# APPENDIX G – SURFACE WATER AND WATER QUALITY

Whitson Engineers. Preliminary Drainage Report. March 22, 2007.

# PRELIMINARY DRAINAGE REPORT

for

# ENCINA HILLS SUBDIVISION

**Monterey County, California**


**Prepared by:**

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**March 22, 2007**
**Project #546.00**

# PRELIMINARY DRAINAGE REPORT
# for
# ENCINA HILLS SUBDIVISION

## Project Overview

The Encina Hills Subdivision encompasses approximately 164 acres of land lying northwest of San Benancio Road and west of Toro Park. A Vicinity Map showing the project site is included as Attachment 1. This report will estimate the increase in runoff due to the proposed project, and will also estimate the volume of drainage detention that will be required. We will also account for the adjacent undeveloped lots in the calculations, so that the detention facilities can be sized to accommodate both the project and the adjacent lots.

This proposed subdivision consists of 17 residential lots with approximately 9,500 linear feet of paved roads. The 14 adjacent undeveloped properties, not located within the Encina Hills Subdivision, will have an estimated 4,200 linear feet of future paved roads.

## Watershed Summary

A Watershed Map showing the proposed development and its relationship to the watersheds is included as Attachment 2. The primary drainage basins involving this project are identified as Watershed A, B, C, D, E, F, G, H, I, J and K on the watershed map. Watersheds A-K are sub-watersheds of El Toro Creek, which is a tributary of the Salinas River. The creek is located approximately 0.7 miles north-west of the project site. The land within these Watersheds is predominantly hilly with slopes varying from 20 to over 50 percent.

There are eleven watersheds, totaling approximately 315 acres, which drain through the Encina Hills project site. Watersheds A, B, C and H are in areas of the subdivision that have no planned development, so no additional runoff will occur in them due to the proposed site improvements. The remaining watersheds D, E, F, G, I, J and K have proposed development in them, including housing and/or paved roads. Their estimated post-development runoff and detention requirements are detailed in Attachment 3.

## Hydrology

This drainage report uses the Rational Method for estimating the peak discharge (Q, $ft^3/sec$) of stormwater from the watersheds (A, acres). This method is a simple technique used for estimating a design discharge for small watersheds up to several hundred acres and assumes that rainfall occurs at a constant rate and is spatially uniform over the drainage area. The Rational method uses the following parameters in the runoff determination:

**Drainage Area, (A):** The area of the watershed, in acres.

**Runoff Coefficient, (C):** A value dependent on the land use, cover condition, watershed slope and soil group of the land. The runoff coefficient values of 0.25 (pervious surface) and 0.90 (impervious surface) have been chosen as appropriate for this area.

**Time of Concentration, $T_c$ :** The time it takes water to flow from the farthest point of the watershed to the point being analyzed. It is determined from travel length and elevation fall of the storm flow, using a standard formula. Time of Concentration calculations was done for each watershed, and all were less than the minimum Time of Concentration of 20 minutes specified by the Water Resources Agency. Therefore, 20 minutes was used in this report.

**Rainfall Intensity:** This is determined by geographical location, as shown on the Monterey County Rainfall Intensity Chart, attached. This area has a rainfall intensity of approximately 0.5 in/hr.

**Storm Frequency:** The number of years that would elapse, on average, before a storm of a particular size would occur. (This is a statistical value, and does not imply that a flood of a certain magnitude will not recur sooner that the stated interval.) This study estimates the flows that would result from 10-year and 100-year storms.

**Discharge:** The discharge is calculated by the formula: $Q = CIA$

**Post Development Flows:**

Post development runoff was estimated by using a runoff coefficient for impervious area and factoring that into the runoff calculations by the same percentage as the area affected by development. The impervious area for the project was estimated by computing the probable impervious areas to be constructed. We estimate that approximately 8.3 acres of impervious area will result from construction of the project: 190,200 square feet of roads, and 170,000 square feet of impervious area on lots (10,000 square feet per homesite). This represents 2.6% of the project gross area.

We estimate that approximately 5.1 acres of impervious area for the adjacent properties within the watershed will result from future development and include approximately 83,900 square feet of roads and 140,000 square feet of imperious area on lots (10,000 square feet per homesite). Including the adjacent properties increases the impervious area to 13.4 acres and represents 4.3% of the project gross area.

The estimated pre-development and post-development peak runoff flows for Watersheds A, B, C, D, E, F, G, H, I, J and K were computed as follows:

| | Estimated Pre-Development Flows (cfs) | Estimated Post-Development Flows (cfs) | Estimated Post-Development Flows Including Adjacent Properties (cfs) |
|---|---|---|---|
| **Watershed A** | $Q_{10}$ = 6.6<br>$Q_{100}$ = 9.9 | No Change | No Change |
| **Watershed B** | $Q_{10}$ = 8.9<br>$Q_{100}$ = 13.3 | No Change | No Change |
| **Watershed C** | $Q_{10}$ = 1.9<br>$Q_{100}$ = 2.8 | No Change | No Change |
| **Watershed D** | $Q_{10}$ =10.8<br>$Q_{100}$ = 16.2 | $Q_{10}$ =12.4<br>$Q_{100}$ =18.6 | $Q_{10}$ =12.4<br>$Q_{100}$ =18.6 |

| | | | |
|---|---|---|---|
| **Watershed E** | $Q_{10}$ = 2.5<br>$Q_{100}$ = 3.8 | $Q_{100}$ = 2.7<br>$Q_{100}$ = 4.1 | $Q_{100}$ = 2.7<br>$Q_{100}$ = 4.1 |
| **Watershed F** | $Q_{10}$ = 30.4<br>$Q_{100}$ = 45.5 | $Q_{10}$ = 33.4<br>$Q_{100}$ = 50.1 | $Q_{10}$ = 34.8<br>$Q_{100}$ = 52.1 |
| **Watershed G** | $Q_{10}$ = 24.2<br>$Q_{100}$ = 36.4 | $Q_{10}$ = 25.5<br>$Q_{100}$ = 38.3 | $Q_{10}$ = 28.0<br>$Q_{100}$ = 42.1 |
| **Watershed H** | $Q_{10}$ = 0.3<br>$Q_{100}$ = 0.4 | No Change | No Change |
| **Watershed I** | $Q_{10}$ = 2.4<br>$Q_{100}$ = 3.6 | $Q_{10}$ = 2.6<br>$Q_{100}$ = 3.9 | $Q_{10}$ = 2.8<br>$Q_{100}$ = 4.2 |
| **Watershed J** | $Q_{10}$ = 1.0<br>$Q_{100}$ = 1.5 | $Q_{10}$ = 1.1<br>$Q_{100}$ = 1.7 | $Q_{10}$ = 1.1<br>$Q_{100}$ = 1.7 |
| **Watershed K** | $Q_{10}$ = 12.1<br>$Q_{100}$ = 18.1 | $Q_{10}$ = 12.6<br>$Q_{100}$ = 18.9 | $Q_{10}$ = 12.8<br>$Q_{100}$ = 19.1 |

Where $Q_{10}$ = estimated 10 year peak flow
$Q_{100}$ = estimated 100 year peak flow.

See Attachment 3 for runoff calculations.

**Drainage Detention Facilities**

The basis for calculation of detention volumes within this development is the standard requirement to mitigate the effect of additional runoff created in up to a 100 year storm event. The volume of the required detention is determined by calculating the volume from the 100 year post-development inflow in the subject watershed, and subtracting the10 year pre-development outflow volume (at an assumed uniform rate), and determine the time at which the differential volume is the largest. The volume thus obtained is the total required detention for the watershed. The detention facilities used for each watershed may vary in type, including detention ponds, dispersion facilities, etc. The design and location of these facilities is part of the final subdivision improvement plans, and will be reviewed and approved by the Monterey County Resources Agency. The flows and detention volumes shown in the report are preliminary, subject to final design calculations.

