APPENDIX F
HYDROLOGY/WATER QUALITY DOCUMENTATION

PRELIMINARY

HYDROLOGY AND HYDRAULIC ANALYSIS

For:

CHICK-FIL-A RESTAURANT # 4306

5850 Avenida Encinas
City of Carlsbad, County of San Diego, California

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1 DISCUSSION

1.1 PURPOSE

This drainage study provides an analysis of the existing and proposed hydrology characteristics for the improvements of the project site at 5850 Avenida Encinas. The site is located just north of the Palomar Airport Rd./I-5 intersection with the Commercial Tourism Zoning. The site is at latitude and longitude of 33°07'32" N and 117°19'29" W, respectively. It is bounded on the west and north by Avenida Encinas, the east by Interstate 5, and the south by In-N-Out Burger.

1.2 EXISTING SITE CONDITION

The project site is currently occupied by a two-story commercial building that sits approx. in the center of the site. Parking stalls exist around the building and follow the perimeter of the site where access is provided by a drive aisle from the adjacent property (In-N-Out) and a driveway into Avenida Encinas just north of the building. The perimeter parking is AC pavement that is in moderate condition and drains surface runoff via a concrete v-gutter. The v-gutter was found to have a high point at the southeast corner of the site where it drains in two directions:

- Northerly to discharge surface runoff out the existing driveway and into Avenida Encinas. Once the surface runoff has entered the curb & gutter in Avenida Encinas it travels south to a municipal curb opening catch basin where it is collected into the municipal storm drain system.
- Westerly to convey runoff through the shared drive aisle and into an existing grated inlet catch basin. Once collected in the private catch basin it is then conveyed through an 18" private storm drain and travels north back onto the project site where it discharges into the same curb opening catch basin in Avenida Encinas as stated above.

The landscaped area in front of the building drains toward Avenida Encinas but also has multiple small grate inlets spared around the landscaping. The small grate inlets appear to discharge through curb openings in Avenida Encinas, but it has not been confirmed.

The survey that was performed revealed that the parking row just south of the building drains to the v-gutter on the project site. This parking row is outside property limits and therefore the project site is accepting offsite drainage.

It was also found that the 18" private storm drain directs concentrated surface runoff from southerly properties through the site, and it was also found that storm water clarifiers were installed in line with this private storm drain upstream of the project site. Therefore offsite surface flows collected upstream of the project site that travel through this private storm drain are anticipated to have been treat by these clarifiers.

1.3 PROPOSED IMPROVEMENTS

The proposed improvements that will take place on this site will include a complete demolition of existing features, re-grading of the site, and construction of a new single-story commercial restaurant, trash enclosure, parking lot and landscape. The site will be designed to follow natural topography as best as possible. Due to the characteristics of this development, this project falls under the 'Priority Development Project' status by City Storm Water Quality standards and is therefore required to implement storm water source control, site design, and structural treatment BMPs throughout the site. The structural BMPs selected for this site are Bio-Filtration basin (BF-1) and have been incorporated into the grading design. To meet Storm Water Quality requirements as well as follow natural topography as best as possible, two bio-filtration basins will be constructed on this site.

Basin #1 is located within DMA-1 and at the most northerly corner of the site. Surface runoff within DMA-1 is directed to a v-gutter from around the south side of the building where it conveys collected runoff to the curb & gutter along the parking stalls following Avenida Encinas. The collected runoff travels through this curb & gutter until it reaches Basin #1 which is its final confluence point.

Basin #2 is located within DMA-2 and in the landscape planter within the proposed drive-thru. This basin will collect runoff from the building roof, the drive-thru, and landscaped area just east of the build. The landscaped area will direct runoff through an earthen swale that discharges into the drive thru. A curb & gutter will collect runoff from the drive-thru where it discharges through a curb opening and into Basin #2

Both basins direct collected runoff either through the underdrain as treated storm water or through the overflow grated inlet for heavier storm events. Once runoff has entered the outlet pipe of each corresponding basin, the storm drain pipe system will direct storm water to a proposed storm capture vault system and then to a proposed storm drain manhole before discharging into the municipal storm drain system.

1.4 METHODOLOGY

For the purpose of this study, all drainage runoffs have been calculated based on a 10 and 100 year frequency. The following hydrology calculations are based on the San Diego County Hydrology Manual where the peak flow is determined by the equation: [Q=C*I*A] using the Advanced Engineering Software (AES) program.

C-Value

For more accurate peak runoff values, a user specified C-Value was used in the rational method calculations. The equation that was used can be found on pg. 3-5 of the San Diego County Hydrology Manual.

$$C = 0.90 * (\%IMP.) + C_p * (1 - \%IMP.)$$

Where $C_p = 0.80$ for General Commercial

Isopluvial Map

The rainfall depths that were used to calculate the peak runoff rates were determined from the 6-hour Isopluvial Maps for 10-yr and 100-yr storm events as found in the Appendix pages of the San Diego County Hydrology Manual. Where the project site falls between two isopluvial contour lines, a graphical interpolation was used to determine the rainfall depth at the project site.

1.5 SUMMARY AND CONCLUSION

TOTAL SITE DISCHARGE FROM THE PROJECT SITE		
STORM EVENT (YEAR)	PRE-DEVELOPMENT CONDITION (cfs)	POST-DEVELOPMENT CONDITION (cfs)
10	4.04	3.69
100	5.94	5.42

1.6 DECLARATION OF CHARGE

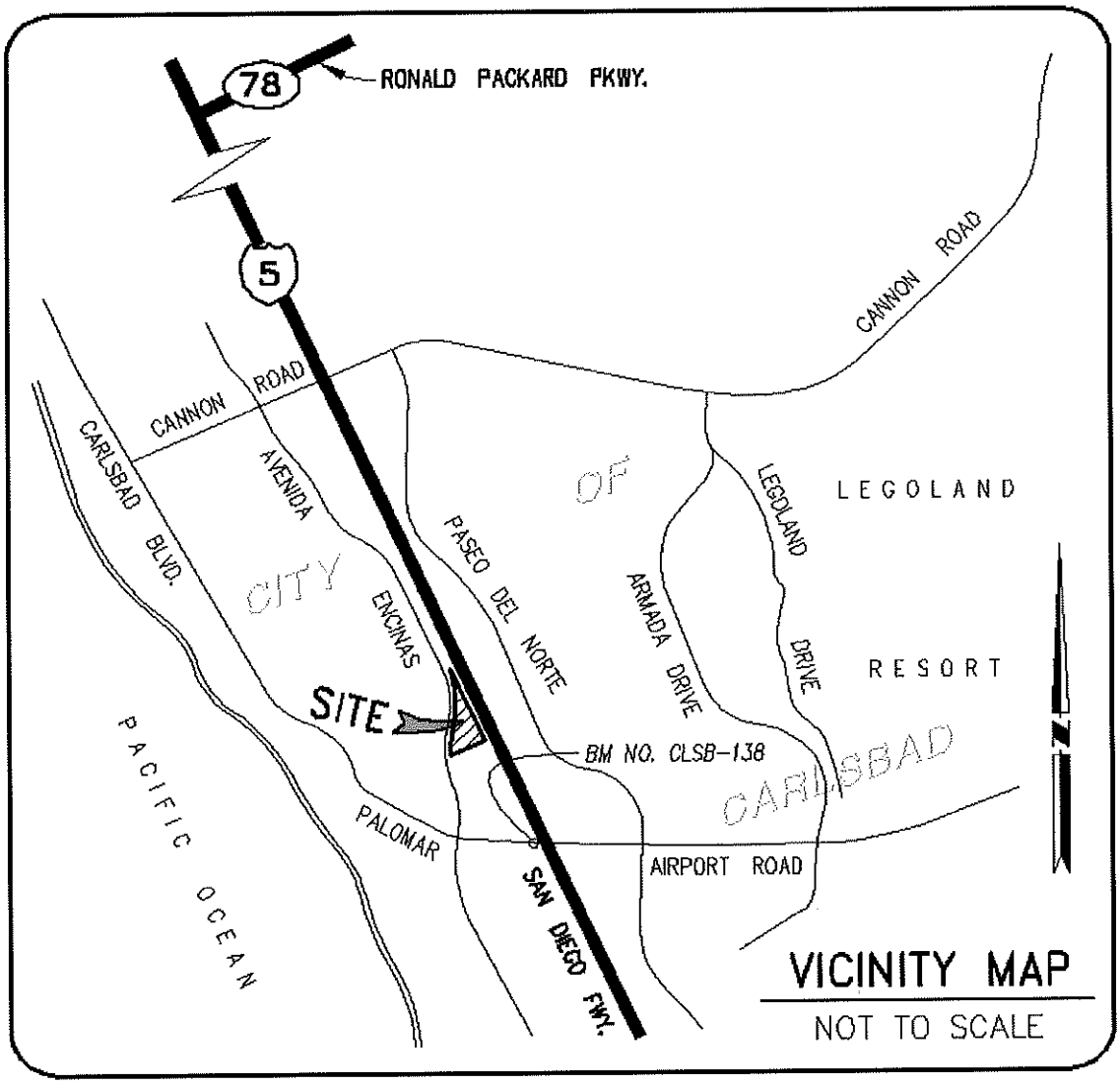
I, HEREBY DECLARE THAT I AM THE CIVIL ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 IN THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE CITY OF POWAY IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES OF PROJECT DESIGN.

_____ _____

Randy Decker, R.C.E. 81077 **Date**

1.7 VICINITY MAP



1.8 SOIL MAP

County of San Diego

PROJECT SITE

SOIL GROUP = B
* SOILS REPORT INDICATES THAT SOIL GROUP D EXISTS AT PROJECT SITE & WAS USED IN CALCULATIONS

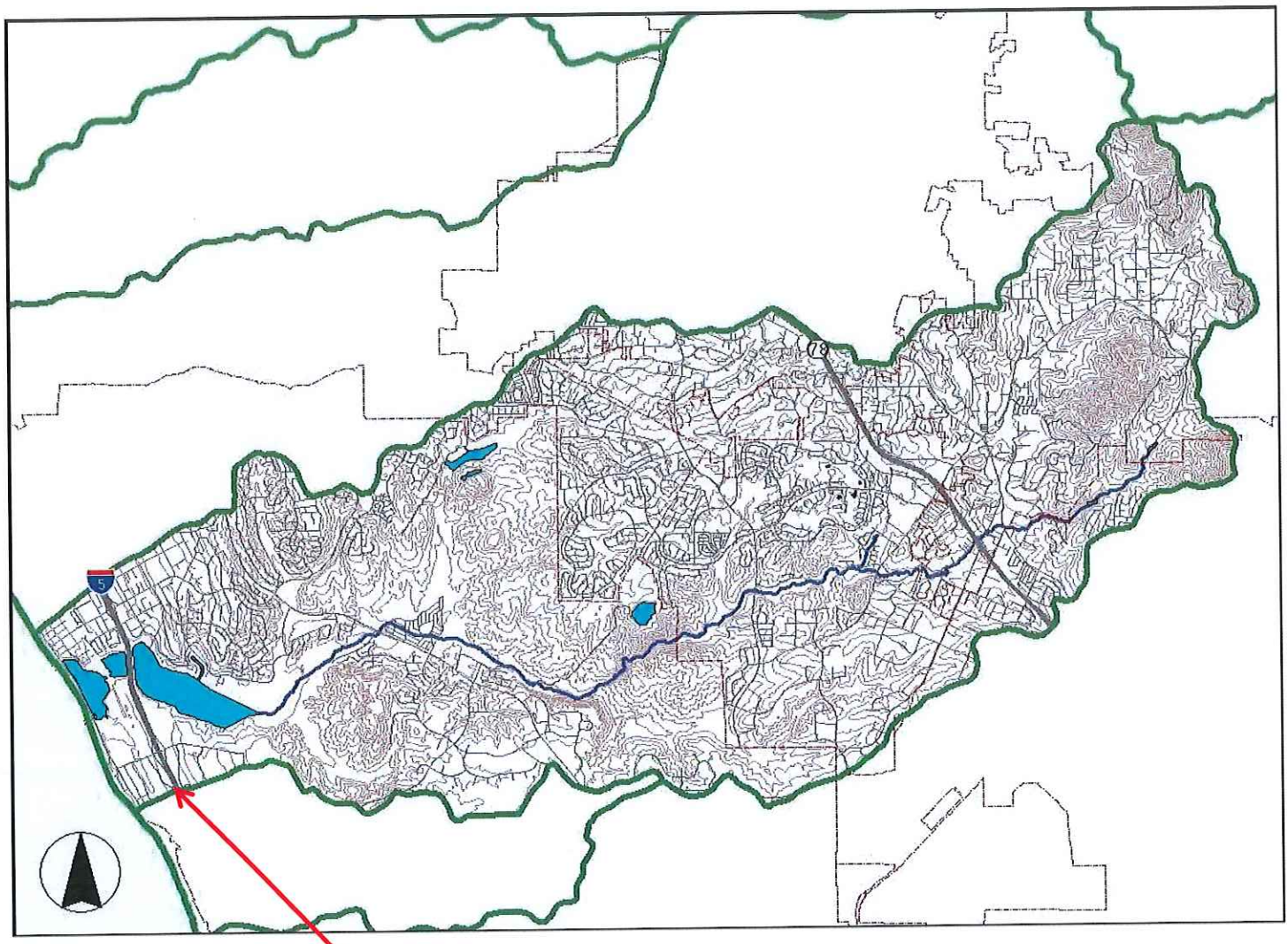
Pacific Ocean

Miles
0 2.5 5 10

Figure C.1
Soils
San Diego County, California

Legend
Hydric Soils
Hydrologic Soils Group
A B C D

1.9 WATERSHED MAP (AGUA HEDIONDA)



2.0 HYDROLOGY ANALYSIS

2.1 10 YEAR HYDROLOGY ANALYSIS (EXISTING CONDITION)

```
**************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
       (c) Copyright 1982-2012 Advanced Engineering Software (aes)
           Ver. 18.2 Release Date: 05/08/2012  License ID 1537

                        Analysis prepared by:


 ************************** DESCRIPTION OF STUDY **************************
* CHICK-FIL-A, #4306                                                      *
* 5850 AVENIDA ENCINAS, CARLSBAD, CA                                      *
* 10-YR PRE-DEVELOPMENT ANALYSIS                                          *
 **************************************************************************

  FILE NAME: 18050EX.DAT
  TIME/DATE OF STUDY: 16:03 07/09/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ======= ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE     100.00 TO NODE     101.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
```

```
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  95
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   260.00
  UPSTREAM ELEVATION(FEET) =     55.93
  DOWNSTREAM ELEVATION(FEET) =     52.46
  ELEVATION DIFFERENCE(FEET) =      3.47
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.691
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.02
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.479
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.90
  TOTAL AREA(ACRES) =      0.52   TOTAL RUNOFF(CFS) =      1.90

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  95
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    98.00
  UPSTREAM ELEVATION(FEET) =     54.83
  DOWNSTREAM ELEVATION(FEET) =     52.58
  ELEVATION DIFFERENCE(FEET) =      2.25
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.373
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    77.96
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.479
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.89
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.89

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  95
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   278.00
  UPSTREAM ELEVATION(FEET) =     56.03
  DOWNSTREAM ELEVATION(FEET) =     53.48
  ELEVATION DIFFERENCE(FEET) =      2.55
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.962
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    58.35
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.479
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.25
  TOTAL AREA(ACRES) =      0.34   TOTAL RUNOFF(CFS) =      1.25
```

```
==========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =        0.3  TC(MIN.) =      3.96
  PEAK FLOW RATE(CFS)    =       1.25
==========================================================================
==========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

2.2 100 YEAR HYDROLOGY ANALYSIS (EXISTING CONDITION)

```
**************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
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            Ver. 18.2 Release Date: 05/08/2012  License ID 1537

                          Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* CHICK-FIL-A, #4306                                                      *
* 5850 AVENIDA ENCINAS, CARLSBAD, CA                                      *
* 100-YR PRE-DEVELOPMENT ANALYSIS                                         *
 **************************************************************************

  FILE NAME: 18050EX.DAT
  TIME/DATE OF STUDY: 16:05 07/09/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE     100.00 TO NODE     101.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
```

```
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   260.00
 UPSTREAM ELEVATION(FEET) =     55.93
 DOWNSTREAM ELEVATION(FEET) =     52.46
 ELEVATION DIFFERENCE(FEET) =      3.47
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.691
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.02
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      2.79
 TOTAL AREA(ACRES) =      0.52   TOTAL RUNOFF(CFS) =      2.79

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    98.00
 UPSTREAM ELEVATION(FEET) =     54.83
 DOWNSTREAM ELEVATION(FEET) =     52.58
 ELEVATION DIFFERENCE(FEET) =      2.25
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.373
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    77.96
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      1.31
 TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.31

****************************************************************************
 FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   278.00
 UPSTREAM ELEVATION(FEET) =     56.03
 DOWNSTREAM ELEVATION(FEET) =     53.48
 ELEVATION DIFFERENCE(FEET) =      2.55
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.962
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    58.35
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      1.84
 TOTAL AREA(ACRES) =      0.34   TOTAL RUNOFF(CFS) =      1.84
```

```
==========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =         0.3  TC(MIN.) =      3.96
  PEAK FLOW RATE(CFS)    =        1.84
==========================================================================
==========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

2.3 10 YEAR HYDROLOGY ANALYSIS

(PROPOSED CONDITION)

```
**************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2012 Advanced Engineering Software (aes)
            Ver. 18.2 Release Date: 05/08/2012  License ID 1537

                        Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* CHICK-FIL-A, #4306                                                      *
* 5850 AVENIDA ENCINAS, CARLSBAD, CA                                      *
* 10-YR POST-DEVELOPMENT ANALYSIS                                         *
 **************************************************************************

  FILE NAME: 18050PO.DAT
  TIME/DATE OF STUDY: 15:45 07/09/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ==================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
```

```
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8800
  S.C.S. CURVE NUMBER (AMC II) =  0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  461.00
  UPSTREAM ELEVATION(FEET) =  55.63
  DOWNSTREAM ELEVATION(FEET) =  52.09
  ELEVATION DIFFERENCE(FEET) =  3.54
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =  3.217
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =  55.36
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.479
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =  2.64
  TOTAL AREA(ACRES) =  0.67  TOTAL RUNOFF(CFS) =  2.64

****************************************************************************
  FLOW PROCESS FROM NODE  200.00 TO NODE  201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =  0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  147.00
  UPSTREAM ELEVATION(FEET) =  55.60
  DOWNSTREAM ELEVATION(FEET) =  53.75
  ELEVATION DIFFERENCE(FEET) =  1.85
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =  3.065
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =  63.88
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.479
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =  1.05
  TOTAL AREA(ACRES) =  0.27  TOTAL RUNOFF(CFS) =  1.05
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)  =  0.3  TC(MIN.) =  3.06
  PEAK FLOW RATE(CFS)  =  1.05
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

2.4 100 YEAR HYDROLOGY ANALYSIS (PROPOSED CONDITION)

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**************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2012 Advanced Engineering Software (aes)
            Ver. 18.2 Release Date: 05/08/2012  License ID 1537

                        Analysis prepared by:



 ************************** DESCRIPTION OF STUDY **************************
* CHICK-FIL-A, #4306                                                      *
* 5850 AVENIDA ENCINAS, CARLSBAD, CA                                      *
* 100-YR POST-DEVELOPMENT ANALYSIS                                        *
 **************************************************************************

  FILE NAME: 18050PO.DAT
  TIME/DATE OF STUDY: 15:55 07/09/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE     100.00 TO NODE     101.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8800
```

```
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   461.00
 UPSTREAM ELEVATION(FEET) =     55.63
 DOWNSTREAM ELEVATION(FEET) =     52.09
 ELEVATION DIFFERENCE(FEET) =      3.54
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.217
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    55.36
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      3.88
 TOTAL AREA(ACRES) =      0.67   TOTAL RUNOFF(CFS) =      3.88

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8700
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   147.00
 UPSTREAM ELEVATION(FEET) =     55.60
 DOWNSTREAM ELEVATION(FEET) =     53.75
 ELEVATION DIFFERENCE(FEET) =      1.85
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.065
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    63.88
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      1.54
 TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      1.54
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =        0.3  TC(MIN.) =      3.06
 PEAK FLOW RATE(CFS)    =       1.54
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

3.0 HYDRAULIC ANALYSIS

3.1 PIPE SIZE ANALYSIS

STORM DRAIN PIPE #1

This pipe will be analyzed under the 100 year storm conditions at Node 101.

```
**************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
     PIPE DIAMETER(FEET) =   1.000
     PIPE SLOPE(FEET/FEET) =  0.0100
     PIPEFLOW(CFS) =          3.88
     MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
     CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
     CRITICAL DEPTH(FEET) =      0.84
     CRITICAL FLOW AREA(SQUARE FEET) =     0.702
     CRITICAL FLOW TOP-WIDTH(FEET) =   0.739
     CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           58.45
     CRITICAL FLOW VELOCITY(FEET/SEC.) =     5.529
     CRITICAL FLOW VELOCITY HEAD(FEET) =           0.47
     CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      0.95
     CRITICAL FLOW SPECIFIC ENERGY(FEET) =           1.31
==========================================================================
     NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
     NORMAL DEPTH(FEET) =      0.76
     FLOW AREA(SQUARE FEET) =      0.64
     FLOW TOP-WIDTH(FEET) =     0.858
     FLOW PRESSURE + MOMENTUM(POUNDS) =           59.28
     FLOW VELOCITY(FEET/SEC.) =           6.084
     FLOW VELOCITY HEAD(FEET) =           0.575
     HYDRAULIC DEPTH(FEET) =      0.74
     FROUDE NUMBER =     1.244
     SPECIFIC ENERGY(FEET) =           1.33
==========================================================================
```

STORM DRAIN PIPE #2

This pipe will be analyzed under the 100 year storm conditions at Node 102

```
**************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
    PIPE DIAMETER(FEET) =    0.670
    PIPE SLOPE(FEET/FEET) =   0.0330
    PIPEFLOW(CFS) =          1.54
    MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    CRITICAL DEPTH(FEET) =      0.58
    CRITICAL FLOW AREA(SQUARE FEET) =     0.324
    CRITICAL FLOW TOP-WIDTH(FEET) =   0.460
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           16.76
    CRITICAL FLOW VELOCITY(FEET/SEC.) =     4.759
    CRITICAL FLOW VELOCITY HEAD(FEET) =            0.35
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =      0.70
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =            0.93
==========================================================================
    NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
    NORMAL DEPTH(FEET) =      0.37
    FLOW AREA(SQUARE FEET) =      0.20
    FLOW TOP-WIDTH(FEET) =     0.667
    FLOW PRESSURE + MOMENTUM(POUNDS) =           25.07
    FLOW VELOCITY(FEET/SEC.) =           7.750
    FLOW VELOCITY HEAD(FEET) =           0.933
    HYDRAULIC DEPTH(FEET) =      0.30
    FROUDE NUMBER =     2.502
    SPECIFIC ENERGY(FEET) =            1.30
==========================================================================
```

STORM DRAIN PIPE #3

This pipe will be analyzed under the 100 year storm conditions at Node 101 & 102

```
**************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
     PIPE DIAMETER(FEET) =    1.000
     PIPE SLOPE(FEET/FEET) =  0.0160
     PIPEFLOW(CFS) =          5.42
     MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
     CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
     CRITICAL DEPTH(FEET) =       0.94
     CRITICAL FLOW AREA(SQUARE FEET) =      0.764
     CRITICAL FLOW TOP-WIDTH(FEET) =    0.489
     CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =            95.95
     CRITICAL FLOW VELOCITY(FEET/SEC.) =      7.092
     CRITICAL FLOW VELOCITY HEAD(FEET) =             0.78
     CRITICAL FLOW HYDRAULIC DEPTH(FEET) =       1.56
     CRITICAL FLOW SPECIFIC ENERGY(FEET) =             1.72
     NOTE:GIVEN NORMAL DEPTH IS LOWER VALUE OF TWO POSSIBLE.
     SUGGEST CONSIDERATION OF WAVE ACTION, UNCERTAINTY, ETC.
==========================================================================
     NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
     NORMAL DEPTH(FEET) =       0.84
     FLOW AREA(SQUARE FEET) =       0.70
     FLOW TOP-WIDTH(FEET) =      0.740
     FLOW PRESSURE + MOMENTUM(POUNDS) =            98.00
     FLOW VELOCITY(FEET/SEC.) =            7.724
     FLOW VELOCITY HEAD(FEET) =            0.926
     HYDRAULIC DEPTH(FEET) =       0.95
     FROUDE NUMBER =      1.397
     SPECIFIC ENERGY(FEET) =             1.76
==========================================================================
```

CURB OPENING

This curb opening will be analyzed under the 100 year storm conditions at 101

