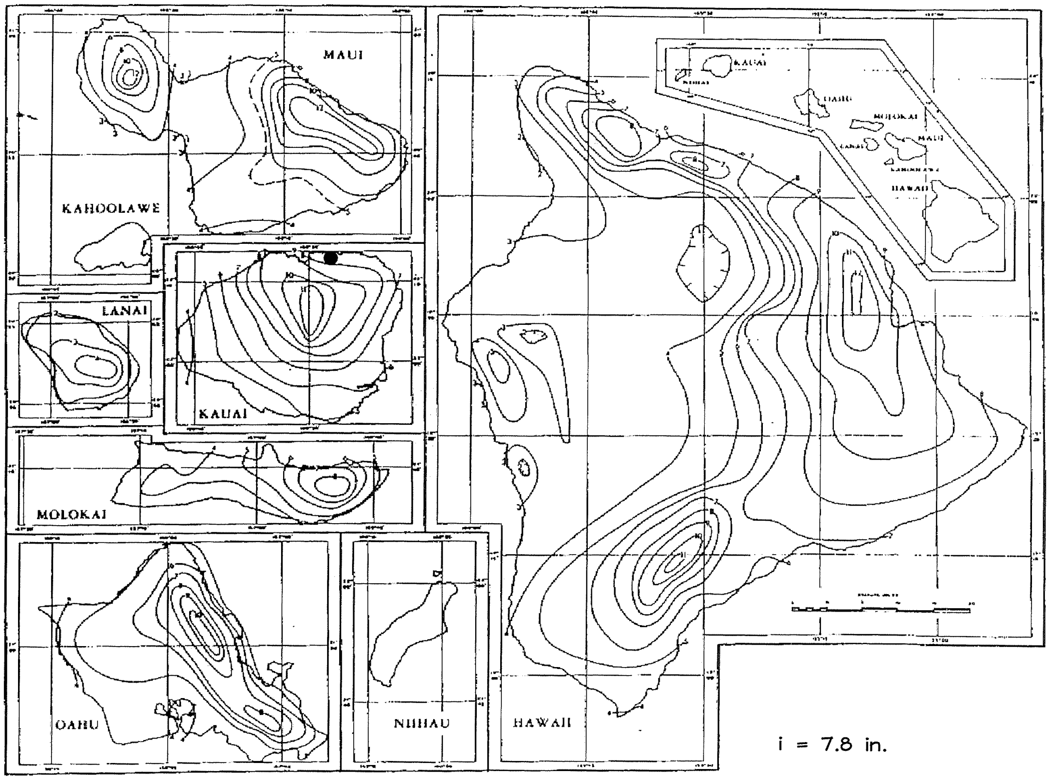
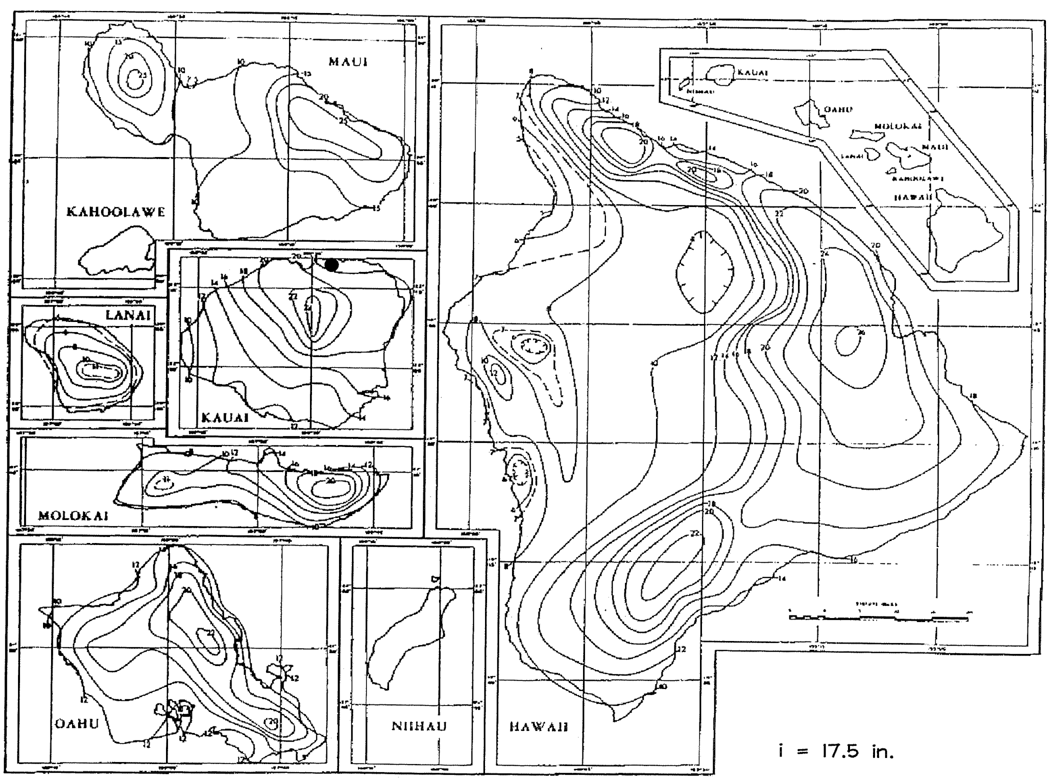
Plate 5



2-Year 24-Hour Rainfall (in.)

Plate 6



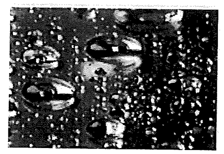
100-Year 24-Hour Rainfall (in.)

```
Quick TR-55 Version: 5.47 S/N:

            >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

                  Retention Basin System Sizing
                          House Site 46
                     Predeveloped Condition

                CALCULATED
                DISK FILE: 06-192  .GPD

      Drainage Area            (acres)   .91    --->   0.0014 sq.mi.
      Runoff Curve Number        (CN)    61
      Time of Concentration,Tc (hrs)     .1
      Rainfall Distribution     (Type)   I
      Pond and Swamp Areas        (%)    0      --->       0.0 acres

                                       Storm #1   Storm #2   Storm #3
                                       --------   --------   --------
  Frequency (years)                     2          100
  Rainfall, P, 24-hr (in)               7.8        17.5

  Initial Abstraction, Ia (in)          1.279      1.279      1.279
  Ia/p Ratio                            0.164      0.073      0.000
  Unit Discharge, * qu (csm/in)           467        504          0
  Runoff, Q (in)                         3.29      11.64       0.00
  Pond & Swamp Adjustment Factor         1.00       1.00       1.00

  PEAK DISCHARGE, qp (cfs)                  2          8          0
  ------------------------------------------------------------------

  Summary of Computations for qu
  -----------------------------
          Ia/p     #1                   0.100      0.100      0.000
          C0       #1                   2.306      2.306      0.000
          C1       #1                  -0.514     -0.514      0.000
          C2       #1                  -0.117     -0.117      0.000
          qu (csm) #1                 503.837    503.837      0.000

          Ia/p     #2                   0.200      0.100      0.000
          C0       #2                   2.235      2.306      0.000
          C1       #2                  -0.504     -0.514      0.000
          C2       #2                  -0.089     -0.117      0.000
          qu (csm) #2                 446.632    503.837      0.000

       * qu (csm)                         467        504          0

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
  If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

                                                   2
  log(qu)  = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc)) )
  qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)
```



```
Quick TR-55 Version: 5.47 S/N:

            >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

                  Retention Basin System Sizing
                          House Site 46
                       Developed Condition

                CALCULATED
                DISK FILE: 06-192  .GPD

      Drainage Area            (acres)   .91    --->   0.0014 sq.mi.
      Runoff Curve Number        (CN)    65
      Time of Concentration,Tc (hrs)     .1
      Rainfall Distribution     (Type)   I
      Pond and Swamp Areas        (%)    0      --->       0.0 acres

                                       Storm #1   Storm #2   Storm #3
                                       --------   --------   --------
  Frequency (years)                     2          100
  Rainfall, P, 24-hr (in)               7.8        17.5

  Initial Abstraction, Ia (in)          1.077      1.077      1.077
  Ia/p Ratio                            0.138      0.062      0.000
  Unit Discharge, * qu (csm/in)           482        504          0
  Runoff, Q (in)                         3.73      12.37       0.00
  Pond & Swamp Adjustment Factor         1.00       1.00       1.00

  PEAK DISCHARGE, qp (cfs)                  3          9          0
  ------------------------------------------------------------------

  Summary of Computations for qu
  -----------------------------
          Ia/p     #1                   0.100      0.100      0.000
          C0       #1                   2.306      2.306      0.000
          C1       #1                  -0.514     -0.514      0.000
          C2       #1                  -0.117     -0.117      0.000
          qu (csm) #1                 503.837    503.837      0.000

          Ia/p     #2                   0.200      0.100      0.000
          C0       #2                   2.235      2.306      0.000
          C1       #2                  -0.504     -0.514      0.000
          C2       #2                  -0.089     -0.117      0.000
          qu (csm) #2                 446.632    503.837      0.000

       * qu (csm)                         482        504          0

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
  If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

                                                   2
  log(qu)  = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc)) )
  qp (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)
```

StormTech
Subsurface Stormwater Management™



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Site Calculator

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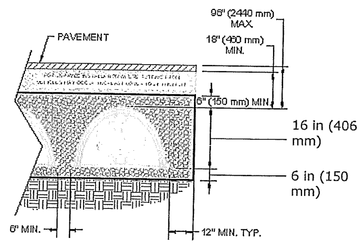


Units: Imperial

Required Storage Volume	2416 CF
Select Stormtech Chamber System	SC-310
Stone Porosity (Industry Standard = 40%)	40 %
Stone Foundation Depth	6 Inches
Storage Volume Per Chamber	31 CF
Avg Cover over Chambers (18 in min. & 96 in max.)	18 Inches
Number of Chambers Required	78 Each
Required Bed Size	2072 SF
Tons of Stone Required	191 Tons
Volume Of Excavation	256 CY
Area Of Filter Fabric	588 SY
# of End Caps Required	22 Each
Length Of ISOLATOR ROW	56.96 FT
ISOLATOR FABRIC	25 SY

Is the limiting dimension for the bed the width of length? width

Controlled by Width (Rows)		Controlled by Length	
Width	40 FT	Length	100 FT
#of Chambers Long	8 EA	#of Chambers Long	NaN EA
#of Rows	11 EA	#of Rows	NaN EA
Actual Length	60.56 FT	Actual Length	NaN FT
Actual Width	38.13 FT	Actual Width	NaN FT

10 of the chambers rows will contain only 7 chambers

IV. HOUSE SITE ANALYSIS

HOUSE SITE ANALYSIS

The house site was analyzed using TR-55 method to determine if retaining storm water from the roof will be adequate to keep runoff at or below pre-developed levels.

Pre-developed condition

A = 39,734 sq. ft. = 0.91 ac.
CN_P = [(39,516)(61) + (218)(74)] / 39,734
= 61
use min. T_C = 0.1 hr.
i_2 = 7.8 inches
i_{100} = 17.5 inches

$Q_{P,2}$ = 2 cfs
$Q_{P,100}$ = 8 cfs

Developed condition

Roof

A = 10,852 sq. ft. = 0.25 ac.
CN_{roof} = 98
use min. T_C = 0.1 hr.
i_2 = 7.8 inches
i_{100} = 17.5 inches

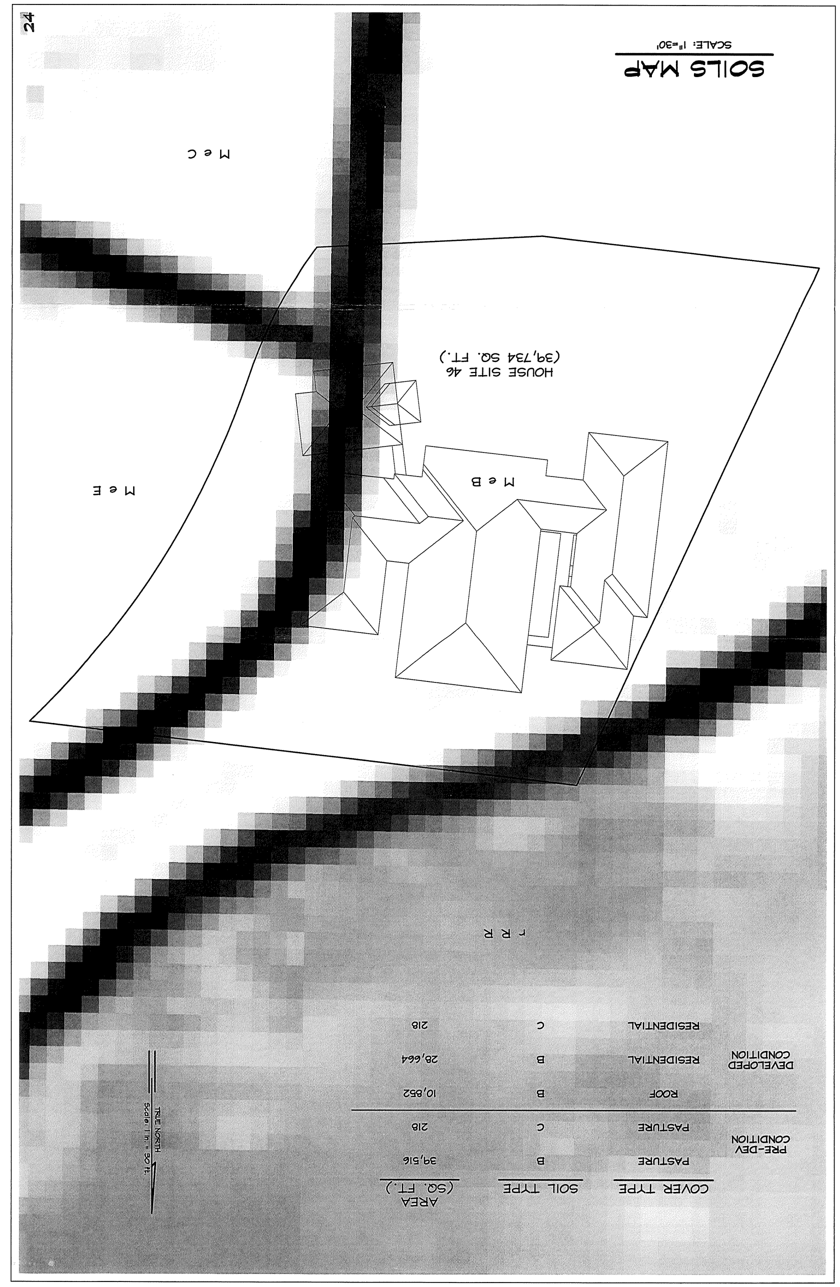
$Q_{roof,2}$ = 1 cfs
$Q_{roof,100}$ = 3 cfs

Yard

A = 28,882 sq. ft. = 0.66 ac.
$A_{type\ B}$ = 28,664 sq. ft.
$A_{type\ C}$ = 218 sq. ft.
CN_{yard} = [(28,664)(65) + (218)(77)] / 28,882
= 65
use min. T_C = 0.1 hr.
i_2 = 7.8 inches
i_{100} = 17.5 inches

$Q_{yard,2}$ = 2 cfs
$Q_{yard,100}$ = 6 cfs

In conclusion, retaining runoff from the roof is adequate to keep runoff at or below pre-developed levels. Runoff will be kept at 2 cfs for the 2-year storm event and reduced to 6 cfs from 8 cfs for the 100-year storm event.



Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	Erosion Factors T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
LoF	LOLEKAA	0.10	5	B	I
LuA	LUALUALEI	0.28	5	D	II
LuB	LUALUALEI	0.28	5	D	II
LvA	LUALUALEI	0.24	5	D	II
LvB	LUALUALEI	0.24	5	D	II
MBL	BADLAND	0.49	3	C	
MBL	MAHANA	0.43	5	B	IV
MID	MAKAALAE	0.17	3	B	III
MJD	MAKAALAE	0.10	3	B	III
MWE	MAKAALAE	0.17	3	B	III
MXC	MAKENA	0.17	4	B	III
MXC	STONY LAND	0.10	2	C	
MYD	MALAMA	0.02	3	A	I
MZ	MARSH	0.02	5	D	
MaC	MAHANA	0.43	5	B	IV
MaD	MAHANA	0.43	5	B	IV
MaD3	MAHANA	0.43	5	B	IV
MaE	MAHANA	0.43	5	B	IV
MaE3	MAHANA	0.43	5	B	IV
McC2	MAHANA	0.43	5	B	IV
McD2	MAHANA	0.43	5	B	IV
McE2	MAHANA	0.43	5	B	IV
MdB	MAKALAPA	0.28	3	D	II
MdC	MAKALAPA	0.28	3	D	II
MdD	MAKALAPA	0.28	3	D	II
MeB	MAKAPILI	0.10	5	B	I
MeC	MAKAPILI	0.10	5	B	I
MeD	MAKAPILI	0.10	5	B	I
MeE	MAKAPILI	0.10	5	B	I
MfB	MAKAWAO	0.10	5	B	I
MfC	MAKAWAO	0.10	5	B	I
MgB	MAKAWELI	0.17	5	B	II
MgC	MAKAWELI	0.17	5	B	II
MgD	MAKAWELI	0.17	5	B	II
MgE2	MAKAWELI	0.17	5	B	II
MhB	MAKAWELI	0.15	5	B	II
MhC	MAKAWELI	0.15	5	B	II
MhD	MAKAWELI	0.15	5	B	II
MhE	MAKAWELI	0.15	5	B	II
MkA	MAKIKI	0.17	5	B	II
MlA	MAKIKI	0.15	5	B	II
MmA	MALA	0.17	5	B	II
MmB	MALA	0.17	5	B	II
MnC	MAMALA	0.15	1	D	II
MoB	MANANA	0.10	5	C	I
MoC	MANANA	0.10	5	C	I
MoD2	MANANA	0.10	5	C	I
MpB	MANANA	0.10	5	C	I
MpC	MANANA	0.10	5	C	I
MpD	MANANA	0.10	5	C	I
MpD2	MANANA	0.10	5	C	I

Soil Properties Related to Erosion and Sedimentation
For the islands of
Kauai, Oahu, Maui, Molokai, and Lanai 1/
July 1993

Soil Symbol 2/	Soil Series or Miscellaneous Land Type	Erosion Factors K	Erosion Factors T (t/a/yr)	Hydrologic Group	Erosion Resistance Group
WxB	WAINEE	0.10	5	B	II
WxC	WAINEE	0.10	5	B	II
WyB	WAINEE	0.10	5	B	II
WyC	WAINEE	0.10	5	B	II
WzA	WAIPAHU	0.28	5	C	II
WzB	WAIPAHU	0.28	5	C	II
WzC	WAIPAHU	0.28	5	C	II
rAAE	ALAKAI	0.05	5	D	I
rAMD	AMALU	0.05	2	D	I
rAOO	AMALU	0.05	2	D	I
rAOO	OLOKUI	0.05	2	D	I
rCI	CINDER LAND	0.02	5	A	
rHOO	HONOMANU	0.05	5	A	I
rHR	AMALU	0.05	2	D	I
rHR	HONOMANU	0.05	5	A	I
rHT	HYDRANDEPTS	0.05	5	B	
rHT	TROPAQUODS	0.05	2	D	
rLW	LAVA FLOWS, AA	0.02	1	A	
rRH	RIVERWASH	0.05	4	A	
rRK	ROCK LAND	0.10	1	D	
rRO	ROCK OUTCROP	0.02	1	D	
rRR	ROUGH BROKEN LAND	0.05	2	C	
rRS	ROUGH BROKEN AND STONY LAND	0.05	2	C	
rRT	ROUGH MOUNTAINOUS LAND	0.20	1	D	
rRU	RUBBLE LAND	0.02	1	A	
rSL	SANDY ALLUVIAL LAND	0.17	5	A	
rSM	STONY ALLUVIAL LAND	0.10	5	B	
rSN	STONY BLOWN-OUT LAND	0.15	2	B	
rSO	STONY COLLUVIAL LAND	0.10	5	B	
rST	STONY LAND	0.10	5	B	
rSY	STONY STEEP LAND	0.10	5	B	
rTO	TROPAQUODS	0.05	2	D	
rTP	DYSTRANDEPTS	0.10	3	B	
rTP	TROPOHUMULTS	0.10	4	C	
rVS	VERY STONY LAND (MAUI)	0.10	1	C	
rVS	VERY STONY LAND	0.10	2	C	
rVT2	VERY STONY LAND, ERODED	0.10	2	C	
rWAF	WAIALEALE	0.05	3	D	I

1/ Replaces Table 14 in Erosion and Sediment Control Guide for Hawaii (1981).

2/ A soil symbol that is repeated indicates the soil map unit has two or more components. See the soil survey to obtain percentage of each component, or make on-site determination.

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

Cover description spans the first two columns; "Curve numbers for hydrologic soil group—" spans columns A–D.

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c.—Runoff curve numbers for other agricultural lands[1]

Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing.[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element.[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	[4]30	48	65	73
Woods—grass combination (orchard or tree farm).[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	[4]30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

Cover description spans the first two columns; "Curve numbers for hydrologic soil group—" spans columns A–D.

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

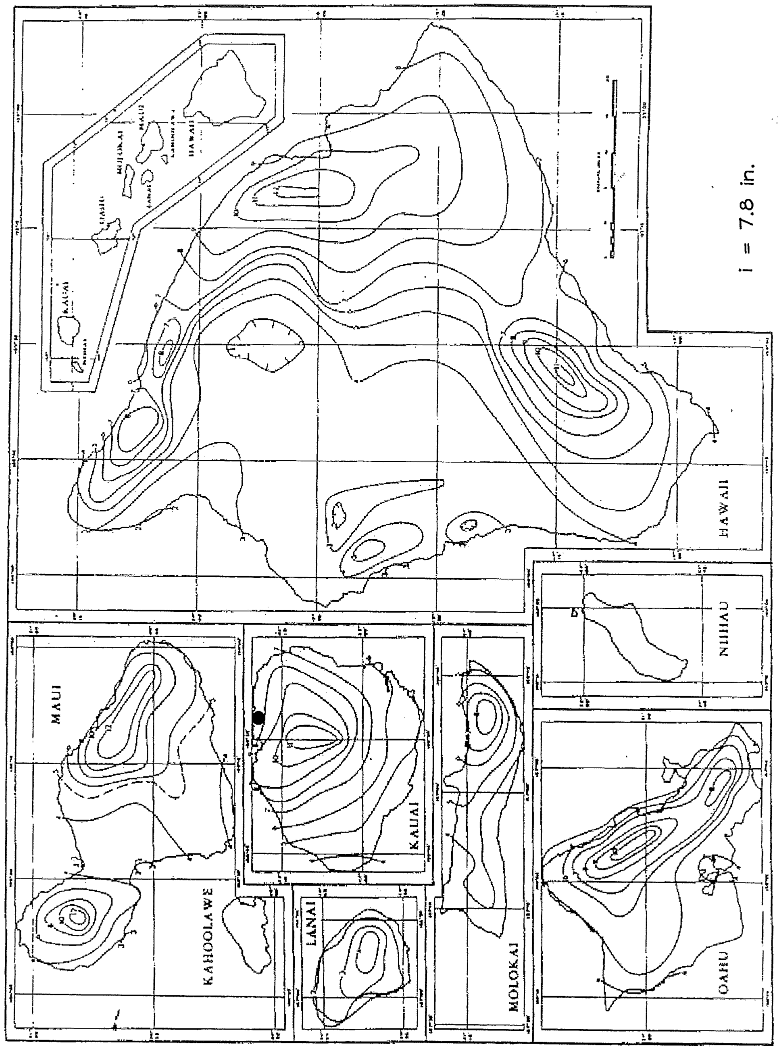
[3]*Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

[4]Actual curve number is less than 30; use CN = 30 for runoff computations.

[5]CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6]*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

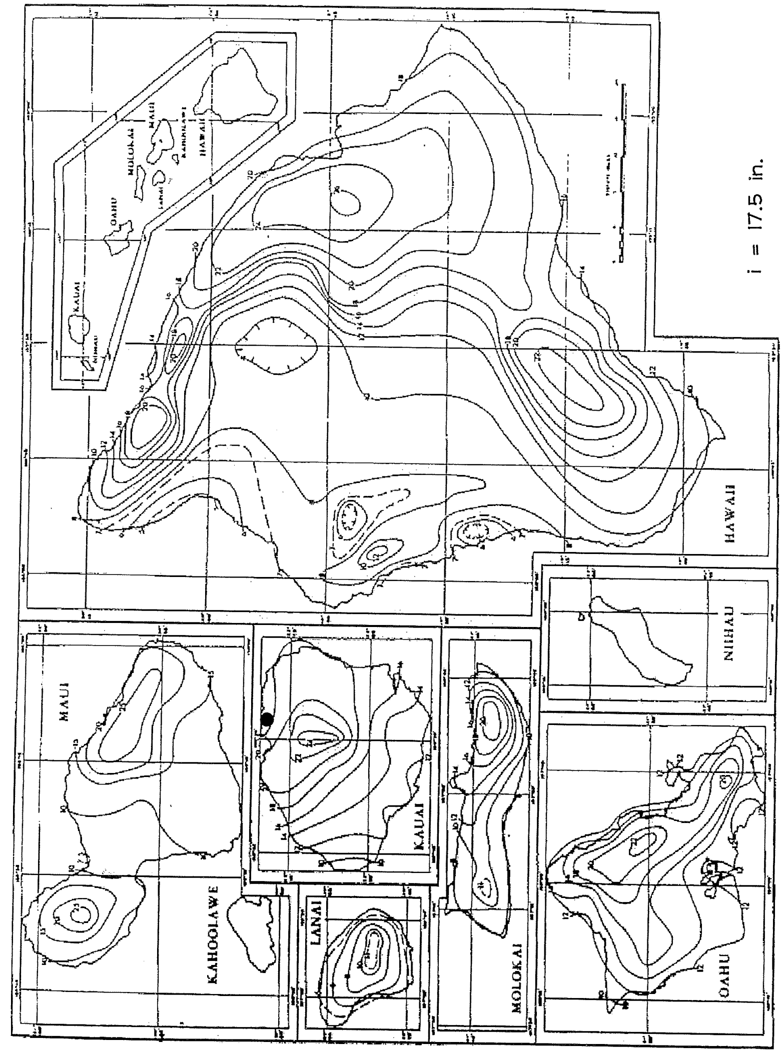
Plate 5



i = 7.8 in.

2–Year 24–Hour Rainfall (in.)

Plate 6



i = 17.5 in.

100–Year 24–Hour Rainfall (in.)

Quick TR-55 Version: 5.47 S/N:

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

House Site 46 Analysis
Pre-developed Condition

CALCULATED
DISK FILE: 06-192 .GPD

Drainage Area	(acres)	.91	--->	0.0014 sq.mi.
Runoff Curve Number	(CN)	61		
Time of Concentration,Tc	(hrs)	.1		
Rainfall Distribution	(Type)	I		
Pond and Swamp Areas	(%)	0	--->	0.0 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	2	100	
Rainfall, P, 24-hr (in)	7.8	17.5	
Initial Abstraction, Ia (in)	1.279	1.279	1.279
Ia/p Ratio	0.164	0.073	0.000
Unit Discharge, * qu (csm/in)	467	504	0
Runoff, Q (in)	3.29	11.64	0.00
Pond & Swamp Adjustment Factor	1.00	1.00	1.00
PEAK DISCHARGE, qp (cfs)	2	8	0

Summary of Computations for qu

Ia/p #1	0.100	0.100	0.000
C0 #1	2.306	2.306	0.000
C1 #1	-0.514	-0.514	0.000
C2 #1	-0.117	-0.117	0.000
qu (csm) #1	503.837	503.837	0.000
Ia/p #2	0.200	0.100	0.000
C0 #2	2.235	2.306	0.000
C1 #2	-0.504	-0.514	0.000
C2 #2	-0.089	-0.117	0.000
qu (csm) #2	446.632	503.837	0.000
* qu (csm)	467	504	0

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$
$$qp\ (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond\ \&\ Swamp\ Adj.)$$

Quick TR-55 Version: 5.47 S/N:

>>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

House Site 46 Analysis
Developed Condition
Roof Area

CALCULATED .GPD
DISK FILE: 06-192 .GPD

Drainage Area	(acres)	.25	--->	0.0004 sq.mi.
Runoff Curve Number	(CN)	98		
Time of Concentration,Tc	(hrs)	.1		
Rainfall Distribution	(Type)	I		
Pond and Swamp Areas	(%)	0	--->	0.0 acres

	Storm #1	Storm #2	Storm #3
Frequency (years)	2	100	
Rainfall, P, 24-hr (in)	7.8	17.5	
Initial Abstraction, Ia (in)	0.041	0.041	0.041
Ia/p Ratio	0.005	0.002	0.000
Unit Discharge, * qu (csm/in)	504	504	0
Runoff, Q (in)	7.56	17.26	0.00
Pond & Swamp Adjustment Factor	1.00	1.00	1.00
PEAK DISCHARGE, qp (cfs)	1	3	0

Summary of Computations for qu

Ia/p #1	0.100	0.100	0.000
C0 #1	2.306	2.306	0.000
C1 #1	-0.514	-0.514	0.000
C2 #1	-0.117	-0.117	0.000
qu (csm) #1	503.837	503.837	0.000
Ia/p #2	0.100	0.100	0.000
C0 #2	2.306	2.306	0.000
C1 #2	-0.514	-0.514	0.000
C2 #2	-0.117	-0.117	0.000
qu (csm) #2	503.837	503.837	0.000
* qu (csm)	504	504	0

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

$$\log(qu) = C0 + (C1 * \log(Tc)) + (C2 * (\log(Tc))^2)$$
$$qp\ (cfs) = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond\ \&\ Swamp\ Adj.)$$

```
Quick TR-55 Version: 5.47 S/N:

          >>>>> GRAPHICAL PEAK DISCHARGE METHOD <<<<<

                    House Site 46 Analysis
                     Developed Condition
                          Yard Area

               CALCULATED          .GPD
               DISK FILE: 06-192   .GPD

      Drainage Area            (acres)   .66    --->   0.0010 sq.mi.
      Runoff Curve Number        (CN)    65
      Time of Concentration,Tc  (hrs)    .1
      Rainfall Distribution    (Type)    I
      Pond and Swamp Areas        (%)    0      --->      0.0 acres

                                       Storm #1    Storm #2    Storm #3
                                       --------    --------    --------
Frequency (years)                       2           100
Rainfall, P, 24-hr (in)                 7.8         17.5


Initial Abstraction, Ia (in)            1.077       1.077       1.077
Ia/p Ratio                              0.138       0.062       0.000
Unit Discharge, * qu (csm/in)             482         504           0
Runoff, Q (in)                           3.73       12.37        0.00
Pond & Swamp Adjustment Factor           1.00        1.00        1.00

PEAK DISCHARGE, qp (cfs)                   2           6           0
-----------------------------------------------------------------------

Summary of Computations for qu
------------------------------
       Ia/p      #1                     0.100       0.100       0.000
       C0        #1                     2.306       2.306       0.000
       C1        #1                    -0.514      -0.514       0.000
       C2        #1                    -0.117      -0.117       0.000
       qu (csm)  #1                   503.837     503.837       0.000

       Ia/p      #2                     0.200       0.100       0.000
       C0        #2                     2.235       2.306       0.000
       C1        #2                    -0.504      -0.514       0.000
       C2        #2                    -0.089      -0.117       0.000
       qu (csm)  #2                   446.632     503.837       0.000

     * qu (csm)                           482         504           0

* Interpolated for computed Ia/p ratio (between Ia/p #1 & Ia/p #2)
  If computed Ia/p exceeds Ia/p limits, bounding limit for Ia/p is used.

                                                         2
  log(qu)   = C0 + ( C1 * log(Tc) ) + ( C2 * (log(Tc)) )
  qp (cfs)  = qu(csm) * Area(sq.mi.) * Q(in.) * (Pond & Swamp Adj.)
```

APPENDIX D

ROADWAY DRAINAGE SYSTEM ANALYSIS

By

Esaki Surveying and Mapping, Inc.

