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Sinclair Weeks, *Secretary*

Coast and Geodetic Survey
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PLANE COORDINATE PROJECTION TABLES
HAWAIIAN ISLANDS

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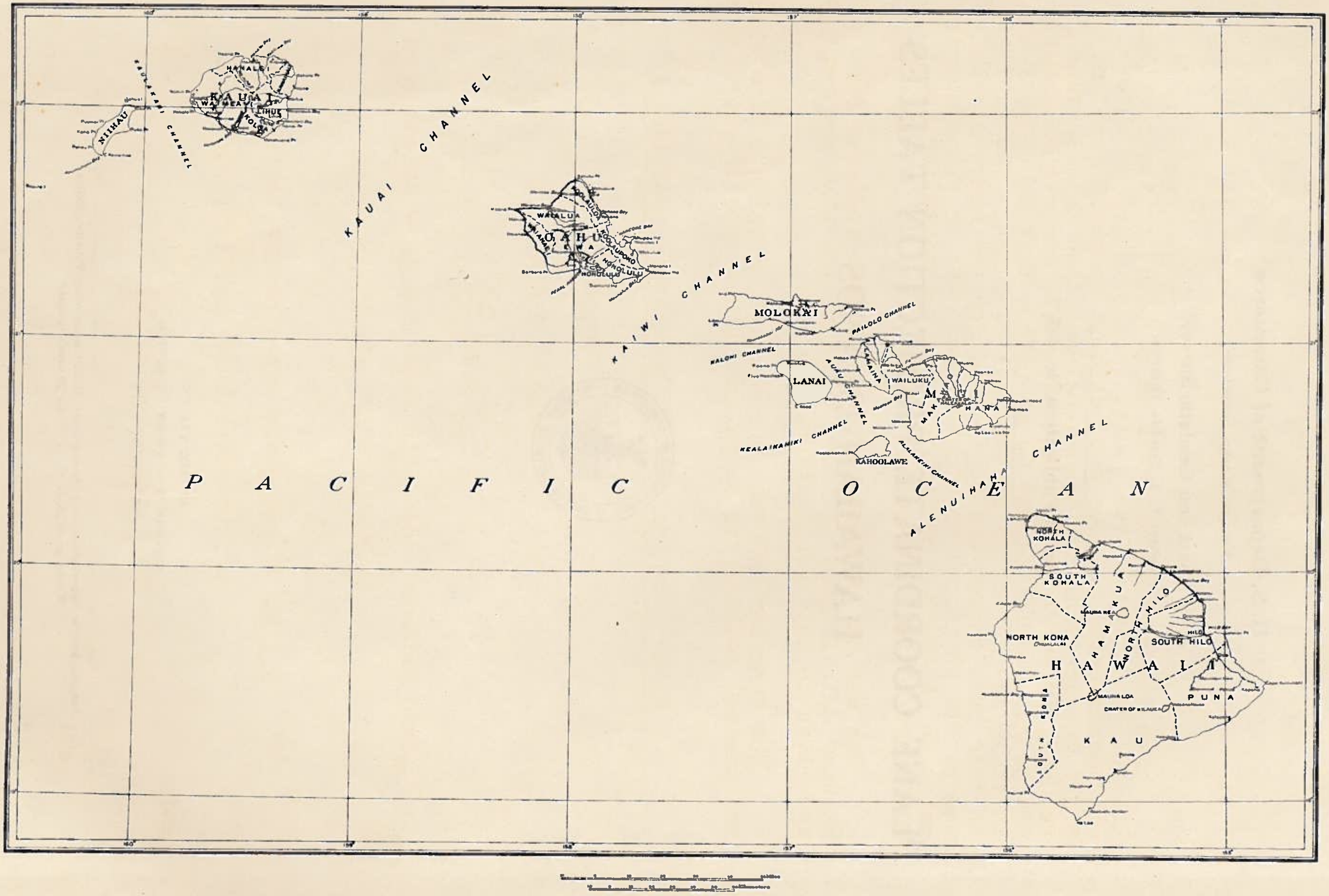

NIIHAU
KAULAKAHI CHANNEL
KAUAI
HANALEI
WAIMEA
LIHUE
KOLOA
KAUAI CHANNEL
OAHU
WAIALUA
WAIANAE
EWA
KOOLAULOA
KOOLAUPOKO
HONOLULU
KAIWI CHANNEL
MOLOKAI
KALOHI CHANNEL
PAILOLO CHANNEL
LANAI
AUAU CHANNEL
LAHAINA
WAILUKU
MAUI
MAKAWAO
HANA
KEALAIKAHIKI CHANNEL
KAHOOLAWE
ALALAKEIKI CHANNEL
ALENUIHAHA CHANNEL
PACIFIC OCEAN
NORTH KOHALA
SOUTH KOHALA
HAMAKUA
NORTH HILO
SOUTH HILO
HILO
NORTH KONA
SOUTH KONA
HAWAII
MAUNA LOA
CRATER OF KILAUEA
PUNA
KAU
160°
159°
158°
157°
156°
155°

Foreword

The plane coordinate system adopted for the Hawaiian Islands consists of five zones, each of which is based on a transverse Mercator projection. In the first four zones the scale along the central meridian in each zone is reduced, in order to minimize the scale error throughout the zone. The fifth zone is so narrow that no reduction in scale is made along its central meridian. The tables in this publication are to be used for the conversion of geographic positions to plane coordinates or plane coordinates to geographic positions. The constants for the zones are listed on page 7.

The methods of computation have been designed for machine calculation. All of the functions that are required are given in this publication.

The formulas and sample computations which follow show the general methods for computing either type of coordinates.

Plane coordinates from geographic positions

$$x = x' + 500{,}000$$

$$x' = H \cdot \Delta\lambda'' \pm a\ b$$

$$y = y_o + V\left(\frac{\Delta\lambda''}{100}\right)^2 \pm c$$

Grid azimuth = geodetic azimuth $- \Delta\alpha$ - second term

$$\Delta\alpha'' = \Delta\lambda'' \sin\phi + g$$

where

y_o, H, V, and a are based on the latitude of the geographic position,

and

b, c, and g are based on $\Delta\lambda''$.

$$\Delta\lambda'' = \text{Central Meridian} - \lambda$$

and

$\Delta\alpha''$ is the convergence of the meridian at the station with respect to the Central Meridian.

The second term for the reduction of geodetic to grid azimuths may be neglected for most work. However, for lines five miles or more in length if the same degree of accuracy is desired as is obtained by geographic computations, this term should be evaluated and used.

$$\text{Second term} = \frac{(y_2 - y_1)\ (2x'_1 + x'_2)}{(6\rho_o^2 \sin 1'')_g}$$

Geographic positions from plane coordinates

For P see Table 2.

