SWMM Model Inputs

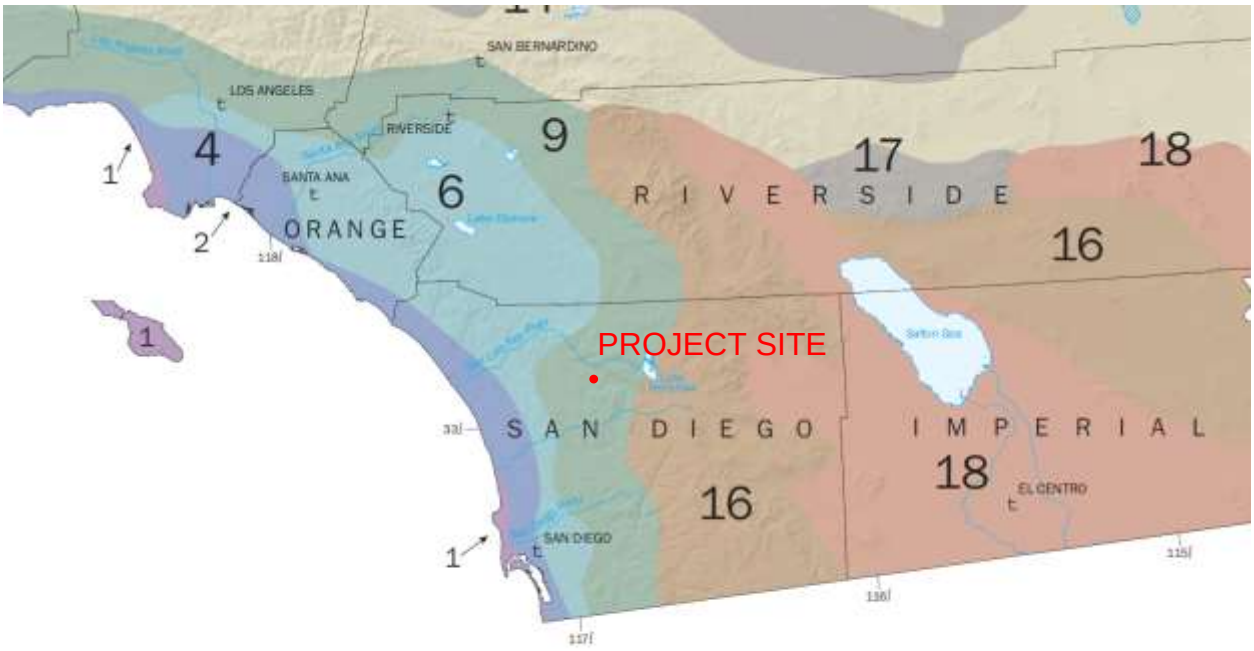


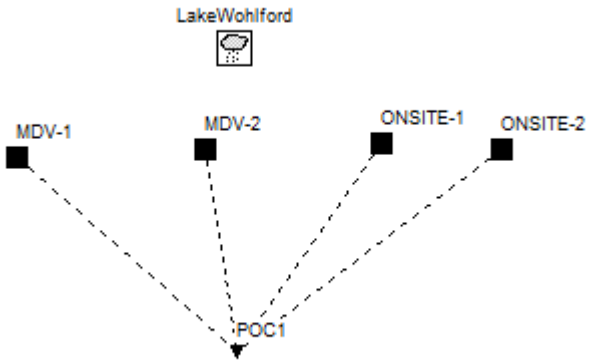
Figure G.1-2: California Irrigation Management Information System "Reference Evapotranspiration Zones"

Table G.1-1: Monthly Average Reference Evapotranspiration by ETo Zone (inches/month and inches/day) for use in SWMM Models for Hydromodification Management Studies in San Diego County CIMIS Zones 1, 4, 6, 9, and 16 (See CIMIS ETo Zone Map)

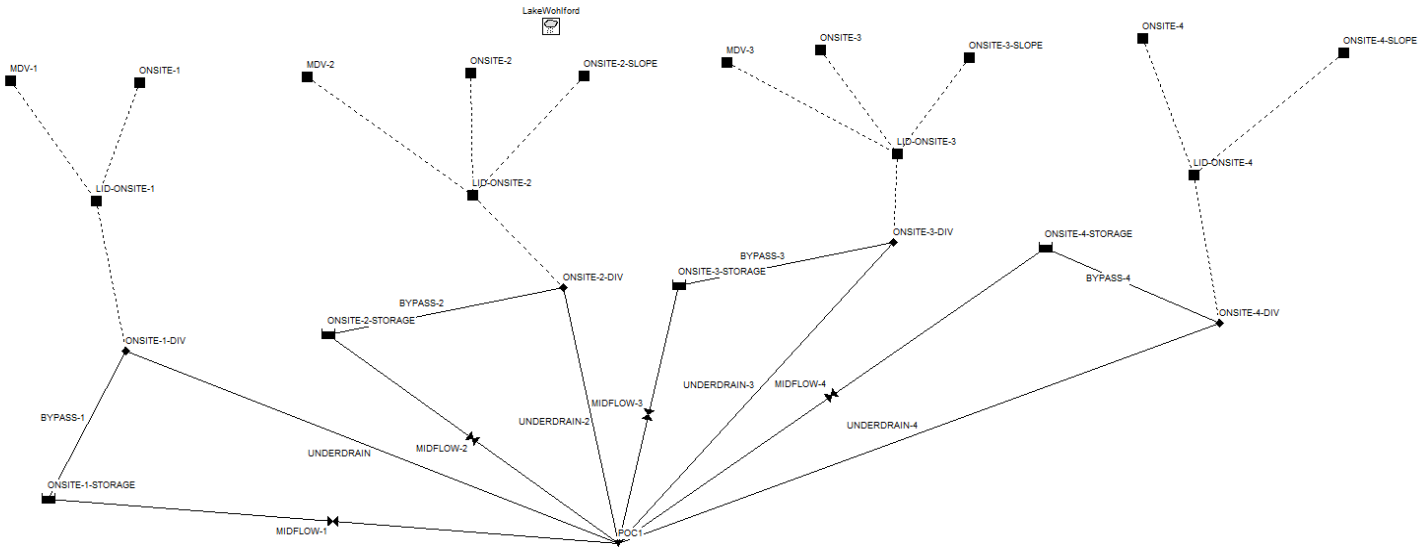
	January	February	March	April	May	June	July	August	September	October	November	December
Zone	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month
1	0.93	1.4	2.48	3.3	4.03	4.5	4.65	4.03	3.3	2.48	1.2	0.62
4	1.86	2.24	3.41	4.5	5.27	5.7	5.89	5.58	4.5	3.41	2.4	1.86
6	1.86	2.24	3.41	4.8	5.58	6.3	6.51	6.2	4.8	3.72	2.4	1.86
9	2.17	2.8	4.03	5.1	5.89	6.6	7.44	6.82	5.7	4.03	2.7	1.86
16	1.55	2.52	4.03	5.7	7.75	8.7	9.3	8.37	6.3	4.34	2.4	1.55
	January	February	March	April	May	June	July	August	September	October	November	December
Days	31	28	31	30	31	30	31	31	30	31	30	31
Zone	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day
1	0.030	0.050	0.080	0.110	0.130	0.150	0.150	0.130	0.110	0.080	0.040	0.020
4	0.060	0.080	0.110	0.150	0.170	0.190	0.190	0.180	0.150	0.110	0.080	0.060
6	0.060	0.080	0.110	0.160	0.180	0.210	0.210	0.200	0.160	0.120	0.080	0.060
9	0.070	0.100	0.130	0.170	0.190	0.220	0.240	0.220	0.190	0.130	0.090	0.060
16	0.050	0.090	0.130	0.190	0.250	0.290	0.300	0.270	0.210	0.140	0.080	0.050