DRAINAGE SYSTEM ANALYSIS

Owner: Princeville Associates LLC
Tax Map Key: (4) 5-3-06: 01, 14
Date: June 2009

BRANDON K. FUJISHIGE
LICENSED PROFESSIONAL ENGINEER
No. 10766-C
HAWAII, U.S.A.

This work was prepared by
me or under my supervision
Expires: April 30, 2010

ESAKI SURVEYING & MAPPING, INC.
1610 Haleukana Street
Lihue, Kauai, Hawaii 96766

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II.	Purpose	5 – 7
III.	Runoff Computations	8 – 16
IV.	Drain Inlet and Swale Analysis	17 – 22
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VI.	Roadway Capacity Analysis (100-yr Storm)	31 – 63
Appendix – Select Sheets from Construction Drawings for Lot 2-A-1, Princeville Phase II		64 – 73

I. FACTS SHEET

FACTS SHEET

General Location and Description

1. Name of town: Hanalei
2. Tax Map Key: (4) 5-3-06: 01, 14
3. Names of local streets within and adjacent to the proposed project: Anini Road and Kuhio Highway
4. Identification of major and local drainageways, facilities, and/or easements within and adjacent to the proposed project: see Location Map (sheet 7)
5. Names of surrounding developments: Princeville Subdivision to the west
6. Flood Information: See this report
7. Property Boundaries: see Location Map (sheet 7)
8. Area of property in acres: 872.290 acres
9. Ground cover (type of trees, shrubs, vegetation, general soil conditions, topography and average slope): typical pasture; see Drainage Basin Maps (sheets 10 thru 13) for topography and slope
10. General project description: the project involves the construction of roadways, which will be used to access cpr units, and installation of underground utilities
11. Proposed land use: agricultural

Hydrologic map and data for the existing drainage condition

See this report

Hydrologic map and data for the proposed onsite and offsite drainage improvements

See this report

Drainage Report Items

1. Plan and profile of proposed onsite and offsite drainage improvements: See Appendix
2. Drainage sub-areas and discharges: Yes
3. Catch basin/drain inlet interception and bypass rates: Yes
4. Street flooding or dry pavement widths: Yes
5. Design flows between manholes and catch basin inlets: Yes
6. Hydraulic grade lines in culverts, manholes and catch basin inlets: Yes

7. Hydraulic grade lines and velocities at outlet structures: Yes
8. Detention basin hydrology and hydraulics: N/A
9. Drainageway and building setback lines and/or floodway, flood fringe and flood elevation lines: N/A
10. Description of changes to existing drainage patterns on adjacent and downstream properties and "unreasonable risk": N/A

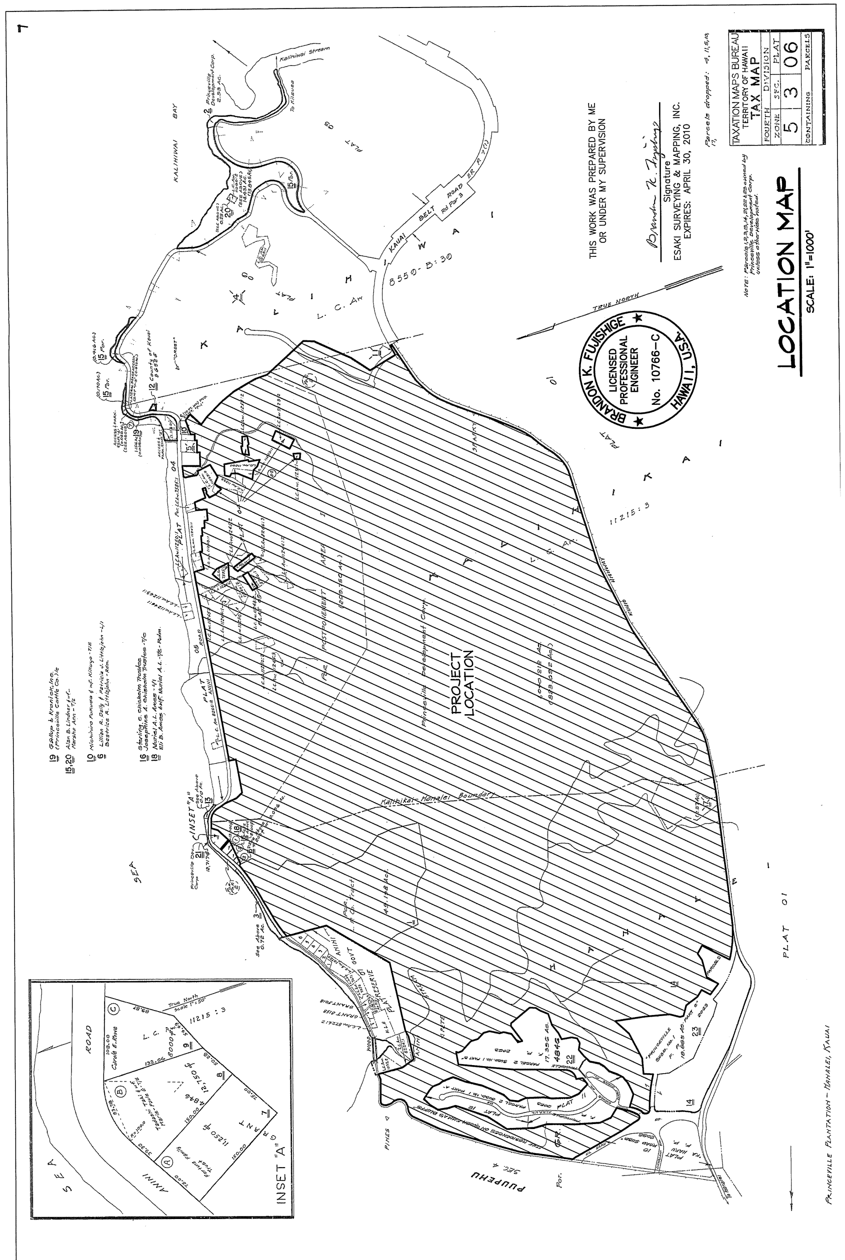
Conclusions

1. Compliance with the MANUAL: Yes
2. The Drainage Concept will not adversely affect adjacent and downstream properties: Yes

II. PURPOSE

PURPOSE

The purpose of this report is to determine the adequacy of the proposed drainage system.



III. RUNOFF COMPUTATIONS

RUNOFF COMPUTATIONS

The Rational Method was used to compute the runoff for the various drainage basins. The drainage basins and drainage structures are shown on Drainage Basin Maps.

<u>Rational Method:</u> $Q(cfs) = C \times i \times i_{CF} \times A$

- Q = Flow Rate in cubic feet per second
- C = Runoff Coefficient
- i = 1-Hour Rainfall for the design recurrence interval
- i_{CF} = Intensity Correction Factor
- A = Drainage Area in acres

<u>Runoff Coefficient (C):</u>

See Table "Composite Runoff Coefficients" for individual drainage basin Runoff Coefficients.

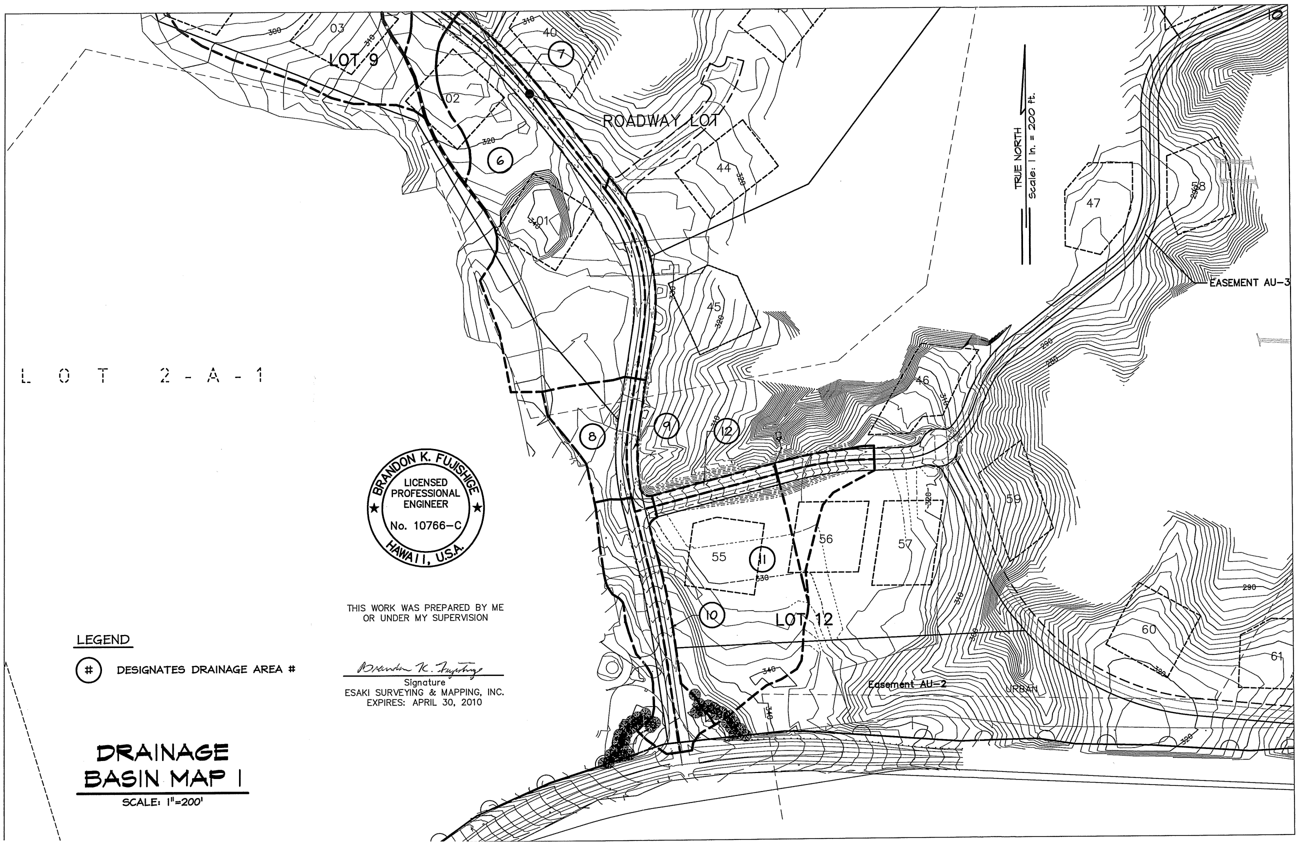
<u>Rainfall Intensity (i):</u>

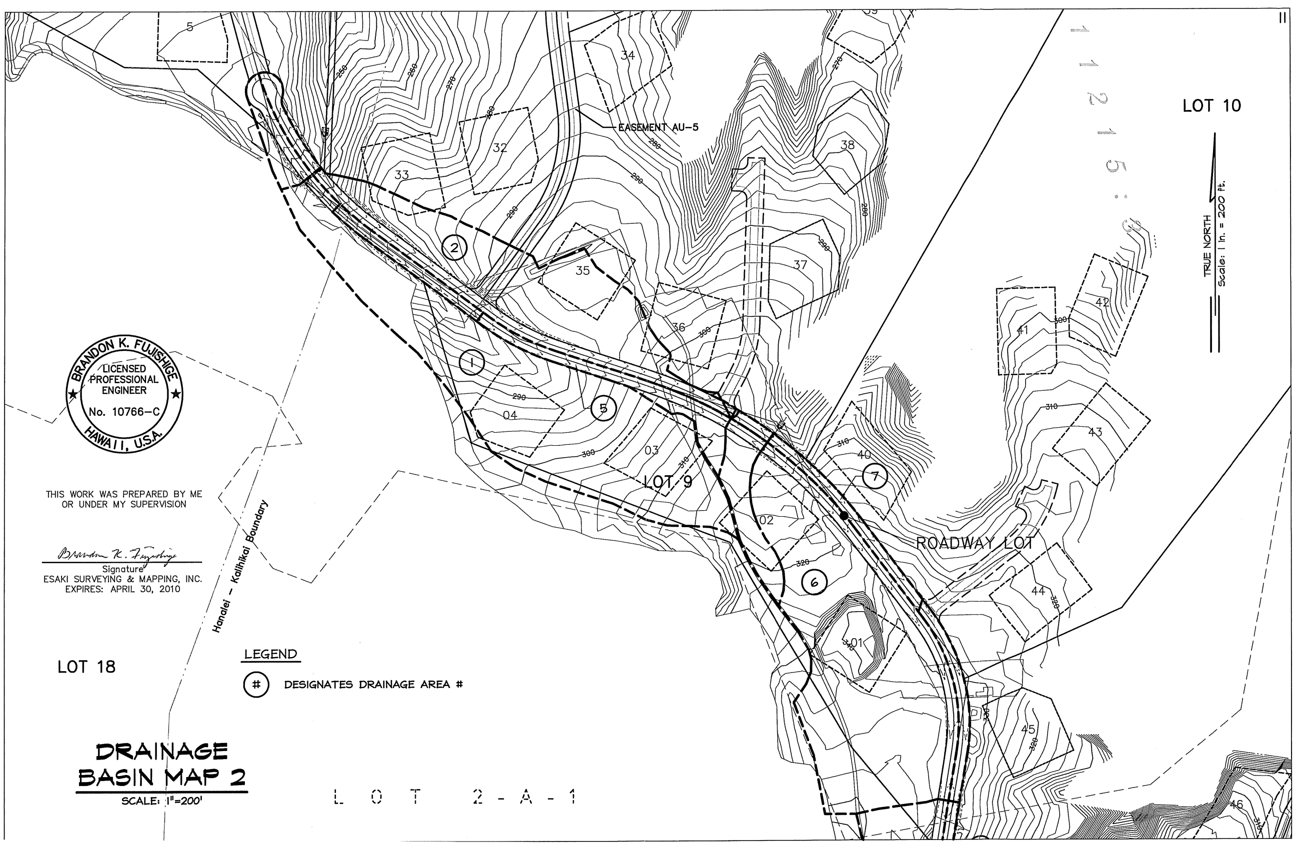
i_2 = 2.9 inches

<u>Intensity Correction Factor (i_{CF}):</u>

A minimum of 6 minutes Time of Concentration was used in determining the Intensity Correction Factor.

i_{CF} = 2.7


LOT 9
ROADWAY LOT
TRUE NORTH
Scale: 1 in. = 200 ft.
EASEMENT AU-3
LOT 2-A-1
LOT 12
Easement AU-2
URBAN
BRANDON K. FUJISHIGE
LICENSED PROFESSIONAL ENGINEER
No. 10766-C
HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION
Signature
ESAKI SURVEYING & MAPPING, INC.
EXPIRES: APRIL 30, 2010
LEGEND
DESIGNATES DRAINAGE AREA
DRAINAGE
BASIN MAP 1
SCALE: 1"=200'


LOT 10
TRUE NORTH
Scale: 1 in. = 200 ft.
EASEMENT AU-5
LOT 9
ROADWAY LOT
BRANDON K. FUJISHIGE
LICENSED PROFESSIONAL ENGINEER
No. 10766-C
HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION
Signature
ESAKI SURVEYING & MAPPING, INC.
EXPIRES: APRIL 30, 2010
Hanalei – Kalihikai Boundary
LOT 18
LEGEND
DESIGNATES DRAINAGE AREA
DRAINAGE
BASIN MAP 2
SCALE: 1"=200'
LOT 2-A-1

Composite Runoff Coefficients

Drainage Area	Area (Acres)			Composite C
	Paved Streets [C=0.87]	Residential (R-2) [C=0.38]	Residential (5 Ac.) [C=0.15]	
1	0.58	1.50	4.97	**0.26**
2	1.21	0.64	2.16	**0.40**
3	0.45	0.02	0.24	**0.61**
4	0.77	1.46	4.89	**0.28**
5	0.78	0.00	0.00	**0.87**
6	0.63	0.00	1.72	**0.34**
7	0.24	0.00	0.00	**0.87**
8	0.56	0.00	0.01	**0.86**
9	0.37	0.96	3.45	**0.25**
10	0.37	0.00	0.01	**0.85**

Table 1

TYPICAL RUNOFF COEFFICIENTS FOR BUILT-UP AREAS

LAND USE OR SURFACE CHARACTERISTICS	AVERAGE* PERCENT IMPERVIOUS	STORM FREQUENCY "C" 2	STORM FREQUENCY "C" 100
Business:			
General Commercial	90	0.82	0.84
Neighborhood Commercial	70	0.60	0.80
Residential:			
R-1	10	0.20	0.40
→ R-2	20	0.38	0.55
R-4	50	0.43	0.70
R-6	50	0.45	0.75
R-10	50	0.50	0.80
R-20	50	0.55	0.80
→ 5 Acre Lot	8	0.15	0.30
Industrial:			
Limited Industrial	80	0.71	0.82
General Industrial	90	0.80	0.90
Parks, Cemeteries:	7	0.10	0.45
Playgrounds:	13	0.15	0.50
Schools:	50	0.45	0.70
Streets:			
→ Paved	100	0.87	0.93
Unpaved	95	0.80	0.90
Driveways and Walks:	96	0.87	0.93
Roofs:	90	0.80	0.90
Lawns, Sandy Soil:	0	0.00	0.20
Lawns, Clayey Soil:	0	0.05	0.50

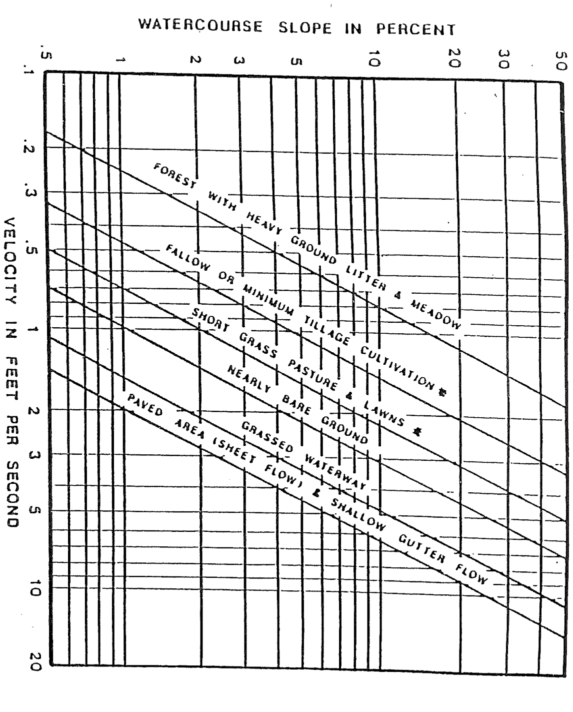
NOTE: (These Rational formula coefficients may not be valid for large basins. These coefficients are also average values and may require adjustments depending on the surface characteristics, soil type, slope, infiltration, evaporation, depression storage, etc. The Engineer shall use sound engineering judgement in selecting the proper coefficient(s).) For composite drainage areas compute "weighted" Rational formula coefficient(s).

*** Average impervious areas do not correlate directly to allowable impervious area.**

Runoff

Drainage Area	C	I			A	Q=CIA
		T_C (minutes)	i_{CF}	i_2 (inches)	(acres)	(cfs)
1	0.26	6	2.7	2.9	7.05	**14.25**
2	0.40	6	2.7	2.9	4.01	**12.68**
3	0.61	6	2.7	2.9	0.71	**3.41**
4	0.28	6	2.7	2.9	7.12	**15.33**
5	0.87	6	2.7	2.9	0.78	**5.31**
6	0.34	6	2.7	2.9	2.35	**6.31**
7	0.87	6	2.7	2.9	0.24	**1.63**
8	0.86	6	2.7	2.9	0.57	**3.83**
9	0.25	6	2.7	2.9	4.78	**9.43**
10	0.85	6	2.7	2.9	0.38	**2.53**

PLATE 1



ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

PLATE 2

Use $T_{C,\ min}$ = 6 minutes
i_{CF} = 2.7

CORRECTION FACTOR
FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

TO BE USED FOR AREA LESS THAN 100 ACRES

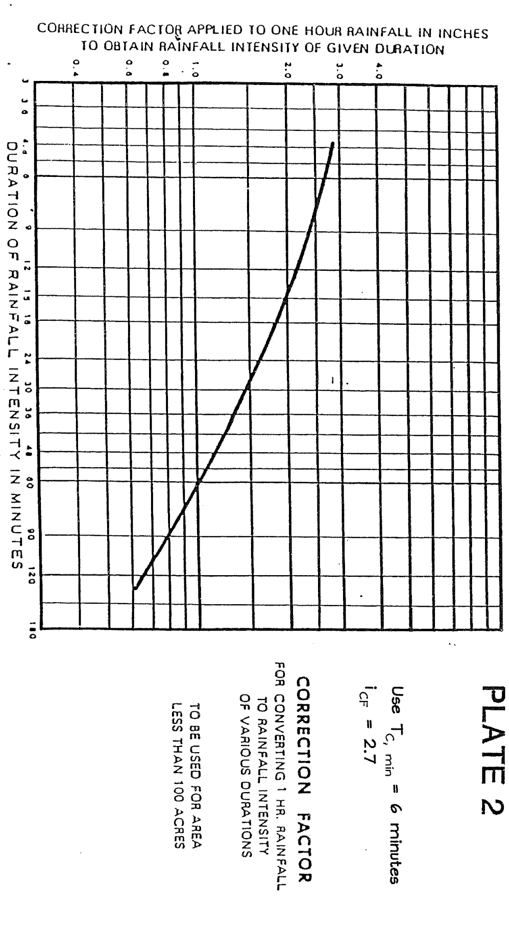
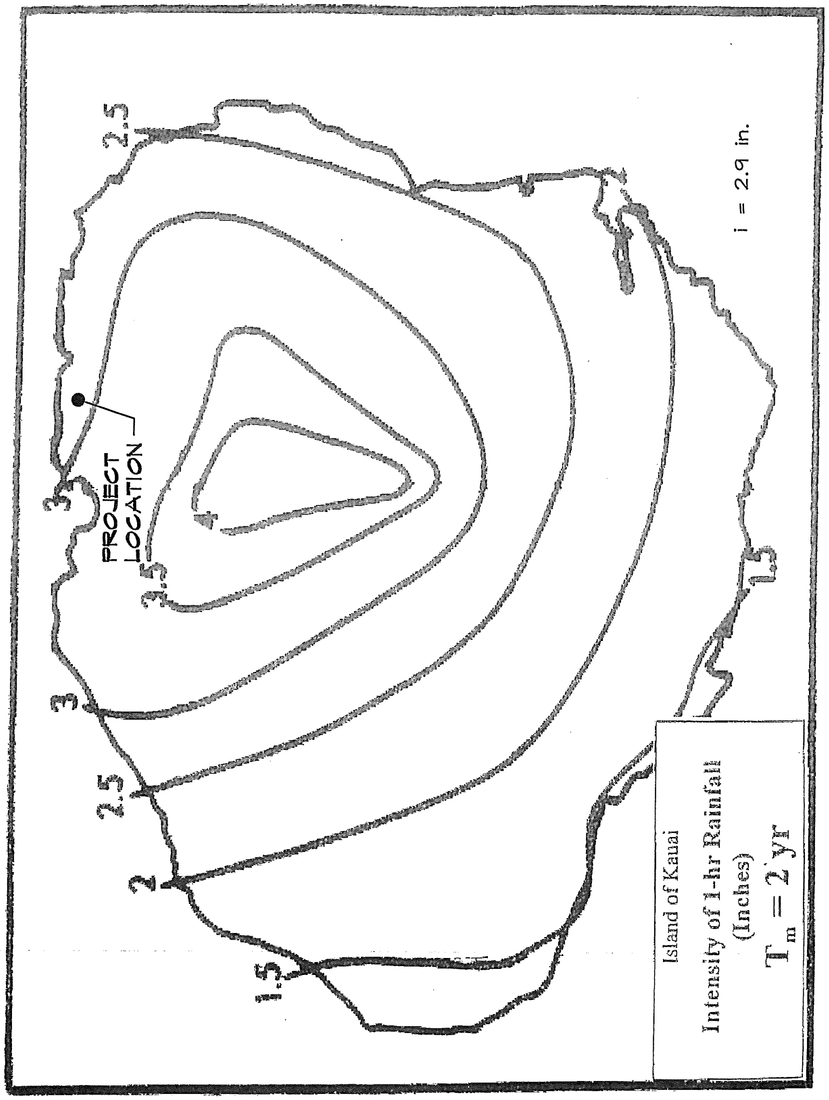


Plate 3



IV. DRAIN INLET AND SWALE ANALYSIS

DRAIN INLET AND SWALE ANALYSIS

The drain inlets are adequately sized and spaced to accommodate runoff from a 2-year storm event.