" d " " $P\,(x'/10{,}000)^2 + d = V\,(\Delta\lambda''/100)^2 + c$

$$y_o = y - P\,(x'/10{,}000)^2 - d$$

Obtain the latitude from the table of y_o.

Use latitude to obtain H from the table.

$$x' = x - 500{,}000$$

$$\text{approximate } \Delta\lambda'' = x' \div H.$$

Determine a from latitude and b from approximate $\Delta\lambda$

then

$$\Delta\lambda'' = (x' \mp a\ b) \div H$$
$$\Delta\alpha'' = Mx'.$$

The following tables are based on the Clarke spheroid of 1866.

DEPARTMENT OF COMMERCE
U. S. Coast and Geodetic Survey
Form No. 744b

PLANE COORDINATES ON TRANSVERSE MERCATOR PROJECTION

(Condensed form for calculating-machine computation)

State Hawaii Zone 1 Central meridian 155° 30′ 00.″000

Station	Kulani (H.G.S.)	Kahelo (H.G.S.)			
ϕ	19° 31′ 24.″578	19° 37′ 23.″477			
λ	155 18 06.262	155 59 16.911			
$\Delta\lambda$ = Central mer. − λ	+ 0° 11′ 53.″738	− 0° 29′ 16.″911			
$\Delta\lambda''$	+ 713.738	− 1756.911			
$\left(\frac{\Delta\lambda''}{100}\right)^2$	50.942	308.674			
Table 1 H	95.653 917	95.595 105			
Table 1 V	0.774 938	0.778 261			
Table 2 a | b	−0.978 | +1.816	−0.974 | +3.112			
$x' = H\cdot\Delta\lambda \pm ab$	+ 68,270.06	− 167,949.06			
$V\left(\frac{\Delta\lambda''}{100}\right)^2 \pm c$ Table 3	39.47	240.22			
Tabular y	250,623.77	286,828.13			
x	568,270.06	332,050.94			
Table 1 y	250,663.24	287,068.35			
$\Delta\alpha''$	+ 238.53	− 590.05			
$\Delta\alpha$	+ 0° 03′ 58.″5	− 0° 09′ 50.″0			
Geod. Az. to Az. Mk.	178° 01′ 51.″2	247° 26′ 52.″8	Assumed		
Grid Az. to Az. Mk.	177° 57′ 53″	247° 36′ 43″			

$x = x' + 500{,}000$

y = Tab. $y + V\left(\frac{\Delta\lambda''}{100}\right)^2 \pm c$

$\Delta\alpha'' = \Delta\lambda'' \sin\phi + g$

Grid Az. = Geod. Az. − $\Delta\alpha$

H and V = Tab. H and Tab. V.

When ab is $\frac{-}{+}$, $\frac{\text{decrease}}{\text{increase}}$ $H\cdot\Delta\lambda$ numerically.

g increases $\Delta\lambda''\cdot\sin\phi$ numerically.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form No. 748a

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GEODETIC POSITIONS FROM TRANSVERSE MERCATOR COORDINATES

(CALCULATING MACHINE COMPUTATION)

STATE – ZONE Hawaii – 1

Station Kulani (H.G.S.)

X	568,270.06	Y	250,663.24
C	– 500,000.00	$P(\frac{X'}{10,000})^2 + d$	– 39.47
X'	+ 68,270.06	Y_o	250,623.77
Table 5 P	0.84688	Approx. $\Delta\lambda = X' \div H$	+ 714"
Table 4 d	0.00	$\Delta\lambda = (X' \mp ab) \div H$	+ 713."738
H	95.653917	$\Delta\lambda$	+ 0° 11' 53."738
a | b	– 0.978 | + 1.817	Central Meridian	155 30 00.000
ϕ	19° 31' 24."578	λ = C.M. – $\Delta\lambda$	155° 18' 06."262

Station Kahelo (H.G.S.)

X	332,050.94	Y	287,068.35
C	– 500,000.00	$P(\frac{X'}{10,000})^2 + d$	– 240.21
X'	– 167,949.06	Y_o	286,828.14
P	0.85158	Approx. $\Delta\lambda = X' \div H$	– 1757"
d	+ 0.01	$\Delta\lambda = (X' \mp ab) \div H$	– 1756."911
H	95.595105	$\Delta\lambda$	– 0° 29' 16."911
a | b	– 0.974 | + 3.112	Central Meridian	155 30 00.000
ϕ	19° 37' 23."477	λ = C.M. – $\Delta\lambda$	155° 59' 16."911

Station

X		Y	
C	–	$P(\frac{X'}{10,000})^2 + d$	–
X'		Y_o	
P		Approx. $\Delta\lambda = X' \div H$	"
d		$\Delta\lambda = (X' \mp ab) \div H$	"
H		$\Delta\lambda$	° ' "
a | b	|	Central Meridian	
ϕ	° ' "	λ = C.M. – $\Delta\lambda$	° ' "

Station

X		Y	
C	–	$P(\frac{X'}{10,000})^2 + d$	–
X'		Y_o	
P		Approx. $\Delta\lambda = X' \div H$	"
d		$\Delta\lambda = (X' \mp ab) \div H$	"
H		$\Delta\lambda$	° ' "
a | b	|	Central Meridian	
ϕ	° ' "	λ = C.M. – $\Delta\lambda$	° "

When ab is $\frac{+, \text{ decrease}}{-, \text{ increase}}$ X' numerically

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS

Constants

Constant	Zone	
	1 Hawaii	2 Maui Lanai Molokai Kahoolawe
C	500,000.00 ft.	500,000.00 ft.
Central Meridian	155°30'00"00	156°40'00"00
Scale reduction along central meridian $\left(\frac{1}{6\rho_o^2 \sin 1''}\right)_g$	1:30,000 0.7892×10^{-10}	1:30,000 0.7891×10^{-10}

Constant	Zone		
	3 Oahu	4 Kauai	5 Niihau
C	500,000.00 ft.	500,000.00 ft.	500,000.00 ft.
Central Meridian	158°00'00"00	159°30'00"00	160°10'00"00
Scale reduction along central meridian $\left(\frac{1}{6\rho_o^2 \sin 1''}\right)_g$	1:100,000 0.7890×10^{-10}	1:100,000 0.7889×10^{-10}	None 0.7889×10^{-10}