```
**************************************************************************
 >>>>CHANNEL INPUT INFORMATION<<<<
--------------------------------------------------------------------------
     CHANNEL Z1(HORIZONTAL/VERTICAL) =     1.00
             Z2(HORIZONTAL/VERTICAL) =     1.00
     BASEWIDTH(FEET) =      4.00
     CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.005000
     UNIFORM FLOW(CFS) =          3.88
     MANNINGS FRICTION FACTOR = 0.0150
==========================================================================
     NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
     >>>>> NORMAL DEPTH(FEET) =   0.31
     FLOW TOP-WIDTH(FEET) =         4.61
     FLOW AREA(SQUARE FEET) =             1.32
     HYDRAULIC DEPTH(FEET) =      0.29
     FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.93
     UNIFORM FROUDE NUMBER =    0.966
     PRESSURE + MOMENTUM(POUNDS) =            34.43
     AVERAGED VELOCITY HEAD(FEET) =      0.134
     SPECIFIC ENERGY(FEET) =      0.441
==========================================================================
     CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
     CRITICAL FLOW TOP-WIDTH(FEET) =          4.60
     CRITICAL FLOW AREA(SQUARE FEET) =             1.29
     CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.28
     CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     3.02
     CRITICAL DEPTH(FEET) =     0.30
     CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           34.41
     AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      0.141
     CRITICAL FLOW SPECIFIC ENERGY(FEET) =      0.440
==========================================================================
```

3.2- GRATE INLET ANALYSIS

36" X 36" GRATE INLET – BASIN #1

This grate will be analyzed under the 100 year storm conditions
Weir Equation

$$Q_{100} = C_w L_w (H)^{1.5}$$

Weir Coefficient (C) = 3.33

Q_{100} = 3.88 cfs

$$3.88 = 3.33 * (4 * 3') * (h)^{1.5}$$

h = 0.21' = 2.5"

24"X24" GRATE INLET – BASIN #2

This grate will be analyzed under the 100 year storm conditions

$$Q_{100} = C\ x\ A\ x\sqrt{2xgxh}$$

Grate Area (A) = 2' x 2' = 4 ft^2
Area of opening = 50%
Assume clogging = 50%
A= 4 x 0.50 x 0.50 = 1.0 ft^2

Orifice Coefficient (C) = 0.67

Q_{100} = 1.54 cfs

$$1.54 = 0.67\ x\ 1.0\ x\ \sqrt{2x32.2xh}$$

h = 0.08' = 1.0"

4.0 ATTACHMENTS

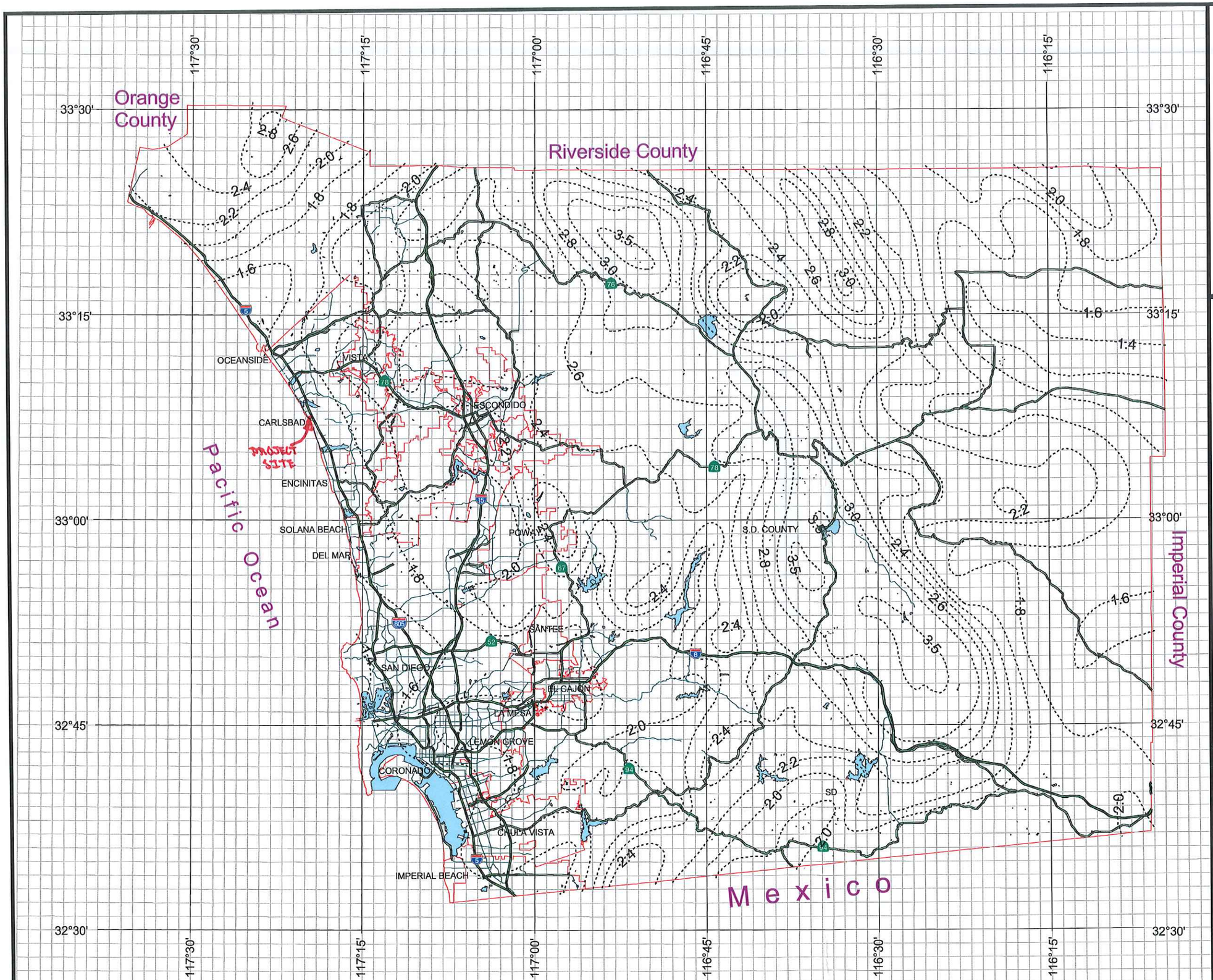
4.1 10-YEAR 6-HOUR ISOPLUVIAL MAP

County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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Department of Public Works
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N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

PROJECT SITE

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

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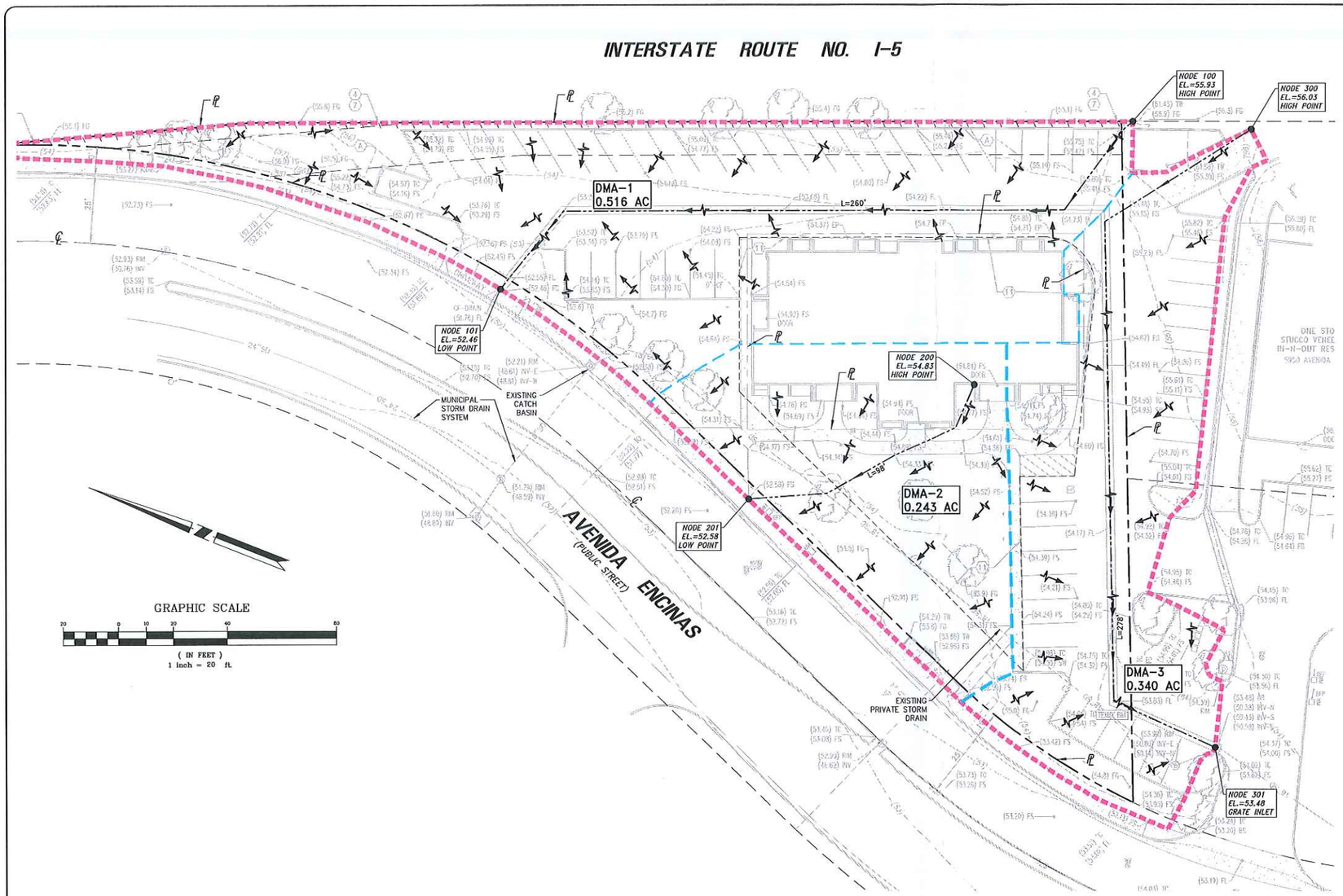
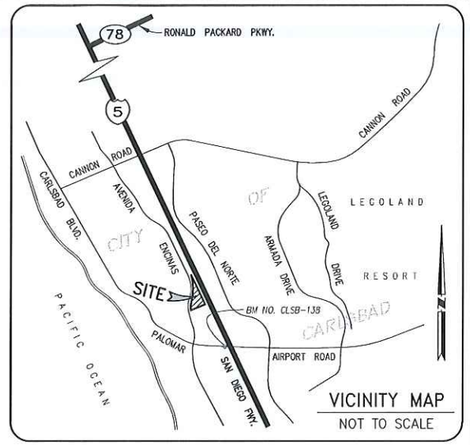
3 0 3 Miles

4.3 PREDEVELOPMENT HYDROLOGY PLAN





LEGEND

- TOTAL TRIBUTARY AREA
- DMA BOUNDARY
- NODE 100 EL.=56.85 HIGH POINT — NODE CONCENTRATION POINT ELEVATION NODE DESCRIPTION
- PATH OF FLOW

SOIL TYPE = 'D'

DMA HYDROLOGY DATA – 10-YR STORM EVENT					
DMA NO.	NODE	AREA (AC)	Tc (min.)	INTENSITY (in/hr)	PEAK RUNOFF RATE (cfs)
1	101	0.516	5.00	4.479	1.90
2	201	0.243	5.00	4.479	0.89
3	301	0.340	5.00	4.479	1.25

DMA HYDROLOGY DATA – 100-YR STORM EVENT					
DMA NO.	NODE	AREA (AC)	Tc (min.)	INTENSITY (in/hr)	PEAK RUNOFF RATE (cfs)
1	101	0.516	5.00	5.269	2.79
2	201	0.243	5.00	5.269	1.31
3	301	0.340	5.00	5.269	1.84

NO.	REVISIONS	DATE

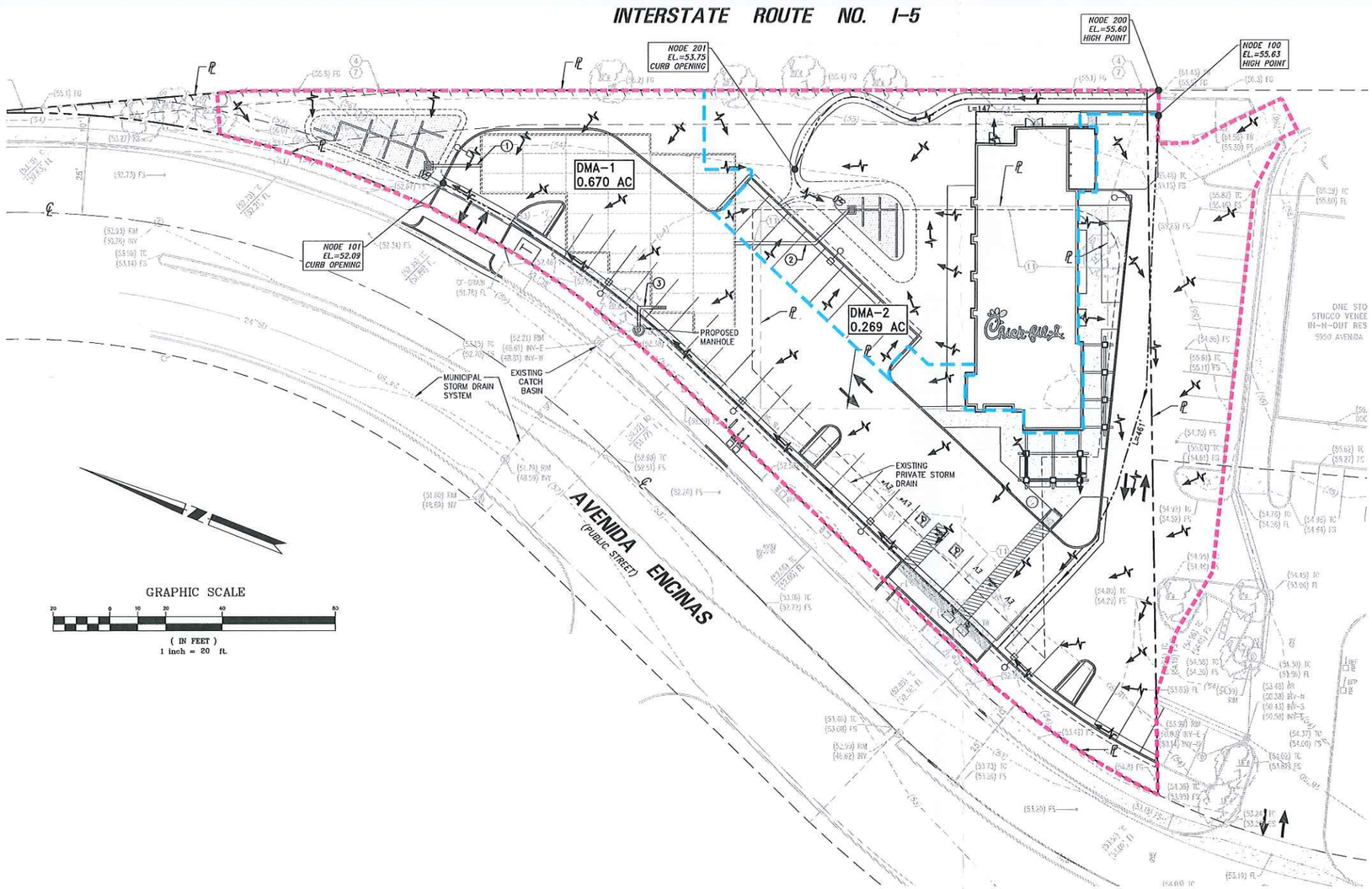
Prepared by:
Joseph C. Truxaw and Associates, Inc.
Civil Engineers and Land Surveyors
1915 W. Orangewood Ave., Suite 101, Orange, CA 92868 (714) 935-0265 Truxaw.com

PRE-DEVELOPMENT HYDROLOGY PLAN

CHICK-FIL-A #4306
5850 AVENIDA ENCINAS
CITY OF CARLSBAD, STATE OF CALIFORNIA

DATE	3-4-19
DRAWN BY	PJS
CHECKED BY	RD/SMH
JOB NO.	CFA18050
SHEET NO.	1 OF 2 SHEETS

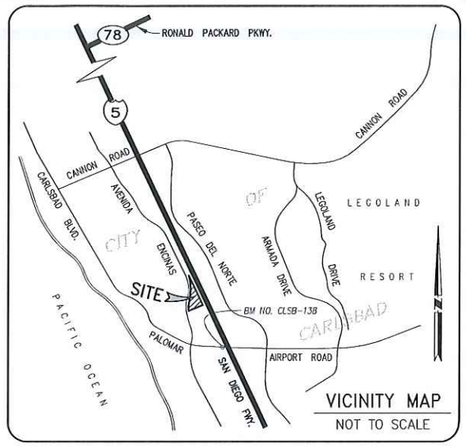
4.4 POST-DEVELOPMENT HYDROLOGY PLAN



GRAPHIC SCALE

20 0 10 20 40 60

(IN FEET)
1 inch = 20 ft.



VICINITY MAP
NOT TO SCALE

LEGEND

- TOTAL TRIBUTARY AREA
- DMA BOUNDARY
- NODE
- CONCENTRATION POINT
- ELEVATION
- NODE DESCRIPTION

NODE 100
EL.=56.83
HIGH POINT

- PATH OF FLOW

SOIL TYPE = 'D'

STORM DRAIN PIPE FLOW CHARACTERISTICS

PIPE NO.	PIPE DIA. (in.)	SLOPE	DESIGN FLOW RATE (cfs) (100-YEAR STORM EVENT)
1	12	0.010	3.88
2	8	0.033	1.54
3	12	0.016	5.42

DMA HYDROLOGY DATA - 10-YR STORM EVENT

DMA NO.	NODE	AREA (AC)	Tc (min.)	INTENSITY (in/hr)	PEAK RUNOFF RATE (cfs)
1	101	0.670	5.00	4.479	2.64
2	201	0.269	5.00	4.479	1.05

DMA HYDROLOGY DATA - 100-YR STORM EVENT

DMA NO.	NODE	AREA (AC)	Tc (min.)	INTENSITY (in/hr)	PEAK RUNOFF RATE (cfs)
1	101	0.611	5.00	5.269	3.88
2	201	0.269	5.00	5.269	1.54

NO.	REVISIONS	DATE

Prepared by:
Joseph C. Truxaw and Associates, Inc.
Civil Engineers and Land Surveyors
1915 W. Orangewood Ave., Suite 101, Orange, CA 92868 (714) 935-0265 Truxaw.com

POST-DEVELOPMENT HYDROLOGY PLAN

CHICK-FIL-A #4306
5850 AVENIDA ENCINAS
CITY OF CARLSBAD, STATE OF CALIFORNIA

DATE	7-11-19
DRAWN BY	PJS
CHECKED BY	RD/SMH
JOB NO.	CFA18050
SHEET NO.	2 OF 2 SHEETS

CITY OF CARLSBAD

PRELIMINARY

PRIORITY DEVELOPMENT PROJECT (PDP)
STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)
FOR
CHICK-FIL-A, #4306

SWQMP No. PENDING

ENGINEER OF WORK:



RANDY J. DECKER
P.E. 81077

PREPARED FOR:

CHICK-FIL-A, INC.
5200 BUFFINGTON RD.
ATLANTA, GA 30349-2998

PREPARED BY:

JOSEPH C. TRUXAW & ASSOCIATES, INC.
1915 W. ORANGEWOOD AVE. SUITE 101
ORANGE, CA 92868
(714) 935-0265

DATE:
September 16, 2019

STORM WATER STANDARDS QUESTIONNAIRE E-34

Development Services
Land Development Engineering
1635 Faraday Avenue
(760) 602-2750
www.carlsbadca.gov

INSTRUCTIONS:

To address post-development pollutants that may be generated from development projects, the city requires that new development and significant redevelopment priority projects incorporate Permanent Storm Water Best Management Practices (BMPs) into the project design per Carlsbad BMP Design Manual (BMP Manual). To view the BMP Manual, refer to the Engineering Standards (Volume 5).

This questionnaire must be completed by the applicant in advance of submitting for a development application (subdivision, discretionary permits and/or construction permits). The results of the questionnaire determine the level of storm water standards that must be applied to a proposed development or redevelopment project. Depending on the outcome, your project will either be subject to '**STANDARD PROJECT**' requirements or be subject to '**PRIORITY DEVELOPMENT PROJECT' (PDP)** requirements.

Your responses to the questionnaire represent an initial assessment of the proposed project conditions and impacts. City staff has responsibility for making the final assessment after submission of the development application. If staff determines that the questionnaire was incorrectly filled out and is subject to more stringent storm water standards than initially assessed by you, this will result in the return of the development application as incomplete. In this case, please make the changes to the questionnaire and resubmit to the city.

If you are unsure about the meaning of a question or need help in determining how to respond to one or more of the questions, please seek assistance from Land Development Engineering staff.

A completed and signed questionnaire must be submitted with each development project application. Only one completed and signed questionnaire is required when multiple development applications for the same project are submitted concurrently.

PROJECT INFORMATION	
PROJECT NAME: CHICK-FIL-A, #4306	PROJECT ID: PENDING
ADDRESS: 5850 AVENIDA ENCINAS, CARLSBAD, CA	APN: 210-170-08-00 & 210-170-09-00
The project is (check one): ☐ New Development ☒ Redevelopment	
The total proposed disturbed area is (Project Area): 41,147 ft² (0.945) acres	
The total proposed newly created and/or replaced impervious area is: 32,998 ft² (0.758) acres	
If your project is covered by an approved SWQMP as part of a larger development project, provide the project ID and the SWQMP # of the larger development project: Project ID_____ SWQMP #: _____ Then, go to Step 1 and follow the instructions. When completed, sign the form at the end and submit this with your application to the city.	

STEP 1
TO BE COMPLETED FOR ALL PROJECTS

To determine if your project is a "development project", please answer the following question:

	YES	NO
Is your project LIMITED TO routine maintenance activity and/or repair/improvements to an existing building or structure that do not alter the size (See Section 1.3 of the BMP Design Manual for guidance)?	☐	☒

If you answered "yes" to the above question, provide justification below then **go to Step 5**, mark the third box stating "my project is **not a 'development project'** and not subject to the requirements of the BMP manual" and complete applicant information.

Justification/discussion: (e.g. the project includes only interior remodels within an existing building):

If you answered "no" to the above question, the project is a '**development project**', **go to Step 2**.

STEP 2
TO BE COMPLETED FOR ALL DEVELOPMENT PROJECTS

To determine if your project is exempt from PDP requirements pursuant to MS4 Permit Provision E.3.b.(3), please answer the following questions:

Is your project LIMITED to one or more of the following:

	YES	NO
1. Constructing new or retrofitting paved sidewalks, bicycle lanes or trails that meet the following criteria: a) Designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas; b) Designed and constructed to be hydraulically disconnected from paved streets or roads; c) Designed and constructed with permeable pavements or surfaces in accordance with USEPA Green Streets guidance?	☐	☒
2. Retrofitting or redeveloping existing paved alleys, streets, or roads that are designed and constructed in accordance with the USEPA Green Streets guidance?	☐	☒
3. Ground Mounted Solar Array that meets the criteria provided in section 1.4.2 of the BMP manual?	☐	☒

If you answered "yes" to one or more of the above questions, provide discussion/justification below, then **go to Step 5**, mark the second box stating "my project is **EXEMPT** from PDP ..." and complete applicant information.

Discussion to justify exemption (e.g. the project redeveloping existing road designed and constructed in accordance with the USEPA Green Street guidance):

If you answered "no" to the above questions, your project is not exempt from PDP, **go to Step 3**.

STEP 3 TO BE COMPLETED FOR ALL NEW OR REDEVELOPMENT PROJECTS		
To determine if your project is a PDP, please answer the following questions (MS4 Permit Provision E.3.b.(1)):	YES	NO
1. Is your project a new development that creates 10,000 square feet or more of impervious surfaces collectively over the entire project site? *This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.*	☐	☒
2. Is your project a redevelopment project creating and/or replacing 5,000 square feet or more of impervious surface collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surface? *This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.*	☒	☐
3. Is your project a new or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surface collectively over the entire project site and supports a restaurant? A restaurant is a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812).	☒	☐
4. Is your project a new or redevelopment project that creates 5,000 square feet or more of impervious surface collectively over the entire project site and supports a hillside development project? A hillside development project includes development on any natural slope that is twenty-five percent or greater.	☐	☒
5. Is your project a new or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surface collectively over the entire project site and supports a parking lot? A parking lot is a land area or facility for the temporary parking or storage of motor vehicles used personally for business or for commerce.	☒	☐
6. Is your project a new or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious street, road, highway, freeway or driveway surface collectively over the entire project site? *A street, road, highway, freeway or driveway is any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.*	☐	☒
7. Is your project a new or redevelopment project that creates and/or replaces 2,500 square feet or more of impervious surface collectively over the entire site, and discharges directly to an Environmentally Sensitive Area (ESA)? *"Discharging Directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).**	☐	☒
8. Is your project a new development or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surface that supports an automotive repair shop? *An automotive repair shop is a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.*	☐	☒
9. Is your project a new development or redevelopment project that creates and/or replaces 5,000 square feet or more of impervious area that supports a retail gasoline outlet (RGO)? *This category includes RGO's that meet the following criteria: (a) 5,000 square feet or more or (b) a project Average Daily Traffic (ADT) of 100 or more vehicles per day.*	☐	☒
10. Is your project a new or redevelopment project that results in the disturbance of one or more acres of land and are expected to generate pollutants post construction?	☐	☒
11. Is your project located within 200 feet of the Pacific Ocean and (1) creates 2,500 square feet or more of impervious surface or (2) increases impervious surface on the property by more than 10%? (CMC 21.203.040)	☐	☒
If you answered "yes" to one or more of the above questions, your project is a **PDP**. If your project is a redevelopment project, **go to step 4**. If your project is a new project, **go to step 5,** check the first box stating "My project is a **PDP** ..." and complete applicant information. If you answered "no" to all of the above questions, your project is a '**STANDARD PROJECT.**' **Go to step 5**, check the second box stating "My project is a 'STANDARD PROJECT'..." and complete applicant information.		

STEP 4
TO BE COMPLETED FOR REDEVELOPMENT PROJECTS THAT ARE PRIORITY DEVELOPMENT PROJECTS (PDP) ONLY

Complete the questions below regarding your redevelopment project (MS4 Permit Provision E.3.b.(2)):	YES	NO
Does the redevelopment project result in the creation or replacement of impervious surface in an amount of less than 50% of the surface area of the previously existing development? Complete the percent impervious calculation below: Existing impervious area (A) = 24,977 sq. ft. Total proposed newly created or replaced impervious area (B) = 27,977sq. ft. Percent impervious area created or replaced (B/A)*100 = 112%	☐	☒

If you answered "yes", the structural BMPs required for PDP apply only to the creation or replacement of impervious surface and not the entire development. **Go to step 5,** check the first box stating "My project is a **PDP** ..." and complete applicant information.

If you answered "no," the structural BMP's required for PDP apply to the entire development. **Go to step 5**, check the check the first box stating "My project is a **PDP** ..." and complete applicant information.

STEP 5
CHECK THE APPROPRIATE BOX AND COMPLETE APPLICANT INFORMATION

☒ My project **is a PDP** and must comply with **PDP** stormwater requirements of the BMP Manual. I understand I must prepare a Storm Water Quality Management Plan **(SWQMP)** for submittal at time of application.

☐ My project **is a 'STANDARD PROJECT'** OR **EXEMPT** from PDP and must only comply with **'STANDARD PROJECT'** stormwater requirements of the BMP Manual. As part of these requirements, I will submit a "*Standard Project Requirement Checklist Form E-36*" and incorporate low impact development strategies throughout my project.

Note: For projects that are close to meeting the PDP threshold, staff may require detailed impervious area calculations and exhibits to verify if 'STANDARD PROJECT' stormwater requirements apply.

☐ My Project is **NOT a 'development project'** and is not subject to the requirements of the BMP Manual.

Applicant Information and Signature Box

Applicant Name: _____ Applicant Title: _____

Applicant Signature:_____ Date: _____

* Environmentally Sensitive Areas include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments); water bodies designated with the RARE beneficial use by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments); areas designated as preserves or their equivalent under the Multi Species Conservation Program within the Cities and County of San Diego; Habitat Management Plan; and any other equivalent environmentally sensitive areas which have been identified by the City.

This Box for City Use Only

City Concurrence:	YES	NO
	☐	☐
By:		
Date:		
Project ID:		

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CERTIFICATION PAGE

Project Name: CHICK-FIL-A, #4306
Project ID: PENDING

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the BMP Design Manual, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 (MS4 Permit) or the current Order.

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

_____
Engineer of Work's Signature, PE Number & Expiration Date

RANDY J. DECKER

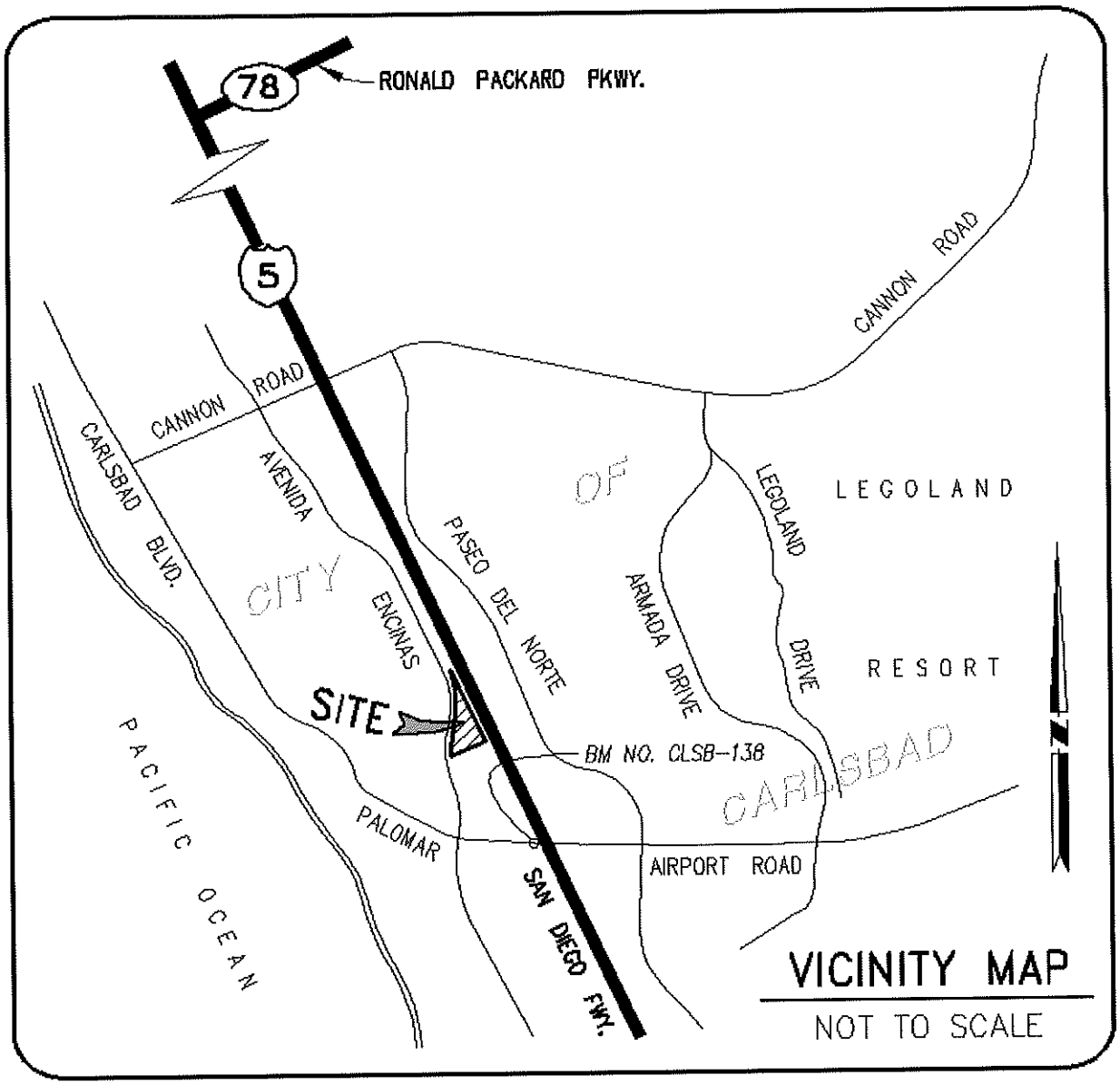
_____
Print Name

JOSEPH C. TRUXAW & ASSOCIATES, INC.

_____
Company

_____
Date

PROJECT VICINITY MAP



SITE INFORMATION CHECKLIST

Project Summary Information	
Project Name	**CHICK-FIL-A, #4306**
Project ID	PENDING
Project Address	5850 AVENIDA ENCINAS CARLSBAD, CA
Assessor's Parcel Number(s) (APN(s))	210-170-08-00 & 210-170-09-00
Project Watershed (Hydrologic Unit)	Carlsbad 904
Parcel Area	0.890 Acres (38,761 Square Feet)
Existing Impervious Area (subset of Parcel Area)	0.594 Acres (25,878 Square Feet)
Area to be disturbed by the project (Project Area)	0.945 Acres (41,147 Square Feet)
Project Proposed Impervious Area (subset of Project Area)	0.758 Acres (32,998 Square Feet)
Project Proposed Pervious Area (subset of Project Area)	0.177 Acres (7,691 Square Feet)

Note:

- Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.
- Disturbed area includes improvements in the Public R/W which consists of both pervious and impervious surfaces. Proposed pervious and impervious values above reflect only proposed surfaces within property limits and therefore do not add up to the total disturbed area.
- Proposed pervious area does not include the surface of the bio-filtration basins.

Description of Existing Site Condition and Drainage Patterns

Current Status of the Site (select all that apply):
X Existing development
☐ Previously graded but not built out
☐ Agricultural or other non-impervious use
☐ Vacant, undeveloped/natural

Description / Additional Information:
Site is currently a developed site with a two-story commercial office building, associated parking and landscaped areas (grass)

Existing Land Cover Includes (select all that apply):
X Vegetative Cover
☐ Non-Vegetated Pervious Areas
X Impervious Areas

Description / Additional Information:
Impervious surfaces include AC pavement, concrete sidewalk, building roof
Pervious surfaces include grassy areas in front of the building, planters around the building and shrubs around the property perimeter

Underlying Soil belongs to Hydrologic Soil Group (select all that apply):
☐ NRCS Type A
☐ NRCS Type B
☐ NRCS Type C
X NRCS Type D

Approximate Depth to Groundwater (GW):
☐ GW Depth < 5 feet
☐ 5 feet < GW Depth < 10 feet
X 10 feet < GW Depth < 20 feet
☐ GW Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):
☐ Watercourses
☐ Seeps
☐ Springs
☐ Wetlands
X None

Description / Additional Information:

Description of Existing Site Topography and Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? if so, describe]:

The project site is currently occupied by a two-story commercial building that site approx. in the center of the site. Parking stalls around the building and follow the perimeter of the site where access is provided by a drive aisle from the adjacent property (In-N-Out) and a driveway into Avenida Encinas just north of the building. The perimeter parking is AC pavement that is in moderate condition and drains surface runoff via a concrete v-gutter. The v-gutter was found to have a high point at the southeast corner of the site where it drains in two directions;

- Northerly to discharge surface runoff out the existing driveway and into Avenida Encinas. Once surface runoff has entered the curb & gutter in Avenida Encinas it travels south to a municipal curb opening catch basin where it is collected into the municipal storm drain system.
- Westerly to convey runoff through the shared drive aisle and into an existing grated inlet catch basin. Once collected in the private catch basin it is conveyed through an 18" private storm drain and travels north back onto the project site where it discharges into the same curb opening catch basin in Avenida Encinas as stated above.

The landscaped area in front of the building drains toward Avenida Encinas but also has multiple small grate inlets sparsed around the landscaping. The small grate inlets appear to discharge through curb openings in Aveninad Encinas, but it has not been confirmed.

The survey that was performed revealed that the parking row just south of the building drains to the v-gutter on the project site. This parking row is outside property limits and therefore the project site is accepting offsite drainage.

It was also found that the 18" private storm drain directs concentrated surface runoff from southerly properties through the site, and it was also found that stormwater clarifiers were installed inline with this private storm drain upstream of the projects site. Therefore offsite surface flows collected upstream of the project site that travel through this private storm drain are anticipated to have been treated by these clarifiers.

Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities: The proposed development will consists of a complete site demolition and removal of existing features for the construction of a new single story restaurant. Proposed improvements will consist of a new building, trash enclosure parking areas, drive-thru, outdoor patio, landscaped areas, and bio-filtration basins. The land use will be commercial and activities will include preparation of food & offsite/onsite food consumption.
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): Proposed impervious surfaces will include the rooftop of the building and trash enclosure, Ac pavement in parking areas, concrete sidewalk, and a concrete drive-thru.
List/describe proposed pervious features of the project (e.g., landscape areas): Proposed pervious surfaces will include landscaped areas planted with drought tolerant species and bio-filtration basin surfaces.
Does the project include grading and changes to site topography? X Yes ☐ No Description / Additional Information: A complete demolition and removal of existing features will be done and grading will be performed to allow for the proposed features. Proposed grading will follow the existing site topography as best as possible.
Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)? X Yes ☐ No Description / Additional Information: The site will be designed to follow the existing topography as best as possible, however to comply with Low Impact Development requirements the runoff will be intercepted by 2 bio-filtration basins before discharging into the municipal storm drain system. Once the treated runoff leaves the bio-filtration basins it will enter the proposed onsite storm drain system where it will discharge into the existing catch basin in Avenida Encinas, the same catch basin as the existing condition. The primary change to the site drainage conditions are the bio-filtration basins that will treat and control the discharge flow of the site runoff. See calculation worksheets and SDHM for bio-filtration sizing and hydromodification calculations.

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

X On-site storm drain inlets
☐ Interior floor drains and elevator shaft sump pumps
☐ Interior parking garages
☐ Need for future indoor & structural pest control
X Landscape/Outdoor Pesticide Use
☐ Pools, spas, ponds, decorative fountains, and other water features
X Food service
X Refuse areas
☐ Industrial processes
☐ Outdoor storage of equipment or materials
☐ Vehicle and Equipment Cleaning
☐ Vehicle/Equipment Repair and Maintenance
☐ Fuel Dispensing Areas
☐ Loading Docks
☐ Fire Sprinkler Test Water
☐ Miscellaneous Drain or Wash Water
X Plazas, sidewalks, and parking lots

Identification of Receiving Water Pollutants of Concern

Describe path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):
Plans provided by the City of Carlsbad and the Storm Drain Atlas found on the City website were used to determine the ultimate flowpath of runoff leaving the project site. It was found that once the treated and controlled runoff discharge into the catch basin in Avenida Encinas, the storm water is directed through a storm drain in Avenida Encinas. The storm drain travels north and outlets runoff into a vegetated ditch where the runoff continues north, then appears to enter a second storm drain pipe that travels underneath the Encinas Power Plant. Finally the storm drain pipe discharges runoff into Agua Hedionda Lagoon.

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs
Agua Hedionda Lagoon	Indicator Bacteria-Total Coliform, Fecal Coliform, Enterococcus,	
Agua Hedionda Lagoon	Invasive Species	
Agua Hedionda Lagoon	Sedimentation/Siltation	

Identification of Project Site Pollutants

Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	X		
Nutrients	X		
Heavy Metals	X		
Organic Compounds	X		
Trash & Debris		X	
Oxygen Demanding Substances		X	
Oil & Grease		X	
Bacteria & Viruses		X	
Pesticides		P	

Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)?

X Yes, hydromodification management flow control structural BMPs required.

☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.

☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.

☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):
As the runoff from the subject site travels throught the municipal storm drain system, there is a section that is a vegetated ditch that is not concrete lined. Therefore, by MS4 permit regulations this site is required control runoff flowrates to reduce sediment transport from this ditch into Agua Hedionda Lagoon

Critical Coarse Sediment Yield Areas*
***This Section only required if hydromodification management requirements apply**

Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries?

☐ Yes

X No, No critical coarse sediment yield areas to be protected based on WMAA maps

If yes, have any of the optional analyses presented in Section 6.2 of the BMP Design Manual been performed?

☐ 6.2.1 Verification of Geomorphic Landscape Units (GLUs) Onsite

☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment

☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite

☐ No optional analyses performed, the project will avoid critical coarse sediment yield areas identified based on WMAA maps

If optional analyses were performed, what is the final result?

☐ No critical coarse sediment yield areas to be protected based on verification of GLUs onsite

☐ Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 8 of the SWQMP.

☐ Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit.

Discussion / Additional Information:

No critical coarse sediment yield areas exist downstream of the project site.

Flow Control for Post-Project Runoff* *This Section only required if hydromodification management requirements apply
List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit. The SDHM program was used to design the hydromodification parameters of the storm water treatment system. After inputting the bio-filtration basin design characteristics, the system passed the hydromodification test using the outlet of the Storm Capture Vaults at the flow control device as the Point of Compliance.
Has a geomorphic assessment been performed for the receiving channel(s)? X No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐ Yes, the result is the low flow threshold is 0.1Q2 ☐ Yes, the result is the low flow threshold is 0.3Q2 ☐ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide title, date, and preparer: Discussion / Additional Information: (optional)

Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or City codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

N/A

Optional Additional Information or Continuation of Previous Sections As Needed

This space provided for additional information or continuation of information from previous sections as needed.

STANDARD PROJECT REQUIREMENT CHECKLIST E-36

City of Carlsbad

Development Services
Land Development Engineering
1635 Faraday Avenue
(760) 602-2750
www.carlsbadca.gov

Project Information