Inlet Analysis

Drain Inlet		Flows (cfs)			Roadway			Inlet Intercept Capacity	Bypass Flow	Remarks
#	Type	Surface	Bypass	Total	Type	Slope (%)	Max. Capacity			
1	G4	14.25	1.59	15.84	collector	N/A	N/A	18.10	N/A	sump
2	G2	12.68	0.00	12.68	collector	N/A	N/A	13.70	N/A	sump
3	G2	3.41	0.00	3.41	collector	3.58	30.00	1.82	1.59	
4	G4	15.33	0.00	15.33	collector	N/A	N/A	18.10	N/A	sump
5	G2	5.31	0.00	5.31	collector	N/A	N/A	13.70	N/A	sump
6	G2	6.31	0.00	6.31	collector	N/A	N/A	13.70	N/A	sump
7	G2	1.63	0.00	1.63	collector	4.59	34.35	0.95	0.68	
8	G2	3.83	0.00	3.83	collector	4.59	34.35	1.92	1.91	
9	G2	9.43	1.91	11.34	collector	N/A	N/A	13.70	N/A	sump
10	G2	2.53	0.68	3.21	collector	N/A	N/A	13.70	N/A	sump

PLATE 17

Allowable Maximum Street Capacity (Half–Section without Curb and Gutter)

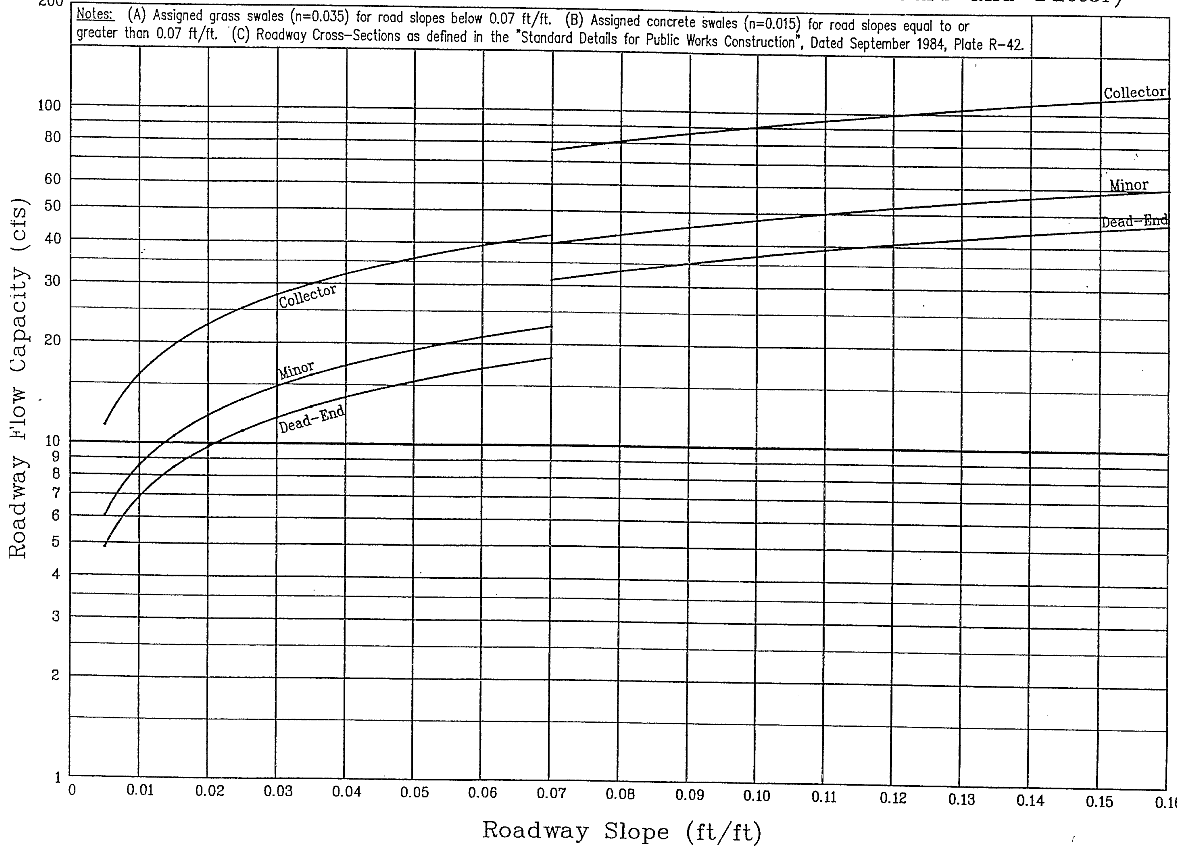


PLATE 24

Intercept Capacity for Type G2 Drain Inlet on a Collector Roadway

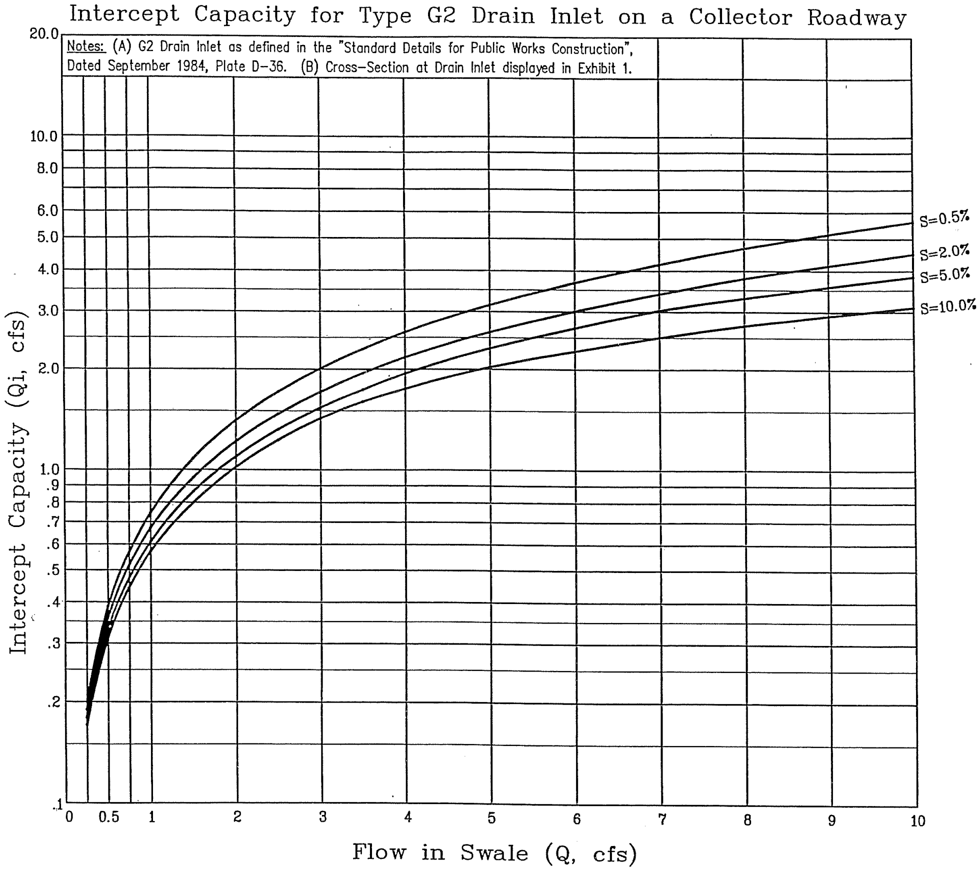


Table 2 - Drain Inlet Capacity for Sump Conditions

Q' (Inlet Flow capacity) =
3 x (Grate Perimeter in ft.) x (Max depth from crown of street in ft.)$^{(3/2)}$

***Calculation Note: Q' values shown were reduced by 25% to account for clogging.**

Inlet Type	Grate Perimeter (ft.)
G2	9.9
G3	15.8
G4	13.1

Roadway Class	Max. Depth from Crown of Street (ft.)
Collector	0.723
Minor	0.583
Dead-End	0.533

Roadway Classification	Inlet Type	Maximum Inlet Capacity (Q') in cfs
Collector	G2	13.7
Collector	G3	21.9
Collector	G4	18.1
Minor	G2	9.9
Minor	G3	15.8
Minor	G4	13.1
Dead-End	G2	8.7
Dead-End	G3	13.8
Dead-End	G4	11.5

V. DRAINAGE SYSTEM DESIGN/ANALYSIS

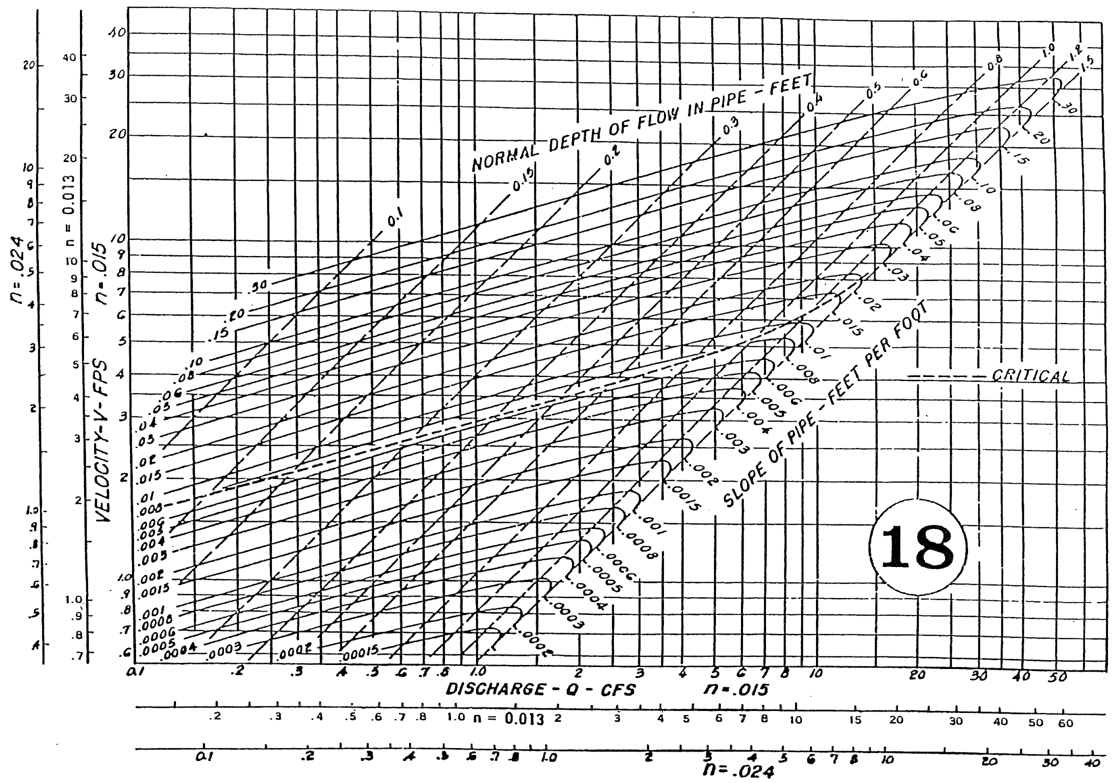
DRAINAGE SYSTEM DESIGN/ANALYSIS

Velocities at the outlet structures exceed 5 feet per second, but are less than 10 feet per second. Rip rap, per Plate 45 from the County of Kauai Storm Water Runoff System Manual, is required for all outlets.

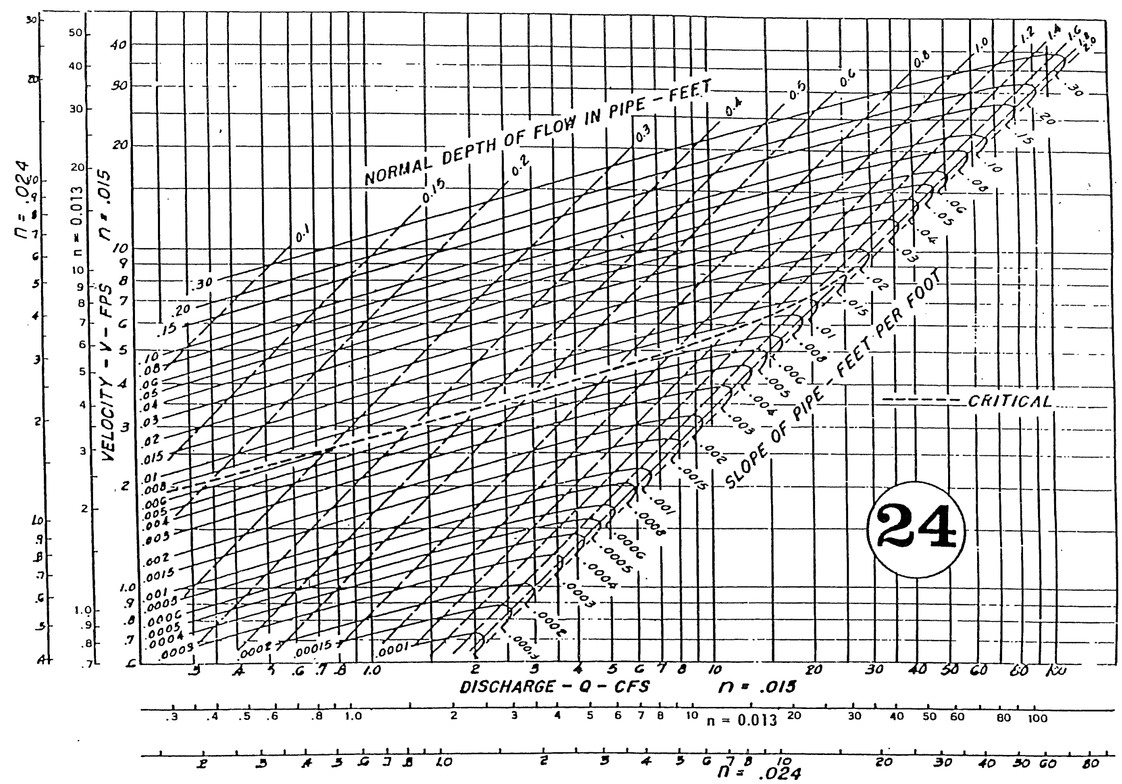
Drainage Design Data

Drainage Structure	Accumulated Runoff (cfs)	Pipe Size (inches)	Pipe Length (feet)	Pipe Slope (ft/ft)	Friction Slope (ft/ft)	Normal Depth (feet)	Critical Depth (feet)	Normal Velocity (fps)	Inv. Elevation (feet)	Friction Loss (feet)	Headwater (feet)	Hydraulic Grade Elevation (ft) Lower	Hydraulic Grade Elevation (ft) Upper	Finish Grade Elevation (ft)	Remarks
Outlet #1									248.64				251.64		
	30.34	36	90.55	0.0050	0.0018	1.66	1.79	7.54		0.16					HDPE
DI #2									249.09		2.70	251.80	251.80	257.55	
	17.66	36	40.50	0.0050	0.0006	1.22	1.34	6.57		0.02					HDPE
DI #1									249.29		1.92	251.82	251.82	257.47	
	1.82	18	103.21	0.0824	0.0003	0.24	0.51	9.95		0.03					HDPE
SDMH #1									257.59		0.75	257.83	258.34	263.09	
	1.82	18	102.98	0.0612	0.0003	0.26	0.51	8.96		0.03					HDPE
SDMH #2									263.75		0.75	264.01	264.50	269.25	
	1.82	18	363.22	0.0272	0.0003	0.32	0.51	6.73		0.11					HDPE
DI #3									273.64			273.96		305.17	
Outlet #2									297.38				300.38		
	20.64	36	22.09	0.0050	0.0008	1.33	1.46	6.84		0.02					HDPE
DI #5									297.49		2.16	300.40	300.40	305.17	
	15.33	24	40.50	0.0050	0.0039	1.46	1.41	6.23		0.16					HDPE
DI #4									297.69			300.56		305.17	
Outlet #3									285.12				287.12		
	23.73	24	22.42	0.0100	0.0094	1.58	1.73	8.89		0.21					HDPE
SDMH #4									285.35		3.70	287.33	289.05	297.36	
	23.73	24	50.37	0.3187	0.0094	0.56	1.73	32.91		0.47					HDPE
DI #10									301.40		3.70	301.96	305.10	309.92	
	20.52	24	41.00	0.0070	0.0070	1.64	1.63	7.44		0.29					HDPE
DI #9									301.69		3.20	305.39	305.39	309.92	
	9.18	18	161.50	0.0615	0.0065	0.59	1.17	14.27		1.05					HDPE
SDMH #3									311.62		2.15	312.21	313.77	318.94	
	9.18	18	161.50	0.0615	0.0065	0.59	1.17	14.27		1.05					HDPE
DI #8									321.55		2.15	322.14	323.70	328.57	
	7.26	18	41.00	0.0139	0.0041	0.79	1.04	7.74		0.17					HDPE
DI #7									322.12		1.74	323.87	323.86	328.55	
	6.31	18	74.48	0.0050	0.0039	1.00	0.97	5.04		0.29					HDPE
DI #6									322.49			324.15		329.36	

PLATE 8



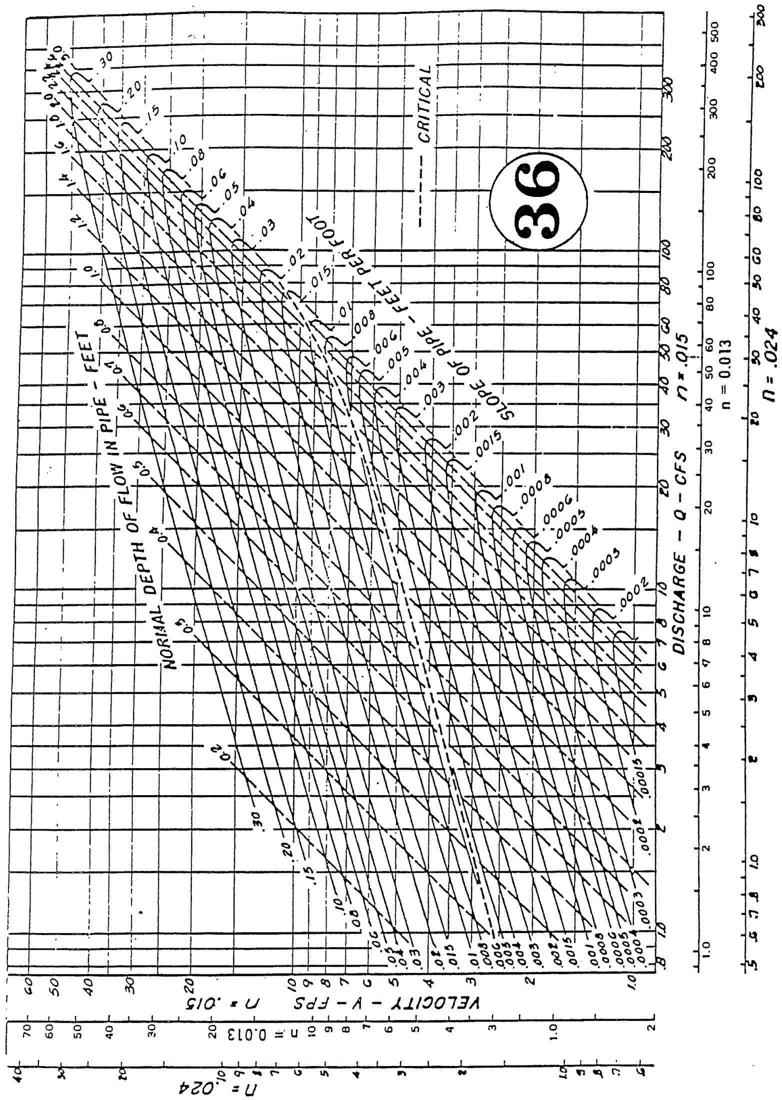
Pipe Flow Chart 18 inch Diameter



Pipe Flow Chart 24 inch Diameter

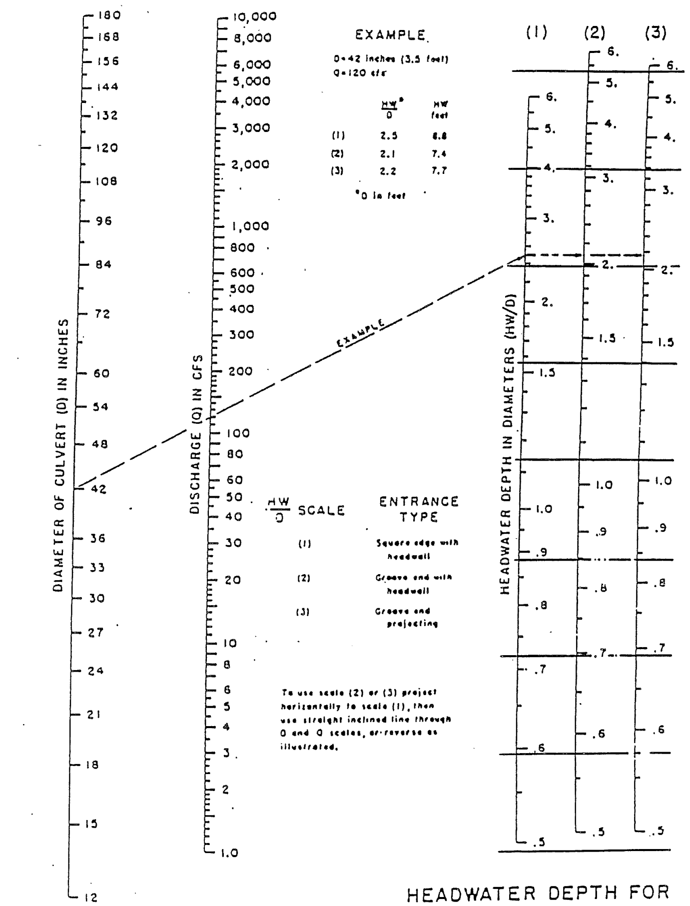
PLATE 9

PLATE 11



Pipe Flow Chart 36 inch Diameter

PLATE 19



HEADWATER DEPTH FOR
CONCRETE PIPE CULVERTS
WITH INLET CONTROL

PLATE 45

ROCK PROTECTION AT OUTFALLS						
Discharge Velocity at Design Flow (fps)		REQUIRED PROTECTION				
Greater than	Less than or equal to	Minimum Dimensions				
		Type	Thickness	Width	Length	Height
0	5	Rock Lining[1]	1 foot	Diameter + 6 feet	8 feet or 4 x Diameter, whichever is greater	Crown + 1 foot
5	10	Rip Rap[2]	2 feet	Diameter + 6 feet or 3 x Diameter, whichever is greater	12 feet or 4 x Diameter, whichever is greater	Crown + 1 foot
10	20	Gabion Outfall	As Required	As Required	As Required	Crown + 1 foot
20	N/A	Engineered Energy Dissipater Required				

(1) Rock lining shall be quarry spalls with gradation as follows:

Passing 8-inch square sieve: 100%
Passing 3-inch square sieve: 40% max.
Passing 3/4-inch square sieve: 0% max.

(2) Rip rap shall be reasonably well graded with gradation as follows:

Maximum stone size, 24" (nominal diameter)
Median stone size, 16"
Minimum stone size, 4"

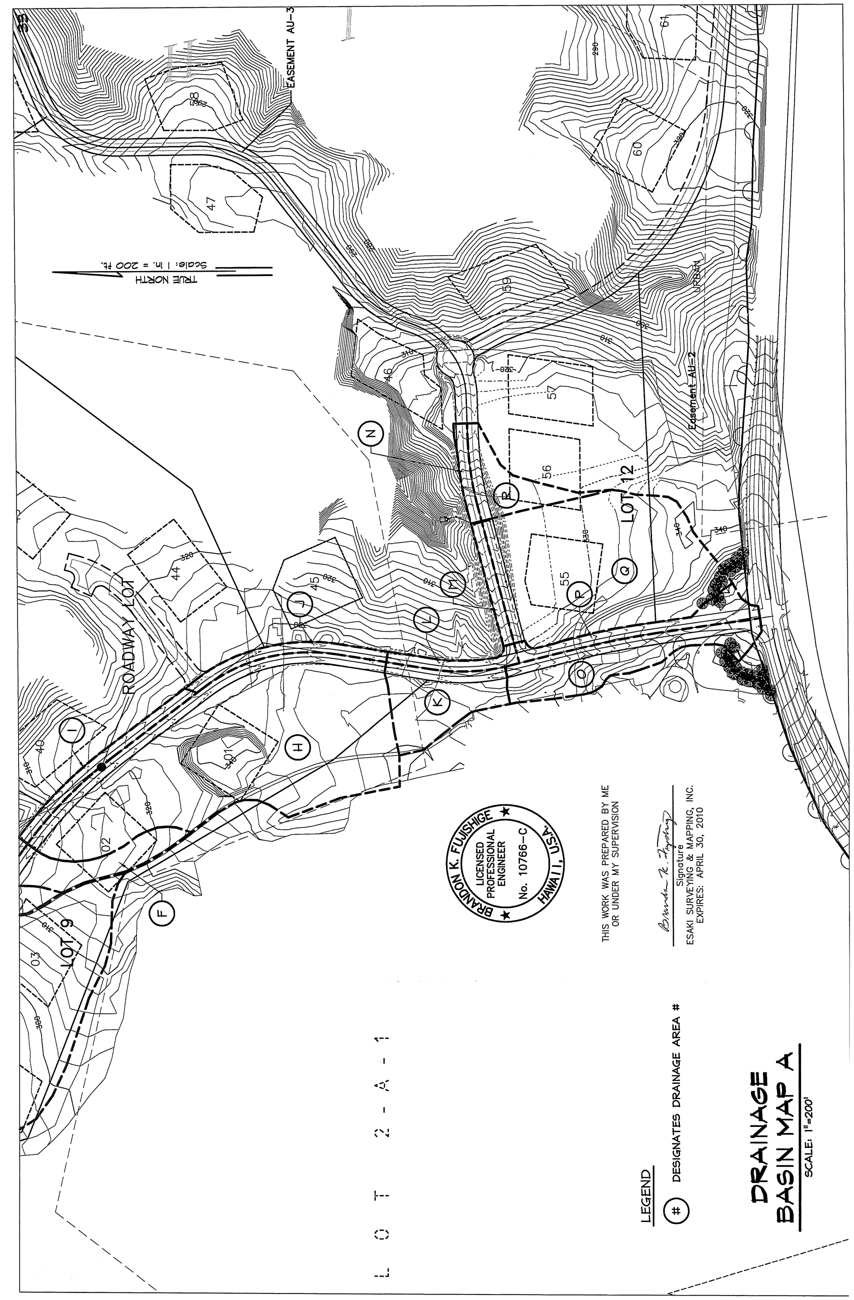
Note: Rip rap sizing governed by side slopes on outlet channel, assumed to be approximately 3:1.

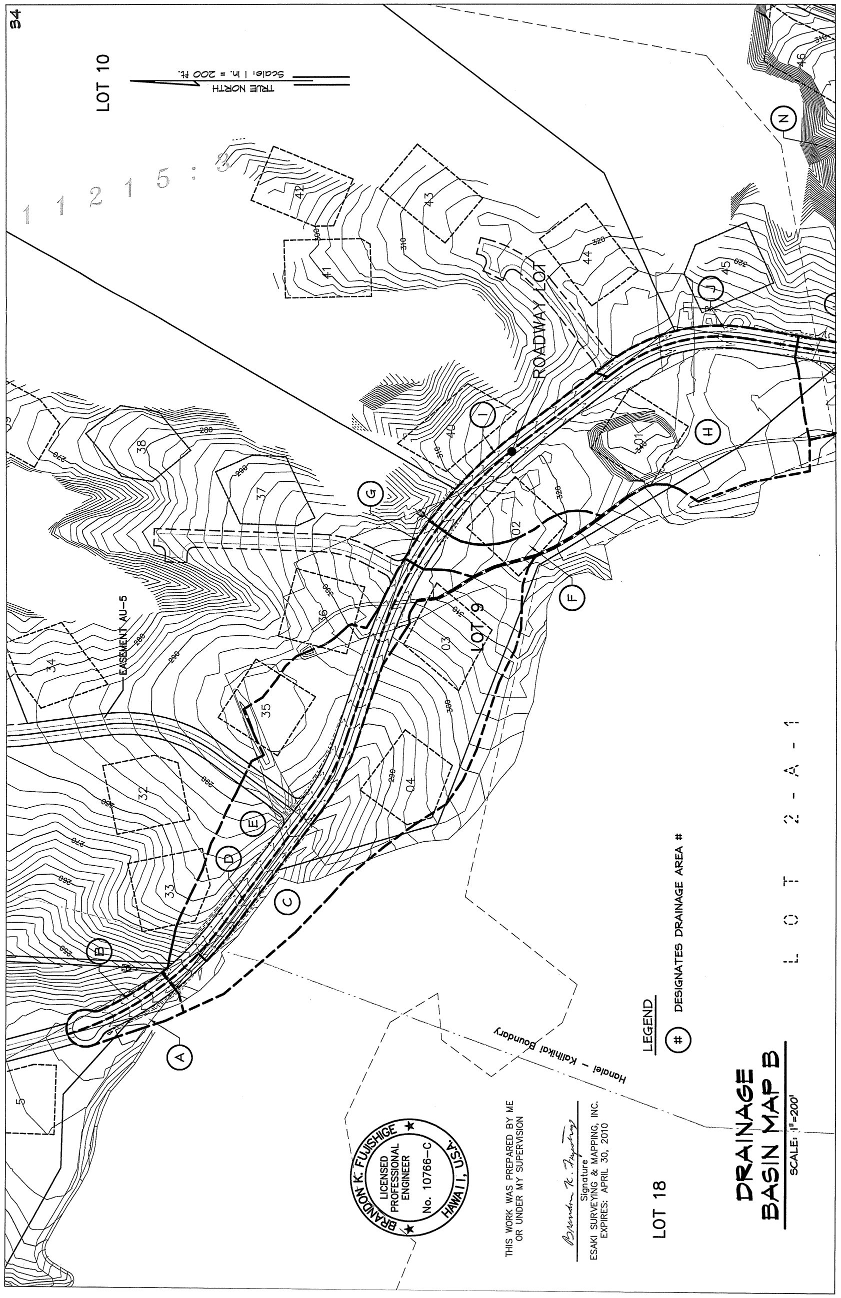
Source: Surface Water Design Manual, King County, Washington, February 1996

VI. ROADWAY CAPACITY ANALYSIS (100-YR STORM)

ROADWAY CAPACITY ANALYSIS (100-YR STORM)

The roadways are able to accommodate runoff from a 100-year storm event. The Rational Method was used to compute the runoff for the various drainage basins. FlowMaster by Haestad Methods, Inc. was used to compute the maximum capacity of the various roadways.





