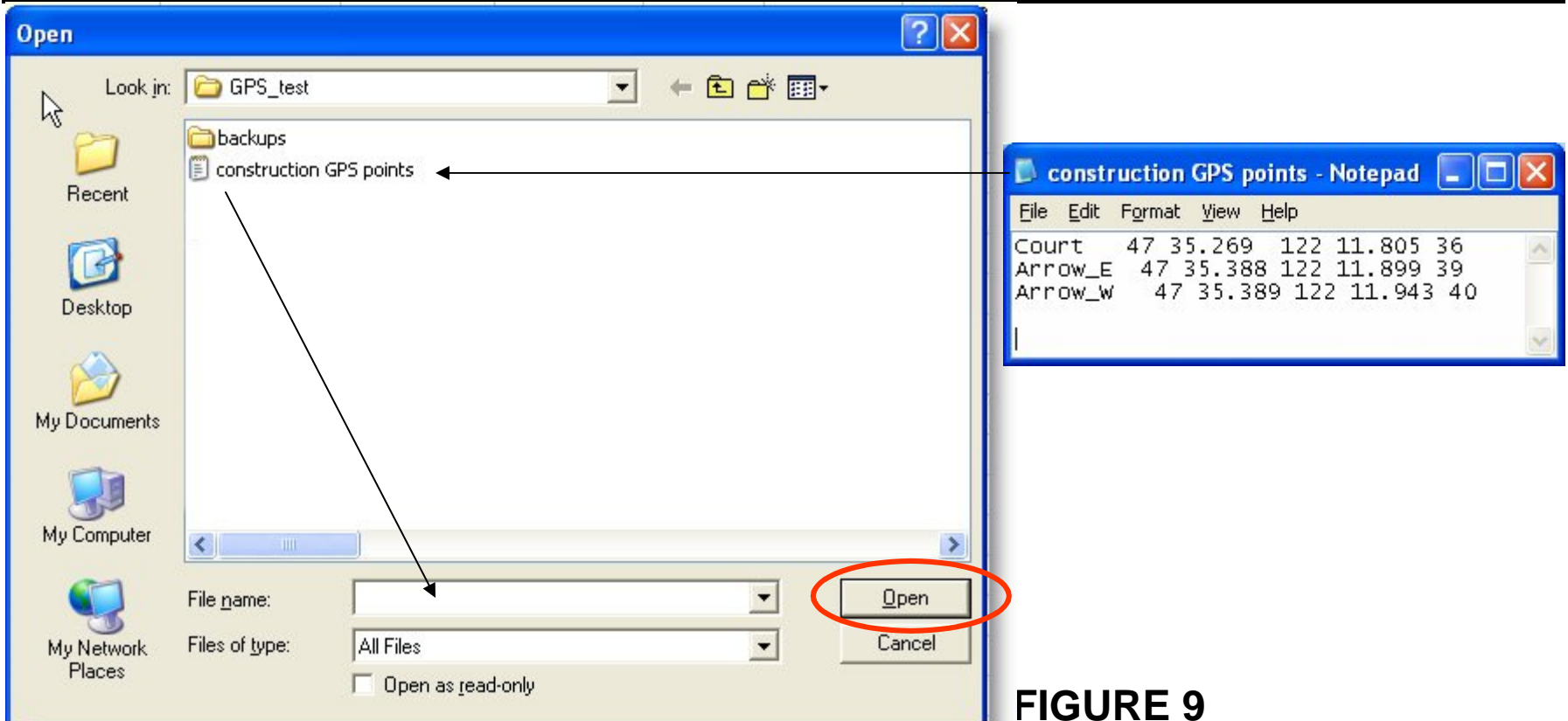
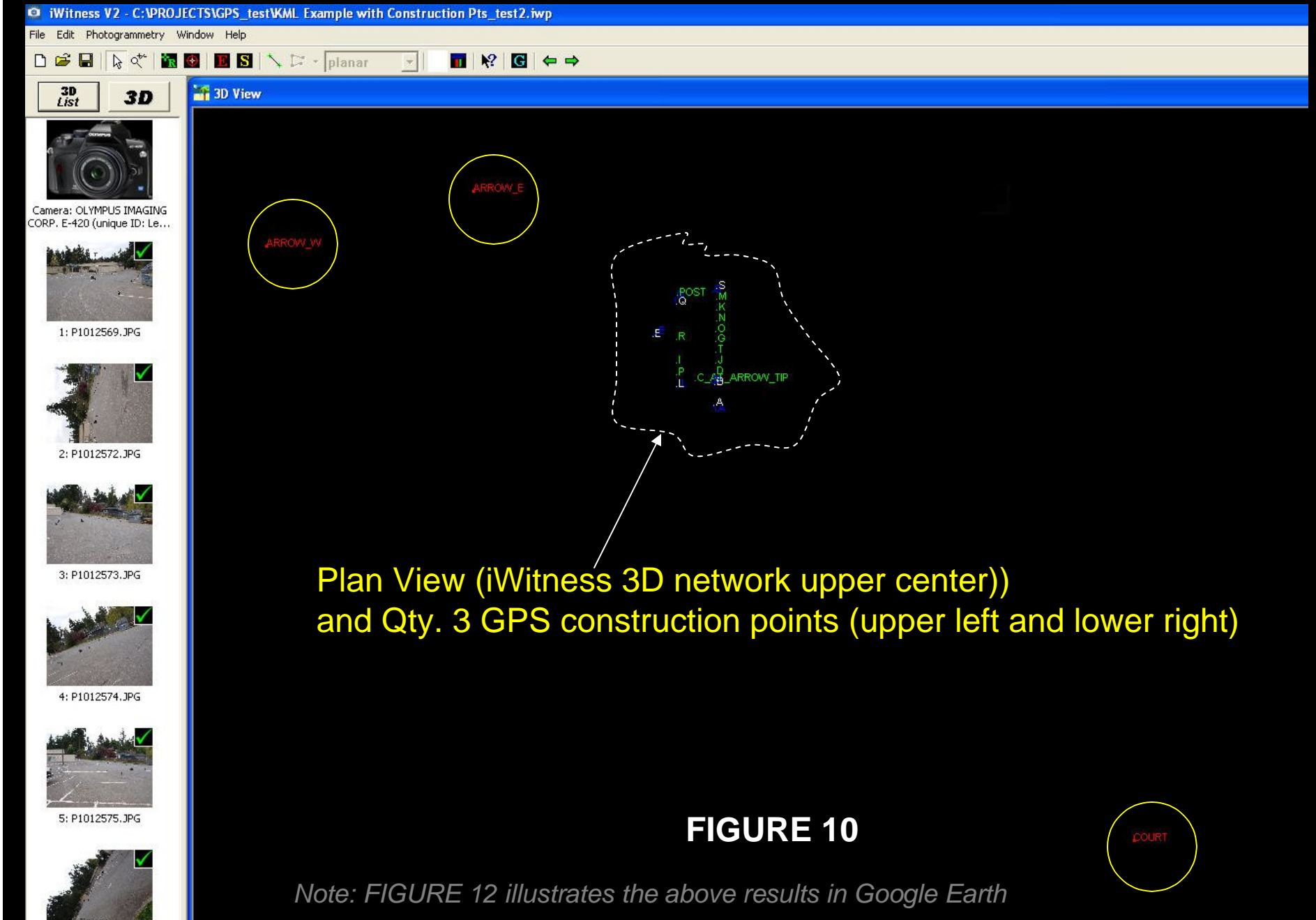