Project Name: I-5 & Palomar, Chick-fil-A FSU
Project ID: PENDING
DWG No. or Building Permit No.: PENDING

Source Control BMPs

All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E.1 of the BMP Design Manual (Volume 5 of City Engineering Standards) for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E.1 of the Model BMP Design Manual. Discussion/justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion/justification must be provided. Please add attachments if more space is needed.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion/justification may be provided.

Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	■ Yes	☐ No	☐ N/A
Discussion/justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	■ Yes	☐ No	☐ N/A
Discussion/justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	■ Yes	☐ No	☐ N/A
Discussion/justification if SC-3 not implemented:			

Source Control Requirement (continued)	Applied?		
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	■ No	☐ N/A

Discussion/justification if SC-4 not implemented:

No materials will be stored outdoors

SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	■ Yes	☐ No	☐ N/A

Discussion/justification if SC-5 not implemented:

SC-6 Additional BMPs based on Potential Sources of Runoff Pollutants must answer for each source listed below and identify additional BMPs. (See Table in Appendix E.1 of BMP Manual for guidance).

☐ On-site storm drain inlets	■ Yes	☐ No	☐ N/A
☐ Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	■ N/A
☐ Interior parking garages	☐ Yes	☐ No	■ N/A
☐ Need for future indoor & structural pest control	☐ Yes	☐ No	■ N/A
☐ Landscape/Outdoor Pesticide Use	■ Yes	☐ No	☐ N/A
☐ Pools, spas, ponds, decorative fountains, and other water features	☐ Yes	☐ No	■ N/A
☐ Food service	■ Yes	☐ No	☐ N/A
☐ Refuse areas	■ Yes	☐ No	☐ N/A
☐ Industrial processes	☐ Yes	☐ No	■ N/A
☐ Outdoor storage of equipment or materials	■ Yes	☐ No	☐ N/A
☐ Vehicle and Equipment Cleaning	☐ Yes	☐ No	■ N/A
☐ Vehicle/Equipment Repair and Maintenance	☐ Yes	☐ No	■ N/A
☐ Fuel Dispensing Areas	☐ Yes	☐ No	■ N/A
☐ Loading Docks	☐ Yes	☐ No	■ N/A
☐ Fire Sprinkler Test Water	☐ Yes	☐ No	■ N/A
☐ Miscellaneous Drain or Wash Water	☐ Yes	☐ No	■ N/A
☐ Plazas, sidewalks, and parking lots	■ Yes	☐ No	☐ N/A

For "Yes" answers, identify the additional BMP per Appendix E.1. Provide justification for "No" answers.

A. On-site storm drain inlets - Grated Inlets are shown on plans. All inlets will have a 'No Dumping' graphic that will be visible.
D2. Landscape/Outdoor Pesticide Use - Landscape areas that incorporate pesticide use will drain to bio-filtration basins, and self-treating areas are shown on the DMA Exhibit. Plant species will be of drought tolerant type and will minimize the use of irrigation and thus reduce runoff of irrigation water.
E. Food Service - Cleaning of floor mats, container, etc. will occur inside over an interior drain that will be connected to the grease waste line.
G. Refuse Areas - The proposed trash enclosure will be covered and a drain inside the refuse area will be connected to the grease waste line. The door will a roll-up type and will prevent wind from spreading trash/debris throughout the site.
P. Plazas, Sidewalks, and Parking Lots - The sidewalk and patio area will be swept daily.

Site Design BMPs

All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E.2 thru E.6 of the BMP Design Manual (Volume 5 of City Engineering Standards) for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMPs as described in Chapter 4 and/or Appendix E.2 thru E.6 of the Model BMP Design Manual. Discussion / justification is not required.
- "No" means the BMPs is applicable to the project but it is not feasible to implement. Discussion/justification must be provided. Please add attachments if more space is needed.
- "N/A" means the BMPs is not applicable at the project site because the project does not include the feature that is addressed by the BMPs (e.g., the project site has no existing natural areas to conserve). Discussion/justification may be provided.

Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-1 not implemented:			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☐ Yes	☐ No	■ N/A
Discussion/justification if SD-2 not implemented:			
SD-3 Minimize Impervious Area	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-3 not implemented:			
SD-4 Minimize Soil Compaction	☐ Yes	☐ No	■ N/A
Discussion/justification if SD-4 not implemented:			
SD-5 Impervious Area Dispersion	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-5 not implemented:			

Site Design Requirement (continued)	Applied?		
SD-6 Runoff Collection	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-6 not implemented:			
SD-7 Landscaping with Native or Drought Tolerant Species	■ Yes	☐ No	☐ N/A
Discussion/justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	■ No	☐ N/A
Discussion/justification if SD-8 not implemented: Toilet Flushing and irrigation demand is less than the DCV and will not drawdown in sufficient time.			

SUMMARY OF PDP STRUCTURAL BMPS

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by the City at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained into perpetuity, and the City must confirm the maintenance (see Section 7 of the BMP Design Manual).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated together or separate.

A soils report was provided to and analyzed to determine if infiltration of storm water runoff is a feasible option for this site. The report shows two percolation borings with infiltration rates found to be: 0.05 & 0.00 in/hr, giving an average of 0.025 in/hr. Using form I-9 from the City BMP Design Manual Appendices, the factor of safety to be used is 3.5 giving a design infiltration rate of 0.007 in/hr which is insufficient for infiltration purposes and therefore deeming infiltration infeasible.

Form I-7 was used to determine the feasibility of harvest and use as a storm water treatment system. However, due to low demand of irrigation water usage and moderate facility usage, harvest and use is also not feasible as the demand will not allow for drawdown of collected storm water in the required time.

Bio-filtration was decided as the proposed BMP for this project site. The site has sufficient landscaped areas to be used for bio-filtration basins however due to the topography certain areas were deemed infeasible, such as the landscape buffer between Avenida Encinas and the site parking fronting Avenida Encinas. The grading design required two (2) basins to be spaced out around the site instead with one basin within the drive-thru to capture the runoff from the building and trash enclosure roof and drive-thru pavement, and a second basin at the north corner of the site to capture the remainder of the parking lot and existing parking area that is to remain adjacent to the In-N-Out. The surface of each bio-filtration basin was maximized due to the fact that the invert of the existing catch basin invert elevation is approx. 3.6' below finished surface. This requires the basins to be designed with the min. depths:

- 18" Engineered Soil
- 12" Gravel (3" above perf. Pipe, 6" perf pipe, 3" below perf. Pipe)

Due to very low infiltration rates the basins are proposed to be lined. Using the applicable worksheets it was found that with the min. depths the basin still provide the necessary storage for treatment. This BMP type was also selected using the BMP fact sheet BF-1 for pollutant control as is removes the anticipated pollutants from this site.

Structural BMP Summary Information **[Copy this page as needed to provide information for each individual proposed structural BMP]**
Structural BMP ID No. T1
DWG: Conceptual Grading Plan Sheet No. 4 – Low Impact Development Plan
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) X Biofiltration (BF-1) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)
Purpose: ☐ Pollutant control only ☐ Hydromodification control only X Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)
Discussion (as needed):

Structural BMP Summary Information **[Copy this page as needed to provide information for each individual proposed structural BMP]**
Structural BMP ID No. T2
DWG: Conceptual Grading Plan Sheet No. 4 – Low Impact Development Plan
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) X Biofiltration (BF-1) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)
Purpose: ☐ Pollutant control only ☐ Hydromodification control only X Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)
Discussion (as needed):

Structural BMP Summary Information
[Copy this page as needed to provide information for each individual proposed structural BMP]

Structural BMP ID No. T3

DWG: Hydromodification Management Plan

Type of structural BMP:
☐ Retention by harvest and use (HU-1)
☐ Retention by infiltration basin (INF-1)
☐ Retention by bioretention (INF-2)
☐ Retention by permeable pavement (INF-3)
☐ Partial retention by biofiltration with partial retention (PR-1)
☐ Partial retention by biofiltration with partial retention (PR-1)
☐ Biofiltration (BF-1)
☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
XDetention pond or vault for hydromodification management
☐ Other (describe in discussion section below)

Purpose:
☐ Pollutant control only
XHydromodification control only
☐ Combined pollutant control and hydromodification control
☐ Pre-treatment/forebay for another structural BMP
☐ Other (describe in discussion section below)

Discussion (as needed):

ATTACHMENT 1

BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

Check which Items are Included behind this cover sheet:

Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist on the back of this Attachment cover sheet. (24"x36" Exhibit typically required)	X Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	X Included on DMA Exhibit in Attachment 1a ☐ Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	X Included ☐ Not included because the entire project will use infiltration BMPs
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	X Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines	X Included

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

X Underlying hydrologic soil group
X Approximate depth to groundwater
X Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
X Critical coarse sediment yield areas to be protected (if present)
X Existing topography and impervious areas
X Existing and proposed site drainage network and connections to drainage offsite
X Proposed grading
X Proposed impervious features
X Proposed design features and surface treatments used to minimize imperviousness
X Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
X Structural BMPs (identify location and type of BMP)

Harvest and Use Feasibility Checklist	Form I-7

1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?

☒ Toilet and urinal flushing
☒ Landscape irrigation
☐ Other:_____

2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.

[Provide a summary of calculations here]

TOILET FLUSHING
PER TABLE B.3-1: 7 USES/PER./DAY
* ASSUMING 3.45 gal/FLUSH
TOTAL CONSUMPTION OVER 36 hrs
12 employees x 7 x 3.45 x 1.5 = 434.7 gal

IRRIGATION
HA = 7,354 s.f.
ETWU = 2.71in x 0.40 x 7,354 s.f. x 0.015 / 0.90
ETWU = 1,323.7 gal.

3. Calculate the DCV using worksheet B.2-1.

DCV = 1,343 (cubic feet)

TOILET FLUSHING + ETWU = 1,758.4 gal
234.5 < 1,343
=> 234.5 cu.ft

3a. Is the 36 hour demand greater than or equal to the DCV?	3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV?	3c. Is the 36 hour demand less than 0.25DCV?
☐ Yes / ☒ No ⇨ ⇩	☐ Yes / ☒ No ⇨ ⇩	☒ Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.

Is harvest and use feasible based on further evaluation?

☐ Yes, refer to Appendix E to select and size harvest and use BMPs.

☒ No, select alternate BMPs.

Categorization of Infiltration Feasibility Condition	Form I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

Provide basis:

PER SOILS REPORT BY GILES ENGINEERING, INFILTRATION RATES ARE 0.0 IN/HR AND 0.05 IN/HR.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Form I-8 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result *	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Form I-8 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

Provide basis: PER SOILS REPORT...

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Form I-8 Page 4 of 4			
Criteria	Screening Question	Yes	No
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 5-8 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Factor of Safety and Design Infiltration Rate Worksheet				Form I-9	
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.50
		Predominant soil texture	0.25	3	0.75
		Site soil variability	0.25	2	0.50
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.00
B	Design	Level of pretreatment/ expected sediment loads	0.5	1	0.50
		Redundancy/resiliency	0.25	3	0.75
		Compaction during construction	0.25	2	0.50
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{total} = S_A \times S_B$					3.5
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					AVG. $K_{OBSERVED}$ = 0.025 in/hr
Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$					0.007 in/hr

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

PERCOLATION TEST PERFORMED AT 2 LOCALIZED BORINGS. SEE SOILS REPORT BY GILES ENGINEERING, SECTION 4.4, DATED 10/5/18.

Automated Worksheet B.1-1: Calculation of Design Capture Volume (V1.3)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Drainage Basin Inputs	0	Drainage Basin ID or Name	DMA-1	DMA-2									unitless
	1	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration									unitless
	2	85th Percentile 24-hr Storm Depth	0.58	0.58									inches
	3	Design Infiltration Rate Recommended by Geotechnical Engineer	0.007	0.007									in/hr
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	24,622	8,320									sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)	0	0									sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	0	0									sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)	0	0									sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)	0	0									sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)	0	0									sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)	4,290	3,398									sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	11	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No		No	No	No	No	No	No	No	yes/no
	12	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	13	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	14	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	16	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	17	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	18	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	19	Number of Tree Wells Proposed per SD-A											#
	20	Average Mature Tree Canopy Diameter											ft
	21	Number of Rain Barrels Proposed per SD-E											#
	22	Average Rain Barrel Size											gal
Treatment Train Inputs & Calculations	23	Does BMP Overflow to Stormwater Features in Downstream Drainage?	No	No		No	No	No	No	No	No	No	unitless
	24	Identify Downstream Drainage Basin Providing Treatment in Series											unitless
	25	Percent of Upstream Flows Directed to Downstream Dispersion Areas											percent
	26	Upstream Impervious Surfaces Directed to Dispersion Area (Ci=0.90)	0	0	0	0	0	0	0	0	0	0	cubic-feet
	27	Upstream Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	0	0	0	0	0	0	0	0	0	0	cubic-feet
Initial Runoff Factor Calculation	28	Total Tributary Area	28,912	11,718	0	0	0	0	0	0	0	0	sq-ft
	29	Initial Runoff Factor for Standard Drainage Areas	0.81	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	30	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	31	Initial Weighted Runoff Factor	0.81	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	32	Initial Design Capture Volume	1,132	413	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	33	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	34	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	35	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	36	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	37	Runoff Factor After Dispersion Techniques	0.81	0.73	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	38	Design Capture Volume After Dispersion Techniques	1,132	413	0	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	39	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	40	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	41	Final Adjusted Runoff Factor	0.81	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	42	Final Effective Tributary Area	23,419	8,554	0	0	0	0	0	0	0	0	sq-ft
	43	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	0	0	cubic-feet
	44	Final Design Capture Volume Tributary to BMP	1,132	413	0	0	0	0	0	0	0	0	cubic-feet

Worksheet B.1-1 General Notes:

A. Applicants may use this worksheet to calculate design capture volumes for up to 10 drainage areas User input must be provided for yellow shaded cells, values for all other cells will be automatically generated, errors/notifications will be highlighted in red and summarized below. Upon completion of this worksheet, proceed to the appropriate BMP Sizing worksheet(s).

Automated Worksheet B.5-1: Sizing Lined or Unlined Biofiltration BMPs (V1.3)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
BMP Inputs	0	Drainage Basin ID or Name	DMA-1	DMA-2	-	-	-	-	-	-	-	-	sq-ft
	1	Design Infiltration Rate Recommended by Geotechnical Engineer	0.007	0.007	-	-	-	-	-	-	-	-	in/hr
	2	Effective Tributary Area	23,419	8,554	-	-	-	-	-	-	-	-	sq-ft
	3	Minimum Biofiltration Footprint Sizing Factor	0.030	0.030	-	-	-	-	-	-	-	-	ratio
	4	Design Capture Volume Tributary to BMP	1,132	413	-	-	-	-	-	-	-	-	cubic-feet
	5	Is Biofiltration Basin Impermeably Lined or Unlined?	Lined	Lined									unitless
	6	Provided Biofiltration BMP Surface Area	779	364									sq-ft
	7	Provided Surface Ponding Depth	6	6									inches
	8	Provided Soil Media Thickness	18	18									inches
	9	Provided Depth of Gravel Above Underdrain Invert	3	3									inches
	10	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	6.00	6.00									inches
	11	Provided Depth of Gravel Below the Underdrain	3	3									inches
Retention Calculations	12	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	13	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	14	Gravel Pore Space Available for Retention	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	15	Effective Retention Depth	0.90	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	16	Calculated Retention Storage Drawdown (Including 6 Hr Storm)	120	120	0	0	0	0	0	0	0	0	hours
	17	Volume Retained by BMP	58	27	0	0	0	0	0	0	0	0	cubic-feet
	18	Fraction of DCV Retained	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	19	Portion of Retention Performance Standard Satisfied	0.06	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	20	Fraction of DCV Retained (normalized to 36-hr drawdown)	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	21	Design Capture Volume Remaining for Biofiltration	1,098	396	0	0	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	22	Max Hydromod Flow Rate through Underdrain	1.3370	1.3370	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	CFS
	23	Max Soil Filtration Rate Allowed by Underdrain Orifice	74.15	158.68	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	in/hr
	24	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	25	Soil Media Filtration Rate to be used for Sizing	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	26	Depth Biofiltered Over 6 Hour Storm	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	inches
	27	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	28	Effective Depth of Biofiltration Storage	10.80	10.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	29	Drawdown Time for Surface Ponding	1	1	0	0	0	0	0	0	0	0	hours
	30	Drawdown Time for Effective Biofiltration Depth	2	2	0	0	0	0	0	0	0	0	hours
	31	Total Depth Biofiltered	40.80	40.80	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	inches
	32	Option 1 - Biofilter 1.50 DCV: Target Volume	1,647	594	0	0	0	0	0	0	0	0	cubic-feet
	33	Option 1 - Provided Biofiltration Volume	1,647	594	0	0	0	0	0	0	0	0	cubic-feet
	34	Option 2 - Store 0.75 DCV: Target Volume	824	297	0	0	0	0	0	0	0	0	cubic-feet
	35	Option 2 - Provided Storage Volume	701	297	0	0	0	0	0	0	0	0	cubic-feet
	36	Portion of Biofiltration Performance Standard Satisfied	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	37	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	Yes	-	-	-	-	-	-	-	-	yes/no
	38	Overall Portion of Performance Standard Satisfied	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	39	This BMP Overflows to the Following Drainage Basin	-	-	-	-	-	-	-	-	-	-	unitless
	40	**Deficit of Effectively Treated Stormwater**	**0**	**0**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	cubic-feet

Worksheet B.5-1 General Notes:

A. Applicants may use this worksheet to size Lined or Unlined Biofiltration BMPs (BF-1, PR-1) for up to 10 basins. User input must be provided for yellow shaded cells, values for blue cells are automatically populated based on user inputs from previous worksheets, values for all other cells will be automatically generated, errors/notifications will be highlighted in red/orange and summarized below. BMPs fully satisfying the pollutant control performance standards will have a deficit treated volume of zero and be highlighted in green.

Summary of Stormwater Pollutant Control Calculations (V1.3)

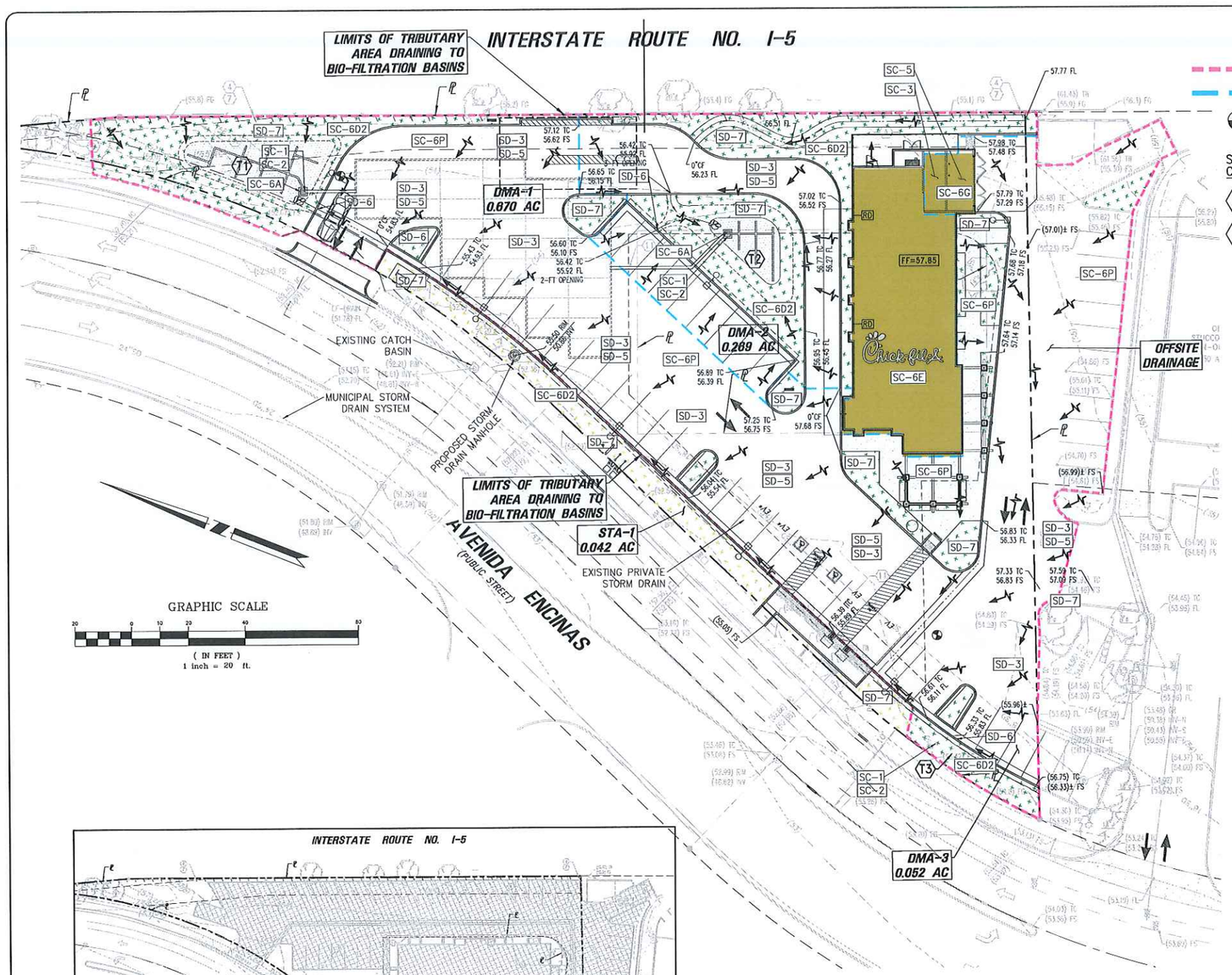
Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
General Info	0	Drainage Basin ID or Name	DMA-1	DMA-2	DMA-3	-	-	-	-	-	-	-	unitless
	1	85th Percentile Storm Depth	0.58	0.58	0.58	-	-	-	-	-	-	-	inches
	2	Design Infiltration Rate Recommended by Geotechnical Engineer	0.007	0.007	0.007	-	-	-	-	-	-	-	in/hr
	3	Total Tributary Area	22,599	11,718	2,265	-	-	-	-	-	-	-	sq-ft
	4	85th Percentile Storm Volume (Rainfall Volume)	1,092	566	109	-	-	-	-	-	-	-	cubic-feet
Initial DCV	5	Initial Weighted Runoff Factor	0.80	0.70	0.67	-	-	-	-	-	-	-	unitless
	6	Initial Design Capture Volume	874	396	73	-	-	-	-	-	-	-	cubic-feet
Site Design Volume Reductions	7	Dispersion Area Reductions	0	0	0	-	-	-	-	-	-	-	cubic-feet
	8	Tree Well and Rain Barrel Reductions	0	0	0	-	-	-	-	-	-	-	cubic-feet
BMP Volume Reductions	9	Effective Area Tributary to BMP	18,079	8,203	1,518	-	-	-	-	-	-	-	square feet
	10	Final Design Capture Volume Tributary to BMP	874	396	73	-	-	-	-	-	-	-	cubic-feet
	11	Basin Drains to the Following BMP Type	Biofiltration	Biofiltration	Biofiltration	-	-	-	-	-	-	-	unitless
	12	Volume Retained by BMP (normalized to 36 hour drawdown)	35	16	4	-	-	-	-	-	-	-	cubic-feet
Total Volume Reductions	13	Total Fraction of Initial DCV Retained within DMA	0.04	0.04	0.05	-	-	-	-	-	-	-	fraction
	14	Percent of Average Annual Runoff Retention Provided	6.1%	6.1%	7.6%	-	-	-	-	-	-	-	%
	15	Percent of Average Annual Runoff Retention Required	4.5%	4.5%	4.5%	-	-	-	-	-	-	-	%
Performance Standard	16	Percent of Pollution Control Standard Satisfied	100.0%	100.0%	100.0%	-	-	-	-	-	-	-	%
Treatment Train	17	Discharges to Secondary Treatment in Drainage Basin	-	-	-	-	-	-	-	-	-	-	unitless
	18	Impervious Surface Area Still Requiring Treatment	0	0	0	-	-	-	-	-	-	-	square feet
	19	Impervious Surfaces Directed to Downstream Dispersion Area	-	-	-	-	-	-	-	-	-	-	square feet
	20	Impervious Surfaces Not Directed to Downstream Dispersion Area	-	-	-	-	-	-	-	-	-	-	square feet
Result	21	Deficit of Effectively Treated Stormwater	0	0	0	-	-	-	-	-	-	-	cubic-feet

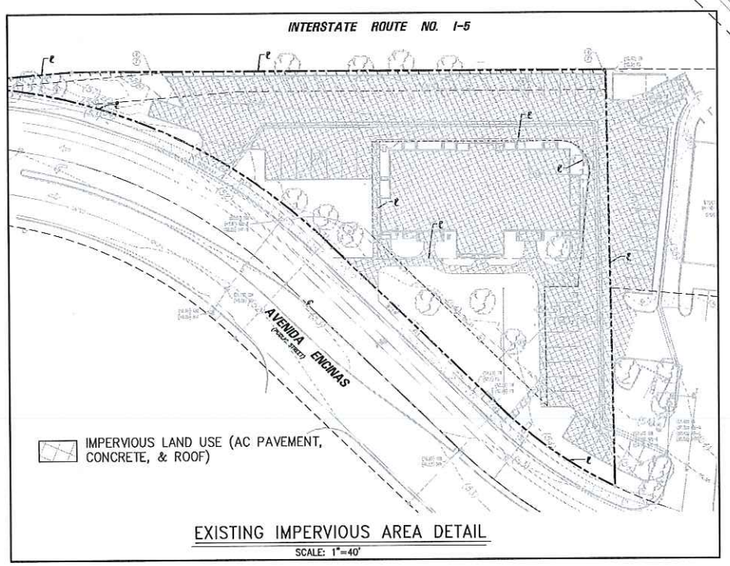
Summary Notes:

All fields in this summary worksheet are populated based on previous user inputs. If applicable, drainage basin elements that require revisions and/or supplemental information outside the scope of these worksheets are highlighted in orange and summairzed in the red text below. If all drainage basins achieve full compliance without a need for supplemental information, a green message will appear below.

-Congratulations, all specified drainage basins and BMPs are in compliance with stormwater pollutant control requirements. Include 11x17 color prints of this summary sheet and supporting worksheet calculations as part of the SWQMP submittal package.

false





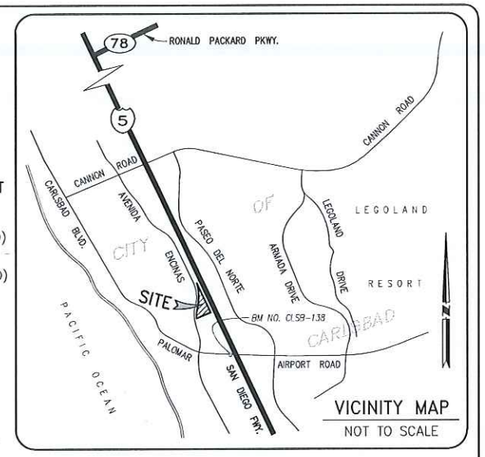
EXISTING IMPERVIOUS AREA DETAIL
SCALE: 1"=40'

LEGEND

- LIMITS OF TOTAL TRIBUTARY AREA
- LIMITS OF DMA
- SOIL BORING

STRUCTURAL BMPs FOR POLLUTANT CONTROL MANAGEMENT

- T1 BIO-FILTRATION BASIN-1 (LINED)
- T2 BIO-FILTRATION BASIN-2 (LINED)



VICINITY MAP
NOT TO SCALE

LAND COVER

- IMPERVIOUS – AC PAVEMENT
- IMPERVIOUS – CONCRETE
- IMPERVIOUS – BUILDING/TRASH ENCLOSURE
- PERVIOUS – LANDSCAPING
- PERVIOUS – SELF TREATING AREA

REGISTERED PROFESSIONAL ENGINEER RANDY J. DECKER No. 81077 CIVIL STATE OF CALIFORNIA

NOTICE TO CONTRACTOR

THE CONTRACTOR SHALL ASCERTAIN THE TRUE VERTICAL AND HORIZONTAL LOCATION AND SIZE OF ALL UTILITIES, PIPES, AND/OR STRUCTURES AND SHALL BE RESPONSIBLE FOR DAMAGE TO ANY PUBLIC OR PRIVATE UTILITIES, SHOWN OR NOT SHOWN HEREON.

IMPORTANT NOTICE
Section 4216 of the Government Code requires a Dig Alert Identification Number be issued before a "Permit to Excavate" will be valid. For your Dig Alert I.D. Number call Underground Service Alert CALL 811 Two working days before you dig.

STORM WATER QUALITY MANAGEMENT PLAN INFORMATION

1. HYDROLOGIC SOIL GROUP 'D'
2. DEPTH TO GROUNDWATER = 17 – 18 ft.
3. NO NATURAL HYDROLOGIC FEATURES EXIST WITHIN THIS PROJECT SITE
4. NO CRITICAL COARSE SEDIMENT YIELD AREAS EXIST DOWNSTREAM OF THIS PROJECT SITE

DISTURBED AREA = 0.945 acres

*TOTAL TRIBUTARY AREA TO BASINS=0.939 acres

* INCLUDES 0.102 ACRES OF OFFSITE DRAINAGE OUTSIDE OF DISTURBED AREA

DRAINAGE MANAGEMENT AREA							
	SURFACE TYPE	AREA AC	PERVIOUS		IMPERVIOUS		PROPOSED BMP
DMA-1	AC/CONCRETE	0.670			0.566	84.5%	BIO-FILTRATION (T1) BASIN-1
	LANDSCAPE		0.104	15.5%			
DMA-2	ROOF – PAVEMENT	0.269			0.191	71.2%	BIO-FILTRATION (T2) BASIN-2
	LANDSCAPE		0.078	28.8%			

SELF-TREATING AREAS							
	SURFACE TYPE	AREA AC	PERVIOUS		IMPERVIOUS		PROPOSED BMP
STA-1	LANDSCAPE	0.042	0.042	100.0%	–		N/A

LID FEATURES

- SC-1 PREVENT ILLICIT DISCHARGES TO THE MS4
- SC-2 IDENTIFY THE STORM DRAIN SYSTEM USING STENCILING OR SIGNAGE
- SC-3 PROTECT OUTDOOR MATERIAL STORAFE AREAS FROM RAINFALL, RUN-ON, RUNOFF AND WIND DISPERSAL
- SC-5 PROTECT TRASH STORAGE AREAS FROM RAINFALL, RUN-ON, RUNOFF, AND WIND DISPERSAL
- SC-6 ADDITIONAL BMPS – POTENTIAL SOURCES OF RUNOFF POLLUTION
  - A. ON-SITE STORM DRAIN INLETS
  - D2. LANDSCAPE/OUTDOOR PESTICIDE USE
  - E. FOOD SERVICE
  - G. REFUSE AREAS
  - P. PLAZAS, SIDEWALKS, AND PARKING LOTS
- SD-3 MINIMIZE IMPERVIOUS AREA
- SD-5 DISPERSE IMPERVIOUS AREAS
- SD-6 COLLECT RUNOFF
- SD-7 LANDSCAPE WITH NATIVE OR DROUGHT TOLERANT SPECIES

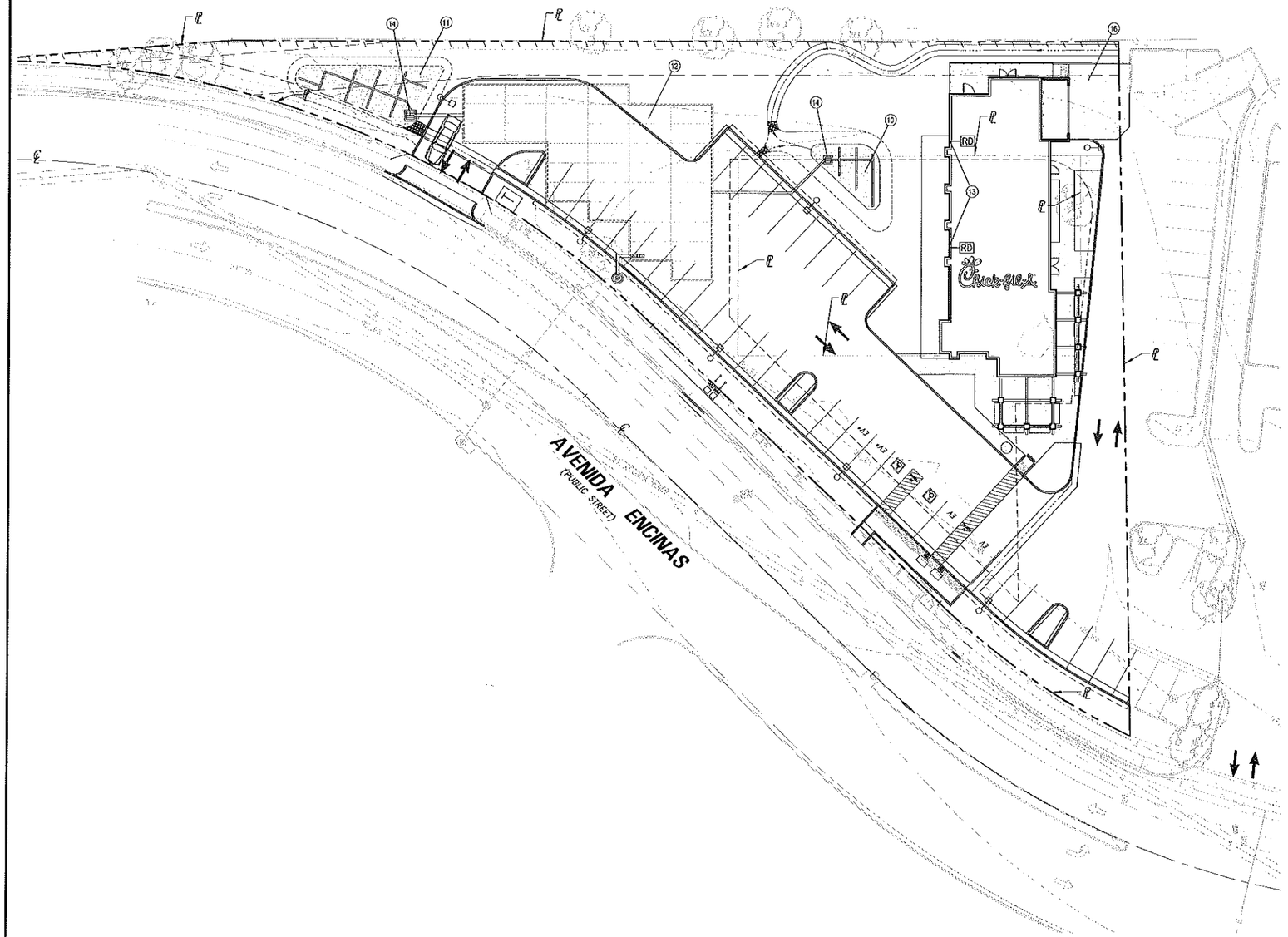
THIS PLAN IS:
PRELIMINARY
(NOT FOR CONSTRUCTION)

NO.	REVISIONS	DATE

Prepared by:
Joseph C. Truxaw and Associates, Inc.
Civil Engineers and Land Surveyors
1915 W. Orangewood Ave., Suite 101, Orange, CA 92868 (714) 935-0265 Truxaw.com

LOW IMPACT DEVELOPMENT
CHICK-FIL-A #4306
5850 AVENIDA ENCINAS
CITY OF CARLSBAD, STATE OF CALIFORNIA

DATE	9-16-19
DRAWN BY	PJS
CHECKED BY	RD/SMH
JOB NO.	CFA18050
SHEET NO.	1 OF 2 SHEETS



SWMP NO. PENDING

PARTY RESPONSIBLE FOR MAINTENANCE:

NAME TBD (STORE OPERATOR)

ADDRESS 5850 AVENIDA ENCINAS CONTACT TBD
CARLSBAD, CA

PHONE NO. TBD

PLAN PREPARED BY:

NAME RANDY J. DECKER _____ SIGNATURE

COMPANY JOSEPH C. TRUXAW & ASSOCIATES, INC.

ADDRESS 1915 W. ORANGEWOOD AVE, SUITE 101
ORANGE, CA 92868

PHONE NO. (714) 935-0265

BMP NOTES: CERTIFICATION _____

1. THESE BMPS ARE MANDATORY TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS OR THESE PLANS.
2. NO CHANGES TO THE PROPOSED BMPS ON THIS SHEET WITHOUT PRIOR APPROVAL FROM THE CITY ENGINEER.
3. NO SUBSTITUTIONS TO THE MATERIAL OR TYPES OR PLANTING TYPES WITHOUT PRIOR APPROVAL FROM THE CITY ENGINEER.
4. NO OCCUPANCY WILL BE GRANTED UNTIL THE CITY INSPECTION STAFF HAS INSPECTED THIS PROJECT FOR APPROPRIATE BMP CONSTRUCTION AND INSTALLATION.
5. REFER TO MAINTENANCE AGREEMENT DOCUMENT.
6. SEE PROJECT SWMP FOR ADDITIONAL INFORMATION.

BMP TABLE

BMP ID #	BMP TYPE	SYMBOL	CASQA NO.	QUANTITY	DRAWING NO.	SHEET NO.(S)	INSPECTION * FREQUENCY	MAINTENANCE * FREQUENCY
HYDROMODIFICATION & TREATMENT CONTROL								
(10) (11)	BIORETENTION AREA		TC-32	1,143 SF.	-	-	QUARTERLY	SEMI-ANNUALLY
HYDROMODIFICATION								
(12)	STORM CAPTURE VAULTS		MP-50	36	-	-	QUARTERLY	SEMI-ANNUALLY
LOW IMPACT DESIGN (L.I.D.)								
(13)	ROOF DRAIN TO LANDSCAPING	RD	SD-11	2	-	-	QUARTERLY	SEMI-ANNUALLY
(14) (15)	INLET FILTER		TC-50	2	-	-	QUARTERLY	SEMI-ANNUALLY
SOURCE CONTROL								
(16)	TRASH ENCLOSURE		SD-32	1	-	-	WEEKLY	MONTHLY
(14) (15)	STENCILS	NO DRAWING (WRITE TO OCEAN)	SD-13	2	-	-	ANNUALLY	ANNUALLY

DATE	INITIAL	REVISION DESCRIPTION	DATE	INITIAL	DATE	INITIAL
ENGINEER OF WORK			OTHER APPROVAL		CITY APPROVAL	