Composite Runoff Coefficients (100-year Storm)

Drainage Area	Area (Acres)			Composite C
	Paved Streets [C=0.93]	Residential (R-2) [C=0.55]	Residential (5 Ac.) [C=0.30]	
A	0.22	0.00	0.20	**0.63**
B	0.21	0.00	0.00	**0.93**
C	0.07	1.50	4.77	**0.37**
D	0.75	0.02	0.24	**0.77**
E	1.02	0.64	2.15	**0.51**
F	0.07	0.23	0.42	**0.44**
G	0.07	0.00	0.00	**0.93**
H	0.70	1.23	4.47	**0.42**
I	0.37	0.00	0.00	**0.93**
J	0.34	0.00	0.00	**0.93**
K	0.20	0.00	0.86	**0.42**
L	0.24	0.00	0.00	**0.93**
M	0.21	0.00	0.00	**0.93**
N	0.17	0.00	0.01	**0.90**
O	0.44	0.00	0.85	**0.51**
P	0.43	0.00	0.14	**0.78**
Q	0.21	0.77	3.15	**0.38**
R	0.16	0.19	0.30	**0.53**

Table 1

TYPICAL RUNOFF COEFFICIENTS FOR BUILT-UP AREAS

LAND USE OR SURFACE CHARACTERISTICS	AVERAGE* PERCENT IMPERVIOUS	STORM FREQUENCY "C" 2	100
Business:			
General Commercial	90	0.82	0.84
Neighborhood Commercial	70	0.60	0.80
Residential:			
R-1	10	0.20	0.40
→ R-2	20	0.38	0.55
R-4	50	0.43	0.70
R-6	50	0.45	0.75
R-10	50	0.50	0.80
R-20	50	0.55	0.80
→ 5 Acre Lot	8	0.15	0.30
Industrial:			
Limited Industrial	80	0.71	0.82
General Industrial	90	0.80	0.90
Parks, Cemeteries:	7	0.10	0.45
Playgrounds:	13	0.15	0.50
Schools:	50	0.45	0.70
Streets:			
→ Paved	100	0.87	0.93
Unpaved	95	0.80	0.90
Driveways and Walks:	96	0.87	0.93
Roofs:	90	0.80	0.90
Lawns, Sandy Soil:	0	0.00	0.20
Lawns, Clayey Soil:	0	0.05	0.50

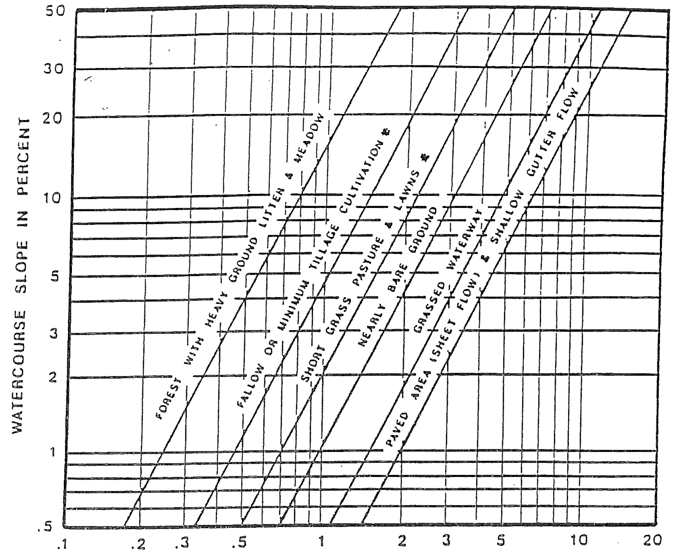
NOTE: (These Rational formula coefficients may not be valid for large basins. These coefficients are also average values and may require adjustments depending on the surface characteristics, soil type, slope, infiltration, evaporation, depression storage, etc. The Engineer shall use sound engineering judgement in selecting the proper coefficient(s).) For composite drainage areas compute "weighted" Rational formula coefficient(s).

*** Average impervious areas do not correlate directly to allowable impervious area.**

Runoff (100-year Storm)

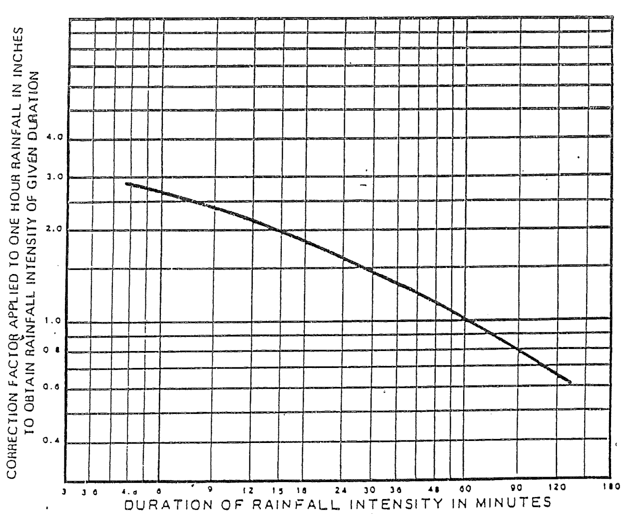
Drainage Area	C	I: T_c (minutes)	I: i_{CF}	I: i_{100} (inches)	A (acres)	Q=CIA (cfs)
A	0.63	6	2.7	5.8	0.42	**4.14**
B	0.93	6	2.7	5.8	0.21	**3.06**
C	0.37	6	2.7	5.8	6.34	**36.35**
D	0.77	6	2.7	5.8	1.01	**12.22**
E	0.51	6	2.7	5.8	3.81	**30.47**
F	0.44	6	2.7	5.8	0.72	**4.97**
G	0.93	6	2.7	5.8	0.07	**1.02**
H	0.42	6	2.7	5.8	6.40	**41.79**
I	0.93	6	2.7	5.8	0.37	**5.39**
J	0.93	6	2.7	5.8	0.34	**4.95**
K	0.42	6	2.7	5.8	1.06	**6.95**
L	0.93	6	2.7	5.8	0.24	**3.50**
M	0.93	6	2.7	5.8	0.21	**3.06**
N	0.90	6	2.7	5.8	0.18	**2.52**
O	0.51	6	2.7	5.8	1.29	**10.40**
P	0.78	6	2.7	5.8	0.57	**6.92**
Q	0.38	6	2.7	5.8	4.13	**24.49**
R	0.53	6	2.7	5.8	0.65	**5.38**

PLATE 1



ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

PLATE 2



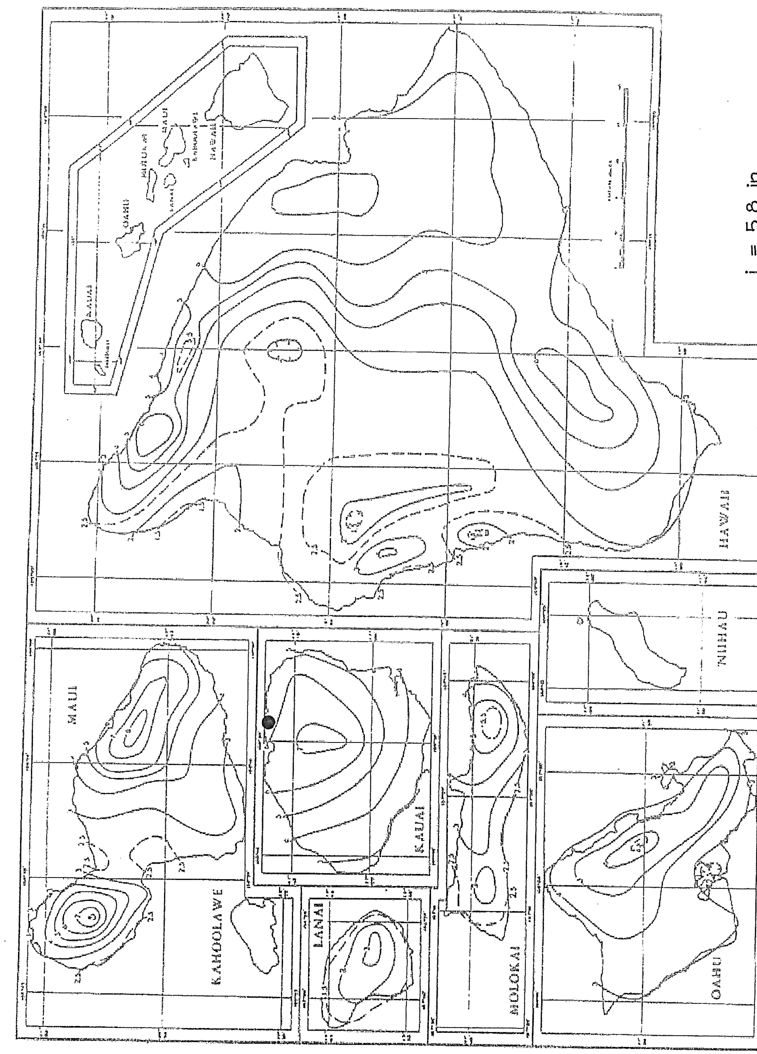
Use $T_{C,\ min}$ = 6 minutes
i_{CF} = 2.7

CORRECTION FACTOR
FOR CONVERTING 1 HR. RAINFALL TO RAINFALL INTENSITY OF VARIOUS DURATIONS

TO BE USED FOR AREA LESS THAN 100 ACRES

Plate 4

i = 5.8 in.



100-Year 1-Hour Rainfall (in.)

Roadway Capacity (100-yr Storm)

Roadway	Station	Contributing Drainage Area(s)		Runoff (cfs)		Total Runoff (cfs)	Maximum Capacity (cfs)
		Left	Right	Left	Right		
A	2+66	O	P	10.40	6.92	17.32	**85.13**
	7+25	K	L	6.95	3.50	10.45	**90.05**
	14+50	H	J	41.79	4.95	46.74	**79.59**
	18+78	H	I, J	41.79	10.34	52.13	**128.34**
	21+25	F	G	4.97	1.02	5.99	**122.69**
	27+50	D	E	12.22	30.47	42.69	**110.52**
	32+55	D	E	12.22	30.47	42.69	**134.70**
	33+75	C, D	E	48.57	30.47	79.04	**189.96**
	36+94	A	B	4.14	3.06	7.20	**71.19**
B	3+39	L, M	P, Q	6.56	31.41	37.97	**176.55**
	4+39	N	R	2.52	5.38	7.90	**215.58**

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 2+66
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope 0.014300 ft/ft
Water Surface Elevation 348.43 ft
Elevation range: 347.63 ft to 348.43 ft.

Station (ft)	Elevation (ft)
-28.00	348.43
-20.00	347.63
-12.00	348.03
0.00	348.27
12.00	348.03
20.00	347.63
28.00	348.43

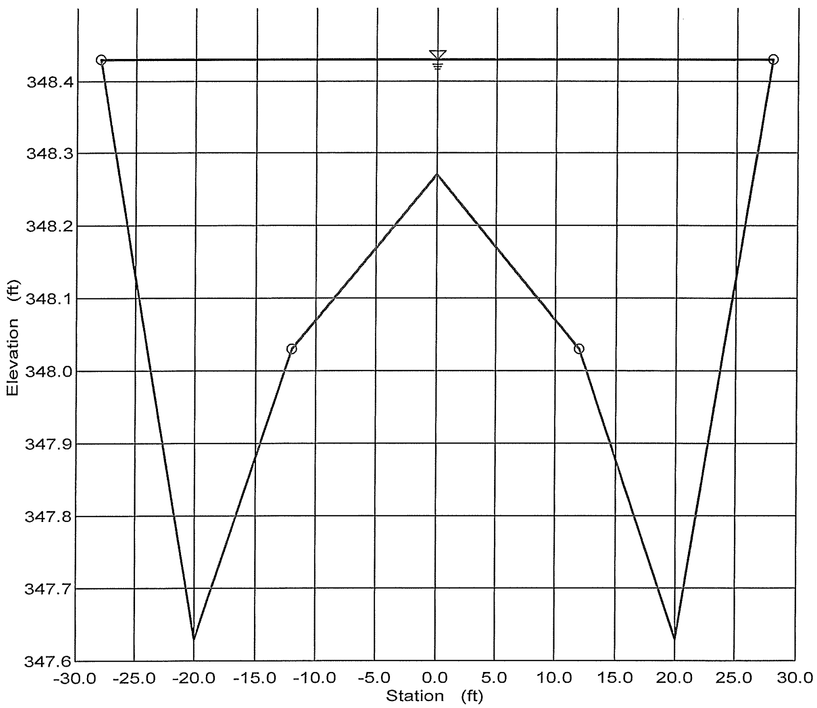
Start Station	End Station	Roughness
-28.00	-12.00	0.035
-12.00	12.00	0.015
12.00	28.00	0.035

Results		
Wtd. Mannings Coefficient	0.026	
Discharge	85.13	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	348.44	ft
Critical Slope	0.013123	ft/ft
Velocity	3.75	ft/s
Velocity Head	0.22	ft
Specific Energy	348.65	ft
Froude Number	1.04	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 2+66
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.014300	ft/ft
Water Surface Elevation	348.43	ft
Discharge	85.13	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 7+25
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope	0.016000	ft/ft
Water Surface Elevation	330.44	ft

Elevation range: 329.64 ft to 330.44 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	330.44	-28.00	-12.00	0.035
-20.00	329.64	-12.00	12.00	0.015
-12.00	330.04	12.00	28.00	0.035
0.00	330.28			
12.00	330.04			
20.00	329.64			
28.00	330.44			

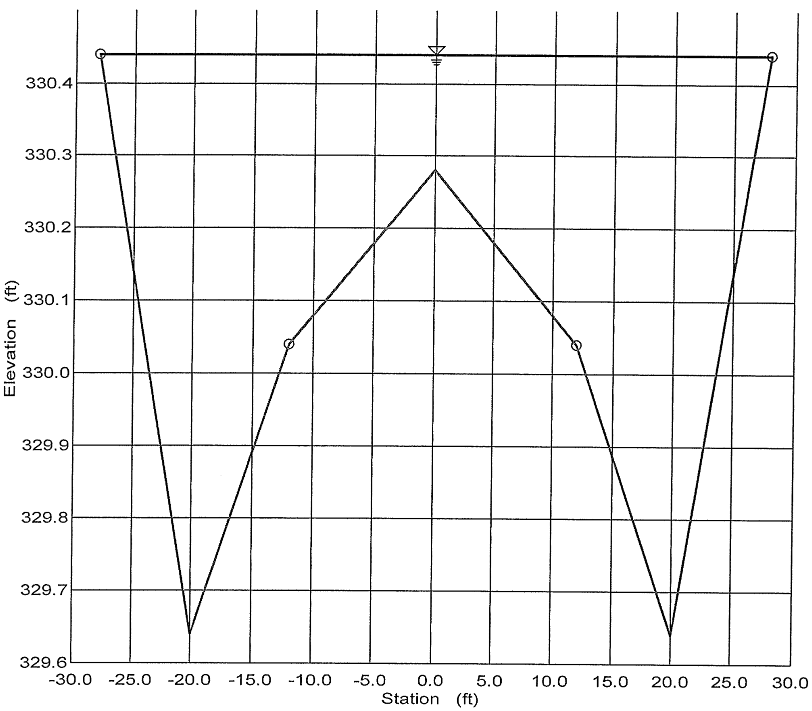
Results		
Wtd. Mannings Coefficient	0.026	
Discharge	90.05	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	330.47	ft
Critical Slope	0.012865	ft/ft
Velocity	3.96	ft/s
Velocity Head	0.24	ft
Specific Energy	330.68	ft
Froude Number	1.10	

Flow is supercritical.

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 7+25
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.016000	ft/ft
Water Surface Elevation	330.44	ft
Discharge	90.05	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 14+50
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.012500	ft/ft
Water Surface Elevation	329.24	ft

Elevation range: 328.44 ft to 329.24 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	329.24	-28.00	-12.00	0.035
-20.00	328.44	-12.00	12.00	0.015
-12.00	328.84	12.00	28.00	0.035
0.00	329.08			
12.00	328.84			
20.00	328.44			
28.00	329.24			

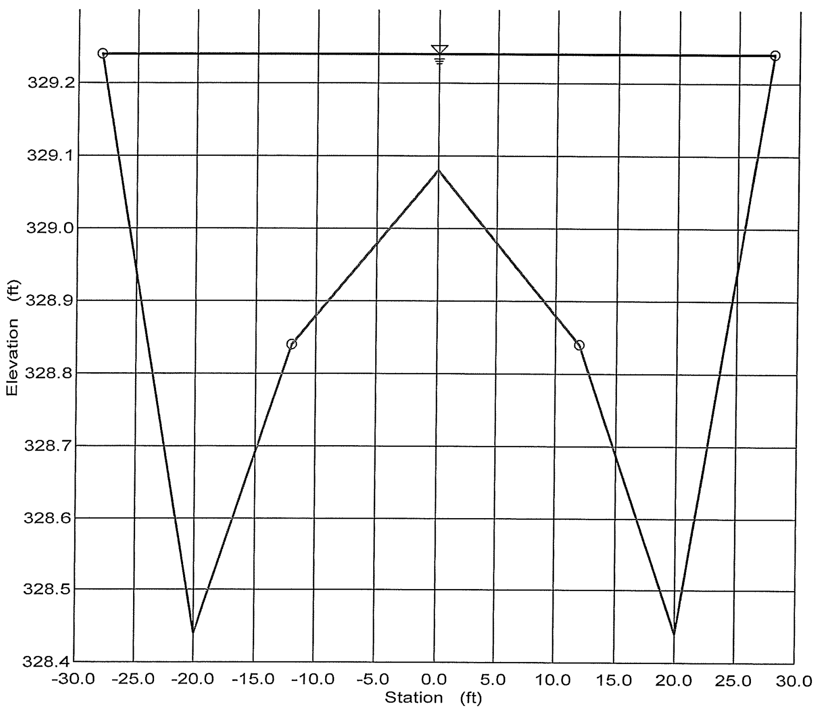
Results		
Wtd. Mannings Coefficient	0.026	
Discharge	79.59	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	329.23	ft
Critical Slope	0.013439	ft/ft
Velocity	3.50	ft/s
Velocity Head	0.19	ft
Specific Energy	329.43	ft
Froude Number	0.97	

Flow is subcritical.

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 14+50
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.012500	ft/ft
Water Surface Elevation	329.24	ft
Discharge	79.59	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 18+78
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope	0.032500	ft/ft
Water Surface Elevation	317.94	ft

Elevation range: 317.14 ft to 317.94 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	317.94	-28.00	-12.00	0.035
-20.00	317.14	-12.00	12.00	0.015
-12.00	317.54	12.00	28.00	0.035
0.00	317.78			
12.00	317.54			
20.00	317.14			
28.00	317.94			

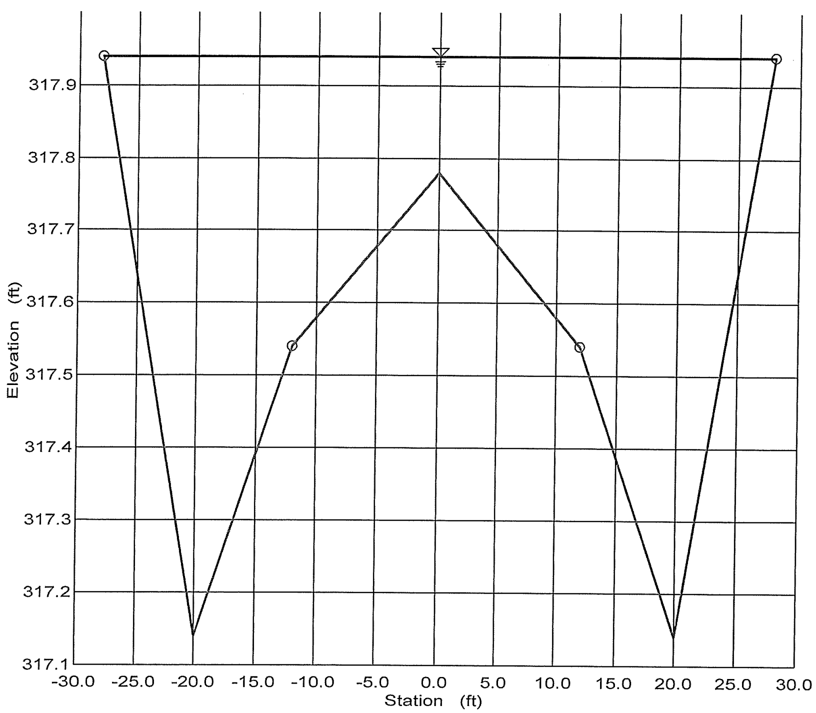
Results		
Wtd. Mannings Coefficient	0.026	
Discharge	128.34	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	318.08	ft
Critical Slope	0.011367	ft/ft
Velocity	5.65	ft/s
Velocity Head	0.50	ft
Specific Energy	318.44	ft
Froude Number	1.56	

Flow is supercritical.

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 18+78
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.032500	ft/ft
Water Surface Elevation	317.94	ft
Discharge	128.34	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 21+25
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope	0.029700	ft/ft
Water Surface Elevation	306.46	ft

Elevation range: 305.66 ft to 306.46 ft.

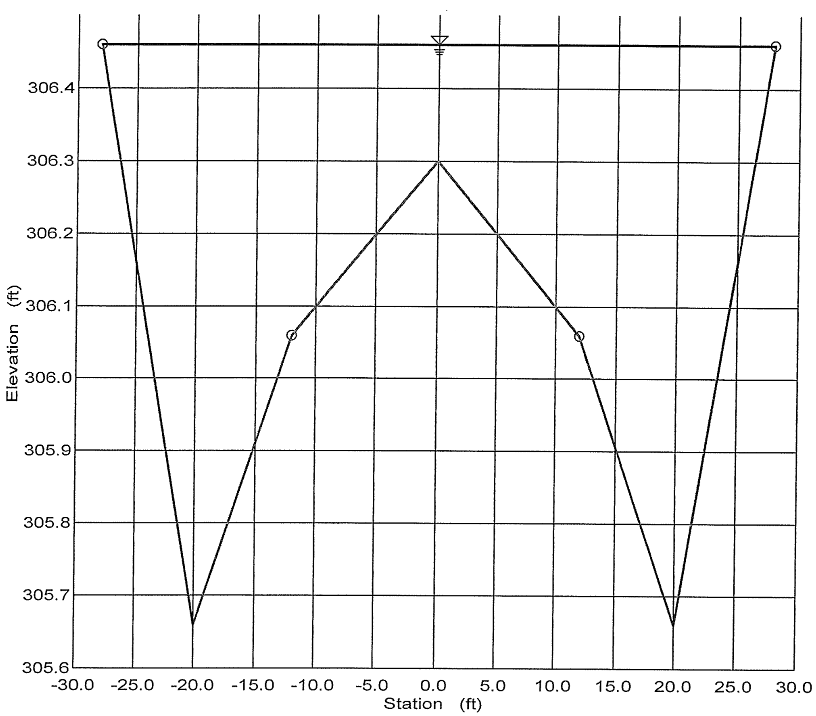
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	306.46	-28.00	-12.00	0.035
-20.00	305.66	-12.00	12.00	0.015
-12.00	306.06	12.00	28.00	0.035
0.00	306.30			
12.00	306.06			
20.00	305.66			
28.00	306.46			

Results		
Wtd. Mannings Coefficient	0.026	
Discharge	122.69	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	306.58	ft
Critical Slope	0.011544	ft/ft
Velocity	5.40	ft/s
Velocity Head	0.45	ft
Specific Energy	306.91	ft
Froude Number	1.49	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 21+25
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.029700	ft/ft
Water Surface Elevation	306.46	ft
Discharge	122.69	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 27+50
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope	0.024100	ft/ft
Water Surface Elevation	288.29	ft

Elevation range: 287.49 ft to 288.29 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	288.29	-28.00	-12.00	0.035
-20.00	287.49	-12.00	12.00	0.015
-12.00	287.89	12.00	28.00	0.035
0.00	288.13			
12.00	287.89			
20.00	287.49			
28.00	288.29			

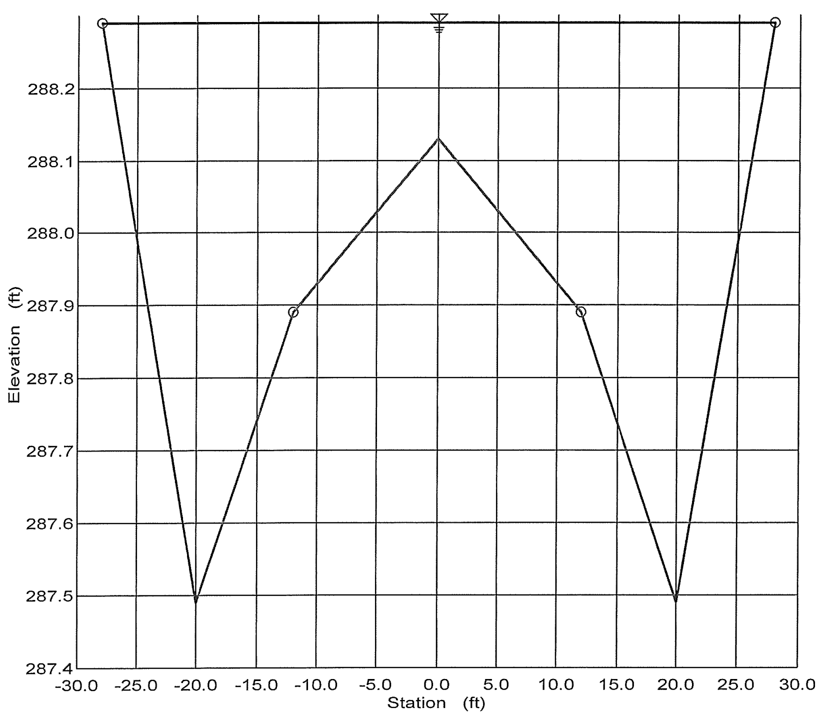
Results		
Wtd. Mannings Coefficient	0.026	
Discharge	110.52	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	288.38	ft
Critical Slope	0.011969	ft/ft
Velocity	4.86	ft/s
Velocity Head	0.37	ft
Specific Energy	288.66	ft
Froude Number	1.35	

Flow is supercritical.

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 27+50
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.024100	ft/ft
Water Surface Elevation	288.29	ft
Discharge	110.52	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 32+55
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope	0.035800	ft/ft
Water Surface Elevation	270.79	ft

Elevation range: 269.99 ft to 270.79 ft.

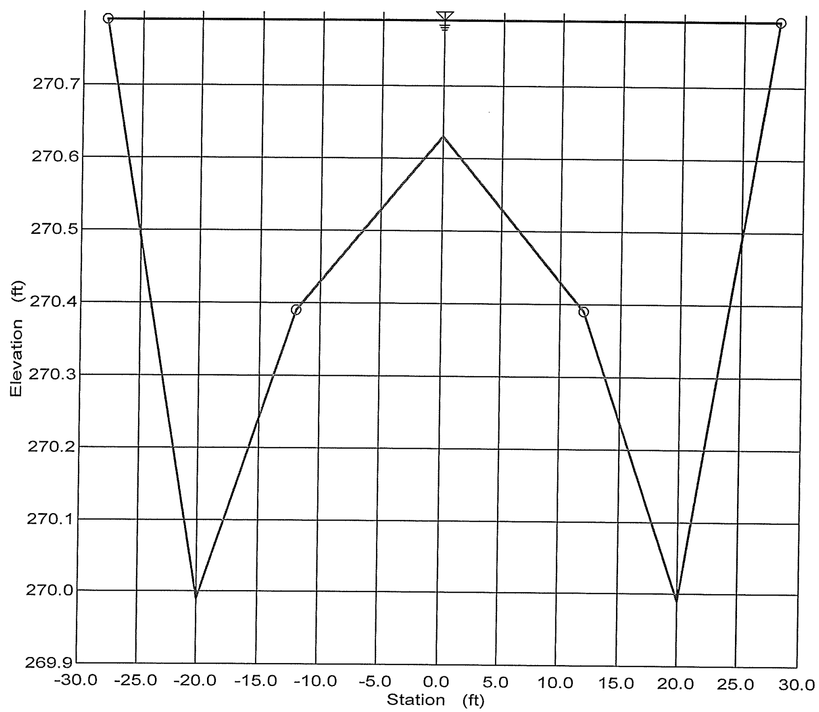
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	270.79	-28.00	-12.00	0.035
-20.00	269.99	-12.00	12.00	0.015
-12.00	270.39	12.00	28.00	0.035
0.00	270.63			
12.00	270.39			
20.00	269.99			
28.00	270.79			

Results		
Wtd. Mannings Coefficient	0.026	
Discharge	134.70	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	270.95	ft
Critical Slope	0.011181	ft/ft
Velocity	5.93	ft/s
Velocity Head	0.55	ft
Specific Energy	271.34	ft
Froude Number	1.64	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 32+55
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.035800	ft/ft
Water Surface Elevation	270.79	ft
Discharge	134.70	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 33+75
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope 0.071200 ft/ft

Water Surface Elevation 263.84 ft

Elevation range: 263.04 ft to 263.84 ft.