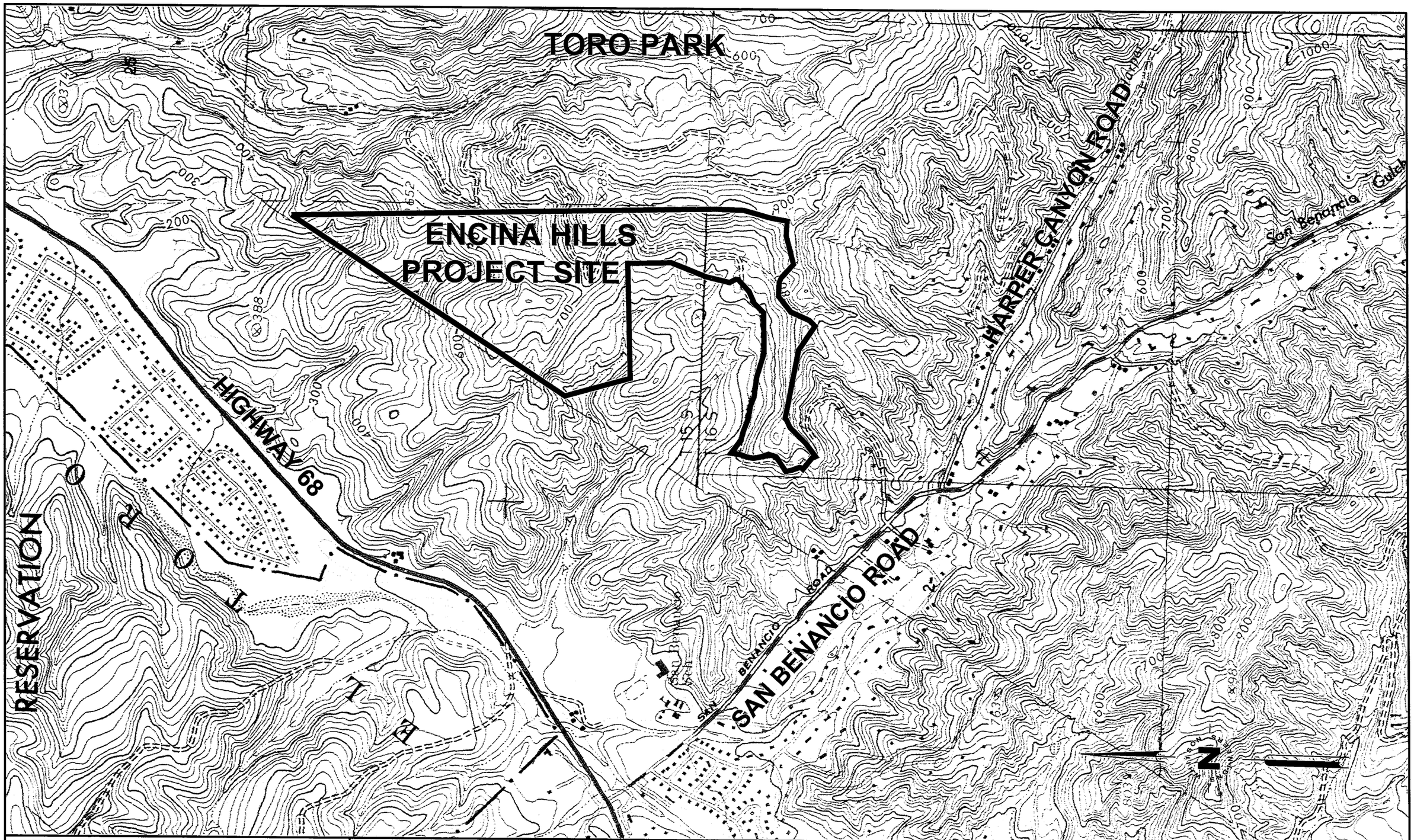
| | **Approximate Detention Requirements For Subject Property** | **Approximate Detention Requirements For Subject Property and Adjacent Parcels** |
|---|---|---|
| **Watershed A:** | 0 $ft^3$ | 0 $ft^3$ |
| **Watershed B:** | 0 $ft^3$ | 0 $ft^3$ |
| **Watershed C:** | 0 $ft^3$ | 0 $ft^3$ |
| **Watershed D:** | 9,363 $ft^3$ | 9,363 $ft^3$ |
| **Watershed E:** | 1,865 $ft^3$ | 1,865 $ft^3$ |
| **Watershed F:** | 23,585 $ft^3$ | 26,076 $ft^3$ |
| **Watershed G:** | 16,897 $ft^3$ | 21,429 $ft^3$ |
| **Watershed H:** | 0 $ft^3$ | 0 $ft^3$ |
| **Watershed I:** | 1,807 $ft^3$ | 2,152 $ft^3$ |
| **Watershed J:** | 799 $ft^3$ | 799 $ft^3$ |
| **Watershed K:** | 8,108 $ft^3$ | 8,438 $ft^3$ |

Storage volume calculations are included in Attachment 3.

## Drainage Detention Locations

Several potential locations for drainage detention facilities have been identified, including at least one location in each watershed in which detention may be required. In some cases, more potential basins have been identified than will be actually required. This will provide flexibility in the final design of the basins. The final design will provide at least the minimum required detention volume, and will be sized to allow for drainage from the adjacent undeveloped lots to be accommodated.

The potential drainage basin locations are shown in Attachment 4.

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# ENCINA HILLS

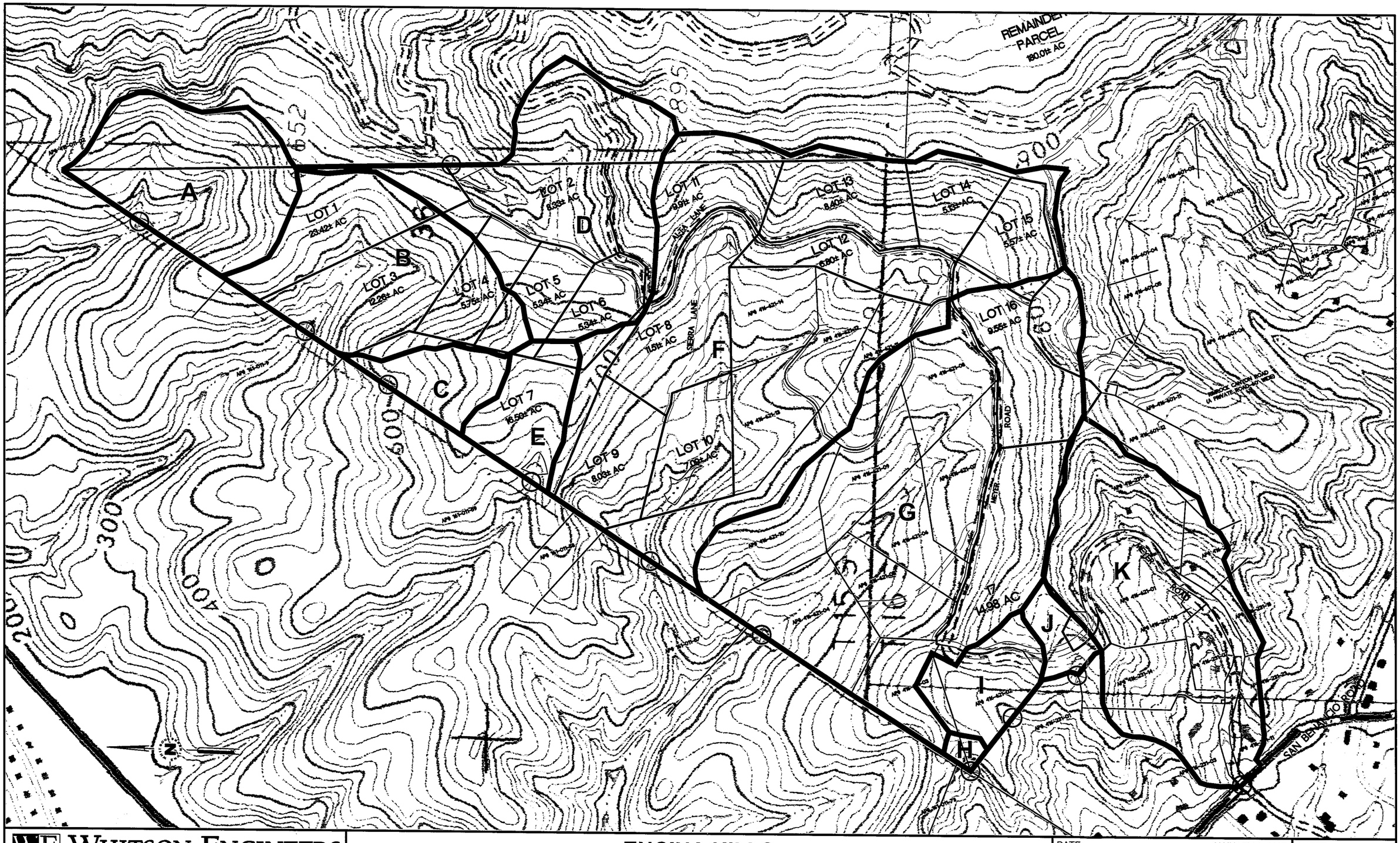
MONTEREY COUNTY — CALIFORNIA

**ATTACHMENT 1: VICINITY MAP**

DRAWING PATH: T:\DWG\546\WATERSHED EXHIBIT.dwg

| | |
|---|---|
| DATE: | JANUARY 8, 2007 |
| SCALE: | 1"=1000' |
| DRAWN: | K.A.Y. |
| CHECKED: | |
| PROJECT No.: | 546.00 |

SHEET 1 OF 1





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# ENCINA HILLS

MONTEREY COUNTY CALIFORNIA

## ATTACHMENT 2: WATERSHED MAP

DRAWING PATH: T:\DWG\546\WATERSHED EXHIBIT.dwg

| | |
|---|---|
| DATE: | JANUARY 8, 2007 |
| SCALE: | 1"=500' |
| DRAWN: | K.A.Y. |
| CHECKED: | KMW |
| PROJECT No.: | 546.00 |

SHEET 1 OF 1

# ATTACHMENT 3

## RATIONAL METHOD
### RUNOFF CALCULATIONS

# ENCINA HILLS SUBDIVISION

**Project Name:** **ENCINA HILLS (WATERSHED A)**

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## 10 year Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | ← | Minimum Per Water Resources Agency |
| C | 0.25 | | ← | Runoff Coefficient of pervious surface |
| A | 20.6 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 10 pre** | **6.6** | **cfs** | | Q=CItA |

## 100 year Runoff (No Development in this watershed)

| | | | | |
|---|---|---|---|---|
| Ap | 20.6 | acres | | Approx Area of Pervious Surface |
| Cp | 0.25 | | | Runoff Coefficient of pervious surface |
| Ai | - | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.25 | | | Composite Runoff Coefficient |
| Total A | 20.6 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 100 post** | **9.9** | **cfs** | | Q=CItA |

**Project Name:** ENCINA HILLS (WATERSHED B)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## 10 year Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | ← | Minimum Per Water Resources Agency |
| C | 0.25 | | ← | Runoff Coefficient of pervious surface |
| A | 27.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 10 pre** | **8.9** | **cfs** | | Q=CItA |

## 100 year Runoff (No Development in this watershed)

| | | | | |
|---|---|---|---|---|
| Ap | 27.7 | acres | | Approx Area of Pervious Surface |
| Cp | 0.25 | | | Runoff Coefficient of pervious surface |
| Ai | - | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.25 | | | Composite Runoff Coefficient |
| Total A | 27.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 100 post** | **13.3** | **cfs** | | Q=CItA |

**Project Name:** **ENCINA HILLS (WATERSHED C)**

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## 10 year Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | ← | Minimum Per Water Resources Agency |
| C | 0.25 | | ← | Runoff Coefficient of pervious surface |
| A | 5.8 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 10 pre** | **1.9** | **cfs** | | Q=CItA |