SHEET 1 | CITY OF CARLSBAD ENGINEERING DEPARTMENT | SHEETS 1

SINGLE SHEET BMP SITE PLAN

CHICK-FIL-A, #4306
5850 AVENIDA ENCINAS

RECORD COPY

INITIAL DATE

PROJECT NO. -

DRAWING NO. -

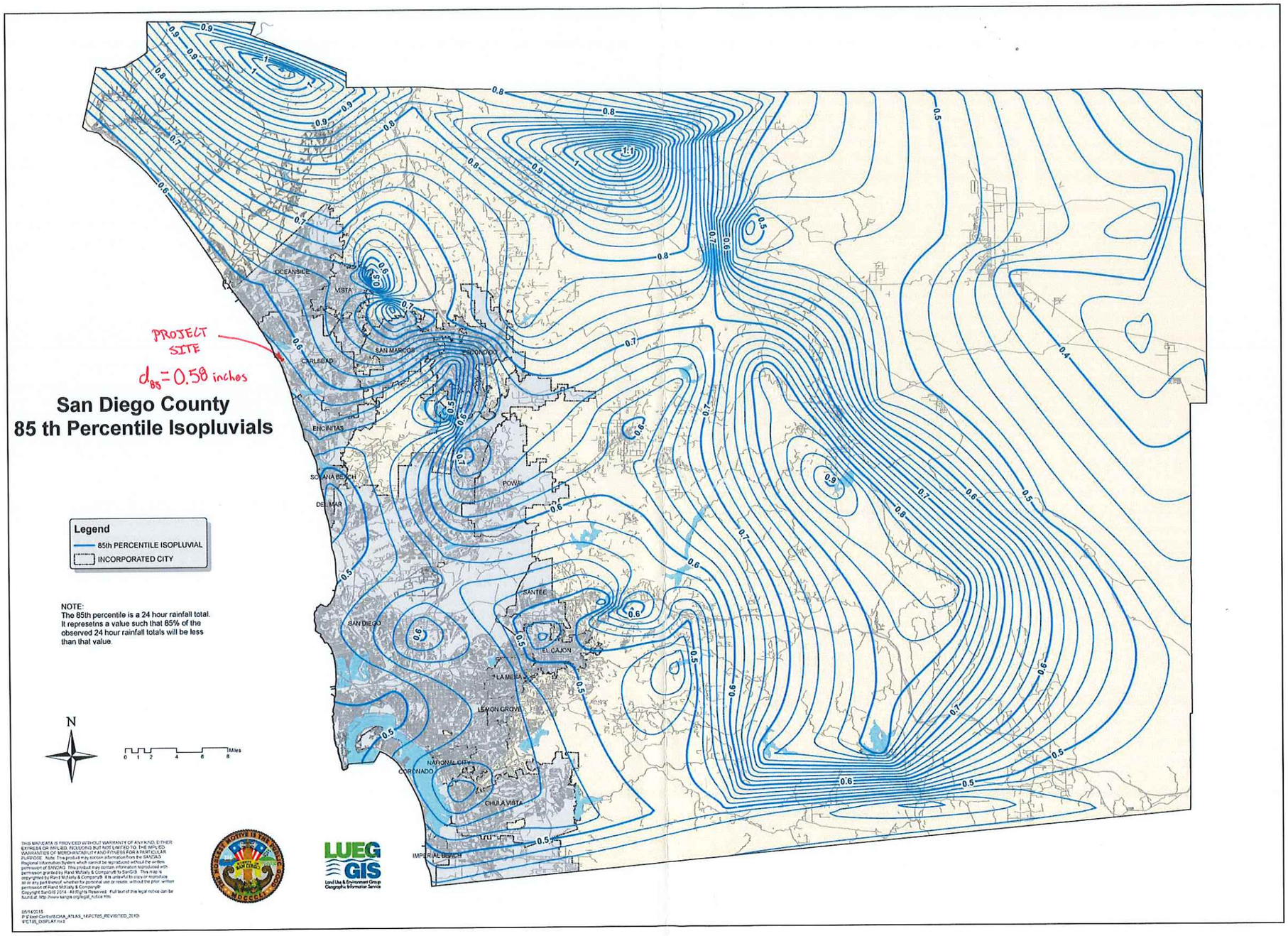
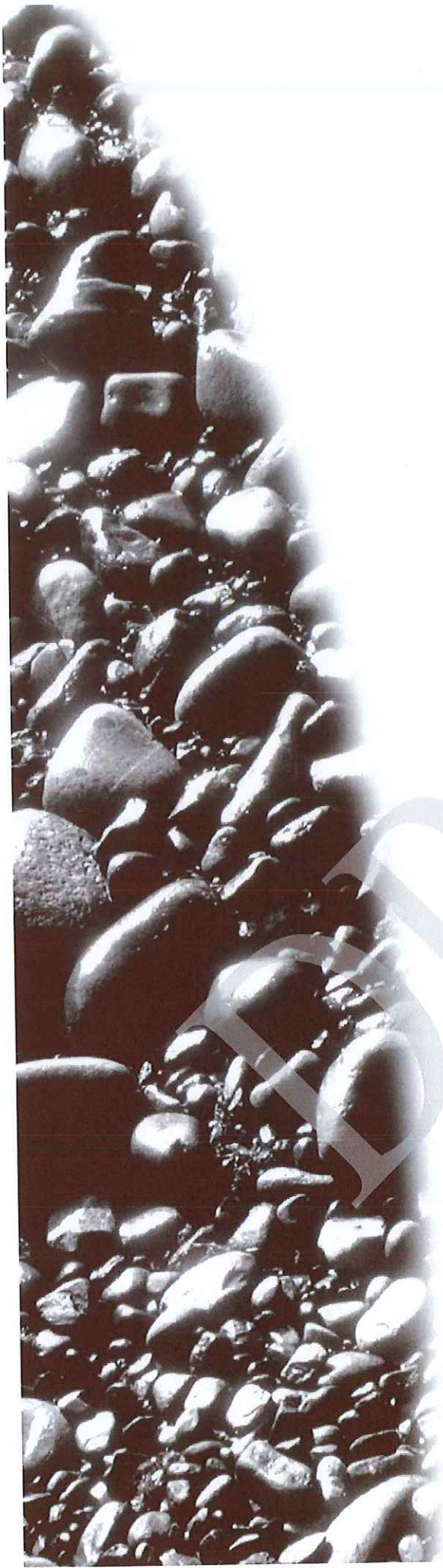


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map



GREEN

Geotechnical Engineering Exploration and Analysis DRAFT

Proposed Chick-fil-A Restaurant #4306
I-5 and Palomar FSU
5850 Avenida Encinas
Carlsbad, California

Prepared for:

Chick-fil-A, Inc.
Irvine, California

Prepared by:

Giles Engineering Associates, Inc.

October 5, 2018
Project No. 2G-1808005

GILES
ENGINEERING ASSOCIATES, INC.

DRAFT

GILES
ENGINEERING ASSOCIATES, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

• Atlanta, GA
• Baltimore, MD
• Dallas, TX
• Los Angeles, CA
• Manassas, VA
• Milwaukee, WI

October 5, 2018

Chick-fil-A, Inc.
15635 Alton Parkway, Suite 350
Irvine, California 92618

Attention: Ms. Beth Witt
Development Coordinator

Subject: Geotechnical Engineering Exploration and Analysis - Draft
Proposed Chick-fil-A Restaurant #4306
I-5 and Palomar FSU
5850 Avenida Encinas
Carlsbad, California
Project No. 2G-1808005

Dear Ms. Witt:

Giles Engineering Associates, Inc. (Giles) is pleased to present our *Geotechnical Engineering Exploration and Analysis* report prepared for the above-referenced project. Conclusions and recommendations developed from the exploration and analysis are discussed in the accompanying report.

We appreciate the opportunity to be of service on this project. If we may be of additional assistance, should geotechnical related problems occur or to provide construction observation and testing services, please do not hesitate to call at any time.

Respectfully submitted,

GILES ENGINEERING ASSOCIATES, INC.

Edgar L. Gatus, P.E.
Assistant Regional Manager

Distribution: Chick-fil-A, Inc.
Attn: Ms. Beth Witt (email: Beth.Witt@cfacorp.com)
Attn: Mr. Jennifer Daw (email: Jennifer.Daw@cfacorp.com)
Attn: Mr. Elizabeth Meloy (email: Elizabeth.Meloy@cfacorp.com)
Attn: Ms. Vicky Burke (email: Vicky.Burke@accesscfa.com)
(1 upload to Buzzsaw)

DRAFT

TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS - DRAFT
PROPOSED CHICK-FIL-A RESTAURANT #4306
I-5 AND PALOMAR FSU
5850 AVENIDA ENCINAS
CARLSBAD, CALIFORNIA
PROJECT NO. 2G-1808005

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APPENDICES
Appendix A – Figure (3), Boring Logs (6) and Liquefaction Analysis
Appendix B – Field Procedures
Appendix C – Laboratory Testing and Classification
Appendix D – General Information (*Modified* Guideline Specifications) and *Important Information About Your Geotechnical Report*

GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS - DRAFT

CHICK-FIL-A RESTAURANT #4306
I-5 AND PALOMAR FSU
5850 AVENIDA ENCINAS
CARLSBAD, CALIFORNIA
PROJECT NO. 2G-1808005

1.0 EXECUTIVE SUMMARY OUTLINE

The executive summary is provided solely for purposes of overview. Any party who relies on this report must read the full report. The executive summary omits a number of details, any one of which could be crucial to the proper application of this report.

Subsurface Conditions

- Site Class designation D is recommended for seismic design considerations.
- Our review of the Geology of San Diego Quadrangle indicates that the site is mapped as being underlain by Old Paralic Deposits consisting generally of poorly sorted, moderately permeable, reddish-brown, interfingered strand like, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate.
- Possible fills were encountered within our test borings to depths of about 3 feet below existing ground surfaces and were noted to be moist, medium dense in relative density clayey sand and silty sand, and firm in comparative consistency sandy clay.
- Native soils encountered below the possible fills were generally moist, medium dense to dense silty sand and sand, and very stiff sandy clay.
- Old Paralic Deposits were encountered within test borings B-1 and B-4 to depths of about 18 to 20 feet below existing ground surface and generally consisted of very dense silty sandstone materials.
- Groundwater was encountered during our subsurface exploration to a depth of about 17 and 18 feet below existing grade within test borings B-1 and B-4.

Site Development

- The proposed site development will include the demolition of existing building for the construction of a new Chick-fil-A single-story building and site improvements that include new concrete walkways, parking stalls, driveways, drive thru lane, and trash enclosure.
- Building Area: Due to the presence of variable strength characteristics of the near surface soils and likely disturbance of site soils during clearing operations, it is recommended that the soils within the proposed new building and an appropriate distance beyond (5 feet minimum) be over-excavated to a depth of at least 2 feet below existing grade or planned grade and 1 foot below bottom of footings, whichever is greater. The soils exposed at the base of this recommended over-excavation should be examined by the geotechnical engineer to document that the soils are suitable for building support. Prior to placement of fill, the exposed surfaces approved for fill placement should be scarified to a depth of at least 12 inches, moisture conditioned and then recompacted to at least 90% of the maximum dry density as determined by Modified Proctor (ASTM D 1557-00).
- Due to the presence of dense to very dense onsite soils some excavation difficulties should be expected.

Building Foundation

- Shallow spread footing foundation systems or turned-down slabs may be designed for a maximum, net allowable soil pressure of 3,000 psf soil bearing pressure supported on newly placed structural compacted fill.
- Minimum reinforcing in the strip footings is recommended to consist of four No. 5 bars (2 top and 2 bottom).

Building Floor Slab

- It is recommended that on grade slab be a minimum 4-inch thick slab-on-grade or turned-down slab, underlain by properly prepared subgrade.
- Minimum slab reinforcing recommended consisting of No. 3 rebars spaced at 18 inches on center, each way.

Parking Improvement

- Asphalt Pavements: 3 inches of asphaltic concrete underlain by 5 and 8 inches of base course aggregate in parking stalls and driveways, respectively.
- Portland Cement Concrete: 6 inches in thickness underlain by 4 inches of base course in high stress areas such as entrance/exit aprons, trash enclosure-loading zone, and the drive through area.

GREEN - This site has been given a Green designation to indicate that there are no significant geotechnical related construction or recognized problems foreseen which are unusual or not typical to this general area.

DRAFT

2.0 SCOPE OF SERVICES

This report provides the results of the *Geotechnical Engineering Exploration and Analysis* that Giles Engineering Associates, Inc. ("Giles") conducted regarding the proposed development. The *Geotechnical Engineering Exploration and Analysis* included several separate, but related, service areas referenced hereafter as the Geotechnical Subsurface Exploration Program, Geotechnical Laboratory Services, and Geotechnical Engineering Services. The scope of each service area was narrow and limited, as directed by our client and in consideration of the proposed project. The scope of each service area is briefly explained in this report.

Geotechnical-related recommendations for design and construction of the foundation and ground-bearing floor slab for the proposed building are provided in this report. Geotechnical-related recommendations are also provided for the proposed parking lot. Site preparation recommendations are also given; however, those recommendations are only preliminary since the means and methods of site preparation will depend on factors that were unknown when this report was prepared. Those factors include the weather before and during construction, the water table at the time of construction, subsurface conditions that are exposed during construction, and finalized details of the proposed development.

Giles conducted a *Phase 1 Environmental Site Assessment* for the subject site. The results of that assessment will be provided under separate cover (2E-1808009).

3.0 SITES AND PROJECT DESCRIPTION

3.1 Site Description

The proposed Chick-fil-A site is currently an active two-story office building, about 10,977 square feet, and located at 5850 Avenida Encinas, in the city of Carlsbad, California.. The roughly triangular shaped property is bounded on the north and west by Avenida Encinas, on the south by In-N-Out restaurant, and on the east by the I-5 freeway. The existing building is situated within the central portion of the site and bordered with parking stalls and drive ways to the north, east and south sides, and landscape area to the west by Avenida Encinas.

Based upon a review of the ALTA/NSPS Land Title Survey prepared by Joseph Truxaw and Associates, elevations at the site range from El. 56 feet to El. 58 feet. The site is relatively level and slopes to the northwest by the adjacent street (Avenida Encinas). The subject property is situated at approximately latitude of 33.1255° North and longitude of -117.3247° West.

The site is currently covered with asphalt pavement, curbs and few landscape planters that contain shrubs and trees. Other existing site improvements include asphalt pavement along with curbs and gutter, concrete v-gutter, concrete walkways, lighting poles, chain linked fence, trash enclosure, landscape areas containing grass, shrubs and trees, and underground utilities.

3.2 Proposed Project Description

The proposed development includes the demolition of existing building for the construction of a new, single-story Chick-fil-A restaurant building with drive through lane to be located along the westerly portion of the site (parking area) adjacent to I-5 freeway and within a portion of the easterly side of the existing building (Figure 1). Although detailed building plans are not yet ready for our review, the new building will be a single-story wood-frame structure, 3,201 square feet, with no basement or underground levels to be located within the northern end of the property. We were not provided with specific loading information for this project at the time of this report; however, based on previous Chick-fil-A projects, we expect maximum combined dead and live loads supported by the bearing walls and columns of 2 to 3 kips per lineal foot (klf) and 40 to 50 kips, respectively. The live load supported by the floor slab is expected to be a maximum of 100 pounds per square foot (psf).

Other planned improvements include new parking lot, menu board signs, outdoor dining area, a playground area, concrete walkways and planter areas, and a trash enclosure. Parking lot improvement within the property will include curbs and gutters, and underground utilities.

Preliminary project information did not indicate the planned finished floor elevation for the proposed building. However, it is anticipated that the finish floor elevation of the new building will be constructed at elevation El 57.0. Therefore, site grading is anticipated to include only minor cut and fill (up to 1 foot) in order to establish the necessary site grade to accommodate the assumed floor elevation, exclusive of site preparation or over-excavation requirements necessary to create a stable site suited for the proposed development.

The traffic loading on the proposed parking lot improvement is understood to predominantly consist of automobiles with occasional heavy trucks resulting from deliveries and trash removal. The parking lot pavement sections have been designed on the basis of daily traffic intensity equivalent to five 18-kip single axle loads and 1,500 automobiles within the main drive lanes and only automobiles of a lesser intensity within the parking stalls. Pavement designs are based on a 20-year design period. Therefore, the parking lot pavement sections have been designed on the basis of a Traffic Index (TI) of 4.0 for the automobile traffic parking stalls (light duty) and a TI of 5.0 for drive lane areas (medium duty).

4.0 SUBSURFACE EXPLORATION

4.1 Subsurface Exploration

Our subsurface exploration consisted of the drilling of six (6) exploratory test borings to depths of about 5 to 35½ feet below existing ground surfaces. The approximate test boring locations are shown in the Test Boring Location Plan (Figure 1). The Test Boring Location Plan and Test Boring Logs (Records of Subsurface Exploration) are enclosed in Appendix A. Field and laboratory test procedures and results are enclosed in Appendix B and C, respectively. The terms and symbols used on the Test Boring Logs are defined on the General Notes in Appendix D.

Our subsurface exploration included the collection of relatively undisturbed samples of subsurface soil materials for laboratory testing purposes. Bulk samples consisted of composite soil materials obtained at selected depth intervals from the borings. Relatively undisturbed samples were collected (per ASTM D-3550) using a 3-inch outside-diameter, modified California split-spoon soil sampler (CS) lined with 1-inch high brass rings. The sampler was driven with successive 30-inch drops of a hydraulically operated, 140-pound automatic trip hammer. Blow counts for each 6-inch driving increment were recorded on the field exploration logs. The central portions of the driven core samples were placed in sealed containers and transported to our laboratory for testing.

Where deemed appropriate, standard split-spoon tests (SS), also called Standard Penetration Test (SPT), were also performed at selected depth intervals in accordance with the American Society for Testing Materials (ASTM) Standard Procedure D 1586. This method consists of mechanically driving an unlined standard split-barrel sampler 18 inches into the soil with successive 30-inch drops of the 140-pound automatic trip hammer. Blow counts for each 6-inch driving increment were recorded on the exploration logs. The number of blows required to drive the standard split-spoon sampler for the last 12 of the 18 inches was identified as the uncorrected standard penetration resistance (N). Disturbed soil samples from the unlined standard split-spoon samplers were placed in plastic containers and transported to our laboratory for testing.

4.2 Subsurface Conditions

The subsurface conditions as subsequently described have been simplified somewhat for ease of report interpretation. A more detailed description of the subsurface conditions at the test boring locations is provided by the logs of the test borings enclosed in Appendix A of this report.

Pavement

Existing pavement encountered within our test borings consisted of approximately 2½ to 5 inches thick asphalt concrete over 4½ to 5 inches of aggregate base. No aggregate base was noted within test borings B-2, B-3 and B-4. Based on our visual observation, the existing asphalt pavement is in fair to poor condition.

Soil

Our review of the Geology of San Diego Quadrangle indicates that the site is mapped as being underlain by Old Paralic Deposits consisting generally of poorly sorted, moderately permeable, reddish-brown, interfingered strand like, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate.

Possible fills were encountered within our test borings to depths of about 3 feet below existing ground surfaces and were noted to be moist, medium dense in relative density clayey sand and silty sand, and firm in comparative consistency sandy clay.

Native soils encountered below the possible fills were generally moist, medium dense to dense silty sand and sand, and very stiff sandy clay.

Old Paralic Deposits were encountered within test borings B-1 and B-4 to depths of about 18 to 20 feet below existing ground surface and generally consisted of very dense silty sandstone materials.

Groundwater

Groundwater was encountered during our subsurface investigation to depths of about 17 and 18 feet below existing grade. However, fluctuations of the groundwater table, localized zones of perched water, and rise in soil moisture content should be anticipated during and after the rainy season. Irrigation of landscape areas on or adjacent to the site can also cause fluctuations of local or shallow perched groundwater levels.

4.3 Photoionization Detector (PID) Screening

Soil samples taken from our subsurface exploration were screened with a Photoionization Detector (PID) to check for the possible presence of volatile vapors. No volatile vapors were detected during the screening of soil samples collected from any of the borings with a PID. Additionally, no odors detected or stains observed that might suggest some form of contamination. PID field-screening results are included on the soil boring logs.

4.4 Infiltration Testing

It is our understanding that an on-site below grade storm water infiltration system is being considered for the subject site. Therefore, percolation tests were performed to assess the infiltration characteristics of the site soils.

Two percolation tests (designated as B-5 and B-6) were conducted and involved the drilling of the test boring utilizing a hollow-stem auger drill rig with an outside diameter of approximately 8 inches. The percolation test procedure by City of San Diego BMP Design Manual (2018) was used in our percolation tests.

The approximate percolation test boring locations are shown in the Test Boring Location Plan (Figure 1). A perforated 2-inch diameter pvc pipe was installed inside each of the test boring with gravel placed below and on the sides of the perforated pipe. The percolation tests involved presoaking the boring and filling the test holes with water, recording the drop in water surface with time, and refilling the holes with water. The results of the percolation test are presented on the following table.

The drop in water level over time is the percolation rate at the test location. The percolation rates were reduced to account for the discharge of water from both the sides and bottom of the boring. The formula below was used to calculate for the infiltration rate.

Infiltration Rate = $\Delta H\ (60r) / \Delta t\ (r + 2Havg)$

Where: r is the radius of the test hole (in)
ΔH is the change in height over the time interval (in)
Δt is the time interval (min)
Havg is the average head height over the time interval

The design infiltration rate noted below has not been reduced to account for a factor safety (FS).

TABLE 1 – PERCOLATION TEST RESULTS

Test Hole	Test Depth[1] (feet)	Percolation Rate (in/hr)	Infiltration Rate (in/hr)	Soil Type
B-5	5.0	0.48	0.05	Clayey Sand
B-6	5.0	0.00	0.00	Sandy Clay

1) Depth is referenced to the existing surface grade at the test location.

It should be noted that the infiltration rate of the on-site soils represents a specific area and depth tested and may fluctuate throughout other parts of the site.

Based on the results of the infiltration, it is our opinion that an on-site stormwater infiltration system is not suitable due to very low infiltration rates obtained during our testing.

5.0 LABORATORY TESTING

Several laboratory tests were performed on selected samples considered representative of those encountered in order to evaluate the engineering properties of on-site soils. The following are brief descriptions of our laboratory test results.

In Situ Moisture and Density

Tests were performed on select samples from the test borings to determine the subsoils dry density and natural moisture contents in accordance with Test Method ASTM 2216-05. The results of these tests are included in the Test Boring Logs enclosed in Appendix A.

Sieve Analysis

Sieve Analyses including Passing No. 200 sieve were performed on selected samples from various depths within Test Borings B-1 and B-5 to assist in soil classification and aid in the liquefaction analysis. These tests were performed in accordance with Test Method ASTM D 1140-00 (Reapproved 2006) and ASTC C 1369-96. The results of the sieve analysis are graphically presented as Figure 2 and passing no. 200 results are presented in Test Boring Logs.

Expansion

To evaluate the expansive potential of the near surface soils encountered during our subsurface exploration, a composite sample collected from Test Boring B-1 (1 to 5 feet) was subjected to Expansive Index (EI) testing in accordance with Test Method ASTM D 4829-08a. The result of our expansion index (EI) test indicates that the near surface sample has a *very low* expansion potential (EI= 14).

Consolidation Test

Settlement prediction under anticipated load was made on the basis of one-dimensional consolidation test. These tests were performed in general accordance with Test Method ASTM D 2435 and ASTM D5333. The test sample was inundated at 2,000 psf pressure in order to evaluate the sudden increase in moisture condition (collapse potential). Result of this test indicated that the tested on-site soils exhibit a slight degree of collapse (1.25%) potential. The Consolidation test curve, Figure 3 is included in Appendix A.

Soluble Sulfate Analysis and Soil Corrosivity

A representative sample of the near surface soils which may contact shallow buried utilities and structural concrete was performed to determine the corrosion potential for buried ferrous metal conduits and the concentrations present of water soluble sulfate which could result in chemical attack of cement. The following table presents the results of our laboratory testing.

Parameter	**B-2 1 to 5 feet**
pH	7.48
Chloride	134 ppm
Sulfate	0.0162%
Resistivity	800 ohm-cm

The chloride content of the near-surface soils was determined for a selected sample in accordance with California Test Method No. 422. The results of this test indicated that tested on-site soil has a Low exposure to chloride. The results of limited in-house testing of soil pH and resistivity were determined in accordance with California Test Method No. 643 and indicated that on-site soil is moderately alkaline with respect to pH and soil resistivity was found to possess a severe degree of corrosivity.

These test results have been evaluated in accordance with criteria established by the Cast Iron Pipe Research Association, Ductile Iron Pipe Research Association, the American Concrete Institute and the National Association of Corrosion Engineers. The test results on a near surface bulk sample from the site generally indicate that tested on-site soils have severe corrosive potential when in contact with ferrous materials. Therefore, special protection for underground cast iron pipe or ductile pipe may be warranted depending on the actual materials in contact with the pipe. We recommend that a corrosion engineer review these results in order to provide specific recommendations for corrosion protection as well as appropriate recommendations for other types of buried metal structures.

Corrosivity testing also included determination of the concentrations of water-soluble sulfates present in the tested soil sample in accordance with California Test Method No. 417. Our laboratory test data indicated that near surface soils contain approximately 0.0162 percent of water soluble sulfates. Based on the 2016 California Building Code (CBC), concrete that may be exposed to sulfate containing soils shall comply with the provisions of ACI 318-05, Section 4.3. Therefore, according to Table 4.3.1 of the ACI 318-05, a low exposure to sulfate corrosivity can be expected for concrete placed in contact with the tested on-site soils. No special sulfate resistant cement is considered necessary for concrete which will be in contact with the tested on-site soils.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our subsurface exploration and laboratory testing, the planned development for the subject site is considered feasible from a geotechnical point of view provided the following conclusions and recommendations are incorporated in the design and project specifications.

Conditions imposed by the proposed improvement have been evaluated on the basis of the engineering characteristics of the subsurface materials encountered during our subsurface investigation and their anticipated behavior both during and after construction. Conclusions and recommendations, along with site preparation recommendations and construction considerations are discussed in the following sections of this report.

Impact of Site on Stability of Adjacent Properties

It is our opinion that the proposed grading and construction for the subject site will not affect adversely impact the stability of adjoining properties provided that grading and construction are performed in accordance with the recommendations provided herein and in accordance with local code guidelines.

6.1 Seismic Design Considerations

Faulting/Seismic Design Parameters

Research of available maps published by the California Geological Survey (CGS) indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. The potential for fault rupture through the site is, therefore, considered to be low. The site may however be subject to strong groundshaking during seismic activity. The proposed structure should be designed in accordance with the current version of the 2016 California Building Code (CBC) and applicable local codes. Based on the results of our subsurface exploration, a Site Class D is recommended for design.

According to the maps of known active fault near-source zones (ICBO, 1998) to be used with the 2016 CBC, the Rose Canyon, Newport Inglewood, Coronado Bank and Elsinore faults are the closest known active faults and are located about 4.11, 4.11, 20.04 and 23.55 miles, respectively, to the site.

The Newport Inglewood Fault would probably generate the most severe site ground motions at the site with an anticipated maximum moment magnitude (Mw) of 7.50.

The proposed structure should be designed in accordance with the current version of the 2016 California Building Code (CBC) and applicable local codes. Within the International Code Council's 2015 International Building Code (IBC), the five-percent damped design spectral response accelerations at short periods, S_{DS}, and at 1-second period, S_{D1}, are used to determine the seismic design base shear. These parameters, which are a function of the site's seismicity and soil, are also used as parts of triggers for other code requirements. The following values are determined by using the USGS published U.S. Seismic Design Maps program based upon the 2016 CBC referenced ASCE 7 (with July 2013 errata).

CBC 2016, Earthquake Loads	
Site Class Definition (Table 1613.5.2)	D
Mapped Spectral Response Acceleration Parameter, S_s (Figure 1613.3.1(1) for 0.2 second)	1.160
Mapped Spectral Response Acceleration Parameter, S_1 (Figure 1613.3.1(2) for 1.0 second)	0.446
Site Coefficient, F_a (Table 1613.3.3 (1) short period)	1.036
Site Coefficient, F_v (Table 1613.3.3 (2) 1-second period)	1.554
Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter, S_{MS} (Eq. 16-37)	1.202
Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter, S_{M1} (Eq. 16-38)	0.693
Design Spectral Response Acceleration Parameter, S_{DS} (Eq. 16-39)	0.801
Design Spectral Response Acceleration Parameter, S_{D1} (Eq. 16-40)	0.462

Liquefaction

A site liquefaction evaluation consistent with the guidelines contained in CDMG Special Publication 117A along with a report by Southern California Earthquake Center (SCEC) has been performed as part of the current investigation. Our site-specific probabilistic seismic hazard analysis was derived using data published by the United States Geological Survey (USGS).

Based on 2016 CBC, Section 1803.5.12, Seismic Design Categories D through F, the peak ground acceleration shall be determined in accordance with Section 11.8.3 of ASCE 7. The predominant earthquake magnitude of 6.72 was obtained from the USGS Interactive Deaggregation web site using 2% probability of exceedance in 50 years. The mean peak ground acceleration for the site used in our liquefaction analysis was determined to be 0.482g.

Our liquefaction analysis was performed using the computer program Liquefypro (version 5) developed by Civil Tech Software. The program is based on the most recent publications of the NCEER Workshop and SP117 Implementation. Corrected SPT blow counts based upon hammer energy ratio, borehole diameter and sampling method were used in analysis calculations. Although groundwater was encountered at a depth of about 17 to 18 feet below existing ground surfaces during

our drilling operations, groundwater of 10 feet was used in our liquefaction analysis. The liquefiable layers at the location of boring B-1 are presented graphically in Plate A1 of Appendix A. The computer output files are also included.