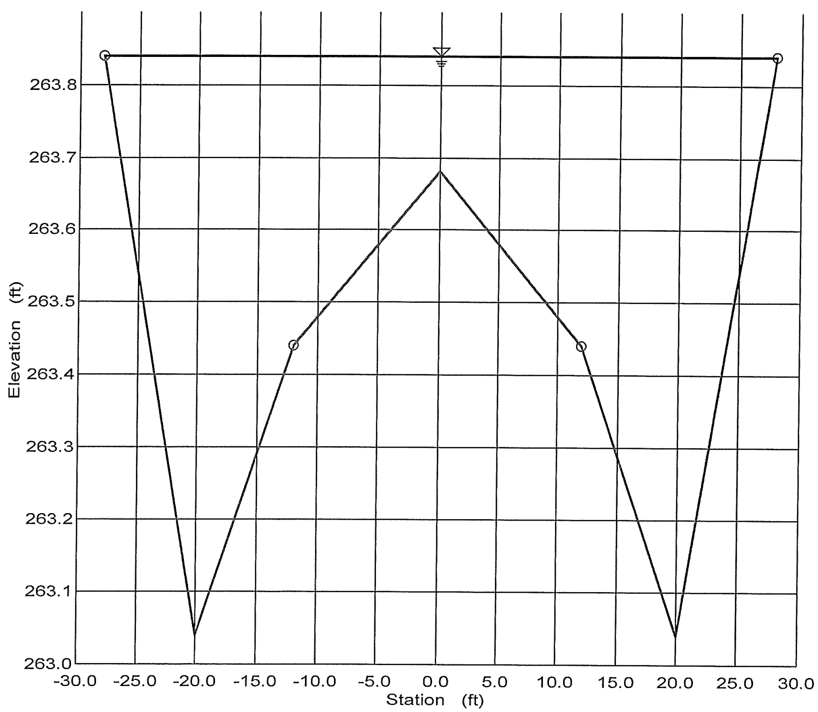
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	263.84	-28.00	-12.00	0.035
-20.00	263.04	-12.00	12.00	0.015
-12.00	263.44	12.00	28.00	0.035
0.00	263.68			
12.00	263.44			
20.00	263.04			
28.00	263.84			

Results		
Wtd. Mannings Coefficient	0.026	
Discharge	189.96	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	264.14	ft
Critical Slope	0.009983	ft/ft
Velocity	8.36	ft/s
Velocity Head	1.09	ft
Specific Energy	264.93	ft
Froude Number	2.31	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 33+75
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.071200	ft/ft
Water Surface Elevation	263.84	ft
Discharge	189.96	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 36+94
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope	0.010000	ft/ft
Water Surface Elevation	267.19	ft

Elevation range: 266.39 ft to 267.19 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	267.19	-28.00	-12.00	0.035
-20.00	266.39	-12.00	12.00	0.015
-12.00	266.79	12.00	28.00	0.035
0.00	267.03			
12.00	266.79			
20.00	266.39			
28.00	267.19			

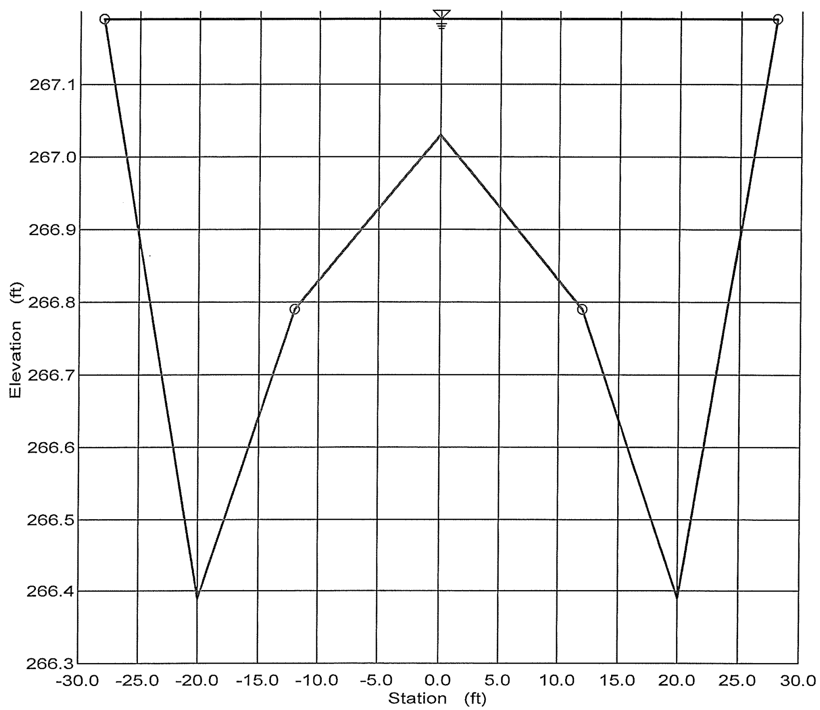
Results		
Wtd. Mannings Coefficient	0.026	
Discharge	71.19	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	267.15	ft
Critical Slope	0.013965	ft/ft
Velocity	3.13	ft/s
Velocity Head	0.15	ft
Specific Energy	267.34	ft
Froude Number	0.87	

Flow is subcritical.

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road A Sta. 36+94
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.026	
Channel Slope	0.010000	ft/ft
Water Surface Elevation	267.19	ft
Discharge	71.19	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road B Sta. 3+39
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Channel Slope	0.061500	ft/ft
Water Surface Elevation	312.02	ft

Elevation range: 311.22 ft to 312.02 ft.

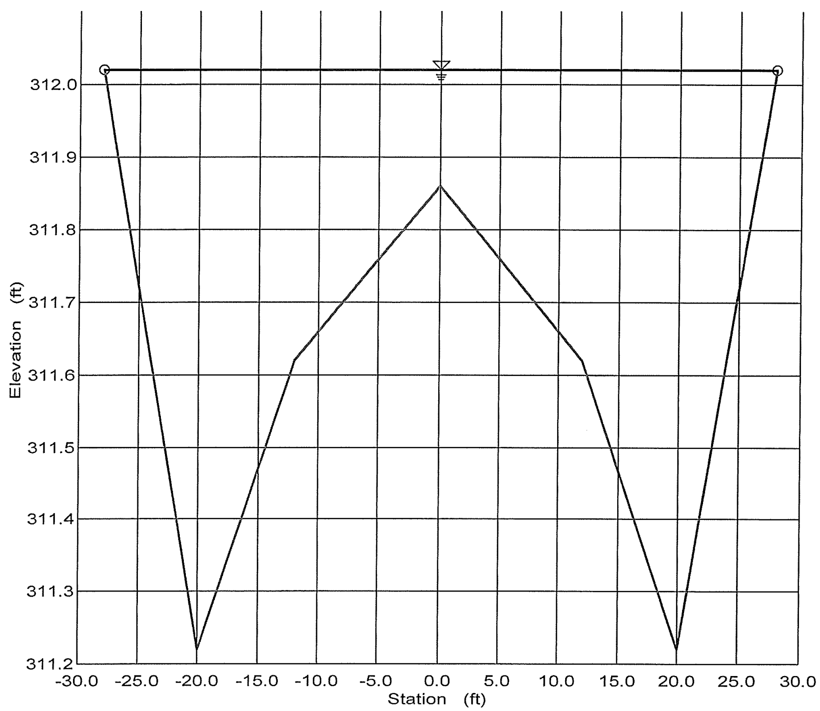
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	312.02	-28.00	28.00	0.035
-20.00	311.22			
-12.00	311.62			
0.00	311.86			
12.00	311.62			
20.00	311.22			
28.00	312.02			

Results		
Wtd. Mannings Coefficient	0.035	
Discharge	130.93	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	312.17	ft
Critical Slope	0.021944	ft/ft
Velocity	5.76	ft/s
Velocity Head	0.52	ft
Specific Energy	312.54	ft
Froude Number	1.60	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road B Sta. 3+39
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.035	
Channel Slope	0.061500	ft/ft
Water Surface Elevation	312.02	ft
Discharge	130.93	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road B Sta. 4+39
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.091700	ft/ft
Water Surface Elevation	313.54	ft

Elevation range: 312.74 ft to 313.54 ft.

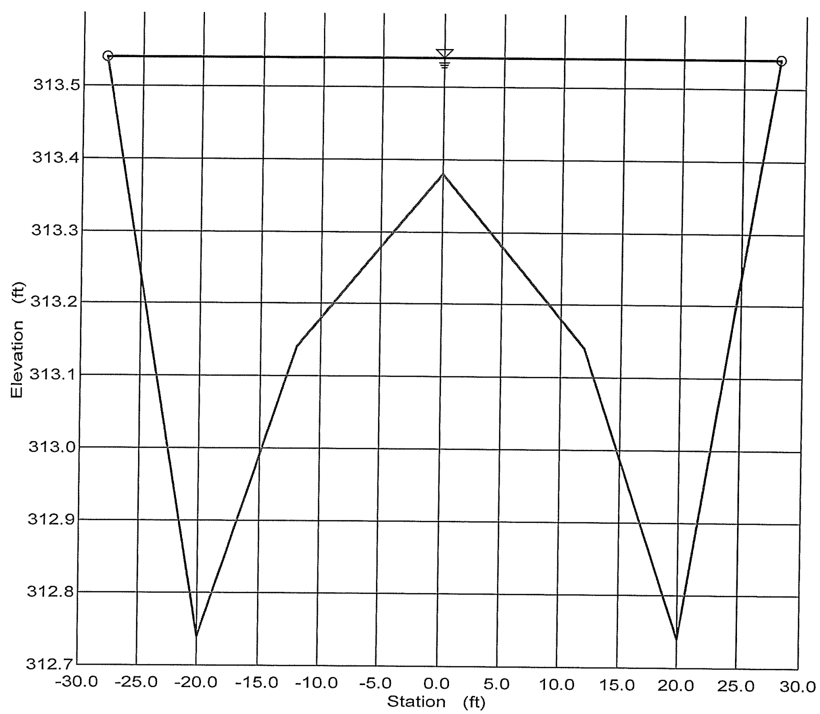
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.00	313.54	-28.00	28.00	0.035
-20.00	312.74			
-12.00	313.14			
0.00	313.38			
12.00	313.14			
20.00	312.74			
28.00	313.54			

Results		
Wtd. Mannings Coefficient	0.035	
Discharge	159.88	cfs
Flow Area	22.72	ft²
Wetted Perimeter	56.10	ft
Top Width	56.00	ft
Height	0.80	ft
Critical Depth	313.77	ft
Critical Slope	0.021070	ft/ft
Velocity	7.04	ft/s
Velocity Head	0.77	ft
Specific Energy	314.31	ft
Froude Number	1.95	
Flow is supercritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\bran\06-192 (drainage system)\06-192.fm2
Worksheet	Road B Sta. 4+39
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.035	
Channel Slope	0.091700	ft/ft
Water Surface Elevation	313.54	ft
Discharge	159.88	cfs



Unlined Channels	Manning's "n"	Maximum Velocity (fps)
Rock	0.035	10
Ledge coral or lime stone	0.025	10
Earth with vegetation (grassed)	0.035	5

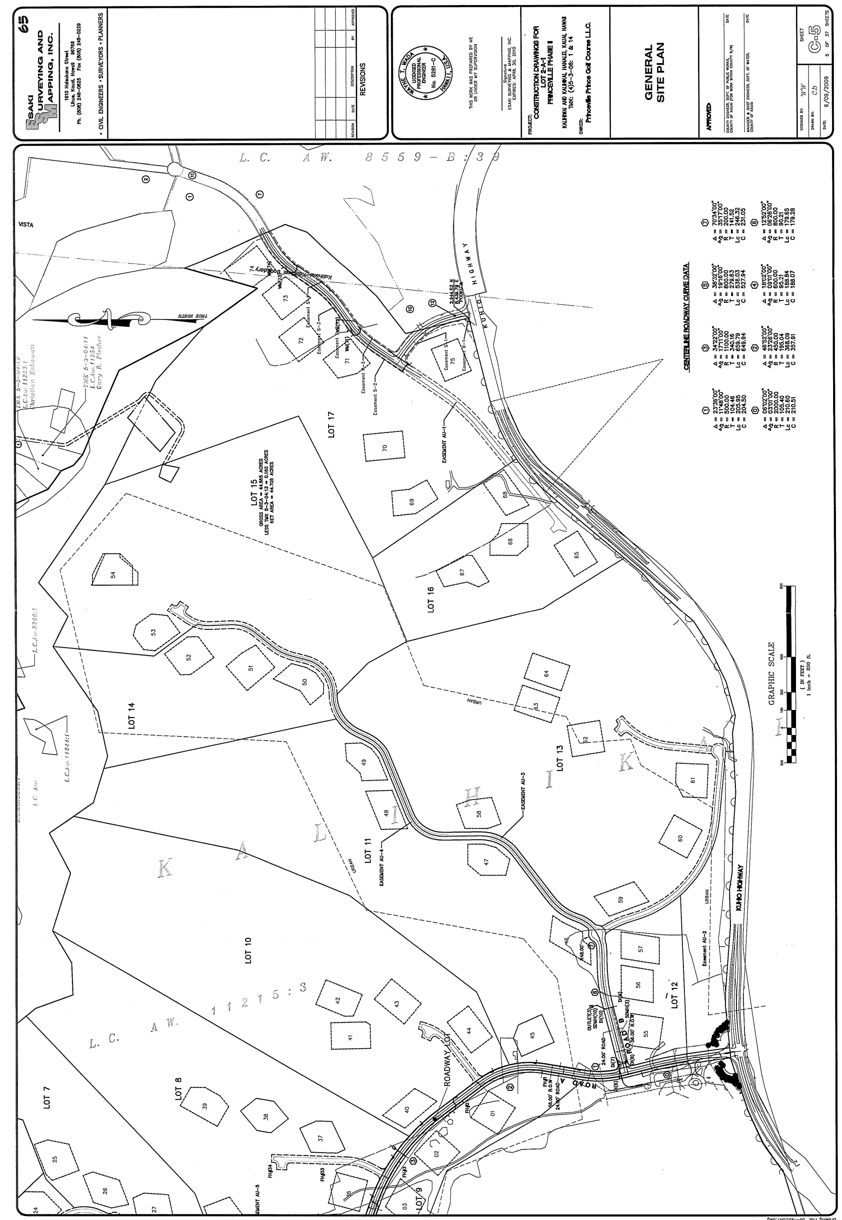
Lined Channels	Manning's "n"	Maximum Velocity (fps)
Conc., trowel finish	0.013	No limitation
Conc., smooth wood forms	0.015	No limitation
Gunite	0.020	20
Grouted riprap and cement rubble masonry (CRM)	0.025	20
Conc., street curb and gutter	0.015	No limitation
Asphalt paved street	0.015	Roadway grade limitation

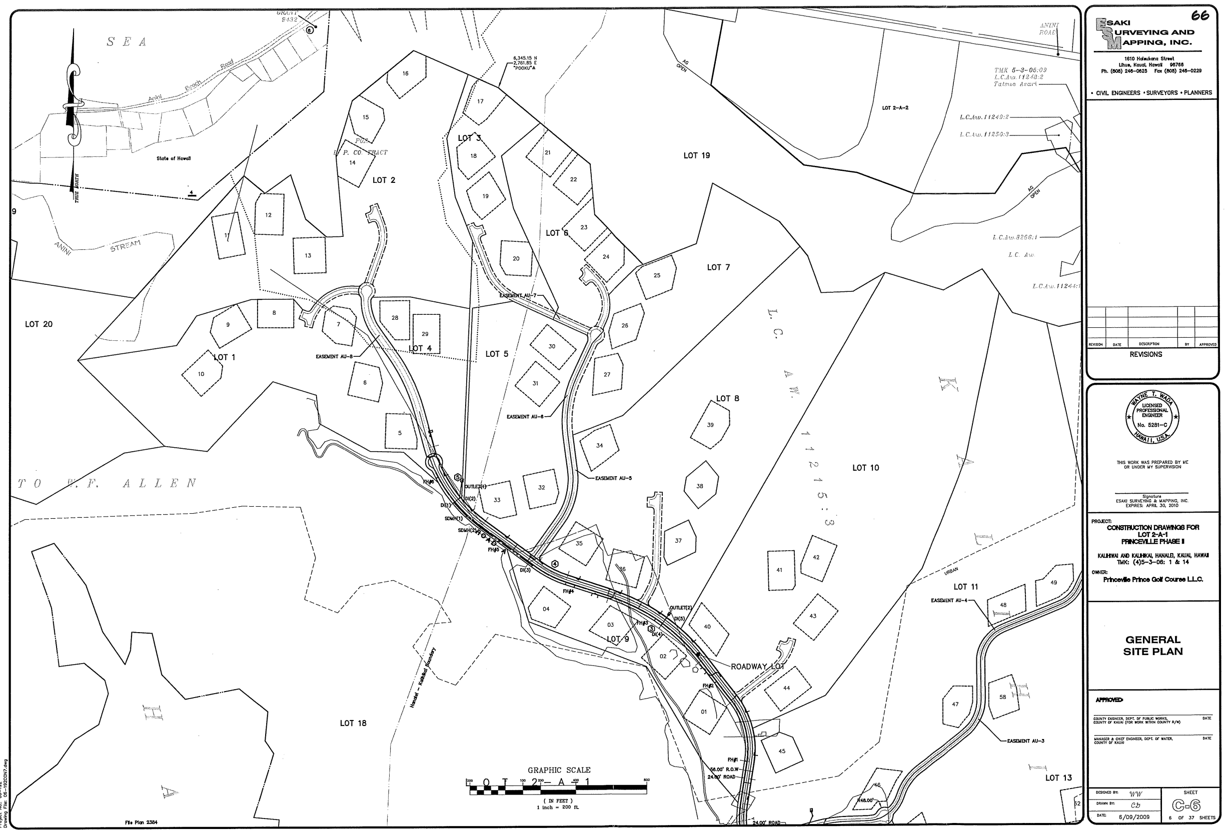
Velocities between 5 feet per second and 10 feet per second will be permitted in material such as cemented gravel, hard pan, or mud rock depending upon its hardness and resistance to scouring. Borings and material samples shall be submitted for evaluation before velocities exceeding 5 feet per second will be permitted.

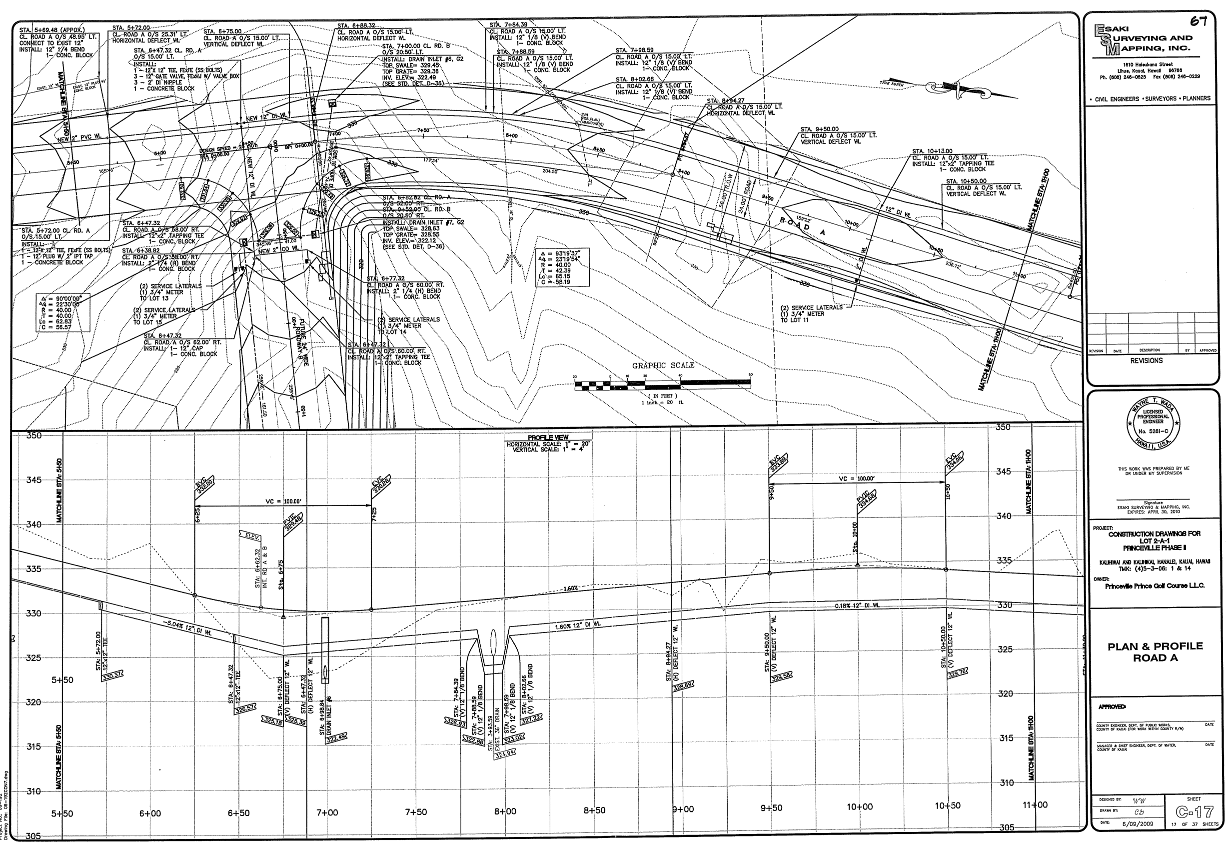
5.3.3 Channel Lining:

a. All drainage channels shall be fully lined for maintenance purposes. Private unlined drainage channels will be allowed if integrated into a multi-purpose drainage facility under the control of the owner.

APPENDIX – SELECT SHEETS FROM CONSTRUCTION DRAWINGS FOR LOT 2-A-1, PRINCEVILLE PHASE II




66
ESAKI SURVEYING AND MAPPING, INC.
1610 Haleukana Street
Lihue, Kauai, Hawaii 96766
Ph. (808) 246-0625 Fax (808) 246-0229
• CIVIL ENGINEERS • SURVEYORS • PLANNERS
REVISIONS
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
ESAKI SURVEYING & MAPPING, INC. EXPIRES: APRIL 30, 2010
PROJECT:
CONSTRUCTION DRAWINGS FOR LOT 2-A-1 PRINCEVILLE PHASE II
KALIHIWAI AND KALIHIKAI, HANALEI, KAUAI, HAWAII TMK: (4)5-3-06: 1 & 14
OWNER:
Princeville Prince Golf Course L.L.C.
GENERAL SITE PLAN
APPROVED:
GRAPHIC SCALE
(IN FEET)
1 inch = 200 ft.
LOT 2-A-1
SEA
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 13
LOT 18
LOT 19
LOT 20
ROADWAY LOT
SHEET C-6
6 OF 37 SHEETS
DATE 6/09/2009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1610 Haleukana Street
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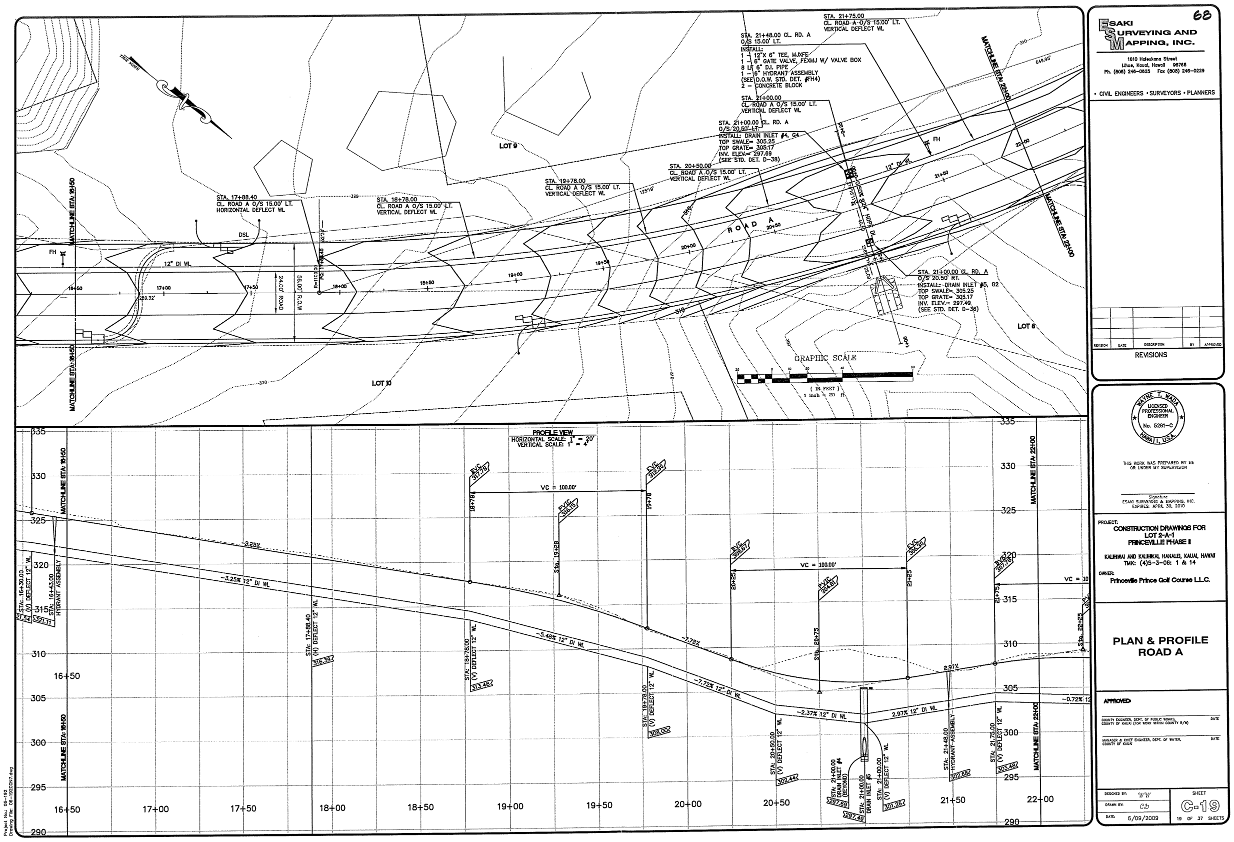
PROJECT:
CONSTRUCTION DRAWINGS FOR LOT 2-A-1 PRINCEVILLE PHASE II
KALIHIWAI AND KALIHIKAI, HANALEI, KAUAI, HAWAII TMK: (4)5-3-06: 1 & 14
OWNER:
Princeville Prince Golf Course L.L.C.
PLAN & PROFILE ROAD A
APPROVED:
GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.
PROFILE VIEW
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'
VC = 100.00'
MATCHLINE STA. 5+50
MATCHLINE STA. 11+00
5+50
6+00
6+50
7+00
7+50
8+00
8+50
9+00
9+50
10+00
10+50
11+00
SHEET C-17
17 OF 37 SHEETS
DATE 6/09/2009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ESAKI SURVEYING AND MAPPING, INC.
1610 Haleukana Street
Lihue, Kauai, Hawaii 96766
Ph. (808) 246-0625 Fax (808) 246-0229
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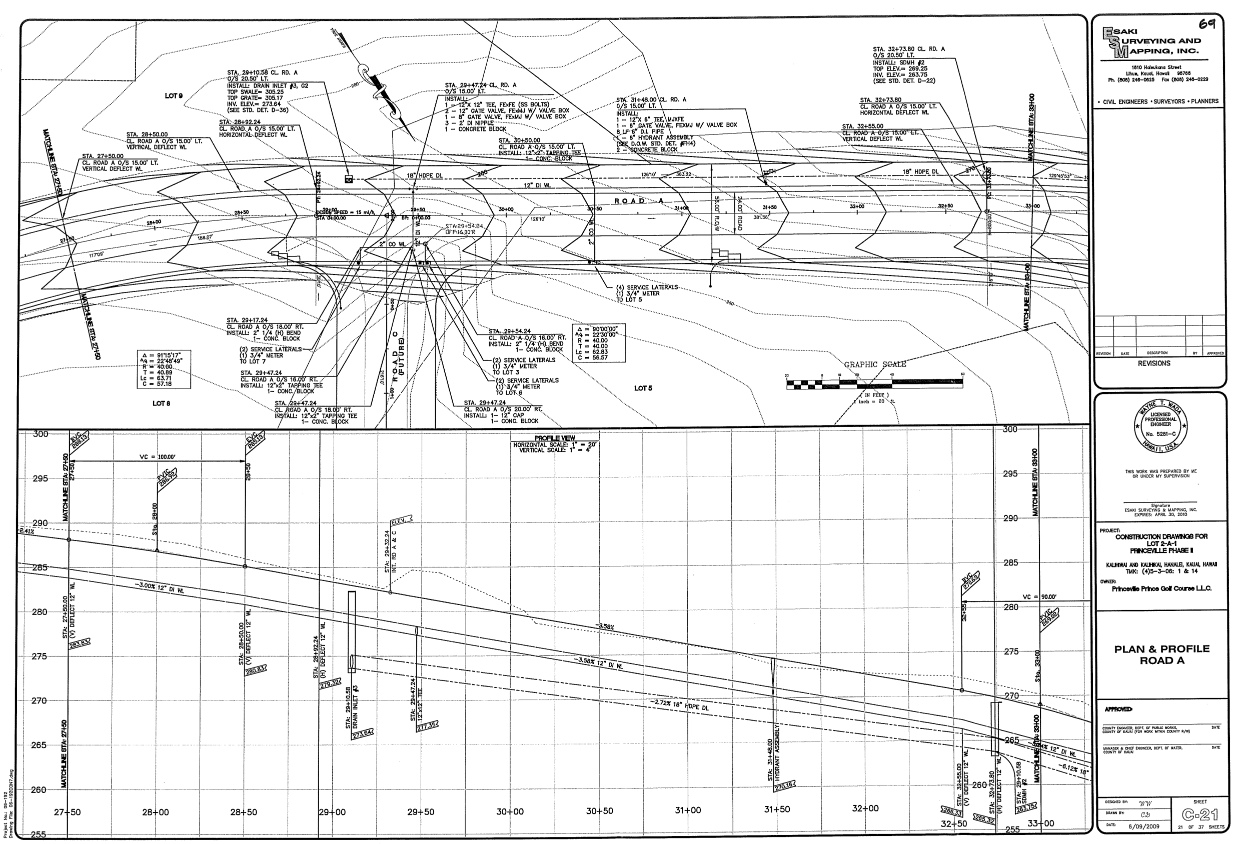
REVISIONS
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
PROJECT: CONSTRUCTION DRAWINGS FOR LOT 2-A-1 PRINCEVILLE PHASE II
KALIHIWAI AND KALIHIKAI, HANALEI, KAUAI, HAWAII
TMK: (4)5-3-06: 1 & 14
OWNER: Princeville Prince Golf Course L.L.C.
PLAN & PROFILE
ROAD A
APPROVED
PROFILE VIEW
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'
GRAPHIC SCALE
ROAD A
LOT 9
LOT 10
LOT 8
MATCHLINE STA. 16+50
MATCHLINE STA. 22+00
C-19
DATE: 5/09/2009
19 OF 37 SHEETS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ESAKI SURVEYING AND MAPPING, INC.
1610 Haleukana Street
Lihue, Kauai, Hawaii 96766
Ph. (808) 246-0625 Fax (808) 246-0229
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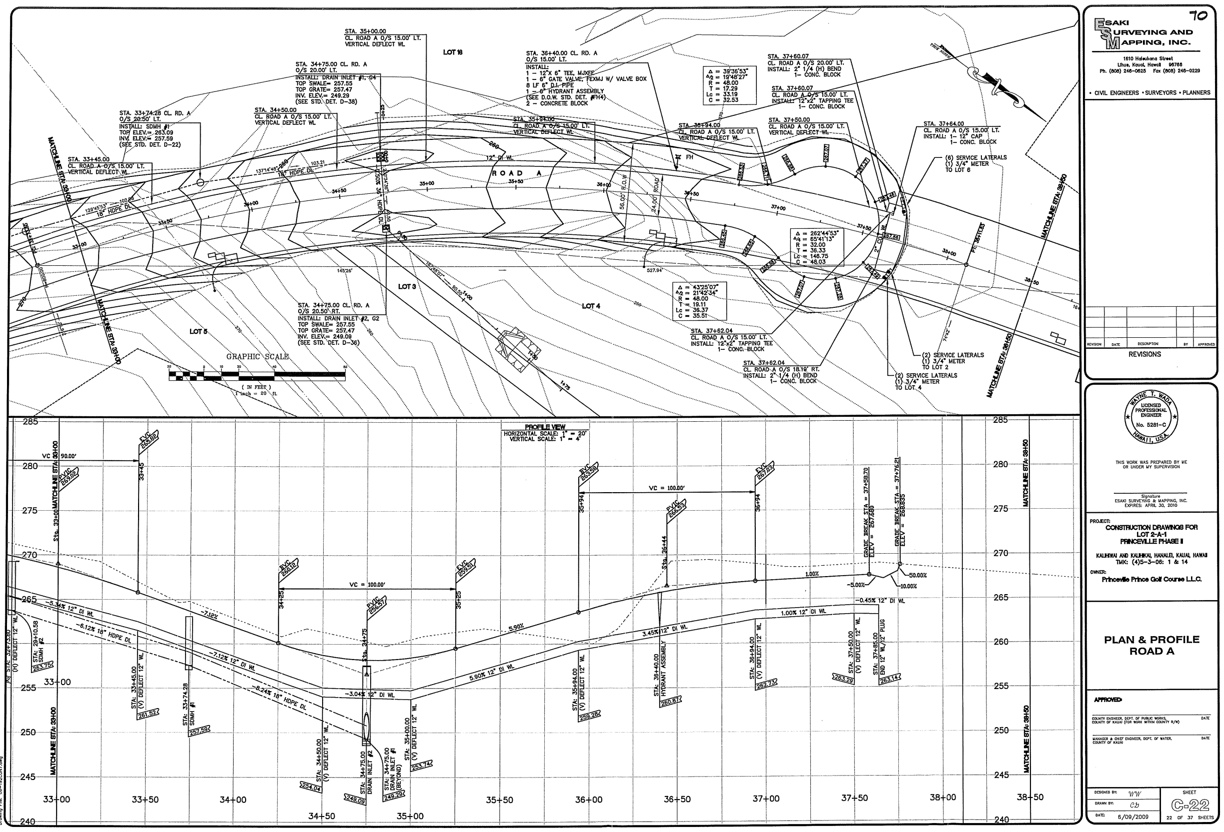
REVISIONS
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
PROJECT: CONSTRUCTION DRAWINGS FOR LOT 2-A-1 PRINCEVILLE PHASE II
KALIHIWAI AND KALIHIKAI, HANALEI, KAUAI, HAWAII
TMK: (4)5-3-06: 1 & 14
OWNER: Princeville Prince Golf Course L.L.C.
PLAN & PROFILE
ROAD A
APPROVED
PROFILE VIEW
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'
GRAPHIC SCALE
ROAD A
ROAD C (FUTURE)
LOT 9
LOT 8
LOT 5
MATCHLINE STA. 27+50
MATCHLINE STA. 33+00
C-21
DATE: 5/09/2009
21 OF 37 SHEETS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Lihue, Kauai, Hawaii 96766
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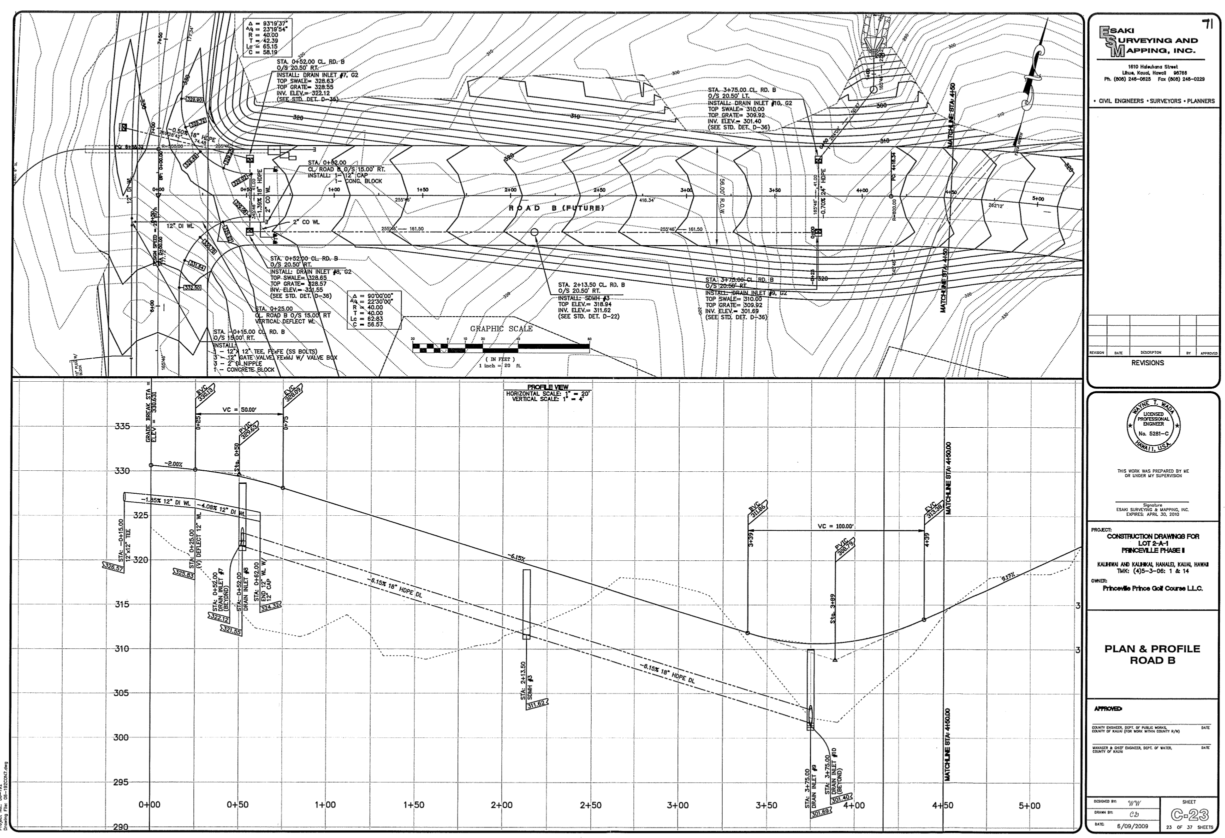
REVISIONS
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
CONSTRUCTION DRAWINGS FOR
LOT 2-A-1
PRINCEVILLE PHASE II
Princeville Prince Golf Course L.L.C.
PLAN & PROFILE
ROAD A
APPROVED:
PROFILE VIEW
ROAD A
GRAPHIC SCALE
LOT 3
LOT 4
LOT 5
LOT 16
C-22
23 OF 37 SHEETS
6/09/2009
70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Lihue, Kauai, Hawaii 96766
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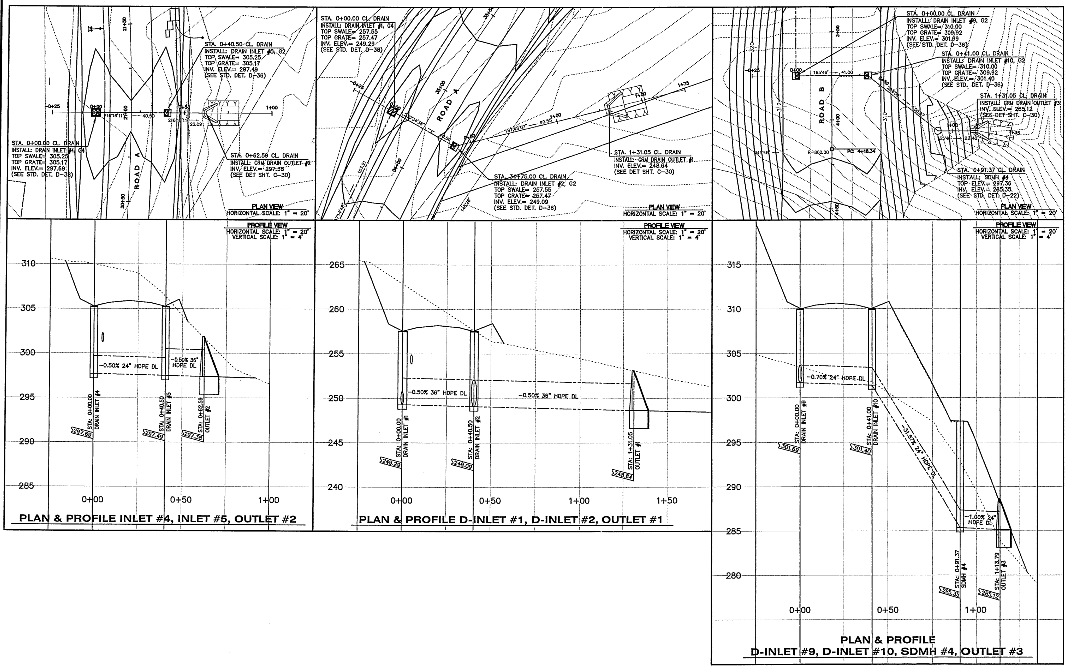
REVISIONS
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
CONSTRUCTION DRAWINGS FOR
LOT 2-A-1
PRINCEVILLE PHASE II
Princeville Prince Golf Course L.L.C.
PLAN & PROFILE
ROAD B
APPROVED:
PROFILE VIEW
ROAD B (FUTURE)
GRAPHIC SCALE
C-23
23 OF 37 SHEETS
6/09/2009
71



