HYDROLOGY STUDY

Ohana Alliance – Mojave Drive Self Storage
NE corner of Mojave Drive and Mesa Linda Avenue
Victorville, CA

City of Victorville Project No.: **PSUB 20-00014**

Prepared for:

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Prepared by:

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August 24, 2020

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Caleb O. Rios   R.C.E. 57587

JN 20091

1.0   PURPOSE

This report has been prepared to accompany the Grading Plan for the proposed construction of a self-storage facility w/ RV parking at the northeast corner of Mojave Drive and Mesa Linda Avenue. The development project includes street improvements on both Mojave Drive and Mesa Linda Avenue fronting the project site. (Victorville Project No.: PSUB 20-00014) (APN: 3128-621-04).

2.0   DESCRIPTION OF SITE

The subject lot is a vacant, rectangular-shaped 8.57-acre (373,268 sq. ft.) parcel of land. The property is bounded on the North and East by similarly sized vacant lot, to the South by Mojave Drive (a paved street, but incomplete per City standards), and to the West by Mesa Linda Avenue (a presently undeveloped dirt road).

3.0   EXISTING DRAINAGE

Storm runoff in the project vicinity flows in a northeasterly direction across the vacant, undeveloped surfaces as both sheet flow and within natural swales as concentrated flow. Project area runoff, and off-site run-on from the area west of the project lot, primarily flows across the subject property within one of two natural swales, the "southerly swale" discharging near the mid-point of the easterly project property boundary and the "northerly swale" flowing along the northerly property boundary. An earthen berm along the northerly edge of Mojave Drive (southerly property boundary) keeps street runoff within the right-of-way.

4.0   PROPOSED DEVELOPMENT

The developer proposes to construct a new self-storage facility with RV parking on private property. Project development includes street improvements to extend Mesa Linda Drive, widen Mojave Drive, and install sidewalk, curb, and gutter within the street rights-of-way. Improvements to Mesa Linda Drive create a high point ~150 feet from the Mojave Drive right-of-way, intended to preserve the existing Mojave Drive drainage pattern; remaining street runoff on Mesa Linda Drive will flow in a northerly direction and enter the existing natural drainage swale at the north end of the project (interim condition) until the street is extended by the City or the northerly neighbor property owner.   Impervious improvements on the project site cover 353,450 sq. ft. (~94.7%) and include the self-storage buildings, office, and paved driveways and parking lot. The proposed improvements are shown on the construction plans for the project, including the Grading Plan referenced above.

5.0   PROPOSED DRAINAGE

The abovementioned Mesa Linda Avenue street improvements effectively block the flow of off-site run-on (from an area measuring ~5.51 acres) within the aforementioned "southerly swale." Toal Engineering proposes a storm drain pipe to convey "southerly swale" off-site run-on from a new drainage culvert on the west side of Mesa Linda Avenue to the easterly edge of the private development for reconnection to the natural swale; this storm drain will cross beneath Mesa Linda

Avenue, and continue across private property within a public storm drain easement (layout shall avoid future buildings).

Project runoff flows across the surface primarily in a northerly direction before turning west and discharging to Mesa Linda Avenue near the northwest corner of the site. The on-site drainage system includes an underground storm water storage chamber, and surface inlets tributary thereto, for water quality treatment.

6.0   METHODOLOGY

The purpose of the calculations presented herein is to size the storm drain pipe (conveying off-site run-on across the project site) and verify the capacity of the on-site surface drainage swales during 100-yr storm conditions.

For this report, we performed a rational method hydrologic analysis based on the San Bernardino County Hydrology Manual (using HydroWin software from Advanced Engineering Solutions (AES), where appropriate).

See Appendix A for tables and charts from the Hydrology Manual. The Drainage Map in Appendix B graphically depicts the project watershed and data relevant to the runoff calculations.

7.0   RESULTS AND ANALYSIS

Our hydrologic and hydraulic analysis of the proposed drainage improvements yielded the following results:

Table 1. Peak Runoff.

Condition	Frequency	Imp %	Tc (min.)	I (in./hr)	A (acres)	Q_{100} (cfs)
Undeveloped Run-on	100-yr	0	17.0	2.90	5.51	13.84
Developed Run-on	100-yr	90[1]	9.0	4.53	5.51	22.27
Project Runoff	100-yr	90	18.2	2.77	8.16	20.07

1 – Impervious % based upon future commercial development of off-site areas.