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 1
Table I

Lat.	y_o feet	Δy_o per second	H	ΔH per second	V	ΔV per second	a
18 50	0.00	100.868 00	96.053 137	157.97	.751 681	9.45	-1.000
18 51	6 052.08	100.868 33	96.043 659	158.08	.752 248	9.45	-.999
18 52	12 104.18	100.868 33	96.034 174	158.23	.752 815	9.43	-.999
18 53	18 156.28	100.868 67	96.024 680	158.35	.753 381	9.43	-.998
18 54	24 208.40	100.868 83	96.015 179	158.50	.753 947	9.43	-.998
18 55	30 260.53	100.868 83	96.005 669	158.63	.754 513	9.42	-.997
18 56	36 312.66	100.869 17	95.996 151	158.75	.755 078	9.42	-.997
18 57	42 364.81	100.869 33	95.986 626	158.92	.755 643	9.43	-.997
18 58	48 416.97	100.869 50	95.977 091	159.03	.756 209	9.40	-.996
18 59	54 469.14	100.869 67	95.967 549	159.17	.756 773	9.42	-.995
19 00	60 521.32	100.869 83	95.957 999	159.30	.757 338	9.40	-.994
19 01	66 573.51	100.870 17	95.948 441	159.45	.757 902	9.40	-.994
19 02	72 625.72	100.870 17	95.938 874	159.57	.758 466	9.40	-.993
19 03	78 677.93	100.870 50	95.929 300	159.72	.759 030	9.38	-.993
19 04	84 730.16	100.870 50	95.919 717	159.85	.759 593	9.40	-.993
19 05	90 782.39	100.870 83	95.910 126	159.97	.760 157	9.37	-.992
19 06	96 834.64	100.871 00	95.900 528	160.12	.760 719	9.38	-.992
19 07	102 886.90	100.871 17	95.890 921	160.25	.761 282	9.38	-.991
19 08	108 939.17	100.871 33	95.881 306	160.38	.761 845	9.37	-.990
19 09	114 991.45	100.871 50	95.871 683	160.52	.762 407	9.37	-.990
19 10	121 043.74	100.871 67	95.862 052	160.65	.762 969	9.37	-.989
19 11	127 096.04	100.872 00	95.852 413	160.78	.763 531	9.35	-.989
19 12	133 148.36	100.872 00	95.842 766	160.92	.764 092	9.35	-.988
19 13	139 200.68	100.872 33	95.833 111	161.07	.764 653	9.35	-.987
19 14	145 253.02	100.872 50	95.823 447	161.18	.765 214	9.35	-.987
19 15	151 305.37	100.872 67	95.813 776	161.33	.765 775	9.33	-.986
19 16	157 357.73	100.872 67	95.804 095	161.45	.766 335	9.33	-.986
19 17	163 410.09	100.873 17	95.794 409	161.60	.766 895	9.33	-.985
19 18	169 462.48	100.873 17	95.784 713	161.73	.767 455	9.33	-.985
19 19	175 514.87	100.873 33	95.775 009	161.87	.768 015	9.32	-.984
19 20	181 567.27	100.873 50	95.765 297	161.98	.768 574	9.32	-.983
19 21	187 619.68	100.873 83	95.755 578	162.15	.769 133	9.32	-.983
19 22	193 672.11	100.874 00	95.745 849	162.27	.769 692	9.32	-.982
19 23	199 724.55	100.874 17	95.736 113	162.40	.770 251	9.30	-.982
19 24	205 777.00	100.874 33	95.726 369	162.53	.770 809	9.30	-.981
19 25	211 829.46	100.874 50	95.716 617	162.67	.771 367	9.30	-.980
19 26	217 881.93	100.874 67	95.706 857	162.82	.771 925	9.30	-.980
19 27	223 934.41	100.874 83	95.697 088	162.93	.772 483	9.28	-.979
19 28	229 986.90	100.875 00	95.687 312	163.07	.773 040	9.28	-.979
19 29	236 039.40	100.875 33	95.677 528	163.20	.773 597	9.28	-.979
19 30	242 091.92	100.875 50	95.667 736	163.35	.774 154	9.27	-.978
19 31	248 144.45	100.875 50	95.657 935	163.48	.774 710	9.27	-.978
19 32	254 196.98	100.875 83	95.648 126	163.60	.775 266	9.27	-.977
19 33	260 249.53	100.876 00	95.638 310	163.75	.775 822	9.27	-.977
19 34	266 302.09	100.876 33	95.628 485	163.88	.776 378	9.27	-.976
19 35	272 354.67	100.876 33	95.618 652	164.02	.776 934	9.25	-.975
19 36	278 407.25	100.876 50	95.608 811	164.15	.777 489	9.25	-.975
19 37	284 459.84	100.876 83	95.598 962	164.28	.778 044	9.23	-.974
19 38	290 512.45	100.877 00	95.589 105	164.42	.778 598	9.25	-.974
19 39	296 565.07	100.877 00	95.579 240	164.55	.779 153	9.23	-.973
19 40	302 617.69	100.877 33	95.569 366	164.68	.779 707	9.23	-.973
19 41	308 670.33	100.877 50	95.559 485	164.82	.780 261	9.23	-.972
19 42	314 722.98	100.877 67	95.549 596	164.95	.780 815	9.22	-.971
19 43	320 775.64	100.878 00	95.539 699	165.08	.781 368	9.22	-.971
19 44	326 828.32	100.878 00	95.529 794	165.23	.781 921	9.22	-.970
19 45	332 881.00	100.878 33	95.519 880	165.35	.782 474	9.22	-.970
19 46	338 933.70	100.878 50	95.509 959	165.50	.783 027	9.18	-.969
19 47	344 986.41	100.878 67	95.500 029	165.63	.783 578	9.22	-.969
19 48	351 039.13	100.878 83	95.490 091	165.75	.784 131	9.20	-.968
19 49	357 091.86	100.879 00	95.480 146	165.88	.784 683	9.18	-.967
19 50	363 144.60		95.470 193		.785 234		-.967