## 100 year Runoff (No Development in this watershed)

| | | | | |
|---|---|---|---|---|
| Ap | 5.8 | acres | | Approx Area of Pervious Surface |
| Cp | 0.25 | | | Runoff Coefficient of pervious surface |
| Ai | - | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.25 | | | Composite Runoff Coefficient |
| Total A | 5.8 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 100 post** | **2.8** | **cfs** | | Q=CItA |

**Project Name:** ENCINA HILLS (WATERSHED D)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | ← | Minimum Per Water Resources Agency |
| C | 0.25 | | ← | Runoff Coefficient of pervious surface |
| A | 33.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 10.8 | cfs | | Q=CItA |
| Q 100 pre | 16.2 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | | |
|---|---|---|---|---|
| Ap | 31.8 | acres | | Approx Area of Pervious Surface |
| Cp | 0.25 | | | Runoff Coefficient of pervious surface |
| Ai | 1.92 | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.29 | | | Composite Runoff Coefficient |
| Total A | 33.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| Q 100 post | 18.6 | cfs | | Q=CItA |
| Q 10 post | 12.4 | cfs | | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 10.80 | 12965 |
| 30 | 10.80 | 19447 |
| 40 | 10.80 | 25930 |
| 50 | 10.80 | 32412 |
| 60 | 10.80 | 38895 |
| 90 | 10.80 | 58342 |
| 120 | 10.80 | 77789 |
| 150 | 10.80 | 97237 |
| 180 | 10.80 | 116684 |
| 210 | 10.80 | 136132 |
| 240 | 10.80 | 155579 |
| 270 | 10.80 | 175026 |
| 300 | 10.80 | 194474 |
| 330 | 10.80 | 213921 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 18.61 | 22328 |
| 30 | 1.57 | 15.19 | 27346 |
| 40 | 1.36 | 13.16 | 31577 |
| 50 | 1.22 | 11.77 | 35304 |
| 60 | 1.11 | 10.74 | 38673 |
| 90 | 0.91 | 8.77 | 47365 |
| 120 | 0.79 | 7.60 | 54692 |
| 150 | 0.70 | 6.79 | 61148 |
| 180 | 0.64 | 6.20 | 66984 |
| 210 | 0.59 | 5.74 | 72351 |
| 240 | 0.56 | 5.37 | 77347 |
| 270 | 0.52 | 5.06 | 82039 |
| 300 | 0.50 | 4.80 | 86476 |
| 330 | 0.47 | 4.58 | 90697 |

## Storage Requirement

| Qin | Qout | =(Qin - Qout) |
|---|---|---|
| 22328 | 12965 | 9363 |
| 27346 | 19447 | 7899 |
| 31577 | 25930 | 5647 |
| 35304 | 32412 | 2892 |
| 38673 | 38895 | -221 |
| 47365 | 58342 | -10977 |
| 54692 | 77789 | -23097 |
| 61148 | 97237 | -36089 |
| 66984 | 116684 | -49700 |
| 72351 | 136132 | -63780 |
| 77347 | 155579 | -78232 |
| 82039 | 175026 | -92988 |
| 86476 | 194474 | -107997 |
| 90697 | 213921 | -123224 |

**Detention 9363 cf**

**Project Name:** ENCINA HILLS (WATERSHED E)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | — | Minimum Per Water Resources Agency |
| C | 0.25 | | — | Runoff Coefficient of pervious surface |
| A | 7.9 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 2.5 | cfs | | Q=CItA |
| Q 100 pre | 3.8 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | |
|---|---|---|---|
| Ap | 7.7 | acres | Approx Area of Pervious Surface |
| Cp | 0.25 | | Runoff Coefficient of pervious surface |
| Ai | 0.23 | acres | Approx Area of Impervious Surface |
| Ci | 0.90 | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | |
| Weighted C | 0.27 | | Composite Runoff Coefficient |
| Total A | 7.9 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | It=7.75*I/SQRT(t) |
| Q 100 post | 4.1 | cfs | Q=CItA |
| Q 10 post | 2.7 | cfs | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 2.53 | 3039 |
| 30 | 2.53 | 4554 |
| 40 | 2.53 | 6072 |
| 50 | 2.53 | 7590 |
| 60 | 2.53 | 9108 |
| 90 | 2.53 | 13662 |
| 120 | 2.53 | 18216 |
| 150 | 2.53 | 22770 |
| 180 | 2.53 | 27324 |
| 210 | 2.53 | 31878 |
| 240 | 2.53 | 36432 |
| 270 | 2.53 | 40986 |
| 300 | 2.53 | 45540 |
| 330 | 2.53 | 50094 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 4.09 | 4904 |
| 30 | 1.57 | 3.34 | 6006 |
| 40 | 1.36 | 2.89 | 6935 |
| 50 | 1.22 | 2.58 | 7754 |
| 60 | 1.11 | 2.36 | 8494 |
| 90 | 0.91 | 1.93 | 10403 |
| 120 | 0.79 | 1.67 | 12012 |
| 150 | 0.70 | 1.49 | 13430 |
| 180 | 0.64 | 1.36 | 14712 |
| 210 | 0.59 | 1.26 | 15891 |
| 240 | 0.56 | 1.18 | 16988 |
| 270 | 0.52 | 1.11 | 18018 |
| 300 | 0.50 | 1.06 | 18993 |
| 330 | 0.47 | 1.01 | 19920 |

## Storage Requirement

| Qin | Qout | =(Qin - Qout) |
|---|---|---|
| 4904 | 3039 | 1865 |
| 6006 | 4554 | 1452 |
| 6935 | 6072 | 863 |
| 7754 | 7590 | 164 |
| 8494 | 9108 | -614 |
| 10403 | 13662 | -3259 |
| 12012 | 18216 | -6204 |
| 13430 | 22770 | -9340 |
| 14712 | 27324 | -12612 |
| 15891 | 31878 | -15987 |
| 16988 | 36432 | -19444 |
| 18018 | 40986 | -22968 |
| 18993 | 45540 | -26547 |
| 19920 | 50094 | -30174 |

**Detention 1865 cf**

**Project Name:** ENCINA HILLS (WATERSHED F)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | ← | |
| C | 0.25 | | ← | Runoff Coefficient of pervious surface |
| A | 94.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 30.4 | cfs | | Q=CItA |
| Q 100 pre | 45.5 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | | |
|---|---|---|---|---|
| Ap | 91.1 | acres | | Approx Area of Pervious Surface |
| Cp | 0.25 | | | Runoff Coefficient of pervious surface |
| Ai | 3.61 | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.27 | | | Composite Runoff Coefficient |
| Total A | 94.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| Q 100 post | 50.1 | cfs | | Q=CItA |
| Q 10 post | 33.4 | cfs | | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 30.40 | 36480 |
| 30 | 30.40 | 54720 |
| 40 | 30.40 | 72960 |
| 50 | 30.40 | 91200 |
| 60 | 30.40 | 109440 |
| 90 | 30.40 | 164160 |
| 120 | 30.40 | 218880 |
| 150 | 30.40 | 273600 |
| 180 | 30.40 | 328320 |
| 210 | 30.40 | 383040 |
| 240 | 30.40 | 437760 |
| 270 | 30.40 | 492480 |
| 300 | 30.40 | 547200 |
| 330 | 30.40 | 601920 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 50.05 | 60065 |
| 30 | 1.57 | 40.87 | 73565 |
| 40 | 1.36 | 35.39 | 84945 |
| 50 | 1.22 | 31.66 | 94971 |
| 60 | 1.11 | 28.90 | 104036 |
| 90 | 0.91 | 23.60 | 127418 |
| 120 | 0.79 | 20.43 | 147129 |
| 150 | 0.70 | 18.28 | 164495 |
| 180 | 0.64 | 16.68 | 180196 |
| 210 | 0.59 | 15.45 | 194634 |
| 240 | 0.56 | 14.45 | 208072 |
| 270 | 0.52 | 13.62 | 220694 |
| 300 | 0.50 | 12.92 | 232632 |
| 330 | 0.47 | 12.32 | 243986 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 60065 | 36480 | 23585 |
| 73565 | 54720 | 18845 |
| 84945 | 72960 | 11985 |
| 94971 | 91200 | 3771 |
| 104036 | 109440 | -5404 |
| 127418 | 164160 | -36742 |
| 147129 | 218880 | -71751 |
| 164495 | 273600 | -109105 |
| 180196 | 328320 | -148124 |
| 194634 | 383040 | -188406 |
| 208072 | 437760 | -229688 |
| 220694 | 492480 | -271786 |
| 232632 | 547200 | -314568 |
| 243986 | 601920 | -357934 |