Table 2. Diameter of RCP Storm Drain for Off-site Run-on

Condition	S (ft/ft)	Dia. (in.)	Q_{FULL} (cfs)	$Q_{FULL} > Q_{100}$
Undeveloped	0.004	24	14.31	Yes
Developed	0.004	24	14.31	No
Developed	0.004	30	25.94	Yes

Table 3. Surface Swale Flow Depths

Location	S (ft/ft)	Z1	Z2	Q_{100} (cfs)	Flow depth (ft)
North-South	0.006	50	100	7.37	0.23
East-West at Parking	0.006	50	100	12.77	0.28
East-West between bldgs.	0.006	33	33	20.07	0.46

See Appendix A for full calculations related to information in Tables 1 and 2.

As shown in Table 1, run-on west of the project varies from 13.84 cfs (existing barren condition) to 22.27 cfs (anticipated future commercial development). On-site project runoff yields a peak flowrate of 20.07 cfs.

As shown in Table 2, the 24" diameter RCP storm drain pipe is adequately sized to convey the existing undeveloped off-site run-on west of the project, however, it is undersized for anticipated future commercial development; to handle future development, a 30" diameter RCP storm drain may be necessary.

As shown in Table 3, flow depths associated with the swales in the central parking area have flow depths on the order of 0.28 ft (~3.5 inches). The swale section connecting the parking lot to Mesa Linda Avenue has a flow depth on the order of 0.46 ft (~5.5 inches) based upon cross slopes of 3% (Z=33) on the paved the surface.

8.0   CONCLUSIONS

Toal Engineering, Inc. proposes a culvert and storm drain on the west side of the Mesa Linda Avenue improvements to collect and convey run-on in the "southerly swale" across the project property. The size of this storm drain pipe requires input from the City of Victorville regarding future use of this storm drain (i.e. will future development of the westerly off-site properties result in abandonment of the pipe, etc.)

Toal Engineering, Inc. proposes FF elevations for the storage buildings along the south, west, and east edges of the property shall be set a minimum of 0.40 feet (~4.5 inches; 3.5" max. flow depth + 1" min. freeboard) above the flow line of any swale in front of the building. The buildings at the north end of the parking lot shall be set 0.55 feet (~6.5 inches; 5.5" max. flow depth + min. 1" freeboard).

APPENDIX A

Calculations

HYDROLOGY & HYDRAULIC CALCULATIONS
Drainage Area NW corner of Mojave and Mesa Linda, Victorville, CA

Project Information:

Soil Type = B (San Bernardino County Storm Water Facility Mapping Tool)

Rainfall Intensity (I):   10-yr 1-hr rainfall depth = 0.75 in. per Figure B9 (SBCHM)

100-yr 1-hr rainfall depth = 1.2 in. per Figure B10 (SBCHM)

slope of intensity duration curve = 0.7 per SBCHM Section D.4 – desert condition)

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                            Analysis prepared by:


                           Toal Engineering, Inc.
                           139 Avenida Navarro
                           San Clemente, CA  92672
                            Tel: (949) 492-8586



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  TIME/DATE OF STUDY: 12:04 08/05/2020
  ============================================================================
    USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
  ============================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

    USER SPECIFIED STORM EVENT(YEAR) =  100.00
    SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
    SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
    *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
    10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.750
    100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
    COMPUTED RAINFALL INTENSITY DATA:
    STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) = 1.2000
    SLOPE OF INTENSITY DURATION CURVE = 0.7000


    *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


    *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
       HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES: MANNING
       WIDTH   CROSSFALL  IN- / OUT-/PARK-   HEIGHT  WIDTH  LIP   HIKE FACTOR
  NO.  (FT)     (FT)      SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)   (n)
  === =====   ========= ================= ====== ===== ====== ===== =======
   1  30.0      20.0     0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

    GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
      1. Relative Flow-Depth =  0.00 FEET
         as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
      2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
     *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
      OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
     *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED


  ****************************************************************************
    FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
  ----------------------------------------------------------------------------
    >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
    >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
  ============================================================================
    INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
    ELEVATION DATA: UPSTREAM(FEET) =   3024.00  DOWNSTREAM(FEET) =   3020.60

    Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
    SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.334
    * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.439
    SUBAREA Tc AND LOSS RATE DATA(AMC III):
```