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 1
Table I

Lat.	y_o feet	Δy_o per second	H	ΔH per second	V	ΔV per second	a
19 50	363 144.60	100.879 17	95.470 193	166.03	.785 234	9.18	-.967
19 51	369 197.35	100.879 50	95.460 231	166.17	.785 785	9.18	-.966
19 52	375 250.12	100.879 50	95.450 261	166.30	.786 336	9.18	-.966
19 53	381 302.89	100.879 83	95.440 283	166.42	.786 887	9.17	-.965
19 54	387 355.68	100.880 00	95.430 298	166.58	.787 437	9.18	-.965
19 55	393 408.48	100.880 17	95.420 303	166.70	.787 988	9.17	-.964
19 56	399 461.29	100.880 50	95.410 301	166.83	.788 538	9.15	-.964
19 57	405 514.12	100.880 50	95.400 291	166.97	.789 087	9.17	-.963
19 58	411 566.95	100.880 67	95.390 273	167.08	.789 637	9.15	-.962
19 59	417 619.79	100.881 00	95.380 248	167.25	.790 186	9.15	-.962
20 00	423 672.65	100.881 17	95.370 213	167.37	.790 735	9.13	-.961
20 01	429 725.52	100.881 33	95.360 171	167.50	.791 283	9.15	-.961
20 02	435 778.40	100.881 50	95.350 121	167.63	.791 832	9.13	-.960
20 03	441 831.29	100.881 67	95.340 063	167.78	.792 380	9.13	-.959
20 04	447 884.19	100.882 00	95.329 996	167.90	.792 928	9.12	-.959
20 05	453 937.11	100.882 00	95.319 922	168.03	.793 475	9.12	-.958
20 06	459 990.03	100.882 33	95.309 840	168.18	.794 022	9.12	-.958
20 07	466 042.97	100.882 50	95.299 749	168.30	.794 569	9.12	-.957
20 08	472 095.92	100.882 67	95.289 651	168.45	.795 116	9.10	-.957
20 09	478 148.88	100.882 83	95.279 544	168.58	.795 662	9.12	-.956
20 10	484 201.85	100.883 00	95.269 429	168.70	.796 209	9.08	-.956
20 11	490 254.83	100.883 33	95.259 307	168.83	.796 754	9.10	-.955
20 12	496 307.83	100.883 33	95.249 177	168.98	.797 300	9.10	-.954
20 13	502 360.83	100.883 67	95.239 038	169.12	.797 846	9.08	-.954
20 14	508 413.85	100.883 83	95.228 891	169.23	.798 391	9.08	-.953
20 15	514 466.88	100.884 00	95.218 737	169.38	.798 936	9.07	-.953
20 16	520 519.92	100.884 33	95.208 574	169.52	.799 480	9.07	-.952
20 17	526 572.98	100.884 33	95.198 403	169.65	.800 024	9.08	-.952
20 18	532 626.04	100.884 67	95.188 224	169.77	.800 569	9.05	-.951
20 19	538 679.12	100.884 83	95.178 038	169.92	.801 112	9.07	-.950
20 20	544 732.21		95.167 843		.801 656		-.950

Table II

$\Delta\lambda''$	b	Δ b	c
0	0.000	+0.269	0.000
100	+0.269	+0.268	0.000
200	+0.537	+0.264	0.000
300	+0.801	+0.259	-0.001
400	+1.060	+0.252	-0.001
500	+1.312	+0.242	-0.001
600	+1.554	+0.232	-0.002
700	+1.786	+0.219	-0.003
800	+2.005	+0.205	-0.004
900	+2.210	+0.189	-0.004
1000	+2.399	+0.170	-0.005
1100	+2.569	+0.152	-0.006
1200	+2.721	+0.129	-0.007
1300	+2.850	+0.105	-0.008
1400	+2.955	+0.081	-0.009
1500	+3.036	+0.054	-0.010

$\Delta\lambda''$	b	Δ b	c
1500	+3.036	+0.054	-0.010
1600	+3.090	+0.025	-0.011
1700	+3.115	-0.006	-0.012
1800	+3.109	-0.038	-0.012
1900	+3.071	-0.073	-0.013
2000	+2.998	-0.108	-0.013
2100	+2.890	-0.146	-0.013
2200	+2.744	-0.185	-0.013
2300	+2.559	-0.227	-0.013
2400	+2.332	-0.270	-0.012
2500	+2.062	-0.316	-0.011
2600	+1.746	-0.362	-0.010
2700	+1.384	-0.410	-0.008
2800	+0.974	-0.461	-0.006
2900	+0.513	-0.513	-0.003
3000	0.000		0.000

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TRANSVERSE MERCATOR PROJECTION

HAWAIIAN ISLANDS
ZONE 1

Table III

y	P	ΔP	M	ΔM
0	0.81464	1282	0.003 3608	529
100,000	0.82746	1287	0.003 4137	531
200,000	0.84033	1292	0.003 4668	533
300,000	0.85325	1296	0.003 5201	535
400,000	0.86621	1300	0.003 5736	536
500,000	0.87921	1304	0.003 6272	538
600,000	0.89225		0.003 6810	

Table IV

x'	d
0	0.00
50,000	0.00
100,000	+0.01
150,000	+0.01
200,000	+0.01
250,000	+0.01
300,000	0.00

Table V

g"

φ \ Δλ	1000"	2000"	3000"
18°	0.00	+0.02	+0.06
19	0.00	+0.02	+0.06
20	0.00	+0.02	+0.06
21	0.00	+0.02	+0.07

Table VI

Scale factors

x'		x'		x'	
0	0.9999 667	100,000	0.9999 781	200,000	1.0000 126
5,000	0.9999 667	105,000	0.9999 793	205,000	1.0000 149
10,000	0.9999 668	110,000	0.9999 806	210,000	1.0000 173
15,000	0.9999 669	115,000	0.9999 818	215,000	1.0000 197
20,000	0.9999 671	120,000	0.9999 832	220,000	1.0000 222
25,000	0.9999 674	125,000	0.9999 846	225,000	1.0000 248
30,000	0.9999 677	130,000	0.9999 861	230,000	1.0000 274
35,000	0.9999 681	135,000	0.9999 876	235,000	1.0000 301
40,000	0.9999 685	140,000	0.9999 892	240,000	1.0000 328
45,000	0.9999 690	145,000	0.9999 908	245,000	1.0000 356
50,000	0.9999 695	150,000	0.9999 925	250,000	1.0000 384
55,000	0.9999 701	155,000	0.9999 942	255,000	1.0000 413
60,000	0.9999 708	160,000	0.9999 960	260,000	1.0000 443
65,000	0.9999 715	165,000	0.9999 979	265,000	1.0000 473
70,000	0.9999 723	170,000	0.9999 998	270,000	1.0000 503
75,000	0.9999 731	175,000	1.0000 018	275,000	1.0000 535
80,000	0.9999 740	180,000	1.0000 039	280,000	1.0000 567
85,000	0.9999 750	185,000	1.0000 059	285,000	1.0000 599
90,000	0.9999 760	190,000	1.0000 081	290,000	1.0000 632
95,000	0.9999 770	195,000	1.0000 103		
100,000	0.9999 781	200,000	1.0000 126		

