PUHE LWM POSITION UNCERTAINTY FOR EACH YEAR OF PHOTO COVERAGE

Calculations of uncertainties for imagery of Puukohola National Historic Site.

These 'accuracy' estimates use approximate numbers due to the processing techniques and unique character of the study site.
All numbers reported here are estimates based on aerial coverage.

Measurement Error **Em** = square root of [(Er)^2 + (Ed)^2 + (Ep)^2 + (Ets)^2]

Enter a "**0**" below for blocks where data doesn't exist.
Obtain **Er** (rectification error) values from next worksheet, "RectifyUncert."
Ed, digitizing error, values come from table on page 2 of Word file, "Calculating Erosion Rate Uncertainty." If the T-sheet isn't listed
Ep = the pixel size for a mosaic, usually 0.5 m.
Ets = 5 m = error associated with plotting on the t-sheet, inc. position of planetable (3 m), posit of plotted points (1 m) and
  field interpretation of MHWL (4 m), from Shalowitz, 1964. Ets applies to T-sheets only and is the root sum of squares of above terms.

year	Er, Rectification Error	Ed	Ep, Pixel Size	Ets	Em
1949	2.61	0.8403	0.50	0	2.790
1950	1.54	0.8403	0.50	0	1.825
1966	1.52	0.8403	0.50	0	1.805
1970	1.15	0.8403	0.50	0	1.510
11/4/1975	1.82	0.8403	0.50	0	2.070
6/3/1975	0.96	0.8403	0.50	0	1.369
1977	0.73	0.8403	0.50	0	1.219
1981	2.07	0.8403	0.50	0	2.292
1987	0.39	0.8403	0.50	0	1.054
1989	0.39	0.8403	0.50	0	1.054
1990	0.89	0.8403	0.50	0	1.321
1998	1.02	0.8403	0.50	0	1.414
2006	1.34	0.8403	0.50	0	1.661

Enter a "**0**" below for blocks where data doesn't exist.
Total Position Uncertainty, Etp = square root of [(Em)^2 + (Etd)^2 + (Etid)^2 + (Es)^2 + (Ec)^2]

Em, measurement error, is from table above.
Etd, tidal fluctuation of the toe position, was found to be 5 for Kekaha area, and applies to Photomosaic shorelines only,
Es, error from seasonal fluctuation of toe position, from the "SeasonalUncert" worksheet.
Ec, uncertainty from coverting HWL to toe, applies to T-sheets only. Get from "Profile Data" worksheet.

year	Em	Etd	Es	Ec	Etp	Etp (ft)
1949	2.790	5	2.870	0.000	6.405	21.012
1950	1.825	5	2.870	0.000	6.047	19.840
1966	1.805	5	2.870	0.000	6.041	19.820
1970	1.510	5	2.870	0.000	5.960	19.553
11/4/1975	2.070	5	2.870	0.000	6.126	20.097
6/3/1975	1.369	5	2.870	0.000	5.926	19.441
1977	1.219	5	2.870	0.000	5.893	19.333
1981	2.292	5	2.870	0.000	6.204	20.354
1987	1.054	5	2.870	0.000	5.861	19.228

**Rectification Error from the geoprocessing procedure, Er**
From RMS reports generated on a project basis in PCI Geomatics OrthoEngine. A 2006 Satellite image was used as the refer

year	x rms (m)	y rms (m)	ttl rms(meter)
1949	1.75	1.94	2.61
1950	1.44	0.55	1.54
1966	1.15	0.99	1.52
1970	0.62	0.97	1.15
11/4/1975	1.64	0.8	1.82
6/3/1975	0.33	0.9	0.96
1977	0.5	0.53	0.73
1981	1.69	1.2	2.07
1992	0.62	0.55	0.83
1989	0.2	0.34	0.39
1990	0.46	0.76	0.89
1998	0.84	0.58	1.02
2006	0.77	1.1	1.34

Seasonal Fluctuation of Beach Step Crest, Es

Replace the below data with that from the mosaic area in question. Check the seasonal uncertainty values against seasonal fluctuations from the profiles to make sure profile fluctuations arenot larger., but are similar (see "ProfileData" worksheet.