```
   DEVELOPMENT TYPE/        SCS SOIL    AREA       Fp         Ap      SCS    Tc
      LAND USE             GROUP     (ACRES)   (INCH/HR)  (DECIMAL)   CN    (MIN.)
   NATURAL POOR COVER
   "BARREN"                  B        0.72      0.11      1.000      97    13.33
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.11
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
   SUBAREA RUNOFF(CFS) =       2.16
   TOTAL AREA(ACRES) =        0.72   PEAK FLOW RATE(CFS) =       2.16

****************************************************************************
   FLOW PROCESS FROM NODE     2.00 TO NODE     3.00 IS CODE = 52
----------------------------------------------------------------------------
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
   ELEVATION DATA: UPSTREAM(FEET) =   3020.60  DOWNSTREAM(FEET) =   3018.30
   CHANNEL LENGTH THRU SUBAREA(FEET) =   220.00   CHANNEL SLOPE =  0.0105
   CHANNEL FLOW THRU SUBAREA(CFS) =       2.16
   FLOW VELOCITY(FEET/SEC) =   1.79 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
   TRAVEL TIME(MIN.) =   2.05   Tc(MIN.) =   15.38
   LONGEST FLOWPATH FROM NODE     1.00 TO NODE     3.00 =    550.00 FEET.

****************************************************************************
   FLOW PROCESS FROM NODE     3.00 TO NODE     3.00 IS CODE = 81
----------------------------------------------------------------------------
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   MAINLINE Tc(MIN.) =   15.38
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.111
   SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/        SCS SOIL    AREA       Fp         Ap      SCS
      LAND USE             GROUP     (ACRES)   (INCH/HR)  (DECIMAL)   CN
   NATURAL POOR COVER
   "BARREN"                  B        1.40      0.11      1.000      97
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.11
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
   SUBAREA AREA(ACRES) =       1.40    SUBAREA RUNOFF(CFS) =    3.79
   EFFECTIVE AREA(ACRES) =       2.12   AREA-AVERAGED Fm(INCH/HR) =  0.11
   AREA-AVERAGED Fp(INCH/HR) =  0.11  AREA-AVERAGED Ap =  1.00
   TOTAL AREA(ACRES) =        2.1       PEAK FLOW RATE(CFS) =       5.73

****************************************************************************
   FLOW PROCESS FROM NODE     3.00 TO NODE     4.00 IS CODE = 52
----------------------------------------------------------------------------
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
   ELEVATION DATA: UPSTREAM(FEET) =   3018.30  DOWNSTREAM(FEET) =   3016.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   220.00   CHANNEL SLOPE =  0.0105
   CHANNEL FLOW THRU SUBAREA(CFS) =       5.73
   FLOW VELOCITY(FEET/SEC) =   2.23 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
   TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =   17.03
   LONGEST FLOWPATH FROM NODE     1.00 TO NODE     4.00 =    770.00 FEET.


****************************************************************************
   FLOW PROCESS FROM NODE     4.00 TO NODE     4.00 IS CODE = 81
----------------------------------------------------------------------------
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   MAINLINE Tc(MIN.) =   17.03
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.898
   SUBAREA LOSS RATE DATA(AMC III):
```

```
 DEVELOPMENT TYPE/     SCS SOIL   AREA      Fp        Ap     SCS
    LAND USE            GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
NATURAL POOR COVER
"BARREN"                  B       3.39     0.11      1.000     97
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.11
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA(ACRES) =    3.39      SUBAREA RUNOFF(CFS) =    8.52
EFFECTIVE AREA(ACRES) =      5.51  AREA-AVERAGED Fm(INCH/HR) =  0.11
AREA-AVERAGED Fp(INCH/HR) = 0.11  AREA-AVERAGED Ap = 1.00
TOTAL AREA(ACRES) =        5.5      PEAK FLOW RATE(CFS) =     13.84
=============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)     =        5.5  TC(MIN.) =      17.03
EFFECTIVE AREA(ACRES) =      5.51  AREA-AVERAGED Fm(INCH/HR)=  0.11
AREA-AVERAGED Fp(INCH/HR) = 0.11  AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE(CFS)   =      13.84
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                            Analysis prepared by:


                            Toal Engineering, Inc.
                            139 Avenida Navarro
                            San Clemente, CA  92672
                            Tel: (949) 492-8586