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 2
Table I

Lat.	y_o feet	Δy_o per second	H	ΔH per second	V	ΔV per second	a
20 20	0.00	100.885 00	95.167 843	170.05	.801 656	9.05	-.950
20 21	6 053.10	100.885 17	95.157 640	170.18	.802 199	9.05	-.949
20 22	12 106.21	100.885 33	95.147 429	170.32	.802 742	9.03	-.949
20 23	18 159.33	100.885 67	95.137 210	170.43	.803 284	9.05	-.948
20 24	24 212.47	100.886 67	95.126 984	170.58	.803 827	9.03	-.947
20 25	30 265.61	100.886 00	95.116 749	170.73	.804 369	9.03	-.947
20 26	36 318.77	100.886 17	95.106 505	170.83	.804 911	9.02	-.946
20 27	42 371.94	100.886 33	95.096 255	170.98	.805 452	9.03	-.946
20 28	48 425.12	100.886 67	95.085 996	171.12	.805 994	9.02	-.945
20 29	54 478.32	100.886 67	95.075 729	171.25	.806 535	9.02	-.945
20 30	60 531.52	100.887 00	95.065 454	171.38	.807 076	9.00	-.944
20 31	66 584.74	100.887 17	95.055 171	171.52	.807 616	9.00	-.943
20 32	72 637.97	100.887 33	95.044 880	171.65	.808 156	9.02	-.943
20 33	78 691.21	100.887 50	95.034 581	171.78	.808 697	8.98	-.942
20 34	84 744.46	100.887 67	95.024 274	171.93	.809 236	8.98	-.942
20 35	90 797.72	100.888 00	95.013 958	172.05	.809 775	9.00	-.941
20 36	96 851.00	100.888 17	95.003 635	172.18	.810 315	8.98	-.941
20 37	102 904.29	100.888 33	94.993 304	172.32	.810 854	8.97	-.940
20 38	108 957.59	100.888 50	94.982 965	172.45	.811 392	8.97	-.939
20 39	115 010.90	100.888 67	94.972 618	172.58	.811 930	8.98	-.939
20 40	121 064.22	100.888 83	94.962 263	172.73	.812 469	8.95	-.939
20 41	127 117.55	100.889 17	94.951 899	172.83	.813 006	8.97	-.938
20 42	133 170.90	100.889 33	94.941 529	173.00	.813 544	8.95	-.937
20 43	139 224.26	100.889 50	94.931 149	173.12	.814 081	8.95	-.937
20 44	145 277.63	100.889 67	94.920 762	173.25	.814 618	8.95	-.936
20 45	151 331.01	100.889 83	94.910 367	173.38	.815 155	8.93	-.935
20 46	157 384.40	100.890 17	94.899 964	173.52	.815 691	8.93	-.935
20 47	163 437.81	100.890 33	94.889 553	173.67	.816 227	8.93	-.934
20 48	169 491.23	100.890 50	94.879 133	173.78	.816 763	8.93	-.933
20 49	175 544.66	100.890 67	94.868 706	173.92	.817 299	8.92	-.933
20 50	181 598.10	100.890 83	94.858 271	174.05	.817 834	8.92	-.932
20 51	187 651.55	100.891 17	94.847 828	174.18	.818 369	8.92	-.932
20 52	193 705.02	100.891 17	94.837 377	174.32	.818 904	8.90	-.931
20 53	199 758.49	100.891 50	94.826 918	174.47	.819 438	8.92	-.931
20 54	205 811.98	100.891 67	94.816 450	174.58	.819 973	8.88	-.930
20 55	211 865.48	100.892 00	94.805 975	174.72	.820 506	8.90	-.929
20 56	217 919.00	100.892 00	94.795 492	174.85	.821 040	8.88	-.929
20 57	223 972.52	100.892 33	94.785 001	174.98	.821 573	8.88	-.928
20 58	230 026.06	100.892 50	94.774 502	175.13	.822 106	8.88	-.928
20 59	236 079.61	100.892 67	94.763 994	175.25	.822 639	8.88	-.927
21 00	242 133.17	100.892 83	94.753 479	175.38	.823 172	8.87	-.926
21 01	248 186.74	100.893 17	94.742 956	175.52	.823 704	8.87	-.926
21 02	254 240.33	100.893 17	94.732 425	175.65	.824 236	8.87	-.926
21 03	260 293.92	100.893 50	94.721 886	175.78	.824 768	8.85	-.925
21 04	266 347.53	100.893 67	94.711 339	175.92	.825 299	8.85	-.924
21 05	272 401.15	100.893 83	94.700 784	176.07	.825 830	8.85	-.924
21 06	278 454.78	100.894 17	94.690 220	176.18	.826 361	8.85	-.923
21 07	284 508.43	100.894 17	94.679 649	176.30	.826 892	8.83	-.922
21 08	290 562.08	100.894 50	94.669 071	176.47	.827 422	8.83	-.922
21 09	296 615.75	100.894 67	94.658 483	176.58	.827 952	8.83	-.921
21 10	302 669.43	100.895 00	94.647 888	176.70	.828 482	8.82	-.921
21 11	308 723.13	100.895 00	94.637 286	176.87	.829 011	8.83	-.920
21 12	314 776.83	100.895 33	94.626 674	176.98	.829 541	8.80	-.920
21 13	320 830.55	100.895 50	94.616 055	177.10	.830 069	8.82	-.919
21 14	326 884.28	100.895 67	94.605 429	177.25	.830 598	8.82	-.919
21 15	332 938.02	100.895 83	94.594 794	177.38	.831 127	8.78	-.918
21 16	338 991.77	100.896 00	94.584 151	177.52	.831 654	8.82	-.917
21 17	345 045.53	100.896 33	94.573 500	177.65	.832 183	8.78	-.917
21 18	351 099.31	100.896 50	94.562 841	177.78	.832 710	8.78	-.916
21 19	357 153.10	100.896 67	94.552 174	177.92	.833 237	8.78	-.915
21 20	363 206.90		94.541 499		.833 764		-.915