POC-1

Pre-Project



Post-Project



```
[TITLE]
;;Project Title/Notes
Shady Oak-Pre-Project Condition

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           10/08/1949
START_TIME           04:00:00
REPORT_START_DATE    10/08/1949
REPORT_START_TIME    04:00:00
END_DATE             05/23/2008
END_TIME             21:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          .07    .1     .13    .17    .19    .22    .24    .22    .19    .13    .09    .06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
LakeWohlford     INTENSITY 1:00     1.0      TIMESERIES TS-LAKEWOHLFORD

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Exist. Offsite Mirar De Valle Pavement and pervious area(Type C Soil)
MDV-1            LakeWohlford     poc1             1.58     26       160      1.66     0
;ONSITE WITHIN TYPE C SOIL
ONSITE-1         LakeWohlford     POC1             1.16     0        135      2.7      0
;Existing Offsite Mirar De Valle Pavement (Type D Soil)
MDV-2            LakeWohlford     poc1             .44      0        31.5     1.9      0
;ONSITE WITHIN TYPE D SOIL
ONSITE-2         LakeWohlford     POC1             3.67     0        410      2.6      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
MDV-1            .012       .15        0.05       .1         25         OUTLET
ONSITE-1         .012       .15        0.05       .1         25         OUTLET
MDV-2            .012       .15        0.05       .1         25         OUTLET
ONSITE-2         .012       .15        0.05       .1         25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
MDV-1            6          .1         .32
ONSITE-1         6          .1         .32
MDV-2            9          .025       .33
ONSITE-2         9          .025       .33
```

```
[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC1             0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
TS-LAKEWOHLFORD  FILE "lakewohlford.dat"

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC1             3112.544           5193.435

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
MDV-1            1846.951           6306.099
ONSITE-1         3941.312           6386.651
MDV-2            2928.654           6352.129
ONSITE-2         4631.761           6352.129

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
LakeWohlford     3112.544           6916.764
```

```
[TITLE]
;;Project Title/Notes
Shady Oak-Post-Project Condition

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           10/08/1949
START_TIME           04:00:00
REPORT_START_DATE    10/08/1949
REPORT_START_TIME    04:00:00
END_DATE             05/23/2008
END_TIME             21:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
MONTHLY          .07    .1     .13    .17    .19    .22    .24    .22    .19    .13    .09    .06
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- ------ ------ ----------
LakeWohlford     INTENSITY 1:00     1.0      TIMESERIES TS-LAKEWOHLFORD

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
;Exist. Offsite Mirar De Valle Pavement (Type C Soil)
MDV-1            LakeWohlford     LID-ONSITE-1     1.58     26       160      1.66     0
;ONSITE WITHIN TYPE C SOIL
ONSITE-1         LakeWohlford     LID-ONSITE-1     1.06     62       128      1.6      0
;Existing Offsite Mirar De Valle Pavement (Type D Soil)
MDV-2            LakeWohlford     LID-ONSITE-2     .18      67       31.5     1.9      0
;ONSITE WITHIN TYPE D SOIL
ONSITE-2         LakeWohlford     LID-ONSITE-2     1.044    64       128      1.8      0
;Biofiltration Basin 1
LID-ONSITE-1     LakeWohlford     ONSITE-1-DIV     .04      0        17.3     0        0
;Biofiltration Basin 4
LID-ONSITE-4     LakeWohlford     ONSITE-4-DIV     .033     0        13.3     0        0
;Biofiltration Basin 3
LID-ONSITE-3     LakeWohlford     ONSITE-3-DIV     .031     0        13.3     0        0
;Biofiltration Basin 2
LID-ONSITE-2     LakeWohlford     ONSITE-2-DIV     .032     0        13.3     0        0
MDV-3            LakeWohlford     LID-ONSITE-3     .28      71       31.5     1.67     0
ONSITE-3         LakeWohlford     LID-ONSITE-3     1.04     62       128      2.1      0
ONSITE-4         LakeWohlford     LID-ONSITE-4     1.467    59       128      2.75     0
;2:1 Slope from Residential Pads to Basin
ONSITE-2-SLOPE   LakeWohlford     LID-ONSITE-2     .021     0        6.8      50       0
ONSITE-3-SLOPE   LakeWohlford     LID-ONSITE-3     .023     0        6.8      50       0
ONSITE-4-SLOPE   LakeWohlford     LID-ONSITE-4     .018     0        6.8      50       0
```

```
[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
MDV-1            .012       .15        0.05       .1         25         OUTLET
ONSITE-1         .012       .15        0.05       .1         25         OUTLET
MDV-2            .012       .15        0.05       .1         25         OUTLET
ONSITE-2         .012       .15        0.05       .1         25         OUTLET
LID-ONSITE-1     .012       .15        0.05       .1         25         OUTLET
LID-ONSITE-4     .012       .15        0.05       .1         25         OUTLET
LID-ONSITE-3     .012       .15        0.05       .1         25         OUTLET
LID-ONSITE-2     .012       .15        0.05       .1         25         OUTLET
MDV-3            .012       .15        0.05       .1         25         OUTLET
ONSITE-3         .012       .15        0.05       .1         25         OUTLET
ONSITE-4         .012       .15        0.05       .1         25         OUTLET
ONSITE-2-SLOPE   .012       .15        0.05       .1         25         OUTLET
ONSITE-3-SLOPE   .012       .15        0.05       .1         25         OUTLET
ONSITE-4-SLOPE   .012       .15        0.05       .1         25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    Ksat       IMD
;;-------------- ---------- ---------- ----------
MDV-1            6          .075       .32
ONSITE-1         6          .075       .32
MDV-2            9          .01875     .33
ONSITE-2         9          .01875     .33
LID-ONSITE-1     6          .075       .32
LID-ONSITE-4     9          .01875     .33
LID-ONSITE-3     9          .01875     .33
LID-ONSITE-2     9          .01875     .33
MDV-3            9          .01875     .33
ONSITE-3         9          .01875     .33
ONSITE-4         9          .01875     .33
ONSITE-2-SLOPE   9          .01875     .33
ONSITE-3-SLOPE   9          .01875     .33
ONSITE-4-SLOPE   9          .025       .33

[LID_CONTROLS]
;;Name           Type/Layer Parameters
;;-------------- ---------- ----------
LID-ONSITE-1     BC
LID-ONSITE-1     SURFACE    12         0.0        0          0          5
LID-ONSITE-1     SOIL       18         .4         0.2        0.1        5          5          1.5
LID-ONSITE-1     STORAGE    12         .67        0          0
LID-ONSITE-1     DRAIN      .4831      0.5        0          6

LID-ONSITE-2     BC
LID-ONSITE-2     SURFACE    13.41      0          0          0          5
LID-ONSITE-2     SOIL       18         0.4        0.2        0.1        5          5          1.5
LID-ONSITE-2     STORAGE    12         .67        0          0
LID-ONSITE-2     DRAIN      .0846      0.5        0          6

LID-ONSITE-3     BC
LID-ONSITE-3     SURFACE    12.18      0.0        0          0          5
LID-ONSITE-3     SOIL       18         0.4        0.2        0.1        5          5          1.5
LID-ONSITE-3     STORAGE    12         .67        0          0
LID-ONSITE-3     DRAIN      .3756      0.5        0          6

LID-ONSITE-4     BC
LID-ONSITE-4     SURFACE    12.21      0.0        0          0          5
LID-ONSITE-4     SOIL       18         .4         0.2        0.1        5          5          1.5
LID-ONSITE-4     STORAGE    12         .67        0          0
LID-ONSITE-4     DRAIN      .0875      0.5        0          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSat    FromImp    ToPerv     RptFile
DrainTo
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- ---------------
---------- ----------------
LID-ONSITE-1     LID-ONSITE-1     1       1742.40    0          0          0          0
LID-ONSITE-4     LID-ONSITE-4     1       1437.48    0          0          0          0
LID-ONSITE-3     LID-ONSITE-3     1       1350.36    0          0          0          0
LID-ONSITE-2     LID-ONSITE-2     1       1393.92    0          0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
POC1             0          FREE                        NO

[DIVIDERS]
```

```
;;Name           Elevation  Diverted Link    Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
ONSITE-1-DIV     0          BYPASS-1         CUTOFF     .1101      0          0          0          0
ONSITE-2-DIV     0          BYPASS-2         CUTOFF     .0156      0          0          0          0
ONSITE-3-DIV     0          BYPASS-3         CUTOFF     .0621      0          0          0          0
ONSITE-4-DIV     0          BYPASS-4         CUTOFF     .0156      0          0          0          0

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi
Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- --------
-------- --------
ONSITE-1-STORAGE 0        1          0          TABULAR    StorageCurve-1               0        0
ONSITE-2-STORAGE 0        1          0          TABULAR    StorageCurve-2               0        0
ONSITE-3-STORAGE 0        1          0          TABULAR    StorageCurve-3               0        0
ONSITE-4-STORAGE 0        1          0          TABULAR    StorageCurve-4               0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ------
----
BYPASS-1         ONSITE-1-DIV     ONSITE-1-STORAGE 400        0.01       0          0          0          0
UNDERDRAIN       ONSITE-1-DIV     POC1             400        0.013      0          0          0          0
BYPASS-2         ONSITE-2-DIV     ONSITE-2-STORAGE 400        0.01       0          0          0          0
UNDERDRAIN-2     ONSITE-2-DIV     POC1             400        0.01       0          0          0          0
BYPASS-3         ONSITE-3-DIV     ONSITE-3-STORAGE 400        0.01       0          0          0          0
BYPASS-4         ONSITE-4-DIV     ONSITE-4-STORAGE 400        0.01       0          0          0          0
UNDERDRAIN-3     ONSITE-3-DIV     POC1             400        0.01       0          0          0          0
UNDERDRAIN-4     ONSITE-4-DIV     POC1             400        0.01       0          0          0          0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type           QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- -------------- ---------------- ---------- ------
--
MIDFLOW-1        ONSITE-1-STORAGE POC1             0          TABULAR/DEPTH  RatingCurve-1               NO
MIDFLOW-2        ONSITE-2-STORAGE POC1             0          TABULAR/DEPTH  RatingCurve-2               NO
MIDFLOW-3        ONSITE-3-STORAGE POC1             0          TABULAR/DEPTH  RatingCurve-3               NO
MIDFLOW-4        ONSITE-4-STORAGE POC1             0          TABULAR/DEPTH  RatingCurve-4               NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
BYPASS-1         DUMMY        0                0          0          0          1
UNDERDRAIN       CIRCULAR     0.33             0          0          0          1
BYPASS-2         DUMMY        0                0          0          0          1
UNDERDRAIN-2     CIRCULAR     0.33             0          0          0          1
BYPASS-3         DUMMY        0                0          0          0          1
BYPASS-4         DUMMY        0                0          0          0          1
UNDERDRAIN-3     CIRCULAR     0.33             0          0          0          1
UNDERDRAIN-4     CIRCULAR     0.33             0          0          0          1

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
RatingCurve-1    Rating     0          0.000
RatingCurve-1               0.083      0.030
RatingCurve-1               0.167      0.043
RatingCurve-1               0.250      0.052
RatingCurve-1               0.333      0.061
RatingCurve-1               0.417      0.068
RatingCurve-1               0.500      0.074
RatingCurve-1               0.583      0.080
RatingCurve-1               0.667      0.086
RatingCurve-1               0.750      0.091
RatingCurve-1               0.833      0.762
RatingCurve-1               0.917      1.985
RatingCurve-1               1.000      3.566
;
RatingCurve-2    Rating     0          0.000
RatingCurve-2               0.083      0.030
RatingCurve-2               0.167      0.043
RatingCurve-2               0.250      0.052
RatingCurve-2               0.333      0.061
RatingCurve-2               0.417      0.068
RatingCurve-2               0.500      0.074
RatingCurve-2               0.583      0.080
RatingCurve-2               0.667      0.086
RatingCurve-2               0.750      0.091
```

```
RatingCurve-2               0.833      0.762
RatingCurve-2               0.917      1.985
RatingCurve-2               1.000      3.566
;
RatingCurve-3    Rating     0          0.000
RatingCurve-3               0.083      0.030
RatingCurve-3               0.167      0.043
RatingCurve-3               0.250      0.052
RatingCurve-3               0.333      0.061
RatingCurve-3               0.417      0.068
RatingCurve-3               0.500      0.074
RatingCurve-3               0.583      0.080
RatingCurve-3               0.667      0.086
RatingCurve-3               0.750      0.091
RatingCurve-3               0.833      0.762
RatingCurve-3               0.917      1.985
RatingCurve-3               1.000      3.566
;
RatingCurve-4    Rating     0          0.000
RatingCurve-4               0.083      0.030
RatingCurve-4               0.167      0.043
RatingCurve-4               0.250      0.052
RatingCurve-4               0.333      0.061
RatingCurve-4               0.417      0.068
RatingCurve-4               0.500      0.074
RatingCurve-4               0.583      0.080
RatingCurve-4               0.667      0.086
RatingCurve-4               0.750      0.091
RatingCurve-4               0.833      0.762
RatingCurve-4               0.917      1.985
RatingCurve-4               1.000      3.566
;
StorageCurve-1   Storage    0          1750.00
StorageCurve-1              0.083      1750.00
StorageCurve-1              0.167      1750.00
StorageCurve-1              0.250      1750.00
StorageCurve-1              0.333      1750.00
StorageCurve-1              0.417      1750.00
StorageCurve-1              0.500      1750.00
StorageCurve-1              0.583      1750.00
StorageCurve-1              0.667      1750.00
StorageCurve-1              0.750      1750.00
StorageCurve-1              0.833      1750.00
StorageCurve-1              0.917      1750.00
StorageCurve-1              1.000      1750.00
;
StorageCurve-2   Storage    0          1203.13
StorageCurve-2              0.083      1224.87
StorageCurve-2              0.167      1246.71
StorageCurve-2              0.250      1268.64
StorageCurve-2              0.333      1290.66
StorageCurve-2              0.417      1312.77
StorageCurve-2              0.500      1334.98
StorageCurve-2              0.583      1357.29
StorageCurve-2              0.667      1379.69
StorageCurve-2              0.750      1402.19
StorageCurve-2              0.833      1424.78
StorageCurve-2              0.917      1447.56
StorageCurve-2              1.000      1470.43
;
StorageCurve-3   Storage    0          1244.61
StorageCurve-3              0.083      1256.51
StorageCurve-3              0.167      1268.32
StorageCurve-3              0.250      1280.06
StorageCurve-3              0.333      1291.71
StorageCurve-3              0.417      1303.29
StorageCurve-3              0.500      1314.79
StorageCurve-3              0.583      1326.20
StorageCurve-3              0.667      1337.54
StorageCurve-3              0.750      1348.81
StorageCurve-3              0.833      1360.00
StorageCurve-3              0.917      1371.10
StorageCurve-3              1.000      1382.13
;
StorageCurve-4   Storage    0          1337.34
StorageCurve-4              0.083      1348.95
StorageCurve-4              0.167      1360.48
StorageCurve-4              0.250      1374.36
StorageCurve-4              0.333      1385.72
```

```
StorageCurve-4              0.417      1394.56
StorageCurve-4              0.500      1405.77
StorageCurve-4              0.583      1416.89
StorageCurve-4              0.667      1427.93
StorageCurve-4              0.750      1438.89
StorageCurve-4              0.833      1449.77
StorageCurve-4              0.917      1460.57
StorageCurve-4              1.000      1471.30

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
TS-LAKEWOHLFORD  FILE "lakewohlford.dat"

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC1             3880.179           750.280
ONSITE-1-DIV     -1869.965          3049.482
ONSITE-2-DIV     3241.881           3807.391
ONSITE-3-DIV     7094.361           4349.827
ONSITE-4-DIV     10903.337          3383.199
ONSITE-1-STORAGE -2779.056          1277.330
ONSITE-2-STORAGE 489.068            3245.109
ONSITE-3-STORAGE 4585.731           3831.991
ONSITE-4-STORAGE 8866.513           4280.783

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
MDV-1            -3216.341          6283.084
ONSITE-1         -1708.861          6260.069
MDV-2            247.411            6329.114
ONSITE-2         2157.652           6375.144
LID-ONSITE-1     -2215.190          4844.649
LID-ONSITE-4     10604.143          5155.351
LID-ONSITE-3     7140.391           5408.516
LID-ONSITE-2     2180.667           4913.694
MDV-3            5149.597           6501.726
ONSITE-3         6243.001           6651.736
ONSITE-4         10005.754          6789.413
ONSITE-2-SLOPE   3481.013           6340.621
ONSITE-3-SLOPE   7980.437           6559.264
ONSITE-4-SLOPE   12353.280          6616.801

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
LakeWohlford     3112.544           6916.764
```