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   TIME/DATE OF STUDY: 16:13 08/04/2020
  ==========================================================================
    USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
  ==========================================================================
                        --*TIME-OF-CONCENTRATION MODEL*--

    USER SPECIFIED STORM EVENT(YEAR) =  100.00
    SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
    SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
    *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
    10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.750
    100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
    COMPUTED RAINFALL INTENSITY DATA:
    STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) = 1.2000
    SLOPE OF INTENSITY DURATION CURVE = 0.7000


    *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


    *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
        HALF-   CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
        WIDTH   CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
    NO.  (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
    === =====  =========  =================  ======  ===== ====== ===== =======
     1  30.0     20.0     0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

    GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
      1. Relative Flow-Depth =  0.00 FEET
         as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
      2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
     *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
      OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
     *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED


  **************************************************************************
    FLOW PROCESS FROM NODE    1.00 TO NODE     2.00 IS CODE =  21
  --------------------------------------------------------------------------
    >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
    >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
  ==========================================================================
    INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
    ELEVATION DATA: UPSTREAM(FEET) =   3024.00  DOWNSTREAM(FEET) =   3020.60

    Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
    SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.721
    * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.041
    SUBAREA Tc AND LOSS RATE DATA(AMC III):
```

```
    DEVELOPMENT TYPE/        SCS SOIL   AREA      Fp        Ap      SCS   Tc
        LAND USE            GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN   (MIN.)
  COMMERCIAL                  B        0.72     0.42      0.100     76    7.72
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.24
  TOTAL AREA(ACRES) =       0.72   PEAK FLOW RATE(CFS) =      3.24

***************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  31
---------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
===========================================================================
  ELEVATION DATA: UPSTREAM(FEET) = 3020.60  DOWNSTREAM(FEET) = 3018.30
  FLOW LENGTH(FEET) =  220.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.12
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        3.24
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =    8.44
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    550.00 FEET.

***************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
---------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
===========================================================================
  MAINLINE Tc(MIN.) =    8.44
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.737
  SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/        SCS SOIL   AREA      Fp        Ap      SCS
        LAND USE            GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.40     0.42      0.100     76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =      1.40     SUBAREA RUNOFF(CFS) =    5.92
  EFFECTIVE AREA(ACRES) =       2.12   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       2.1      PEAK FLOW RATE(CFS) =      8.96

***************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
---------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
===========================================================================
  ELEVATION DATA: UPSTREAM(FEET) = 3018.30  DOWNSTREAM(FEET) = 3016.00
  FLOW LENGTH(FEET) =  220.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.66
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        8.96
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =    8.99
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    770.00 FEET.

***************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
---------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
===========================================================================
  MAINLINE Tc(MIN.) =    8.99
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.532
```

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SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL    AREA      Fp          Ap      SCS
    LAND USE              GROUP    (ACRES)  (INCH/HR)  (DECIMAL)   CN
COMMERCIAL                  B        3.39     0.42       0.100     76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
SUBAREA AREA(ACRES) =    3.39      SUBAREA RUNOFF(CFS) =   13.70
EFFECTIVE AREA(ACRES) =      5.51   AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =        5.5      PEAK FLOW RATE(CFS) =     22.27
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =       5.5  TC(MIN.) =      8.99
EFFECTIVE AREA(ACRES) =      5.51  AREA-AVERAGED Fm(INCH/HR)=  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.100
```
PEAK FLOW RATE(CFS)   =   22.27

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                           Analysis prepared by:


                           Toal Engineering, Inc.
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                           San Clemente, CA  92672
                            Tel: (949) 492-8586



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  =============================================================================
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
  =============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

   USER SPECIFIED STORM EVENT(YEAR) =  100.00
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
   *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
   10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.750
   100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
   COMPUTED RAINFALL INTENSITY DATA:
   STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) = 1.2000
   SLOPE OF INTENSITY DURATION CURVE = 0.7000


   *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-   CROWN TO    STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH   CROSSFALL   IN- / OUT-/PARK- HEIGHT  WIDTH  LIP   HIKE   FACTOR
  NO.  (FT)     (FT)      SIDE / SIDE/ WAY   (FT)   (FT)  (FT)  (FT)    (n)
  === =====  =========  ================= ======  ===== ====== ===== =======
   1  30.0     20.0     0.018/0.018/0.020   0.67   2.00 0.0313 0.167 0.0150

   GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
     1. Relative Flow-Depth =  0.00 FEET
        as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
     2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
    *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
     OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
    *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED


  ****************************************************************************
   FLOW PROCESS FROM NODE    10.00 TO NODE     20.00 IS CODE =  21
  -----------------------------------------------------------------------------
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
   >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
  =============================================================================
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   330.00
   ELEVATION DATA: UPSTREAM(FEET) =   3020.40  DOWNSTREAM(FEET) =   3018.10

   Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
   SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.349
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.772
   SUBAREA Tc AND LOSS RATE DATA(AMC III):
```

```
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS    Tc
      LAND USE             GROUP    (ACRES)  (INCH/HR)  (DECIMAL)   CN   (MIN.)
   COMMERCIAL                B        0.72     0.42      0.100     76    8.35
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
   SUBAREA RUNOFF(CFS) =      3.07
   TOTAL AREA(ACRES) =       0.72   PEAK FLOW RATE(CFS) =      3.07

****************************************************************************
   FLOW PROCESS FROM NODE     20.00 TO NODE     30.00 IS CODE =  91
----------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
   UPSTREAM NODE ELEVATION(FEET) =   3018.10
   DOWNSTREAM NODE ELEVATION(FEET) =   3014.30
   CHANNEL LENGTH THRU SUBAREA(FEET) =   635.00
   "V" GUTTER WIDTH(FEET) =  3.00   GUTTER HIKE(FEET) = 0.080
   PAVEMENT LIP(FEET) = 0.040   MANNING'S N = .0150
   PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
   MAXIMUM DEPTH(FEET) =   0.33
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.237
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP    (ACRES)  (INCH/HR)  (DECIMAL)   CN
   COMMERCIAL                B        1.44     0.42      0.100     76
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.13
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.71
   AVERAGE FLOW DEPTH(FEET) =   0.27   FLOOD WIDTH(FEET) =   33.35
   "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.19   Tc(MIN.) =   14.54
   SUBAREA AREA(ACRES) =    1.44        SUBAREA RUNOFF(CFS) =    4.14
   EFFECTIVE AREA(ACRES) =    2.16    AREA-AVERAGED Fm(INCH/HR) =   0.04
   AREA-AVERAGED Fp(INCH/HR) =   0.42  AREA-AVERAGED Ap =   0.10
   TOTAL AREA(ACRES) =       2.2        PEAK FLOW RATE(CFS) =      6.21

   END OF SUBAREA "V" GUTTER HYDRAULICS:
   DEPTH(FEET) =  0.29   FLOOD WIDTH(FEET) =   36.30
   FLOW VELOCITY(FEET/SEC.) =   1.77   DEPTH*VELOCITY(FT*FT/SEC) =   0.51
   LONGEST FLOWPATH FROM NODE     10.00 TO NODE     30.00 =    965.00 FEET.

****************************************************************************
   FLOW PROCESS FROM NODE     30.00 TO NODE     40.00 IS CODE =  91
----------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
   UPSTREAM NODE ELEVATION(FEET) =   3014.30
   DOWNSTREAM NODE ELEVATION(FEET) =   3012.60
   CHANNEL LENGTH THRU SUBAREA(FEET) =   290.00
   "V" GUTTER WIDTH(FEET) =  3.00   GUTTER HIKE(FEET) = 0.080
   PAVEMENT LIP(FEET) = 0.040   MANNING'S N = .0150
   PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
   MAXIMUM DEPTH(FEET) =   0.50
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.947
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP    (ACRES)  (INCH/HR)  (DECIMAL)   CN
   COMMERCIAL                B        2.80     0.42      0.100     76
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      9.86
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.32
   AVERAGE FLOW DEPTH(FEET) =   0.37   FLOOD WIDTH(FEET) =   28.46
```

```
   "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.08   Tc(MIN.) =   16.62
   SUBAREA AREA(ACRES) =    2.80        SUBAREA RUNOFF(CFS) =    7.32
   EFFECTIVE AREA(ACRES) =    4.96     AREA-AVERAGED Fm(INCH/HR) =   0.04
   AREA-AVERAGED Fp(INCH/HR) =   0.42  AREA-AVERAGED Ap =   0.10
   TOTAL AREA(ACRES) =        5.0      PEAK FLOW RATE(CFS) =       12.97

   END OF SUBAREA "V" GUTTER HYDRAULICS:
   DEPTH(FEET) =  0.41   FLOOD WIDTH(FEET) =   31.87
   FLOW VELOCITY(FEET/SEC.) =   2.46   DEPTH*VELOCITY(FT*FT/SEC) =   1.00
   LONGEST FLOWPATH FROM NODE    10.00 TO NODE    40.00 =   1255.00 FEET.