In order to estimate the amount of post-earthquake settlement, methods proposed by Tokimatsu and Seed (1987) were used for the settlement calculations. Based on our analysis and under the current site conditions, we estimate that the maximum total seismic-induced ground settlement at the site would be negligible (0.01 inch) and therefore, not significant to the proposed development.

6.2 Site Improvement Recommendations

The following recommendations for site development have been based upon the assumed floor elevation and foundation bearing grades and the conditions encountered at the test boring locations.

Site Clearing

Clearing and demolition operations should include the removal of all landscape vegetation and existing structural features such as asphaltic concrete pavement, concrete curb and gutters within the area of the proposed new building and site improvements. Existing pavement within areas of proposed development should be removed or processed to a maximum 3-inch size and stockpiled for use as compacted fill or stabilizing material for the new development. Processed asphalt may be used as fill, sub-base course material, or subgrade stabilization material beyond the building perimeter. Processed concrete or existing base may be used as fill, sub-base course material, or subgrade stabilization material both within and outside of the building perimeter. Due to the moisture sensitivity, the pavement is recommended to remain in-place as long as possible to help protect the subgrade from construction traffic disturbance.

All soils disturbed by the demolition of the existing improvements should be removed to expose a competent subgrade, as determined by the project geotechnical engineer. Debris resulting from the demolition and clearing operations should be legally exported from the site.

Existing Utilities

All existing utilities should be located. Utilities that are not reused should be capped off and removed or properly abandoned in-place in accordance with local codes and ordinances. The excavations made for removed utilities that are in the influence zone of new construction are recommended to be backfilled with structural compacted fill. Underground utilities, which are to be reused or abandoned in-place, are recommended to be evaluated by the structural engineer and utility backfill is recommended to be evaluated by the geotechnical engineer, to determine their potential effect on the new improvement. If any existing utilities are to be preserved, grading operations must be carefully performed so as not to disturb or damage the existing utility.

Building Area

Due to the presence of variable strength characteristics of the near surface soils and likely disturbance of site soils during clearing operations, it is recommended that the soils within the proposed new building area and an appropriate distance beyond (5 feet minimum) be over-excavated to a depth of at least 2 feet below existing grade or planned grade and 1 foot below bottom of footings, whichever is greater. The soils exposed at the base of this recommended over-excavation should be examined by the geotechnical engineer to document that the soils are suitable for building support. Prior to placement of fill, the exposed surfaces approved for fill placement should be scarified to a depth of at least 12 inches, moisture conditioned and then recompacted to at least 90% of the maximum dry density as determined by Modified Proctor (ASTM D 1557-00). A representative of the project geotechnical engineer should be present on site during grading operations to verify proper placement and adequate compaction of all fills.

Proofroll and Compact Subgrade

The subgrades within the new pavement area should be proofrolled in the presence of the geotechnical engineer with appropriate rubber-tire mounted heavy construction equipment or a loaded dump truck to detect very loose/soft yielding soil which should be removed to a stable subgrade. Following proofrolling and completion of any necessary overexcavation, the subgrades should be scarified to a depth of at least 8 inches, moisture conditioned and recompacted to at least 90 percent of the Modified Proctor maximum dry density. In accordance with the enclosed Guide Specifications and in the event that new pavement is constructed within the site, the top 12 inches of the pavement subgrade soils should be compacted to at least 95 percent of the Modified Proctor maximum density, or, 5 percent higher than the underlying fill materials. Low areas and excavations may then be backfilled in lifts with suitable very low to low expansive structural compacted fill.

The selection, placement and compaction of structural fill should be performed in accordance with the project specifications. The Guide Specifications included in Appendix D (Modified Proctor) of this report should be used as a minimum in developing the project specifications. The need may arise to recompact the floor slab and pavement subgrades immediately prior to construction due to the effects of weather and construction traffic on a previously prepared subgrade.

Reuse of On-site Soil

On-site material may be reused as structural compacted fill within the proposed building and pavement improvement area provided they are moisture conditioned and compacted as recommended, and do not contain oversized materials, significant quantities of organic matter, or other deleterious materials. Care should be used in controlling the moisture content of the soils to achieve proper compaction for pavement support. All subgrade soil compaction as well as the selection, placement and compaction of new fill soils should be performed in accordance with the project specifications under engineering controlled conditions.

Import Structural Fill

Any soil imported to the site (if required) for use as structural fill should consist of very low expansive soils (EI less than 21). Material designated for import should be submitted to the project geotechnical engineer no less than three working days prior to placement for evaluation.

In addition to expansion criteria, soils imported to the site should exhibit adequate characteristics for the recommended pavement support characteristics and soluble sulfate content.

Subgrade Protection

The near surface soils that are expected to comprise the subgrade are sensitive to water. Unstable soil conditions will develop if these soils are exposed to moisture increases or are disturbed (rutted) by construction traffic. The site should be graded to prevent water from ponding within construction areas and/or flowing into excavations. Accumulated water must be removed immediately along with any unstable soil. Foundation concrete should be placed and excavations backfilled as soon as possible to protect the bearing grade. The degree of subgrade instability and associated remedial construction is dependent, in part, upon precautions taken by the contractor to protect the subgrade during site development.

Silt fences or other appropriate erosion control devices should be installed in accordance with local, state and federal requirements at the perimeter of the development areas to control sediment from erosion. Since silt fences or other erosion control measures are temporary structures, careful and continuous monitoring and periodic maintenance to remove accumulated soil and/or replacement should be anticipated.

Fill Placement

Material for engineered fill should be moisture conditioned and compacted in accordance with the specifications, be free of organic material, debris, and other deleterious substances, and should not contain fragments greater than 3 inches in maximum dimension. On-site excavated soils that meet these requirements may be used to backfill the excavated pavement areas.

All fill should be placed in 8-inch-thick maximum loose lifts, moisture conditioned and then compacted in accordance with recommendation herein and with the enclosed "Guide Structural Fill Specifications". A representative of the geotechnical engineer should be present on-site during grading operations to verify proper placement and compaction of all fill, as well as to verify compliance with the other geotechnical recommendations presented herein.

6.3 Construction Considerations

Construction Dewatering

As mentioned previously, groundwater was encountered at depths of about 17 and 18 feet below existing grade during our subsurface investigation. In the event that shallow perched water is encountered, filter sump pumps placed within pits in the bottoms of excavations are expected to be the most feasible method of construction dewatering.

Soil Excavation

Some slope stability problems may be encountered for shallow unbraced excavations considering the nature of the subsoils. All excavations must be performed in accordance with CAL-OSHA requirements, which is the responsibility of the contractor. Shallow excavations may be adequately sloped for bank stability while deeper excavations or excavations where adequate back sloping cannot be performed may require some form of external support such as shoring or bracing.

Due to the presence of dense to very dense on-site soils at shallow depths, some difficulty may be encountered during excavation with conventional equipment. The use of specialized excavation equipment may be necessary.

6.4 Foundation Recommendations

Vertical Load Capacity

Upon completion of the building pad preparation, the proposed structure may be supported by a shallow foundation system. The foundation system may consist of either independently constructed spread footings or monolithically constructed foundation and floor slab thereby using a turned-down slab construction technique. Foundations may be designed for a maximum, net, allowable soil-bearing pressure of 3,000 pounds per square foot (psf). Minimum foundation widths for walls and columns should be 16 and 24 inches, respectively, regardless of the calculated soil bearing pressure. The recommended allowable soil bearing pressure may be increased by one-third for short term wind and/or seismic loads.

Reinforcing

The recommended minimum quantity of longitudinal reinforcing for geotechnical considerations within continuous strip footing is four No. 5 bars (2 top and 2 bottom) continuous through column pads within the strip footings. The recommended quantity of longitudinal reinforcing pertains to a minimum 12-inch thick and a maximum 24-inch wide footing pad; additional reinforcing may be necessary if a thinner or wider footing pad is used to develop equivalent rigidity. Conventional reinforcing is considered suitable in isolated column pad footings. The final design of the foundations as well as determination of the actual quantity of steel reinforcing and the footing dimensions should be performed by the structural engineer.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. Passive pressure and friction may be used in combination, without reduction, in determining the total resistance to lateral loads. A one-third increase in the passive pressure value may be used for short duration wind or seismic loads.

A coefficient of friction of 0.35 may be used with dead load forces for footings placed on competent native soil and/or newly placed compacted fill soil. An allowable passive earth pressure of 250 psf per foot of footing depth (pcf) below the lowest adjacent grade may be used for the sides of footings placed against newly placed structural fill. The maximum recommended allowable passive pressure is 2,000 psf.

Bearing Material Criteria

Soil suitable to serve as the foundation bearing grade should exhibit at least a loose relative density (average N value of at least 10) for non-cohesive soils or possess a stiff consistency (average unconfined compressive strength of 1.50 tsf) for cohesive soils for the recommended 3,000 psf allowable soil bearing pressure. For design and construction estimating purposes, suitable bearing soils are expected to be encountered at nominal foundation depths following the recommended site preparation activities. However, field testing by the Geotechnical Engineer within the foundation bearing soils is recommended to document that the foundation support soils possess the minimum strength parameters noted above. If unsuitable bearing soils are encountered, they should be recompacted in-place, if feasible, or excavated to a suitable bearing soil subgrade and to a lateral extent as defined by Item No. 3 of the enclosed Guide Specifications, with the excavation backfilled with structural compacted fill to develop a uniform bearing grade.

Foundation Embedment

The California Building Code (CBC) requires a minimum 12-inch foundation embedment depth. However, it is recommended that exterior foundations extend at least 18 inches below the adjacent exterior grade for bearing capacity consideration. Interior footings may be supported at nominal depth below the floor. All footings must be protected against weather and water damage during and after construction, and must be supported within suitable bearing materials.

Estimated Foundation Settlement

Post-construction total and differential static movement (settlement) of a shallow foundation system designed and constructed in accordance with the recommendations provided in this report are estimated to be less than ¾ and ½ inch, respectively, for static conditions. The estimated differential movement is anticipated to result in an angular distortion of less than 0.002 inches per inch on the

basis of a minimum clear span of 20 feet. The maximum estimated total and differential movement is considered within tolerable limits for the proposed structure provided it is considered in the structural design.

6.5 Floor Slab Recommendations

Subgrade

The floor slab subgrade should be prepared in accordance with the appropriate recommendations presented in the Site Development Recommendations section of this report. Foundation, utility trenches and other below-slab excavations should be backfilled with structural compacted fill in accordance with the project specifications.

Design

The floor of the proposed building may be designed and constructed as a conventional slab-on-grade supported on a properly prepared subgrade. If desired, the floor slab may be poured monolithically with perimeter foundations where the foundations consist of thickened sections thereby using a turned-down slab construction technique. The minimum slab reinforcing for geotechnical considerations is recommended to consist of No. 3 rebars at 18 inches on center, each way. Based on the recommended reinforcing and the assumed live loading, the slab is recommended to be a minimum of 4 inches in thickness. A qualified structural engineer should perform the actual design of the slab to ensure proper thickness and reinforcing. If desired, a Subgrade Modulus of 150 pci may be used for floor slab design.

The floor slab is recommended to be underlain by a 4 inch thick layer of granular material. A minimum 10-mil synthetic sheet should be placed below the floor slab to serve as a vapor retarder where required to protect moisture sensitive floor coverings (i.e. tile, or carpet, etc.). It is recommended that a structural engineer or architect specify the vapor retarder location with careful consideration of concrete curing and the effects of moisture on future flooring materials. The vapor retarder is recommended to be in accordance with ASTM E 1745-11, which is entitled: *Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs*. The sheets of the vapor retarder material should be evaluated for holes and/or punctures prior to placement and the edges overlapped and taped. If materials underlying the synthetic sheet contain sharp, angular particles, a layer of coarse sand (Sand Equivalent>30) approximately 2 inches thick or a geotextile should be provided to protect it from puncture. An additional 2-inch thick layer of coarse sand may be needed between the slab and the vapor retarder to promote proper curing. Proper curing techniques are recommended to reduce the potential for shrinkage cracking and slab curling.

Estimated Movements

Post-construction total and differential movements of the floor slab designed and constructed in accordance with the recommendations provided in this report are estimated to be less than ½ and ⅓ inch, respectively. Movements on the order of those estimated for foundations should be expected

when the foundation and floor slab are structurally connected or constructed monolithically. The estimated differential movement is anticipated to occur across the short dimension of the structure. The maximum total and differential movement is considered within tolerable limits for the proposed structure, provided that the structural design adequately considers this distortion.

6.6 Retaining Wall Recommendations (If Required)

It is possible that retaining walls may be needed for this site. The retaining wall(s) may be supported by conventional shallow spread footings designed for an allowable soil bearing pressure of 3,000 psf. A higher allowable soil bearing pressure may be possible, but that determination should be based on a review of the locations and details of the planned wall and foundation elevations.

Design of walls should incorporate an adequate factor-of-safety against both over-turning and sliding (FS=1.5). The overturning resultant should also fall within the center third (kern) of the retaining wall footing for stability, or the design must be re-evaluated with a reduced bearing area.

Static Lateral Earth Pressures

Retaining walls should be designed to resist the applicable lateral earth pressures. On-site soil materials may be used as backfill behind walls, provided they are confirmed to have very low expansive characteristic and allow for a drainage layer as discussed in subsequent paragraphs. For on-site soils and/or imported soils (EI less than 21) to be used as backfill materials, an active earth pressure of 35 pounds per cubic foot (equivalent fluid pressure) should be used assuming a level adjacent backfill and drained conditions. For walls to be restrained at the top, an at-rest pressure of 55 pcf should be used for design. All retaining walls should be supplied with a proper subdrain system. All walls should be designed to support any adjacent structural surcharge loads imposed by other nearby walls or footings and vehicles in addition to the above recommended active earth pressure.

Crushed rock or clean sand and gravel exhibiting a sand equivalent of 30 or greater may also be used for retaining wall backfill. If these materials are used as backfill within the active zone, the retaining wall may be designed for an active earth pressure of 30 pounds per cubic foot (equivalent fluid pressure) and 45 pounds per cubic foot for at rest pressure.

Drainage and Damp-proofing

Retaining walls are recommended to be designed for drained earth pressures and therefore, adequate drainage should be provided behind the walls. This can be accomplished by installing subdrains at the base of the walls. Wall footing-drains should consist of a system of filter material and perforated pipe. The perforated pipe system should consist of 4-inch diameter, schedule 40, PVC pipe or equivalent, embedded in 1 cubic foot of Class II Permeable Material (CALTRANS Standard Specifications, latest edition) or equivalent per lineal foot of pipe. Alternatively, ¾-inch open graded gravel or crushed rock enveloped in Mirafi 140 geofabric or equivalent may be used instead of the

Class II Permeable Material. The pipe should be placed at the base of the wall, and then routed to a suitable area for discharge of accumulated water. Wall backfill should be protected against infiltration of surface water. Backfill adjacent to walls should be sloped so that surface water drains freely away from the wall and will not pond. Damp-proofing of walls below-grade is recommended especially where moisture control is required by an approved waterproofing compound or covered with similar material to inhibit infiltration of moisture through the walls.

Wall Backfill

Retaining wall backfill behind the drainage layers should consist of low expansive soils with an E.I. less than 51, as determined by ASTM D 4829-03 method. Wall backfill should not contain organic material, rubble, debris, and rocks or cemented fragments larger than 3 inches in greatest dimension. A 1 foot thick low-expansive cohesive layer or pavement should be placed at the surface to help prevent surface water intrusion. A geotextile or filter fabric should be placed between the granular drainage layers and adjacent soils (excavated face or compacted materials) to prevent fines from migrating into the drainage layers.

Backfill should be placed in lifts not exceeding 8 inches in thickness, moisture conditioned and mechanically compacted throughout to at least 90 percent of the maximum dry density as determined by Modified Proctor (ASTM D 1557). Retaining walls should be properly braced prior to placement and compaction of backfill should be performed with extreme care not to damage the walls.

6.7 New Pavement

The following recommendations for the new pavement are intended for vehicular traffic associated with the restaurant development within the subject property.

New Pavement Subgrades

Following completion of the recommended subgrade preparation procedures, the subgrade in areas of new pavement construction are expected to consist of existing on-site soil that exhibit a very low to low expansion potential. An R-value of 20 has been assumed in the preparation of the pavement design. It should however, be recognized that the City of Carlsbad may require a specific R-value test to verify the use of the following design. It is recommended that this testing, if required, be conducted following completion of rough grading in the proposed pavement areas so that the R-value test results are indicative of the actual pavement subgrade soils. Alternatively, a minimum code pavement section may be required if a specific R-value test is not performed. To use this R-value, all fill added to the pavement subgrade must have pavement support characteristics at least equivalent to the existing soils, and must be placed and compacted in accordance with the project specifications.

Asphalt Pavements

The following table presents recommended thicknesses for a new flexible pavement structure consisting of asphaltic concrete over a granular base, along with the appropriate CALTRANS specifications for proper materials and placement procedures. An alternate pavement section has been provided for use in parking stall areas due to the anticipated lower traffic intensity in these areas. However, care must be used so that truck traffic is excluded from areas where the thinner pavement section is used, since premature pavement distress may occur. In the event that heavy vehicle traffic cannot be excluded from the specific areas, the pavement section recommended for drive lanes should be used throughout the parking lot.

ASPHALT PAVEMENTS

Materials	Thickness (inches)		CALTRANS Specifications
	Parking Stalls (TI=4.0)	Drive Lanes (TI=5.0)	
Asphaltic Concrete Surface Course (b)	1	1	Section 39, (a)
Asphaltic Concrete Binder Course (b)	2	2	Section 39, (a)
Crushed Aggregate Base Course	5	8	Section 26, Class 2 (R-value at least 78)

NOTES:
(a) Compaction to density between 95 and 100 percent of the 50-Blow Marshall Density
(b) The surface and binder course may be combined as a single layer placed in one lift if similar materials are utilized.

Pavement recommendations are based upon CALTRANS design parameters for a twenty-year design period and assume proper drainage and construction monitoring. It is, therefore, recommended that the geotechnical engineer monitors and tests subgrade preparation, and that the subgrade be evaluated immediately before pavement construction.

Portland Concrete Pavements

Portland Cement Concrete pavements are recommended in areas where traffic is concentrated such as the entrance/exit aprons as well as areas subjected to heavy loads such as the trash enclosure loading zone. The preparation of the subgrade soils within concrete pavement areas should be performed as previously described in this report. Portland Cement Concrete pavements in high stress areas are recommended to be at least 6 inches thick containing No. 3 bars at 18-inch on-center both ways placed at mid-height. The pavement should be constructed in accordance with Section 40 of the CALTRANS Standard Specifications. A minimum 4-inch thick layer of base course (CALTRANS Class 2) is recommended below the concrete pavement. This base course should be compacted to at least 95% of the material's maximum dry density.

The maximum joint spacing within all of the Portland Cement Concrete pavements is recommended to be 15 feet to control shrinkage cracking. Load transfer reinforcing is recommended at construction joints perpendicular to traffic flow if construction joints are not properly keyed. In this event, ¾-inch diameter smooth dowel bars, 18 inches in length placed at 12 inches on-center are recommended where joints are perpendicular to the anticipated traffic flow. Expansion joints are recommended only where the pavement abuts fixed objects such as light standard foundations. Tie bars are recommended at the first joint within the perimeter of the concrete pavement area. Tie bars are recommended to be No. 4 bars at 42-inch on-center spacings and at least 48 inches in length.

General Considerations

Pavement recommendations assume proper drainage and construction monitoring and are based on traffic loads as indicated previously. Pavement designs are based on either PCA or CALTRANS design parameters for twenty (20) year design period. However, these designs are also based on a routine pavement maintenance program and significant asphalt concrete pavement rehabilitation after about 8 to 10 years, in order to obtain a reasonable pavement service life.

6.8 Recommended Construction Materials Testing Services

The report was prepared assuming that Giles will perform Construction Materials Testing (CMT) services during construction of the proposed development. In general, CMT services are recommended (and expected) to at least include observation and testing of foundation and pavement support soil and other construction materials. It might be necessary for Giles to provide supplemental geotechnical recommendations based on the results of CMT services and specific details of the project not known at this time.

6.9 Basis of Report

This report is based on Giles' proposal, which is dated August 17, 2018 and is referenced by Giles' proposal number 2GEP-1808006. The actual services for the project varied somewhat from those described in the proposal because of the conditions that were encountered while performing the services and in consideration of the proposed project.

This report is strictly based on the project description given earlier in this report. Giles must be notified if any parts of the project description or our assumptions are not accurate so that this report can be amended, if needed. This report is based on the assumption that the facility will be designed and constructed according to the codes that govern construction at the site.

The conclusions and recommendations in this report are based on estimated subsurface conditions as shown on the *Records of Subsurface Exploration*. Giles must be notified if the subsurface conditions that are encountered during construction of the proposed development differ from those shown on the *Records of Subsurface Exploration* because this report will likely need to be revised. General comments and limitations of this report are given in the appendix.

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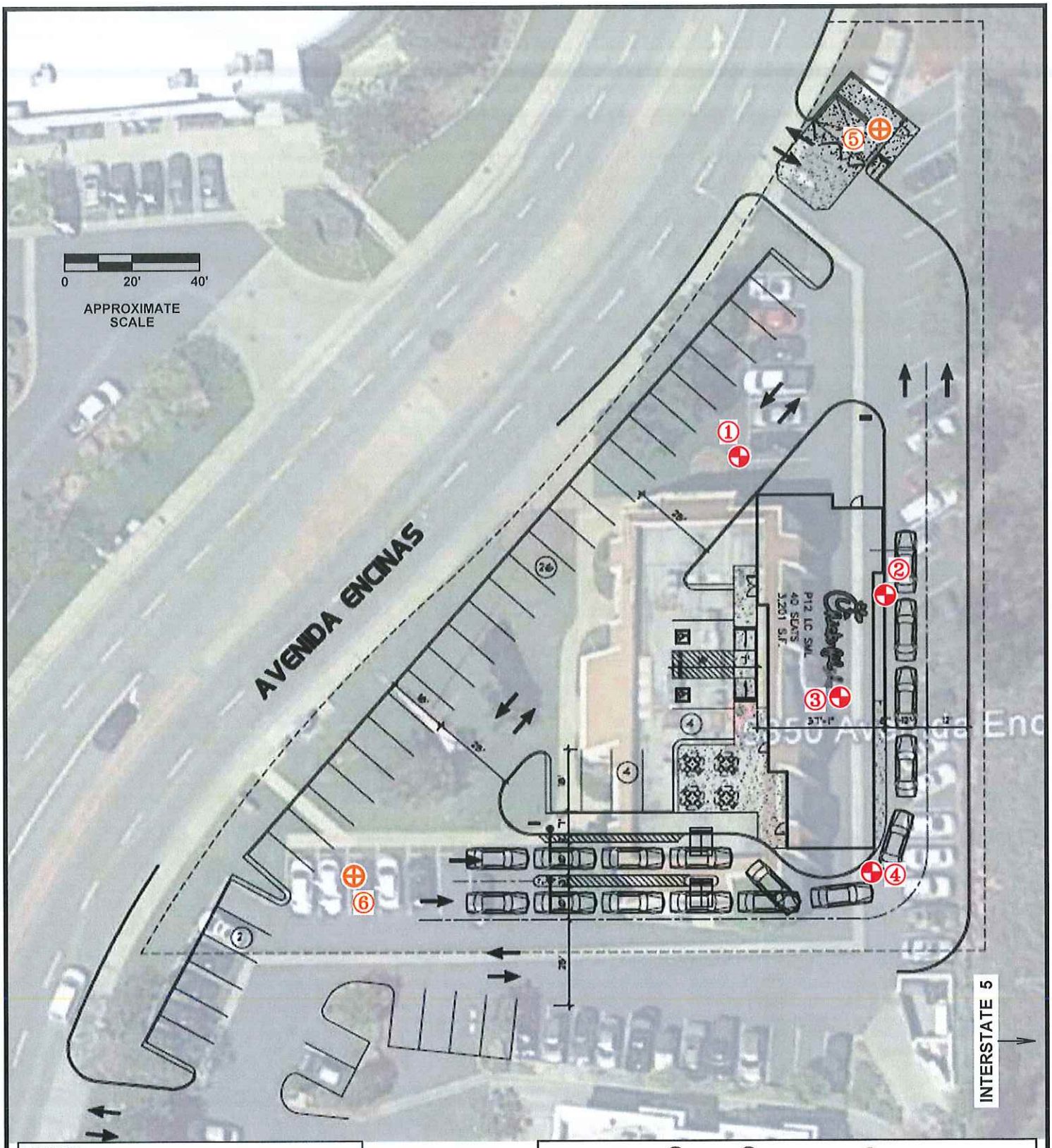
APPENDIX A

FIGURES AND TEST BORING LOGS

The Test Boring Location Plan contained herein was prepared based upon information supplied by *Giles'* client, or others, along with *Giles'* field measurements and observations. The diagram is presented for conceptual purposes only and is intended to assist the reader in report interpretation.

The Test Boring Logs and related information enclosed herein depict the subsurface (soil and water) conditions encountered at the specific boring locations on the date that the exploration was performed. Subsurface conditions may differ between boring locations and within areas of the site that were not explored with test borings. The subsurface conditions may also change at the boring locations over the passage of time.



LEGEND:

① GEOTECHNICAL TEST BORING

⑤ GEOTECHNICAL TEST BORING / PERCOLATION TEST BORING

N W E S

NOTES:

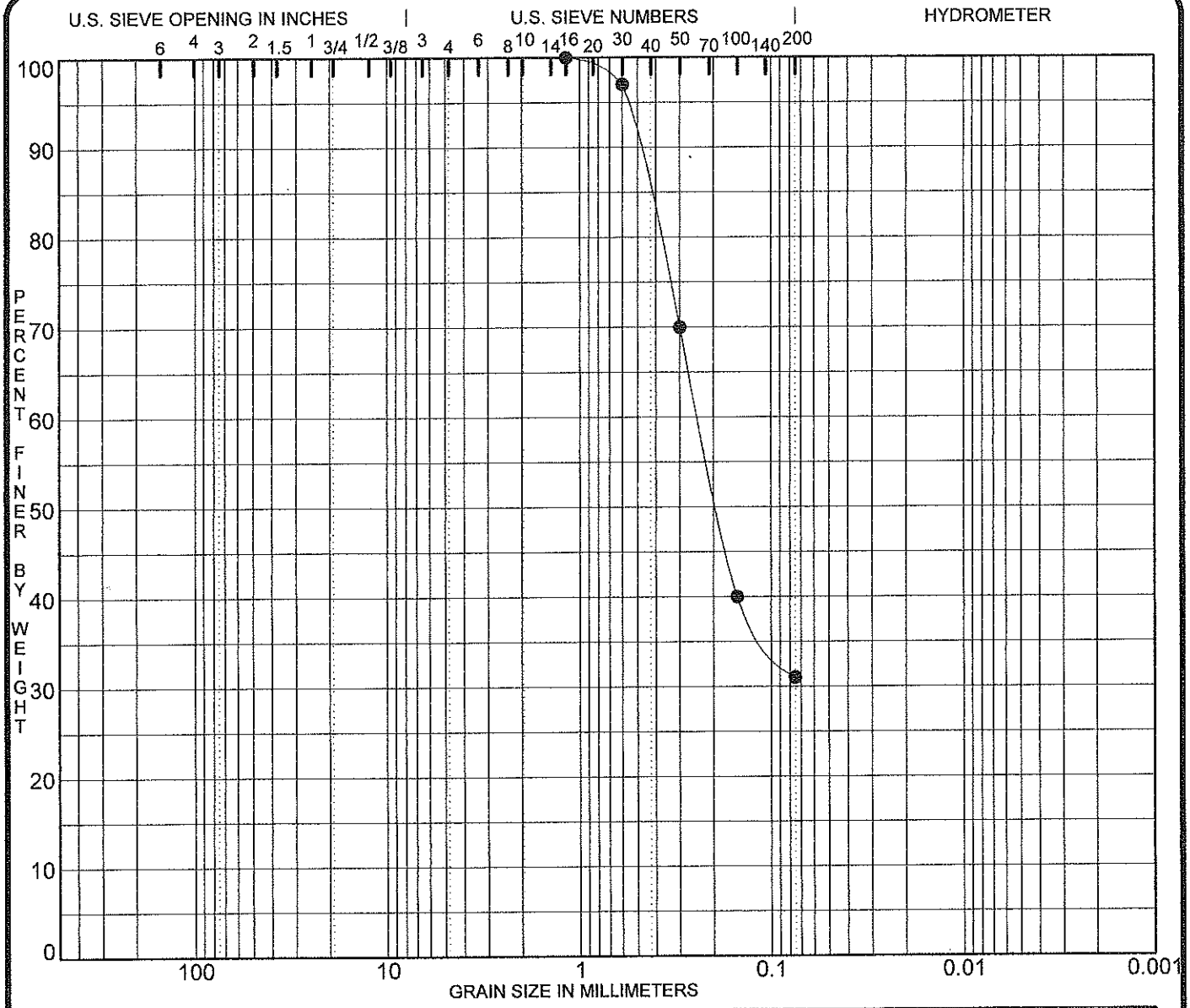
1.) TEST BORING LOCATIONS ARE APPROXIMATE.

2.) BASE MAP DEVELOPED FROM THE "PRELIMINARY SITE PLAN" (SHEET PSP-17), REV. 8-3-18, PREPARED BY CRHO ARCHITECTS.

GILES ENGINEERING ASSOCIATES, INC.
1965 N. MAIN STREET
ORANGE, CA 92865 (714)279-0817
www.gilesengr.com

FIGURE 1
TEST BORING LOCATION PLAN