**Detention 23585 cf**

**Project Name:** ENCINA HILLS (WATERSHED F INCLUDING ADJACENT PARCELS)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | — | |
| C | 0.25 | | — | Runoff Coefficient of pervious surface |
| A | 94.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 30.4 | cfs | | Q=CItA |
| Q 100 pre | 45.5 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | | |
|---|---|---|---|---|
| Ap | 89.4 | acres | | Approx Area of Pervious Surface |
| Cp | 0.25 | | | Runoff Coefficient of pervious surface |
| Ai | 5.27 | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.29 | | | Composite Runoff Coefficient |
| Total A | 94.7 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| Q 100 post | 52.1 | cfs | | Q=CItA |
| Q 10 post | 34.8 | cfs | | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 30.40 | 36480 |
| 30 | 30.40 | 54720 |
| 40 | 30.40 | 72960 |
| 50 | 30.40 | 91200 |
| 60 | 30.40 | 109440 |
| 90 | 30.40 | 164160 |
| 120 | 30.40 | 218880 |
| 150 | 30.40 | 273600 |
| 180 | 30.40 | 328320 |
| 210 | 30.40 | 383040 |
| 240 | 30.40 | 437760 |
| 270 | 30.40 | 492480 |
| 300 | 30.40 | 547200 |
| 330 | 30.40 | 601920 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 52.13 | 62556 |
| 30 | 1.57 | 42.56 | 76615 |
| 40 | 1.36 | 36.86 | 88467 |
| 50 | 1.22 | 32.97 | 98910 |
| 60 | 1.11 | 30.10 | 108350 |
| 90 | 0.91 | 24.57 | 132701 |
| 120 | 0.79 | 21.28 | 153230 |
| 150 | 0.70 | 19.04 | 171316 |
| 180 | 0.64 | 17.38 | 187668 |
| 210 | 0.59 | 16.09 | 202704 |
| 240 | 0.56 | 15.05 | 216700 |
| 270 | 0.52 | 14.19 | 229845 |
| 300 | 0.50 | 13.46 | 242278 |
| 330 | 0.47 | 12.83 | 254103 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 62556 | 36480 | 26076 |
| 76615 | 54720 | 21895 |
| 88467 | 72960 | 15507 |
| 98910 | 91200 | 7710 |
| 108350 | 109440 | -1090 |
| 132701 | 164160 | -31459 |
| 153230 | 218880 | -65650 |
| 171316 | 273600 | -102284 |
| 187668 | 328320 | -140652 |
| 202704 | 383040 | -180336 |
| 216700 | 437760 | -221060 |
| 229845 | 492480 | -262635 |
| 242278 | 547200 | -304922 |
| 254103 | 601920 | -347817 |

**Detention 26076 cf**

**Project Name:** ENCINA HILLS WATERSHED (G)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | |
|---|---|---|---|
| Tc | 20 | minutes | — Minimum Per Water Resources Agency |
| C | 0.25 | | — Runoff Coefficient of pervious surface |
| A | 75.6 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | It=7.75*I/SQRT(t) |
| Q 10 pre | 24.2 | cfs | Q=CItA |
| Q 100 pre | 36.4 | cfs | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | |
|---|---|---|---|
| Ap | 74.1 | acres | Approx Area of Pervious Surface |
| Cp | 0.25 | | Runoff Coefficient of pervious surface |
| Ai | 1.54 | acres | Approx Area of Impervious Surface |
| Ci | 0.90 | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | |
| Weighted C | 0.26 | | Composite Runoff Coefficient |
| Total A | 75.6 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | It=7.75*I/SQRT(t) |
| Q 100 post | 38.3 | cfs | Q=CItA |
| Q 10 post | 25.5 | cfs | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 24.20 | 29040 |
| 30 | 24.20 | 43560 |
| 40 | 24.20 | 58080 |
| 50 | 24.20 | 72600 |
| 60 | 24.20 | 87120 |
| 90 | 24.20 | 130680 |
| 120 | 24.20 | 174240 |
| 150 | 24.20 | 217800 |
| 180 | 24.20 | 261360 |
| 210 | 24.20 | 304920 |
| 240 | 24.20 | 348480 |
| 270 | 24.20 | 392040 |
| 300 | 24.20 | 435600 |
| 330 | 24.20 | 479160 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 38.28 | 45937 |
| 30 | 1.57 | 31.26 | 56262 |
| 40 | 1.36 | 27.07 | 64965 |
| 50 | 1.22 | 24.21 | 72633 |
| 60 | 1.11 | 22.10 | 79566 |
| 90 | 0.91 | 18.05 | 97448 |
| 120 | 0.79 | 15.63 | 112523 |
| 150 | 0.70 | 13.98 | 125805 |
| 180 | 0.64 | 12.76 | 137812 |
| 210 | 0.59 | 11.81 | 148854 |
| 240 | 0.56 | 11.05 | 159132 |
| 270 | 0.52 | 10.42 | 168785 |
| 300 | 0.50 | 9.88 | 177915 |
| 330 | 0.47 | 9.42 | 186598 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 45937 | 29040 | 16897 |
| 56262 | 43560 | 12702 |
| 64965 | 58080 | 6885 |
| 72633 | 72600 | 33 |
| 79566 | 87120 | -7554 |
| 97448 | 130680 | -33232 |
| 112523 | 174240 | -61717 |
| 125805 | 217800 | -91995 |
| 137812 | 261360 | -123548 |
| 148854 | 304920 | -156066 |
| 159132 | 348480 | -189348 |
| 168785 | 392040 | -223255 |
| 177915 | 435600 | -257685 |
| 186598 | 479160 | -292562 |

**Detention 16897 cf**

**Project Name:** ENCINA HILLS (WATERSHED G INCLUDING ADJACENT PARCELS)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | — | Minimum Per Water Resources Agency |
| C | 0.25 | | — | Runoff Coefficient of pervious surface |
| A | 75.6 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 24.2 | cfs | | Q=CItA |
| Q 100 pre | 36.4 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | |
|---|---|---|---|
| Ap | 71.0 | acres | Approx Area of Pervious Surface |
| Cp | 0.25 | | Runoff Coefficient of pervious surface |
| Ai | 4.56 | acres | Approx Area of Impervious Surface |
| Ci | 0.90 | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | |
| Weighted C | 0.29 | | Composite Runoff Coefficient |
| Total A | 75.6 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | It=7.75*I/SQRT(t) |
| Q 100 post | 42.1 | cfs | Q=CItA |
| Q 10 post | 28.0 | cfs | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 24.20 | 29040 |
| 30 | 24.20 | 43560 |
| 40 | 24.20 | 58080 |
| 50 | 24.20 | 72600 |
| 60 | 24.20 | 87120 |
| 90 | 24.20 | 130680 |
| 120 | 24.20 | 174240 |
| 150 | 24.20 | 217800 |
| 180 | 24.20 | 261360 |
| 210 | 24.20 | 304920 |
| 240 | 24.20 | 348480 |
| 270 | 24.20 | 392040 |
| 300 | 24.20 | 435600 |
| 330 | 24.20 | 479160 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 42.06 | 50469 |
| 30 | 1.57 | 34.34 | 61811 |
| 40 | 1.36 | 29.74 | 71373 |
| 50 | 1.22 | 26.60 | 79798 |
| 60 | 1.11 | 24.28 | 87414 |
| 90 | 0.91 | 19.83 | 107060 |
| 120 | 0.79 | 17.17 | 123622 |
| 150 | 0.70 | 15.36 | 138214 |
| 180 | 0.64 | 14.02 | 151406 |
| 210 | 0.59 | 12.98 | 163537 |
| 240 | 0.56 | 12.14 | 174828 |
| 270 | 0.52 | 11.45 | 185433 |
| 300 | 0.50 | 10.86 | 195464 |
| 330 | 0.47 | 10.35 | 205004 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 50469 | 29040 | 21429 |
| 61811 | 43560 | 18251 |
| 71373 | 58080 | 13293 |
| 79798 | 72600 | 7198 |
| 87414 | 87120 | 294 |
| 107060 | 130680 | -23620 |
| 123622 | 174240 | -50618 |
| 138214 | 217800 | -79586 |
| 151406 | 261360 | -109954 |
| 163537 | 304920 | -141383 |
| 174828 | 348480 | -173652 |
| 185433 | 392040 | -206607 |
| 195464 | 435600 | -240136 |
| 205004 | 479160 | -274156 |

**Detention 21429 cf**

**Project Name:** **ENCINA HILLS (WATERSHED H)**

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## 10 year Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | ← | Minimum Per Water Resources Agency |
| C | 0.25 | | ← | Runoff Coefficient of pervious surface |
| A | 0.8 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 10 pre** | **0.3** | **cfs** | | Q=CItA |

## 100 year Runoff (No Development in this watershed)

| | | | | |
|---|---|---|---|---|
| Ap | 0.8 | acres | | Approx Area of Pervious Surface |
| Cp | 0.3 | | | Runoff Coefficient of pervious surface |
| Ai | - | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.25 | | | Composite Runoff Coefficient |
| Total A | 0.8 | acres | | |
| I (2 yr) | 0.50 | in/hr | ← | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | ← | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| **Q 100 post** | **0.4** | **cfs** | | Q=CItA |

**Project Name:** ENCINA HILLS (WATERSHED I)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | — | Minimum Per Water Resources Agency |
| C | 0.25 | | — | Runoff Coefficient of pervious surface |
| A | 7.6 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 2.4 | cfs | | Q=CItA |
| Q 100 pre | 3.6 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | |
|---|---|---|---|
| Ap | 7.3 | acres | Approx Area of Pervious Surface |
| Cp | 0.25 | | Runoff Coefficient of pervious surface |
| Ai | 0.22 | acres | Approx Area of Impervious Surface |
| Ci | 0.90 | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | |
| Weighted C | 0.27 | | Composite Runoff Coefficient |
| Total A | 7.6 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | It=7.75*I/SQRT(t) |
| Q 100 post | 3.9 | cfs | Q=CItA |
| Q 10 post | 2.6 | cfs | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 2.40 | 2880 |
| 30 | 2.40 | 4320 |
| 40 | 2.40 | 5760 |
| 50 | 2.40 | 7200 |
| 60 | 2.40 | 8640 |
| 90 | 2.40 | 12960 |
| 120 | 2.40 | 17280 |
| 150 | 2.40 | 21600 |
| 180 | 2.40 | 25920 |
| 210 | 2.40 | 30240 |
| 240 | 2.40 | 34560 |
| 270 | 2.40 | 38880 |
| 300 | 2.40 | 43200 |
| 330 | 2.40 | 47520 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 3.91 | 4687 |
| 30 | 1.57 | 3.19 | 5740 |
| 40 | 1.36 | 2.76 | 6628 |
| 50 | 1.22 | 2.47 | 7411 |
| 60 | 1.11 | 2.26 | 8118 |
| 90 | 0.91 | 1.84 | 9943 |
| 120 | 0.79 | 1.59 | 11481 |
| 150 | 0.70 | 1.43 | 12836 |
| 180 | 0.64 | 1.30 | 14061 |
| 210 | 0.59 | 1.21 | 15188 |
| 240 | 0.56 | 1.13 | 16236 |
| 270 | 0.52 | 1.06 | 17221 |
| 300 | 0.50 | 1.01 | 18153 |
| 330 | 0.47 | 0.96 | 19039 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 4687 | 2880 | 1807 |
| 5740 | 4320 | 1420 |
| 6628 | 5760 | 868 |
| 7411 | 7200 | 211 |
| 8118 | 8640 | -522 |
| 9943 | 12960 | -3017 |
| 11481 | 17280 | -5799 |
| 12836 | 21600 | -8764 |
| 14061 | 25920 | -11859 |
| 15188 | 30240 | -15052 |
| 16236 | 34560 | -18324 |
| 17221 | 38880 | -21659 |
| 18153 | 43200 | -25047 |
| 19039 | 47520 | -28481 |