HAWAIIAN ISLANDS
ZONE 2

Table II

Δλ"	b	Δ b	c	Δλ"	b	Δ b	c
0	0.000	+0.269	0.000	1500	+3.036	+0.054	-0.010
100	+0.269	+0.268	0.000	1600	+3.090	+0.025	-0.011
200	+0.537	+0.264	0.000	1700	+3.115	-0.006	-0.012
300	+0.801	+0.259	-0.001	1800	+3.109	-0.038	-0.012
400	+1.060	+0.252	-0.001	1900	+3.071	-0.073	-0.013
500	+1.312	+0.242	-0.001	2000	+2.998	-0.108	-0.013
600	+1.554	+0.232	-0.002	2100	+2.890	-0.146	-0.013
700	+1.786	+0.219	-0.003	2200	+2.744	-0.185	-0.013
800	+2.005	+0.205	-0.004	2300	+2.559	-0.227	-0.013
900	+2.210	+0.189	-0.004	2400	+2.332	-0.270	-0.012
1000	+2.399	+0.170	-0.005	2500	+2.062	-0.316	-0.011
1100	+2.569	+0.152	-0.006	2600	+1.746	-0.362	-0.010
1200	+2.721	+0.129	-0.007	2700	+1.384	-0.410	-0.008
1300	+2.850	+0.105	-0.008	2800	+0.974	-0.461	-0.006
1400	+2.955	+0.081	-0.009	2900	+0.513	-0.513	-0.003
1500	+3.036	+0.054	-0.010	3000	0.000		0.000

Table III

y	P	Δ P	M	Δ M
0	0.88503	1307	0.003 6512	540
100,000	0.89810	1311	0.003 7052	541
200,000	0.91121	1316	0.003 7593	543
300,000	0.92437	1321	0.003 8136	544
400,000	0.93758		0.003 8680	

Table IV

x'	d
0	0.00
50,000	0.00
100,000	+0.01
150,000	+0.01
200,000	+0.01
250,000	+0.01
300,000	0.00

Table V

g"

φ \ Δλ	1000"	2000"	3000"
20°	0.00	+0.02	+0.06
21	0.00	+0.02	+0.07
22	0.00	+0.02	+0.07

TRANSVERSE MERCATOR PROJECTION

HAWAIIAN ISLANDS
ZONE 2

Table VI
Scale factors

x'	
0	0.9999 667
5,000	0.9999 667
10,000	0.9999 668
15,000	0.9999 669
20,000	0.9999 671
25,000	0.9999 674
30,000	0.9999 677
35,000	0.9999 681
40,000	0.9999 685
45,000	0.9999 690
50,000	0.9999 695
55,000	0.9999 701
60,000	0.9999 708
65,000	0.9999 715
70,000	0.9999 723
75,000	0.9999 731
80,000	0.9999 740
85,000	0.9999 750
90,000	0.9999 760
95,000	0.9999 770
100,000	0.9999 781
105,000	0.9999 793
110,000	0.9999 806
115,000	0.9999 818
120,000	0.9999 832
125,000	0.9999 846
130,000	0.9999 861
135,000	0.9999 876
140,000	0.9999 892
145,000	0.9999 908
150,000	0.9999 925

x'	
150,000	0.9999 925
155,000	0.9999 942
160,000	0.9999 960
165,000	0.9999 979
170,000	0.9999 998
175,000	1.0000 018
180,000	1.0000 039
185,000	1.0000 059
190,000	1.0000 081
195,000	1.0000 103
200,000	1.0000 126
205,000	1.0000 149
210,000	1.0000 173
215,000	1.0000 197
220,000	1.0000 222
225,000	1.0000 248
230,000	1.0000 274
235,000	1.0000 301
240,000	1.0000 328
245,000	1.0000 356
250,000	1.0000 384
255,000	1.0000 413
260,000	1.0000 443
265,000	1.0000 473
270,000	1.0000 503
275,000	1.0000 535
280,000	1.0000 567
285,000	1.0000 599
290,000	1.0000 632

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 3
Table I

Lat.	y_o feet	Δy_o per second	H	ΔH per second	V	ΔV per second	a
21 10	0.00	100.897 17	94.648 234	176.72	.828 455	8.82	-1.000
21 11	6 053.83	100.897 50	94.637 631	176.83	.828 984	8.82	-.999
21 12	12 107.68	100.897 67	94.627 021	176.97	.829 513	8.82	-.999
21 13	18 161.54	100.897 83	94.616 403	177.10	.830 042	8.82	-.999
21 14	24 215.41	100.898 00	94.605 777	177.23	.830 571	8.80	-.998
21 15	30 269.29	100.898 17	94.595 143	177.37	.831 099	8.80	-.997
21 16	36 323.18	100.898 50	94.584 501	177.50	.831 627	8.80	-.996
21 17	42 377.09	100.898 67	94.573 851	177.63	.832 155	8.78	-.996
21 18	48 431.01	100.898 83	94.563 193	177.77	.832 682	8.80	-.995
21 19	54 484.94	100.899 00	94.552 527	177.90	.833 210	8.78	-.994
21 20	60 538.88	100.899 33	94.541 853	178.02	.833 737	8.77	-.994
21 21	66 592.84	100.899 33	94.531 172	178.17	.834 263	8.78	-.993
21 22	72 646.80	100.899 67	94.520 482	178.30	.834 790	8.77	-.993
21 23	78 700.78	100.900 00	94.509 784	178.43	.835 316	8.77	-.992
21 24	84 754.78	100.900 00	94.499 078	178.55	.835 842	8.75	-.991
21 25	90 808.78	100.900 17	94.488 365	178.70	.836 367	8.75	-.991
21 26	96 862.79	100.900 67	94.477 643	178.83	.836 892	8.75	-.990
21 27	102 916.83	100.900 50	94.466 913	178.97	.837 417	8.75	-.989
21 28	108 970.86	100.900 83	94.456 175	179.08	.837 942	8.73	-.989
21 29	115 024.91	100.901 17	94.445 430	179.23	.838 466	8.75	-.988
21 30	121 078.98	100.901 33	94.434 676	179.35	.838 991	8.73	-.988
21 31	127 133.06	100.901 33	94.423 915	179.50	.839 515	8.72	-.987
21 32	133 187.14	100.901 67	94.413 145	179.62	.840 038	8.72	-.986
21 33	139 241.24	100.902 00	94.402 368	179.77	.840 561	8.72	-.986
21 34	145 295.36	100.902 00	94.391 582	179.88	.841 084	8.72	-.985
21 35	151 349.48	100.902 33	94.380 789	180.02	.841 607	8.72	-.984
21 36	157 403.62	100.902 50	94.369 988	180.17	.842 130	8.70	-.984
21 37	163 457.77	100.902 67	94.359 178	180.28	.842 652	8.70	-.983
21 38	169 511.93	100.903 00	94.348 361	180.42	.843 174	8.68	-.982
21 39	175 566.11	100.903 17	94.337 536	180.55	.843 695	8.68	-.982
21 40	181 620.30	100.903 17	94.326 703	180.70	.844 216	8.68	-.981
21 41	187 674.49	100.903 67	94.315 861	180.82	.844 737	8.68	-.981
21 42	193 728.71	100.903 67	94.305 012	180.95	.845 258	8.68	-.980
21 43	199 782.93	100.904 00	94.294 155	181.08	.845 779	8.67	-.979
21 44	205 837.17	100.904 17	94.283 290	181.22	.846 299	8.65	-.979
21 45	211 891.42	100.904 33	94.272 417	181.35	.846 818	8.67	-.978
21 46	217 945.68	100.904 50	94.261 536	181.47	.847 338	8.67	-.977
21 47	223 999.95	100.904 67	94.250 648	181.63	.847 858	8.63	-.977
21 48	230 054.23	100.905 00	94.239 750	181.75	.848 376	8.65	-.976
21 49	236 108.53	100.905 17	94.228 845	181.87	.848 895	8.65	-.976
21 50	242 162.84		94.217 933		.849 414		-.975