SWMM - LID Control Calculations

PARAMETER	ABBREV.	LID Onsite-1 ("Bio-Retention Cell")		LID Onsite-2 ("Bio-Retention Cell")		LID Onsite-3 ("Bio-Retention Cell")		LID Onsite-4 ("Bio-Retention Cell")	
Ponding Depth	PD	12	in	12	in	12	in	12	in
Bioretention Soil Layer	S	18	in	18	in	18	in	18	in
Gravel Layer	G	12	in	12	in	12	in	12	in
TOTAL		3.5 42	ft in	3.5 42	ft in	3.5 42	ft in	3.5 42	ft in
Orifice Coefficient	c_g	0.6	--	0.6	--	0.6	--	0.6	--
Low Flow Orifice Diameter	D	1.6	in	0.6	in	1.2	in	0.6	in
Drain exponent	n	0.5	--	0.5	--	0.5	--	0.5	--
Flow Rate (volumetric)	Q	0.125	cfs	0.018	cfs	0.070	cfs	0.018	cfs
Ponding Depth Surface Area	A_{PD}	1750	ft^2	1405	ft^2	1266	ft^2	1359	ft^2
Bioretention Surface Area	A_S, A_G	1750	ft^2	1138	ft^2	1230	ft^2	1312	ft^2
Porosity of Bioretention Soil	n	0.40	-	0.40	-	0.40	-	0.40	-
Effective Ponding Depth	PD_{eff}	**12.00**	in	**13.41**	in	**12.18**	in	**12.21**	in
Flow Coefficient	C	**0.4831**	--	**0.0846**	--	**0.3756**	--	**0.0875**	--
Cutoff Flow	Q_{cutoff}	**0.1101**	cfs	**0.0156**	cfs	**0.0621**	cfs	**0.0156**	cfs

LID Onsite-1		LID Onsite-2		LID Onsite-3		LID Onsite-4		
Ponding Depth, h (feet)	Area (ft^2)	Ponding Depth, h (feet)	Area (ft^2)	Ponding Depth, h (feet)	Area (ft^2)	Ponding Depth, h (feet)	Area (ft^2)	
0	1750.00	0	1203.13	0	1244.61	0	1337.34	Area at 3" above bottom of basin
0.083	1750.00	0.083	1224.87	0.083	1256.51	0.083	1348.95	
0.167	1750.00	0.167	1246.71	0.167	1268.32	0.167	1360.48	
0.250	1750.00	0.250	1268.64	0.250	1280.06	0.250	1374.36	
0.333	1750.00	0.333	1290.66	0.333	1291.71	0.333	1385.72	
0.417	1750.00	0.417	1312.77	0.417	1303.29	0.417	1394.56	
0.500	1750.00	0.500	1334.98	0.500	1314.79	0.500	1405.77	
0.583	1750.00	0.583	1357.29	0.583	1326.20	0.583	1416.89	
0.667	1750.00	0.667	1379.69	0.667	1337.54	0.667	1427.93	
0.750	1750.00	0.750	1402.19	0.750	1348.81	0.750	1438.89	
0.833	1750.00	0.833	1424.78	0.833	1360.00	0.833	1449.77	
0.917	1750.00	0.917	1447.56	0.917	1371.10	0.917	1460.57	
1.000	1750.00	1.000	1470.43	1.000	1382.13	1.000	1471.30	
1.083	1750.00	1.083	1493.40	1.083	1393.09	1.083	1481.94	
1.167	1750.00	1.167	1516.47	1.167	1403.97	1.167	1492.51	
1.250	1750.00	1.250	1539.65	1.250	1414.78	1.250	1503.00	
1.333	1750.00	1.333	1562.93	1.333	1423.76	1.333	1513.42	
1.417	1750.00	1.417	1586.32	1.417	1436.15	1.417	1523.75	
1.500	1750.00	1.500	1609.81	1.500	1446.80	1.500	1534.02	
1.583	1750.00	1.583	1633.41	1.583	1448.81	1.583	1544.20	
1.667	1750.00	1.667	1657.13	1.667	1457.46	1.667	1554.32	
1.750	1750.00	1.750	1680.97	1.750	1468.24	1.750	1556.75	

Ponding Depth, h (feet)	Orifice Capacity(ft^3/sec)	Weir Capacity (ft^3/sec)	Total Outflow (ft^3/sec)
0	0.000		0.000
0.083	0.030		0.030
0.167	0.043		0.043
0.250	0.052		0.052
0.333	0.061		0.061
0.417	0.068		0.068
0.500	0.074		0.074
0.583	0.080		0.080
0.667	0.086		0.086
0.750	0.091		0.091
0.833	0.096	0.666117873	0.762
0.917	0.101	1.88406586	1.985
1.000	0.105	3.46125	3.566

Weir Coefficient, C_w	3
Orifice Coefficient, C_o	0.6
Orifice Diameter (inches)	2
Orifice Area,A_e (ft^2)	0.022
Type I Catch Basin Effective Length, L_e (ft)	9.23

Weir equation, $Q = C_w L_e (h)^{3/2}$

Orifice equation, $Q = C_o A_e (2gh)1/2$

SWMM Model Outputs

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)

Shady Oak-Pre-Project Condition

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Starting Date OCT-08-1949 04:00:00
Ending Date MAY-23-2008 21:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Wet Time Step 00:15:00
Dry Time Step 04:00:00

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	571.884	1001.840
Evaporation Loss	21.274	37.268
Infiltration Loss	436.724	765.063
Surface Runoff	118.696	207.935
Final Storage	0.001	0.002
Continuity Error (%)	-0.841	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	118.696	38.679
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	118.696	38.679
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
MDV-1	1001.84	0.00	44.74	681.11	280.97	12.05	1.59	0.280
ONSITE-1	1001.84	0.00	10.12	919.60	73.70	2.32	1.07	0.074
MDV-2	1001.84	0.00	42.70	763.91	206.66	2.47	0.39	0.206
ONSITE-2	1001.84	0.00	41.98	752.50	219.07	21.83	3.99	0.219

Analysis begun on: Tue Jun 13 13:21:26 2017
Analysis ended on: Tue Jun 13 13:21:46 2017
Total elapsed time: 00:00:20

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)

Shady Oak-Post-Project Condition

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date OCT-08-1949 04:00:00
Ending Date MAY-23-2008 21:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Wet Time Step 00:15:00
Dry Time Step 04:00:00
Routing Time Step ..... 60.00 sec

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Initial LID Storage	0.020	0.036
Total Precipitation	571.800	1001.840
Evaporation Loss	64.001	112.134
Infiltration Loss	206.918	362.537
Surface Runoff	77.310	135.453
LID Drainage	227.964	399.412
Final Storage	0.138	0.241
Continuity Error (%)	-0.789	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	305.273	99.478
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	132.393	43.142
Flooding Loss	174.595	56.895
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.003	0.001
Continuity Error (%)	-0.563	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 60.00 sec
Average Time Step : 60.00 sec
Maximum Time Step : 60.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.02

Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
MDV-1	1001.84	0.00	46.97	670.59	289.41	12.42	1.68	0.289
ONSITE-1	1001.84	0.00	96.02	341.76	572.24	16.47	1.32	0.571
MDV-2	1001.84	0.00	111.45	219.77	681.47	3.33	0.23	0.680
ONSITE-2	1001.84	0.00	109.88	242.33	658.92	18.68	1.36	0.658
LID-ONSITE-1	1001.84	26596.03	1133.69	0.00	26460.21	28.74	2.84	0.959
LID-ONSITE-4	1001.84	28085.28	1160.38	0.00	27911.48	25.01	1.75	0.960
LID-ONSITE-3	1001.84	28273.42	1137.55	0.00	28132.50	23.68	1.61	0.961
LID-ONSITE-2	1001.84	25532.23	1154.29	0.00	25365.41	22.04	1.46	0.956
MDV-3	1001.84	0.00	117.93	195.77	697.22	5.30	0.37	0.696
ONSITE-3	1001.84	0.00	107.35	255.69	648.29	18.31	1.35	0.647
ONSITE-4	1001.84	0.00	105.16	276.61	628.67	25.04	1.89	0.628
ONSITE-2-SLOPE	1001.84	0.00	42.14	661.17	307.25	0.18	0.03	0.307
ONSITE-3-SLOPE	1001.84	0.00	42.23	662.20	305.85	0.19	0.03	0.305
ONSITE-4-SLOPE	1001.84	0.00	33.56	723.40	253.19	0.12	0.02	0.253

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Initial Storage in	Final Storage in	Continuity Error %
LID-ONSITE-1	LID-ONSITE-1	27597.87	1133.73	0.00	3910.50	22550.68	1.80	5.82	-0.00
LID-ONSITE-4	LID-ONSITE-4	29087.12	1160.42	0.00	10724.64	17187.87	1.80	16.87	-0.00
LID-ONSITE-3	LID-ONSITE-3	29275.26	1137.59	0.00	4661.76	23471.77	1.80	7.07	-0.00
LID-ONSITE-2	LID-ONSITE-2	26534.07	1154.33	0.00	8528.17	16838.17	1.80	16.02	-0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
POC1	OUTFALL	0.04	0.33	0.33	9 15:54	0.33
ONSITE-1-DIV	DIVIDER	0.01	0.33	0.33	9 15:19	0.33
ONSITE-2-DIV	DIVIDER	0.03	0.33	0.33	9 16:31	0.33
ONSITE-3-DIV	DIVIDER	0.01	0.33	0.33	9 15:23	0.33
ONSITE-4-DIV	DIVIDER	0.03	0.33	0.33	9 15:59	0.33
ONSITE-1-STORAGE	STORAGE	0.00	0.96	0.96	15822 13:16	0.92
ONSITE-2-STORAGE	STORAGE	0.00	0.88	0.88	15822 13:09	0.87
ONSITE-3-STORAGE	STORAGE	0.00	0.89	0.89	15822 13:05	0.87
ONSITE-4-STORAGE	STORAGE	0.00	0.90	0.90	15822 13:16	0.88

****
Node Inflow Summary
****

	Maximum Lateral Inflow	Maximum Total Inflow	Time of Max Occurrence	Lateral Inflow Volume	Total Inflow Volume	Flow Balance Error

Node	Type	CFS	CFS	days	hr:min	10^6 gal	10^6 gal	Percent
POC1	OUTFALL	0.00	7.45	15822	13:16	0	43.1	0.000
ONSITE-1-DIV	DIVIDER	2.84	2.84	15822	13:16	28.7	28.7	0.000
ONSITE-2-DIV	DIVIDER	1.46	1.46	15822	13:16	22	22	0.002
ONSITE-3-DIV	DIVIDER	1.61	1.61	15822	13:16	23.7	23.7	0.000
ONSITE-4-DIV	DIVIDER	1.75	1.75	15822	13:16	25	25	0.002
ONSITE-1-STORAGE	STORAGE	0.00	2.73	15822	13:16	0	4.75	0.145
ONSITE-2-STORAGE	STORAGE	0.00	1.45	15822	13:16	0	7.96	0.084
ONSITE-3-STORAGE	STORAGE	0.00	1.55	15822	13:16	0	4.98	0.108
ONSITE-4-STORAGE	STORAGE	0.00	1.73	15822	13:16	0	10.6	0.085

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
ONSITE-1-DIV	DIVIDER	513905.00	0.330	0.000
ONSITE-2-DIV	DIVIDER	513905.00	0.330	0.000
ONSITE-3-DIV	DIVIDER	513905.00	0.330	0.000
ONSITE-4-DIV	DIVIDER	513905.00	0.330	0.000
ONSITE-1-STORAGE	STORAGE	513905.00	0.955	0.045
ONSITE-2-STORAGE	STORAGE	513905.00	0.881	0.119
ONSITE-3-STORAGE	STORAGE	513905.00	0.888	0.112
ONSITE-4-STORAGE	STORAGE	513905.00	0.900	0.100

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CFS	Time of Max Occurrence days	hr:min	Total Flood Volume 10^6 gal	Maximum Ponded Volume 1000 ft3
ONSITE-1-DIV	18462.18	0.11	4873	02:52	22.501	0.000
ONSITE-2-DIV	44271.13	0.01	4873	02:42	8.794	0.000
ONSITE-3-DIV	20998.77	0.06	4873	02:54	16.470	0.000
ONSITE-4-DIV	44715.23	0.01	4873	02:40	9.126	0.000

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow CFS
ONSITE-1-STORAGE	0.002	0	0	0	1.673	96	15822	13:16	2.71
ONSITE-2-STORAGE	0.003	0	0	0	1.164	87	15822	13:08	1.46
ONSITE-3-STORAGE	0.002	0	0	0	1.163	88	15822	13:04	1.57
ONSITE-4-STORAGE	0.004	0	0	0	1.259	90	15822	13:16	1.73

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
POC1	11.39	0.03	7.45	43.139
System	11.39	0.03	7.45	43.139