**Detention 1807 cf**

**Project Name:** ENCINA HILLS (WATERSHED I INCLUDING ADJACENT PARCELS)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | — | Minimum Per Water Resources Agency |
| C | 0.25 | | — | Runoff Coefficient of pervious surface |
| A | 7.6 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 2.4 | cfs | | Q=CItA |
| Q 100 pre | 3.6 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | |
|---|---|---|---|
| Ap | 7.1 | acres | Approx Area of Pervious Surface |
| Cp | 0.25 | | Runoff Coefficient of pervious surface |
| Ai | 0.45 | acres | Approx Area of Impervious Surface |
| Ci | 0.90 | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | |
| Weighted C | 0.29 | | Composite Runoff Coefficient |
| Total A | 7.6 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | It=7.75*I/SQRT(t) |
| Q 100 post | 4.2 | cfs | Q=CItA |
| Q 10 post | 2.8 | cfs | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 2.40 | 2880 |
| 30 | 2.40 | 4320 |
| 40 | 2.40 | 5760 |
| 50 | 2.40 | 7200 |
| 60 | 2.40 | 8640 |
| 90 | 2.40 | 12960 |
| 120 | 2.40 | 17280 |
| 150 | 2.40 | 21600 |
| 180 | 2.40 | 25920 |
| 210 | 2.40 | 30240 |
| 240 | 2.40 | 34560 |
| 270 | 2.40 | 38880 |
| 300 | 2.40 | 43200 |
| 330 | 2.40 | 47520 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 4.19 | 5032 |
| 30 | 1.57 | 3.42 | 6163 |
| 40 | 1.36 | 2.97 | 7116 |
| 50 | 1.22 | 2.65 | 7956 |
| 60 | 1.11 | 2.42 | 8716 |
| 90 | 0.91 | 1.98 | 10675 |
| 120 | 0.79 | 1.71 | 12326 |
| 150 | 0.70 | 1.53 | 13781 |
| 180 | 0.64 | 1.40 | 15096 |
| 210 | 0.59 | 1.29 | 16306 |
| 240 | 0.56 | 1.21 | 17432 |
| 270 | 0.52 | 1.14 | 18489 |
| 300 | 0.50 | 1.08 | 19489 |
| 330 | 0.47 | 1.03 | 20440 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 5032 | 2880 | 2152 |
| 6163 | 4320 | 1843 |
| 7116 | 5760 | 1356 |
| 7956 | 7200 | 756 |
| 8716 | 8640 | 76 |
| 10675 | 12960 | -2285 |
| 12326 | 17280 | -4954 |
| 13781 | 21600 | -7819 |
| 15096 | 25920 | -10824 |
| 16306 | 30240 | -13934 |
| 17432 | 34560 | -17128 |
| 18489 | 38880 | -20391 |
| 19489 | 43200 | -23711 |
| 20440 | 47520 | -27080 |

**Detention 2152 cf**

**Project Name:** ENCINA HILLS (WATERSHED J)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | — | Minimum Per Water Resources Agency |
| C | 0.25 | | — | Runoff Coefficient of pervious surface |
| A | 3.1 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 1.0 | cfs | | Q=CItA |
| Q 100 pre | 1.5 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | |
|---|---|---|---|
| Ap | 3.0 | acres | Approx Area of Pervious Surface |
| Cp | 0.25 | | Runoff Coefficient of pervious surface |
| Ai | 0.14 | acres | Approx Area of Impervious Surface |
| Ci | 0.90 | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | |
| Weighted C | 0.28 | | Composite Runoff Coefficient |
| Total A | 3.1 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | It=7.75*I/SQRT(t) |
| Q 100 post | 1.7 | cfs | Q=CItA |
| Q 10 post | 1.1 | cfs | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 1.00 | 1200 |
| 30 | 1.00 | 1800 |
| 40 | 1.00 | 2400 |
| 50 | 1.00 | 3000 |
| 60 | 1.00 | 3600 |
| 90 | 1.00 | 5400 |
| 120 | 1.00 | 7200 |
| 150 | 1.00 | 9000 |
| 180 | 1.00 | 10800 |
| 210 | 1.00 | 12600 |
| 240 | 1.00 | 14400 |
| 270 | 1.00 | 16200 |
| 300 | 1.00 | 18000 |
| 330 | 1.00 | 19800 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 1.67 | 1999 |
| 30 | 1.57 | 1.36 | 2448 |
| 40 | 1.36 | 1.18 | 2827 |
| 50 | 1.22 | 1.05 | 3161 |
| 60 | 1.11 | 0.96 | 3462 |
| 90 | 0.91 | 0.79 | 4240 |
| 120 | 0.79 | 0.68 | 4896 |
| 150 | 0.70 | 0.61 | 5474 |
| 180 | 0.64 | 0.56 | 5997 |
| 210 | 0.59 | 0.51 | 6477 |
| 240 | 0.56 | 0.48 | 6925 |
| 270 | 0.52 | 0.45 | 7345 |
| 300 | 0.50 | 0.43 | 7742 |
| 330 | 0.47 | 0.41 | 8120 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 1999 | 1200 | 799 |
| 2448 | 1800 | 648 |
| 2827 | 2400 | 427 |
| 3161 | 3000 | 161 |
| 3462 | 3600 | -138 |
| 4240 | 5400 | -1160 |
| 4896 | 7200 | -2304 |
| 5474 | 9000 | -3526 |
| 5997 | 10800 | -4803 |
| 6477 | 12600 | -6123 |
| 6925 | 14400 | -7475 |
| 7345 | 16200 | -8855 |
| 7742 | 18000 | -10258 |
| 8120 | 19800 | -11680 |

**Detention 799 cf**

**Project Name:** ENCINA HILLS (WATERSHED K)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | |
|---|---|---|---|
| Tc | 20 | minutes | — Minimum Per Water Resources Agency |
| C | 0.25 | | — Runoff Coefficient of pervious surface |
| A | 37.6 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | It=7.75*I/SQRT(t) |
| Q 10 pre | 12.1 | cfs | Q=CItA |
| Q 100 pre | 18.1 | cfs | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | |
|---|---|---|---|
| Ap | 37.0 | acres | Approx Area of Pervious Surface |
| Cp | 0.25 | | Runoff Coefficient of pervious surface |
| Ai | 0.62 | acres | Approx Area of Impervious Surface |
| Ci | 0.90 | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | |
| Weighted C | 0.26 | | Composite Runoff Coefficient |
| Total A | 37.6 | acres | |
| I (2 yr) | 0.50 | in/hr | — Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | It=7.75*I/SQRT(t) |
| Q 100 post | 18.9 | cfs | Q=CItA |
| Q 10 post | 12.6 | cfs | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 12.10 | 14520 |
| 30 | 12.10 | 21780 |
| 40 | 12.10 | 29040 |
| 50 | 12.10 | 36300 |
| 60 | 12.10 | 43560 |
| 90 | 12.10 | 65340 |
| 120 | 12.10 | 87120 |
| 150 | 12.10 | 108900 |
| 180 | 12.10 | 130680 |
| 210 | 12.10 | 152460 |
| 240 | 12.10 | 174240 |
| 270 | 12.10 | 196020 |
| 300 | 12.10 | 217800 |
| 330 | 12.10 | 239580 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 18.85 | 22628 |
| 30 | 1.57 | 15.40 | 27714 |
| 40 | 1.36 | 13.33 | 32001 |
| 50 | 1.22 | 11.93 | 35778 |
| 60 | 1.11 | 10.89 | 39193 |
| 90 | 0.91 | 8.89 | 48002 |
| 120 | 0.79 | 7.70 | 55428 |
| 150 | 0.70 | 6.89 | 61970 |
| 180 | 0.64 | 6.29 | 67885 |
| 210 | 0.59 | 5.82 | 73324 |
| 240 | 0.56 | 5.44 | 78386 |
| 270 | 0.52 | 5.13 | 83141 |
| 300 | 0.50 | 4.87 | 87639 |
| 330 | 0.47 | 4.64 | 91916 |

## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 22628 | 14520 | 8108 |
| 27714 | 21780 | 5934 |
| 32001 | 29040 | 2961 |
| 35778 | 36300 | -522 |
| 39193 | 43560 | -4367 |
| 48002 | 65340 | -17338 |
| 55428 | 87120 | -31692 |
| 61970 | 108900 | -46930 |
| 67885 | 130680 | -62795 |
| 73324 | 152460 | -79136 |
| 78386 | 174240 | -95854 |
| 83141 | 196020 | -112879 |
| 87639 | 217800 | -130161 |
| 91916 | 239580 | -147664 |

**Detention 8108 cf**

**Project Name:** ENCINA HILLS (WATERSHED K INCLUDING ADJACENT PARCEL)

Project No. 546.00
Calculations by KAY/KMW/CLL
Date: 3/22/2007

## Pre-Development Runoff

| | | | | |
|---|---|---|---|---|
| Tc | 20 | minutes | — | Minimum Per Water Resources Agency |
| C | 0.25 | | — | Runoff Coefficient of pervious surface |
| A | 37.6 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (10 yr) | 0.74 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.28 | in/hr | | It=7.75*I/SQRT(t) |
| Q 10 pre | 12.1 | cfs | | Q=CItA |
| Q 100 pre | 18.1 | cfs | | Q100=Q10*(1.11/0.74) |