Table II

$\Delta\lambda$	b	Δb	c
0	0.000	+0.062	0.000
100	+0.062	+0.060	0.000
200	+0.122	+0.057	0.000
300	+0.179	+0.052	0.000
400	+0.231	+0.045	0.000
500	+0.276	+0.037	0.000
600	+0.313	+0.027	0.000
700	+0.340	+0.016	0.000
800	+0.356	+0.002	0.000
900	+0.358	-0.013	0.000

$\Delta\lambda$	b	Δb	c
1000	+0.345	-0.029	0.000
1100	+0.316	-0.047	0.000
1200	+0.269	-0.068	0.000
1300	+0.201	-0.088	0.000
1400	+0.113	-0.113	0.000
1500	0.000		0.000

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 3

Table III

y	P	ΔP	M	ΔM
0	0.92476	1321	0.003 8150	545
100,000	0.93797	1326	0.003 8695	547
200,000	0.95123	1331	0.003 9242	549
300,000	0.96454		0.003 9791	

Table IV

x'	d
0	0.00
50,000	0.00
100,000	0.00
150,000	0.00

Table V

g"

φ \ Δλ	1000"	2000"
21°	0.00	+0.02
22	0.00	+0.02

Table VI
Scale factors

x'		x'	
0	0.9999 900	75,000	0.9999 965
5,000	0.9999 900	80,000	0.9999 973
10,000	0.9999 901	85,000	0.9999 983
15,000	0.9999 903	90,000	0.9999 993
20,000	0.9999 905	95,000	1.0000 004
25,000	0.9999 907	100,000	1.0000 015
30,000	0.9999 910	105,000	1.0000 027
35,000	0.9999 914	110,000	1.0000 039
40,000	0.9999 918	115,000	1.0000 052
45,000	0.9999 923	120,000	1.0000 065
50,000	0.9999 929	125,000	1.0000 079
55,000	0.9999 935	130,000	1.0000 094
60,000	0.9999 941	135,000	1.0000 109
65,000	0.9999 948	140,000	1.0000 125
70,000	0.9999 956	145,000	1.0000 141
75,000	0.9999 965	150,000	1.0000 158

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 4
Table I

Lat.	y_o feet	Δy_o per second	H	ΔH per second	V	ΔV per second	a
21 50	0.00	100.905 33	94.217 933	182.02	.849 414	8.63	-.975
21 51	6 054.32	100.905 67	94.207 012	182.13	.849 932	8.63	-.974
21 52	12 108.66	100.905 67	94.196 084	182.28	.850 450	8.62	-.974
21 53	18 163.00	100.906 00	94.185 147	182.40	.850 967	8.62	-.973
21 54	24 217.36	100.906 33	94.174 203	182.55	.851 484	8.63	-.972
21 55	30 271.74	100.906 33	94.163 250	182.67	.852 002	8.60	-.972
21 56	36 326.12	100.906 67	94.152 290	182.80	.852 518	8.60	-.971
21 57	42 380.52	100.906 83	94.141 322	182.95	.853 034	8.62	-.970
21 58	48 434.93	100.907 00	94.130 345	183.07	.853 551	8.60	-.969
21 59	54 489.35	100.907 17	94.119 361	183.22	.854 067	8.58	-.969
22 00	60 543.78	100.907 50	94.108 368	183.32	.854 582	8.58	-.968
22 01	66 598.23	100.907 67	94.097 369	183.48	.855 097	8.58	-.967
22 02	72 652.69	100.907 83	94.086 360	183.58	.855 612	8.58	-.967
22 03	78 707.16	100.908 00	94.075 345	183.73	.856 127	8.57	-.966
22 04	84 761.64	100.908 33	94.064 321	183.88	.856 641	8.57	-.965
22 05	90 816.14	100.908 50	94.053 288	183.98	.857 155	8.58	-.965
22 06	96 870.65	100.908 67	94.042 249	184.13	.857 670	8.55	-.964
22 07	102 925.17	100.908 83	94.031 201	184.25	.858 183	8.55	-.963
22 08	108 979.70	100.909 17	94.020 146	184.40	.858 696	8.55	-.962
22 09	115 034.25	100.909 33	94.009 082	184.52	.859 209	8.55	-.962
22 10	121 088.81	100.909 50	93.998 011	184.65	.859 722	8.53	-.961
22 11	127 143.38	100.909 67	93.986 932	184.82	.860 234	8.53	-.960
22 12	133 197.96	100.909 83	93.975 843	184.92	.860 746	8.53	-.960
22 13	139 252.55	100.910 17	93.964 748	185.05	.861 258	8.53	-.959
22 14	145 307.16	100.910 50	93.953 645	185.18	.861 770	8.52	-.958
22 15	151 361.79	100.910 50	93.942 534	185.32	.862 281	8.52	-.958
22 16	157 416.42	100.910 83	93.931 415	185.45	.862 792	8.52	-.957
22 17	163 471.07	100.910 83	93.920 288	185.58	.863 303	8.50	-.956
22 18	169 525.72	100.911 33	93.909 153	185.72	.863 813	8.50	-.955
22 19	175 580.40	100.911 33	93.898 010	185.85	.864 323	8.50	-.955
22 20	181 635.08		93.886 859		.864 833		-.954