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
BYPASS-1	DUMMY	2.73	15822	13:16			
UNDERDRAIN	CONDUIT	0.00	20600	14:14	0.09	1.08	1.00
BYPASS-2	DUMMY	1.45	15822	13:16			
UNDERDRAIN-2	CONDUIT	0.00	6728	21:19	0.10	1.08	1.00
BYPASS-3	DUMMY	1.55	15822	13:16			
BYPASS-4	DUMMY	1.73	15822	13:16			
UNDERDRAIN-3	CONDUIT	0.00	3762	02:47	0.12	1.08	1.00
UNDERDRAIN-4	CONDUIT	0.00	15129	20:25	0.10	1.08	1.00
MIDFLOW-1	DUMMY	2.71	15822	13:16			
MIDFLOW-2	DUMMY	1.46	15822	13:09			
MIDFLOW-3	DUMMY	1.57	15822	13:05			
MIDFLOW-4	DUMMY	1.73	15822	13:16			

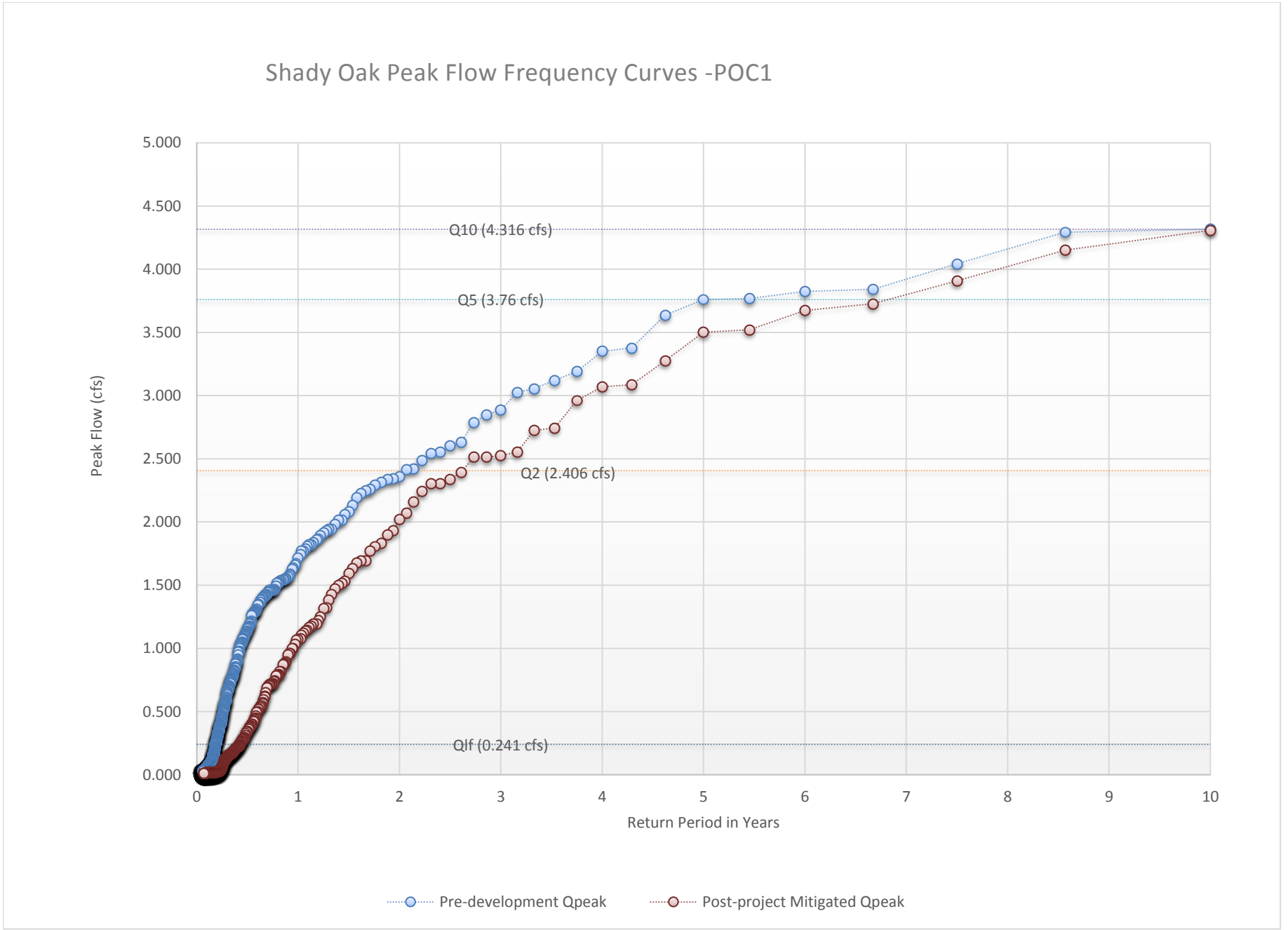
****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
UNDERDRAIN	18466.90	18466.90	18466.90	18117.90	18466.90
UNDERDRAIN-2	44650.97	44650.97	44650.97	45257.82	44650.97
UNDERDRAIN-3	21032.67	21032.67	21032.67	20810.83	21032.67
UNDERDRAIN-4	45055.77	45055.77	45055.77	45707.45	45055.77

Analysis begun on: Wed Jun 14 15:57:44 2017
Analysis ended on: Wed Jun 14 16:00:17 2017
Total elapsed time: 00:02:33

Peak Flow Frequency Summary

Return Period (years)	Pre-development Qpeak (cfs)	Post-project - Mitigated Q (cfs)	Reduction Q (cfs)
LF = 0.1*Q2	0.241	0.198	0.043
2-year	2.406	1.979	0.427
3-year	2.885	2.524	0.361
4-year	3.351	3.069	0.282
5-year	3.760	3.502	0.258
6-year	3.824	3.673	0.151
7-year	3.921	3.799	0.122
8-year	4.160	4.021	0.139
9-year	4.301	4.198	0.102
10-year	4.316	4.308	0.008

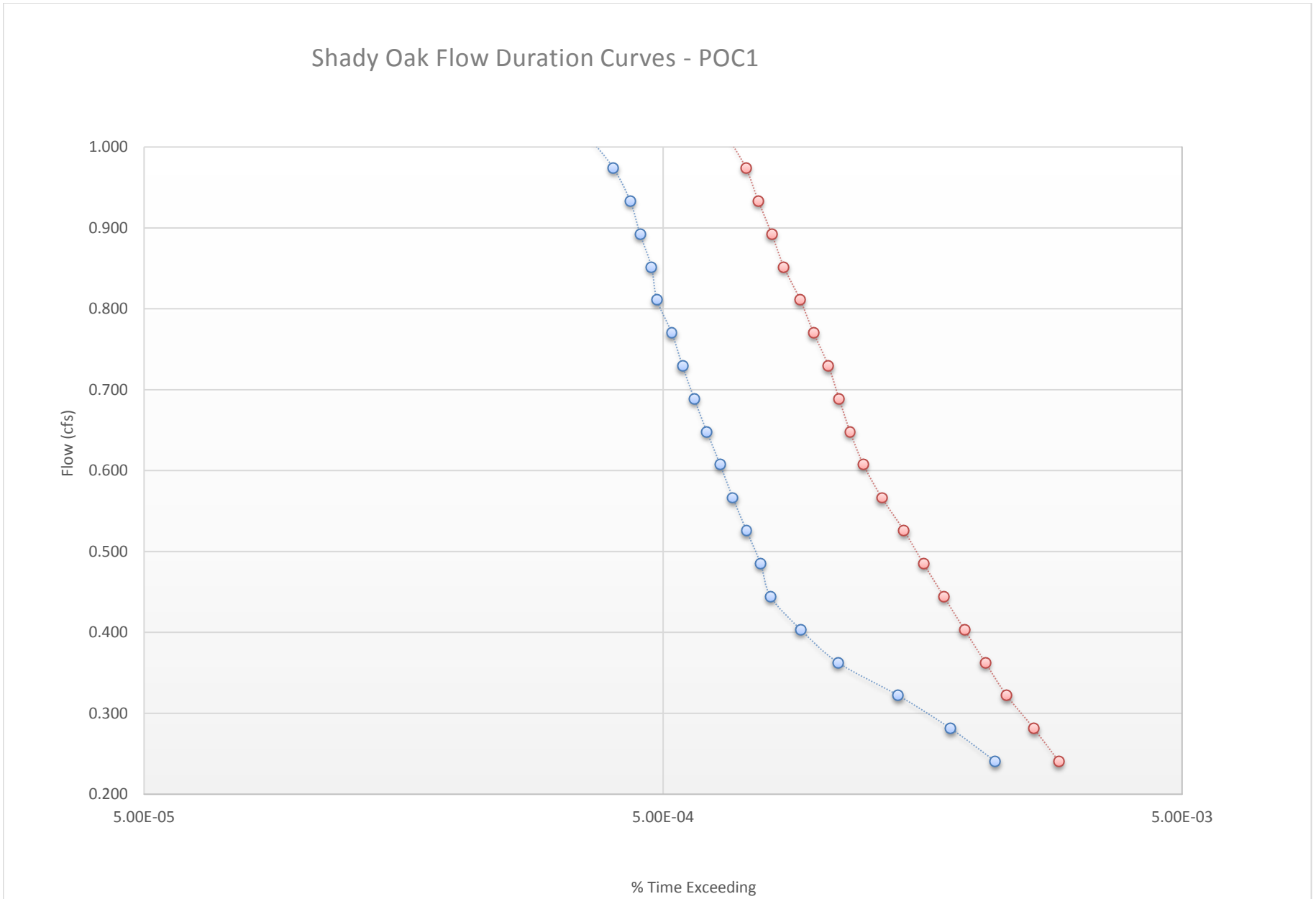

Shady Oak Peak Flow Frequency Curves -POC1
Peak Flow (cfs)
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Q10 (4.316 cfs)
Q5 (3.76 cfs)
Q2 (2.406 cfs)
Qlf (0.241 cfs)
0
1
2
3
4
5
6
7
8
9
10
Return Period in Years
Pre-development Qpeak
Post-project Mitigated Qpeak

Low-flow Threshold:	10%	
0.1xQ2 (Pre):	0.241	cfs
Q10 (Pre):	4.316	cfs
Ordinate #:	100	
Incremental Q (Pre):	0.04075	cfs
Total Hourly Data:	513905	hours

The proposed BMP: PASSED

Beginning of Interval	Pre-develop. Flow (cfs)	Pre-develop. Hours	Pre-develop. % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
1	0.241	1487	2.89E-03	1122	2.18E-03	75%	Pass
2	0.281	1331	2.59E-03	920	1.79E-03	69%	Pass
3	0.322	1180	2.30E-03	729	1.42E-03	62%	Pass
4	0.363	1073	2.09E-03	558	1.09E-03	52%	Pass
5	0.404	978	1.90E-03	473	9.20E-04	48%	Pass
6	0.444	893	1.74E-03	414	8.06E-04	46%	Pass
7	0.485	816	1.59E-03	396	7.71E-04	49%	Pass
8	0.526	748	1.46E-03	372	7.24E-04	50%	Pass
9	0.567	678	1.32E-03	350	6.81E-04	52%	Pass
10	0.607	625	1.22E-03	331	6.44E-04	53%	Pass
11	0.648	589	1.15E-03	312	6.07E-04	53%	Pass
12	0.689	561	1.09E-03	295	5.74E-04	53%	Pass
13	0.730	535	1.04E-03	280	5.45E-04	52%	Pass
14	0.770	501	9.75E-04	267	5.20E-04	53%	Pass
15	0.811	472	9.18E-04	250	4.86E-04	53%	Pass
16	0.852	439	8.54E-04	244	4.75E-04	56%	Pass
17	0.893	416	8.09E-04	232	4.51E-04	56%	Pass
18	0.933	392	7.63E-04	222	4.32E-04	57%	Pass
19	0.974	371	7.22E-04	206	4.01E-04	56%	Pass
20	1.015	341	6.64E-04	184	3.58E-04	54%	Pass
21	1.056	317	6.17E-04	169	3.29E-04	53%	Pass
22	1.096	296	5.76E-04	152	2.96E-04	51%	Pass
23	1.137	280	5.45E-04	141	2.74E-04	50%	Pass
24	1.178	256	4.98E-04	133	2.59E-04	52%	Pass
25	1.219	240	4.67E-04	126	2.45E-04	53%	Pass
26	1.259	231	4.49E-04	121	2.35E-04	52%	Pass
27	1.300	211	4.11E-04	120	2.34E-04	57%	Pass
28	1.341	198	3.85E-04	114	2.22E-04	58%	Pass
29	1.382	184	3.58E-04	112	2.18E-04	61%	Pass
30	1.422	175	3.41E-04	108	2.10E-04	62%	Pass
31	1.463	163	3.17E-04	105	2.04E-04	64%	Pass
32	1.504	156	3.04E-04	98	1.91E-04	63%	Pass
33	1.545	145	2.82E-04	92	1.79E-04	63%	Pass
34	1.585	136	2.65E-04	87	1.69E-04	64%	Pass
35	1.626	130	2.53E-04	81	1.58E-04	62%	Pass
36	1.667	120	2.34E-04	76	1.48E-04	63%	Pass
37	1.708	116	2.26E-04	70	1.36E-04	60%	Pass
38	1.748	110	2.14E-04	68	1.32E-04	62%	Pass
39	1.789	105	2.04E-04	66	1.28E-04	63%	Pass
40	1.830	99	1.93E-04	63	1.23E-04	64%	Pass
41	1.871	93	1.81E-04	62	1.21E-04	67%	Pass
42	1.912	87	1.69E-04	61	1.19E-04	70%	Pass
43	1.952	81	1.58E-04	60	1.17E-04	74%	Pass
44	1.993	76	1.48E-04	59	1.15E-04	78%	Pass
45	2.034	73	1.42E-04	54	1.05E-04	74%	Pass
46	2.075	70	1.36E-04	52	1.01E-04	74%	Pass
47	2.115	67	1.30E-04	51	9.92E-05	76%	Pass
48	2.156	65	1.26E-04	49	9.53E-05	75%	Pass
49	2.197	61	1.19E-04	47	9.15E-05	77%	Pass
50	2.238	59	1.15E-04	46	8.95E-05	78%	Pass
51	2.278	56	1.09E-04	43	8.37E-05	77%	Pass
52	2.319	51	9.92E-05	38	7.39E-05	75%	Pass
53	2.360	48	9.34E-05	37	7.20E-05	77%	Pass