PROPOSED CHICK-FIL-A RESTAURANT NO. 04306
I-5 AND PALOMAR FSU
5850 AVENIDA ENCINAS
CARLSBAD, CALIFORNIA

DESIGNED	DRAWN	SCALE	DATE	REVISED
ELG	Jdid	approx. 1"=40'	10-01-18	--
PROJECT NO.: 2G-1808005			CAD No. 2g1808005-blp	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
● B-5	3.5	**Clayey Sand to Silty Sand**						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-5**	**3.5**	**1.18**	**0.24**			**0.0**	**69.0**	**31.0**	

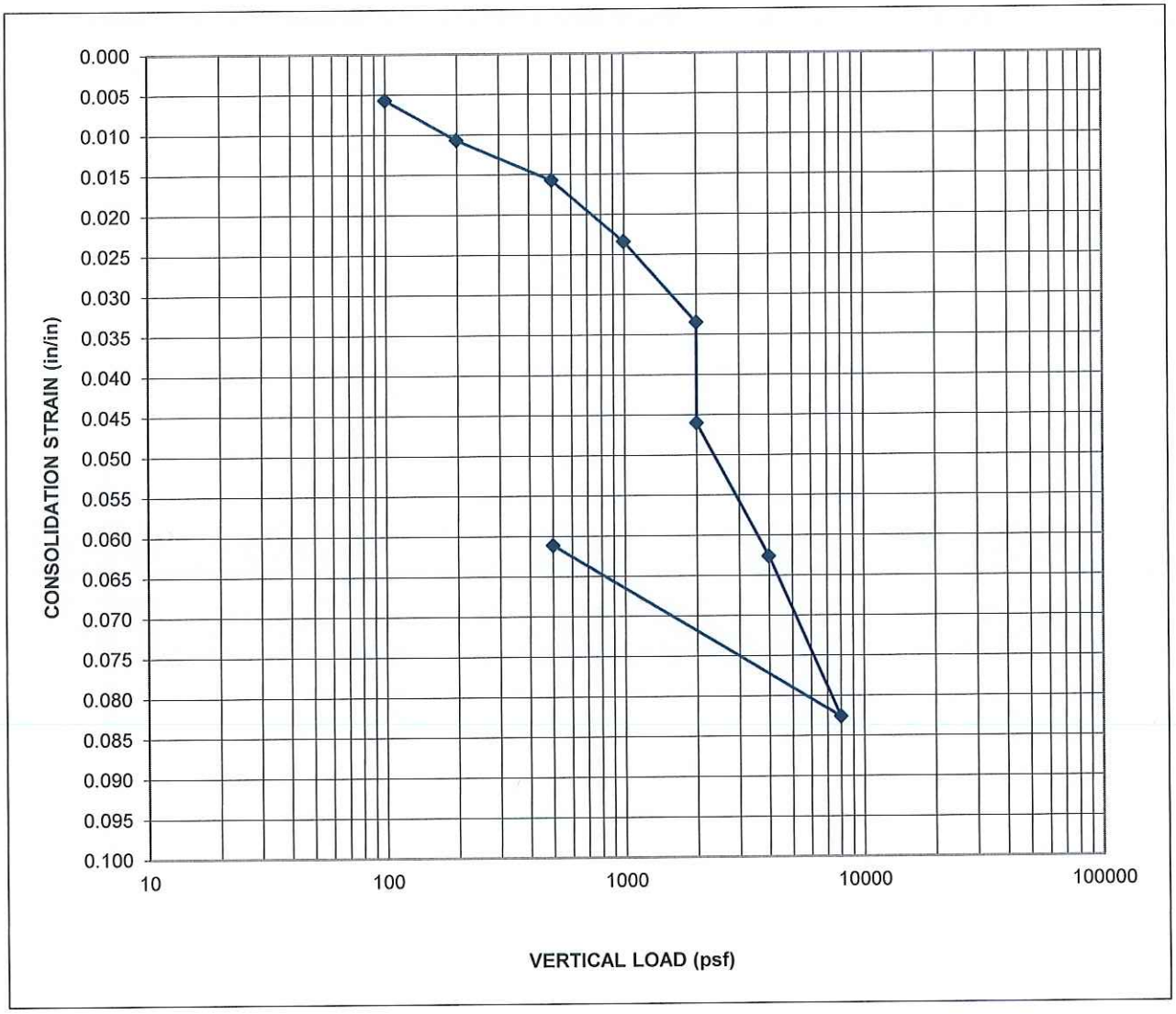
PROJECT **Proposed CFA #4306 - Carlsbad, CA** JOB NO. **2G-1808005**

FIGURE 2 DATE **10/4/18**

GRADATION CURVES

Giles Engineering Associates, Inc

CONSOLIDATION / COLLAPSE TEST ASTM D2435/ASTM D5333



Classification	Clayey Sand
Boring No.	B-3
Sample No.	2-CS
Depth (ft.)	3.0
Elevation	
Liquid Limit	
Plastic Limit	
Specimen Diameter (in.)	2.42
Initial Specimen Thickness (in.)	1.00

Initial Moisture Content (%)	11.2
Final Moisture Content (%)	15.5
Natural Density (pcf)	123.4
Initial Dry Density (pcf)	110.9
Final Dry Density (pcf)	119.4
Collapse @ 2000 psf	1.25%

Sample inundated at 2000 psf pressure

Project:	CFA Carlsbad
Client:	Chick-fil-A
Project No.:	2G-1808005
Figure No.:	3

GILES ENGINEERING ASSOCIATES, INC.

-GEOTECHNICAL, ENVIRONMENTAL, AND CONSTRUCTION MATERIALS-

1965 NORTH MAIN STREET, ORANGE, CALIFORNIA

OFFICE: 714-279-0817 FAX : 714-279-9687

BORING NO. & LOCATION: B-1	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 56.5 feet	PROPOSED CHICK-FIL-A RESTAURANT #4306	
COMPLETION DATE: 09/11/18	5850 AVENIDA ENCINAS CARLSBAD, CA	
FIELD REP: TREVOR SLAZAS	PROJECT NO: 2G-1808005	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Approximately 2.5 inches of asphaltic concrete over 4.5 inches of aggregate base										
Brown Clayey fine Sand - Moist (Possible Fill)		55	1-SS	18				13	BDL	P_{200}=40%
Gray fine Sand, some Silt, some layers of Silty Sand - Moist (Native)	5	50	2-SS	20				13	BDL	P_{200}=23%
Light Brown Silty Sand to fine to medium Sand, trace Silt - Moist	10	45	3-SS	32				13	BDL	P_{200}=20%
	15	40	4-SS	51				14	BDL	
Light Yellowish Silty Sandstone - Moist (Old Paralic Deposits)	20	35	5-SS	50/3"				16	BDL	P_{200}=27%
	25	30	6-SS	50/6"				15	BDL	
	30	25	7-SS	50/5"				15	BDL	P_{200}=23%
	35		8-SS	50/4"				10	BDL	
Groundwater encountered at 18 feet Boring Terminated at about 35.5 feet (EL. 21')										

Water Observation Data	Remarks:
▽ Water Encountered During Drilling: 18'	SS = Standard Penetration Test
▼ Water Level At End of Drilling:	BDL - Below Detection Level
Cave Depth At End of Drilling:	
▼ Water Level After Drilling:	
Cave Depth After Drilling:	

GILES LOG REPORT 2G-1808005.GPJ GILES.GDT 10/5/18

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B-2	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 57 feet	PROPOSED CHICK-FIL-A RESTAURANT #4306	
COMPLETION DATE: 09/11/18	5850 AVENIDA ENCINAS CARLSBAD, CA	
FIELD REP: TREVOR SLAZAS	PROJECT NO: 2G-1808005	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Approximately 4 inches of asphaltic concrete										
Light Brown Clayey Sand - Moist (Possible Fill)		55	1-SS	11				17	BDL	
Brown Clayey fine Sand - Moist (Native)	5		2-CS	48				14	BDL	Dd=124.9 pcf
Light Brown Silty Sand to fine Sand with Silt - Moist		50	3-CS	53				8	BDL	Dd=104.5 pcf
			4-CS	63				12	BDL	Dd=116.8 pcf
	10									

No groundwater encountered
Boring Terminated at about 10 feet (EL. 47')

Water Observation Data	Remarks:
Water Encountered During Drilling: None	CS = California Split Spoon
Water Level At End of Drilling:	SS = Standard Penetration Test
Cave Depth At End of Drilling:	BDL - Below Detection Level
Water Level After Drilling:	
Cave Depth After Drilling:	

GILES LOG REPORT 2G-1808005.GPJ GILES.GDT 10/5/18

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B-3	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 56.8 feet	PROPOSED CHICK-FIL-A RESTAURANT #4306	
COMPLETION DATE: 09/11/18	5850 AVENIDA ENCINAS CARLSBAD, CA	
FIELD REP: TREVOR SLAZAS	PROJECT NO: 2G-1808005	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Approximately 5 inches of asphaltic concrete										
Brown Clayey fine Sand - Moist (Possible Fill)		55	1-SS	9				20	BDL	
Brown to Light Brown Clayey fine Sand - Moist (Native)	5		2-CS	27				17	BDL	Dd=111.0 pcf
Yellowish Brown fine Sand to Silty fine Sand, some iron oxide staining - Moist		50	3-CS	40				8	BDL	Dd=112.3 pcf
			4-CS	46				13	BDL	Dd=104.7 pcf
	10									

No groundwater encountered
Boring Terminated at about 10 feet (EL. 46.8')

Water Observation Data	Remarks:
Water Encountered During Drilling: None	CS = California Split Spoon
Water Level At End of Drilling:	SS = Standard Penetration Test
Cave Depth At End of Drilling:	BDL - Below Detection Level
Water Level After Drilling:	
Cave Depth After Drilling:	

GILES LOG REPORT 2G-1808005.GPJ GILES.GDT 10/5/18

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B-4	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 57.5 feet	PROPOSED CHICK-FIL-A RESTAURANT #4306	
COMPLETION DATE: 09/11/18	5850 AVENIDA ENCINAS CARLSBAD, CA	
FIELD REP: TREVOR SLAZAS	PROJECT NO: 2G-1808005	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Approximately 5 inches of asphaltic concrete										
Brown Clay fine Sand - Moist (Possible Fill)		55	1-SS	15				17	BDL	
Light Brown fine Sand, trace of Clay, some layers of Silty Sand - Moist (Native)	5		2-SS	25				10	BDL	
		50								
Brown fine Sand, trace to little Silt - Moist	10		3-SS	30				10	BDL	
		45								
	15		4-SS	35				16	BDL	
		40								
Yellowish Brown Silty Sandstone - Moist (Old Paralic Deposits)	20		5-SS	50/5"				11	BDL	
Groundwater encountered at 17 feet Boring Terminated at about 21.5 feet (EL. 36')										

Water Observation Data	Remarks:
▽ Water Encountered During Drilling: 17'	SS = Standard Penetration Test
▼ Water Level At End of Drilling:	BDL - Below Detection Level
Cave Depth At End of Drilling:	
▼ Water Level After Drilling:	
Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

GILES LOG REPORT 2G-1808005.GPJ GILES.GDT 10/5/18

BORING NO. & LOCATION: B-5	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 56.3 feet	PROPOSED CHICK-FIL-A RESTAURANT #4306	
COMPLETION DATE: 09/11/18	5850 AVENIDA ENCINAS CARLSBAD, CA	
FIELD REP: TREVOR SLAZAS	PROJECT NO: 2G-1808005	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Approximately 3 inches of asphaltic concrete over 5 inches of aggregate base										
Brown Clayey fine Sand to Silty fine Sand - Moist (Possible Fill to Native)		55.0	1-SS	17				14	BDL	
	2.5									
		52.5	2-SS	38				7	BDL	P_{200}=30%
	5.0									
No groundwater encountered Boring Terminated at about 5 feet (EL. 51.3')										

	Water Observation Data
▽	Water Encountered During Drilling: None
▼	Water Level At End of Drilling:
	Cave Depth At End of Drilling:
▼	Water Level After Drilling:
	Cave Depth After Drilling:

Remarks:

SS = Standard Penetration Test

BDL - Below Detection Level

GILES LOG REPORT 2G-1808005.GPJ GILES.GDT 10/5/18

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: B-6	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 56.4 feet	PROPOSED CHICK-FIL-A RESTAURANT #4306	
COMPLETION DATE: 09/11/18	5850 AVENIDA ENCINAS CARLSBAD, CA	
FIELD REP: TREVOR SLAZAS	PROJECT NO: 2G-1808005	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Approximately 4 inches of asphaltic concrete over 5 inches of aggregate base										
Brown fine Sandy Clay - Moist (Possibble Fill to Native)		55.0	1-SS	5				25	BDL	
	2.5									
		52.5	2-SS	18				22	BDL	
	5.0									
No groundwater encountered Boring Terminated at about 5 feet (EL. 51.4')										

Water Observation Data	Remarks:
Water Encountered During Drilling: None	SS = Standard Penetration Test
Water Level At End of Drilling:	BDL - Below Detection Level
Cave Depth At End of Drilling:	
Water Level After Drilling:	
Cave Depth After Drilling:	

GILES LOG REPORT 2G-1808005.GPJ GILES.GDT 10/5/18

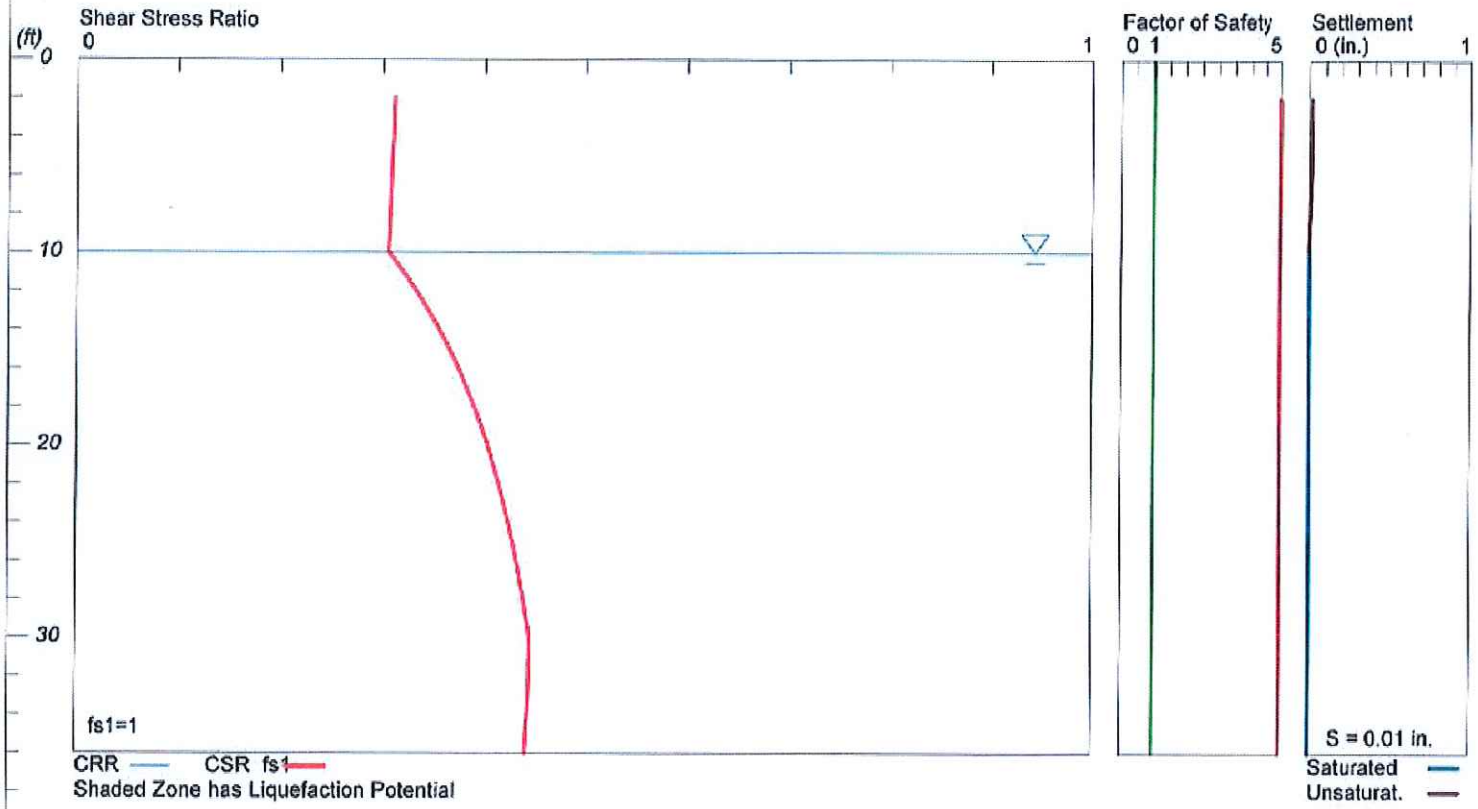
Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

LIQUEFACTION ANALYSIS

CFA #4306 - Carlsbad, CA

Hole No.=B-1 ***Water Depth=10 ft***

Magnitude=6.72
Acceleration=0.482g



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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: UNTITLED
Title: CFA #4306 - Carlsbad, CA
Subtitle: 2G-1808005, 5850 Avenida Encinas

Surface Elev.=
Hole No.=B-1
Depth of Hole= 36.00 ft
Water Table during Earthquake= 10.00 ft
Water Table during In-Situ Testing= 18.00 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.72

Input Data:
Surface Elev.=
Hole No.=B-1
Depth of Hole=36.00 ft
Water Table during Earthquake= 10.00 ft
Water Table during In-Situ Testing= 18.00 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.72
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu/Seed
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1
   Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
2.00	18.00	120.00	15.00
5.00	20.00	120.00	15.00
10.00	32.00	120.00	10.00
15.00	51.00	120.00	5.00
20.00	50.00	120.00	5.00
25.00	50.00	120.00	5.00
30.00	50.00	120.00	5.00
35.00	50.00	120.00	4.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.01 in.
Total Settlement of Saturated and Unsaturated Sands=0.01 in.
Differential Settlement=0.006 to 0.008 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
2.00	2.65	0.31	5.00	0.00	0.01	0.01
2.50	2.65	0.31	5.00	0.00	0.01	0.01
3.00	2.65	0.31	5.00	0.00	0.01	0.01
3.50	2.65	0.31	5.00	0.00	0.01	0.01
4.00	2.65	0.31	5.00	0.00	0.01	0.01
4.50	2.65	0.31	5.00	0.00	0.01	0.01
5.00	2.65	0.31	5.00	0.00	0.01	0.01
5.50	2.65	0.31	5.00	0.00	0.01	0.01
6.00	2.65	0.31	5.00	0.00	0.01	0.01
6.50	2.65	0.31	5.00	0.00	0.01	0.01
7.00	2.65	0.31	5.00	0.00	0.01	0.01
7.50	2.65	0.31	5.00	0.00	0.00	0.00
8.00	2.65	0.31	5.00	0.00	0.00	0.00
8.50	2.65	0.31	5.00	0.00	0.00	0.00
9.00	2.65	0.31	5.00	0.00	0.00	0.00
9.50	2.65	0.31	5.00	0.00	0.00	0.00
10.00	2.65	0.31	5.00	0.00	0.00	0.00
10.50	2.65	0.31	5.00	0.00	0.00	0.00
11.00	2.65	0.32	5.00	0.00	0.00	0.00
11.50	2.65	0.33	5.00	0.00	0.00	0.00
12.00	2.65	0.33	5.00	0.00	0.00	0.00
12.50	2.65	0.34	5.00	0.00	0.00	0.00
13.00	2.65	0.35	5.00	0.00	0.00	0.00
13.50	2.65	0.35	5.00	0.00	0.00	0.00
14.00	2.65	0.36	5.00	0.00	0.00	0.00
14.50	2.65	0.36	5.00	0.00	0.00	0.00
15.00	2.65	0.37	5.00	0.00	0.00	0.00
15.50	2.65	0.37	5.00	0.00	0.00	0.00
16.00	2.65	0.37	5.00	0.00	0.00	0.00
16.50	2.65	0.38	5.00	0.00	0.00	0.00
17.00	2.65	0.38	5.00	0.00	0.00	0.00
17.50	2.65	0.39	5.00	0.00	0.00	0.00
18.00	2.65	0.39	5.00	0.00	0.00	0.00
18.50	2.65	0.39	5.00	0.00	0.00	0.00
19.00	2.65	0.40	5.00	0.00	0.00	0.00
19.50	2.65	0.40	5.00	0.00	0.00	0.00
20.00	2.65	0.40	5.00	0.00	0.00	0.00
20.50	2.65	0.41	5.00	0.00	0.00	0.00
21.00	2.65	0.41	5.00	0.00	0.00	0.00
21.50	2.65	0.41	5.00	0.00	0.00	0.00
22.00	2.65	0.41	5.00	0.00	0.00	0.00
22.50	2.65	0.42	5.00	0.00	0.00	0.00
23.00	2.65	0.42	5.00	0.00	0.00	0.00
23.50	2.65	0.42	5.00	0.00	0.00	0.00
24.00	2.65	0.42	5.00	0.00	0.00	0.00
24.50	2.65	0.43	5.00	0.00	0.00	0.00
25.00	2.65	0.43	5.00	0.00	0.00	0.00
25.50	2.65	0.43	5.00	0.00	0.00	0.00
26.00	2.65	0.43	5.00	0.00	0.00	0.00
26.50	2.65	0.43	5.00	0.00	0.00	0.00
27.00	2.65	0.44	5.00	0.00	0.00	0.00
27.50	2.65	0.44	5.00	0.00	0.00	0.00
28.00	2.65	0.44	5.00	0.00	0.00	0.00
28.50	2.65	0.44	5.00	0.00	0.00	0.00

29.00	2.65	0.44	5.00	0.00	0.00	0.00
29.50	2.65	0.44	5.00	0.00	0.00	0.00
30.00	2.65	0.45	5.00	0.00	0.00	0.00
30.50	2.65	0.45	5.00	0.00	0.00	0.00
31.00	2.65	0.45	5.00	0.00	0.00	0.00
31.50	2.65	0.45	5.00	0.00	0.00	0.00
32.00	2.65	0.45	5.00	0.00	0.00	0.00
32.50	2.65	0.45	5.00	0.00	0.00	0.00
33.00	2.65	0.44	5.00	0.00	0.00	0.00
33.50	2.65	0.44	5.00	0.00	0.00	0.00
34.00	2.65	0.44	5.00	0.00	0.00	0.00
34.50	2.65	0.44	5.00	0.00	0.00	0.00
35.00	2.65	0.44	5.00	0.00	0.00	0.00
35.50	2.65	0.44	5.00	0.00	0.00	0.00
36.00	2.65	0.44	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

APPENDIX B

FIELD PROCEDURES

The field operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) designation D

420 entitled "Standard Guide for Sampling Rock and Rock" and/or other relevant specifications. Soil samples were preserved and transported to *Giles'* laboratory in general accordance with the procedures recommended by ASTM designation D 4220 entitled "Standard Practice for Preserving and Transporting Soil Samples." Brief descriptions of the sampling, testing and field procedures commonly performed by *Giles* are provided herein.

GENERAL FIELD PROCEDURES

Test Boring Elevations

The ground surface elevations reported on the Test Boring Logs are referenced to the assumed benchmark shown on the Boring Location Plan (Figure 1). Unless otherwise noted, the elevations were determined with a conventional hand-level and are accurate to within about 1 foot.

Test Boring Locations

The test borings were located on-site based on the existing site features and/or apparent property lines. Dimensions illustrating the approximate boring locations are reported on the Boring Location Plan (Figure 1).

Water Level Measurement

The water levels reported on the Test Boring Logs represent the depth of "free" water encountered during drilling and/or after the drilling tools were removed from the borehole. Water levels measured within a granular (sand and gravel) soil profile are typically indicative of the water table elevation. It is usually not possible to accurately identify the water table elevation with cohesive (clayey) soils, since the rate of seepage is slow. The water table elevation within cohesive soils must therefore be determined over a period of time with groundwater observation wells.

It must be recognized that the water table may fluctuate seasonally and during periods of heavy precipitation. Depending on the subsurface conditions, water may also become perched above the water table, especially during wet periods.

Borehole Backfilling Procedures

Each borehole was backfilled upon completion of the field operations. If potential contamination was encountered, and/or if required by state or local regulations, boreholes were backfilled with an "impervious" material (such as bentonite slurry). Borings that penetrated pavements, sidewalks, etc. were "capped" with Portland Cement concrete, asphaltic concrete, or a similar surface material. It must, however, be recognized that the backfill material may settle, and the surface cap may subside, over a period of time. Further backfilling and/or re-surfacing by *Giles'* client or the property owner may be required.

FIELD SAMPLING AND TESTING PROCEDURES

Auger Sampling (AU)

Soil samples are removed from the auger flights as an auger is withdrawn above the ground surface. Such samples are used to determine general soil types and identify approximate soil stratifications. Auger samples are highly disturbed and are therefore not typically used for geotechnical strength testing.

Split-Barrel Sampling (SS) – (ASTM D-1586)

A split-barrel sampler with a 2-inch outside diameter is driven into the subsoil with a 140-pound hammer free-falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the "Standard Penetration Resistance" or N-value is an index of the relative density of granular soils and the comparative consistency of cohesive soils. A soil sample is collected from each SPT interval.

Shelby Tube Sampling (ST) – (ASTM D-1587)

A relatively undisturbed soil sample is collected by hydraulically advancing a thin-walled Shelby Tube sampler into a soil mass. Shelby Tubes have a sharp cutting edge and are commonly 2 to 5 inches in diameter.

Bulk Sample (BS)

A relatively large volume of soils is collected with a shovel or other manually-operated tool. The sample is typically transported to *Giles'* materials laboratory in a sealed bag or bucket.

Dynamic Cone Penetration Test (DC) – (ASTM STP 399)

This test is conducted by driving a 1.5-inch-diameter cone into the subsoil using a 15-pound steel ring (hammer), free-falling a vertical distance of 20 inches. The number of hammer-blows required to drive the cone 1¾ inches is an indication of the soil strength and density, and is defined as "N". The Dynamic Cone Penetration test is commonly conducted in hand auger borings, test pits and within excavated trenches.

- Continued -

Ring-Lined Barrel Sampling – (ASTM D 3550)

In this procedure, a ring-lined barrel sampler is used to collect soil samples for classification and laboratory testing. This method provides samples that fit directly into laboratory test instruments without additional handling/disturbance.

Sampling and Testing Procedures

The field testing and sampling operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the field testing (i.e. N-values) are reported on the Test Boring Logs. Explanations of the terms and symbols shown on the logs are provided on the appendix enclosure entitled "General Notes".

APPENDIX C

LABORATORY TESTING AND CLASSIFICATION

The laboratory testing was conducted under the supervision of a geotechnical engineer in accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Brief descriptions of laboratory tests commonly performed by *Giles* are provided herein.

LABORATORY TESTING AND CLASSIFICATION

Photoionization Detector (PID)

In this procedure, soil samples are "scanned" in *Giles'* analytical laboratory using a Photoionization Detector (PID). The instrument is equipped with an 11.7 eV lamp calibrated to a Benzene Standard and is capable of detecting a minute concentration of **certain** Volatile Organic Compound (VOC) vapors, such as those commonly associated with petroleum products and some solvents. Results of the PID analysis are expressed in HNu (manufacturer's) units rather than actual concentration.

Moisture Content (w) (ASTM D 2216)

Moisture content is defined as the ratio of the weight of water contained within a soil sample to the weight of the dry solids within the sample. Moisture content is expressed as a percentage.

Unconfined Compressive Strength (qu) (ASTM D 2166)

An axial load is applied at a uniform rate to a cylindrical soil sample. The unconfined compressive strength is the maximum stress obtained or the stress when 15% axial strain is reached, whichever occurs first.

Calibrated Penetrometer Resistance (qp)

The small, cylindrical tip of a hand-held penetrometer is pressed into a soil sample to a prescribed depth to measure the soils capacity to resist penetration. This test is used to evaluate unconfined compressive strength.

Vane-Shear Strength (qs)

The blades of a vane are inserted into the flat surface of a soil sample and the vane is rotated until failure occurs. The maximum shear resistance measured immediately prior to failure is taken as the vane-shear strength.

Loss-on-Ignition (ASTM D 2974; Method C)

The Loss-on-Ignition (L.O.I.) test is used to determine the organic content of a soil sample. The procedure is conducted by heating a dry soil sample to 440°C in order to burn-off or "ash" organic matter present within the sample. The L.O.I. value is the ratio of the weight loss due to ignition compared to the initial weight of the dry sample. L.O.I. is expressed as a percentage.

Particle Size Distribution (ASTB D 421, D 422, and D 1140)

This test is performed to determine the distribution of specific particle sizes (diameters) within a soil sample. The distribution of coarse-grained soil particles (sand and gravel) is determined from a "sieve analysis," which is conducted by passing the sample through a series of nested sieves. The distribution of fine-grained soil particles (silt and clay) is determined from a "hydrometer analysis" which is based on the sedimentation of particles suspended in water.

Consolidation Test (ASTM D 2435)

In this procedure, a series of cumulative vertical loads are applied to a small, laterally confined soil sample. During each load increment, vertical compression (consolidation) of the sample is measured over a period of time. Results of this test are used to estimate settlement and time rate of settlement.

Classification of Samples

Each soil sample was visually-manually classified, based on texture and plasticity, in general accordance with the Unified Soil Classification System (ASTM D-2488-75). The classifications are reported on the Test Boring Logs.

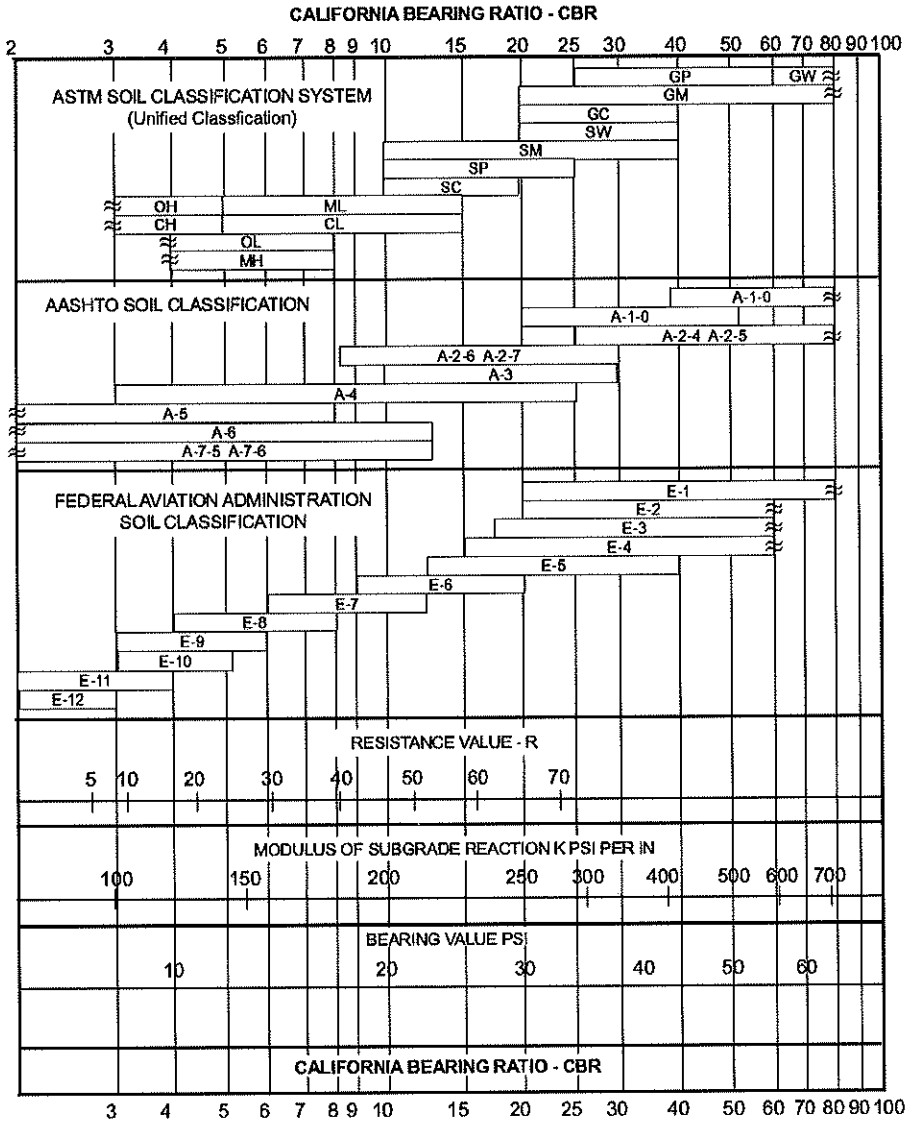
Laboratory Testing

The laboratory testing operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the laboratory tests are provided on the Test Boring Logs or other appendix enclosures. Explanation of the terms and symbols used on the logs is provided on the appendix enclosure entitled "General Notes."

California Bearing Ratio (CBR) Test ASTM D-1833

The CBR test is used for evaluation of a soil subgrade for pavement design. The test consists of measuring the force required for a 3-square-inch cylindrical piston to penetrate 0.1 or 0.2 inch into a compacted soil sample. The result is expressed as a percent of force required to penetrate a standard compacted crushed stone.

Unless a CBR test has been specifically requested by the client, the CBR is estimated from published charts, based on soil classification and strength characteristics. A typical correlation chart is below.



APPENDIX D

GENERAL INFORMATION

GUIDE SPECIFICATIONS FOR SUBGRADE AND PREPARATION FOR FILL, FOUNDATION, FLOOR SLAB AND PAVEMENT SUPPORT; AND SELECTION, PLACEMENT AND COMPACTION OF FILL SOILS USING MODIFIED PROCTOR PROCEDURES

1. Construction monitoring and testing of subgrades and grades for fill, foundation, floor slab and pavement; and fill selection, placement and compaction shall be performed by an experienced soils engineer and/or his representatives.

2. All compacted fill, subgrades, and grades shall be (a) underlain by suitable bearing material, (b) free of all organic frozen, or other deleterious material, and (c) observed, tested and approved by qualified engineering personnel representing an experienced soils engineer. Preparation of subgrades after stripping vegetation, organic or other unsuitable materials shall consist of (a) proofrolling to detect soft, wet, yielding soils or other unstable materials that must be undercut, (b) scarifying top 6 to 8 inches, (c) moisture conditioning the soils as required, and (d) recompaction to same minimum in-situ density required for similar material indicated under Item 5. Note: Compaction requirements for pavement subgrade are higher than other areas. Weather and construction equipment may damage compacted fill surface and reworking and retesting may be necessary for proper performance.

3. In overexcavation and fill areas, the compacted fill must extend (a) a minimum 1 foot lateral distance beyond the exterior edge of the foundation at bearing grade or pavement at subgrade and down to compacted fill subgrade on a maximum 0.5(H):1(v) slope, (b) 1 foot above footing grade outside the building, and (c) to floor subgrade inside the building. Fill shall be placed and compacted on a 5(H):1(V) slope or must be stepped or benched as required to flatten if not specifically approved by qualified personnel under the direction of an experienced soils engineer.

4. The compacted fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated", and shall be low-expansive with a maximum Liquid Limit (ASTM D-423) and Plasticity Index (ASTM D-424) of 30 and 15, respectively, unless specifically tested and found to have low expansive properties and approved by an experienced soils engineer. The top 12 inches of compacted fill should have a maximum 3 inch particle diameter and all underlying compacted fill a maximum 6 inch diameter unless specifically approved by an experienced soils engineer. All fill material must be tested and approved under the direction of an experienced soils engineer prior to placement. If the fill is to provide non-frost susceptible characteristics, it must be classified as a clean GW, GP, SW or SP per Unified Soils Classification System (ASTM D-2487).

5. For structural fill depths less than 20 feet, the density of the structural compacted fill and scarified subgrade and grades shall not be less than 90 percent of the maximum dry density as determined by Modified Proctor (ASTM D-1557) with the exception of the top 12 inches of pavement subgrade which shall have a minimum in-situ density of 95 percent of maximum dry density, or 5 percent higher than underlying structural fill materials. Where the structural fill depth is greater than 20 feet, the portion below 20 feet should have a minimum in-place density of 95 percent of its maximum dry density or 5 percent higher than the top 20 feet. Cohesive soils shall not vary by more than -1 to +3 percent moisture content and granular soil ±3 percent from the optimum when placed and compacted or recompacted, unless specifically recommended/approved by the soils engineer observing the placement and compaction. Cohesive soils with moderate to high expansion potentials (PI>15) should, however, be placed, compacted and maintained prior to construction at a 3±1 percent moisture content above optimum moisture content to limit future heave. Fill shall be placed in layers with a maximum loose thickness of 8 inches for foundations and 10 inches for floor slabs and pavements, unless specifically approved by the soils engineer taking into consideration the type of materials and compaction equipment being used. The compaction equipment should consist of suitable mechanical equipment specifically designed for soil compaction. Bulldozers or similar tracked vehicles are typically not suitable for compaction.

6. Excavation, filing, subgrade grade preparation shall be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working platform. Springs or water seepage encountered during grade/foundation construction must be called to the soils engineer's attention immediately for possible construction procedure revision or inclusion of an underdrain system.

7. Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls (i.e. basement walls and retaining walls) must be properly tested and approved by an experienced soils engineer with consideration for the lateral pressure used in the wall design.

8. Wherever, in the opinion of the soils engineer or the Owner's Representatives, an unstable condition is being created either by cutting or filling, the work should not proceed into that area until an appropriate geotechnical exploration and analysis has been performed and the grading plan revised, if found necessary.

GENERAL COMMENTS

The soil samples obtained during the subsurface exploration will be retained for a period of thirty days. If no instructions are received, they will be disposed of at that time.

This report has been prepared exclusively for the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. Copies of this report may be provided to contractor(s), with contract documents, to disclose information relative to this project. The report, however, has not been prepared to serve as the plans and specifications for actual construction without the appropriate interpretation by the project architect, structural engineer, and/or civil engineer. Reproduction and distribution of this report must be authorized by the client and *Giles*.

This report has been based on assumed conditions/characteristics of the proposed development where specific information was not available. It is recommended that the architect, civil engineer and structural engineer along with any other design professionals involved in this project carefully review these assumptions to ensure they are consistent with the actual planned development. When discrepancies exist, they should be brought to our attention to ensure they do not affect the conclusions and recommendations provided herein. The project plans and specifications may also be submitted to *Giles* for review to ensure that the geotechnical related conclusions and recommendations provided herein have been correctly interpreted.

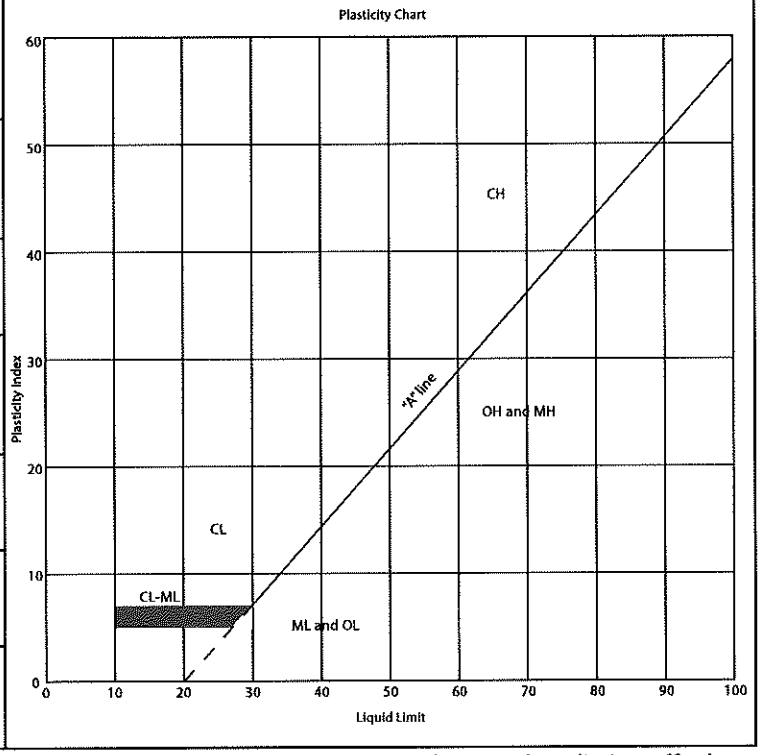
The analysis of this site was based on a subsoil profile interpolated from a limited subsurface exploration. If the actual conditions encountered during construction vary from those indicated by the borings, *Giles* must be contacted immediately to determine if the conditions alter the recommendations contained herein.

The conclusions and recommendations presented in this report have been promulgated in accordance with generally accepted professional engineering practices in the field of geotechnical engineering. No other warranty is either expressed or implied.

ARACTERISTICS AND RATINGS OF UNIFIED SOIL SYSTEM CLASSES FOR SOIL CONSTRUCTION *								
ion istics	Max. Dry Density Standard Proctor (pcf)	Compressibility and Expansion	Drainage and Permeability	Value as an Embankment Material	Value as Subgrade When Not Subject to Frost	Value as Base Course	Value as Temporary Pavement	
							With Dust Palliative	With Bituminous Treatment
-tired, steel ller	125-135	Almost none	Good drainage, pervious	Very stable	Excellent	Good	Fair to poor	Excellent
-tired, steel ller	115-125	Almost none	Good drainage, pervious	Reasonably stable	Excellent to good	Poor to fair	Poor	