ESAKI SURVEYING AND MAPPING, INC. 72

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• CIVIL ENGINEERS • SURVEYORS • PLANNERS

REVISION	DATE	DESCRIPTION	BY	APPROVED

REVISIONS

WAYNE T. WADA LICENSED PROFESSIONAL ENGINEER No. 5281-C HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Signature
ESAKI SURVEYING & MAPPING, INC.
EXPIRES: APRIL 30, 2010

PROJECT:
CONSTRUCTION DRAWINGS FOR
LOT 2-A-1
PRINCEVILLE PHASE II
KALIHIWAI AND KALIHIKAI, HANALEI, KAUAI, HAWAII
TMK: (4)5-3-06: 1 & 14
OWNER:
Princeville Prince Golf Course L.L.C.

PLAN & PROFILE
DRAINLINE

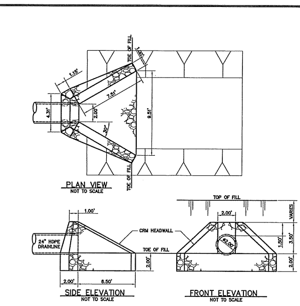
APPROVED:

COUNTY ENGINEER, DEPT. OF PUBLIC WORKS, COUNTY OF KAUAI (FOR WORK WITHIN COUNTY R/W) DATE

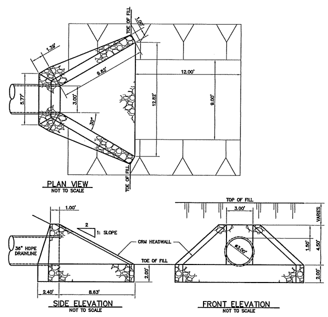
MANAGER & CHIEF ENGINEER, DEPT. OF WATER, COUNTY OF KAUAI DATE

DESIGNED BY: WW
DRAWN BY: CB
DATE: 6/09/2009
SHEET C-25
35 OF 37 SHEETS

Project No.: 06-192
Drawing File: 06-192CN.dwg



OUTLET #3
CEMENT RUBBLE MASONRY STRUCTURE
NOT TO SCALE



OUTLET #1, OUTLET #2 & INLET #1
CEMENT RUBBLE MASONRY STRUCTURE
NOT TO SCALE

ESAKI SURVEYING AND MAPPING, INC. 73

1610 Haleukana Street
Lihue, Kauai, Hawaii 96766
Ph. (808) 246-0625 Fax (808) 246-0229

• CIVIL ENGINEERS • SURVEYORS • PLANNERS

REVISION	DATE	DESCRIPTION	BY	APPROVED

REVISIONS

WAYNE T. WADA LICENSED PROFESSIONAL ENGINEER No. 5281-C HAWAII, U.S.A.

MY LICENSE EXPIRES : APRIL, 2010
THIS WORK WAS PREPARED
BY ME OR UNDER MY SUPERVISION

PROJECT:
CONSTRUCTION DRAWINGS FOR
LOT 2-A-1
PRINCEVILLE PHASE II
KALIHIWAI AND KALIHIKAI, HANALEI, KAUAI, HAWAII
TMK: (4)5-3-06: 1 & 14
OWNER:
Princeville Prince Golf Course L.L.C.

MISCELLANEOUS
DETAILS

APPROVED:
N/A
COUNTY ENGINEER, DEPT. OF PUBLIC WORKS, COUNTY OF KAUAI (FOR WORK WITHIN COUNTY R/W) DATE

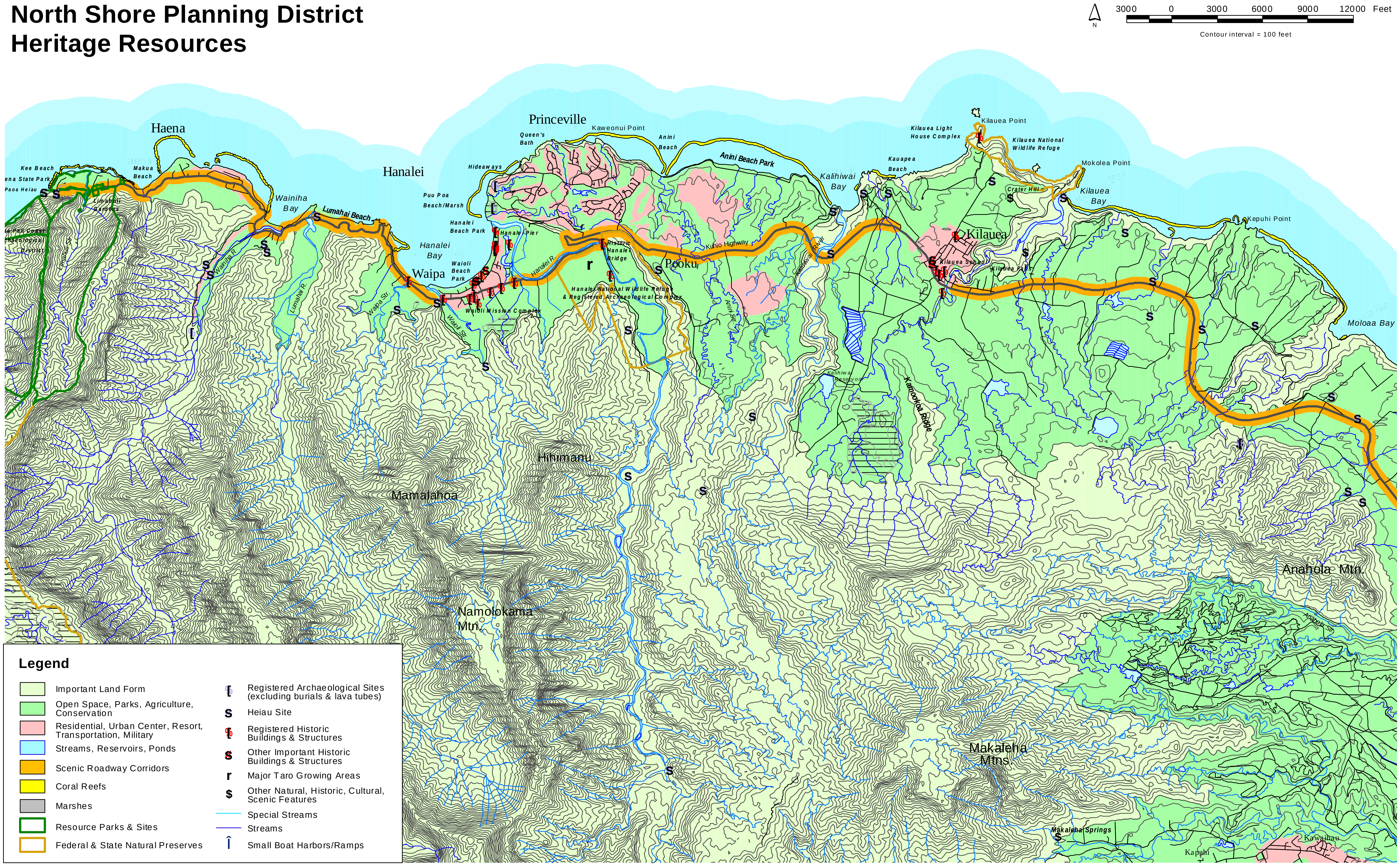
MANAGER & CHIEF ENGINEER, DEPT. OF WATER, COUNTY OF KAUAI DATE

DESIGNED BY: WW
DRAWN BY: CB
DATE: 6/09/2009
SHEET C-30
36 OF 37 SHEETS

Project No.: 06-192
Drawing File: 06-192C.dwg

APPENDIX L. NORTH SHORE PLANNING DISTRICT HERITAGE RESOURCES

North Shore Planning District
Heritage Resources



M. Princeville Hydrology Study

TNWRE
Tom Nance Water
Resource Engineering

No. of pages: 8
Email: mloo@princeville.com

Original ☑ will ☐ will not be mailed to you.

August 27, 2009
09-208.r1 (09-51)

MEMORANDUM

To: Mike Loo - Princeville

From: Tom Nance

Subject: Potential Impact on Groundwater of the Proposed Princeville Agricultural Subdivision

Introduction

Princeville Golf Course, LLC has filed a motion with the State Land Use Commission (LUC) to revert the land use designation of a 120-acre area in Princeville from Urban to Agriculture. This will enable the 120-acre area to be incorporated into a proposed agricultural subdivision that would encompass about 480 acres and have up to 75 dwellings. The 120-acre petition area is outlined in red on Figure 1. If the motion is granted, the area could ultimately be developed with up to 15 homesites, each of one-acre size, and portions of two other, similar-sized homesites (also shown on Figure 1). The remainder of the 120-acre area, amounting to about 104 acres, would remain essentially unchanged as unirrigated pasture and steeply sloping and heavily forested drainage ravines.

This memo and its attachments provide an assessment of the impact of this development on groundwater resources. Because the 120-acre area is part of the larger 480-acre Agricultural Subdivision (Lots 1 through 17 on Figure 1), the impacts of both areas are considered throughout the assessment.

Development Actions That May Impact Groundwater

Three actions resulting from the project's development have the potential to impact groundwater resources. These are: (1) use of groundwater for potable consumption and landscape irrigation; (2) subsurface disposal of wastewater treated in individual septic tank and leach field systems; and (3) percolation of excess applied irrigation water on residential landscaping. Each of these is described below.

Water Use for Potable Consumption and Landscape Irrigation. Water for all of the Agricultural Subdivision would be supplied by the Princeville Utilities Company, Inc. (PUCI) system. PUCI is a private, PUC-regulated company that provides water for all of the Princeville Resort. At present, its system is supplied by three wells (identified by State Nos. 1126-01, 1126-02, and 1127-02) and from three storage tanks of 1.5, 0.5, and 0.05 million gallons (MG) in size. A fourth well has been drilled and its permanent pump and connecting pipeline have been designed as an addition to the PUCI system. Table 1 summarizes information on these four wells.

Supply to the Agricultural Subdivision has been anticipated in planning by PUCI. PUCI expects the year-round average use to be 1000 gallons per day (GPD) per homesite. For the 120-acre petition area, this would amount to about 16,000 GPD. For the entire 480-acre agricultural subdivision with up to 75 homesites, the total would be 75,000 GPD. PUCI has also allocated 3500 GPD per acre for five acres of entry feature and roadway landscape irrigation. Of this 17,500 GPD, about one-third (5800 GPD) would be used on the 120-acre petition area. However, no water use to irrigate the pasture land outside of any of the one-acre homesites is anticipated.

Wastewater Treatment and Disposal. Most of the Princeville Resort is served by PUCI's wastewater collection, treatment, and disposal system. However, the proposed Agricultural Subdivision is outside of that system's service area. For the very small quantities of wastewater that will be generated, extending sewer service to the Agricultural System is simply not cost effective. As such, each of the homesites will have an individual system consisting of a septic tank and leach field. Of the 1000 GPD/homesite of expected water use, about 320 GPD would be within-building use (based on 80 GPD per person and four people per dwelling) that would be treated and disposed of in the individual septic tank and leach field systems. Total wastewater treated and disposed of in this manner within the 120-acre petition area would be about 5120 GPD. Over the entire Agricultural Subdivision, wastewater disposal would be up to 24,000 GPD.

Percolation of Excess Landscape Irrigation. As a year-round average, landscape irrigation is expected to be about 680 GPD per homesite. With the common area landscaping included, this would amount to about 16,700 GPD on the 120-acre petition area and up to 68,500 GPD over the larger, 480-acre area. If it is assumed that 15 percent of this is applied in excess of the evapotranspiration of the landscaping, about 2500 GPD would percolate below the root zone to the groundwater at depth within the 120-acre petition area. Over to 480-acre area, it would amount to about 10,300 GPD.

Hydro-Geologic Setting

Topography. The 120-acre site consists of a narrow and gently sloping (about 3 percent) plateau bounded by steep-sided drainage gullies. The steeply sloping land, defined as having slopes greater than 20 percent, comprises about 80 acres or 67 percent of the 120-acre site. The planned one-acre homesites would be arrayed along the moderately sloping plateau. Drainage would occur laterally into the adjacent gulches. Topography of the 120-acre site is typical for the remainder of the 480-acre Agricultural Subdivision.

Geology. All of the proposed 480-acre Agricultural Subdivision would be on the gently sloping plateau created by latter stage volcanics of the Koloa formation that has been incised by a number of eroded drainage gullies. Three boreholes have been drilled by Geolabs, Inc. along the central plateau in the 120-acre petition area, two of them to a depth of about 90 feet. All three encountered residual (weathered in place) silty clay soil underlain by a deeply weathered sapprolite. The two deeper boreholes encountered water seeping into the boreholes at several depths in the sapprolite, but did not encounter a groundwater body (the bottoms of these boreholes were more than 150 feet above sea level). These conditions are typical across the entire Princeville plateau.

The thickness of the latter stage, Koloa volcanics is not known, but it is likely to be substantially more than 1000 feet Kuhio Highway and even greater at the seaward end of the plateau. Presumably, the Koloa volcanics are separated from the original, shield building Waimea volcanics at depth by a weathered surface created by the several-million year interval between the two periods of volcanic activity. To the extent that it is known, the two geologic formations are hydrologically distinct from each other.

Groundwater Occurrence. Groundwater occurs in two different regimes in the Princeville area, each associated with the two different volcanic formations. In inland areas where the Waimea volcanics are exposed or accessible at practical drilling depths, groundwater occurs in very permeable volcanics that yield water to wells in great quantities. Groundwater in this formation is partially to fully confined by the weathered surface of the Waimea lavas and by the overlying and less permeable Koloa volcanics. PUCI's first two wells, Nos. 1126-01 and 1126-02 on Table 1 and Figure 2, draw water from the Waimea volcanics. Both wells have very large hydraulic capacities (1400 GPM). However, the long term yield of the compartment they both draw from has been determined to be about 1.0 million gallons per day (MGD).

Occurrence of groundwater in the latter stage Koloa volcanics has far more variability than in the Waimea volcanics. The Koloa lavas are poorly to moderately permeable and have numerous interbedded weathered soil layers which locally function as perching members. As a result, water levels in the Koloa volcanics range from a few feet to hundreds of feet above sea level and well yields vary from a few GPM to as much as 500 GPM.

Two of PUCI's well, Nos. 1127-02 and 1126-03, draw water from the Koloa volcanics. As the data in Table 1 demonstrate, their water levels are profoundly different (240 feet above sea level in 1127-02 and 11 feet in 1126-03) as are their yields (230 feet of drawdown at 400 GPM in 1127-02 compared to 28 feet of drawdown at 550 GPM in 1126-03). A much smaller private well has been drilled into the Koloa volcanics seaward of the 120-acre petition area (No. 1326-03 on Table 2 and Figure 2). It was drilled through alluvium and encountered Koloa volcanics about 70 feet below sea level. The piezometric head in the Koloa volcanics at that location was six feet above sea level and the well's yield was a very modest five GPM. As an aside, the other well in the near vicinity, No. 1326-02, is 85 feet deep (to 75 feet below sea level). It was drilled through clay, coral, and sand. It was not drilled deep enough to reach the Koloa volcanics.

Based on the foregoing, it is reasonable to expect that groundwater exists in the poor to moderately permeable Koloa volcanics beneath the Agricultural Subdivision site. The piezometric head may be between five and ten feet above sea level. However, the flow lavas in which this groundwater resides are likely to be at least tens of feet below sea level. Lava flows above these water bearing lavas are deeply weathered and poorly permeable. As such, they function as a confining layer over the aquifer in the unweathered Koloa volcanics rather than being a part of the aquifer itself. Except to supply individual households at modest pumping rates, the aquifer below the site does not constitute a significant, exploitable resource.

Potential Impacts to Groundwater

Changes to the Groundwater Flowrate. Supply of 21,800 GPD for the 120-acre area and 92,500 GPD for the entire 480-acre Agricultural Subdivision will come from any of PUCI's four wells, two of which draw from the Waimea volcanics and the other two from the Koloa formation. These water supply amounts are not significant in terms of PUCI system's capacity or in comparison to the natural flow of groundwater in either volcanic formation.

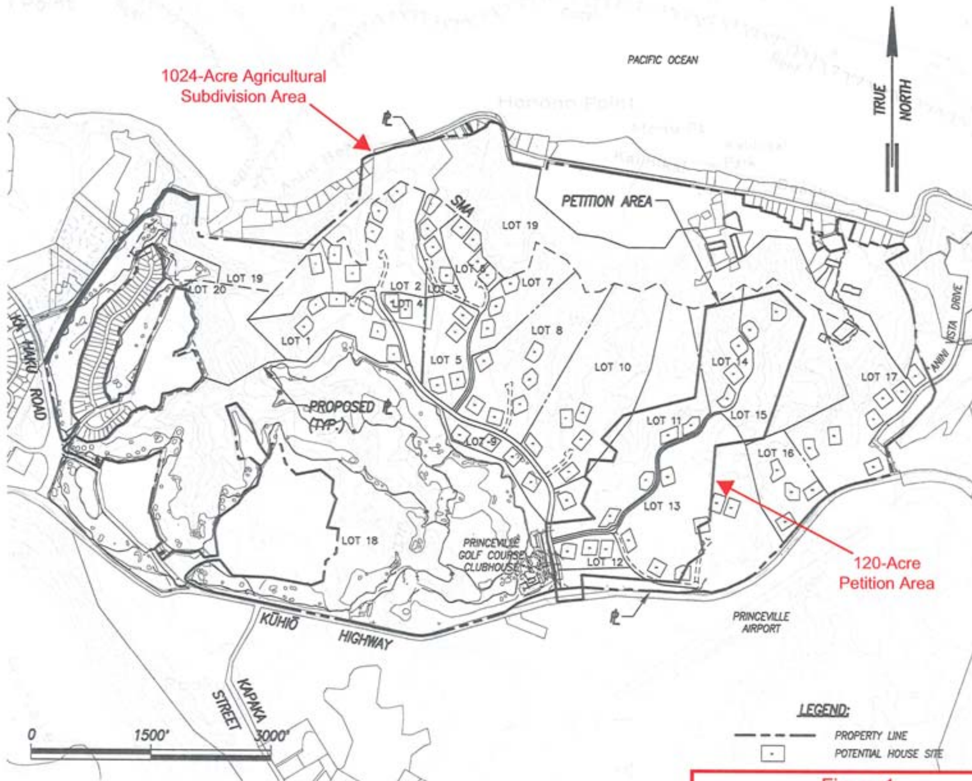
With regard to onsite changes to the quantity of groundwater, the 120-acre petition area is likely to contribute about 7620 GPD (5120 GPD as wastewater and 2500 and landscape irrigation return flow). This water will percolate below the soil mantle toward the groundwater below. For the entire Agricultural Subdivision, the figures are 34,300 GPD (24,000 GPD as wastewater and 10,300 GPD as irrigation return flow). As an order of magnitude comparison, about 25 percent of onsite rainfall percolates below the root zone. Over the 120-acre petition area, this amounts to about a year round average of 150,000 GPD. The projected increase of 7620 GPD would be an increase of about five percent. Over the entire 480-acre Agricultural Subdivision, rainfall-recharge is about 600,000 GPD on average. The project would increase this by about six percent.

Given the perching layers in the sapprolite encountered in the two deep onsite boreholes, percolating rainfall or wastewater produced by the project is not likely to reach the groundwater body which exists tens of feet below sea level beneath the site. The percolate is more likely to drain into the gulches which are incised into the plateau. Despite their very small watershed sizes, these gulches are essentially perennial in their lower reaches. Their flows, albeit quite small amounts, are sustained by water moving laterally along the surface of perching members in the sapprolite and seeping into the gulches.

Changes to Groundwater Quality. Percolate from individual wastewater leach fields and as excess applied landscape irrigation water will be higher in dissolved nutrients than percolating rainfall recharge or in the groundwater at depth. However, essentially all of the phosphorus in the project's percolate would be absorbed during passage through the sapprolite and a substantial portion of the nitrogen would also be removed by denitrification processes. In other words, most of the nutrients will be stripped out by natural processes. As the percolating quantities are also quite small, no significant water quality impact is expectable.

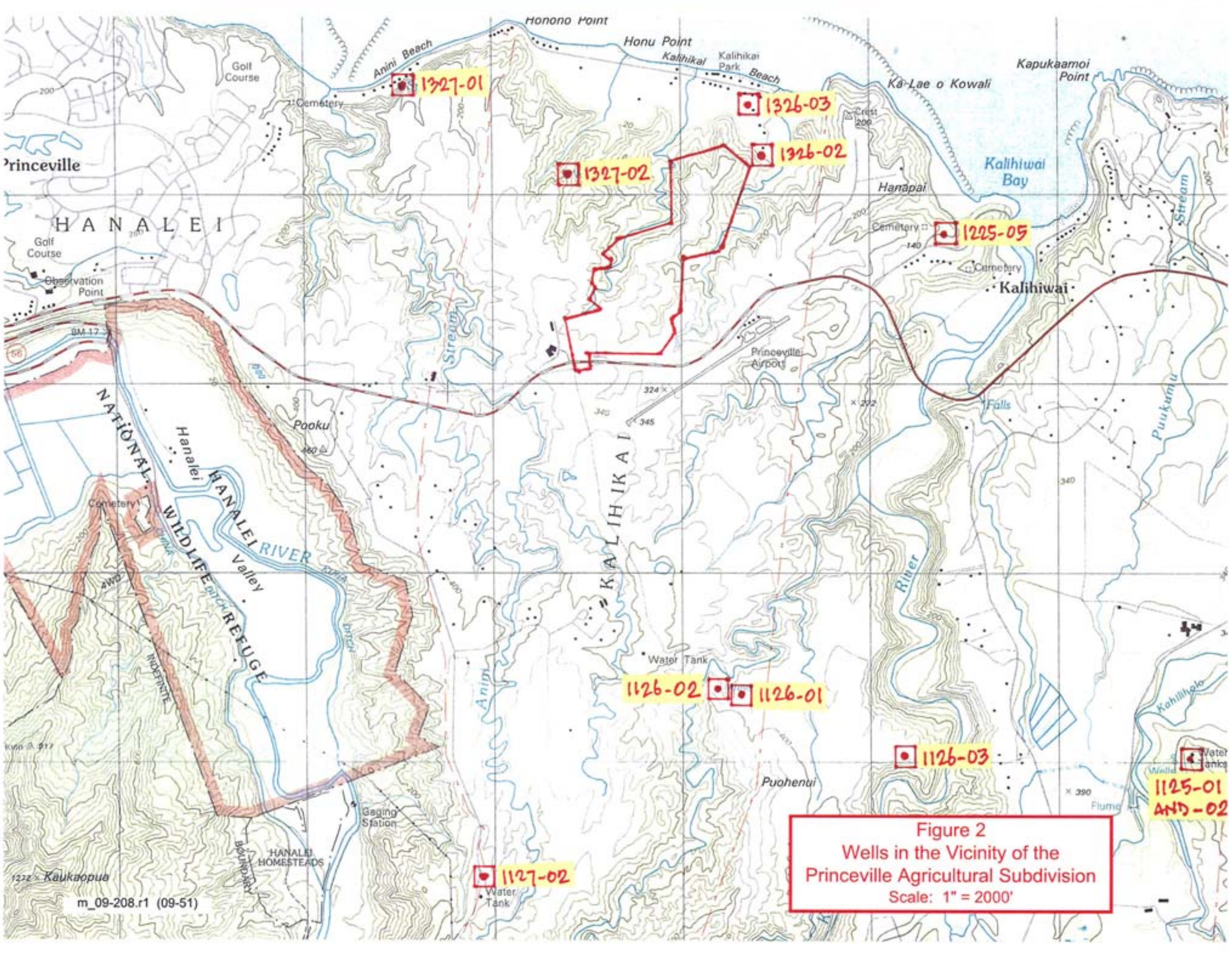
Email Only cc: Larry Dill - Princeville
George Atta - Group 70
Vi Verawudh - Group 70

Attachments



m_09-208.r1 (09-51)

Figure 1
120-Acre Petition Area
Within the 1024-Acre Princeville
Agricultural Subdivision



m_09-208.r1 (09-51)

Figure 2
Wells in the Vicinity of the
Princeville Agricultural Subdivision
Scale: 1" = 2000'

Table 1

Information on Wells Inland of the
Proposed Princeville Agricultural Subdivision

Parameter	PUCI Wells				Kauai DOW Wells	
Well : State Number	1126-01	1126-02	1127-02	1126-03	1125-01	1125-02
: Name	Princeville 1	Princeville 2	Princeville 4	Princeville 5	Kilauea 1	Kilauea 2
Year Drilled	1970	1970	1995	1995 / 2008	1972	1975
Ground Elevation (Feet MSL)	347	332	573	379	390	389
Total Depth (Feet)	763	760	1250	972	790	830
Elevation at Bottom (Feet MSL)	-416	-428	-677	-593	-400	-441
Casing : Diameter (Inches)	16	16	12	12	12	12
: Length of Solid (Feet)	435	423	320	351	390	510
: Length of Perforated (Feet)	None	None	400	621	29	None
Static Water Level (Feet MSL)	27	31	239	11	16.5	16.5
Hydraulic Performance (Feet @ GPM)	18.5 @ 2000	16 @ 2000	230 @ 400	28 @ 550	12.2 @ 1000	20 @ 1000
Installed Pump Capacity (GPM)	1400	1400	400	550	700	700
Formation Tapped by Well	Waimea	Waimea	Koloa	Koloa	Waimea	Waimea

Note: Princeville Well 5 (No. 1126-03) is not yet in service.

m_09-208

Table 2

Information on Wells Located Seaward of the
Proposed Princeville Agricultural Subdivision

Well : State Number	1225-05	1326-02	1326-03	1327-01	1327-02
: Name	Pilaa 3	Fischer	Brescia	Anini Tunnel	Kalihiwai
Year Drilled	2002	1995	2006	Not Known	1962
Ground Elevation (Feet MSL)	213	8	12	--	190
Total Depth (Feet)	320	85	120	--	580
Elevation at Bottom (Feet MSL)	-107	-77	-108	--	-390
Casing : Diameter (Inches)	6	4	4	--	5
: Length of Solid (Feet)	260	65	80	--	--
: Length of Perforated (Feet)	60	20	None	--	--
Static Water Level (Feet MSL)	4.0	No Data	6	--	--
Hydraulic Performance (Feet @ GPM)	4.2 @ 205	No Data	No Data	--	--
Installed Pump Capacity (GPM)	200	10	5	Not Used	Not Used
Formation Tapped by Well	Koloa	Alluvium	Koloa	Koloa	Koloa

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N. Princeville Resort Agricultural Lot Market Study

I. IDENTIFICATION OF THE PROJECT AND MARKET

OVERVIEW: the Princeville Ranch Preservation Plan ("Plan") encompasses the lands that are currently leased to the Ranch, plus other agricultural lands owned by Princeville Associates LLC and subsidiary companies. These comprise three areas: the "Makai Lands" located below Kuhio Highway, the "Makua Lands" located above the highway, and "Hanalei Lands" which are used for ranching and taro farming. This agricultural subdivision project involves only the Makai Lands.

On the Makai Lands, the plan will create an agricultural subdivision with 17 agricultural lots (with a total of 476.986 acres), two golf course lots, one SMA lot and on rural road lot. Under this plan, much of the land within each lot will remain available for grazing livestock and related agricultural operations – owners will be required to make portions of their land not used for their home sites or private agricultural activity available to the Ranch operators for the Ranch's agricultural operations. This differs from typical agricultural subdivisions where an entire lot is designated for the exclusive use of the landowner, who in turn must develop a specific agricultural use and operate it.

After ranch houses are built in the area, it is expected that the Ranch will use the Makai lands primarily to graze horses. Alternatively, cattle grazing and other agricultural activities could be carried out.

It should be recognized that while these lands have adequate soils for cultivating crops, intensive farm operations are not currently feasible: solar radiation is comparatively low and they lack irrigation systems (however, drinking water is provided by the Princeville Utilities Company Inc., a privately owned public utility).

Of the 17 ranch lots, ten will be located primarily in the County's Agricultural District, and seven will be located primarily in the Open District. The new owners will be allowed to build one or more farm dwelling units on their agricultural lots.

This decision will rest with each individual, some of whom will opt to be the only resident on the parcel while others will build as many residential buildings as allowed. If so, then there would be a maximum of 75 farm dwelling units to be located within 75 designated home sites on the 17 agricultural lots.

TARGET MARKET: The new lot/Ranch owners will be families who enjoy the ranching lifestyle, and who could chose to help to perpetuate the Ranch by leasing their lands out to ranching activities. Additionally, they would value the beauty of the land, the spirit of the community and the lifestyle. They would be financially capable of making a substantial investment, both in building their home, as well as being responsible for fulfilling the condition that agricultural activities must take place on a portion of their lot.

POSITIONING AND MARKETIBILITY: Since the breakup of Kilauea Sugar, there have been a number of successful agricultural subdivisions developed and created. This project seeks to build on that success, given the natural beauty of the site, (particularly, the strong views), the proximity to the resort and the on-going agricultural activity.

The project's marketability depends on a number of factors, some exogenous and some inherent. The exogenous factors include the stability of the US (and state of Hawaii) financial system, the economic growth of the US, global and state economy, state tourism, national, state and county farming regulation (including immigration), and off-shore demand for short and long term accommodation (i.e. migration for primary and/or second home), the demand for beef and agricultural products that can be produced on this land and the costs of construction (labor and materials).

Endogenous factors include pricing of parcels, the cost of construction (as the relate to CCR

mandates), the cost of maintaining the house and surrounding land, the associated costs of living on the ranch (including ranch operations).

DESCRIPTION: The following table describes and summarizes the zoning designations and lot features.

SUMMARY DESCRIPTION OF PROJECT OFFERING

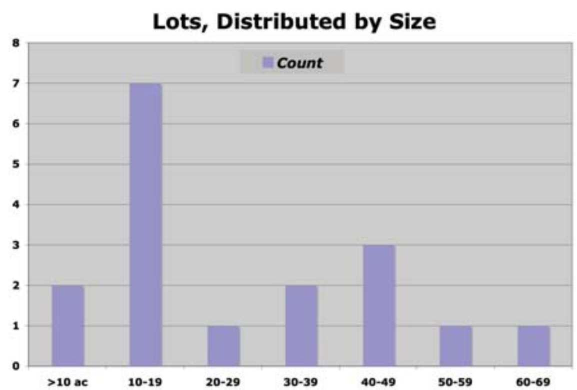
Area	Units	Minimum Area	Average Area	Maximum Area
Ag Parcels	17	10 acres	20 acres	200 acres
Homesites	75	35,000 sf	35,000 sf	35,000 sf

In sum, there will be 17 lots offered with 75 total potential homesites, at the maximum, (and, by extension, 17 homesites at the minimum). The table however describes the maximum homes allowed (not including worker housing, which will be determined by both exogenous and endogenous factors).

PRINCEVILLE RANCH AG SUBDIVISION, LOT SIZE AND HOMESITE DENSITY

		LOT SIZE (Acres)			FARM DWELLING DENSITY				
Lot	Ag/	Lot Sizes (Acres)			Allowable			Proposed	
No	Open	AG (Ag)	OPEN (O)	TOTAL	Ag	O	TOTAL	Ag/O	Total
1	O	11.2	12.4	23.7	4	2	6	4/2	6
2	A	25.3	11.0	36.3	5	2	7	4/2	6
3	A	10.8	0.0	10.8	4	0	4	4/0	4
4	A	7.2	0.0	7.2	3	0	3	2/0	2
5	A	16.2	0.0	16.2	5	0	5	4/0	4
6	A	11.3	0.5	11.9	4	0	4	4/0	4
7	O	5.4	11.7	17.2	2	2	4	2/1	3
8	O	14.2	25.1	39.3	5	5	10	4/2	6
9	A	10.8	0.0	10.8	4	0	4	4/0	4
10	O	12.7	40.1	52.8	4	8	12	4/1	5
11	O	7.3	41.6	48.9	3	8	11	2/3	5
12	A	7.6	0.0	7.6	3	0	3	3/0	3
13	A	54.7	11.1	65.8	5	2	7	7/0	7
14	O	7.7	11.8	19.5	2	2	4	3/0	3
15	O	6.0	38.7	44.7	2	7	9	0/2	2
16	A	11.0	7.1	18.1	4	1	5	3/1	4
17	A	25.1	21.3	46.3	5	4	9	4/3	7
18	O	105.0	157.4	262.5	5	31	36		0
19	O	6.0	120.5	126.5	3	23	26		0
20	O	29.1	36.4	65.5	5	5	10		0
Roadway				12.0			0		0
Total		384	547	943	77	102	179		75

The following chart summarizes this offering by lot size, with most of the units sized 10-19 acres.



In light of the particulars of the offered lots, we estimated what each lot would bring, based on several scenarios:

1. What the lot would bring as a developable piece of property, reselling the individual homesites for profit;
2. What the lot would bring as a stand-alone homesite, purchased for it's quality of life (livability); and,
3. What the lot would bring as a part of a functioning agricultural operation.

Note that two out of these three scenarios (one and three) estimate the lot value from the bottom up in a logical way – by setting a value on each lot, it attempts to establish a baseline value based on a market in which buyers are 'rational' in the sense that they buy with investment return their primary motive. Thus, they would buy the lot at a price that would allow them to recoup their investment plus a profit.

Conversely, there are buyers who are 'emotional' and purchase for other reasons. And since these are 'emotional' buyers, it is somewhat more difficult to put an estimate on their valuations. This is the scenario number two.

Regardless of whether the purchase decision is primarily logical or emotional, we went through the exercise of valuing the lots at a fair-market basis, as both kinds of buyers will buy at the price that the open market indicates is fair.

We began this valuation using current values, but understood that these values will change over time. This is germane since these units will not come to market in the immediate future. Nor will they completely sell out in the first year they are marketed.

Therefore, the current values will change with the market, and are most likely to rise, given that the broader market for real property in the county and the state is at a low mark in the real estate cycle, both in terms of activity and in terms of values (prices).

Looking into the future, we think that sales activity will stay low over the near term, at the same time we think values will continue to fall. Thereafter, it is reasonable to expect that activity will recover, at the same time that values stabilize. Finally, in the longer run, after real estate activity has risen on a consistent basis over a couple of years, overall values will then follow suit.

In recognition of these fluctuating values, the exercise we went through estimated a high and a low value for each lot. Thus, the low value encompasses a decline of about 20% in value from today. Similarly, the high value given in the table encompasses a rise of 20% from today.

The following table describes this:

ESTIMATED LOT VALUES BASED ON HOMESITE VALUES

Lot	Home Sites	Ave. Price, Low Range	Ave. Price, High Range	Gross Revs, Low End	Gross Revs, High End
1	6	$724,952	$1,087,428	$4,349,712	$6,524,568
2	6	$2,331,894	$3,497,841	$13,991,364	$20,987,045
3	4	$2,156,073	$3,234,109	$8,624,291	$12,936,436
4	2	$531,360	$797,040	$1,062,720	$1,594,080
5	4	$542,959	$814,439	$2,171,837	$3,257,755
6	4	$2,656,545	$3,984,818	$10,626,180	$15,939,270
7	3	$2,835,052	$4,252,577	$8,505,155	$12,757,732
8	6	$907,310	$1,360,965	$5,443,861	$8,165,791
9	4	$633,559	$950,339	$2,534,236	$3,801,355
10	5	$732,976	$1,099,465	$3,664,882	$5,497,323
11	5	$911,682	$1,367,523	$4,558,409	$6,837,614
12	3	$500,939	$751,409	$1,502,818	$2,254,227
13	5	$595,615	$893,423	$2,978,075	$4,467,113
14	3	$886,076	$1,329,115	$2,658,229	$3,987,344
15	2	$1,556,728	$2,335,091	$3,113,455	$4,670,183
16	6	$516,004	$774,005	$3,096,021	$4,644,032
17	7	$754,616	$1,131,924	$5,282,314	$7,923,470
TOTAL	75			$87,239,736	$126,245,339

This valuation thus sets a benchmark for what the potential value of each lot would bring at the retail level. Specifically, this is the value a lot buyer might expect to be returned to him if he was to buy a lot and resell the components, the homesites.

However, since this is what a buyer can expect to make on a lot purchased from the master developer, he will only buy it at a substantial discount (to accommodate the risk, to make a return, etc.). For this reason, the master developer would have to discount the value of the lot, in order to entice buyers with a 'reasonable' profit.

This discount (from retail to wholesale) can be as large as 60%-70% of retail in a slow or down market, and as little as 30%-40% in a hot or up market. Thus, we looked at the high-low scenario of 60% and 40% to arrive at a reasonable range of values that these lots might be sold at.

(Note: a further caveat is that the lots with excellent views would be more marketable than those with more commonplace views, and thus the discount applied to the view lots would be less than the non-view lots).

The table below uses a mid-point for the gross revenue value of the lot and applies a 40% and 60% discount factor to arrive at a reasonable range of price points:

ESTIMATED LOT VALUES BASED ON HOMESITE VALUES

Lot	Home Sites	Gross Revs, Mid-Point	Value, with 60% Discount	Value, with 40% Discount
1	6	$5,437,140	$2,174,856.0	$3,262,284.0
2	6	$17,489,205	$6,995,681.8	$10,493,522.7
3	4	$10,780,363	$4,312,145.3	$6,468,218.0
4	2	$1,328,400	$531,360.0	$797,040.0
5	4	$2,714,796	$1,085,918.4	$1,628,877.6
6	4	$13,282,725	$5,313,090.0	$7,969,635.0
7	3	$10,631,444	$4,252,577.4	$6,378,866.2
8	6	$6,804,826	$2,721,930.5	$4,082,895.7
9	4	$3,167,795	$1,267,118.2	$1,900,677.3
10	5	$4,581,102	$1,832,440.9	$2,748,661.4
11	5	$5,698,011	$2,279,204.5	$3,418,806.8
12	3	$1,878,523	$751,409.1	$1,127,113.6
13	5	$3,722,594	$1,489,037.7	$2,233,556.6
14	3	$3,322,787	$1,329,114.7	$1,993,672.0
15	2	$3,891,819	$1,556,727.6	$2,335,091.4
16	6	$3,870,026	$1,548,010.6	$2,322,015.9
17	7	$6,602,892	$2,641,156.8	$3,961,735.2
TOTAL	75	$106,742,537	$42,081,779.6	$63,122,669.4

As seen in the bottom of the table, we estimate the net value to the master developer of these lot sales will be between $42 and $63 million dollars. Again, this depends on the evolution of values in the market over the period of time it takes to bring these units up for sale and then to sell them out.

The chart below summarizes the lot offering by price range, showing that the bulk of sales will come in the $2-$3 million range.

Next, we look at the other two scenarios for projecting the values for these lots. These are:

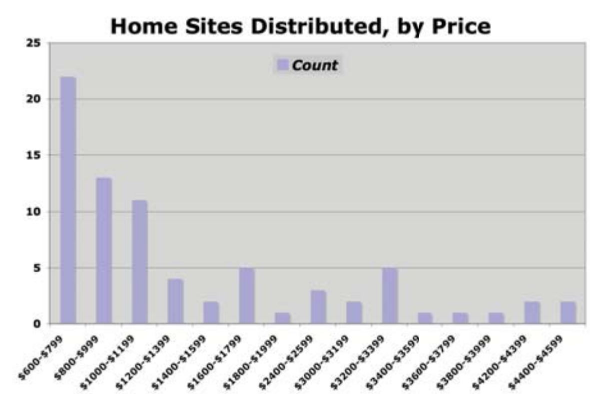
- Buying into an agricultural operation; and,
- Buying a homesite for an individual (the emotional purchase).

First, the idea of buying into an ongoing cattle ranching operation is not particularly attractive to the overall market for large land parcels on Kauai. This is because the returns on ranching are low on average (that also goes for agriculture, although to a lesser extent). As such, this kind of an investment is low risk/low return. However, it has the benefit of being countercyclical, returning higher yields than real estate when the market is down. However, there is not as much upside potential, as residential returns historically have shown very good appreciation over 10-20 years.

Having diminished the idea buyers will be motivated by the profits via investing in ranching, we hasten to say that ranching, per say, is an important contributor to the emotional motivation to purchase. This is because it delivers on the promise of lifestyle and extraordinary experience. Simply put, there is no better way of capturing the sense of place on these bluffs, and of living in the community of Kauai, than riding around the property, overseeing the livestock, checking the fencing, maintaining the water and the feedstock distribution network, etc. Additionally, it provides a basis for camaraderie and good will amongst those who buy here.

Second, the idea of buying a homesite for emotional reasons is a very viable proposition. This is exemplified by a long history of rising prices on the North Shore of Kauai for view lots. This is particularly so in the case of homesites with a western exposure, the 'Bali Hai' view, the values of which appear to at a premium over non-Bali Hai views on the order of 25% and higher.

Ultimately, we believe this will be the primary demand for these lots - individuals wanting to secure a unique view. The second greatest demand will come from developers looking to provide a high-end home for offshore buyers. It should be noted that these two segments overlap, with some buyers not reselling some or all of their homesites, and some developers taking one or more of the homesites for their own personal use.



That said, if every lot purchaser was interested in maximizing their return by reselling their homesites, this 'reoffering' would be concentrated mainly in the mid-range price brackets. As seen in the distribution below, most of the resales would be below a million dollars.

Finally, we tried to look what would be the benefit (and the detriment) for these lots of being tied to a relationship to the ranch and the resort. The benefits would be:

- The access to resort facilities and services, including security; and,
- The ability of using ranch resources to maintain and improve their homesite (fencing, assistance in the event of natural disaster, upkeep of the paths and pasture).

The negatives would be the obligation to lease some of their land to the ranch at very low rental rates.

In sum, the target market for this offering will see it primarily in light of the value of the homesites, be they one per lot or be they the entire potential provision of homesites per lot.

With that in mind, we begin to look at the overall market for high-end properties on the island and throughout the state (as the uniqueness of the locale and the views warrant attention from buyers who consider themselves allied or tied to other islands, like Maui or the Big Island).

We start by looking at an overview of the general economy, and then relate that to the market for these lots.

II. OVERVIEW OF THE ECONOMY & REAL ESTATE MARKET

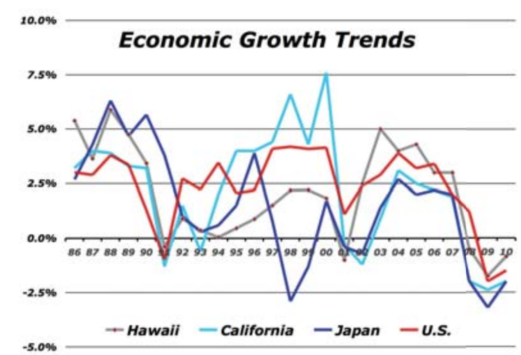
ECONOMIC ACTIVITY GLOBALLY: Through the 2nd quarter of 2009, the 18-month slowdown in the Hawaiian economy is accelerating, with no end in sight.

***The Economist* poll of forecasters, August averages** (previous month's, if changed)

	Real GDP, % change Low/high range		Real GDP, % change average		Consumer prices % increase		Current account % of GDP	
	2009	2010	2009	2010	2009	2010	2009	2010
Australia	−0.6/0.4	0.8/2.7	nil (−0.2)	1.8 (1.7)	1.7 (1.8)	2.3 (2.4)	−4.0 (−4.1)	−4.5 (−4.6)
Belgium	−4.5/−2.8	−0.8/1.3	−3.5	0.4	0.3 (0.4)	1.2	−2.4	−2.5
Britain	−4.6/−3.4	−0.5/1.9	−4.2 (−3.7)	1.0 (1.1)	1.8 (1.7)	1.9	−1.7	−1.4
Canada	−2.9/−1.2	0.7/2.5	−2.2	1.8 (1.9)	0.5 (0.6)	1.8	−2.3 (−1.8)	−1.6 (−1.0)
France	−3.3/−2.4	−0.4/2.3	−2.8 (−2.9)	0.8 (0.7)	0.2	0.9 (1.0)	−2.1 (−2.2)	−2.1 (−2.5)
Germany	−6.3/−5.3	−0.9/2.8	−5.9 (−6.0)	0.8 (0.6)	0.2	0.8	3.7 (3.9)	4.1 (3.9)
Italy	−5.6/−4.7	−0.5/1.3	−5.1 (−5.0)	0.4	0.8 (0.9)	1.3 (1.4)	−2.8	−2.8 (−2.9)
Japan	−7.4/−5.4	0.1/2.5	−6.4 (−6.1)	1.1 (1.0)	−1.1	−0.6	2.5 (1.9)	2.7 (2.4)
Netherlands	−4.9/−4.0	−0.3/1.6	−4.3 (−4.5)	0.7	1.3	0.9	6.1	5.3 (5.4)
Spain	−4.5/−3.2	−1.5/0.2	−3.9 (−3.8)	−0.6	−0.4 (−0.3)	1.1 (1.3)	−7.1 (−7.2)	−5.8 (−6.2)
Sweden	−5.5/−4.3	0.3/3.1	−4.9 (−5.1)	1.3 (1.1)	−0.2 (−0.3)	1.2	6.7 (7.0)	7.0 (6.8)
Switzerland	−3.5/−1.4	−0.7/1.9	−2.3 (−2.2)	0.4	−0.5	0.4	7.4 (7.6)	8.0
United States	−3.0/−1.9	0.6/2.9	−2.6 (−2.7)	2.0	−0.3 (−0.4)	1.3	−3.0	−3.1 (−3.2)
Euro area	−4.6/−4.2	−0.5/2.1	−4.4	0.6	0.5 (0.4)	1.1	−1.3 (−1.0)	−0.7 (−0.8)

Sources: BNP Paribas, Citigroup, Decision Economics, Deutsche Bank, Economist Intelligence Unit, Goldman Sachs, HSBC Securities, KBC Bank, JPMorgan Chase, Morgan Stanley, RBS, Scotiabank, UBS

This is reflected in the table above, which shows that, of late, the US and European economy has stabilized, while Japan's economy still shows weakness. This does not portend good news for Hawaii over the next 1-2 years. The chart below takes these numbers and uses them to illustrate the long-term trend in the economy.

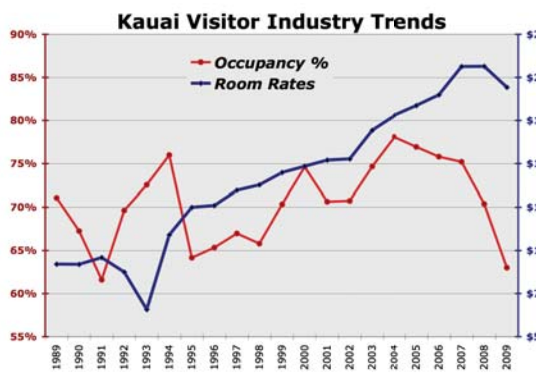


Source: DBEDT, Economist Magazine, UCLA Anderson School

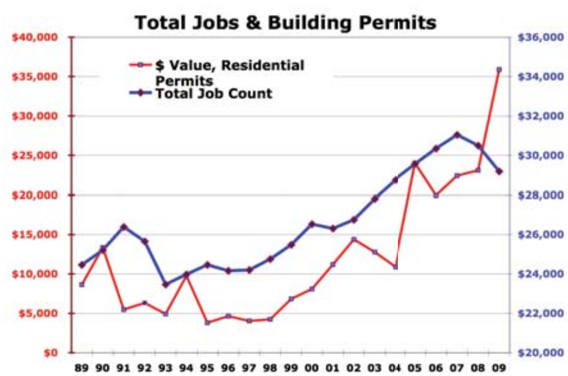
Given the ongoing job and income growth weakness in the country and the state, consumption spending has been cut back drastically. This will negatively affect our number one industry, tourism, both for the short and, more importantly, the mid-term future. Overtime, we think that Asia will rebound first, with our visitor growth starting there.

ECONOMIC CONDITIONS ON KAUAI: The island economy is in poor shape: Jobs are down 3 percent, Unemployment up 4%, visitor arrivals down 14%, visitor spending down 18%, private building permits (in dollars) down 27%, government contracts down 59%, General Excise Taxes down 13%, and Matson Container Volume down 14%. Construction is very depressed, with a large number of private projects stalled or mothballed.

As seen in the following chart, the island's visitor industry has fallen off significantly, and looks to fall more this year. Indeed, YTD tourism spending is off over 16%, with a very slow recovery being forecast. If the economy turns around next year, then it still would take another 1-2 years for visitor counts to rise and another 2-3 for room rates to move up again.

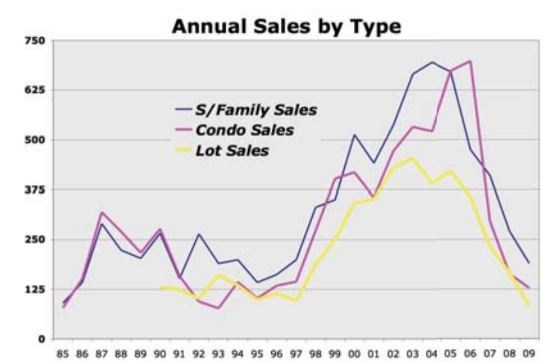


The impact of this on the overall Kauai county economy is falling jobs. At the same time, the value of residential permits has been boosted by the number of affordable projects that have begun. However, we think this is only temporary, as a number of other projects, both primary and second home housing, have slowed or been put on hold.



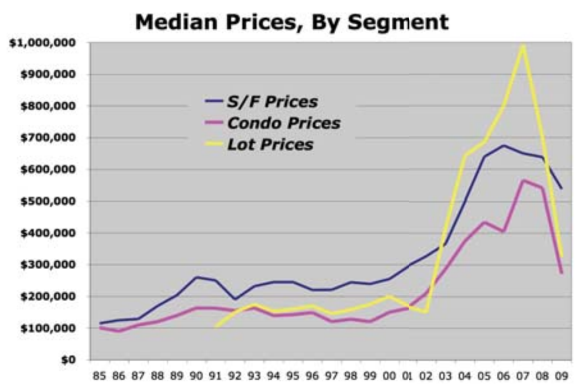
REAL ESTATE MARKET: The real estate market in Kauai topped out 3 years ago, and has fallen dramatically since. It is currently near to the last low in the cycle, brought on by Hurricane Iniki. As seen in the chart below, total resale activity (since new homes closings are volatile and misrepresent the overall trend) is down significantly, followed by prices to a lesser extent.

Looking at sales by the individual type, we see they all are down, but especially condo sales (as they are preferred by offshore buyers. Lot sales have held up better than the rest, possibly since there is an additional economic benefit to owning them (agricultural activities) besides shelter.



Looking ahead, we are pessimistic. While the number of transactions may well increase, it will be mainly because families lose their homes in foreclosure. This will depress prices significantly.

Looking at the price trend for particular property types, we see that lot prices have been the most volatile, with single-family prices being the least volatile. The peak in lot prices came well after the peak in lot sales, and appears to be the most attractive to the high-end of the market (by dint of its dramatic appreciation).



Looking just at the Resort Market housing segment (properties sold within a resort-zoned master planned community), we see overall sales are down but prices are holding up. In contrast with the total market, sales are far less volatile, as are prices. These characteristics (stability, as opposed to volatility, both in terms of activity and values) are prized by investors, part of this project's target market.

Isolating just for the homesite sales for the resort market, we see that this market has slowed down this year, after having a very good one last year (thanks to DMB/AB project in Poipu, Kekuiula).

KAUAI RESORT HOMESITE MARKET TRENDS

	2003	2004	2005	2006	2007	2008
Closed	77	51	60	29	74	32
Ave Price	$493,362	$670,133	$828,803	$1,200,969	$1,165,259	$1,183,176
Top Price	$2,400,000	$2,750,000	$3,000,000	$2,250,000	$3,149,000	$3,200,000
	2003	2004	2005	2006	2007	2008
Closed	4.1%	-33.8%	17.6%	-51.7%	155.2%	-56.8%
Ave Price	84.9%	35.8%	23.7%	44.9%	-3.0%	1.5%

In terms of this market, the proposed project is compatible in terms of pricing, as well as in terms of velocity. The average number of sales since 2003 is over 50 units, which is at a level that is well within the comfort zone of most developers/investors looking to market either 17 lots or 75 homesites.

Looking at the competition, the overall activity in the agricultural estate lot market has been significantly diminished by the market downturn, both on Kauai and throughout the state. Two years ago, there were a great many high-end lot programs (albeit not necessarily ag lots, particularly on the Big Island, where land is plentiful). Kauai had two such projects, one mauka of Kealia beach (Kealanani) and the other on the south shore at Kekui'ula.

The first, Kealanani, was a potential competitor in terms of prices, although not in terms of product or services. Kealanani does not have anywhere near the quality of views for it units, except the immediate ravine ones (lots of ravines in this project, but hardly any panoramas). It also is dependent on a novel agricultural operation, that of growing and harvesting tea. While this may prove very successful, there is a lot of uncertainty in starting it up. Finally, it has significant financing difficulties and is currently dead in the water.

The other project, Kekui'ula, is much more competitive to this one, in the sense that it provides a large lot in a resort setting at high prices. That said, it also comes with a long list of features and services that will result in dramatically higher annual maintenance fees for their buyers, as opposed to this one (even with the ranching operation).

In sum, we see some competition, but very little of it direct. As such, there is not a lot of potential for competition to interfere with the marketing of this project. An, even if there was, the market should be able to absorb much if not all of it, as conditions improve.

III. HISTORICAL TRENDS OF THE TARGET MARKET

We look specifically at lot sales (over 2 acres, over 3/4 acre) whose values are greater than $1 million, as that approximates the sub-market that the subject property targets (this is in light of the fact that the immediate area surrounding the homesites that can be contained, i.e., fenced off, is about 35,000 sf).

KAUAI LARGE LOT HOMESITE SALES TRENDS

Year	Lots Closed	Ave Price	Ave Acres
1992	2	$1,455,000	168
1993	3	$1,730,000	7
1994	1	$1,400,000	26
1995	4	$2,168,750	50
1996	4	$1,293,750	95
1997	5	$2,242,580	88
1998	4	$1,875,000	48
1999	5	$2,772,000	367
2000	11	$1,780,455	35
2001	14	$3,035,714	54
2002	13	$1,925,858	34
2003	28	$2,277,781	99
2004	38	$2,933,836	26
2005	47	$2,718,213	13
2006	33	$3,792,727	52
2007	28	$2,675,385	22
2008	14	$2,530,000	90
2009*	3	$1,102,667	4

** Through June 2009*

As seen, relative to the 17 lots being offered, there has been a sizable demand for high quality homesites, certainly well within the feasibility to sell these out within 3-5 years, if and when the market returns to a level of activity that approximates the averages for 5 and 10 years (13-18 sales, p.a.). Given an average rate of 16 sales a year, as well as potential capture rate of 25% of the market, this project should sell out in a little more than 4 years.

In addition to the market for large lot, high-end homesites, there is an additional consideration regarding the marketability of the project, and that is that it relates to the market for a high-end house. As noted earlier, there are a number of developers who will purchase these lots in order to covert them into individual house/lot packages and resell them on the open market. As such, the high-end home market needs also to be considered. In fact, it probably is as good an indicator of the depth of the market, as most if not all lot purchasers will calibrate their offer to what they could resell the components of their lot, i.e., the homesites.

The parameters we think appropriate for this market would be single family sales over $1.5 million on lots larger than 35,000 sf (the envelope of area specifically dedicated, and fenced off, for homesites within this project).

The long-range trend for this market segment is described in the table below:

KAUAI LARGE LOT HOMESITE SALES TRENDS

Year	Homes Closed	Ave Price	Ave Acres
1993	2	$1,410,000	9.5
1994	1	$1,250,000	5.1
1995	2	$1,537,500	4.4
1996	5	$3,135,500	47.7
1997	1	$1,500,000	7.0
1998	6	$3,233,333	42.5
1999	5	$1,905,500	9.4
2000	12	$2,491,667	11.0
2001	7	$2,337,857	3.7
2002	9	$3,486,111	4.8
2003	8	$3,580,625	5.1
2004	16	$2,293,063	4.8
2005	28	$3,204,893	5.5
2006	20	$2,881,100	3.2
2007	28	$3,731,433	4.9
2008	7	$4,127,857	4.0
2009*	5	$6,410,000	24.1

* Through June 2009

Next, we assume a share of market for this project, which is essentially a capture rate at which they would convert potential to actual buyers. In arriving at this factor, we considered the marketability of the project in relation to comparable offerings being made in both the developer and the resale market.

We think a 25% to 33% capture rate is attainable, given the following:

- The location of the project on Kauai, and in particular, on the north shore;
- The panoramic views of the ocean, mountain and sunset;
- The ample and attractive space in the lots and around the homes;
- The affiliation with the resort and the ranch; and
- The uncertainty of the impact of ranching operations, going forward.

KAUAI LARGE LOT SALES AVERAGES

Year	Lots Closed	33% Share	25% Share
2000	11	3.7	2.8
2001	14	4.7	3.5
2002	13	4.3	3.3
2003	28	9.3	7.0
2004	38	12.7	9.5
2005	47	15.7	11.8
2006	33	11.0	8.3
2007	28	9.3	7.0
2008	14	4.7	3.5
2009 (Est.)	6	2.0	1.5
Sales, p.a.		7.7	5.8
Yrs. To Complete		***2.2***	***2.9***

Assuming the average sales over the last decade, this project would sell out within 2.2 to 2.9 years. To be sure, the current market's activity is under this, meaning that sell out will be slower. That said, there should be a recovery in the next 2-4 years, and the sales rates associated with that event are quite high, relative to this project's 17-lot offering, to have confidence that it will be sold out within these next 4-6 years.

Finally, we took the other segment of this demand, that for high-end large lot homes, and subjected that data to the same kind of analysis. The table below shows that, under this scenario, that completion would occur between 15 and 20 years.

KAUAI LARGE LOT HIGH-END HOME SALE AVERAGES

Year	Lots Closed	33% Share	25% Share
2000	12	4.0	3.0
2001	7	2.3	1.8
2002	9	3.0	2.3
2003	8	2.7	2.0
2004	16	5.3	4.0
2005	28	9.3	7.0
2006	20	6.7	5.0
2007	28	9.3	7.0
2008	7	2.3	1.8
2009 (Est.)	10	3.3	2.5
Sales, p.a.		4.8	3.6
Yrs. To Complete		***15.5***	***20.7***

This assumes that each and every available homesite will become a home, which we are skeptical of. As mentioned earlier, we believe that a number of these lots will be sold to buyers for emotional reasons, and that these people will not develop all the homesites available to them.

IV. SUMMARY

In conclusion, there has been and still is a market for high-end view lots on Kauai, particularly on the North Shore, and particularly of the ocean. The market makes little distinction whether that view is on an agricultural zoned lot or not, or whether it is particularly large or not. The driving force is to secure a view, with the secondary considerations being privacy, space and security.

This project manifests all of these features, and if the market cycle performs according to historical patterns, and if the units are priced competitively, there is no reason not to expect that it would completely sell out within a few years, 2-4 years potentially.

be affected by the proposed project, but have been mitigated by gathering sufficient information regarding the location, function, age, and construction methods. We concur with these mitigation measures.

In our previous review we asked for some revisions. These included expanding the survey methodology language, clarification of the age of irrigation ditches, modification of the Predictive Model, more interpretation for Site# 5023, and supporting the nomination of the cemetery to the National Register and to preserve the military bunker.

We are in receipt of a finalized report. Though it is marked "DRAFT" we will re-mark it as FINAL. Please send a text searchable CD to the attention of Wendy Tolleson and the "**SHPD Library**" at the Kapolei SHPD office.

Please contact Wendy Tolleson at (808) 692-8024 if you have any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon (Deputy SHPO)
Archaeology and Historic Preservation Manager

O. STATE HISTORIC PRESERVATION DIVISION ACCEPTANCE LETTER

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

May 12, 2009

Mr. David Shideler
Cultural Surveys Hawai'i
P. O. Box 1114
Kailua, Hawai'i 96734

LOG NO: 2009.2001
DOC NO: 0905WT38
Archaeology

Dear Mr. Shideler:

**SUBJECT: 6E-42 Historic Preservation Review—
FINAL Archaeological Inventory Survey—for the Proposed Agricultural Subdivision, Including Developed and Undeveloped Lands for the Princeville Final Subdivision Project on Approximately 400 Acres,
Hanalei, Kalihikai, and Kalihiwai Ahupua'a, Hanalei District, Kauai Island, Hawai'i
TMK: (4) 5-3-006: 001 & 014**

Thank you for providing the opportunity to review this FINAL Archaeological Inventory Survey *(FINAL Archaeological Inventory Survey for the Proposed Agricultural Subdivision, Including Developed and Undeveloped Lands for the Princeville Final Subdivision Project on Approximately 400 Acres, Hanalei, Kalihikai, and Kalihiwai Ahupua'a, Hanalei District, Kauai Island TMK: (4) 5-3-006: 001 & 014[Yucha and Hammatt, PhD, December 2008])* which we received on April 29, 2009.

This project was the 100% pedestrian survey of 400 acres for the proposed subdivision by Princeville Prince Golf Course, LLC into twenty agricultural lots accessible by a system of roadways that extend from Kuhio Highway. A total of eleven historic properties were recorded within or adjacent to the project area.

Eleven historic properties were recorded during this work. They include SIHP# 50-80-03-5013 (pre-contact era irrigation ditch), -5014 (pre-contact habitation/agricultural), 5015 (pre-contact era terrace), -5016 (pre-contact era modified outcrop), -5017 (historic era wall), -5018 (pre-contact era irrigation ditch), -5019 (pre-contact irrigation ditch), -5020 (historic era bunker), -1521 (historic cemetery), -5022 (pre-contact era terrace), -5023 (pre-contact habitation /burial). All the sites were deemed eligible to the Historic Register through Criterion D, with the exception of -5020 (military bunker) under A and D, and -5021 (historic cemetery) under D and E, and -5023 (pre-contact habitation/burial) under D and E.

We concur with significance assessments, and recommend that a Preservation Plan be developed to address the five sites that are recommended for preservation. They include -5013, -5014, -5020, -5021, -5023. Consultation with our office is recommended regarding the appropriateness of addressing -5021 and -5023 with an additional Burial Treatment Plan for each site.

Mitigation measures regarding the remaining historic properties, -5015, -5016, 5017, -5018, -5019, and -5022 included locating with a GPS unit, documenting using detailed descriptions, mapping in scale drawings, and photography. The proposed project may have an adverse affect on the southern portion of -5013 (irrigation ditch), it is recommended that consultation with SHPD occur to determine what mitigation measures should be taken for this historic property. The remaining historic properties will not

be affected by the proposed project, but have been mitigated by gathering sufficient information regarding the location, function, age, and construction methods. We concur with these mitigation measures.

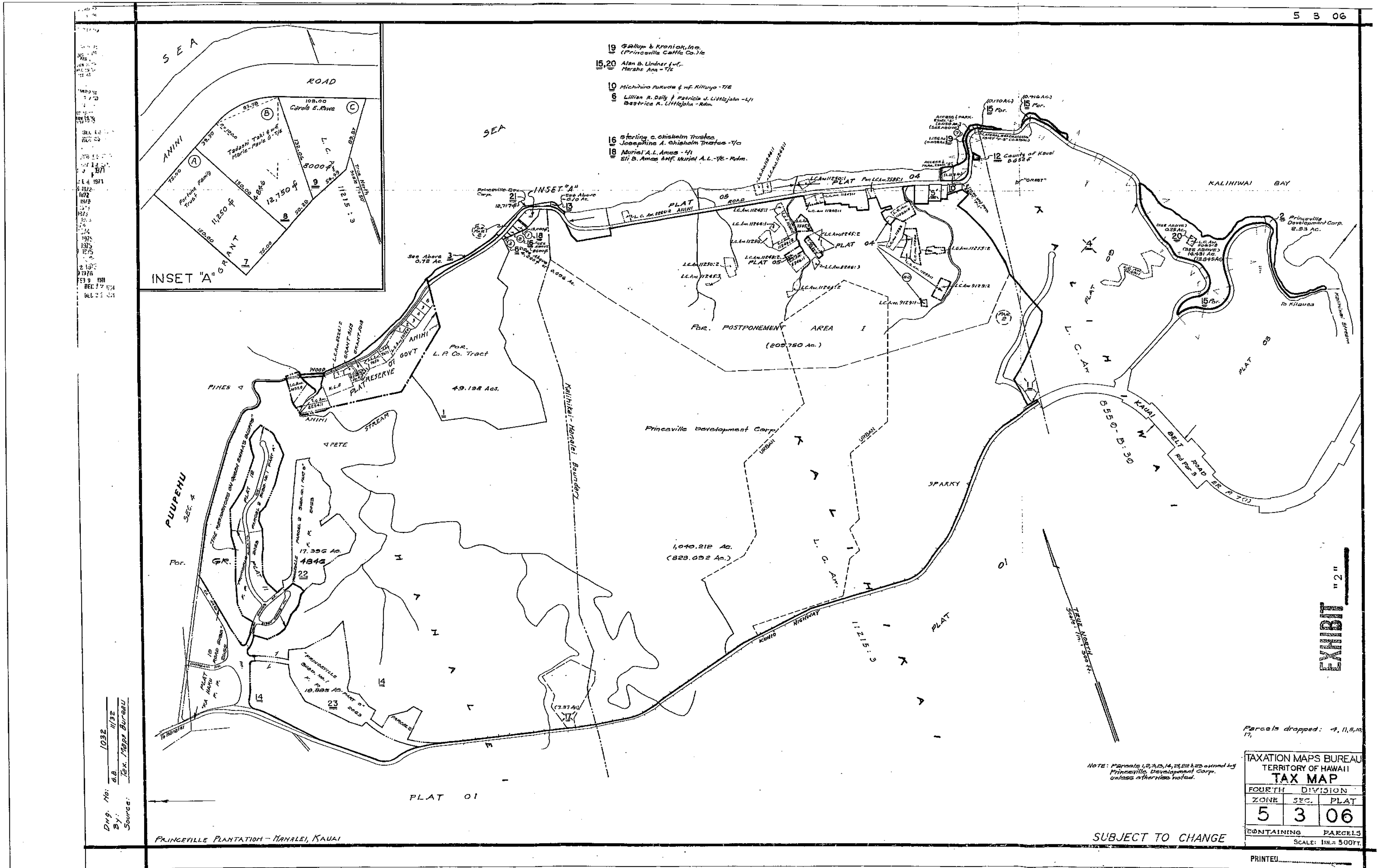
In our previous review we asked for some revisions. These included expanding the survey methodology language, clarification of the age of irrigation ditches, modification of the Predictive Model, more interpretation for Site# 5023, and supporting the nomination of the cemetery to the National Register and to preserve the military bunker.

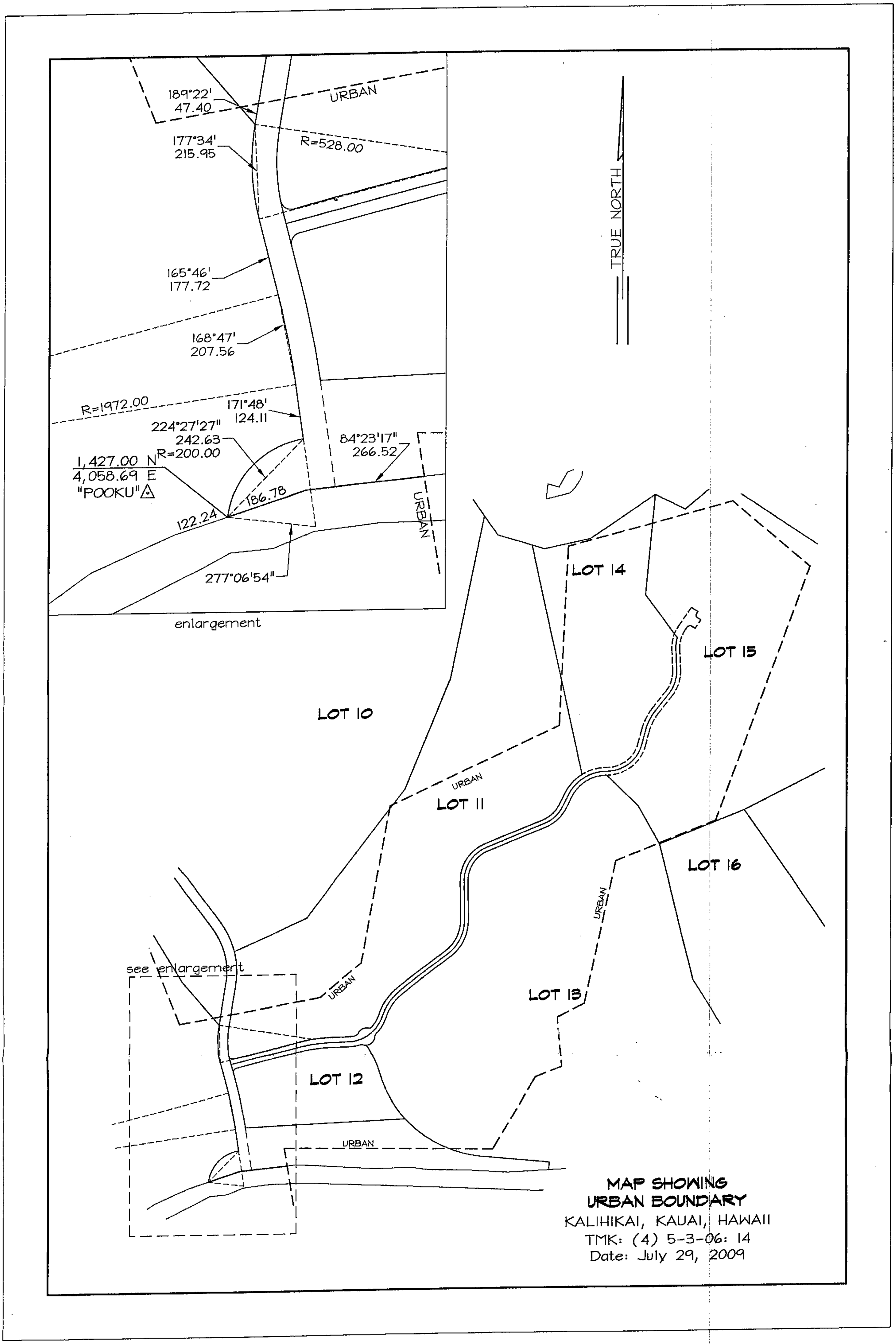
We are in receipt of a finalized report. Though it is marked "DRAFT" we will re-mark it as FINAL. Please send a text searchable CD to the attention of Wendy Tolleson and the "**SHPD Library**" at the Kapolei SHPD office.

Please contact Wendy Tolleson at (808) 692-8024 if you have any questions or concerns regarding this letter.

Aloha,

Nancy A. McMahon (Deputy SHPO)
Archaeology and Historic Preservation Manager


5 3 06
19 Gallup & Kroniok, Inc. (Princeville Cattle Co.) le
15,20 Alan B. Lindner & wf. Marsha Ann - T/E
10 Michihiro Fukuda & wf. Kikuyo - T/E
6 Lillian R. Daily & Patricia J. Littlejohn - L/I Beatrice R. Littlejohn - Rdm.
16 Sterling C. Chisholm Trustee Josephine A. Chisholm Trustee - T/C
18 Muriel A.L. Ames - L/I Eli B. Ames & wf. Muriel A.L. - T/E - Rdm.
SEA
ROAD
ANINI
Carole E. Rowe
Tadashi Taki & wf. Marie-Paule G. - T/E
Fortune Family Trust
INSET "A"
GRANT
KALIHIWAI BAY
Princeville Development Corp. 2.93 Ac.
County of Kauai
POSTPONEMENT AREA I
(203.750 Ac.)
Princeville Development Corp.
1,040.212 Ac.
(823.032 Ac.)
Kalihiwai - Hanalei Boundary
KUHIO HIGHWAY
KAUAI BELT ROAD
PUUPEHU SEC. 4
GOV'T RESERVE
L.P. Co. Tract
49.198 Acs.
STREAM
PLAT 01
PLAT 04
PLAT 05
PLAT 03
TRUE NORTH Scale 1 in. = 500 ft.
Parcels dropped: 4, 11, 5, 10, 17.
NOTE: Parcels 1, 2, 3, 13, 14, 21, 22 & 23 owned by Princeville Development Corp. unless otherwise noted.
EXHIBIT "2"
Dwg. No: 1032
Source: Tax Maps Bureau
Princeville Plantation - Hanalei, Kauai
SUBJECT TO CHANGE
TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
FOURTH DIVISION
ZONE 5 SEC. 3 PLAT 06
CONTAINING PARCELS
SCALE: 1 IN. = 500 FT.
PRINTED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TRUE NORTH
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4,058.69 E
"POOKU"
186.78
122.24
URBAN
277°06'54"
enlargement
LOT 14
LOT 15
LOT 10
URBAN
LOT 11
LOT 16
URBAN
see enlargement
URBAN
LOT 13
LOT 12
URBAN
MAP SHOWING
URBAN BOUNDARY
KALIHIKAI, KAUAI, HAWAII
TMK: (4) 5-3-06: 14
Date: July 29, 2009

EXHIBIT "3"

25

R-592 STATE OF HAWAII
BUREAU OF CONVEYANCES
RECORDED
MAR 18, 2005 08:01 AM

Doc No(s) 2005-053754

/s/ CARL T. WATANABE
REGISTRAR OF CONVEYANCES

20 18/25 Z3

CONVEYANCE TAX: $17130.90

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL ( ) PICK UP ( )

To:

STARN O'TOOLE MARCUS & FISHER
737 BISHOP STREET
SUITE 1740, MAUKA TOWER
HONOLULU, HAWAII 96813

TG: 200452087-S
TGE: A41013043
ANN OGINO

This document contains 11 pages.

350911.2

Tax Map Keys: (4) 5-3-006-001; (4) 5-3-006-003; (4) 5-3-006-013; (4) 5-3-006-014 (por.); (4) 5-3-006-021

QUITCLAIM DEED

THIS INDENTURE made as of March 18, 2005, by **PRINCEVILLE CORPORATION, a Colorado corporation**, whose address is P. O. Box 223040, Princeville, Hawaii 96722-3040, hereinafter called the "Grantor", to **PRINCEVILLE PRINCE GOLF COURSE, LLC, a Delaware limited liability company**, whose address is P. O. Box 223888, Princeville, Hawaii 96722-3888, hereinafter called the "Grantee",

WITNESSETH THAT:

The Grantor, for and in consideration of the sum of TEN DOLLARS ($10.00) and other good and valuable consideration to Grantor paid by the Grantee, the receipt whereof is hereby acknowledged, does hereby grant, release, remise and quitclaim all of its right, title and interest in and to the real property described in Exhibit A attached hereto and incorporated herein and made a part hereof by this reference, hereinafter referred to as the "real property", unto Grantee;

And the reversions, remainders, rents, issues and profits thereof and all of the estate, right, title and interest of the Grantor, both at law and in equity, therein and thereto;

EXHIBIT "4"

TO HAVE AND TO HOLD the same, as to said real property, together with all buildings, improvements, tenements, hereditaments, rights, easements, privileges and appurtenances thereunto belonging or appertaining or held and enjoyed therewith unto the Grantee, absolutely and forever and in fee simple, and as to said personal property (if any), absolutely and forever.

And the Grantee hereby accepts said real property described in Exhibit A.

And the Grantee covenants and agrees with the Grantor as follows:

a. "As Is" Condition. Grantee, in accepting the real property, expressly acknowledges and agrees that, in accordance the provisions of section 7.5 of that certain Purchase and Sale Agreement dated July 14, 2004, by and between the Grantor, as Seller, and Princeville Associates LLC, as Purchaser (the "Purchase Agreement"), it is buying the real property "as is" and "where is" with all faults and, except as expressly set forth in said Purchase Agreement, without any representations or warranties, express, implied or statutory, or of any kind whatsoever, by Grantor, Grantor's Affiliates, Grantor's Representatives, or any other person.

b. Release. Grantee, on behalf of itself and any successor owner of the real property, fully and irrevocably releases Grantor, Grantor's Affiliates, and Grantor's Representatives from any and all claims that they may now have or hereafter acquire against Grantor, Grantor's Affiliates, or Grantor's Representatives, for any cost, loss, liability, damage, expense, action or cause of action, whether foreseen or unforeseen, arising from or related to any of the matters set forth herein or in Section 7.5 of the Purchase Agreement, or any other matter relating to or affecting the real property, except as expressly set forth in the Purchase Agreement. Grantee further acknowledges and agrees that this release shall be given full force and effect according to each of its expressed terms and provisions, including but not limited to, those relating to unknown and suspected claims, damages and causes of action.

c. Indemnity. Subject to the provisions of the Purchase Agreement, including without limitation Article 20 thereof, Grantee ,on behalf of itself and any of Grantee's Affiliates who becomes a successor owner of the real property, shall indemnify, defend and hold harmless Grantor, Grantor's Affiliates, and Grantor's Representatives, from and against any and all claims, liabilities, demands for loss or damage, including claims for personal injury, property damage or wrongful death arising at any time as a result of any mold existing on the real property on, before or after the closing date, or any hazardous materials existing on or in the real property on or before the date of this Deed, or existing, released, leaked, discharged onto or into the real property on or after the date of this Deed. Without limiting the foregoing, Grantee, on behalf of itself and any successor owner of the real property, shall indemnify Grantor, Grantor's Affiliates and Grantor's Representatives from and against any and all claims and demands for loss or damage, including claims for personal injury, property damage or wrongful death, arising as a direct or indirect result of or in connection with Hazardous Materials caused or permitted by such grantee to be leaked, spilled or discharged on the real property, or otherwise resulting from the ownership, occupancy, or use of the real property by such grantee.

The terms "Grantor" and "Grantee", as and when used herein, or any pronouns used in place thereof, shall mean and include the masculine, feminine or neuter, the singular or plural number, individuals, trustees, partnerships or corporations, and their and each of their respective successors, heirs, personal representatives, successors in trust and assigns, according to the context thereof. "Grantor's Affiliates", as and when used herein, shall mean those entities identified as "Seller's Affiliates" in the Purchase Agreement, together with any person or entity which directly or indirectly owns or controls any such entity. "Grantee's Affiliates", as and when used herein, shall mean any entity that directly or indirectly controls, is controlled by, or is under common control with Grantee. "Grantor's Representatives", as and when used herein, shall mean the respective officers, directors, employees, agents, accountants, consultants, attorneys, advisors, lenders and operators of Grantor and Grantor's Affiliates. All covenants and obligations undertaken by two or more persons shall be deemed to be joint and several unless a contrary intention is clearly expressed elsewhere herein.

IN WITNESS WHEREOF, the Grantor and Grantee have duly executed these presents as of the day and year first above written.

PRINCEVILLE CORPORATION

By [signature]
Takashi Nishii
Its President

"Grantor"

STATE OF HAWAII)
) SS:
CITY AND COUNTY OF HONOLULU)

On MAR - 7 2005, before me personally appeared TAKASHI NISHII, to me personally known, who, being by me duly sworn or affirmed did say that such person(s) executed the foregoing instrument as the free act and deed of such person(s), and if applicable, in the capacity shown, having been duly authorized to execute such instrument in such capacity.

[signature]
Kiley M. Chun-Kawakami
Notary Public, State of Hawaii

My commission expires: 4/11/08