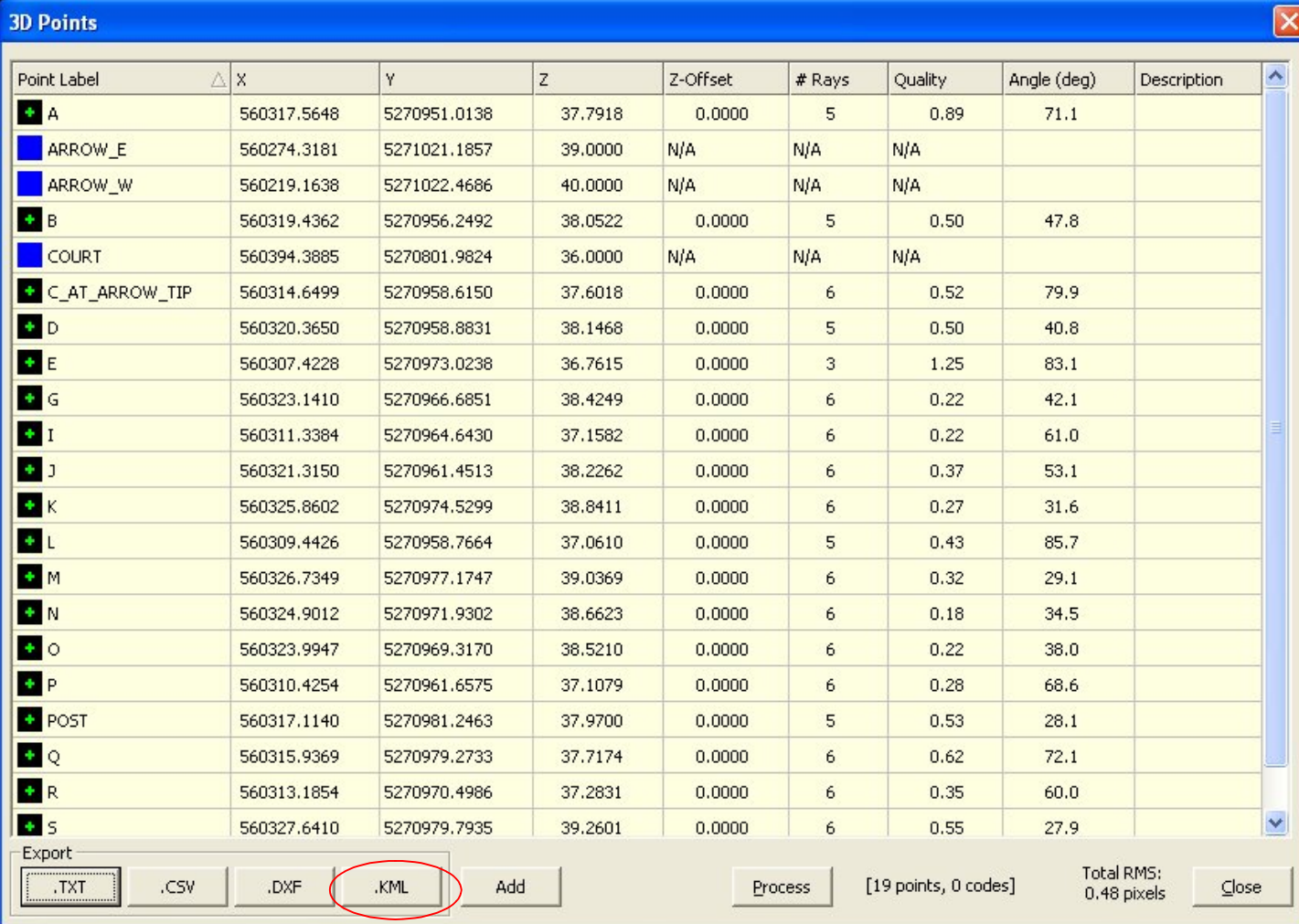