## Post-Development Runoff

| | | | | |
|---|---|---|---|---|
| Ap | 36.8 | acres | | Approx Area of Pervious Surface |
| Cp | 0.25 | | | Runoff Coefficient of pervious surface |
| Ai | 0.84 | acres | | Approx Area of Impervious Surface |
| Ci | 0.90 | | | Runoff Coeficient of impervious surface |
| Tc | 20 | minutes | | |
| Weighted C | 0.26 | | | Composite Runoff Coefficient |
| Total A | 37.6 | acres | | |
| I (2 yr) | 0.50 | in/hr | — | Per Monterey County Plate No. 25 |
| I (100 yr) | 1.11 | in/hr | — | Per Monterey County Plate No. 25 |
| It | 1.92 | in/hr | | It=7.75*I/SQRT(t) |
| Q 100 post | 19.1 | cfs | | Q=CItA |
| Q 10 post | 12.8 | cfs | | Q10=Q100*(.74/1.11) |

## 10 year Pre-Development Outflow

| Tc Min | Q cfs | Qout cf |
|---|---|---|
| 20 | 12.10 | 14520 |
| 30 | 12.10 | 21780 |
| 40 | 12.10 | 29040 |
| 50 | 12.10 | 36300 |
| 60 | 12.10 | 43560 |
| 90 | 12.10 | 65340 |
| 120 | 12.10 | 87120 |
| 150 | 12.10 | 108900 |
| 180 | 12.10 | 130680 |
| 210 | 12.10 | 152460 |
| 240 | 12.10 | 174240 |
| 270 | 12.10 | 196020 |
| 300 | 12.10 | 217800 |
| 330 | 12.10 | 239580 |

## 100 year Post-Development Inflow

| Tc Min | I 100yr in/hr | Q cfs | Qin cf |
|---|---|---|---|
| 20 | 1.92 | 19.13 | 22958 |
| 30 | 1.57 | 15.62 | 28118 |
| 40 | 1.36 | 13.53 | 32468 |
| 50 | 1.22 | 12.10 | 36300 |
| 60 | 1.11 | 11.05 | 39765 |
| 90 | 0.91 | 9.02 | 48702 |
| 120 | 0.79 | 7.81 | 56236 |
| 150 | 0.70 | 6.99 | 62874 |
| 180 | 0.64 | 6.38 | 68875 |
| 210 | 0.59 | 5.90 | 74393 |
| 240 | 0.56 | 5.52 | 79530 |
| 270 | 0.52 | 5.21 | 84354 |
| 300 | 0.50 | 4.94 | 88917 |
| 330 | 0.47 | 4.71 | 93257 |

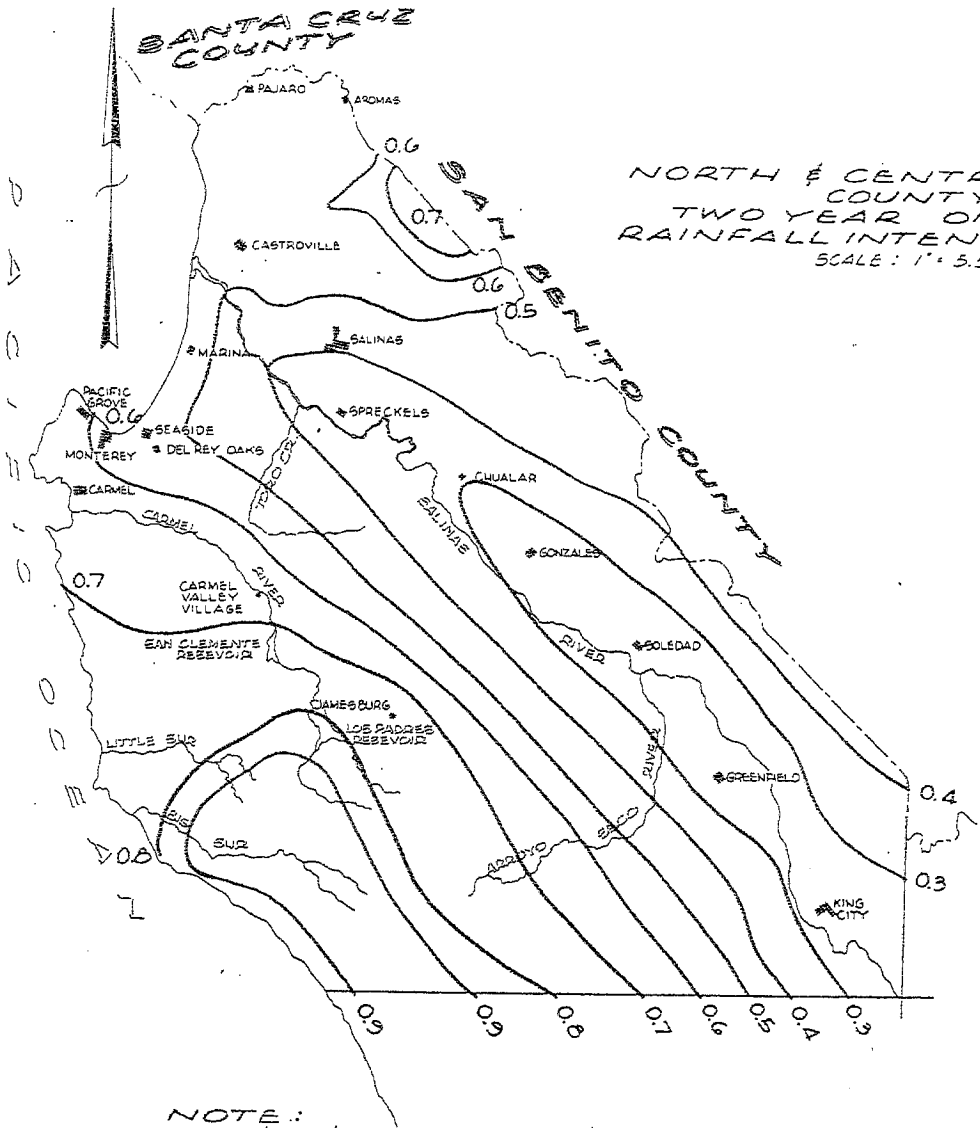
## Storage Requirement

| Qin | Qout | = (Qin - Qout) |
|---|---|---|
| 22958 | 14520 | 8438 |
| 28118 | 21780 | 6338 |
| 32468 | 29040 | 3428 |
| 36300 | 36300 | 0 |
| 39765 | 43560 | -3795 |
| 48702 | 65340 | -16638 |
| 56236 | 87120 | -30884 |
| 62874 | 108900 | -46026 |
| 68875 | 130680 | -61805 |
| 74393 | 152460 | -78067 |
| 79530 | 174240 | -94710 |
| 84354 | 196020 | -111666 |
| 88917 | 217800 | -128883 |
| 93257 | 239580 | -146323 |