Table II

$\Delta\lambda''$	b	Δ b	c
0	0.000	+0.062	0.000
100	+0.062	+0.060	0.000
200	+0.122	+0.057	0.000
300	+0.179	+0.052	0.000
400	+0.231	+0.045	0.000
500	+0.276	+0.037	0.000
600	+0.313	+0.027	0.000
700	+0.340	+0.016	0.000
800	+0.356	+0.002	0.000
900	+0.358	-0.013	0.000
1000	+0.345	-0.029	0.000
1100	+0.316	-0.047	0.000
1200	+0.269	-0.068	0.000
1300	+0.201	-0.088	0.000
1400	+0.113	-0.113	0.000
1500	0.000		0.000

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 4

Table III

y	P	ΔP	M	ΔM
0	0.95684	1333	0.003 9473	550
100,000	0.97017	1338	0.004 0023	552
200,000	0.98355		0.004 0575	

Table IV

x'	d
0	0.00
50,000	0.00
100,000	0.00
150,000	0.00

Table V

g"

φ \ Δλ	1000"	2000"
21°	0.00	+0.02
22	0.00	+0.02
23	0.00	+0.02

Table VI
Scale factors

x'		x'	
0	0.9999 900	75,000	0.9999 965
5,000	0.9999 900	80,000	0.9999 973
10,000	0.9999 901	85,000	0.9999 983
15,000	0.9999 903	90,000	0.9999 993
20,000	0.9999 905	95,000	1.0000 004
25,000	0.9999 907	100,000	1.0000 015
30,000	0.9999 910	105,000	1.0000 027
35,000	0.9999 914	110,000	1.0000 039
40,000	0.9999 918	115,000	1.0000 052
45,000	0.9999 923	120,000	1.0000 065
50,000	0.9999 929	125,000	1.0000 079
55,000	0.9999 935	130,000	1.0000 094
60,000	0.9999 941	135,000	1.0000 109
65,000	0.9999 948	140,000	1.0000 125
70,000	0.9999 956	145,000	1.0000 141
75,000	0.9999 965	150,000	1.0000 158

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS
ZONE 5
Table I

Lat.	y_o feet	Δy_o per second	H	ΔH per second	V	ΔV per second	a
21 40	0.00	100.904 33	94.327 134	180.68	.844 211	8.68	-1.000
21 41	6 054.26	100.904 50	94.316 293	180.82	.844 732	8.68	-1.000
21 42	12 108.53	100.904 83	94.305 444	180.95	.845 253	8.68	-1.000
21 43	18 162.82	100.904 83	94.294 587	181.08	.845 774	8.67	-1.000
21 44	24 217.11	100.905 17	94.283 722	181.20	.846 294	8.67	-1.000
21 45	30 271.42	100.905 33	94.272 850	181.35	.846 814	8.65	-1.000
21 46	36 325.74	100.905 67	94.261 969	181.48	.847 333	8.67	-1.000
21 47	42 380.08	100.905 67	94.251 080	181.62	.847 853	8.65	-1.000
21 48	48 434.42	100.906 00	94.240 183	181.73	.848 372	8.63	-1.000
21 49	54 488.78	100.906 17	94.229 279	181.87	.848 890	8.65	-1.000
21 50	60 543.15	100.906 33	94.218 367	182.00	.849 409	8.63	-1.000
21 51	66 597.53	100.906 67	94.207 447	182.15	.849 927	8.63	-1.000
21 52	72 651.93	100.906 83	94.196 518	182.27	.850 445	8.62	-1.000
21 53	78 706.34	100.907 00	94.185 582	182.42	.850 962	8.63	-1.000
21 54	84 760.76	100.907 17	94.174 637	182.53	.851 480	8.62	-1.000
21 55	90 815.19	100.907 50	94.163 685	182.67	.851 997	8.60	-1.000
21 56	96 869.64	100.907 50	94.152 725	182.80	.852 513	8.62	-1.000
21 57	102 924.09	100.907 83	94.141 757	182.95	.853 030	8.60	-1.000
21 58	108 978.56	100.908 00	94.130 780	183.05	.853 546	8.60	-1.000
21 59	115 033.04	100.908 33	94.119 797	183.20	.854 062	8.58	-1.000
22 00	121 087.54	100.908 33	94.108 805	183.33	.854 577	8.60	-1.000
22 01	127 142.04	100.908 67	94.097 805	183.47	.855 093	8.57	-1.000
22 02	133 196.56	100.908 83	94.086 797	183.60	.855 607	8.60	-1.000
22 03	139 251.09	100.909 17	94.075 781	183.72	.856 123	8.57	-1.000
22 04	145 305.64	100.909 17	94.064 758	183.87	.856 637	8.57	-1.000
22 05	151 360.19		94.053 726		.857 151		-1.000

Table II

$\Delta\lambda''$	b	Δb	c
0	0.000	+0.009	0.000
100	+0.009	+0.008	0.000
200	+0.017	+0.005	0.000
300	+0.022	0.000	0.000
400	+0.022	-0.007	0.000
500	+0.015	-0.015	0.000
600	0.000		0.000

HAWAIIAN ISLANDS
ZONE 5

Table III

y	P	ΔP	M	ΔM
0	0.94880	1330	0.003 9141	549
100,000	0.96210	1335	0.003 9690	551
200,000	0.97545		0.004 0241	

Table IV

x'	d
0	0.00
50,000	0.00
100,000	0.00

Table V

	g"
ø \ Δλ	1000"
21°	0.00
22	0.00

Table VI
Scale factors

x'	
0	1.0000 000
5,000	1.0000 000
10,000	1.0000 001
15,000	1.0000 003
20,000	1.0000 005
25,000	1.0000 007
30,000	1.0000 010
35,000	1.0000 014
40,000	1.0000 018
45,000	1.0000 023
50,000	1.0000 029
55,000	1.0000 035
60,000	1.0000 041

TRANSVERSE MERCATOR PROJECTION
HAWAIIAN ISLANDS

CORRECTIONS TO NATURAL SCALE FACTORS*
(in units of the 7th decimal place)

Δx (feet)	Correction (plus)	Δx (feet)	Correction (plus)
10,000	0	210,000	42
20,000	0	220,000	46
30,000	1	230,000	50
40,000	2	240,000	55
50,000	2	250,000	59
60,000	3	260,000	64
70,000	5	270,000	69
80,000	6	280,000	74
90,000	8	290,000	80
100,000	10	300,000	86
110,000	11	310,000	91
120,000	14	320,000	97
130,000	16	330,000	103
140,000	19	340,000	110
150,000	21	350,000	116
160,000	24		
170,000	27		
180,000	31		
190,000	34		
200,000	38		
210,000	42		

plane coordinate distance = geodetic distance X scale factor

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* The scale factor interpolated for the mean x' of the ends of a line and corrected by the above table is a true mean value accurate to within one unit in the seventh decimal place.

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