FIGURE 9



STEP v) Click the .KML and save to your working folder. The .KML can now be “shifted” as indicated in FIGURE 7.

FIGURE 12 is a screen capture of the .KML result in Google Earth.



Point Label	X	Y	Z	Z-Offset	# Rays	Quality	Angle (deg)	Description
A	560317.5648	5270951.0138	37.7918	0.0000	5	0.89	71.1	
ARROW_E	560274.3181	5271021.1857	39.0000	N/A	N/A	N/A		
ARROW_W	560219.1638	5271022.4686	40.0000	N/A	N/A	N/A		
B	560319.4362	5270956.2492	38.0522	0.0000	5	0.50	47.8	
COURT	560394.3885	5270801.9824	36.0000	N/A	N/A	N/A		
C_AT_ARROW_TIP	560314.6499	5270958.6150	37.6018	0.0000	6	0.52	79.9	
D	560320.3650	5270958.8831	38.1468	0.0000	5	0.50	40.8	
E	560307.4228	5270973.0238	36.7615	0.0000	3	1.25	83.1	
G	560323.1410	5270966.6851	38.4249	0.0000	6	0.22	42.1	
I	560311.3384	5270964.6430	37.1582	0.0000	6	0.22	61.0	
J	560321.3150	5270961.4513	38.2262	0.0000	6	0.37	53.1	
K	560325.8602	5270974.5299	38.8411	0.0000	6	0.27	31.6	
L	560309.4426	5270958.7664	37.0610	0.0000	5	0.43	85.7	
M	560326.7349	5270977.1747	39.0369	0.0000	6	0.32	29.1	
N	560324.9012	5270971.9302	38.6623	0.0000	6	0.18	34.5	
O	560323.9947	5270969.3170	38.5210	0.0000	6	0.22	38.0	
P	560310.4254	5270961.6575	37.1079	0.0000	6	0.28	68.6	
POST	560317.1140	5270981.2463	37.9700	0.0000	5	0.53	28.1	
Q	560315.9369	5270979.2733	37.7174	0.0000	6	0.62	72.1	
R	560313.1854	5270970.4986	37.2831	0.0000	6	0.35	60.0	
S	560327.6410	5270979.7935	39.2601	0.0000	6	0.55	27.9	