Transect no.	6/3/1975	11/4/1975	June75-Nov75	absolute
0	65.6796	66.863	-1.1834	1.1834
1	70.3992	71.052	-0.6528	0.6528
2	72.858	72.9758	-0.1178	0.1178
3	73.1653	73.3358	-0.1705	0.1705
4	71.2202	68.6818	2.5384	2.5384
5	38.2746	39.3287	-1.0541	1.0541
6	37.1127	35.366	1.7467	1.7467
7	30.3	33.2439	-2.9439	2.9439
8	34.8595	46.6191	-11.7596	11.7596
9	42.5086	49.4372	-6.9286	6.9286
10	45.0621	48.2126	-3.1505	3.1505
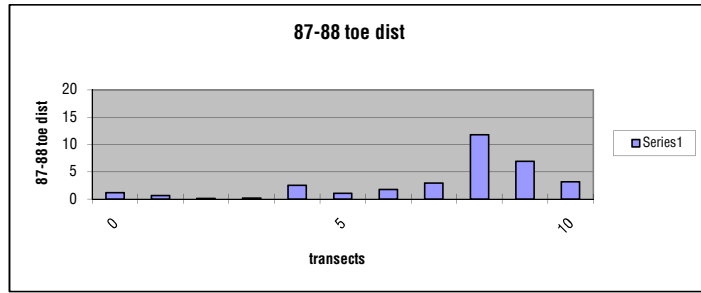
87-88 toe dist

Overall 87-88 toe distance stats - for mosaic areas with a single uncertainty value for seasonal toe movement

Mean absolute value 87-88 toe dist = X =	2.93148182
Std dev 87-88 toe dist =	3.50473306
|x|+2*std (goes to matlab - seasonaluncert.m)	9.94094794

for a 1-sig uncertainty, the standard deviation of the difference between 1988 and 1987 is used.

using the mean absolute value plus 2*standard deviation, we generated the uncertainty in matlab using seasonaluncert.m. We used synthetic data to calcualate Es.
Es=   2.8701

Beachwdth Calculation
From "EroRateUncert.doc" document describing how to calculate beachwidth uncertainty (**Ev-t**). Beach
width uncertainty is used in eigan beaches, px and pxt. These erosion hazard zone calculation methods work on
individual beaches, not multiple beaches at once.

$$\textbf{Ev-t} = sqrt(\textbf{Etp\^2 + Ev\^2})$$

Etp, total positional uncertainty for the beach toe from the first worksheet of this book.
 Ev, vegetation line position uncertainty (calculated below)

$$\textbf{Ev = } sqrt(\textbf{Em\^2 + Evid\^2})$$

Em, measurement error, is from table on the first worksteet of this book
Evid, uncertainty associated with identifying the vegetation line on photomosaics
(estimated by John Rooney to be 2m)

Year	Em	Evid	Ev	Etp	Ev-t
2006	1.054374	2	2.26	5.860817	6.28179

For the Eigen beaches routine and px and pxt methods, only the most recent year beachwidth and uncertainty is
needed.
Beachwidth = Vegetation position - LWM position

Year =   2006

Transect #	ToeDist	VegDist	Beachwidth(m)
0	54.9965	80.0559	25.06
1	59.7389	79.019	19.28
2	62.9288	79.3398	16.41
3	65.1326	79.4585	14.33
4	64.9446	79.4584	14.51
5	37.7336	56.185	18.45
6	36.9185	67.0663	30.15
7	38.5928	70.5965	32.00
8	47.9111	76.0654	28.15
9	52.187	80.8396	28.65
10	51.7508	76.4088	24.66

Boundary File denoting continuous homogenous sections of beach

0	0	4	10
4	0	4	10
5	0		
10	0		

NaN	1949	1966	1970	19752	1977	1981	1987	1990	1998	2006
NaN	6.404661	6.041207	5.959772	5.925578	5.892748	6.204005	5.860817	5.914624	5.935956	5.999707
0	161.769	82.8105	14.3191	66.863	66.9318	56.2771	39.2373	42.6175	31.6308	54.9965
1	147.743	87.5957	34.7947	71.052	61.7538	62.9492	55.279	49.2776	41.1925	59.7389
2	106.84	92.3322	94.7667	72.9758	69.7286	63.1011	59.1976	55.9851	51.8964	62.9288
3	102.032	90.715	84.4797	73.3358	72.7219	77.5401	65.7412	63.7431	59.8014	65.1326
4	76.8063	73.2639	61.1583	68.6818	69.7369	76.4875	67.171	67.1301	63.8061	64.9446
5	37.9383	37.6754	38.368	39.3287	39.1037	48.3893	38.1742	42.919	43.8982	37.7336
6	23.7799	30.7607	32.2005	35.366	39.8298	47.2545	27.3253	38.6859	41.597	36.9185
7	27.0998	30.0374	27.9198	33.2439	32.6864	42.6494	25.8869	40.236	38.3248	38.5928
8	44.1044	43.2412	34.8218	46.6191	33.7571	39.8351	45.6815	52.3115	45.575	47.9111
9	50.4683	52.5654	42.1581	49.4372	42.0582	47.6678	50.3218	58.0456	49.0697	52.187
10	49.9963	50.4487	41.1952	48.2126	43.7119	50.0822	50.0464	56.9097	50.7016	51.7508