r light	120-135	Slight	Poor drainage, semipervious	Reasonably stable	Excellent to good	Fair to poor	Poor	Poor to fair
tired or	115-130	Slight	Poor drainage, impervious	Reasonably stable	Good	Good to fair **	Excellent	Excellent
-tired or	110-130	Almost none	Good drainage, pervious	Very stable	Good	Fair to poor	Fair to poor	Good
-tired or	100-120	Almost none	Good drainage, pervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
r sheepsfoot	110-125	Slight	Poor drainage, impervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
tired or	105-125	Slight to medium	Poor drainage, impervious	Reasonably stable	Good to fair	Fair to poor	Excellent	Excellent
-tired or	95-120	Slight to medium	Poor drainage, impervious	Poor stability, high density required	Fair to poor	Not suitable	Poor	Poor
oot or rubber-	95-120	Medium	No drainage, impervious	Good stability	Fair to poor	Not suitable	Poor	Poor
oot or rubber-	80-100	Medium to high	Poor drainage, impervious	Unstable, should not be used	Poor	Not suitable	Not suitable	Not suitable
oot or rubber-	70-95	High	Poor drainage, impervious	Poor stability, should not be used	Poor	Not suitable	Very poor	Not suitable
oot roller	80-105	Very high	No drainage, impervious	Fair stability, may soften on expansion	Poor to very poor	Not suitable	Very poor	Not suitable
oot roller	65-100	High	No drainage, impervious	Unstable, should not be used	Very poor	Not suitable	Not suitable	Not suitable
		Very high	Fair to poor drainage	Should not be used	Not suitable	Not suitable	Not suitable	Not suitable

pendix A - Characteristics of Soil, Groups Pertaining to Roads and Airfields, and Appendix B - Characteristics of Soil Groups Pertaining to Embankments
emorandum 357, U.S. Waterways Ixperiment Station, Vicksburg, 1953.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (more than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent: GW, GP, SW, SP; More than 12 percent: GM, GC, SM, SC; 5 to 12 percent: *Borderline* cases requiring dual symbols[b]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtrues, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (appreciable amount of fines)	GM[a] d	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Limits plotting within shaded area, above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GM[a] u			
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM[a] d	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Limits plotting within shaded area, above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SM[a] u			
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve size)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits, suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u is used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group sympols. For example GW-GC, well-graded gravel-sand mixture with clay binder.

Giles Engineering Associates, Inc.

GENERAL NOTES

SAMPLE IDENTIFICATION

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-75)

DESCRIPTIVE TERM (% BY DRY WEIGHT)

Trace:	1-10%
Little:	11-20%
Some:	21-35%
And/Adjective	36-50%

PARTICLE SIZE (DIAMETER)

Boulders:	8 inch and larger
Cobbles:	3 inch to 8 inch
Gravel:	coarse - ¾ to 3 inch
	fine – No. 4 (4.76 mm) to ¾ inch
Sand:	coarse – No. 4 (4.76 mm) to No. 10 (2.0 mm)
	medium – No. 10 (2.0 mm) to No. 40 (0.42 mm)
	fine – No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt:	No. 200 (0.074 mm) and smaller (non-plastic)
Clay:	No 200 (0.074 mm) and smaller (plastic)

SOIL PROPERTY SYMBOLS

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance (correlated to Unconfined Compressive Strength, tsf)
PID:	Results of vapor analysis conducted on representative samples utilizing a Photoionization Detector calibrated to a benzene standard. Results expressed in HNU-Units. (BDL=Below Detection Limit)

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon
ST:	Shelby Tube – 3 inch O.D. (except where noted)
CS:	3 inch O.D. California Ring Sampler
DC:	Dynamic Cone Penetrometer per ASTM Special Technical Publication No. 399
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample
RB:	Rock-Roller Bit
BS:	Bulk Sample
Note:	Depth intervals for sampling shown on Record of Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

N: Penetration Resistance per 12 inch interval, or fraction thereof, for a standard 2 inch O.D. (1⅜ inch I.D.) split spoon sampler driven with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N-Values where plus sign (+) is shown.

Nc: Penetration Resistance per 1¾ inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test N-Value in blows per foot.

Nr: Penetration Resistance per 12 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

SOIL STRENGTH CHARACTERISTICS

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	BLOWS PER FOOT (N)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
Very Soft	0 - 2	0 - 0.25
Soft	3 - 4	0.25 - 0.50
Medium Stiff	5 – 8	0.50 - 1.00
Stiff	9 – 15	1.00 - 2.00
Very Stiff	16 – 30	2.00 - 4.00
Hard	31+	4.00+

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	BLOWS PER FOOT (N)
Very Loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very Dense	51+

DEGREE OF PLASTICITY	PI	DEGREE OF EXPANSIVE POTENTIAL	PI
None to Slight	0 - 4	Low	0 - 15
Slight	5 - 10	Medium	15 - 25
Medium	11 - 30	High	25+
High to Very High	31+		

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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IIGER06045.0M

Geotechnical, Environmental & Construction Materials Consultants



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ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

[This is the cover sheet for Attachment 2.]

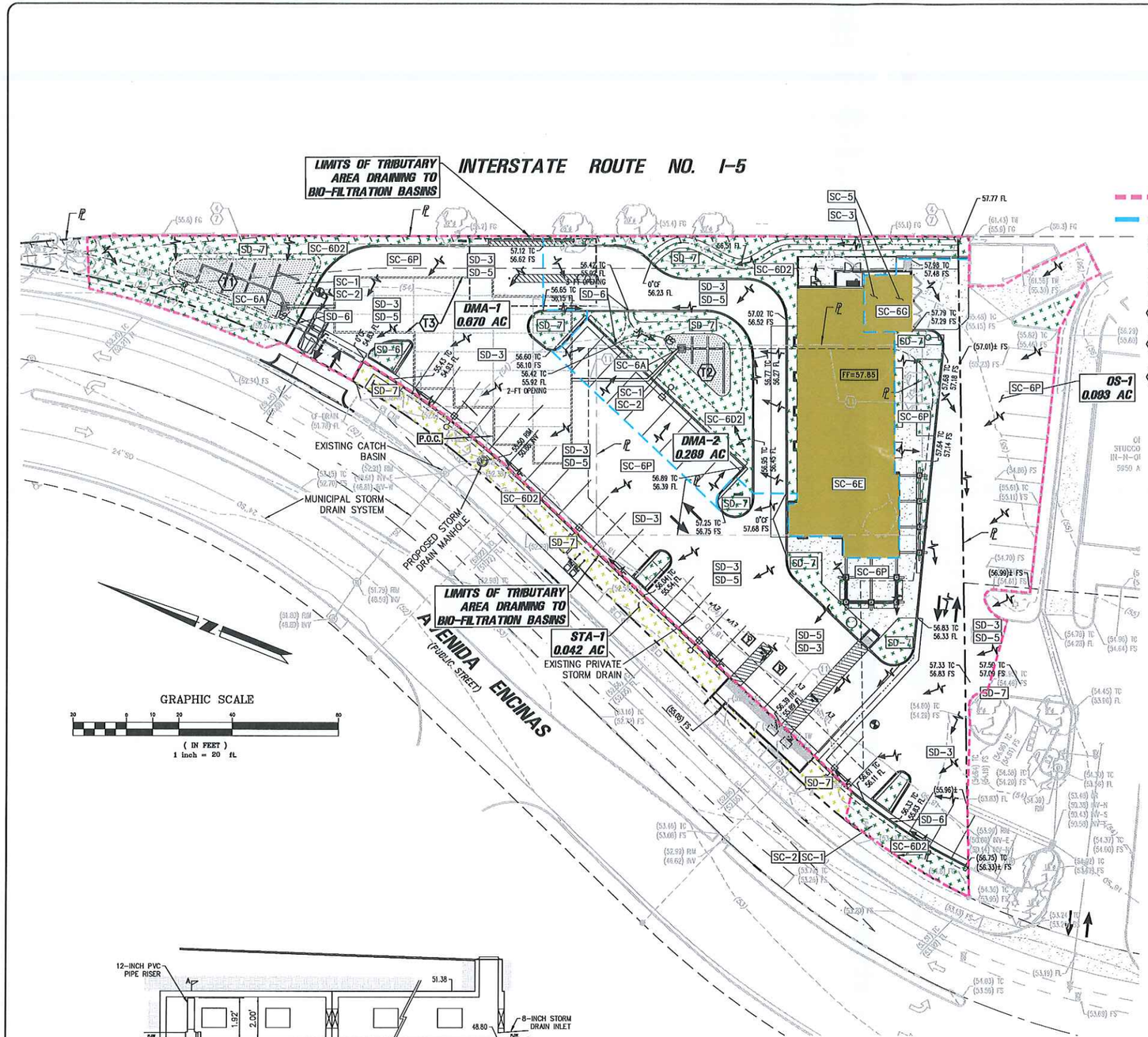
Indicate which Items are Included behind this cover sheet:

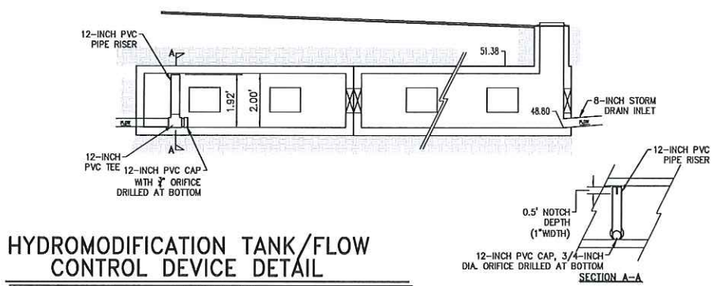
Attachment Sequence	Contents	Checklist
Attachment 2a	Hydromodification Management Exhibit (Required)	X Included See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	X Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	X Not performed ☐ Included
Attachment 2d	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) See Chapter 6 and Appendix G of the BMP Design Manual	X Included

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

X Underlying hydrologic soil group
X Approximate depth to groundwater
X Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
X Critical coarse sediment yield areas to be protected (if present)
X Existing topography
X Existing and proposed site drainage network and connections to drainage offsite
X Proposed grading
X Proposed impervious features
X Proposed design features and surface treatments used to minimize imperviousness
X Point(s) of Compliance (POC) for Hydromodification Management
X Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
X Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)





HYDROMODIFICATION TANK/FLOW CONTROL DEVICE DETAIL

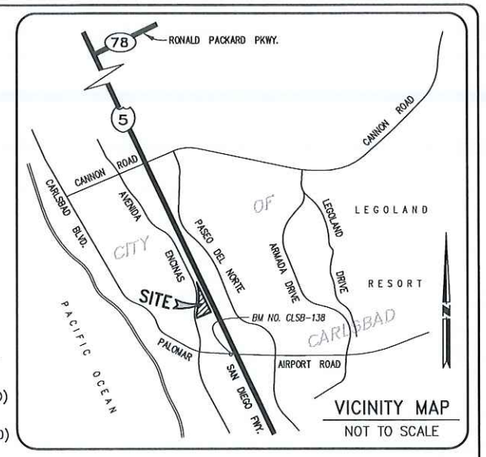
NOT TO SCALE

LEGEND

- LIMITS OF TOTAL TRIBUTARY AREA
- LIMITS OF DMA
- SOIL BORING

STRUCTURAL BMPs FOR HYDROMODIFICATION MANAGEMENT

- T1 BIO-FILTRATION BASIN-1 (LINED)
- T2 BIO-FILTRATION BASIN-2 (LINED)
- T3 STORM CAPTURE VAULTS



VICINITY MAP
NOT TO SCALE

LAND COVER

- IMPERVIOUS – AC PAVEMENT
- IMPERVIOUS – CONCRETE
- IMPERVIOUS – BUILDING/TRASH ENCLOSURE
- PERVIOUS – LANDSCAPING
- PERVIOUS – SELF TREATING AREA

REGISTERED PROFESSIONAL ENGINEER RANDY J. DEVICK No. 81077 CIVIL STATE OF CALIFORNIA

NOTICE TO CONTRACTOR

THE CONTRACTOR SHALL ASCERTAIN THE TRUE VERTICAL AND HORIZONTAL LOCATION AND SIZE OF ALL UTILITIES, PIPES, AND/OR STRUCTURES AND SHALL BE RESPONSIBLE FOR DAMAGE TO ANY PUBLIC OR PRIVATE UTILITIES, SHOWN OR NOT SHOWN HEREON.

IMPORTANT NOTICE

Section 4216 of the Government Code requires a Dig Alert Identification Number be issued before a "Permit to Excavate" will be valid. For your Dig Alert I.D. Number call Underground Service Alert CALL 811 Two working days before you dig.

HYDROMODIFICATION MANAGEMENT PLAN INFORMATION

1. HYDROLOGIC SOIL GROUP 'D'
2. DEPTH TO GROUNDWATER = 17 – 18 ft.
3. NO NATURAL HYDROLOGIC FEATURES EXIST WITHIN THIS PROJECT SITE
4. NO CRITICAL COARSE SEDIMENT YIELD AREAS EXIST DOWNSTREAM OF THIS PROJECT SITE

LID FEATURES

- SC-1 PREVENT ILLICIT DISCHARGES TO THE MS4
- SC-2 IDENTIFY THE STORM DRAIN SYSTEM USING STENCILING OR SIGNAGE
- SC-3 PROTECT OUTDOOR MATERIAL STORAFE AREAS FROM RAINFALL, RUN-ON, RUNOFF AND WIND DISPERSAL
- SC-5 PROTECT TRASH STORAGE AREAS FROM RAINFALL, RUN-ON, RUNOFF, AND WIND DISPERSAL
- SC-6 ADDITIONAL BMPS – POTENTIAL SOURCES OF RUNOFF POLLUTION
  - A. ON-SITE STORM DRAIN INLETS
  - D2. LANDSCAPE/OUTDOOR PESTICIDE USE
  - E. FOOD SERVICE
  - G. REFUSE AREAS
  - P. PLAZAS, SIDEWALKS, AND PARKING LOTS
- SD-3 MINIMIZE IMPERVIOUS AREA
- SD-5 DISPERSE IMPERVIOUS AREAS
- SD-6 COLLECT RUNOFF
- SD-7 LANDSCAPE WITH NATIVE OR DROUGHT TOLERANT SPECIES

THIS PLAN IS:
PRELIMINARY
(NOT FOR CONSTRUCTION)

NO.	REVISIONS	DATE

Prepared by:
Joseph C. Truxaw and Associates, Inc.
Civil Engineers and Land Surveyors
1915 W. Orangewood Ave., Suite 101, Orange, CA 92868 (714) 935-0265 Truxaw.com

HYDROMODIFICATION MANAGEMENT PLAN
CHICK-FIL-A #4306
5850 AVENIDA ENCINAS
CITY OF CARLSBAD, STATE OF CALIFORNIA

DATE	7-11-19
DRAWN BY	PJS
CHECKED BY	RD/SMH
JOB NO.	CFA18050
SHEET NO.	2 OF 2 SHEETS



*CCSYA info is .kmz file uploaded into Google Earth, provided by www.projectcleanwater.org

Prepared by:
Joseph C. Truxaw and Associates, Inc.
Civil Engineers and Land Surveyors
265 S. Anita Dr., Suite 111, Orange, CA 92868 (714)935-0265 fax:(714)935-0106

Critical Coarse Sediment Yield Areas Exhibit
5850 Avenida Encinas, Carlsbad, CA

SDHM 3.1

PROJECT REPORT

General Model Information

Project Name:	CFA18050(2)
Site Name:	CFA I-5 & Palomar
Site Address:	5850 Avenida Encinas
City:	Carlsbad
Report Date:	7/9/2019
Gage:	OCEANSID
Data Start:	10/01/1959
Data End:	09/30/2004
Timestep:	Hourly
Precip Scale:	1.000
Version Date:	2018/07/12

POC Thresholds

Low Flow Threshold for POC1:	10 Percent of the 2 Year
High Flow Threshold for POC1:	10 Year

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Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
D,NatVeg,Flat	0.939
Pervious Total	0.939
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.939

Element Flows To:

Surface	Interflow	Groundwater

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Mitigated Land Use

DMA-1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
D,NatVeg,Flat	0.104
Pervious Total	0.104
Impervious Land Use	acre
IMPERVIOUS-FLAT	0.566
Impervious Total	0.566
Basin Total	0.67

Element Flows To:

Surface	Interflow	Groundwater
Surface Biofilter 1	Surface Biofilter 1	

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Basin 2

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
D,NatVeg,Flat	0.078
Pervious Total	0.078

Impervious Land Use	acre
IMPERVIOUS-FLAT	0.191
Impervious Total	0.191
Basin Total	0.269

Element Flows To:

Surface	Interflow	Groundwater
Surface Biofilter 2	Surface Biofilter 2	

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Routing Elements
Predeveloped Routing

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Mitigated Routing

Biofilter 1

Bottom Length:	38.95 ft.
Bottom Width:	20.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	ESM
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	6
Orifice Diameter (in.):	6
Offset (in.):	3
Flow Through Underdrain (ac-ft.):	16.57
Total Outflow (ac-ft.):	19.819
Percent Through Underdrain:	83.6
Discharge Structure	
Riser Height:	0.5 ft.
Riser Diameter:	27.1 in.
Element Flows To:	
Outlet 1	Outlet 2
Storm Capture 1	

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Biofilter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0179	0.0000	0.0000	0.0000
0.0403	0.0179	0.0002	0.0000	0.0000
0.0807	0.0179	0.0004	0.0000	0.0000
0.1210	0.0179	0.0006	0.0000	0.0000
0.1613	0.0179	0.0009	0.0000	0.0000
0.2016	0.0179	0.0011	0.0000	0.0000
0.2420	0.0179	0.0013	0.0000	0.0000
0.2823	0.0179	0.0015	0.0000	0.0000
0.3226	0.0179	0.0017	0.0000	0.0000
0.3630	0.0179	0.0019	0.0000	0.0000
0.4033	0.0179	0.0022	0.0000	0.0000
0.4436	0.0179	0.0024	0.0000	0.0000
0.4840	0.0179	0.0026	0.0000	0.0000
0.5243	0.0179	0.0028	0.0000	0.0000
0.5646	0.0179	0.0030	0.0000	0.0000
0.6049	0.0179	0.0032	0.0000	0.0000
0.6453	0.0179	0.0035	0.0000	0.0000
0.6856	0.0179	0.0037	0.0000	0.0000
0.7259	0.0179	0.0039	0.0000	0.0000
0.7663	0.0179	0.0041	0.0000	0.0000
0.8066	0.0179	0.0043	0.0000	0.0000
0.8469	0.0179	0.0045	0.0000	0.0000
0.8873	0.0179	0.0048	0.0000	0.0000
0.9276	0.0179	0.0050	0.0000	0.0000
0.9679	0.0179	0.0052	0.0000	0.0000
1.0082	0.0179	0.0054	0.0000	0.0000
1.0486	0.0179	0.0056	0.0000	0.0000
1.0889	0.0179	0.0058	0.0000	0.0000
1.1292	0.0179	0.0061	0.0000	0.0000

1.1696	0.0179	0.0063	0.0000	0.0000
1.2099	0.0179	0.0065	0.0000	0.0000
1.2502	0.0179	0.0067	0.0000	0.0000
1.2905	0.0179	0.0069	0.0000	0.0000
1.3309	0.0179	0.0071	0.0000	0.0000
1.3712	0.0179	0.0074	0.0000	0.0000
1.4115	0.0179	0.0076	0.0000	0.0000
1.4519	0.0179	0.0078	0.0000	0.0000
1.4922	0.0179	0.0080	0.0000	0.0000
1.5325	0.0179	0.0083	0.0000	0.0000
1.5729	0.0179	0.0086	0.0000	0.0000
1.6132	0.0179	0.0089	0.0000	0.0000
1.6535	0.0179	0.0092	0.0000	0.0000
1.6938	0.0179	0.0095	0.0000	0.0000
1.7342	0.0179	0.0098	0.0000	0.0000
1.7745	0.0179	0.0101	0.0000	0.0000
1.8148	0.0179	0.0104	0.0000	0.0000
1.8552	0.0179	0.0107	0.0000	0.0000
1.8955	0.0179	0.0110	0.0000	0.0000
1.9358	0.0179	0.0113	0.0000	0.0000
1.9762	0.0179	0.0116	0.0000	0.0000
2.0165	0.0179	0.0119	0.0000	0.0000
2.0568	0.0179	0.0122	0.0000	0.0000
2.0971	0.0179	0.0125	0.0000	0.0000
2.1375	0.0179	0.0128	0.0000	0.0000
2.1778	0.0179	0.0131	0.0000	0.0000
2.2181	0.0179	0.0134	0.0000	0.0000
2.2585	0.0179	0.0137	0.0000	0.0000
2.2988	0.0179	0.0140	0.0000	0.0000
2.3391	0.0179	0.0143	0.0000	0.0000
2.3795	0.0179	0.0146	0.0000	0.0000
2.4198	0.0179	0.0149	0.0000	0.0000
2.4601	0.0179	0.0152	0.0000	0.0000
2.5000	0.0179	0.0155	0.0000	0.0000

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Biofilter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.0179	0.0155	0.0000	0.0926	0.0000
2.5403	0.0179	0.0162	0.0000	0.0926	0.0000
2.5807	0.0179	0.0169	0.0000	0.0950	0.0000
2.6210	0.0179	0.0176	0.0000	0.0974	0.0000
2.6613	0.0179	0.0184	0.0000	0.0999	0.0000
2.7016	0.0179	0.0191	0.0000	0.1023	0.0000
2.7420	0.0179	0.0198	0.0000	0.1047	0.0000
2.7823	0.0179	0.0205	0.0000	0.1071	0.0000
2.8226	0.0179	0.0213	0.0000	0.1096	0.0000
2.8630	0.0179	0.0220	0.0000	0.1120	0.0000
2.9033	0.0179	0.0227	0.0000	0.1144	0.0000
2.9436	0.0179	0.0234	0.0000	0.1168	0.0000
2.9840	0.0179	0.0241	0.0000	0.1193	0.0000
3.0243	0.0179	0.0249	0.0000	0.1217	0.0000
3.0646	0.0179	0.0256	0.0000	0.1241	0.0000
3.1049	0.0179	0.0263	0.0020	0.1265	0.0000
3.1453	0.0179	0.0270	0.0024	0.1289	0.0000
3.1856	0.0179	0.0277	0.0031	0.1314	0.0000
3.2259	0.0179	0.0285	0.0039	0.1338	0.0000
3.2663	0.0179	0.0292	0.0049	0.1362	0.0000
3.3066	0.0179	0.0299	0.0060	0.1386	0.0000

3.3469	0.0179	0.0306	0.0073	0.1411	0.0000
3.3873	0.0179	0.0314	0.0087	0.1435	0.0000
3.4276	0.0179	0.0321	0.0103	0.1459	0.0000
3.4679	0.0179	0.0328	0.0120	0.1483	0.0000
3.5082	0.0179	0.0335	0.0138	0.1508	0.0000
3.5486	0.0179	0.0342	0.0159	0.1532	0.0000
3.5889	0.0179	0.0350	0.0181	0.1556	0.0000
3.6292	0.0179	0.0357	0.0205	0.1580	0.0000
3.6696	0.0179	0.0364	0.0231	0.1605	0.0000
3.6700	0.0179	0.0364	0.0258	0.1605	0.0000

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Surface Biofilter 1

Element Flows To:

Outlet 1	Outlet 2
Storm Capture 1	Biofilter 1

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Biofilter 2

Bottom Length:	18.20 ft.
Bottom Width:	20.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	ESM
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	6
Orifice Diameter (in.):	6
Offset (in.):	3
Flow Through Underdrain (ac-ft.):	6.185
Total Outflow (ac-ft.):	6.906
Percent Through Underdrain:	89.56

Discharge Structure

Riser Height:	0.5 ft.
Riser Diameter:	27.1 in.

Element Flows To:

Outlet 1 Outlet 2

Storm Capture 1

DRAFT

Biofilter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0084	0.0000	0.0000	0.0000
0.0495	0.0084	0.0001	0.0000	0.0000
0.0989	0.0084	0.0002	0.0000	0.0000
0.1484	0.0084	0.0004	0.0000	0.0000
0.1978	0.0084	0.0005	0.0000	0.0000
0.2473	0.0084	0.0006	0.0000	0.0000
0.2967	0.0084	0.0007	0.0000	0.0000
0.3462	0.0084	0.0009	0.0000	0.0000
0.3956	0.0084	0.0010	0.0000	0.0000
0.4451	0.0084	0.0011	0.0000	0.0000
0.4945	0.0084	0.0012	0.0000	0.0000
0.5440	0.0084	0.0014	0.0000	0.0000
0.5934	0.0084	0.0015	0.0000	0.0000
0.6429	0.0084	0.0016	0.0000	0.0000
0.6923	0.0084	0.0017	0.0000	0.0000
0.7418	0.0084	0.0019	0.0000	0.0000
0.7912	0.0084	0.0020	0.0000	0.0000
0.8407	0.0084	0.0021	0.0000	0.0000
0.8901	0.0084	0.0022	0.0000	0.0000
0.9396	0.0084	0.0024	0.0000	0.0000
0.9890	0.0084	0.0025	0.0000	0.0000
1.0385	0.0084	0.0026	0.0000	0.0000
1.0879	0.0084	0.0027	0.0000	0.0000
1.1374	0.0084	0.0029	0.0000	0.0000
1.1868	0.0084	0.0030	0.0000	0.0000
1.2363	0.0084	0.0031	0.0000	0.0000
1.2857	0.0084	0.0032	0.0000	0.0000
1.3352	0.0084	0.0033	0.0000	0.0000
1.3846	0.0084	0.0035	0.0000	0.0000
1.4341	0.0084	0.0036	0.0000	0.0000
1.4835	0.0084	0.0037	0.0000	0.0000

1.5330	0.0084	0.0039	0.0000	0.0000
1.5824	0.0084	0.0041	0.0000	0.0000
1.6319	0.0084	0.0042	0.0000	0.0000
1.6813	0.0084	0.0044	0.0000	0.0000
1.7308	0.0084	0.0046	0.0000	0.0000
1.7802	0.0084	0.0047	0.0000	0.0000
1.8297	0.0084	0.0049	0.0000	0.0000
1.8791	0.0084	0.0051	0.0000	0.0000
1.9286	0.0084	0.0053	0.0000	0.0000
1.9780	0.0084	0.0054	0.0000	0.0000
2.0275	0.0084	0.0056	0.0000	0.0000
2.0769	0.0084	0.0058	0.0000	0.0000
2.1264	0.0084	0.0059	0.0000	0.0000
2.1758	0.0084	0.0061	0.0000	0.0000
2.2253	0.0084	0.0063	0.0000	0.0000
2.2747	0.0084	0.0065	0.0000	0.0000
2.3242	0.0084	0.0066	0.0000	0.0000
2.3736	0.0084	0.0068	0.0000	0.0000
2.4231	0.0084	0.0070	0.0000	0.0000
2.4725	0.0084	0.0071	0.0000	0.0000
2.5000	0.0084	0.0072	0.0000	0.0000

Biofilter Hydraulic Table

DRAFT

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.0084	0.0072	0.0000	0.0435	0.0000
2.5495	0.0084	0.0077	0.0000	0.0435	0.0000
2.5989	0.0084	0.0081	0.0000	0.0449	0.0000
2.6484	0.0084	0.0085	0.0000	0.0463	0.0000
2.6978	0.0084	0.0089	0.0000	0.0477	0.0000
2.7473	0.0084	0.0093	0.0000	0.0491	0.0000
2.7967	0.0084	0.0097	0.0000	0.0505	0.0000
2.8462	0.0084	0.0101	0.0000	0.0519	0.0000
2.8956	0.0084	0.0105	0.0000	0.0532	0.0000
2.9451	0.0084	0.0110	0.0000	0.0546	0.0000
2.9945	0.0084	0.0114	0.0000	0.0560	0.0000
3.0440	0.0084	0.0118	0.0000	0.0574	0.0000
3.0934	0.0084	0.0122	0.0009	0.0588	0.0000
3.1429	0.0084	0.0126	0.0011	0.0602	0.0000
3.1923	0.0084	0.0130	0.0016	0.0616	0.0000
3.2418	0.0084	0.0134	0.0021	0.0630	0.0000
3.2912	0.0084	0.0139	0.0027	0.0644	0.0000
3.3407	0.0084	0.0143	0.0034	0.0657	0.0000
3.3901	0.0084	0.0147	0.0042	0.0671	0.0000
3.4396	0.0084	0.0151	0.0051	0.0685	0.0000
3.4890	0.0084	0.0155	0.0062	0.0699	0.0000
3.5385	0.0084	0.0159	0.0073	0.0713	0.0000
3.5879	0.0084	0.0163	0.0086	0.0727	0.0000
3.6374	0.0084	0.0167	0.0100	0.0741	0.0000
3.6868	0.0084	0.0172	0.0115	0.0755	0.0000
3.7363	0.0084	0.0176	0.0132	0.0769	0.0000
3.7857	0.0084	0.0180	0.0149	0.0782	0.0000
3.8352	0.0084	0.0184	0.0169	0.0796	0.0000
3.8846	0.0084	0.0188	0.0189	0.0810	0.0000
3.9341	0.0084	0.0192	0.0212	0.0824	0.0000
3.9835	0.0084	0.0196	0.0235	0.0838	0.0000
4.0330	0.0084	0.0201	0.0260	0.0852	0.0000
4.0824	0.0084	0.0205	0.0287	0.0866	0.0000
4.1319	0.0084	0.0209	0.0316	0.0880	0.0000

4.1813	0.0084	0.0213	0.0332	0.0894	0.0000
4.2308	0.0084	0.0217	0.0377	0.0907	0.0000
4.2802	0.0084	0.0221	0.0393	0.0921	0.0000
4.3297	0.0084	0.0225	0.0421	0.0935	0.0000
4.3791	0.0084	0.0229	0.0421	0.0949	0.0000
4.4286	0.0084	0.0234	0.0421	0.0963	0.0000
4.4780	0.0084	0.0238	0.0421	0.0977	0.0000
4.5000	0.0084	0.0240	0.0421	0.0983	0.0000

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Surface Biofilter 2

Element Flows To:

Outlet 1	Outlet 2
Storm Capture 1	Biofilter 2

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Storm Capture 1

Dimensions

Depth:	2 ft.	
Length:	540 ft.	
Width:	7 ft.	
Infiltration On		
Infiltration rate:	0.05	
Infiltration safety factor:	1	
Total Volume Infiltrated (ac-ft.):		9.507
Total Volume Through Riser (ac-ft.):		17.222
Total Volume Through Facility (ac-ft.):		26.729
Percent Infiltrated:		35.57
Total Precip Applied to Facility:		0
Total Evap From Facility:		0
Discharge Structure		
Riser Height:	1.92 ft.	
Riser Diameter:	12 in.	
Notch Type:	Rectangular	
Notch Width:	0.080 ft.	
Notch Height:	0.500 ft.	
Orifice 1 Diameter:	0.75 in.	Elevation:0 ft.

Element Flows To:
Outlet 1 Outlet 2

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SCapture Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.086	0.000	0.000	0.000
0.0222	0.086	0.001	0.002	0.004
0.0444	0.086	0.003	0.003	0.004
0.0667	0.086	0.005	0.003	0.004
0.0889	0.086	0.007	0.004	0.004
0.1111	0.086	0.009	0.005	0.004
0.1333	0.086	0.011	0.005	0.004
0.1556	0.086	0.013	0.006	0.004
0.1778	0.086	0.015	0.006	0.004
0.2000	0.086	0.017	0.006	0.004
0.2222	0.086	0.019	0.007	0.004
0.2444	0.086	0.021	0.007	0.004
0.2667	0.086	0.023	0.007	0.004
0.2889	0.086	0.025	0.008	0.004
0.3111	0.086	0.027	0.008	0.004
0.3333	0.086	0.028	0.008	0.004
0.3556	0.086	0.030	0.009	0.004
0.3778	0.086	0.032	0.009	0.004
0.4000	0.086	0.034	0.009	0.004
0.4222	0.086	0.036	0.009	0.004
0.4444	0.086	0.038	0.010	0.004
0.4667	0.086	0.040	0.010	0.004
0.4889	0.086	0.042	0.010	0.004
0.5111	0.086	0.044	0.010	0.004
0.5333	0.086	0.046	0.011	0.004
0.5556	0.086	0.048	0.011	0.004
0.5778	0.086	0.050	0.011	0.004
0.6000	0.086	0.052	0.011	0.004
0.6222	0.086	0.054	0.012	0.004

0.6444	0.086	0.055	0.012	0.004
0.6667	0.086	0.057	0.012	0.004
0.6889	0.086	0.059	0.012	0.004
0.7111	0.086	0.061	0.012	0.004
0.7333	0.086	0.063	0.013	0.004
0.7556	0.086	0.065	0.013	0.004
0.7778	0.086	0.067	0.013	0.004
0.8000	0.086	0.069	0.013	0.004
0.8222	0.086	0.071	0.013	0.004
0.8444	0.086	0.073	0.014	0.004
0.8667	0.086	0.075	0.014	0.004
0.8889	0.086	0.077	0.014	0.004
0.9111	0.086	0.079	0.014	0.004
0.9333	0.086	0.081	0.014	0.004
0.9556	0.086	0.082	0.014	0.004
0.9778	0.086	0.084	0.015	0.004
1.0000	0.086	0.086	0.015	0.004
1.0222	0.086	0.088	0.015	0.004
1.0444	0.086	0.090	0.015	0.004
1.0667	0.086	0.092	0.015	0.004
1.0889	0.086	0.094	0.015	0.004
1.1111	0.086	0.096	0.016	0.004
1.1333	0.086	0.098	0.016	0.004
1.1556	0.086	0.100	0.016	0.004
1.1778	0.086	0.102	0.016	0.004
1.2000	0.086	0.104	0.016	0.004
1.2222	0.086	0.106	0.016	0.004
1.2444	0.086	0.108	0.017	0.004
1.2667	0.086	0.109	0.017	0.004
1.2889	0.086	0.111	0.017	0.004
1.3111	0.086	0.113	0.017	0.004
1.3333	0.086	0.115	0.017	0.004
1.3556	0.086	0.117	0.017	0.004
1.3778	0.086	0.119	0.017	0.004
1.4000	0.086	0.121	0.018	0.004
1.4222	0.086	0.123	0.018	0.004
1.4444	0.086	0.125	0.019	0.004
1.4667	0.086	0.127	0.021	0.004
1.4889	0.086	0.129	0.023	0.004
1.5111	0.086	0.131	0.026	0.004
1.5333	0.086	0.133	0.028	0.004
1.5556	0.086	0.135	0.032	0.004
1.5778	0.086	0.136	0.035	0.004
1.6000	0.086	0.138	0.038	0.004
1.6222	0.086	0.140	0.042	0.004
1.6444	0.086	0.142	0.046	0.004
1.6667	0.086	0.144	0.050	0.004
1.6889	0.086	0.146	0.055	0.004
1.7111	0.086	0.148	0.059	0.004
1.7333	0.086	0.150	0.063	0.004
1.7556	0.086	0.152	0.068	0.004
1.7778	0.086	0.154	0.073	0.004
1.8000	0.086	0.156	0.078	0.004
1.8222	0.086	0.158	0.083	0.004
1.8444	0.086	0.160	0.088	0.004
1.8667	0.086	0.162	0.093	0.004
1.8889	0.086	0.163	0.098	0.004
1.9111	0.086	0.165	0.103	0.004

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1.9333	0.086	0.167	0.122	0.004
1.9556	0.086	0.169	0.177	0.004
1.9778	0.086	0.171	0.253	0.004
2.0000	0.086	0.173	0.345	0.004

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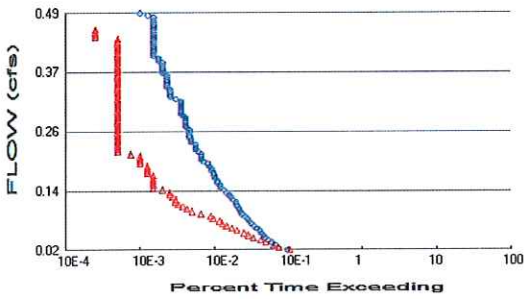
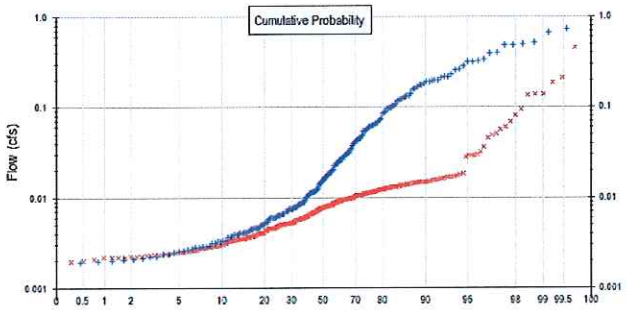
Analysis Results
POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.939
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.182
Total Impervious Area: 0.757

Flow Frequency Method: Weibull

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.192823
5 year	0.337038
10 year	0.490837
25 year	0.677956

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.018
5 year	0.0672
10 year	0.139321
25 year	0.235251

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Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0193	385	424	110	Pass
0.0240	287	296	103	Pass
0.0288	263	248	94	Pass
0.0336	233	198	84	Pass
0.0383	209	167	79	Pass
0.0431	192	133	69	Pass
0.0479	184	115	62	Pass
0.0526	170	100	58	Pass
0.0574	158	80	50	Pass
0.0622	147	68	46	Pass
0.0669	135	58	42	Pass
0.0717	124	51	41	Pass
0.0764	118	47	39	Pass
0.0812	109	38	34	Pass
0.0860	101	35	34	Pass
0.0907	93	26	27	Pass
0.0955	88	20	22	Pass
0.1003	84	17	20	Pass
0.1050	81	15	18	Pass
0.1098	78	13	16	Pass
0.1145	76	12	15	Pass
0.1193	70	12	17	Pass
0.1241	65	11	16	Pass
0.1288	62	10	16	Pass
0.1336	57	10	17	Pass
0.1384	53	8	15	Pass
0.1431	48	6	12	Pass
0.1479	47	6	12	Pass
0.1527	43	6	13	Pass
0.1574	43	6	13	Pass
0.1622	40	6	15	Pass
0.1669	39	6	15	Pass
0.1717	38	5	13	Pass
0.1765	36	5	13	Pass
0.1812	36	5	13	Pass
0.1860	34	5	14	Pass
0.1908	32	4	12	Pass
0.1955	28	4	14	Pass
0.2003	26	4	15	Pass
0.2050	26	4	15	Pass
0.2098	26	3	11	Pass
0.2146	24	2	8	Pass
0.2193	22	2	9	Pass
0.2241	22	2	9	Pass
0.2289	22	2	9	Pass
0.2336	19	2	10	Pass
0.2384	19	2	10	Pass
0.2432	18	2	11	Pass
0.2479	18	2	11	Pass
0.2527	18	2	11	Pass
0.2574	18	2	11	Pass
0.2622	17	2	11	Pass
0.2670	16	2	12	Pass

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0.2717	16	2	12	Pass
0.2765	16	2	12	Pass
0.2813	16	2	12	Pass
0.2860	15	2	13	Pass
0.2908	14	2	14	Pass
0.2955	14	2	14	Pass
0.3003	14	2	14	Pass
0.3051	14	2	14	Pass
0.3098	14	2	14	Pass
0.3146	14	2	14	Pass
0.3194	12	2	16	Pass
0.3241	10	2	20	Pass
0.3289	10	2	20	Pass
0.3337	10	2	20	Pass
0.3384	10	2	20	Pass
0.3432	9	2	22	Pass
0.3479	9	2	22	Pass
0.3527	9	2	22	Pass
0.3575	9	2	22	Pass
0.3622	9	2	22	Pass
0.3670	9	2	22	Pass
0.3718	8	2	25	Pass
0.3765	8	2	25	Pass
0.3813	8	2	25	Pass
0.3860	8	2	25	Pass
0.3908	8	2	25	Pass
0.3956	7	2	28	Pass
0.4003	7	2	28	Pass
0.4051	6	2	33	Pass
0.4099	6	2	33	Pass
0.4146	6	2	33	Pass
0.4194	6	2	33	Pass
0.4242	6	2	33	Pass
0.4289	6	2	33	Pass
0.4337	6	2	33	Pass
0.4384	6	2	33	Pass
0.4432	6	1	16	Pass
0.4480	6	1	16	Pass
0.4527	6	1	16	Pass
0.4575	6	1	16	Pass
0.4623	6	0	0	Pass
0.4670	6	0	0	Pass
0.4718	6	0	0	Pass
0.4765	6	0	0	Pass
0.4813	6	0	0	Pass
0.4861	5	0	0	Pass
0.4908	4	0	0	Pass

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POC 2

POC #2 was not reported because POC must exist in both scenarios and both scenarios must have been run.

DRAFT

POC 3

POC #3 was not reported because POC must exist in both scenarios and both scenarios must have been run.

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Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

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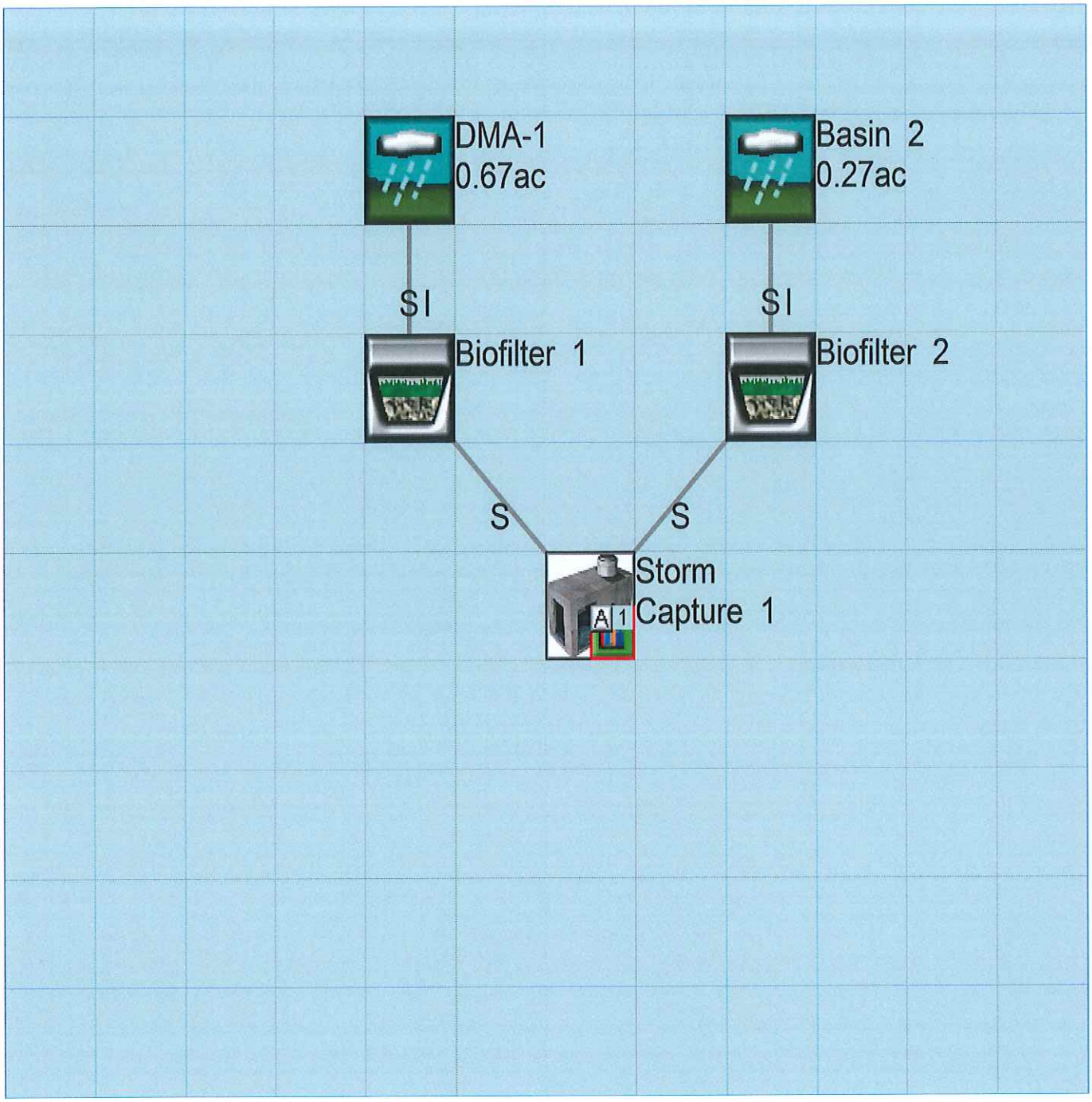
Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1959 10 01         END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   CFA18050(2).wdm
MESSU       25   PreCFA18050(2).MES
            27   PreCFA18050(2).L61
            28   PreCFA18050(2).L62
            30   POCCFA18050(2)1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:60
      PERLND      40
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                  MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1          1    1
  501          1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #          K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
   40      B,Urban,Flat            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   40          0    0    1    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   40          0    0    4    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

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```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   40         0    1    1    1    0    0    0    0    1    1    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN     INFILT      LSUR      SLSUR      KVARY      AGWRC
   40              0         4       0.07        50       0.05        2.5      0.915
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   40              0         0         2         2         0      0.05      0.05
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >      PWATER input info: Part 4                                  ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   40              0       0.6      0.03         1       0.3         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3          ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   40       0.6  0.6  0.6  0.6  0.7  0.7  0.7  0.7  0.7  0.6  0.6  0.6
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3          ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   40       0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS       GWVS
   40              0         0      0.15          0         1      0.05          0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                    User  t-series Engl Metr ***
                                  in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2          ***
    # -  # ***  LSUR      SLSUR      NSUR      RETSC
  END IWAT-PARM2
```