Beginning of Interval	Pre-develop. Flow (cfs)	Pre-develop. Hours	Pre-develop. % Time Exceeding	Post-project Hours	Post-project % Time Exceeding	Percentage	Pass/Fail
54	2.401	47	9.15E-05	35	6.81E-05	74%	Pass
55	2.441	45	8.76E-05	34	6.62E-05	76%	Pass
56	2.482	42	8.17E-05	33	6.42E-05	79%	Pass
57	2.523	40	7.78E-05	31	6.03E-05	78%	Pass
58	2.564	38	7.39E-05	29	5.64E-05	76%	Pass
59	2.604	36	7.01E-05	28	5.45E-05	78%	Pass
60	2.645	35	6.81E-05	28	5.45E-05	80%	Pass
61	2.686	34	6.62E-05	28	5.45E-05	82%	Pass
62	2.727	33	6.42E-05	27	5.25E-05	82%	Pass
63	2.767	33	6.42E-05	26	5.06E-05	79%	Pass
64	2.808	31	6.03E-05	26	5.06E-05	84%	Pass
65	2.849	29	5.64E-05	25	4.86E-05	86%	Pass
66	2.890	28	5.45E-05	24	4.67E-05	86%	Pass
67	2.930	27	5.25E-05	24	4.67E-05	89%	Pass
68	2.971	27	5.25E-05	23	4.48E-05	85%	Pass
69	3.012	26	5.06E-05	21	4.09E-05	81%	Pass
70	3.053	24	4.67E-05	19	3.70E-05	79%	Pass
71	3.093	23	4.48E-05	17	3.31E-05	74%	Pass
72	3.134	21	4.09E-05	17	3.31E-05	81%	Pass
73	3.175	20	3.89E-05	17	3.31E-05	85%	Pass
74	3.216	19	3.70E-05	17	3.31E-05	89%	Pass
75	3.256	19	3.70E-05	17	3.31E-05	89%	Pass
76	3.297	19	3.70E-05	16	3.11E-05	84%	Pass
77	3.338	18	3.50E-05	16	3.11E-05	89%	Pass
78	3.379	16	3.11E-05	16	3.11E-05	100%	*Pass^*
79	3.419	16	3.11E-05	16	3.11E-05	100%	*Pass^*
80	3.460	15	2.92E-05	15	2.92E-05	100%	*Pass^*
81	3.501	14	2.72E-05	15	2.92E-05	107%	*Pass^*
82	3.542	14	2.72E-05	12	2.34E-05	86%	Pass
83	3.582	14	2.72E-05	11	2.14E-05	79%	Pass
84	3.623	13	2.53E-05	11	2.14E-05	85%	Pass
85	3.664	12	2.34E-05	11	2.14E-05	92%	Pass
86	3.705	12	2.34E-05	9	1.75E-05	75%	Pass
87	3.745	12	2.34E-05	8	1.56E-05	67%	Pass
88	3.786	10	1.95E-05	8	1.56E-05	80%	Pass
89	3.827	9	1.75E-05	8	1.56E-05	89%	Pass
90	3.868	8	1.56E-05	8	1.56E-05	100%	*Pass^*
91	3.908	8	1.56E-05	7	1.36E-05	88%	Pass
92	3.949	8	1.56E-05	7	1.36E-05	88%	Pass
93	3.990	8	1.56E-05	7	1.36E-05	88%	Pass
94	4.031	8	1.56E-05	7	1.36E-05	88%	Pass
95	4.071	7	1.36E-05	7	1.36E-05	100%	*Pass^*
96	4.112	7	1.36E-05	7	1.36E-05	100%	*Pass^*
97	4.153	7	1.36E-05	6	1.17E-05	86%	Pass
98	4.194	7	1.36E-05	6	1.17E-05	86%	Pass
99	4.234	7	1.36E-05	6	1.17E-05	86%	Pass
100	4.275	7	1.36E-05	6	1.17E-05	86%	Pass


Shady Oak Flow Duration Curves - POC1
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
Flow (cfs)
5.00E-05
5.00E-04
5.00E-03
% Time Exceeding

CD of SWMM Electronic Files

ATTACHMENT 3

Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

Indicate which Items are Included behind this cover sheet:

Attachment Sequence	Contents	Checklist
Attachment 3a	Structural BMP Maintenance Plan (Required)	☐ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3b	Draft Stormwater Maintenance Notification / Agreement (when applicable)	☐ Included ☒ Not Applicable

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

Attachment 3a must identify:

- ☐ Specific maintenance indicators and actions for proposed structural BMP(s). This must 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 specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ 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 3b: For all Structural BMPs, Attachment 3b must include a draft maintenance agreement in the County's standard format depending on the Category (PDP applicant to contact County staff to obtain the current maintenance agreement forms). Refer to Section 7.3 in the BMP Design Manual for a description of the different categories.

Attachment 3a

Maintenance Indicators and Actions

Maintenance shall be per "Summary of Standard Inspection and Maintenance for BF-1 Biofiltration" provided in the following sheet.

Accessibility to Structural BMPs

Maintenance crews to access the biolfiltration basins through Alleys A-D. Vehicles shall park at the end of the alleys and access the basins through a gate in the 6' CMU sound wall.

Inspection Facilitation Features

Cleanouts at the upstream end of the biofiltration basins and Grated Inlets at the downstream end are provided for each biofiltration basin.

Responsible Party for Maintenance and Funding Mechanism

Structural BMPs will be the responsibility of the developer up until a Homeowner Association is established. The Homeowner Association will charge homeowners a monthly fee for the upkeep of the project which includes maintenance of the Structural BMPs.

BF-1
Biofiltration

BMP MAINTENANCE FACT SHEET
FOR
STRUCTURAL BMP BF-1 BIOFILTRATION

Biofiltration facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Biofiltration facilities have limited or no infiltration. They are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Typical biofiltration components include:

- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure

Normal Expected Maintenance

Biofiltration requires routine maintenance to: remove accumulated materials such as sediment, trash or debris; maintain vegetation health; maintain infiltration capacity of the media layer; replenish mulch; and maintain integrity of side slopes, inlets, energy dissipators, and outlets. A summary table of standard inspection and maintenance indicators is provided within this Fact Sheet.

Non-Standard Maintenance or BMP Failure

If any of the following scenarios are observed, the BMP is not performing as intended to protect downstream waterways from pollution and/or erosion. Corrective maintenance, increased inspection and maintenance, BMP replacement, or a different BMP type will be required.

- The BMP is not drained between storm events. Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.
- Sediment, trash, or debris accumulation greater than 25% of the surface ponding volume within one month. This means the load from the tributary drainage area is too high, reducing BMP function or clogging the BMP. This would require pretreatment measures within the tributary area draining to the BMP to intercept the materials. Pretreatment components, especially for sediment, will extend the life of components that are more expensive to replace such as media, filter course, and aggregate layers.
- Erosion due to concentrated storm water runoff flow that is not readily corrected by adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.

Other Special Considerations

Biofiltration is a vegetated structural BMP. Vegetated structural BMPs that are constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of the United States Army Corps of Engineers, SDRWQCB, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, **routine maintenance is key to preventing this scenario**.

BF-1
Biofiltration

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION		
The property owner is responsible to ensure inspection, operation and maintenance of permanent BMPs on their property unless responsibility has been formally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. Maintenance frequencies listed in this table are average/typical frequencies. Actual maintenance needs are site-specific, and maintenance may be required more frequently. Maintenance must be performed whenever needed, based on maintenance indicators presented in this table. The BMP owner is responsible for conducting regular inspections to see when maintenance is needed based on the maintenance indicators. During the first year of operation of a structural BMP, inspection is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation or compaction of the media layer.	• Inspect monthly. If the BMP is 25% full* or more in one month, increase inspection frequency to monthly plus after every 0.1-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Obstructed inlet or outlet structure	Clear blockage.	• Inspect monthly and after every 0.5-inch or larger storm event. • Remove any accumulated materials found at each inspection.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable	• Inspect annually. • Maintenance when needed.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Dead or diseased vegetation	Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans.	• Inspect monthly. • Maintenance when needed.
Overgrown vegetation	Mow or trim as appropriate.	• Inspect monthly. • Maintenance when needed.
2/3 of mulch has decomposed, or mulch has been removed	Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches.	• Inspect monthly. • Replenish mulch annually, or more frequently when needed based on inspection.

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

SUMMARY OF STANDARD INSPECTION AND MAINTENANCE FOR BF-1 BIOFILTRATION (Continued from previous page)		
Threshold/Indicator	**Maintenance Action**	**Typical Maintenance Frequency**
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.	• Inspect monthly. • Maintenance when needed.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.	• Inspect after every 0.5-inch or larger storm event. If erosion due to storm water flow has been observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in BMP for longer than 24 hours following a storm event Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils.	• Inspect monthly and after every 0.5-inch or larger storm event. If standing water is observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology	If mosquitos/larvae are observed: first, immediately remove any standing water by dispersing to nearby landscaping; second, make corrective measures as applicable to restore BMP drainage to prevent standing water. If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.	• Inspect monthly and after every 0.5-inch or larger storm event. If mosquitos are observed, increase inspection frequency to after every 0.1-inch or larger storm event. • Maintenance when needed.
Underdrain clogged	Clear blockage.	• Inspect if standing water is observed for longer than 24-96 hours following a storm event. • Maintenance when needed.

References

American Mosquito Control Association.
http://www.mosquito.org/
California Storm Water Quality Association (CASQA). 2003. Municipal BMP Handbook.
https://www.casqa.org/resources/bmp-handbooks/municipal-bmp-handbook
County of San Diego. 2014. Low Impact Development Handbook.
http://www.sandiegocounty.gov/content/sdc/dpw/watersheds/susmp/lid.html
San Diego County Copermittees. 2016. Model BMP Design Manual, Appendix E, Fact Sheet BF-1.
http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=250&Itemid=220

Page Intentionally Blank for Double-Sided Printing

BF-1
Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	
Property / Development Name:	Responsible Party Name and Phone Number:	
Property Address of BMP:	Responsible Party Address:	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 1 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Accumulation of sediment, litter, or debris Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove and properly dispose of accumulated materials, without damage to the vegetation ☐ If sediment, litter, or debris accumulation exceeds 25% of the surface ponding volume within one month (25% full*), add a forebay or other pre-treatment measures within the tributary area draining to the BMP to intercept the materials. ☐ Other / Comments:		
Poor vegetation establishment Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		

*"25% full" is defined as ¼ of the depth from the design bottom elevation to the crest of the outflow structure (e.g., if the height to the outflow opening is 12 inches from the bottom elevation, then the materials must be removed when there is 3 inches of accumulation – this should be marked on the outflow structure).