Export: .TXT .CSV .DXF .KML [19 points, 0 codes] Total RMS: 0.48 pixels

FIGURE 11

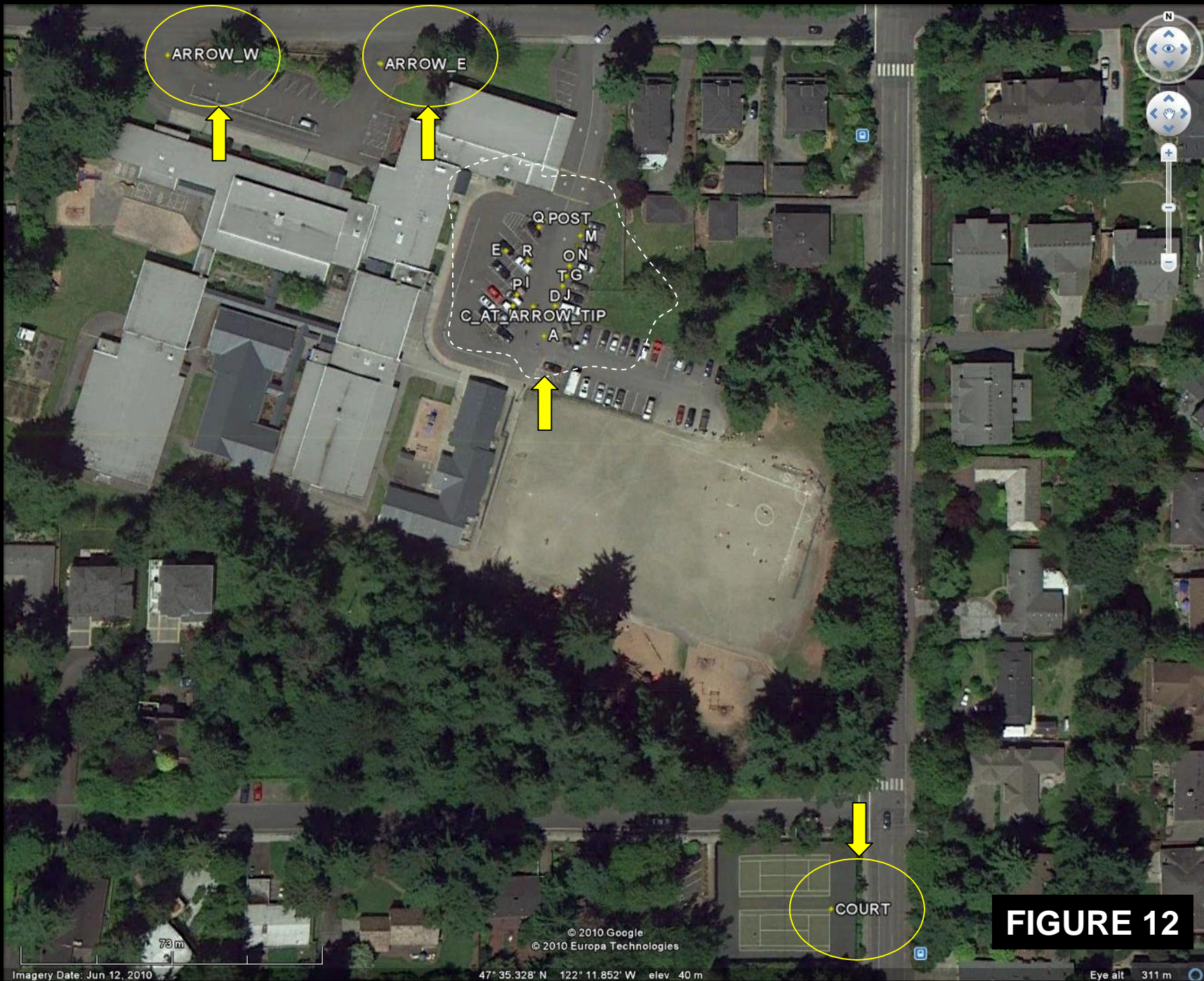


FIGURE 12