*************************************************************************
   FLOW PROCESS FROM NODE    40.00 TO NODE    50.00 IS CODE = 91
-------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
=========================================================================
   UPSTREAM NODE ELEVATION(FEET) =   3012.60
   DOWNSTREAM NODE ELEVATION(FEET) =   3012.10
   CHANNEL LENGTH THRU SUBAREA(FEET) =    77.00
   "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.080
   PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
   PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
   MAXIMUM DEPTH(FEET) =   0.50
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.890
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL    AREA      Fp        Ap      SCS
         LAND USE           GROUP    (ACRES)  (INCH/HR) (DECIMAL)  CN
   COMMERCIAL                  B        3.07     0.42     0.100     76
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
   TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     16.90
   TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.70
   AVERAGE FLOW DEPTH(FEET) =   0.44   FLOOD WIDTH(FEET) =   34.84
   "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.48   Tc(MIN.) =   17.10
   SUBAREA AREA(ACRES) =    3.07        SUBAREA RUNOFF(CFS) =    7.87
   EFFECTIVE AREA(ACRES) =    8.03     AREA-AVERAGED Fm(INCH/HR) =   0.04
   AREA-AVERAGED Fp(INCH/HR) =   0.42  AREA-AVERAGED Ap =   0.10
   TOTAL AREA(ACRES) =        8.0      PEAK FLOW RATE(CFS) =       20.58

   END OF SUBAREA "V" GUTTER HYDRAULICS:
   DEPTH(FEET) =  0.47   FLOOD WIDTH(FEET) =   37.66
   FLOW VELOCITY(FEET/SEC.) =   2.82   DEPTH*VELOCITY(FT*FT/SEC) =   1.32
   LONGEST FLOWPATH FROM NODE    10.00 TO NODE    50.00 =   1332.00 FEET.

*************************************************************************
   FLOW PROCESS FROM NODE    50.00 TO NODE    60.00 IS CODE = 91
-------------------------------------------------------------------------
   >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
=========================================================================
   UPSTREAM NODE ELEVATION(FEET) =   3012.10
   DOWNSTREAM NODE ELEVATION(FEET) =   3011.80
   CHANNEL LENGTH THRU SUBAREA(FEET) =    72.00
   "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.080
   PAVEMENT LIP(FEET) =  0.040   MANNING'S N = .0150
   PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.03000
   MAXIMUM DEPTH(FEET) =   0.67
   * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.837
   SUBAREA LOSS RATE DATA(AMC III):
    DEVELOPMENT TYPE/       SCS SOIL    AREA      Fp        Ap      SCS
         LAND USE           GROUP    (ACRES)  (INCH/HR) (DECIMAL)  CN
   COMMERCIAL                  B        0.13     0.42     0.100     76
   SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
   SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
```

```
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    20.74
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.65
AVERAGE FLOW DEPTH(FEET) =   0.55   FLOOD WIDTH(FEET) =   31.97
"V" GUTTER FLOW TRAVEL TIME(MIN.) =    0.45   Tc(MIN.) =   17.55
SUBAREA AREA(ACRES) =    0.13      SUBAREA RUNOFF(CFS) =    0.33
EFFECTIVE AREA(ACRES) =    8.16    AREA-AVERAGED Fm(INCH/HR) =   0.04
AREA-AVERAGED Fp(INCH/HR) =   0.42  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =       8.2    PEAK FLOW RATE(CFS) =      20.58
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.55   FLOOD WIDTH(FEET) =   31.82
FLOW VELOCITY(FEET/SEC.) =   2.65   DEPTH*VELOCITY(FT*FT/SEC) =   1.46
LONGEST FLOWPATH FROM NODE     10.00 TO NODE     60.00 =    1404.00 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)     =        8.2  TC(MIN.) =     17.55
EFFECTIVE AREA(ACRES) =       8.16  AREA-AVERAGED Fm(INCH/HR)=  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS)   =      20.58
```

```
_____
*************************************************************************
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             Ver. 19.0   Release Date: 06/01/2012  License ID 1448

                         Analysis prepared by:

                         Toal Engineering, Inc.
                          139 Avenida Navarro
                         San Clemente, CA  92672
                          Tel: (949) 492-8586

-------------------------------------------------------------------------
  TIME/DATE OF STUDY: 11:50 08/25/2020
=========================================================================
 Problem Descriptions:

 Flow rate for 24" and 30" RCP Storm Drain Pipes (flowing full)

*************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
-------------------------------------------------------------------------
    PIPE DIAMETER(FEET) =   2.000
    FLOWDEPTH(FEET) =   2.000
    PIPE SLOPE(FEET/FEET) =  0.0040
    MANNINGS FRICTION FACTOR = 0.013000
    >>>>> NORMAL DEPTH FLOW(CFS) =     14.31
=========================================================================


 Problem Descriptions:



*************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
-------------------------------------------------------------------------
    PIPE DIAMETER(FEET) =   2.500
    FLOWDEPTH(FEET) =   2.500
    PIPE SLOPE(FEET/FEET) =  0.0040
    MANNINGS FRICTION FACTOR = 0.013000
    >>>>> NORMAL DEPTH FLOW(CFS) =      25.94
=========================================================================
```

```
_____
  ***************************************************************************
                HYDRAULIC ELEMENTS - I  PROGRAM PACKAGE
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               Ver. 19.0  Release Date: 06/01/2012  License ID 1448

                          Analysis prepared by:

                          Toal Engineering, Inc.
                          139 Avenida Navarro
                          San Clemente, CA  92672
                           Tel: (949) 492-8586


  -------------------------------------------------------------------------------
    TIME/DATE OF STUDY: 10:19 08/05/2020
  ===============================================================================
   Problem Descriptions:

   Flow Depth for north-south swales using 2% cross slope on building side,
    1% cross slope on parking side, and 7.37 cfs (flow at Node 40)

  ***************************************************************************
  >>>>CHANNEL INPUT INFORMATION<<<<
  -------------------------------------------------------------------------------
      CHANNEL Z1(HORIZONTAL/VERTICAL) =   50.00
             Z2(HORIZONTAL/VERTICAL) =  100.00
      BASEWIDTH(FEET) =      0.00
      CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.006000
      UNIFORM FLOW(CFS) =        7.37
      MANNINGS FRICTION FACTOR = 0.0150
  ===============================================================================
      NORMAL-DEPTH FLOW INFORMATION:
  -------------------------------------------------------------------------------
      >>>>> NORMAL DEPTH(FEET) =    0.23
      FLOW TOP-WIDTH(FEET) =         34.62
      FLOW AREA(SQUARE FEET) =          3.99
      HYDRAULIC DEPTH(FEET) =      0.12
      FLOW AVERAGE VELOCITY(FEET/SEC.) =     1.84
      UNIFORM FROUDE NUMBER =    0.957
      PRESSURE + MOMENTUM(POUNDS) =         45.53
      AVERAGED VELOCITY HEAD(FEET) =      0.053
      SPECIFIC ENERGY(FEET) =      0.284
  ===============================================================================
      CRITICAL-DEPTH FLOW INFORMATION:
  -------------------------------------------------------------------------------
      CRITICAL FLOW TOP-WIDTH(FEET) =        34.15
      CRITICAL FLOW AREA(SQUARE FEET) =          3.89
      CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.11
      CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     1.90
      CRITICAL DEPTH(FEET) =     0.23
      CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         45.49
      AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      0.056
      CRITICAL FLOW SPECIFIC ENERGY(FEET) =      0.283
  ===============================================================================
```

```
    Problem Descriptions:
```

<mark>**Flow Depth for east-west swale using 2% cross slope on building side,
1% cross slope on parking side, and 12.77 cfs (flow at Node 40)**</mark>