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 2 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Dead or diseased vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove dead or diseased vegetation, re-seed, re-plant, or re-establish vegetation per original plans ☐ Other / Comments:		
Overgrown vegetation Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Mow or trim as appropriate ☐ Other / Comments:		
2/3 of mulch has decomposed, or mulch has been removed Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Remove decomposed fraction and top off with fresh mulch to a total depth of 3 inches ☐ Other / Comments:		

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 3 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Erosion due to concentrated irrigation flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas and adjust the irrigation system ☐ Other / Comments:		
Erosion due to concentrated storm water runoff flow Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan ☐ If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction ☐ Other / Comments:		

BF-1
Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 4 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Obstructed inlet or outlet structure Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Underdrain clogged (inspect underdrain if standing water is observed for longer than 24-96 hours following a storm event) Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Clear blockage ☐ Other / Comments:		
Damage to structural components such as weirs, inlet or outlet structures Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Repair or replace as applicable ☐ Other / Comments:		

BF-1
Biofiltration

Date:	Inspector:	BMP ID No.:
Permit No.:	APN(s):	

INSPECTION AND MAINTENANCE CHECKLIST FOR BF-1 BIOFILTRATION PAGE 5 of 5			
Threshold/Indicator	**Maintenance Recommendation**	**Date**	**Description of Maintenance Conducted**
Standing water in BMP for longer than 24-96 hours following a storm event* Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains, or repairing/replacing clogged or compacted soils ☐ Other / Comments:		
Presence of mosquitos/larvae For images of egg rafts, larva, pupa, and adult mosquitos, see http://www.mosquito.org/biology Maintenance Needed? ☐ YES ☐ NO ☐ N/A	☐ Apply corrective measures to remove standing water in BMP when standing water occurs for longer than 24-96 hours following a storm event.** ☐ Other / Comments:		

*Surface ponding longer than approximately 24 hours following a storm event may be detrimental to vegetation health, and surface ponding longer than approximately 96 hours following a storm event poses a risk of vector (mosquito) breeding. Poor drainage can result from clogging of the media layer, filter course, aggregate storage layer, underdrain, or outlet structure. The specific cause of the drainage issue must be determined and corrected.

**If mosquitos persist following corrective measures to remove standing water, or if the BMP design does not meet the 96-hour drawdown criteria due to release rates controlled by an orifice installed on the underdrain, the [City Engineer] shall be contacted to determine a solution. A different BMP type, or a Vector Management Plan prepared with concurrence from the County of San Diego Department of Environmental Health, may be required.

ATTACHMENT 4

County of San Diego PDP Structural BMP Verification for Permitted Land Development Projects

This page was left intentionally blank.

County of San Diego BMP Design Manual Verification Form	
Project Summary Information	
Project Name	Shady Oak
Record ID (e.g., grading/improvement plan number)	PDS2016-MPA-001
Project Address	27522 Valley Center Road] Valley Center,Ca 92082
Assessor's Parcel Number(s) (APN(s))	186-270-01
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	San Luis Rey Hydrologic Unit, Lower San Luis Hydrologic Area, Valley Center Hydrologic Subarea 903.14
Responsible Party for Construction Phase	
Developer's Name	Touchstone Communities
Address	9909 Mira Mesa Boulevard, Suite 150] San Diego, Ca 92127
Email Address	kerry@touchstonecommunities.com
Phone Number	(858) 586-0414
Engineer of Work	Stephen J. McPartland
Engineer's Phone Number	(858) 762-9611
Responsible Party for Ongoing Maintenance	
Owner's Name(s)*	Touchstone Development, LLC
Address	9909 Mira Mesa Boulevard, Suite 150] San Diego, Ca 92127
Email Address	kerry@touchstonecommunities.com
Phone Number	(858) 586-0414
*Note: If a corporation or LLC, provide information for principal partner or Agent for Service of Process. If an HOA, provide information for the Board or property manager at time of project closeout.	

County of San Diego BMP Design Manual Verification Form Page 2 of 4					
Stormwater Structural Pollutant Control & Hydromodification Control BMPs* (List all from SWQMP)					
Description/Type of Structural BMP	**Plan Sheet #**	**STRUCT-URAL BMP ID#**	**Maint-enance Category**	**Maintenance Agreement Recorded Doc #**	**Revisions**
Biofiltration basin, BF-1,BF-2	TM shts. 2-3	LID-ONSITE-1	Two		
Biofiltration Basin, BF-1,BF-2	TM shts. 2-3	LID-ONSITE-2	Two		
Biofiltration Basin, BF-1,BF-2	TM shts. 2-3	LID-ONSITE-3	Two		
Biofiltration Basin, BF-1,BF-2	TM shts. 2-3	LID-ONSITE-4	Two		
Tree Well, SD-1	TM sht. 4	LID-OLD-MDV			
*All Priority Development Projects (PDPs) require a Structural BMP					

Note: If this is a partial verification of Structural BMPs, provide a list and map denoting Structural BMPs that have already been submitted, those for this submission, and those anticipated in future submissions.

County of San Diego BMP Design Manual Verification Form Page 3 of 4

Checklist for Applicant to submit to PDCI:

- ☐ Copy of the final accepted SWQMP and any accepted addendum.
- ☐ Copy of the most current plan showing the Stormwater Structural BMP Table, plans/cross-section sheets of the Structural BMPs and the location of each verified as-built Structural BMP.
- ☐ Photograph of each Structural BMP.
- ☐ Photograph(s) of each Structural BMP during the construction process to illustrate proper construction.
- ☐ Copy of the approved Structural BMP maintenance agreement and associated security

By signing below, I certify that the Structural BMP(s) for this project have been constructed and all BMPs are in substantial conformance with the approved plans and applicable regulations. I understand the County reserves the right to inspect the above BMPs to verify compliance with the approved plans and Watershed Protection Ordinance (WPO). Should it be determined that the BMPs were not constructed to plan or code, corrective actions may be necessary before permits can be closed.

Please sign your name and seal.

Professional Engineer's Printed Name: _____

Professional Engineer's Signed Name: _____

[SEAL]

Date: _____

County of San Diego BMP Design Manual Verification Form Page 4 of 4

COUNTY - OFFICIAL USE ONLY:

For PDCI: Verification Package #: _____

PDCI Inspector: _____

Date Project has/expects to close: _____

Date verification received from EOW: _____

By signing below, PDCI Inspector concurs that every noted Structural BMP has been installed per plan.

PDCI Inspector's Signature: _____ Date: _____

FOR WPP:

Date Received from PDCI: _____

WPP Submittal Reviewer: _____

WPP Reviewer concurs that the information provided for the following Structural BMPs is acceptable to enter into the Structural BMP Maintenance verification inventory:

List **acceptable** Structural BMPs:

WPP Reviewer's Signature: _____ Date: _____

ATTACHMENT 5

Copy of Plan Sheets Showing Permanent Storm Water BMPs, Source Control, and Site Design

This is the cover sheet for Attachment 5.

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

The plans must identify:

☒ Structural BMP(s) with ID numbers matching Step 6 Summary of PDP Structural BMPs
☒ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
☒ Details and specifications for construction of structural BMP(s)
☐ Signage indicating the location and boundary of structural BMP(s) as required by County staff
☐ 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 specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
☐ 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
☐ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
☐ All BMPs must be fully dimensioned on the plans
☐ When proprietary BMPs are used, site-specific cross section with outflow, inflow, and model number must be provided. Photocopies of general brochures are not acceptable.
☐ Include all source control and site design measures described in Steps 4 and 5 of the SWQMP. Can be included as a separate exhibit as necessary.

This page was left intentionally blank.

ATTACHMENT 6

Copy of Project's Drainage Report

This is the cover sheet for Attachment 6.

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

Preliminary Drainage Study

for

Shady Oak

Project No.:

PDS2016-TM-5614

PDS2016-REZ-16-005

PDS2016-STP-16-019

Prepared For:

Touchstone Communities

9909 Mira Mesa Blvd., Suite 150

San Diego, CA 92131

Mr. Kerry Garza

Prepared By:

TSAC
ENGINEERING
16885 Via Del Campo Ct, Suite 304, SD, CA 92127
www.tsacengineering.com

TSAC Job No. 2142

Declaration of Responsible 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 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of the Drainage Report by the County of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

_____

Stephen J. McPartland RCE 35109 Date

TABLE OF CONTENTS

1.0 Introduction……1-2

2.0 Hydrologic Methodology and Criteria..……..3-5

3.0 Hydrologic Results……..5-6

4.0 Conclusion..…….6

Tables:

Table 3.1: Summary of Pre-Post Project 100-Year Peak Discharge Rates for Shady Oak

Appendices:

Appendix A: Hydrologic Reference Materials

Appendix B: 100-Year Pre-Project Condition Hydrologic Output

Appendix C: 100-Year Post-Project Condition Output

Appendix D: HEC-1 Detention Calculations

Map Pockets:

Map Pocket 1: Pre-Project Hydrologic Unit Work Map for Shady Oak

Map Pocket 2: Post-Project Hydrologic Unit Work Map for Shady Oak

INTRODUCTION 1.0

The project site fronts Mirar De Valle Road and is located approximately 600 feet west of Valley Center Road and is bounded by open space and low density residential from the south and west. Refer to the Vicinity Map shown at the end of this section. The site is characterized by gentle and uniform topography with elevations ranging from 1316 to 1297 feet above mean sea level.

The site is relatively flat with gentle to moderate sloping towards the northeast. The project proposes to develop a vacant lot into a residential subdivision consisting of 47 residential lots, private internal streets,alleys and associated offsite improvements. Offsite improvements include the removal of existing AC berm and portion of AC pavement fronting the property on Mirar De Valle. Curb and gutter is proposed in the frontage along with a 5' decomposed granite pathway. Old Mirar De Valle is designed as a secondary fire access plan and is only to be constructed if Street A of Park Circle TM 5603 is not constructed prior to Shady Oak project.

Shady Oak is located within Valley Center Hydrologic Sub-Area (HSA 903.14), which is part of the Lower San Luis Hydrologic Area (HA 903.10) and San Luis Rey Hydrologic Unit (HU 903.00).

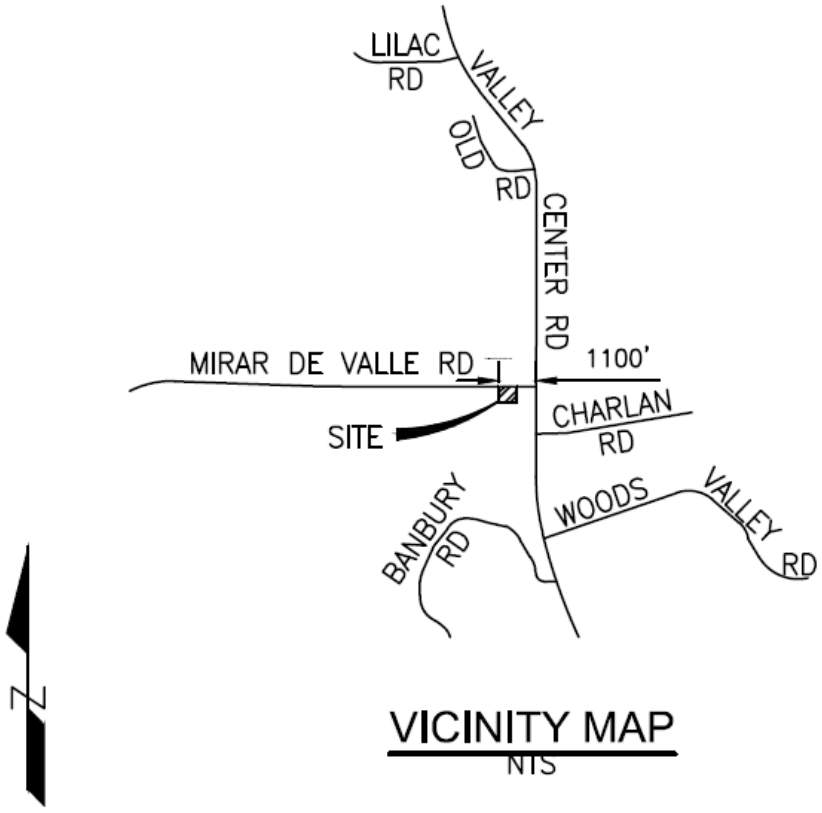
In Pre-project condition, a portion of the hillside south of the project sheet flows onto the site and confluences with site flows in a northeasterly direction, eventually converging with surrounding flows associated with Mirar De Valle and low density residential areas to the south. Flows discharge to the north of Mirar De Valle via a 3- 8' (W) x 2' (H) RCB constructed as part of Mirar de Valle Improvements (CG 4307). Runoff continues its course north eventually discharging into Moosa Canyon Creek. Flows continue west on Moosa Canyon Creek eventually joining with San Luis Rey River which ultimately outlets to the Pacific Ocean.