**Detention 8438 cf**

# NORTH & CENTRAL MONTEREY COUNTY TWO YEAR ONE HOUR RAINFALL INTENSITIES CHART

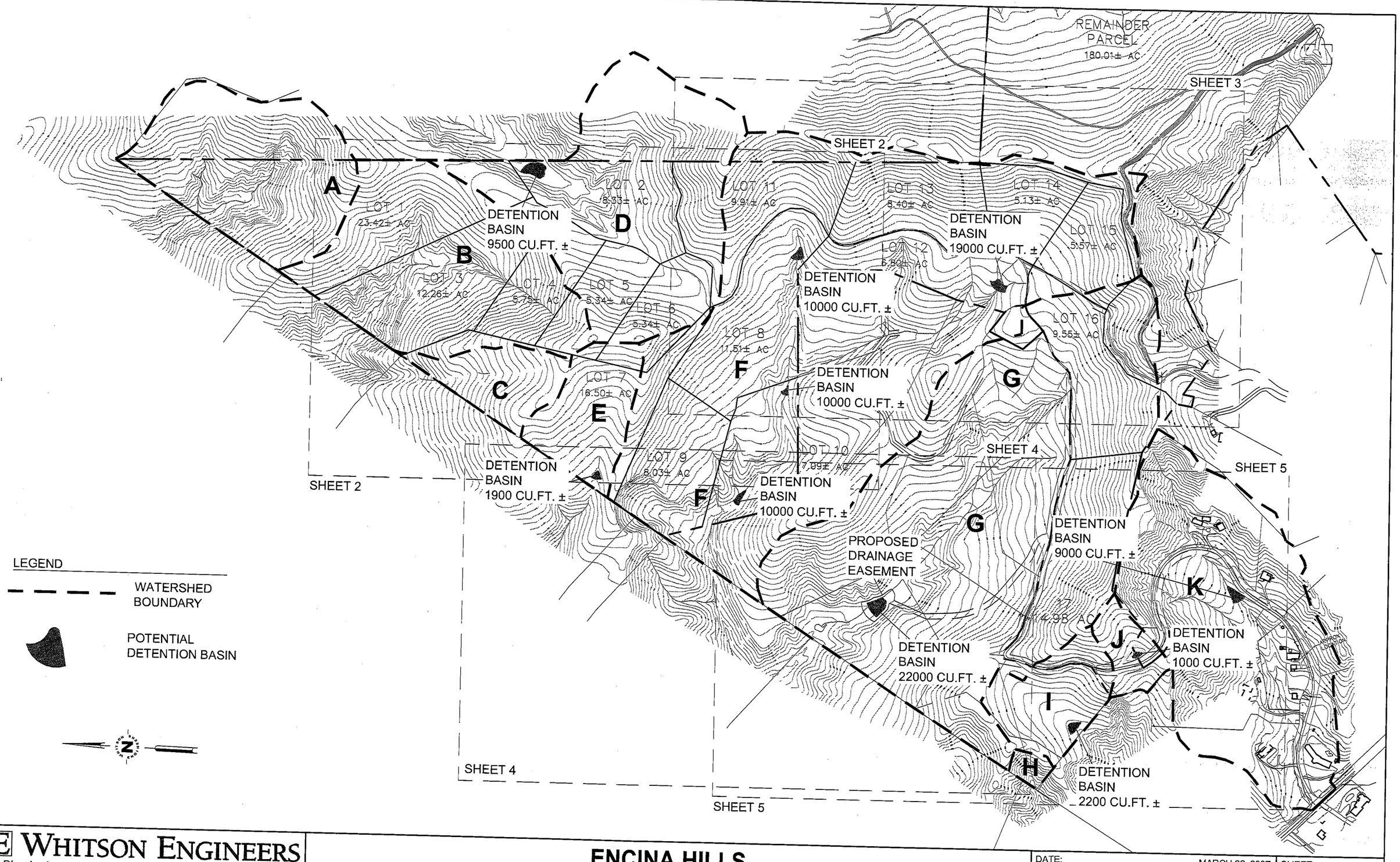
SCALE: 1" = 5.5 MILES




## NOTE:

1. Intensities for particular location in the Southern part of the County available from County Surveyors Office.
2. Conversion Factors:
   Intensity of a 10-year Design storm equals a 2 year Design storm times 1.48
   " " " 25 year " " " " " " " " 1.73
   " " " 50 year " " " " " " " " 1.92
   " " " 100 year " " " " " " " " 2.22
3. The maximum intensity ($I_t$) for storms of various duration is determined by the formula. $I_t = 1.75\ i/\sqrt{t}$ in which variable are as follows.
   $I_t$ = maximum intensity of storm of t minutes duration.
   i = one hour rainfall intensity from above chart and note 2.
   t = time in minutes shortest time it takes storm runoff to flow from the farthest point in the drainage area to the point in question.
4. Example:
   Find maximum intensity of 20 minute storm in Chualar expected to occur on the average of once in 25 years.
   Solution: From chart 0.5"/hr. intensity for 2-year design storm
   From note 2, 0.5 times 1.73 equals 0.82"/hr. the maximum intensity of a 25 year one hour design storm.
   From note 3, $I = 1.75\ i/\sqrt{t} = (1.75)(0.82)/\sqrt{20} = 1.42"/hr.$
   Therefore the maximum 20 min. intensity of a storm that on the average would occur once every 25 years would be 1.42"/hr.

| | | |
|---|---|---|
| MONTEREY COUNTY | | DEPT. OF PUBLIC WORKS |
| STANDARD DETAILS<br>RAINFALL INTENSITIES CHART | | |
| APPROVED [signature] | DATE 10-24-77 | |
| REVISED | DATE | PLATE NO. 25 |





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CIVIL ENGINEERING ▪ LAND SURVEYING ▪ PROJECT MANAGEMENT


# ENCINA HILLS

MONTEREY COUNTY CALIFORNIA

**ATTACHMENT 4: POTENTIAL DETENTION BASINS**

DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

| | |
|---|---|
| DATE: | MARCH 22, 2007 |
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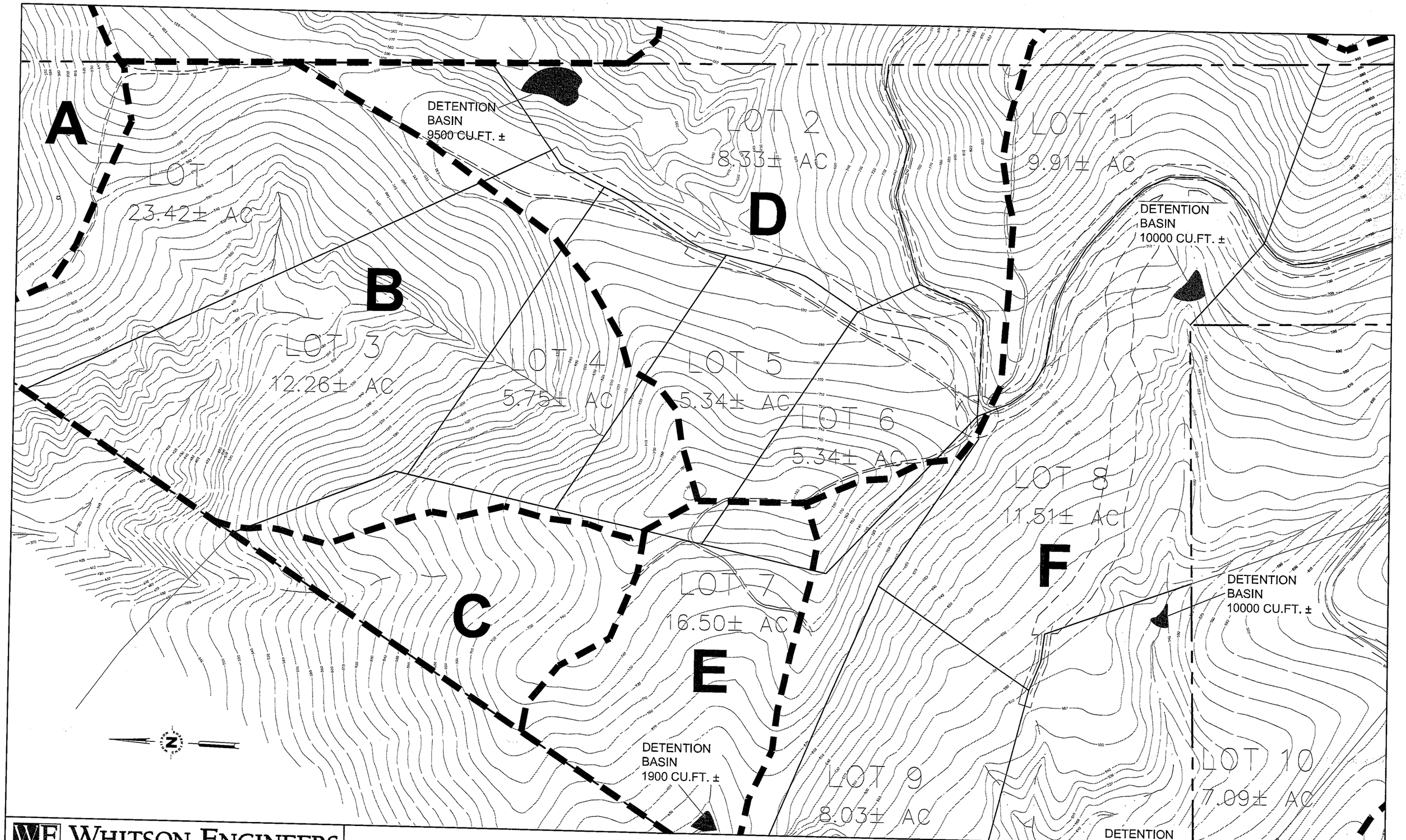
| DRAWN: | J.V |
| CHECKED: | K.W |
| PROJECT No.: | 546.00 |

SHEET 1 OF 5





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MONTEREY COUNTY CALIFORNIA

**ATTACHMENT 4: POTENTIAL DETENTION BASINS**

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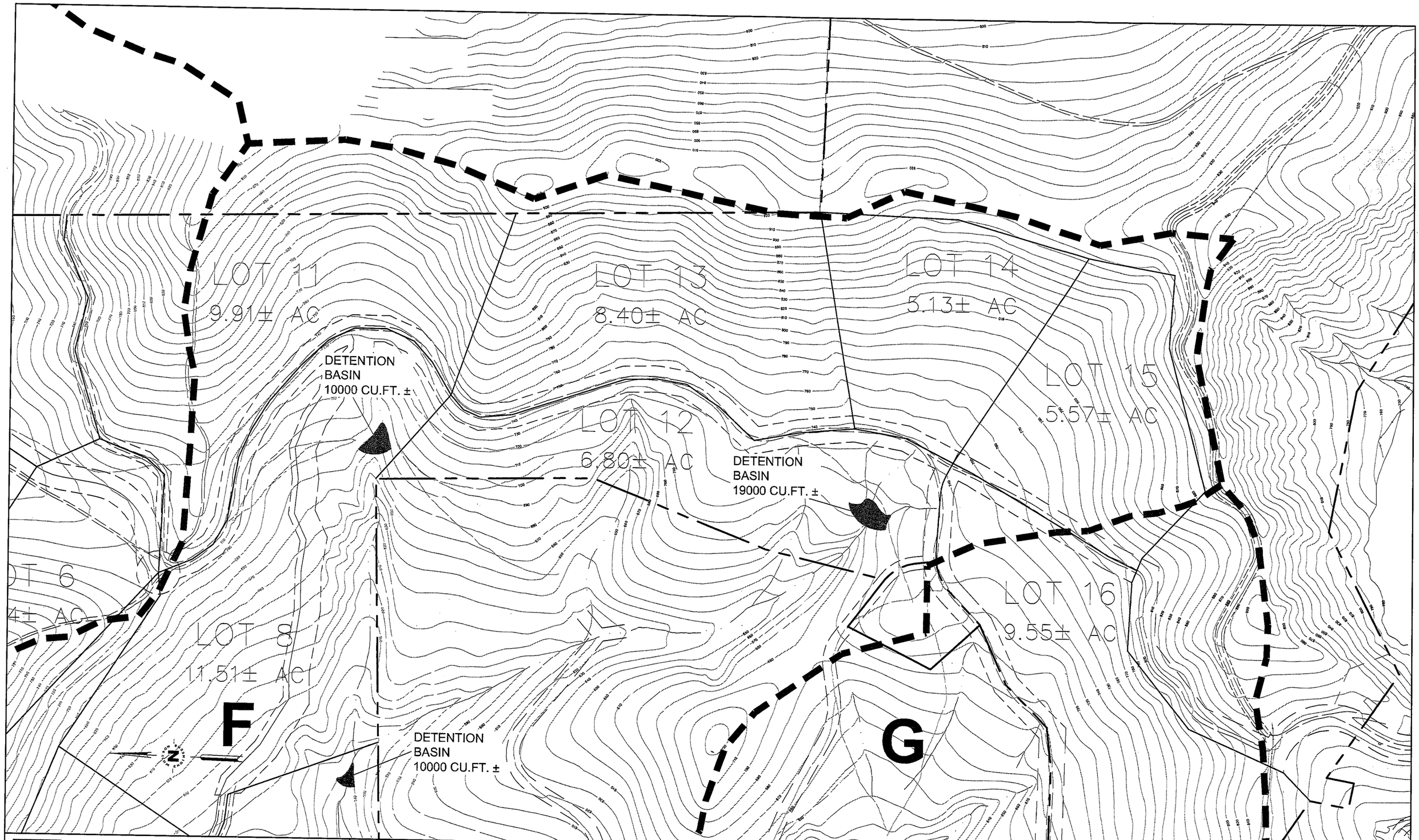
| | |
|---|---|
| DATE: | MARCH 22, 2007 |
| SCALE: | 1"=200' |
| DRAWN: | J.V |
| CHECKED: | K.W |
| PROJECT No.: | 546.00 |