```
    *************************************************************************
    >>>>CHANNEL INPUT INFORMATION<<<<
    -------------------------------------------------------------------------
        CHANNEL Z1(HORIZONTAL/VERTICAL) =   50.00
                Z2(HORIZONTAL/VERTICAL) =  100.00
        BASEWIDTH(FEET) =      0.00
        CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.006000
        UNIFORM FLOW(CFS) =       12.77
        MANNINGS FRICTION FACTOR = 0.0150
    =========================================================================
        NORMAL-DEPTH FLOW INFORMATION:
    -------------------------------------------------------------------------
```
<mark>**>>>>> NORMAL DEPTH(FEET) =   0.28**</mark>
```
        FLOW TOP-WIDTH(FEET) =          42.63
        FLOW AREA(SQUARE FEET) =           6.06
        HYDRAULIC DEPTH(FEET) =      0.14
        FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.11
        UNIFORM FROUDE NUMBER =    0.986
        PRESSURE + MOMENTUM(POUNDS) =          87.98
        AVERAGED VELOCITY HEAD(FEET) =      0.069
        SPECIFIC ENERGY(FEET) =      0.353
    =========================================================================
        CRITICAL-DEPTH FLOW INFORMATION:
    -------------------------------------------------------------------------
        CRITICAL FLOW TOP-WIDTH(FEET) =         42.38
        CRITICAL FLOW AREA(SQUARE FEET) =          5.99
        CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.14
        CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =      2.13
        CRITICAL DEPTH(FEET) =     0.28
        CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =           87.97
        AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =      0.071
        CRITICAL FLOW SPECIFIC ENERGY(FEET) =      0.353
    =========================================================================
```

```
    Problem Descriptions:
```

```
    ************************************************************************
    >>>>CHANNEL INPUT INFORMATION<<<<
    ----------------------------------------------------------------------
    CHANNEL Z1(HORIZONTAL/VERTICAL) =   33.00
            Z2(HORIZONTAL/VERTICAL) =   33.00
    BASEWIDTH(FEET) =     0.00
    CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.006000
    UNIFORM FLOW(CFS) =        20.07
    MANNINGS FRICTION FACTOR = 0.0150
    ======================================================================
    NORMAL-DEPTH FLOW INFORMATION:
    ----------------------------------------------------------------------
    >>>>> NORMAL DEPTH(FEET) =    0.46
    FLOW TOP-WIDTH(FEET) =          30.34
    FLOW AREA(SQUARE FEET) =          6.97
    HYDRAULIC DEPTH(FEET) =     0.23
    FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.88
    UNIFORM FROUDE NUMBER =    1.058
    PRESSURE + MOMENTUM(POUNDS) =          178.62
    AVERAGED VELOCITY HEAD(FEET) =     0.129
    SPECIFIC ENERGY(FEET) =      0.588
    ======================================================================
    CRITICAL-DEPTH FLOW INFORMATION:
    ----------------------------------------------------------------------
    CRITICAL FLOW TOP-WIDTH(FEET) =          31.08
    CRITICAL FLOW AREA(SQUARE FEET) =          7.32
    CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.24
    CRITICAL FLOW AVERAGE VELOCITY(FEET/SEC.) =     2.74
    CRITICAL DEPTH(FEET) =     0.47
    CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          178.35
    AVERAGED CRITICAL FLOW VELOCITY HEAD(FEET) =     0.117
    CRITICAL FLOW SPECIFIC ENERGY(FEET) =      0.588
    ======================================================================
```

APPENDIX B

Drainage Map

NODE 1
ELEV.=3024.0'

A=0.72 AC

L=330'

NODE 2
ELEV.=3020.6'

A=1.40 AC

L=220'

NODE 3
ELEV.=3018.3'

A=3.39 AC

L=220'

NODE 4
ELEV.=3016.0'

NODE 60
ELEV.=3011.8'

NODE 50
ELEV.=3012.1'

A=2.92 AC

L=72'

A=0.13 AC

A=2.07 AC

A=0.15 AC

NODE 20
ELEV.=3018.1'

L=77'

NODE 40
ELEV.=3012.6'

L=635'

L=290'

A=0.73 AC

A=0.72 AC

A=1.44 AC

NODE 30
ELEV.=3014.3'

NODE 10
ELEV.=3020.4'

NODE 5
ELEV.=3010.75'

MOJAVE

MESA LINDA AVENUE

N

0   60   90
SCALE: 1" = 60'

REVISIONS   BY   DATE   APVD.   DATE

MOJAVE DRIVE SELF STORAGE

HYDROLOGY MAP

PARCEL 3, PMB 2092 (APN: 3128-621-04)
NE CORNER OF MOJAVE DRIVE AND MESA LINDA AVENUE

DATE: 8/5/2020	H. SCALE: 1"=60'
SURVEY DATE: N/A	V. SCALE: N/A
DRN.: M.F.B.	DWG. NO.
CHD.: M.F.B.	H1
APPD.: C.R.	
JOB NO. 20091	SHEET 1	OF 1