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```
  IWAT-PARM3
    <PLS >       IWATER input info: Part 3          ***
    # -   # ***PETMAX     PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -   # ***   RETS       SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                    <--Area-->      <-Target->   MBLK    ***
<Name>    #                   <-factor->      <Name>    #   Tbl#    ***
Basin   1***
PERLND   40                        0.935      COPY    501      12

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->   ***
<Name>    #         <Name> # #<-factor->strg <Name>    #    #         <Name> # #   ***
COPY    501 OUTPUT MEAN    1 1    12.1        DISPLY    1      INPUT   TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->   ***
<Name>    #         <Name> # #<-factor->strg <Name>    #    #         <Name> # #   ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name          Nexits   Unit Systems   Printer                  ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG              ***
                                       in  out                                  ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -   # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -   # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -   #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -   #    FTABNO       LEN      DELTH     STCOR        KS       DB50        ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -   # ***   VOL      Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft      for each possible exit        for each possible exit
  <------><-------->      <---><---><---><---><---> *** <---><---><---><---><
```

```
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM     22 IRRG     ENGL    0.7       SAME PERLND  40     EXTNL  SURLI

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333     COPY           INPUT  MEAN
  END MASS-LINK   12


END MASS-LINK

END RUN
```

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Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1959 10 01         END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3     0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   CFA18050(2).wdm
MESSU       25   MitCFA18050(2).MES
            27   MitCFA18050(2).L61
            28   MitCFA18050(2).L62
            30   POCCFA18050(2)1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:60
      PERLND       28
      IMPLND        1
      GENER         2
      RCHRES        1
      RCHRES        2
      GENER         4
      RCHRES        3
      RCHRES        4
      RCHRES        5
      COPY          1
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Storm Capture  1             MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1          1    1
  501          1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2         24
    4         24
  END OPCODE
  PARM
    #    #          K ***
    2              0.
    4              0.
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out            ***
   28      D,NatVeg,Flat          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***
```

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```
  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   28         0    0    1    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   28         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   28         0    1    1    1    0    0    0    0    1    1    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -   # ***FOREST      LZSN    INFILT      LSUR     SLSUR      KVARY      AGWRC
   28              0       3.3      0.03       100      0.05        2.5      0.915
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -   # ***PETMAX    PETMIN     INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   28              0         0          2         2         0      0.05      0.05
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >      PWATER input info: Part 4                                  ***
    # -   #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   28             0       0.6      0.04         1       0.3         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3          ***
    # -   #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   28       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3          ***
    # -   #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   28       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -   # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS       GWVS
   28             0         0      0.01          0       0.4       0.01          0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -   #                    User  t-series Engl Metr ***
                                     in  out           ***
    1      IMPERVIOUS-FLAT        1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -   # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY
```

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```
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    1
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            100      0.05     0.011       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1               0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1               0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                <--Area-->      <-Target->   MBLK    ***
<Name>   #                <-factor->      <Name>   #   Tbl#    ***
DMA-1***
PERLND  28                     0.104      RCHRES   1      2
PERLND  28                     0.104      RCHRES   1      3
IMPLND   1                     0.566      RCHRES   1      5
Basin  2***
PERLND  28                     0.078      RCHRES   3      2
PERLND  28                     0.078      RCHRES   3      3
IMPLND   1                     0.191      RCHRES   3      5

******Routing******
RCHRES   2                         1      RCHRES   5      6
RCHRES   2                                COPY     1     16
RCHRES   1                         1      RCHRES   5      7
RCHRES   1                                COPY     1     17
RCHRES   1                         1      RCHRES   2      8
RCHRES   4                         1      RCHRES   5      6
RCHRES   4                                COPY     1     16
RCHRES   3                         1      RCHRES   5      7
RCHRES   3                                COPY     1     17
RCHRES   3                         1      RCHRES   4      8
RCHRES   5                         1      COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1
GENER    2 OUTPUT TIMSER       .0002778    RCHRES   1     EXTNL  OUTDGT 1
GENER    4 OUTPUT TIMSER       .0002778    RCHRES   3     EXTNL  OUTDGT 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK
```

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```
RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                  ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                        in  out                               ***
    1     Surface Biofilte-020    3     1    1     1    28    0    1
    2     Biofilter  1            1     1    1     1    28    0    1
    3     Surface Biofilte-022    3     1    1     1    28    0    1
    4     Biofilter  2            1     1    1     1    28    0    1
    5     Storm Capture  1-025    2     1    1     1    28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1          1    0    0    0    0    0    0    0    0    0
    2          1    0    0    0    0    0    0    0    0    0
    3          1    0    0    0    0    0    0    0    0    0
    4          1    0    0    0    0    0    0    0    0    0
    5          1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1          4    0    0    0    0    0    0    0    0    0    1    9
    2          4    0    0    0    0    0    0    0    0    0    1    9
    3          4    0    0    0    0    0    0    0    0    0    1    9
    4          4    0    0    0    0    0    0    0    0    0    1    9
    5          4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each    FUNCT for each
           FG FG FG FG  possible  exit  *** possible  exit     possible  exit
            *  *  *  *   *  *  *  *  *      *  *  *  *  *        ***
    1       0  1  0  0    4  5  6  0  0       0  1  0  0  0       2  1  2  2  2
    2       0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
    3       0  1  0  0    4  5  6  0  0       0  1  0  0  0       2  1  2  2  2
    4       0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
    5       0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN      DELTH      STCOR        KS       DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
    1              1      0.01        0.0        0.0        0.5        0.0
    2              2      0.01        0.0        0.0        0.5        0.0
    3              3      0.01        0.0        0.0        0.5        0.0
    4              4      0.01        0.0        0.0        0.5        0.0
    5              5       0.1        0.0        0.0        0.5        0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial value of COLIND     Initial value of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><--------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1             0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2             0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3             0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    4             0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    5             0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
*** User-Defined Variable Quantity Lines
```

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```
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><---------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><---------> <><-> <><-> <--> ***
  UVQUAN vol4   RCHRES   4 VOL              4
  UVQUAN v2m4   GLOBAL     WORKSP  3        3
  UVQUAN vpo4   GLOBAL     WORKSP  4        3
  UVQUAN v2d4   GENER    4 K       1        3
*** User-Defined Target Variable Names
***                  addr or                          addr or
***                 <------>                         <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** User-Defined Target Variable Names
***                  addr or                          addr or
***                 <------>                         <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m4    1 WORKSP  3         1.0 QUAN
  UVNAME  vpo4    1 WORKSP  4         1.0 QUAN
  UVNAME  v2d4    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><---------> <> <-><->
  GENER   2                               v2m2            =  628.
*** Compute remaining available pore space
  GENER   2                               vpo2            =  v2m2
  GENER   2                               vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2            =  vpo2
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><---------> <> <-><->
  GENER   4                               v2m4            =  295.
*** Compute remaining available pore space
  GENER   4                               vpo4            =  v2m4
  GENER   4                               vpo4           -=  vol4
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo4 < 0.0) THEN
  GENER   4                               vpo4            =  0.0
END IF
*** Infiltration volume
  GENER   4                               v2d4            =  vpo4
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   63    4
     Depth      Area     Volume  Outflow1 Velocity  Travel Time***
      (ft)    (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.017883  0.000000  0.000000
  0.040330  0.017883  0.000216  0.000000
  0.080659  0.017883  0.000433  0.000000
  0.120989  0.017883  0.000649  0.000000
  0.161319  0.017883  0.000865  0.000000
  0.201648  0.017883  0.001082  0.000000
  0.241978  0.017883  0.001298  0.000000
```

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```
  0.282308  0.017883  0.001515  0.000000
  0.322637  0.017883  0.001731  0.000000
  0.362967  0.017883  0.001947  0.000000
  0.403297  0.017883  0.002164  0.000000
  0.443626  0.017883  0.002380  0.000000
  0.483956  0.017883  0.002596  0.000000
  0.524286  0.017883  0.002813  0.000000
  0.564615  0.017883  0.003029  0.000000
  0.604945  0.017883  0.003246  0.002034
  0.645275  0.017883  0.003462  0.002355
  0.685604  0.017883  0.003678  0.003083
  0.725934  0.017883  0.003895  0.003935
  0.766264  0.017883  0.004111  0.004916
  0.806593  0.017883  0.004327  0.006033
  0.846923  0.017883  0.004544  0.007291
  0.887253  0.017883  0.004760  0.008696
  0.927582  0.017883  0.004976  0.010252
  0.967912  0.017883  0.005193  0.011967
  1.008242  0.017883  0.005409  0.013843
  1.048571  0.017883  0.005626  0.015887
  1.088901  0.017883  0.005842  0.018102
  1.129231  0.017883  0.006058  0.020494
  1.169560  0.017883  0.006275  0.023067
  1.209890  0.017883  0.006491  0.025826
  1.250220  0.017883  0.006707  0.028773
  1.290549  0.017883  0.006924  0.031915
  1.330879  0.017883  0.007140  0.035254
  1.371209  0.017883  0.007357  0.038795
  1.411538  0.017883  0.007573  0.042541
  1.451868  0.017883  0.007789  0.046497
  1.492198  0.017883  0.008006  0.050665
  1.532527  0.017883  0.008305  0.055050
  1.572857  0.017883  0.008604  0.059655
  1.613187  0.017883  0.008904  0.064484
  1.653516  0.017883  0.009203  0.069538
  1.693846  0.017883  0.009502  0.074822
  1.734176  0.017883  0.009802  0.080336
  1.774505  0.017883  0.010101  0.082049
  1.814835  0.017883  0.010400  0.090162
  1.855165  0.017883  0.010699  0.090162
  1.895495  0.017883  0.010999  0.090162
  1.935824  0.017883  0.011298  0.090162
  1.976154  0.017883  0.011597  0.090162
  2.016484  0.017883  0.011897  0.090162
  2.056813  0.017883  0.012196  0.090162
  2.097143  0.017883  0.012495  0.090162
  2.137473  0.017883  0.012795  0.090162
  2.177802  0.017883  0.013094  0.090162
  2.218132  0.017883  0.013393  0.090162
  2.258462  0.017883  0.013693  0.090162
  2.298791  0.017883  0.013992  0.090162
  2.339121  0.017883  0.014291  0.090162
  2.379451  0.017883  0.014590  0.090162
  2.419780  0.017883  0.014890  0.090162
  2.460110  0.017883  0.015189  0.090162
  2.500000  0.017883  0.032519  0.090162
  END FTABLE  2
  FTABLE      1
   31    6
     Depth       Area     Volume   Outflow1   Outflow2   outflow 3 Velocity  Travel
Time***
       (ft)    (acres) (acre-ft)    (cfs)       (cfs)      (cfs)    (ft/sec)
(Minutes)***
  0.000000  0.017883  0.000000  0.000000  0.000000  0.000000
  0.040330  0.017883  0.000721  0.000000  0.092586  0.000000
  0.080659  0.017883  0.001442  0.000000  0.095010  0.000000
  0.120989  0.017883  0.002164  0.000000  0.097435  0.000000
  0.161319  0.017883  0.002885  0.000000  0.099859  0.000000
  0.201648  0.017883  0.003606  0.000000  0.102283  0.000000
  0.241978  0.017883  0.004327  0.000000  0.104707  0.000000
```

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0.282308	0.017883	0.005049	0.000000	0.107131	0.000000
0.322637	0.017883	0.005770	0.000000	0.109555	0.000000
0.362967	0.017883	0.006491	0.000000	0.111979	0.000000
0.403297	0.017883	0.007212	0.000000	0.114403	0.000000
0.443626	0.017883	0.007934	0.000000	0.116828	0.000000
0.483956	0.017883	0.008655	0.000000	0.119252	0.000000
0.524286	0.017883	0.009376	0.090729	0.121676	0.000000
0.564615	0.017883	0.010097	0.393444	0.124100	0.000000
0.604945	0.017883	0.010818	0.813776	0.126524	0.000000
0.645275	0.017883	0.011540	1.324073	0.128948	0.000000
0.685604	0.017883	0.012261	1.909104	0.131372	0.000000
0.725934	0.017883	0.012982	2.557879	0.133797	0.000000
0.766264	0.017883	0.013703	3.261166	0.136221	0.000000
0.806593	0.017883	0.014425	4.010432	0.138645	0.000000
0.846923	0.017883	0.015146	4.797350	0.141069	0.000000
0.887253	0.017883	0.015867	5.613548	0.143493	0.000000
0.927582	0.017883	0.016588	6.450513	0.145917	0.000000
0.967912	0.017883	0.017310	7.299574	0.148341	0.000000
1.008242	0.017883	0.018031	8.151957	0.150766	0.000000
1.048571	0.017883	0.018752	8.998863	0.153190	0.000000
1.088901	0.017883	0.019473	9.831606	0.155614	0.000000
1.129231	0.017883	0.020194	10.64175	0.158038	0.000000
1.169560	0.017883	0.020916	11.42130	0.160462	0.000000
1.170000	0.017883	0.020924	12.16288	0.160489	0.000000

END FTABLE 1

FTABLE 4

52 4

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.008356	0.000000	0.000000		
0.049451	0.008356	0.000124	0.000000		
0.098901	0.008356	0.000248	0.000000		
0.148352	0.008356	0.000372	0.000000		
0.197802	0.008356	0.000496	0.000000		
0.247253	0.008356	0.000620	0.000000		
0.296703	0.008356	0.000744	0.000000		
0.346154	0.008356	0.000868	0.000000		
0.395604	0.008356	0.000992	0.000000		
0.445055	0.008356	0.001116	0.000000		
0.494505	0.008356	0.001240	0.000000		
0.543956	0.008356	0.001364	0.000000		
0.593407	0.008356	0.001488	0.000942		
0.642857	0.008356	0.001612	0.001126		
0.692308	0.008356	0.001736	0.001558		
0.741758	0.008356	0.001860	0.002077		
0.791209	0.008356	0.001983	0.002689		
0.840659	0.008356	0.002107	0.003399		
0.890110	0.008356	0.002231	0.004213		
0.939560	0.008356	0.002355	0.005134		
0.989011	0.008356	0.002479	0.006167		
1.038462	0.008356	0.002603	0.007317		
1.087912	0.008356	0.002727	0.008587		
1.137363	0.008356	0.002851	0.009981		
1.186813	0.008356	0.002975	0.011504		
1.236264	0.008356	0.003099	0.013158		
1.285714	0.008356	0.003223	0.014948		
1.335165	0.008356	0.003347	0.016877		
1.384615	0.008356	0.003471	0.018948		
1.434066	0.008356	0.003595	0.021165		
1.483516	0.008356	0.003719	0.023530		
1.532967	0.008356	0.003890	0.026048		
1.582418	0.008356	0.004062	0.028720		
1.631868	0.008356	0.004233	0.031550		
1.681319	0.008356	0.004405	0.033168		
1.730769	0.008356	0.004576	0.037692		
1.780220	0.008356	0.004748	0.039329		
1.829670	0.008356	0.004919	0.042130		
1.879121	0.008356	0.005091	0.042130		
1.928571	0.008356	0.005262	0.042130		
1.978022	0.008356	0.005434	0.042130		

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2.027473	0.008356	0.005605	0.042130	
2.076923	0.008356	0.005777	0.042130	
2.126374	0.008356	0.005948	0.042130	
2.175824	0.008356	0.006120	0.042130	
2.225275	0.008356	0.006291	0.042130	
2.274725	0.008356	0.006463	0.042130	
2.324176	0.008356	0.006634	0.042130	
2.373626	0.008356	0.006806	0.042130	
2.423077	0.008356	0.006977	0.042130	
2.472527	0.008356	0.007149	0.042130	
2.500000	0.008356	0.015212	0.042130	

END FTABLE 4

FTABLE 3

42 6

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	outflow 3 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.008356	0.000000	0.000000	0.000000	0.000000		
0.049451	0.008356	0.000413	0.000000	0.043519	0.000000		
0.098901	0.008356	0.000826	0.000000	0.044907	0.000000		
0.148352	0.008356	0.001240	0.000000	0.046296	0.000000		
0.197802	0.008356	0.001653	0.000000	0.047685	0.000000		
0.247253	0.008356	0.002066	0.000000	0.049074	0.000000		
0.296703	0.008356	0.002479	0.000000	0.050463	0.000000		
0.346154	0.008356	0.002893	0.000000	0.051852	0.000000		
0.395604	0.008356	0.003306	0.000000	0.053241	0.000000		
0.445055	0.008356	0.003719	0.000000	0.054630	0.000000		
0.494505	0.008356	0.004132	0.000000	0.056019	0.000000		
0.543956	0.008356	0.004545	0.220835	0.057407	0.000000		
0.593407	0.008356	0.004959	0.683479	0.058796	0.000000		
0.642857	0.008356	0.005372	1.291254	0.060185	0.000000		
0.692308	0.008356	0.005785	2.012784	0.061574	0.000000		
0.741758	0.008356	0.006198	2.827810	0.062963	0.000000		
0.791209	0.008356	0.006612	3.719715	0.064352	0.000000		
0.840659	0.008356	0.007025	4.672998	0.065741	0.000000		
0.890110	0.008356	0.007438	5.672260	0.067130	0.000000		
0.939560	0.008356	0.007851	6.701818	0.068519	0.000000		
0.989011	0.008356	0.008264	7.745651	0.069907	0.000000		
1.038462	0.008356	0.008678	8.787553	0.071296	0.000000		
1.087912	0.008356	0.009091	9.811421	0.072685	0.000000		
1.137363	0.008356	0.009504	10.80165	0.074074	0.000000		
1.186813	0.008356	0.009917	11.74359	0.075463	0.000000		
1.236264	0.008356	0.010331	12.62413	0.076852	0.000000		
1.285714	0.008356	0.010744	13.43226	0.078241	0.000000		
1.335165	0.008356	0.011157	14.15972	0.079630	0.000000		
1.384615	0.008356	0.011570	14.80175	0.081019	0.000000		
1.434066	0.008356	0.011983	15.35779	0.082407	0.000000		
1.483516	0.008356	0.012397	15.83232	0.083796	0.000000		
1.532967	0.008356	0.012810	16.23562	0.085185	0.000000		
1.582418	0.008356	0.013223	16.58469	0.086574	0.000000		
1.631868	0.008356	0.013636	17.08966	0.087963	0.000000		
1.681319	0.008356	0.014050	17.45899	0.089352	0.000000		
1.730769	0.008356	0.014463	17.82067	0.090741	0.000000		
1.780220	0.008356	0.014876	18.17515	0.092130	0.000000		
1.829670	0.008356	0.015289	18.52284	0.093519	0.000000		
1.879121	0.008356	0.015702	18.86413	0.094907	0.000000		
1.928571	0.008356	0.016116	19.19935	0.096296	0.000000		
1.978022	0.008356	0.016529	19.52882	0.097685	0.000000		
2.000000	0.008356	0.016713	19.85283	0.098303	0.000000		

END FTABLE 3

FTABLE 5

92 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.086777	0.000000	0.000000	0.000000		
0.022222	0.086777	0.002020	0.002275	0.004375		
0.044444	0.086777	0.003967	0.003218	0.004375		
0.066667	0.086777	0.005896	0.003941	0.004375		
0.088889	0.086777	0.007824	0.004551	0.004375		

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0.111111	0.086777	0.009752	0.005088	0.004375
0.133333	0.086777	0.011681	0.005574	0.004375
0.155556	0.086777	0.013609	0.006020	0.004375
0.177778	0.086777	0.015537	0.006436	0.004375
0.200000	0.086777	0.017466	0.006826	0.004375
0.222222	0.086777	0.019394	0.007196	0.004375
0.244444	0.086777	0.021323	0.007547	0.004375
0.266667	0.086777	0.023251	0.007883	0.004375
0.288889	0.086777	0.025179	0.008204	0.004375
0.311111	0.086777	0.027108	0.008514	0.004375
0.333333	0.086777	0.029036	0.008813	0.004375
0.355556	0.086777	0.030964	0.009102	0.004375
0.377778	0.086777	0.032893	0.009382	0.004375
0.400000	0.086777	0.034821	0.009654	0.004375
0.422222	0.086777	0.036750	0.009919	0.004375
0.444444	0.086777	0.038678	0.010176	0.004375
0.466667	0.086777	0.040606	0.010428	0.004375
0.488889	0.086777	0.042535	0.010673	0.004375
0.511111	0.086777	0.044463	0.010913	0.004375
0.533333	0.086777	0.046391	0.011148	0.004375
0.555556	0.086777	0.048320	0.011377	0.004375
0.577778	0.086777	0.050248	0.011603	0.004375
0.600000	0.086777	0.052177	0.011824	0.004375
0.622222	0.086777	0.054105	0.012041	0.004375
0.644444	0.086777	0.056033	0.012254	0.004375
0.666667	0.086777	0.057962	0.012463	0.004375
0.688889	0.086777	0.059890	0.012669	0.004375
0.711111	0.086777	0.061818	0.012872	0.004375
0.733333	0.086777	0.063747	0.013072	0.004375
0.755556	0.086777	0.065675	0.013268	0.004375
0.777778	0.086777	0.067604	0.013462	0.004375
0.800000	0.086777	0.069532	0.013653	0.004375
0.822222	0.086777	0.071460	0.013841	0.004375
0.844444	0.086777	0.073389	0.014027	0.004375
0.866667	0.086777	0.075317	0.014210	0.004375
0.888889	0.086777	0.077245	0.014391	0.004375
0.911111	0.086777	0.079174	0.014570	0.004375
0.933333	0.086777	0.081102	0.014747	0.004375
0.955556	0.086777	0.083031	0.014921	0.004375
0.977778	0.086777	0.084959	0.015094	0.004375
1.000000	0.086777	0.086887	0.015264	0.004375
1.022222	0.086777	0.088816	0.015433	0.004375
1.044444	0.086777	0.090744	0.015600	0.004375
1.066667	0.086777	0.092672	0.015765	0.004375
1.088889	0.086777	0.094601	0.015928	0.004375
1.111111	0.086777	0.096529	0.016090	0.004375
1.133333	0.086777	0.098458	0.016250	0.004375
1.155556	0.086777	0.100386	0.016409	0.004375
1.177778	0.086777	0.102314	0.016566	0.004375
1.200000	0.086777	0.104243	0.016721	0.004375
1.222222	0.086777	0.106171	0.016875	0.004375
1.244444	0.086777	0.108099	0.017028	0.004375
1.266667	0.086777	0.110028	0.017180	0.004375
1.288889	0.086777	0.111956	0.017330	0.004375
1.311111	0.086777	0.113885	0.017478	0.004375
1.333333	0.086777	0.115813	0.017626	0.004375
1.355556	0.086777	0.117741	0.017772	0.004375
1.377778	0.086777	0.119670	0.017917	0.004375
1.400000	0.086777	0.121598	0.018061	0.004375
1.422222	0.086777	0.123526	0.018232	0.004375
1.444444	0.086777	0.125455	0.019359	0.004375
1.466667	0.086777	0.127383	0.021147	0.004375
1.488889	0.086777	0.129312	0.023376	0.004375
1.511111	0.086777	0.131240	0.025957	0.004375
1.533333	0.086777	0.133168	0.028835	0.004375
1.555556	0.086777	0.135097	0.031973	0.004375
1.577778	0.086777	0.137025	0.035342	0.004375
1.600000	0.086777	0.138953	0.038920	0.004375
1.622222	0.086777	0.140882	0.042688	0.004375
1.644444	0.086777	0.142810	0.046630	0.004375

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  1.666667  0.086777  0.144738  0.050732  0.004375
  1.688889  0.086777  0.146667  0.054984  0.004375
  1.711111  0.086777  0.148595  0.059374  0.004375
  1.733333  0.086777  0.150524  0.063893  0.004375
  1.755556  0.086777  0.152452  0.068532  0.004375
  1.777778  0.086777  0.154380  0.073284  0.004375
  1.800000  0.086777  0.156309  0.078140  0.004375
  1.822222  0.086777  0.158237  0.083096  0.004375
  1.844444  0.086777  0.160165  0.088143  0.004375
  1.866667  0.086777  0.162094  0.093277  0.004375
  1.888889  0.086777  0.164022  0.098492  0.004375
  1.911111  0.086777  0.165951  0.103783  0.004375
  1.933333  0.086777  0.167879  0.122333  0.004375
  1.955556  0.086777  0.169807  0.177208  0.004375
  1.977778  0.086777  0.171736  0.253351  0.004375
  2.000000  0.086777  0.173664  0.345629  0.004375
  2.022222  0.086777  0.175592  0.451047  0.004375
  END FTABLE  5
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL     1             PERLND   1 999 EXTNL   PREC
WDM      2 PREC     ENGL     1             IMPLND   1 999 EXTNL   PREC
WDM      1 EVAP     ENGL     1             PERLND   1 999 EXTNL   PETINP
WDM      1 EVAP     ENGL     1             IMPLND   1 999 EXTNL   PETINP
WDM      2 PREC     ENGL     1             RCHRES   1     EXTNL   PREC
WDM      2 PREC     ENGL     1             RCHRES   3     EXTNL   PREC
WDM      1 EVAP     ENGL     0.5           RCHRES   1     EXTNL   POTEV
WDM      1 EVAP     ENGL     0.7           RCHRES   2     EXTNL   POTEV
WDM      1 EVAP     ENGL     0.5           RCHRES   3     EXTNL   POTEV
WDM      1 EVAP     ENGL     0.7           RCHRES   4     EXTNL   POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   #  <Name>    tem strg strg***
RCHRES   5 HYDR   RO      1 1         1    WDM   1040 FLOW     ENGL      REPL
RCHRES   5 HYDR   O       1 1         1    WDM   1041 FLOW     ENGL      REPL
RCHRES   5 HYDR   O       2 1         1    WDM   1042 FLOW     ENGL      REPL
RCHRES   5 HYDR   STAGE   1 1         1    WDM   1043 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN    1 1      12.1    WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN    1 1      12.1    WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>    <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
RCHRES     ROFLOW                          RCHRES         INFLOW
  END MASS-LINK    6

  MASS-LINK        7
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    7
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  MASS-LINK         8
RCHRES      OFLOW   OVOL    2                   RCHRES          INFLOW IVOL
  END MASS-LINK     8

  MASS-LINK        16
RCHRES      ROFLOW                              COPY            INPUT  MEAN
  END MASS-LINK    16

  MASS-LINK        17
RCHRES      OFLOW   OVOL    1                   COPY            INPUT  MEAN
  END MASS-LINK    17


END MASS-LINK

END RUN
```

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```
ERROR/WARNING ID:    238    1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1962/ 6/30 24: 0

RCHRES :     1

RELERR        STORS         STOR        MATIN       MATDIF
-1.000E+00      0.00000  0.0000E+00      0.00000  2.6360E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:    238    1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1962/ 6/30 24: 0

RCHRES :     3

RELERR        STORS         STOR        MATIN       MATDIF
-1.000E+00      0.00000  0.0000E+00      0.00000  1.9770E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:    238    1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
```

DRAFT

DATE/TIME: 1963/ 6/30 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-1.000E+00	0.00000	0.0000E+00	0.00000	3.0345E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1963/ 6/30 24: 0

RCHRES : 3

RELERR	STORS	STOR	MATIN	MATDIF
-1.000E+00	0.00000	0.0000E+00	0.00000	2.2759E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1976/ 6/30 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-3.697E-01	0.00000	0.0000E+00	0.00000	3.7344E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.

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REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1976/ 6/30 24: 0

RCHRES : 3

RELERR	STORS	STOR	MATIN	MATDIF
-3.697E-01	0.00000	0.0000E+00	0.00000	2.8008E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

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ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1977/ 7/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-1.000E+00	0.00000	0.0000E+00	0.00000	1.2596E-11

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1977/ 7/31 24: 0

RCHRES : 3

RELERR	STORS	STOR	MATIN	MATDIF
-1.000E+00	0.00000	0.0000E+00	0.00000	9.4471E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1982/ 6/30 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-1.000E+00	0.00000	0.0000E+00	0.00000	3.7183E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

The count for the WARNING printed above has reached its maximum.

If the condition is encountered again the message will not be repeated.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:

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DATE/TIME: 1982/ 6/30 24: 0

RCHRES : 3

RELERR	STORS	STOR	MATIN	MATDIF
-1.000E+00	0.00000	0.0000E+00	0.00000	2.7887E-12

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

The count for the WARNING printed above has reached its maximum.

If the condition is encountered again the message will not be repeated.

ERROR/WARNING ID: 341 6

DATE/TIME: 1995/ 1/ 4 21: 0

RCHRES: 5

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
92	7.5648E+03	7648.8	7943.0

ERROR/WARNING ID: 341 5

DATE/TIME: 1995/ 1/ 4 21: 0

RCHRES: 5

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	7560.0	-3.405E+04	4.5034	4.5034E+00	2

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ATTACHMENT 3
Structural BMP Maintenance Information

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Preliminary Design/Planning/CEQA level submittal:

Attachment 3 must identify:

- ☐ Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual

Final Design level submittal:

Attachment 3 must identify:

- ☐ Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
- ☐ How to access the structural BMP(s) to inspect and perform maintenance
- ☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds for BMPs subject to siltation or heavy trash(e.g., silt level posts or other markings shall be included in all BMP components that will trap and store sediment, trash, and/or debris, so that the inspector may determine how full the BMP is, and the maintenance personnel may determine where the bottom of the BMP is . If required, posts or other markings shall be indicated and described on structural BMP plans.)
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

ATTACHMENT 4
City standard Single Sheet BMP (SSBMP) Exhibit

[Use the City's standard Single Sheet BMP Plan.]