In the Post-project condition, drainage areas and patterns will not be altered or diverted. Offsite flows will be bypassed and not comingle with project runoff. Storm water runoff from the project will flow into Treatment Control BMPs along the sites frontage. The increase of impervious surfaces will generate additional runoff. However, through the use of Low Impact Development (LID) practices, Treatment Control BMPs and discharge limiting orifices, flows leaving the site will be detained to be equal or less than pre-project condition.

STORM WATER PLAN REQUIREMENTS 1.1

The site design BMPs, source control and treatment control BMPs utilized to address water quality and hydromodification requirements have been designed in accordance to the February 2016 County of San Diego BMP Design Manual. Refer to the Storm Water Quality Management Plan (SWQMP) titled, "Major Storm Water Quality Management Plan (Major SWQMP) for Shady Oak", prepared by TSAC Engineering.

VICINITY MAP 1.2



HYDROLOGIC METHODOLOGY AND CRITERIA 2.0

This study has been prepared consistent with current County of San Diego's ordinances and procedures. All components of the study are designed to convey storm water based on a 100-year flood event. The anticipated storm runoff has been calculated using the Rational Method based on the 2003 County of San Diego Hydrology Manual.

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures.

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (Tc), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

Q = C I A

Q = peak discharge, cubic feet per second (cfs)

C = runoff coefficient, based on San Diego County Hydrology Manual (Refer to Appendix A)

I = Rainfall intensity (in/hr) (Refer to Appendix A)

A = Drainage Area, (Acres)

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Runoff coefficients (C) based on land use and soil types were obtained from the San Diego County Hydrology Manual, Table 3-1. Soil types were determined from the Hydrology Soils

Map provided in Appendix A as well as the US Department of Agriculture (USDA) Soil Survey program. This runoff coefficient was then multiplied by the percentage of total area (A) included in that class.

The rainfall intensity (I) can be determined from the County of San Diego Intensity-Duration Design Chart. The 6-hour storm rainfall amount (P6) and 24-hour storm rainfall amount (P24), were determined from the isopluvial maps provided in Appendix A. Intensity can also be calculated using the following equation:

$I = 7.44 (P_6) (D^{-.645})$

I = Intensity (inches/hour)

P_6 = 6 Hour Precipitation (inches)

D = Duration in minutes (use Tc)

The Time of Concentration (Tc) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The Tc is composed of two components: initial time of concentration (Ti) and travel time (Tt). The Ti is the time required for runoff to travel across the surface of the most remote subarea in the study, or "initial subarea." The Tt is the time required for the runoff to flow in a watercourse or series of watercourses from the initial subarea to the point of interest. For the RM, the Tc at any point within the drainage area is given by:

$Tc = Ti + Tt$

The Civilcadd/Civil Design Engineering Software, based on the 2003 County of San Diego Hydrology Manual, was used to determine on-site 100-year, 6-hour peak flow rates.

The Civil Design Hydrology Program is a computer-aided design program in which the user develops a node-link model of the watershed. The hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The program has the capability to perform calculations for 11

hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significance are as follows:

Subarea Hydrologic Processes (Codes)

Code 1: Initial subarea input, top of stream

Code 2: Street flow thru subarea, includes subarea runoff

Code 3: Addition of runoff from subarea to stream

Code 4: Street Inlet + parallel street & pipe flow + area

Code 5: Pipeflow travel time (program estimated pipesize)

Code 6: Pipeflow travel time (user specified pipesize)

Code 7: Improved channel travel time (open or box)

Code 8: Irregular channel travel time

Code 9: User specified entry of data at a point

Code 10: Confluence at downstream point in current stream

Code 11: Confluence at main stream

HYDROLOGIC RESULTS 3.0

The 100-year 6-hour peak flow rates for the pre- and post-project conditions can be found in Table 3.1. Drainage Basin boundaries, and drainage areas can be found on the workmaps titled,“Pre-Project Hydrologic Workmap for Shady Oak” and “Post-Project Hydrologic Workmap for Shady Oak”, located in Map Pocket 1 and 2.

Pre-project and post-project hydrologic analyses have been performed for the 100-year storm event. For the purpose of this drainage report one major drainage basin has been identified,

herein referred to as Drainage Basin 100. The proposed project will mimic the existing drainage patterns, which flow in a northeasterly direction. Onsite runoff will sheet flow northerly into Biofiltration Basins proposed along the northerly portion of the site. Once treated, the flows will be piped into a proposed curb inlet on Mirar de Valle used to capture offsite flows.The mainline will continue its course east until discharging into a channel proposed with the Park Circle Project, County of San Diego Tract No. 5603.

Table 3.1 summarizes the results of the 100-year pre-project and post-project hydrologic analyses for Shady Oak.

Table 3.1: Summary of Pre- and Post-Project 100-Year Peak Discharge Rates

	Node Number	Area (acres)	Q_{100} (cfs)	Q_{100} with mitigation (cfs)	T_c (min)	I (in/hr)
Pre-Project/ Post-Project (undetained)	105/105	31.8/31.8	63.9 /66.1	63.9	14.5/14.5	5.0/5.0

CONCLUSION 4.0

This preliminary drainage report presents the 100-year, 6-hour post-project hydrologic analyses for the Shady Oak Project. The post project condition peak discharge rates were determined using the Rational Method based on the hydrologic methodology and criteria described in the San Diego County Hydrology Manual, dated June 2003.

As designed, the development will not alter the natural drainage path or divert any water from the existing natural conditions or drainage boundaries. Runoff from the Shady Oak site will sheet flow into a biofiltration basins along the northerly portion of the site. Street A “Road 19” will be directed to the biofiltration basins via reverse curb outlet and ditch for treatment.

Old Mirar De Valle is designed as a secondary fire access plan and is only to be constructed if Street A of Park Circle TM 5603 is not constructed prior to Shady Oak project. A biofiltration basin has been designed for this alternative.

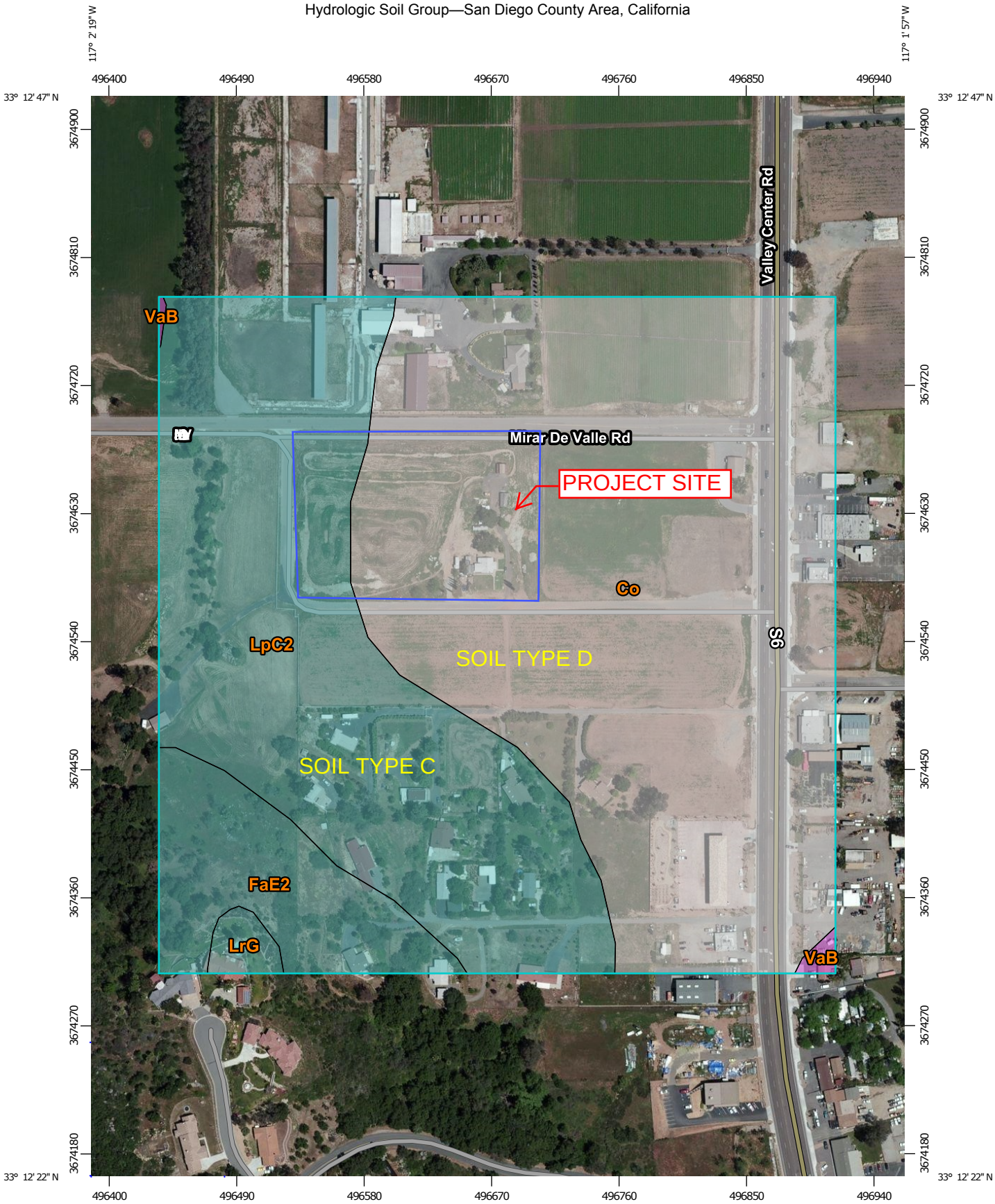
On and offsite runoff ultimately discharge to the Moosa Canyon Creek. Once treated, onsite flows will be piped into a proposed curb inlet on Mirar de Valle used to capture offsite flows.

The mainline will continue its course east until discharging into a channel associated with the Park Circle Project, County of San Diego Tract No. 5603.
The basins have been designed to meet the Water Quality and Hydromodification standards. By treating and detaining flows on-site, downstream impacts such as erosion and sedimentation will be nonexistent.

The pre and post project drainage area is 31.8 Acres. In the pre-project condition, 63.9 CFS discharge into the property north of Mirar de Valle via 3-2' (h) x 8' (w) box culverts. In the post project condition, 63.9 CFS (66.1 CFS undetained) will discharge into the box culverts, which have capacity for 128.5 CFS as shown on the As-Builts (CG 4307, TM 5039-2). The increase in runoff will be mitigated by detaining within the biofiltration basins. In order to detain 2.2 cfs, 0.06 acre-feet (2613 ft^3) of volume is required. This will be accomplished by allowing 6" of ponding above the Hydromodification volume within the biofiltration basins. Detailed outlet works will be designed in the Final Engineering stage.
The project site is located south of Moosa Canyon Creek and out of the 100-year flood hazard area as shown on the FIRM provided in Appendix A.