SHEET **2** OF 5

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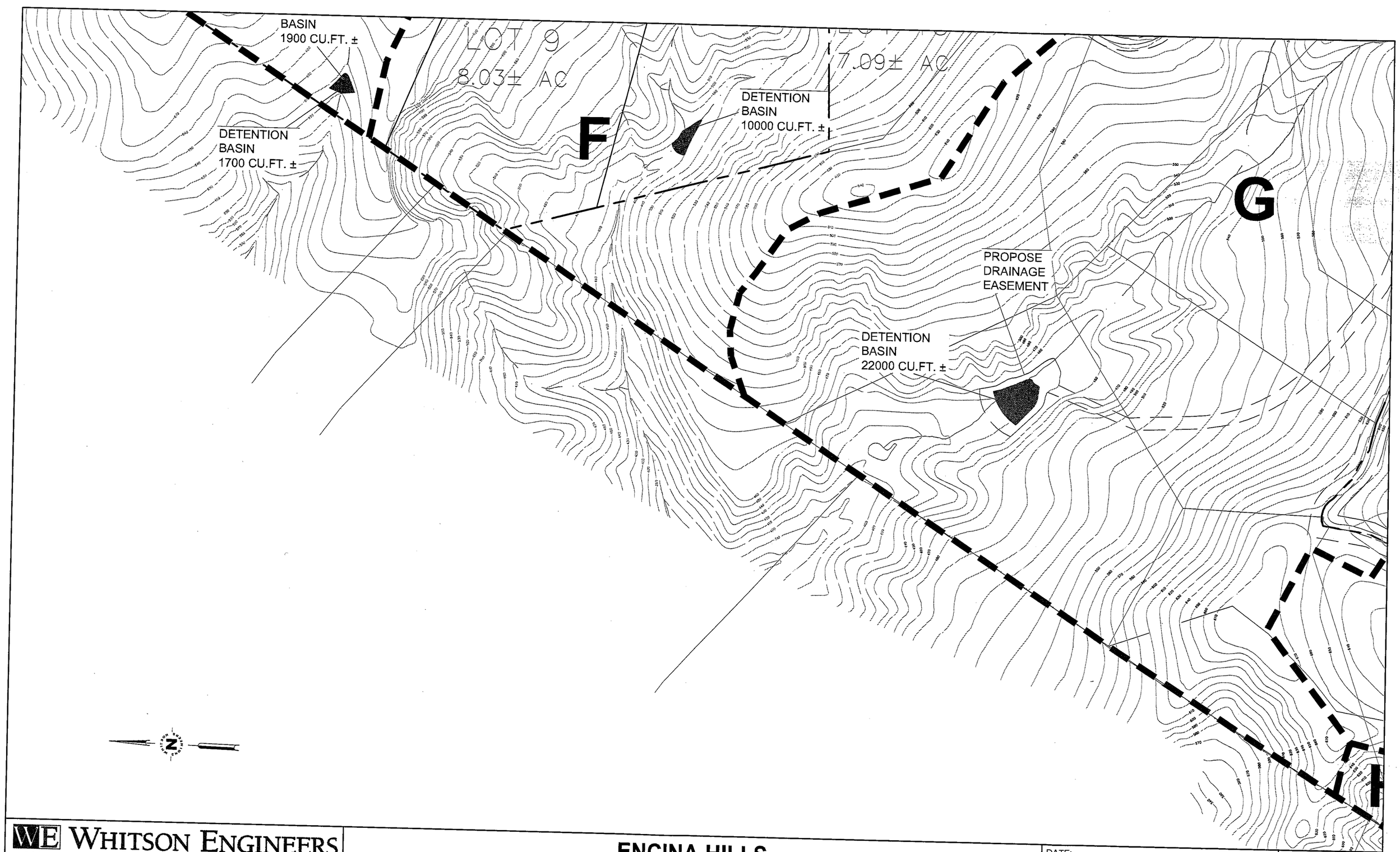
| | |
|---|---|
| DATE: | MARCH 22, 2007 |
| SCALE: | 1"=200' |
| DRAWN: | J.V |
| CHECKED: | K.W |
| PROJECT No.: | 546.00 |

SHEET 3 OF 5

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# ENCINA HILLS

MONTEREY COUNTY — CALIFORNIA

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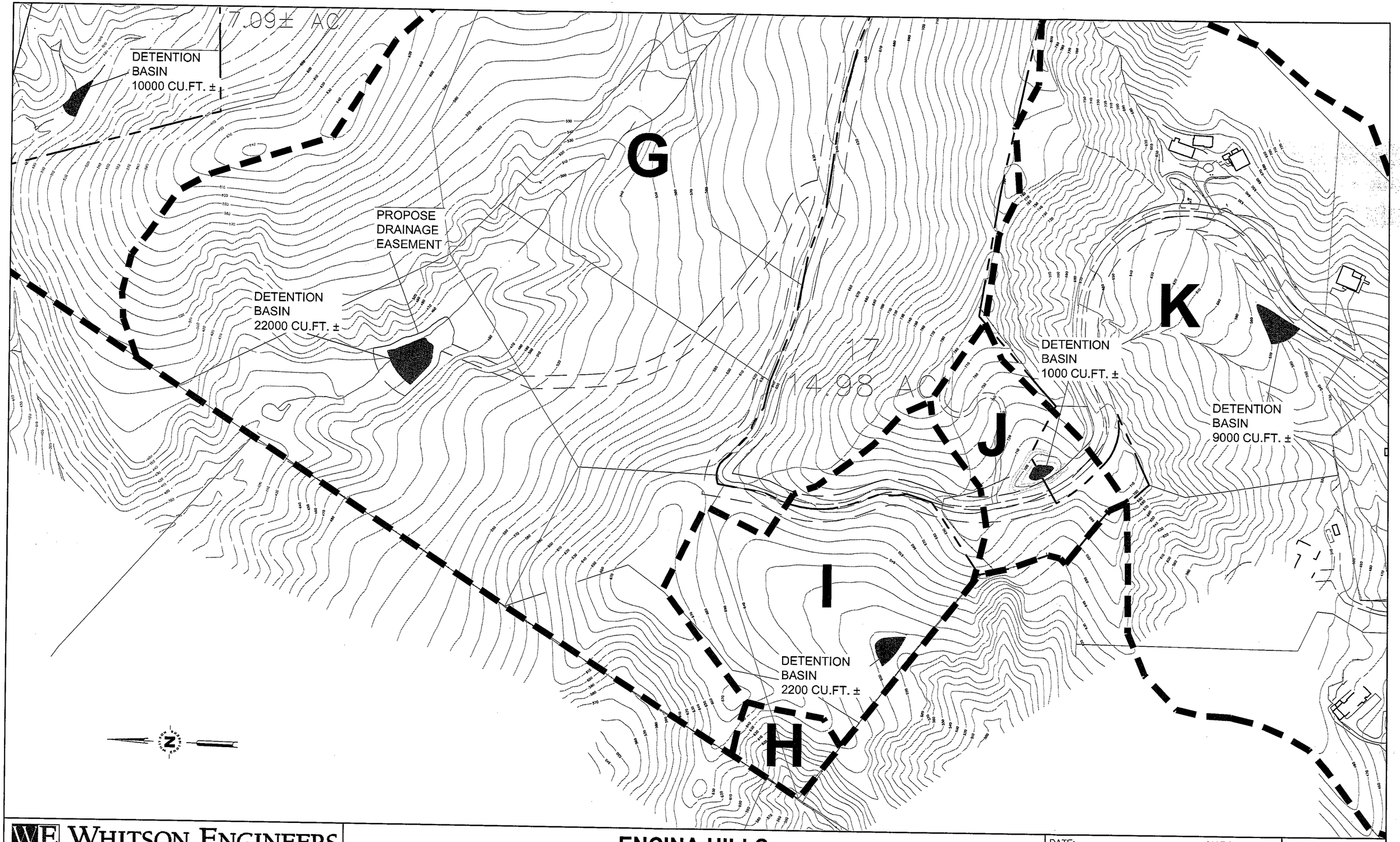
DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

| | |
|---|---|
| DATE: | MARCH 22, 2007 |
| SCALE: | 1"=200' |
| DRAWN: | J.V |
| CHECKED: | K.W |
| PROJECT No.: | 546.00 |

SHEET 4 OF 5





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MONTEREY COUNTY — CALIFORNIA

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DRAWING PATH: T:\DWG\546\DETENTION BASIN EXHIBIT.dwg

| | |
|---|---|
| DATE: | MARCH 22, 2007 |
| SCALE: | 1"=200' |
| DRAWN: | J.V |
| CHECKED: | K.W |
| PROJECT No.: | 546.00 |

SHEET 5 OF 5