Appendix A: Hydrologic Reference Material

Hydrologic Soil Group—San Diego County Area, California



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 9, Sep 17, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Co	Clayey alluvial land		32.0	56.7%
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded	C	4.5	7.9%
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, erode d	C	19.3	34.2%
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slope s	C	0.5	0.8%
VaB	Visalia sandy loam, 2 to 5 percent slopes	A	0.2	0.3%
Totals for Area of Interest			**56.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

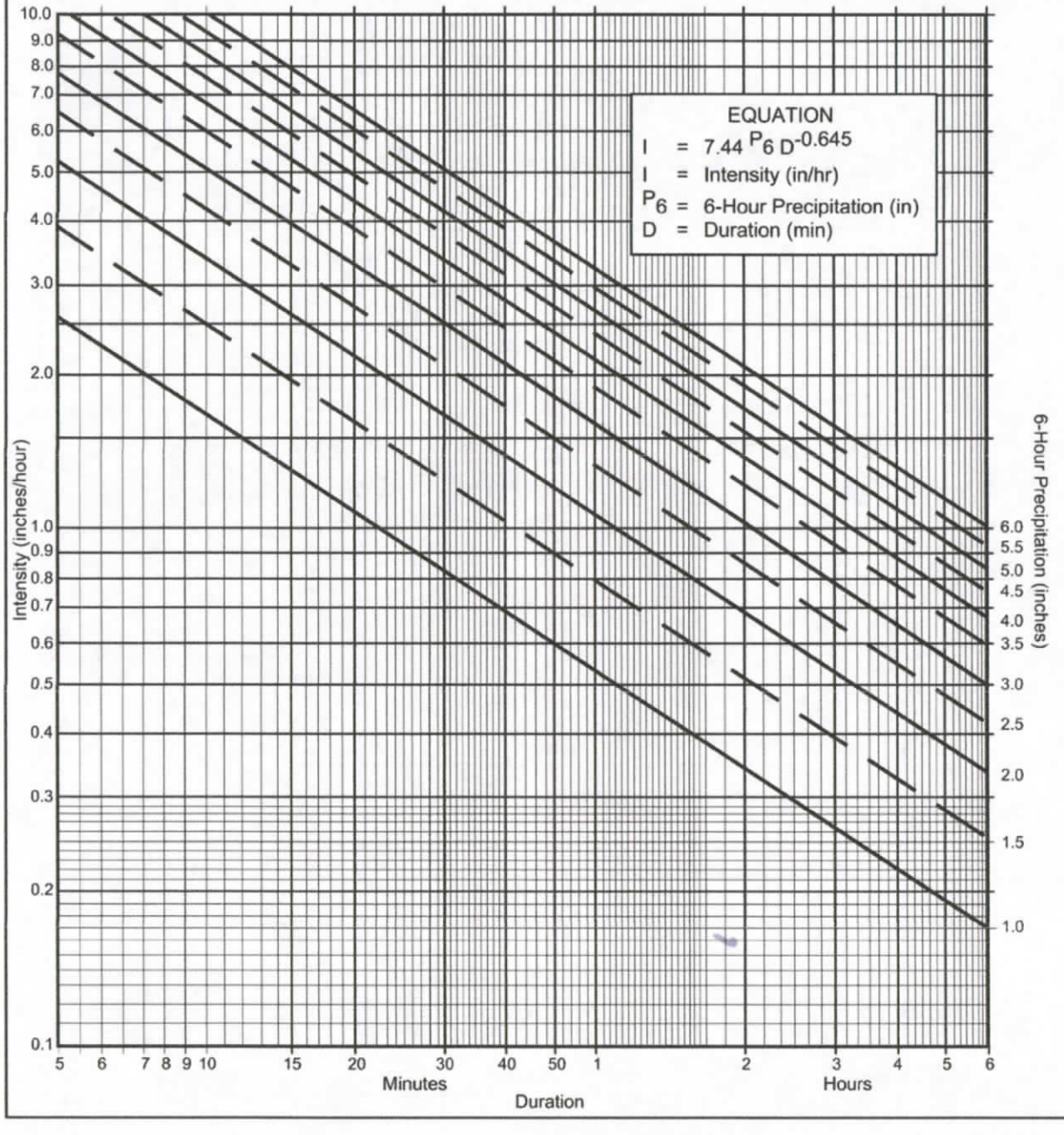
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.75 in., P_{24} = 8.2, $\frac{P_6}{P_{24}}$ = 45.7 %(2)

(c) Adjusted P_6(2) = 3.75 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

4.1.2.1 Hydrologic Soil Group

Soil properties influence the relationship between rainfall and runoff since soils have differing rates of infiltration. Based on infiltration rates, the NRCS has divided soils into four hydrologic soil groups.

Group A

Soils have high infiltration rate when thoroughly wetted; chiefly deep, well-drained to excessively drained sand, gravel, or both. Rate of water transmission is high; thus runoff potential is low.

Group B

Soils have moderate infiltration rate when thoroughly wetted; chiefly soils that are moderately deep to deep, moderately well drained to well drained, and moderately coarse textured. Rate of water transmission is moderate.

Group C

Soils have slow infiltration rate when thoroughly wetted; chiefly soils that have a layer impeding downward movement of water, or moderately fine to fine textured soils that have a slow infiltration rate. Rate of water transmission is slow.

Group D

Soils have very slow infiltration rate when thoroughly wetted; chiefly clays that have a high shrink-swell potential, soils that have a high permanent water table, soils that have a claypan or clay layer at or near the surface, or soils that are shallow over nearly impervious material. Rate of water transmission is very slow.

A list of soils throughout San Diego County and their hydrologic classification is located on the map in Appendix A. Soil Survey maps can be obtained from local NRCS offices for use in estimating soil type. The NRCS maps are also available at the County of San Diego DPWFCS. Consideration should be given to the effects of urbanization on the

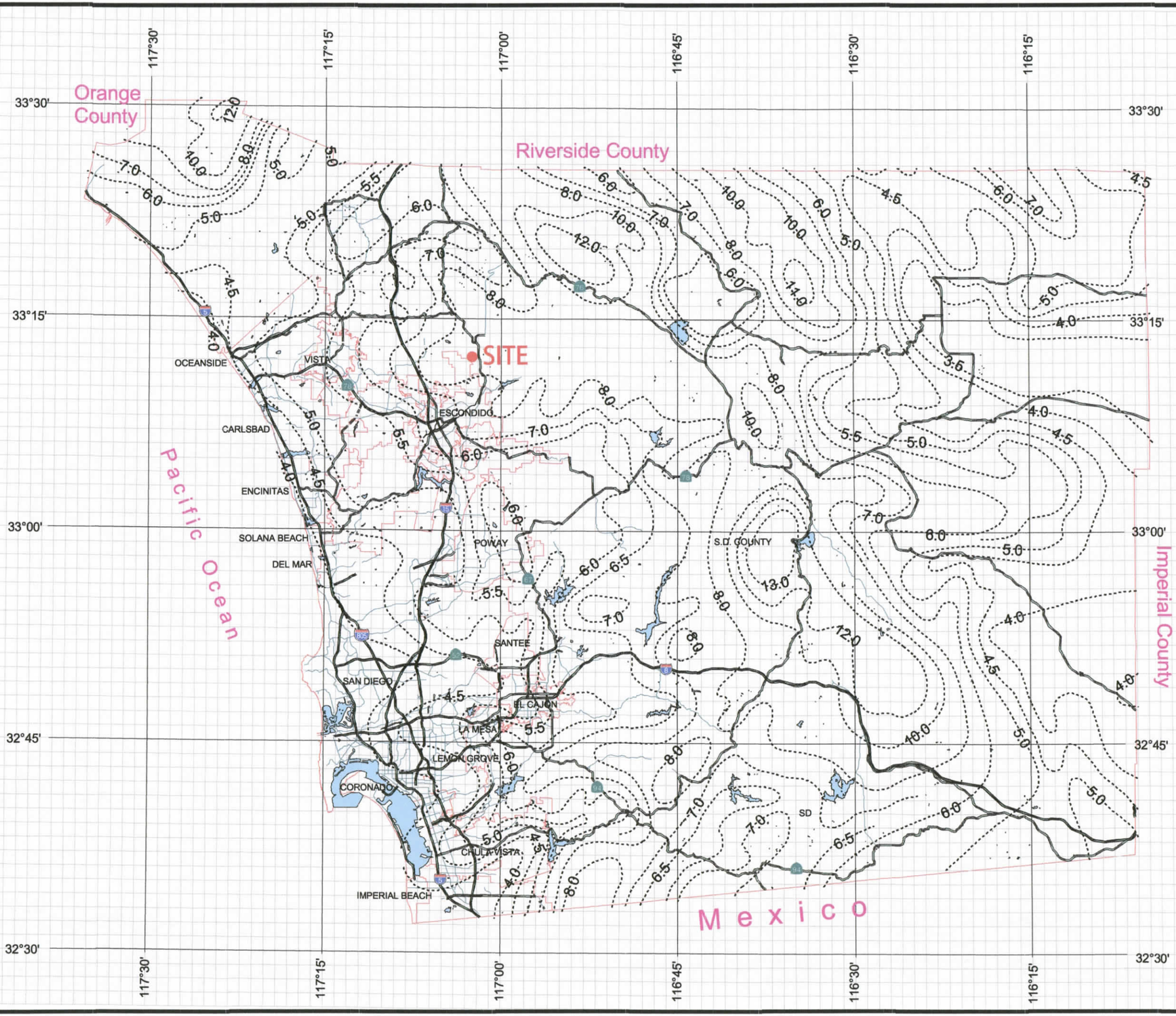
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

P24 = 8.2"



DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

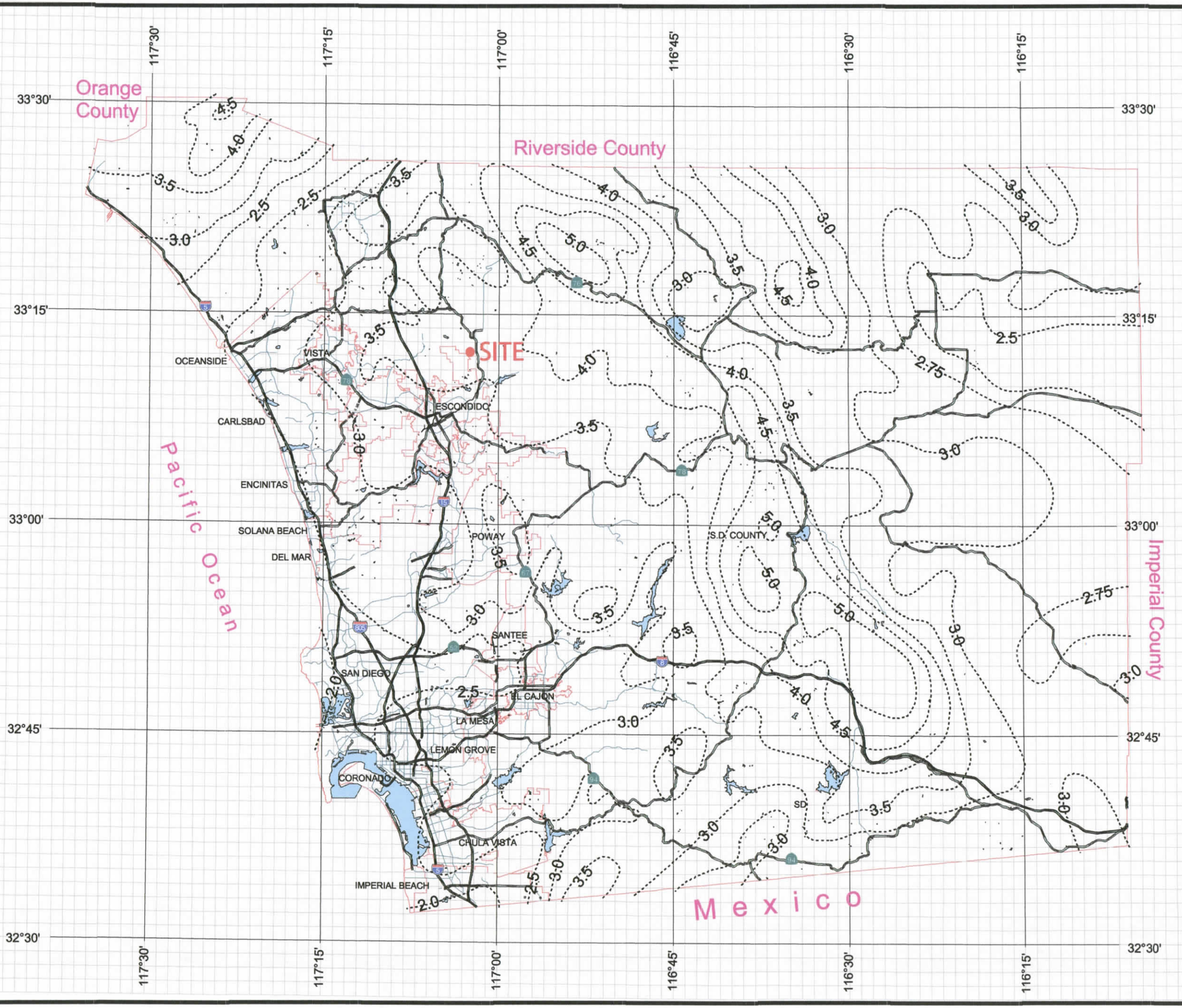
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

P6 = 3.75"



DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles