```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.614
 USER-SPECIFIED RUNOFF COEFFICIENT = .3500
 S.C.S. CURVE NUMBER (AMC II) =  88
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.38
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.23
 AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   1.26
 Tc(MIN.) =    8.94
 SUBAREA AREA(ACRES) =     0.17       SUBAREA RUNOFF(CFS) =    0.33
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
 TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.53

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   1.31
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     148.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  458.10  DOWNSTREAM ELEVATION(FEET) =  422.00
 STREET LENGTH(FEET) =   923.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 30.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.018
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.82
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.27
   HALFSTREET FLOOD WIDTH(FEET) =    7.71
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.70
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
 STREET FLOW TRAVEL TIME(MIN.) =   4.15   Tc(MIN.) =   13.09
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.390
 USER-SPECIFIED RUNOFF COEFFICIENT = .8700
 S.C.S. CURVE NUMBER (AMC II) =  98
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.815
 SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    8.78
 TOTAL AREA(ACRES) =        2.6        PEAK FLOW RATE(CFS) =       9.20

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.35
 FLOW VELOCITY(FEET/SEC.) =  4.27   DEPTH*VELOCITY(FT*FT/SEC.) =   1.34
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1071.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =        2.6  TC(MIN.) =     13.09
 PEAK FLOW RATE(CFS)   =       9.20
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

APPENDIX E

PROPOSED CONDITION HYDROLOGY CALCULATIONS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2011 Advanced Engineering Software (aes)
              Ver. 18.0 Release Date: 07/01/2011  License ID 1499

                            Analysis prepared by:

                        Kimley-Horn and Associates, Inc.
                               765 The City Drive
                                   Suite 200
                                Orange, CA 92868

 ************************* DESCRIPTION OF STUDY *************************
* MODERA MELROSE                                                        *
* PROPOSED 100 YR RATIONAL METHOD                                       *
* DECEMBER 2021 ELL                                                     *
 *************************************************************************

  FILE NAME: MOD100PR.DAT
  TIME/DATE OF STUDY: 09:52 12/15/2021
-------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.100
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    456.08
  DOWNSTREAM ELEVATION(FEET) =    454.24
  ELEVATION DIFFERENCE(FEET) =      1.84
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.180
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.65
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.65

**************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
--------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    454.24  DOWNSTREAM(FEET) =    450.54
  CHANNEL LENGTH THRU SUBAREA(FEET) =   586.00   CHANNEL SLOPE =  0.0063
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.419
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.79
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.72
  AVERAGE FLOW DEPTH(FEET) =   0.50   TRAVEL TIME(MIN.) =   2.62
  Tc(MIN.) =    5.80
  SUBAREA AREA(ACRES) =     0.72       SUBAREA RUNOFF(CFS) =    4.22
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.790
  TOTAL AREA(ACRES) =        0.8         PEAK FLOW RATE(CFS) =       4.81

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.


  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =   6.41

  ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     651.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.419
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.73   SUBAREA RUNOFF(CFS) =    4.28
  TOTAL AREA(ACRES) =        1.6   TOTAL RUNOFF(CFS) =       9.08
  TC(MIN.) =    5.80

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   444.26
  FLOW LENGTH(FEET) =    74.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.08
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    5.98
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     725.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.278
```

```
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.19   SUBAREA RUNOFF(CFS) =    1.09
  TOTAL AREA(ACRES) =        1.7   TOTAL RUNOFF(CFS) =      10.00
  TC(MIN.) =    5.98

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   444.26  DOWNSTREAM(FEET) =   444.07
  FLOW LENGTH(FEET) =    19.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.10
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.00
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    6.02
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     744.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.243
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.14   SUBAREA RUNOFF(CFS) =    0.80
  TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =      10.76
  TC(MIN.) =    6.02

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   444.07  DOWNSTREAM(FEET) =   443.70
  FLOW LENGTH(FEET) =    37.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.15
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.76
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    6.11
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =     781.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.177
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.12   SUBAREA RUNOFF(CFS) =    0.68
  TOTAL AREA(ACRES) =        2.0   TOTAL RUNOFF(CFS) =      11.34
  TC(MIN.) =    6.11

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.70  DOWNSTREAM(FEET) =   443.05
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.012
```

```
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.48
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.34
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    6.26
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =     846.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.069
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.20   SUBAREA RUNOFF(CFS) =    1.12
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =      12.29
  TC(MIN.) =    6.26

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.069
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.18   SUBAREA RUNOFF(CFS) =    1.01
  TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =      13.29
  TC(MIN.) =    6.26

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.05  DOWNSTREAM(FEET) =   442.14
  FLOW LENGTH(FEET) =    91.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.72
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.29
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    6.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =     937.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.929
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.07   SUBAREA RUNOFF(CFS) =    0.38
  TOTAL AREA(ACRES) =        2.5   TOTAL RUNOFF(CFS) =      13.41
  TC(MIN.) =    6.45

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   442.14  DOWNSTREAM(FEET) =   441.69
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.73
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.41
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    6.55
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =     982.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.863
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.14   SUBAREA RUNOFF(CFS) =    0.76
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =      14.04
  TC(MIN.) =    6.55

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   441.69  DOWNSTREAM(FEET) =   441.15
  FLOW LENGTH(FEET) =    54.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.79
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.04
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    6.66
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =    1036.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    109.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.786
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.34   SUBAREA RUNOFF(CFS) =    1.82
  TOTAL AREA(ACRES) =        2.9   TOTAL RUNOFF(CFS) =      15.71
  TC(MIN.) =    6.66

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   441.15  DOWNSTREAM(FEET) =   438.59
  FLOW LENGTH(FEET) =   256.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.91
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.71
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =    7.20
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =    1292.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.454
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.39   SUBAREA RUNOFF(CFS) =    1.99
```

```
  TOTAL AREA(ACRES) =        3.3   TOTAL RUNOFF(CFS) =      16.93
  TC(MIN.) =    7.20

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.59  DOWNSTREAM(FEET) =   438.04
  FLOW LENGTH(FEET) =    54.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.31
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.93
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    7.31
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    111.00 =    1346.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    111.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.392
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.09   SUBAREA RUNOFF(CFS) =    0.45
  TOTAL AREA(ACRES) =        3.4   TOTAL RUNOFF(CFS) =      17.22
  TC(MIN.) =    7.31

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.04  DOWNSTREAM(FEET) =   437.65
  FLOW LENGTH(FEET) =    39.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.28
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.22
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.39
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =    1385.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.348
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.20   SUBAREA RUNOFF(CFS) =    1.00
  TOTAL AREA(ACRES) =        3.6   TOTAL RUNOFF(CFS) =      18.10
  TC(MIN.) =    7.39

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   437.65  DOWNSTREAM(FEET) =   436.60
  FLOW LENGTH(FEET) =   106.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.33
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.10
```

```
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    7.60
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =    1491.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.60
  RAINFALL INTENSITY(INCH/HR) =   6.23
  TOTAL STREAM AREA(ACRES) =     3.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     18.10

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    454.99
  DOWNSTREAM ELEVATION(FEET) =    453.11
  ELEVATION DIFFERENCE(FEET) =      1.88
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.158
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.65
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.65

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    453.11  DOWNSTREAM(FEET) =    440.97
  CHANNEL LENGTH THRU SUBAREA(FEET) =   517.00   CHANNEL SLOPE =  0.0235
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.19
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.37
  AVERAGE FLOW DEPTH(FEET) =   0.45   TRAVEL TIME(MIN.) =   1.61
  Tc(MIN.) =    4.76
  SUBAREA AREA(ACRES) =     0.79       SUBAREA RUNOFF(CFS) =    5.10
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.790
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       5.74

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.


  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =   7.66

  ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     582.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.72   SUBAREA RUNOFF(CFS) =    4.65
  TOTAL AREA(ACRES) =        1.6   TOTAL RUNOFF(CFS) =      10.39
  TC(MIN.) =    4.76

********************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
--------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    440.97  DOWNSTREAM(FEET) =    439.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   209.00   CHANNEL SLOPE =  0.0070
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.168
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.10
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  14.80
  AVERAGE FLOW DEPTH(FEET) =   0.50   TRAVEL TIME(MIN.) =   0.24
  Tc(MIN.) =    5.00
  SUBAREA AREA(ACRES) =     0.22       SUBAREA RUNOFF(CFS) =    1.42
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.790
  TOTAL AREA(ACRES) =        1.8         PEAK FLOW RATE(CFS) =      11.81

         ==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
             CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
             ALLOWABLE DEPTH).
             AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
             ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.


  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.50   FLOW VELOCITY(FEET/SEC.) =  15.74

  ==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     791.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   437.63  DOWNSTREAM(FEET) =   436.81
  FLOW LENGTH(FEET) =   164.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.61
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.81
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =    5.49
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     955.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
```

```
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.694
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.29   SUBAREA RUNOFF(CFS) =    1.76
  TOTAL AREA(ACRES) =        2.1   TOTAL RUNOFF(CFS) =      12.89
  TC(MIN.) =    5.49

********************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.694
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.18   SUBAREA RUNOFF(CFS) =    1.09
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =      13.98
  TC(MIN.) =    5.49

********************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    113.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   436.81  DOWNSTREAM(FEET) =   436.60
  FLOW LENGTH(FEET) =    43.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.95
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.98
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    5.61
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    113.00 =     998.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.61
  RAINFALL INTENSITY(INCH/HR) =   7.59
  TOTAL STREAM AREA(ACRES) =     2.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.98

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       18.10     7.60        6.233          3.61
      2       13.98     5.61        7.587          2.30

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       27.33     5.61       7.587
      2       29.59     7.60       6.233

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.59   Tc(MIN.) =    7.60
  TOTAL AREA(ACRES) =        5.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =    1491.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    114.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   436.60  DOWNSTREAM(FEET) =   436.42
  FLOW LENGTH(FEET) =    18.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.32
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      29.59
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.63
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    114.00 =    1509.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    114.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.216
  USER-SPECIFIED RUNOFF COEFFICIENT = .7900
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7900
  SUBAREA AREA(ACRES) =    0.21   SUBAREA RUNOFF(CFS) =    1.03
  TOTAL AREA(ACRES) =        6.1   TOTAL RUNOFF(CFS) =      30.05
  TC(MIN.) =    7.63

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    115.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   428.10  DOWNSTREAM(FEET) =   418.10
  FLOW LENGTH(FEET) =    92.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.10
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.05
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    7.70
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    115.00 =    1601.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    115.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.182
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7957
  SUBAREA AREA(ACRES) =    0.47   SUBAREA RUNOFF(CFS) =    2.53
  TOTAL AREA(ACRES) =        6.6   TOTAL RUNOFF(CFS) =      32.41
  TC(MIN.) =    7.70

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    116.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   418.10  DOWNSTREAM(FEET) =   416.00
  FLOW LENGTH(FEET) =    94.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.87
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.41
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    7.82
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    116.00 =    1695.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    116.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.119
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7864
  SUBAREA AREA(ACRES) =    0.14   SUBAREA RUNOFF(CFS) =    0.30
  TOTAL AREA(ACRES) =        6.7   TOTAL RUNOFF(CFS) =      32.41
  TC(MIN.) =    7.82
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    116.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.119
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6896
  SUBAREA AREA(ACRES) =    1.92   SUBAREA RUNOFF(CFS) =    4.11
  TOTAL AREA(ACRES) =        8.6   TOTAL RUNOFF(CFS) =      36.50
  TC(MIN.) =    7.82

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    466.09
  DOWNSTREAM ELEVATION(FEET) =    464.87
  ELEVATION DIFFERENCE(FEET) =      1.22
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.677
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.194
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    464.87  DOWNSTREAM(FEET) =    458.10
  CHANNEL LENGTH THRU SUBAREA(FEET) =    83.00   CHANNEL SLOPE =  0.0816
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.672
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =  88
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.39
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.23
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   1.12
  Tc(MIN.) =    8.80
  SUBAREA AREA(ACRES) =     0.17       SUBAREA RUNOFF(CFS) =    0.34
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.54

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   1.33
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  62
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  458.10  DOWNSTREAM ELEVATION(FEET) =  422.00
  STREET LENGTH(FEET) =   923.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    7.51
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.66
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.96
  STREET FLOW TRAVEL TIME(MIN.) =   4.21   Tc(MIN.) =   13.01
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.409
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  S.C.S. CURVE NUMBER (AMC II) =  98
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.812
  SUBAREA AREA(ACRES) =    2.15      SUBAREA RUNOFF(CFS) =    8.25
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       8.66

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.12
  FLOW VELOCITY(FEET/SEC.) =  4.19   DEPTH*VELOCITY(FT*FT/SEC.) =   1.30
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =    1061.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.4  TC(MIN.) =     13.01
  PEAK FLOW RATE(CFS)   =       8.66
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX F

DETENTION BASINS CALCULATIONS

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RATIONAL METHOD HYDROGRAPH PROGRAM

RUN DATE 12/15/2021
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 5 MIN.
6 HOUR RAINFALL 3.1 INCHES
BASIN AREA 6.1 ACRES
RUNOFF COEFFICIENT 0.79
PEAK DISCHARGE 30.1 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 5	DISCHARGE (CFS) = 0.9
TIME (MIN) = 10	DISCHARGE (CFS) = 0.9
TIME (MIN) = 15	DISCHARGE (CFS) = 0.9
TIME (MIN) = 20	DISCHARGE (CFS) = 0.9
TIME (MIN) = 25	DISCHARGE (CFS) = 0.9
TIME (MIN) = 30	DISCHARGE (CFS) = 1
TIME (MIN) = 35	DISCHARGE (CFS) = 1
TIME (MIN) = 40	DISCHARGE (CFS) = 1
TIME (MIN) = 45	DISCHARGE (CFS) = 1
TIME (MIN) = 50	DISCHARGE (CFS) = 1
TIME (MIN) = 55	DISCHARGE (CFS) = 1
TIME (MIN) = 60	DISCHARGE (CFS) = 1
TIME (MIN) = 65	DISCHARGE (CFS) = 1.1
TIME (MIN) = 70	DISCHARGE (CFS) = 1.1
TIME (MIN) = 75	DISCHARGE (CFS) = 1.1
TIME (MIN) = 80	DISCHARGE (CFS) = 1.1
TIME (MIN) = 85	DISCHARGE (CFS) = 1.2
TIME (MIN) = 90	DISCHARGE (CFS) = 1.2
TIME (MIN) = 95	DISCHARGE (CFS) = 1.2
TIME (MIN) = 100	DISCHARGE (CFS) = 1.2
TIME (MIN) = 105	DISCHARGE (CFS) = 1.3
TIME (MIN) = 110	DISCHARGE (CFS) = 1.3
TIME (MIN) = 115	DISCHARGE (CFS) = 1.3
TIME (MIN) = 120	DISCHARGE (CFS) = 1.3
TIME (MIN) = 125	DISCHARGE (CFS) = 1.4
TIME (MIN) = 130	DISCHARGE (CFS) = 1.4
TIME (MIN) = 135	DISCHARGE (CFS) = 1.5
TIME (MIN) = 140	DISCHARGE (CFS) = 1.5
TIME (MIN) = 145	DISCHARGE (CFS) = 1.6
TIME (MIN) = 150	DISCHARGE (CFS) = 1.6
TIME (MIN) = 155	DISCHARGE (CFS) = 1.7
TIME (MIN) = 160	DISCHARGE (CFS) = 1.7
TIME (MIN) = 165	DISCHARGE (CFS) = 1.8
TIME (MIN) = 170	DISCHARGE (CFS) = 1.9
TIME (MIN) = 175	DISCHARGE (CFS) = 2
TIME (MIN) = 180	DISCHARGE (CFS) = 2.1
TIME (MIN) = 185	DISCHARGE (CFS) = 2.2
TIME (MIN) = 190	DISCHARGE (CFS) = 2.3
TIME (MIN) = 195	DISCHARGE (CFS) = 2.5
TIME (MIN) = 200	DISCHARGE (CFS) = 2.6
TIME (MIN) = 205	DISCHARGE (CFS) = 2.9
TIME (MIN) = 210	DISCHARGE (CFS) = 3.1
TIME (MIN) = 215	DISCHARGE (CFS) = 3.5
TIME (MIN) = 220	DISCHARGE (CFS) = 3.8
TIME (MIN) = 225	DISCHARGE (CFS) = 4.7
TIME (MIN) = 230	DISCHARGE (CFS) = 5.3
TIME (MIN) = 235	DISCHARGE (CFS) = 7.8
TIME (MIN) = 240	DISCHARGE (CFS) = 20.2
TIME (MIN) = 245	DISCHARGE (CFS) = 30.1
TIME (MIN) = 250	DISCHARGE (CFS) = 6.3
TIME (MIN) = 255	DISCHARGE (CFS) = 4.2
TIME (MIN) = 260	DISCHARGE (CFS) = 3.3
TIME (MIN) = 265	DISCHARGE (CFS) = 2.7
TIME (MIN) = 270	DISCHARGE (CFS) = 2.4
TIME (MIN) = 275	DISCHARGE (CFS) = 2.1
TIME (MIN) = 280	DISCHARGE (CFS) = 1.9
TIME (MIN) = 285	DISCHARGE (CFS) = 1.8
TIME (MIN) = 290	DISCHARGE (CFS) = 1.6
TIME (MIN) = 295	DISCHARGE (CFS) = 1.5
TIME (MIN) = 300	DISCHARGE (CFS) = 1.5
TIME (MIN) = 305	DISCHARGE (CFS) = 1.4
TIME (MIN) = 310	DISCHARGE (CFS) = 1.3
TIME (MIN) = 315	DISCHARGE (CFS) = 1.2
TIME (MIN) = 320	DISCHARGE (CFS) = 1.2
TIME (MIN) = 325	DISCHARGE (CFS) = 1.1
TIME (MIN) = 330	DISCHARGE (CFS) = 1.1
TIME (MIN) = 335	DISCHARGE (CFS) = 1.1
TIME (MIN) = 340	DISCHARGE (CFS) = 1
TIME (MIN) = 345	DISCHARGE (CFS) = 1
TIME (MIN) = 350	DISCHARGE (CFS) = 1
TIME (MIN) = 355	DISCHARGE (CFS) = 0.9
TIME (MIN) = 360	DISCHARGE (CFS) = 0.9

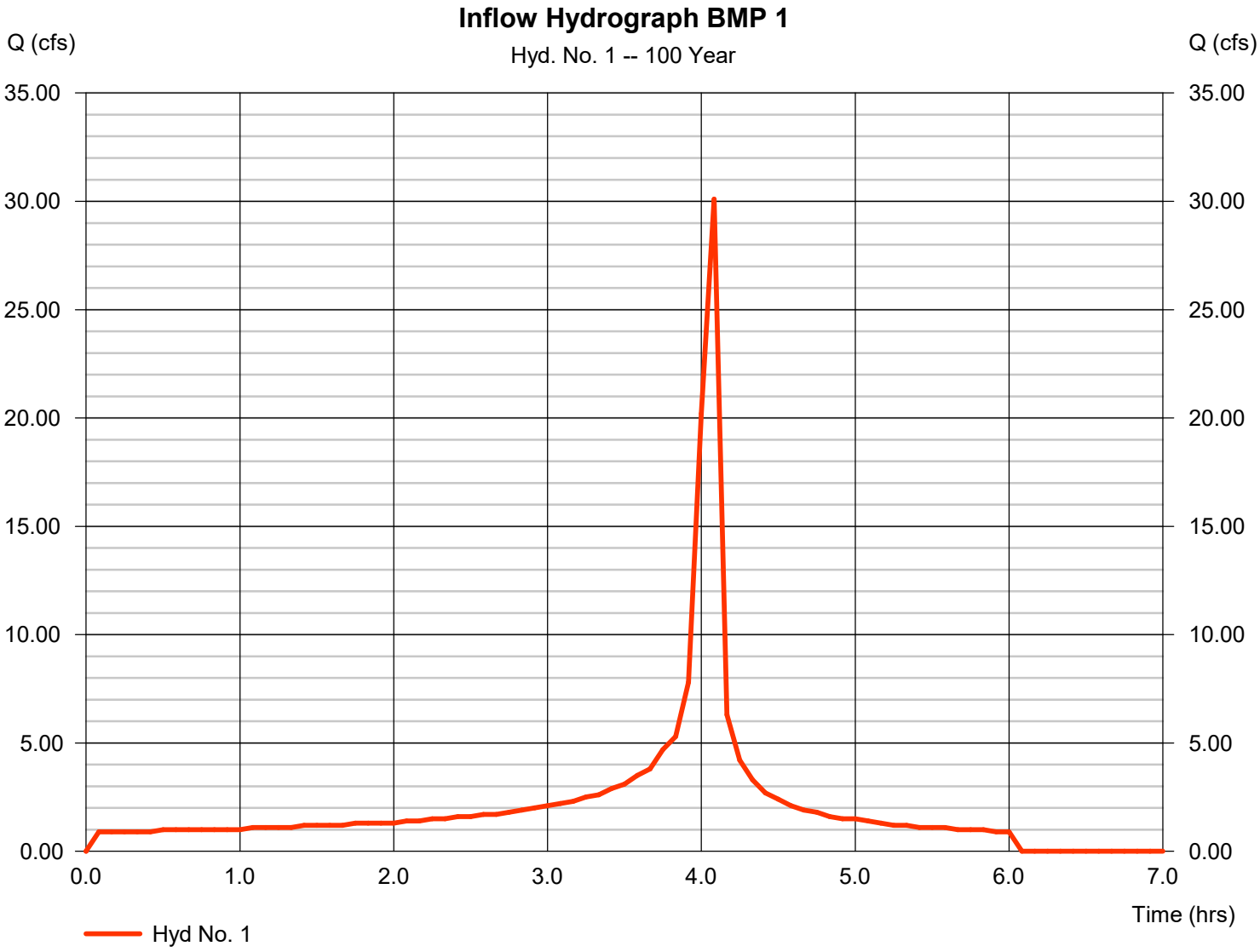
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4 Wednesday, 12 / 15 / 2021

Hyd. No. 1

Inflow Hydrograph BMP 1

Hydrograph type	= Manual	Peak discharge	= 30.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 5 min	Hyd. volume	= 53,880 cuft



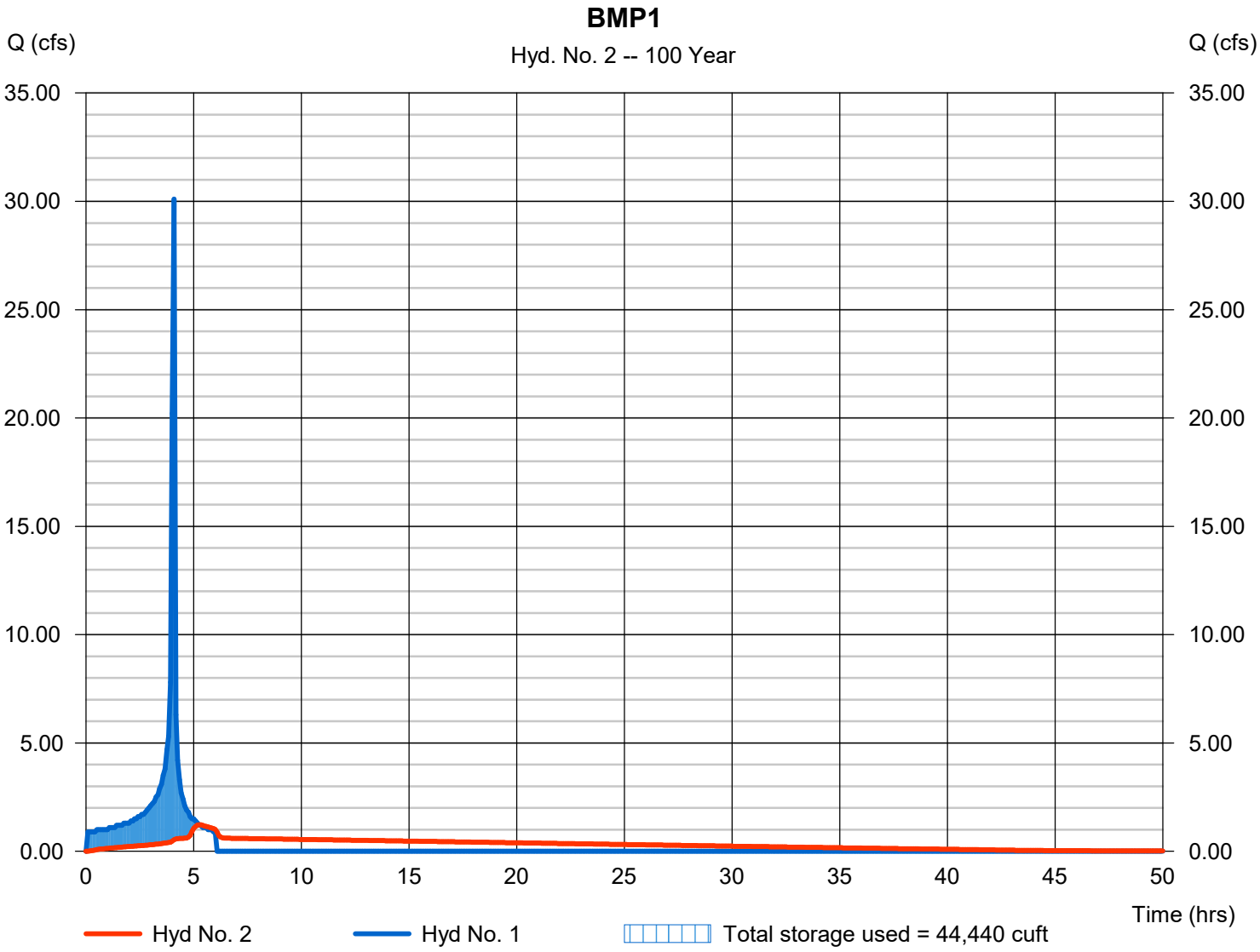
Hydrograph Report

Hyd. No. 2

BMP1

Hydrograph type	=	Reservoir	Peak discharge	=	1.225 cfs
Storm frequency	=	100 yrs	Time to peak	=	5.25 hrs
Time interval	=	5 min	Hyd. volume	=	53,836 cuft
Inflow hyd. No.	=	1 - Inflow Hydrograph BMP 1	Max. Elevation	=	435.23 ft
Reservoir name	=	Underground Detention Vault	Max. Storage	=	44,440 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Underground Detention Vault

Pond Data

UG Chambers -Invert elev. = 428.10 ft, Rise x Span = 8.00 x 50.00 ft, Barrel Len = 124.66 ft, No. Barrels = 1, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	428.10	n/a	0	0
0.80	428.90	n/a	4,987	4,987
1.60	429.70	n/a	4,988	9,975
2.40	430.50	n/a	4,987	14,962
3.20	431.30	n/a	4,988	19,950
4.00	432.10	n/a	4,987	24,937
4.80	432.90	n/a	4,987	29,924
5.60	433.70	n/a	4,988	34,912
6.40	434.50	n/a	4,987	39,899
7.20	435.30	n/a	4,988	44,887
8.00	436.10	n/a	4,987	49,874

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	3.00	0.00	0.00
Span (in)	= 12.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 428.10	428.10	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 435.10	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	428.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.08	499	428.18	0.01 ic	0.01 ic	---	---	0.00	---	---	---	---	---	0.011
0.16	997	428.26	0.04 ic	0.04 ic	---	---	0.00	---	---	---	---	---	0.041
0.24	1,496	428.34	0.08 ic	0.08 ic	---	---	0.00	---	---	---	---	---	0.077
0.32	1,995	428.42	0.10 ic	0.10 ic	---	---	0.00	---	---	---	---	---	0.098
0.40	2,494	428.50	0.12 ic	0.12 ic	---	---	0.00	---	---	---	---	---	0.115
0.48	2,992	428.58	0.13 ic	0.13 ic	---	---	0.00	---	---	---	---	---	0.131
0.56	3,491	428.66	0.15 ic	0.15 ic	---	---	0.00	---	---	---	---	---	0.145
0.64	3,990	428.74	0.16 ic	0.16 ic	---	---	0.00	---	---	---	---	---	0.158
0.72	4,489	428.82	0.18 ic	0.17 ic	---	---	0.00	---	---	---	---	---	0.170
0.80	4,987	428.90	0.19 ic	0.18 ic	---	---	0.00	---	---	---	---	---	0.182
0.88	5,486	428.98	0.20 ic	0.19 ic	---	---	0.00	---	---	---	---	---	0.193
0.96	5,985	429.06	0.21 ic	0.20 ic	---	---	0.00	---	---	---	---	---	0.203
1.04	6,484	429.14	0.21 ic	0.21 ic	---	---	0.00	---	---	---	---	---	0.214
1.12	6,982	429.22	0.22 ic	0.22 ic	---	---	0.00	---	---	---	---	---	0.223
1.20	7,481	429.30	0.24 ic	0.23 ic	---	---	0.00	---	---	---	---	---	0.232
1.28	7,980	429.38	0.25 ic	0.24 ic	---	---	0.00	---	---	---	---	---	0.241
1.36	8,479	429.46	0.25 ic	0.25 ic	---	---	0.00	---	---	---	---	---	0.250
1.44	8,977	429.54	0.26 ic	0.26 ic	---	---	0.00	---	---	---	---	---	0.258
1.52	9,476	429.62	0.28 ic	0.27 ic	---	---	0.00	---	---	---	---	---	0.266
1.60	9,975	429.70	0.28 ic	0.27 ic	---	---	0.00	---	---	---	---	---	0.274
1.68	10,474	429.78	0.29 ic	0.28 ic	---	---	0.00	---	---	---	---	---	0.282
1.76	10,972	429.86	0.29 ic	0.29 ic	---	---	0.00	---	---	---	---	---	0.290
1.84	11,471	429.94	0.31 ic	0.30 ic	---	---	0.00	---	---	---	---	---	0.296
1.92	11,970	430.02	0.31 ic	0.30 ic	---	---	0.00	---	---	---	---	---	0.304
2.00	12,469	430.10	0.32 ic	0.31 ic	---	---	0.00	---	---	---	---	---	0.311
2.08	12,967	430.18	0.32 ic	0.32 ic	---	---	0.00	---	---	---	---	---	0.318
2.16	13,466	430.26	0.32 ic	0.32 ic	---	---	0.00	---	---	---	---	---	0.324
2.24	13,965	430.34	0.34 ic	0.33 ic	---	---	0.00	---	---	---	---	---	0.331
2.32	14,463	430.42	0.34 ic	0.34 ic	---	---	0.00	---	---	---	---	---	0.337
2.40	14,962	430.50	0.35 ic	0.34 ic	---	---	0.00	---	---	---	---	---	0.344
2.48	15,461	430.58	0.35 ic	0.35 ic	---	---	0.00	---	---	---	---	---	0.350

Continues on next page...

Underground Detention Vault

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
2.56	15,960	430.66	0.36 ic	0.36 ic	---	---	0.00	---	---	---	---	---	0.356
2.64	16,458	430.74	0.37 ic	0.36 ic	---	---	0.00	---	---	---	---	---	0.362
2.72	16,957	430.82	0.37 ic	0.37 ic	---	---	0.00	---	---	---	---	---	0.368
2.80	17,456	430.90	0.39 ic	0.37 ic	---	---	0.00	---	---	---	---	---	0.374
2.88	17,955	430.98	0.39 ic	0.38 ic	---	---	0.00	---	---	---	---	---	0.379
2.96	18,453	431.06	0.39 ic	0.39 ic	---	---	0.00	---	---	---	---	---	0.385
3.04	18,952	431.14	0.40 ic	0.39 ic	---	---	0.00	---	---	---	---	---	0.391
3.12	19,451	431.22	0.40 ic	0.40 ic	---	---	0.00	---	---	---	---	---	0.396
3.20	19,950	431.30	0.40 ic	0.40 ic	---	---	0.00	---	---	---	---	---	0.402
3.28	20,448	431.38	0.41 ic	0.41 ic	---	---	0.00	---	---	---	---	---	0.407
3.36	20,947	431.46	0.42 ic	0.41 ic	---	---	0.00	---	---	---	---	---	0.412
3.44	21,446	431.54	0.42 ic	0.42 ic	---	---	0.00	---	---	---	---	---	0.418
3.52	21,945	431.62	0.42 ic	0.42 ic	---	---	0.00	---	---	---	---	---	0.423
3.60	22,443	431.70	0.44 ic	0.43 ic	---	---	0.00	---	---	---	---	---	0.428
3.68	22,942	431.78	0.44 ic	0.43 ic	---	---	0.00	---	---	---	---	---	0.433
3.76	23,441	431.86	0.44 ic	0.44 ic	---	---	0.00	---	---	---	---	---	0.438
3.84	23,940	431.94	0.44 ic	0.44 ic	---	---	0.00	---	---	---	---	---	0.443
3.92	24,438	432.02	0.46 ic	0.45 ic	---	---	0.00	---	---	---	---	---	0.448
4.00	24,937	432.10	0.46 ic	0.45 ic	---	---	0.00	---	---	---	---	---	0.453
4.08	25,436	432.18	0.46 ic	0.46 ic	---	---	0.00	---	---	---	---	---	0.458
4.16	25,934	432.26	0.46 ic	0.46 ic	---	---	0.00	---	---	---	---	---	0.462
4.24	26,433	432.34	0.48 ic	0.47 ic	---	---	0.00	---	---	---	---	---	0.467
4.32	26,932	432.42	0.48 ic	0.47 ic	---	---	0.00	---	---	---	---	---	0.472
4.40	27,431	432.50	0.48 ic	0.48 ic	---	---	0.00	---	---	---	---	---	0.476
4.48	27,929	432.58	0.48 ic	0.48 ic	---	---	0.00	---	---	---	---	---	0.481
4.56	28,428	432.66	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.485
4.64	28,927	432.74	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.490
4.72	29,426	432.82	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.494
4.80	29,924	432.90	0.50 ic	0.50 ic	---	---	0.00	---	---	---	---	---	0.499
4.88	30,423	432.98	0.52 ic	0.50 ic	---	---	0.00	---	---	---	---	---	0.503
4.96	30,922	433.06	0.52 ic	0.51 ic	---	---	0.00	---	---	---	---	---	0.507
5.04	31,421	433.14	0.52 ic	0.51 ic	---	---	0.00	---	---	---	---	---	0.512
5.12	31,919	433.22	0.52 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.516
5.20	32,418	433.30	0.52 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.520
5.28	32,917	433.38	0.54 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.524
5.36	33,416	433.46	0.54 ic	0.53 ic	---	---	0.00	---	---	---	---	---	0.528
5.44	33,914	433.54	0.54 ic	0.53 ic	---	---	0.00	---	---	---	---	---	0.533
5.52	34,413	433.62	0.54 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.537
5.60	34,912	433.70	0.54 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.541
5.68	35,411	433.78	0.56 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.545
5.76	35,909	433.86	0.56 ic	0.55 ic	---	---	0.00	---	---	---	---	---	0.549
5.84	36,408	433.94	0.56 ic	0.55 ic	---	---	0.00	---	---	---	---	---	0.553
5.92	36,907	434.02	0.56 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.557
6.00	37,405	434.10	0.56 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.561
6.08	37,904	434.18	0.58 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.564
6.16	38,403	434.26	0.58 ic	0.57 ic	---	---	0.00	---	---	---	---	---	0.568
6.24	38,902	434.34	0.58 ic	0.57 ic	---	---	0.00	---	---	---	---	---	0.572
6.32	39,400	434.42	0.58 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.576
6.40	39,899	434.50	0.58 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.580
6.48	40,398	434.58	0.58 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.584
6.56	40,897	434.66	0.60 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.587
6.64	41,395	434.74	0.60 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.591
6.72	41,894	434.82	0.60 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.595
6.80	42,393	434.90	0.60 ic	0.60 ic	---	---	0.00	---	---	---	---	---	0.599
6.88	42,892	434.98	0.60 ic	0.60 ic	---	---	0.00	---	---	---	---	---	0.602
6.96	43,390	435.06	0.62 ic	0.61 ic	---	---	0.00	---	---	---	---	---	0.606
7.04	43,889	435.14	0.71 ic	0.61 ic	---	---	0.11	---	---	---	---	---	0.714
7.12	44,388	435.22	1.16 ic	0.61 ic	---	---	0.55	---	---	---	---	---	1.158
7.20	44,887	435.30	1.79 ic	0.60 ic	---	---	1.19	---	---	---	---	---	1.793
7.28	45,385	435.38	2.57 ic	0.59 ic	---	---	1.97	---	---	---	---	---	2.568
7.36	45,884	435.46	3.46 ic	0.58 ic	---	---	2.88	---	---	---	---	---	3.457
7.44	46,383	435.54	4.44 ic	0.56 ic	---	---	3.89	---	---	---	---	---	4.444
7.52	46,882	435.62	4.44 ic	0.56 ic	---	---	3.88 ic	---	---	---	---	---	4.438
7.60	47,380	435.70	4.72 ic	0.56 ic	---	---	4.16 ic	---	---	---	---	---	4.721
7.68	47,879	435.78	4.98 ic	0.55 ic	---	---	4.43 ic	---	---	---	---	---	4.985
7.76	48,378	435.86	5.23 ic	0.55 ic	---	---	4.69 ic	---	---	---	---	---	5.233
7.84	48,877	435.94	5.47 ic	0.54 ic	---	---	4.93 ic	---	---	---	---	---	5.469
7.92	49,375	436.02	5.69 ic	0.54 ic	---	---	5.16 ic	---	---	---	---	---	5.693
8.00	49,874	436.10	5.91 ic	0.53 ic	---	---	5.38 ic	---	---	---	---	---	5.908

...End

Worksheet for Circular Orifice - BMP 1

Project Description	
Solve For	Discharge

Input Data	
Headwater Elevation	96.00 in
Centroid Elevation	6.00 in
Tailwater Elevation	0.00 in
Discharge Coefficient	0.600
Diameter	3.0 in

Results	
Discharge	0.65 cfs
Headwater Height Above Centroid	90.00 in
Tailwater Height Above Centroid	-6.00 in
Flow Area	0.0 ft^2
Velocity	13.18 ft/s

Worksheet for Circular Pipe - Offsite Pipe Sizing

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.028	
Channel Slope	2.230	%
Diameter	18.0	in
Discharge	3.70	cfs

Results

Normal Depth	9.1	in
Flow Area	0.9	ft²
Wetted Perimeter	2.4	ft
Hydraulic Radius	4.5	in
Top Width	1.50	ft
Critical Depth	8.8	in
Percent Full	50.5	%
Critical Slope	2.468	%
Velocity	4.14	ft/s
Velocity Head	0.27	ft
Specific Energy	1.02	ft
Froude Number	0.945	
Maximum Discharge	7.83	cfs
Discharge Full	7.28	cfs
Slope Full	0.576	%
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	33.0	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	9.1	in
Critical Depth	8.8	in
Channel Slope	2.230	%
Critical Slope	2.468	%

Worksheet for Circular Pipe - POC 1 EX

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	12.500	%
Diameter	24.0	in
Discharge	15.40	cfs

Results		
Normal Depth	7.1	in
Flow Area	0.8	ft²
Wetted Perimeter	2.3	ft
Hydraulic Radius	4.1	in
Top Width	1.83	ft
Critical Depth	17.0	in
Percent Full	29.7	%
Critical Slope	0.643	%
Velocity	19.66	ft/s
Velocity Head	6.01	ft
Specific Energy	6.60	ft
Froude Number	5.297	
Maximum Discharge	86.03	cfs
Discharge Full	79.98	cfs
Slope Full	0.463	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	29.7	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.1	in
Critical Depth	17.0	in
Channel Slope	12.500	%
Critical Slope	0.643	%

Worksheet for Circular Pipe - POC 1 PROP

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	12.500	%
Diameter	24.0	in
Discharge	8.10	cfs

Results		
Normal Depth	5.2	in
Flow Area	0.5	ft²
Wetted Perimeter	1.9	ft
Hydraulic Radius	3.1	in
Top Width	1.64	ft
Critical Depth	12.2	in
Percent Full	21.5	%
Critical Slope	0.491	%
Velocity	16.34	ft/s
Velocity Head	4.15	ft
Specific Energy	4.58	ft
Froude Number	5.247	
Maximum Discharge	86.03	cfs
Discharge Full	79.98	cfs
Slope Full	0.128	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	21.5	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.2	in
Critical Depth	12.2	in
Channel Slope	12.500	%
Critical Slope	0.491	%

Worksheet for Circular Pipe - POC 2 EX

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	4.350	%
Diameter	18.0	in
Discharge	9.20	cfs

Results		
Normal Depth	8.1	in
Flow Area	0.8	ft²
Wetted Perimeter	2.2	ft
Hydraulic Radius	4.2	in
Top Width	1.49	ft
Critical Depth	14.1	in
Percent Full	45.2	%
Critical Slope	0.841	%
Velocity	11.85	ft/s
Velocity Head	2.18	ft
Specific Energy	2.86	ft
Froude Number	2.899	
Maximum Discharge	23.57	cfs
Discharge Full	21.91	cfs
Slope Full	0.767	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	45.2	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	8.1	in
Critical Depth	14.1	in
Channel Slope	4.350	%
Critical Slope	0.841	%

Worksheet for Circular Pipe - POC 2 PROP

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	4.350	%
Diameter	18.0	in
Discharge	8.70	cfs

Results		
Normal Depth	7.9	in
Flow Area	0.7	ft²
Wetted Perimeter	2.2	ft
Hydraulic Radius	4.1	in
Top Width	1.49	ft
Critical Depth	13.7	in
Percent Full	43.8	%
Critical Slope	0.797	%
Velocity	11.68	ft/s
Velocity Head	2.12	ft
Specific Energy	2.78	ft
Froude Number	2.911	
Maximum Discharge	23.57	cfs
Discharge Full	21.91	cfs
Slope Full	0.686	%
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	43.8	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.9	in
Critical Depth	13.7	in
Channel Slope	4.350	%
Critical Slope	0.797	%

APPENDIX G

FEMA MAP

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NOTES TO USERS

LEGEND

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0757G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 757 OF 2375

MAP NUMBER 06073C0757G

MAP REVISED MAY 16, 2012

Federal Emergency Management Agency

EXHIBIT A

EXISTING DRAINAGE EXHIBIT

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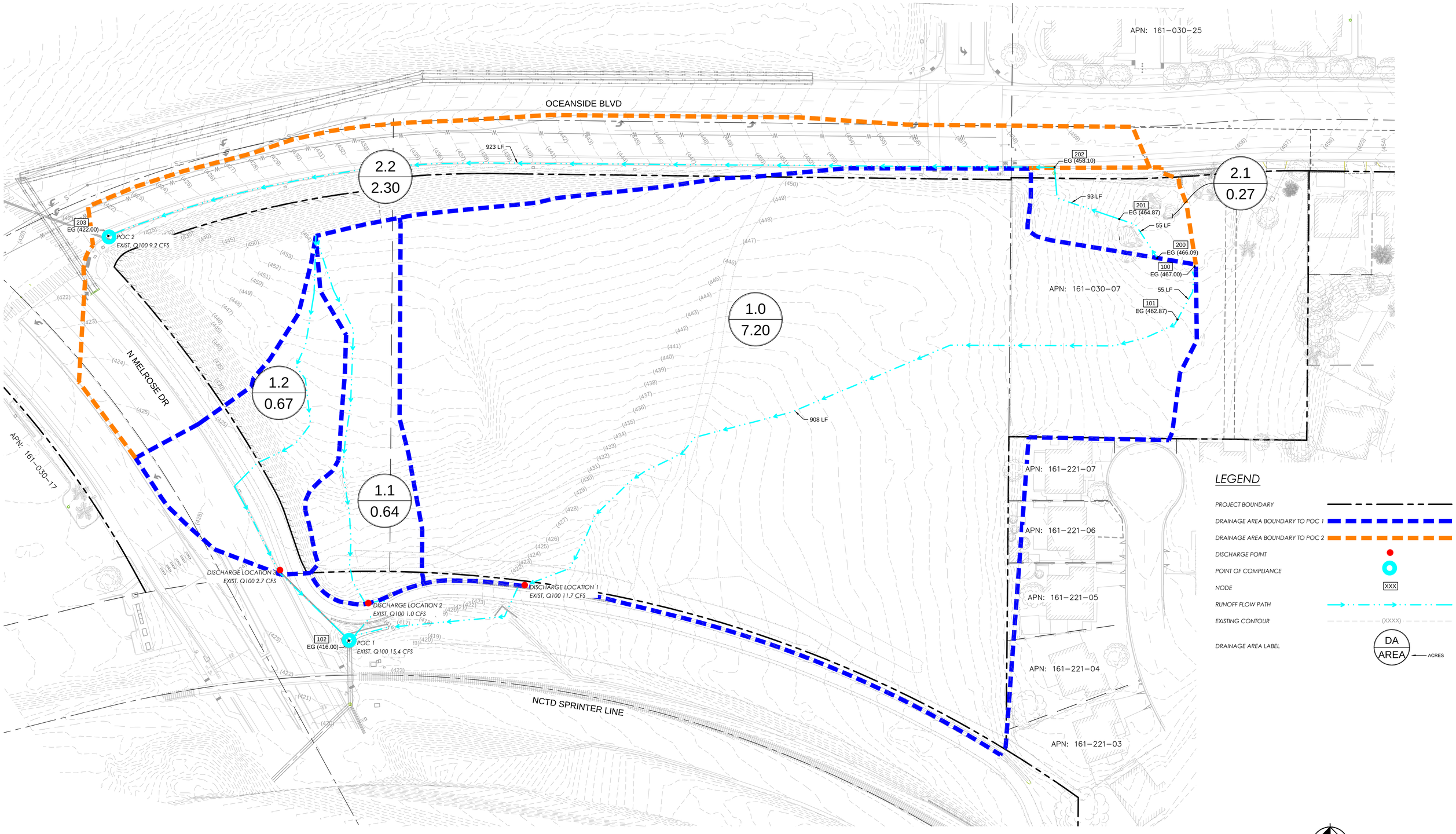

LEGEND

- PROJECT BOUNDARY
- DRAINAGE AREA BOUNDARY TO POC 1
- DRAINAGE AREA BOUNDARY TO POC 2
- DISCHARGE POINT
- POINT OF COMPLIANCE
- NODE — XXX
- RUNOFF FLOW PATH
- EXISTING CONTOUR — (XXXX)
- DRAINAGE AREA LABEL — DA / AREA — ACRES

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80

Kimley»Horn

EXISTING DRAINAGE EXHIBIT

MODERA MELROSE

10/14/2021

EXHIBIT B

PROPOSED DRAINAGE EXHIBIT

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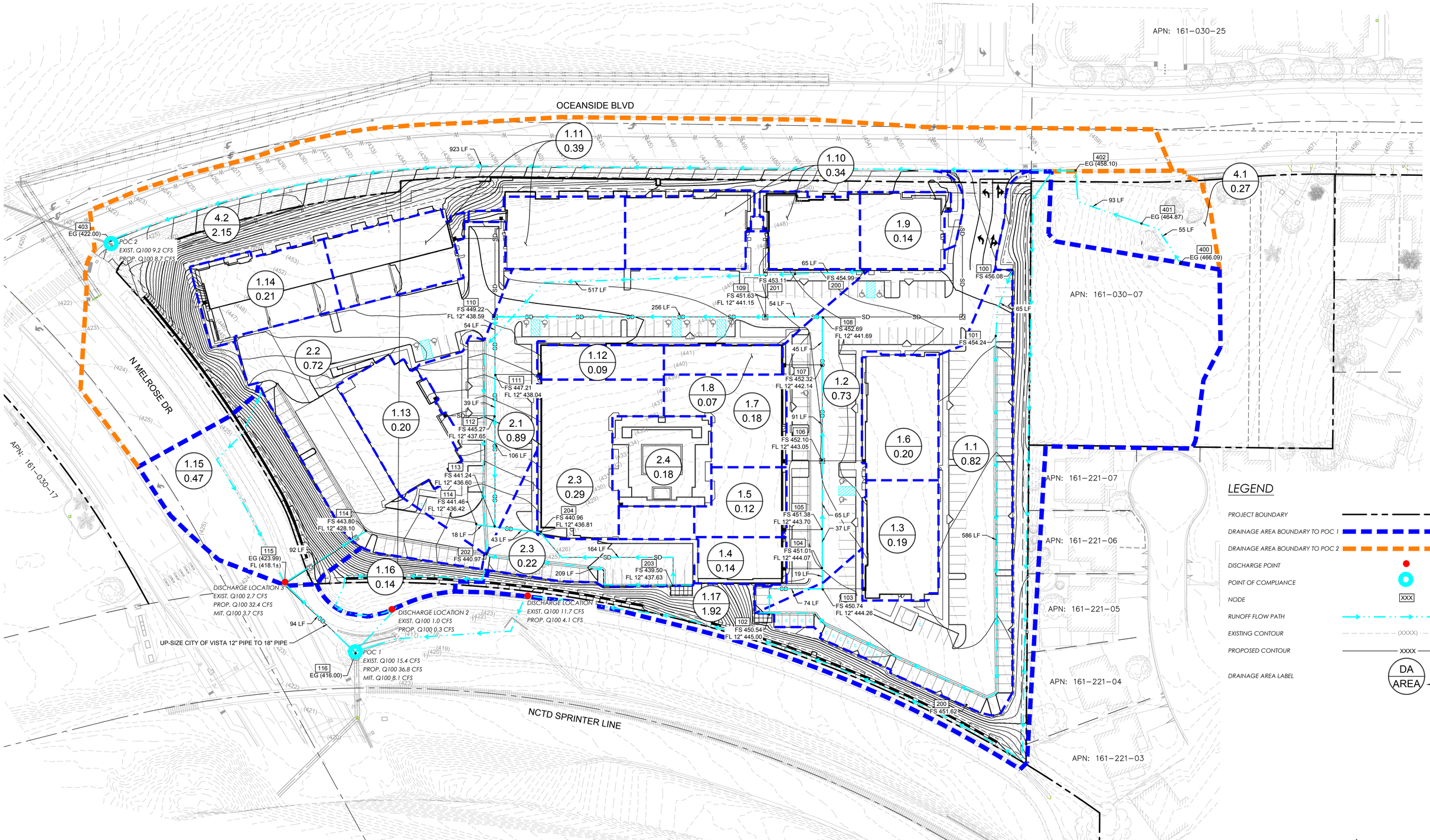


Kimley»Horn

PROPOSED DRAINAGE EXHIBIT

MODERA MELROSE

12/15/2021

ATTACHMENT 6
Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 6.

PRELIMINARY
GEOTECHNICAL INVESTIGATION

MODERA MELROSE
OCEANSIDE, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

MCRT INVESTMENTS, LLC
COSTA MESA, CALIFORNIA

JANUARY 26, 2021
PROJECT NO. 07647-32-04

Project No. 07647-32-04
January 26, 2021

MCRT Investments LLC
949 South Coast Drive, Suite 400
Costa Mesa, California 92626

Attention: Mr. John Colletti

Subject: PRELIMINARY GEOTECHNICAL INVESTIGATION
MODERA MELROSE
OCEANSIDE, CALIFORNIA

Dear Mr. Colletti:

In accordance with your request, and our Proposal No. LG-21015, dated January 12, 2021, we have prepared a preliminary geotechnical investigation on the subject property southeast of the intersection between Oceanside Boulevard (West Bobier Drive) and North Melrose Drive in Oceanside, California. The accompanying report presents our conclusions and preliminary recommendations pertaining to the geotechnical aspects of project development. The results of our study indicate that the site can be developed as planned, provided the recommendations of this report are followed. An update to this report should be performed once the project grading plans are developed.

If there are any questions regarding this update report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Trevor E. Myers
RCE 63773

REGISTERED PROFESSIONAL ENGINEER
TREVOR E. MYERS
No. RCE63773
CIVIL
STATE OF CALIFORNIA

David B. Evans
CEG 1860

PROFESSIONAL GEOLOGIST
DAVID B. EVANS
NO. 1860
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

TEM:DBE:dmc

(email) Addressee

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

PRELIMINARY GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a preliminary geotechnical study for a proposed residential development in Oceanside, California (see *Vicinity Map*, Figure 1). The purpose of this report was to present a compilation of previous geotechnical information and to provide recommendations for the new land use plan in accordance with the 2019 California Building Code (CBC). Once the project grading plans are developed, this report should be updated, as necessary.

The scope of our study included a review of the following reports:

1. Geotechnical Investigation, Oceanside (Melrose) Neighboorhood Market Store 5905-00, Oceanside, California, prepared by Geocon Incorporated, dated October 5, 2011 (Project No. 07647-42-03).

2. *Supplemental Rippability Study, Melrose Gateway Shopping Center, Oceanside, California,* prepared by Geocon Incorporated, dated October 23, 2006 (Project No. 07647-32-02).

3. *Geotechnical Investigation, Melrose and Bobier Property, Oceanside, California*, prepared by Geocon Incorporated, dated February 9, 2006 (Project No. 07647-32-01).

4. *Updated Geotechnical Considerations, Melrose Station Market Commercial Development, Southeast Corner of Melrose Drive and Oceanside Boulevard, Oceanside, San Diego County, California*, prepared by EEI, dated October 31, 2008 (Project No. GAT-70622).

5. *Geotechnical Update for 2007 California Building Code, Melrose Station Market Commercial Development, Southeast Corner of Melrose Drive and Oceanside Boulevard, Oceanside, San Diego County, California*, prepared by EEI, dated July 29, 2008 (Project No. GAT-70622).

6. *Preliminary Geotechnical Evaluation, Melrose Station Market, Southeast Corner of Melrose Drive and Oceanside Boulevard, Oceanside and Future Residential Parcel, 552 West Bobier Avenue, Vista, San Diego County, California,* prepared by EEI, dated September 18, 2007 (Project No. GAT-70622).

Previous field and laboratory test information obtained by Geocon Incorporated are provided in Appendices A through C. Field and laboratory test results performed by EEI on the property are presented in Appendix D. The descriptions of the soil and geologic conditions presented herein are based on review of the above referenced reports.

2. SITE AND PROJECT DESCRIPTION

The site is located southeast of the intersection of Oceanside Boulevard and North Melrose Drive, in Oceanside, California. The site is bounded by Oceanside Boulevard to the north, North Melrose Drive to the west, residential homes and an open space lot to the east, and a railroad easement to the south.

The site is undeveloped with gentle southward sloping terrain and a small drainage course near the south-central portion of the site. This drainage course has been partially in-filled with undocumented fill and organic debris. Minor amounts of trash were also observed on the property. A north-south trending trail bisects the site and is used primarily by pedestrians to access the bus stop located south of the railroad tracks. Two relatively large boulders (approximately 5 feet in size) were observed at the surface near the southwest corner of the site and an outcrop of very large boulders is present in the eastern portion of the property. Existing elevations vary from approximately 424 Mean Sea Level (MSL) in the south-central portion of the site to approximately 455 MSL in the northern portion of the property.

Based on our discussions with you, and review of the conceptual site plan provided, we understand the approximate 9-acre property will be graded to accommodate 275 apartment homes with 9,500 square feet of retail and 7,500 square feet of amenities situated in two to five, four-story buildings with associated parking lots and underground and surface improvements. Grading plans were not available at the time of this study.

A square-shaped parcel of land situated immediately to the east of the subject parcel is shown with proposed residential development on the conceptual plan. This parcel of land is situated in the City of Vista. Although it is our understanding that this parcel is not currently planned for development, we have included the air-track logs in Appendix C and locations on Figure 2 for reference.

The above locations, site descriptions, and proposed development are based on a site reconnaissance, review of the conceptual site plan, published geologic literature and our previous in-house geotechnical reports. If the final development plans differ from those described herein, Geocon Incorporated should be contacted for review of the plans and possible revisions to this report.

3. SOIL AND GEOLOGIC CONDITIONS

Two surficial soil units and two geologic formations were observed at the site. The surficial materials consist of undocumented fill and colluvium. The geologic formations encountered consist of the Santiago Formation and granitic rock (Bonsall Tonalite). The estimated distribution of the units is shown on the Geologic Map, Figure 2. A contact between the granitic rock and Santiago formation can be observed in the existing slope adjacent to Melrose Drive and in the grade cuts within the railroad easement. The units encountered are discussed below in order of increasing age.

3.1 Undocumented Fill (Qudf)

We encountered undocumented fill in the drainage course near the south-central portion of the site. The fill encountered in Geocon's previous exploratory trench T-2 was approximately 4 feet thick and consisted of loose, porous, clayey sand with abundant organics (straw, tree branches, etc.) and plastic

bags. The upper 1 foot of the undocumented fill observed in the trench excavation was relatively clean of organic debris. The lower 3 feet consisted primarily of organic debris. This material will require complete removal and exportation from the site.

3.2 Colluvium (Col)

Colluvium blankets the majority of the site and underlies the undocumented fill. This material ranges from approximately 2 to 5-feet-thick and generally consists of loose to medium dense, medium stiff to stiff, silty to clayey sand and silty to sandy clay. Based on the laboratory test results, the colluvium possesses a *medium* to *high* expansion potential. The colluvium is compressible and is considered unsuitable in its present condition. Remedial grading of this unit will be required within areas of proposed development.

3.3 Santiago Formation (Tsa)

We encountered the Eocene-age Santiago Formation in the majority of exploratory borings and trenches performed throughout the site. The Santiago Formation consists of massive, dense to hard, damp to moist, silty to clayey, fine- to medium-grained sandstone, sandy to clayey siltstone, and silty claystone. Bedding was not observed to the maximum depth explored. This unit is considered suitable for the support of additional structural fill and settlement sensitive structures.

The Santiago Formation often exhibits highly cemented zones that may result in excavation difficulty during grading and construction of site improvements (e.g., underground utility lines and building foundations). Although blasting is not expected, moderate to heavy ripping may be necessary in portions of this formation to facilitate excavation. Oversize materials, if generated, will need to be placed in deeper fill areas in accordance with the grading specifications contained in Appendix E, or exported from the site. Consideration should be given to undercutting cemented zones if they are found within areas of future improvements. Undercutting during grading will help reduce the potential for excavation difficulty during the construction of site improvements, including foundations and landscaping.

3.4 Bonsall Tonalite (Kb)

Cretaceous-age Bonsall Tonalite (granitic rock) of the Southern California Batholith was encountered in the eastern portion of the site and is exposed along the western margin of the property. The granitic rock generally consists of fresh to highly weathered decomposed granite. Granitic units generally exhibit adequate slope stability characteristics and slopes excavated at an inclination of 2:1 (horizontal:vertical) or flatter should be stable to the proposed heights if free of adversely oriented joints or fractures.

The soils derived from excavations within the decomposed granitic rock are expected to consist of low expansive, silty to clayey, medium- to coarse-grained sands and should provide suitable foundation support in either a natural or properly compacted condition.

It should be expected that excavations within the granitic rock will generate boulders and oversize materials (rocks greater than 12 inches) and will require special handling and placement in deeper fill areas as outlined in the grading specifications contained in Appendix E, or exportation from the site. In addition, the surface boulders and large rock outcroppings may require breaking and special handling during grading. Consideration should be given to using these core stone boulders as landscape features, where practical.

Areas of very hard granitic rock and corestones are expected at depth. Excavations, particularly those for deeper utilities, may generate oversize material that could necessitate burying the rock in deeper fill areas or exporting.

4. GROUNDWATER

We did not observe groundwater during our field investigation. We do not expect groundwater to adversely impact proposed project development; however, it is not uncommon for groundwater or seepage conditions to develop where none previously existed. Groundwater elevations are dependent on seasonal precipitation, irrigation; land use, among other factors, and vary as a result. Proper surface drainage will be important to future performance of the project.

5. GEOLOGIC HAZARDS

5.1 Ground Rupture

United States Geological Survey maps (2016) indicates that there are no mapped Quaternary faults crossing or trending toward the property. In addition, the site is not located within a currently established Alquist-Priolo Earthquake Fault Zone.

The nearest known active-fault zones are the Rose Canyon and Newport Inglewood Faults, located approximately 11 miles west of the subject site. The risk associated with ground rupture hazard is low.

5.2 Seismicity

The San Diego County and Southern California region is seismically active. Considerations important in seismic design include the frequency and duration of motion and the soil conditions underlying the site. Seismic design of structures should be performed in accordance with the California Building Code (CBC) guidelines currently adopted by the local agency. The risk associated with strong ground shaking due to earthquake at the site is no greater than that for the region.

5.3 Soil Liquefaction

Soil liquefaction occurs within relatively loose, cohesionless sands located below the water table that are subjected to ground accelerations from earthquakes. Due to the absence of permanent groundwater, the dense nature of the soil and rock beneath the site, and the proposed removal and compaction of compressible soils, the potential for liquefaction occurring at the site is considered very low.

5.4 Landslides

No landslides were mapped or observed on the property.

6. RIPPABILITY AND ROCK CONSIDERATIONS

Rock rippability studies were performed during previous investigations consisting of drilling hydraulic rotary percussion borings (generically referenced herein as air-track borings) in the areas where significant excavations were previously proposed. The borings were advanced using an Ingersoll Rand ECM-370 drill rig equipped with a 4-inch drill bit. The approximate locations of the air-track borings are shown on the Geologic Map, Figure 2.

A frequently used guideline to equate rock rippability to drill penetration rate is that a penetration rate of approximately 0 to 20 seconds per foot (spf) generally indicates rippable material, 20 to 30 spf indicates marginally to non-rippable material, and greater than 30 spf indicates non-rippable rock. These general guidelines are typically based on drill rates using a rotary percussion drill rig similar to an Ingersoll Rand ECM 360 with a 3½-inch drill bit.

The penetration rate (recorded in seconds per foot) for each air track boring is presented in Appendix C, Figures C-16 through C-57. The estimated depth and thickness of non-rippable material for each boring in the western portion of the site, using 20 seconds per foot as the boundary between rippable and marginal to non-rippable rock is presented on Table 6 below. The estimate is derived from a literal interpretation of the penetration rate from each boring. Perspective contractors should use their own judgment to identify the penetration rate boundary between productive and non-productive ripping, and rippable and non-rippable rock.

Since the Santiago Formation non-conformably overlies granitic rock, and this interface often undulates, the majority of the air-track borings in the western portion of the site were initiated in the sedimentary rocks in an attempt to define the contact where a risk of encountering hard rock was present (AT-1 through AT-21). Borings performed in the eastern portion of the site were in advanced in Granitic Rock (AT-22 through AT-42).

TABLE 6
SUMMARY OF AIR TRACK DRILLING DATA

Boring No.	Approximate Elevation of top of boring (feet)	Total Drill Depth (feet)	Depth to Non-Rippable Material (feet)*	Geologic Formation
AT-1	445	34	n/a	Santiago
AT-2	453	34	n/a	Santiago
AT-3	455	23	n/a	Santiago
AT-4	454	22	n/a	Santiago
AT-5	450	22	n/a	Santiago
AT-6	447	10	n/a	Santiago
AT-7	447	20	17-18	Granitic Rock
AT-8	447	22	21+	Granitic Rock
AT-9	446	10	n/a	Granitic Rock
AT-10	443	10	8-9	Granitic Rock
AT-11	441	10	n/a	Santiago
AT-12	443	16	n/a	Santiago
AT-13	443	20	n/a	Santiago
AT-14	446	22	n/a	Santiago
AT-15	444	25	n/a	Santiago
AT-16	436	15	12+	Santiago/Granitic Rock
AT-17	442	22	n/a	Santiago
AT-18	433	10	n/a	Granitic Rock
AT-19	436	10	n/a	Santiago
AT-20	437	10	n/a	Santiago
AT-21	437	10	n/a	Santiago
AT-22	467	22	14	Granitic Rock
AT-23	464	22	4	Granitic Rock
AT-24	455	20	n/a	Granitic Rock
AT-25	462	20	1	Granitic Rock
AT-26	466	18	10	Granitic Rock
AT-27	465	10	3	Granitic Rock
AT-28	463	16	3	Granitic Rock
AT-29	455	18	3	Granitic Rock
AT-30	451	17	4	Granitic Rock
AT-31	454	17	3	Granitic Rock
AT-32	458	18	3	Granitic Rock
AT-33	459	16	2	Granitic Rock
AT-34	462	15	3	Granitic Rock
AT-35	461	22	12	Granitic Rock
AT-36	457	17	3	Granitic Rock

Boring No.	Approximate Elevation of top of boring (feet)	Total Drill Depth (feet)	Depth to Non-Rippable Material (feet)*	Geologic Formation
AT-37	459	18	1	Granitic Rock
AT-38	462	20	2	Granitic Rock
AT-39	462	20	4	Granitic Rock
AT-40	457	17	6	Granitic Rock
AT-41	454	18	4	Granitic Rock
AT-42	461	18	3	Granitic Rock

* Based on penetration rate of 20 spf or greater.

During air-track drilling through the Santiago Formation, we encountered difficulty measuring accurate penetration rates due to the presence of claystones which constricted the bore holes, preventing the soil cuttings from escaping. Since the data appeared erroneous in some instances, validation drilling was performed on October 10, 2006, using an A-300 truck mounted drill rig equipped with 6-inch diameter augers to verify the "augerability" of the materials encountered.

In general, if a small-diameter boring can be drilled with light to moderate effort, the material is likely rippable with conventional heavy-duty grading equipment. The relative ease with which the 5 verification borings were advanced during this study indicates that favorable rippability characteristics exist within the majority of the western portion of the site. Logs of the verification borings are presented in Appendix C, Figures C-58 through C-62. The approximate locations of the verification borings are shown on the Geologic Map, Figure 2.

Proposed excavations within the eastern portion of the site (granitic rock) will require very heavy ripping and/or blasting. Based on our observations of significant rock outcroppings, and the penetration rates recorded in some of the borings blasting will be required in some locations at the existing ground surface.

An evaluation of the anticipated volume of hard rock materials compared to the available rock fill volume should be performed once the grading plan is developed. Rock crushing may be required to satisfy the rock hold down/particle restriction zones. Roadway/utility corridor and lot undercutting criteria should also be considered when calculating the volume of hard rock. Proposed cuts in hard rock areas can be expected to generate oversized fragments (rocks greater than 12 inches in dimension) which will necessitate typical hard rock handling and placement procedures during grading operations.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 From a geotechnical standpoint, it is our opinion that the site is suitable for the planned development, provided the recommendations presented herein are implemented in design and construction of the project. An update to this report should be performed once the project grading plans are developed.

7.1.2 The site is underlain by surficial units that include undocumented fill and colluvium. These deposits are unsuitable in their present condition and will require remedial grading where improvements are planned. Organic and trash debris in the undocumented fill will need to be exported. The actual extent of unsuitable soil removal will be determined in the field by the geotechnical engineer and/or engineering geologist.

7.1.3 Significant outcrops, and shallow hardrock at or near the surface is present in the eastern portion of the site (AT-22 through AT-42). Based on our boring data, blasting will be necessary for excavations in this area. Roadway/utility corridor and lot undercutting is recommended and should be considered when calculating the volume of hard rock. Proposed cuts in hard rock areas can be expected to generate oversized fragments (rocks greater than 12 inches in dimension) which will necessitate typical hard rock handling and placement procedures during grading operations.

7.1.4 The proposed structures can be supported on conventional shallow footings founded in properly compacted fill or dense formational materials as recommended herein.

7.1.5 Subsurface conditions observed may be extrapolated to reflect general soil/geologic conditions at the site; however, some variations in subsurface conditions between boring and trench locations should be expected.

7.1.6 Project grading plans were not provided for our use in preparation of this report. Once grading plans are available, we should review the plans and provide updated recommendations.

7.2 Excavation and Soil Characteristics

7.2.1 The soil encountered in the field investigations are considered to be “expansive” (expansion index [EI] of greater than 20) as defined by 2019 California Building Code (CBC) Section 1803.5.3. Table 7.2.1 presents soil classifications based on the expansion index. Based on previous laboratory testing by Geocon and EEI, the expansion index for

on-site soil possesses a “medium” to “high” expansion potential (EI of 130 or less). We expect the sandy portion of the granitic rock to have a “low” expansion potential.

TABLE 7.2.1
SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Soil Classification
0 – 20	Very Low
21 – 50	Low
51 – 90	Medium
91 – 130	High
Greater Than 130	Very High

7.2.2 On-site soil can be excavated with light to heavy effort using conventional heavy-duty grading equipment. Cemented zones in the Santiago Formation will require a very heavy effort to excavate, and may generate oversize material that will require placement in deeper fills or export from the site. Some excavations, if planned in the granitic rock area of the eastern portion of the site will require blasting.

7.2.3 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content (California Test No. 417). Results from the laboratory water-soluble sulfate content tests are presented in Appendix B and indicate that the on-site materials at the locations tested possess a “Not Applicable” and “S0” sulfate exposure to concrete structures as defined by 2019 CBC Section 1904 and ACI 318-14 Chapter 19. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration. Table 7.2.2 presents a summary of concrete requirements set forth by 2019 CBC Section 1904 and ACI 318.

TABLE 7.2.2
REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Severity	Exposure Class	Water-Soluble Sulfate (SO_4) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight[1]	Minimum Compressive Strength (psi)
Not Applicable	S0	$SO_4<0.10$	No Type Restriction	n/a	2,500
Moderate	S1	$0.10\leq SO_4<0.20$	II	0.50	4,000
Severe	S2	$0.20\leq SO_4\leq 2.00$	V	0.45	4,500
Very Severe	S3	$SO_4>2.00$	V+Pozzolan or Slag	0.45	4,500

[1] Maximum water to cement ratio limits do not apply to lightweight concrete.

7.2.4 We performed laboratory Chloride tests on selected soil samples to check the corrosion potential to subsurface metal structures. The laboratory test results are presented in Appendix B.

7.2.5 Geocon Incorporated does not practice in the field of corrosion engineering; therefore, further evaluation by a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of underground pipes and buried metal in direct contact with soil.

7.3 Grading

7.3.1 All grading should be performed in accordance with the City of Oceanside grading ordinance and the *Recommended Grading Specifications* contained in Appendix E. Where the recommendations of Appendix E conflict with this section of the report, the recommendations of this section shall take precedence.

7.3.2 Prior to commencing grading, a preconstruction conference should be held at the site with the grading contractor, civil engineer, a representative of the City of Oceanside, and geotechnical engineer in attendance. Specific soil handling and/or the grading plans can be discussed at that time.

7.3.3 Site preparation should begin with the removal of deleterious material, including trash and vegetation. Existing building foundations, septic tanks, leach fields, and other associated underground pipes or structures should also be removed from the property, if any. Site demolition of the property should include the proper destruction of any existing water wells

in accordance with the County of San Diego Department of Environmental Health. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter and debris. Material generated from stripping and/or site demolition should be exported from the site.

7.3.4 Surficial soil should be removed to formational material or granitic rock and replaced with properly compacted fill. The exposed formational material or granitic rock should then be scarified, moisture conditioned as necessary, and properly compacted.

7.3.5 The site should be brought to final design elevations with structural fill compacted in layers. In general, existing soil is suitable for re-use as fill if free from vegetation, debris, and other deleterious material. All fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content, in accordance with ASTM Test Procedure D 1557. Materials placed below optimum moisture content may be considered unacceptable.

7.3.6 Where practical, the upper 3 feet of all building pads should be composed of properly compacted fill or undisturbed formational soils that possess a ***very low*** to ***low*** expansion potential (EI of 50 or less). In pavement areas, the upper 2 feet of soil should have an expansion potential no greater than 90. Soil with a ***high*** expansion potential (EI of greater than 90) should be placed no closer than 3 feet below finish pad grade. Rocks greater than 12 inches in maximum dimension should not be placed within 10 feet of finish grade or 3 feet of the deepest utility. Rocks greater than 6 inches in maximum dimension should not be placed within 3 feet of finish grade in building pad areas.

7.3.7 To reduce the potential for differential settlement, it is recommended that building areas with a cut-fill transition be undercut at least 3 feet and replaced with properly compacted “very low” to “low” expansive fill soils. Where dense formational material and/or fresh granitic rock is present at or near finish grade, consideration should be given to undercutting the building pad to create favorable conditions for footing and utility trench excavations. The lateral limits of the undercut should extend minimum 5 feet outside the building footprint. Deeper undercutting of street areas exposing hard formational materials and/or fresh granitic rock should be considered to facilitate the excavation of underground utilities. If subsurface improvements or landscape zones are planned outside these areas, consideration should be given to undercutting these areas as well.

7.3.8 Imported soil, if required, should be tested and approved by Geocon Incorporated prior to importation. At least 3 working days should be allowed for laboratory testing of the soil

prior to its importation. The import soil should be predominantly granular and have an Expansion Index less than 50.

7.4 Slope Stability

7.4.1 Slope stability analysis utilizing average drained direct shear strength parameters based on laboratory tests and experience with similar soil types indicates that proposed fill slopes, constructed of on-site materials up to approximately 15 feet high, should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions. Proposed cut slopes in Santiago Formation/granitic rock up to approximately 30 feet were also found to possess a calculated factor of safety in excess of 1.5 for a deep-seated failure condition. Surficial and deep-seated slope stability calculations are presented on Figures 3 through 5.

7.4.2 It is recommended that all cut slope excavations be observed during grading by an engineering geologist to verify that soil and geologic conditions do not differ significantly from those anticipated.

7.4.3 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soils with an Expansion Index of less than 90 or at least 35 percent sand size particles should be acceptable as "granular" fill. Soils of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength.

7.4.4 Fill slopes should be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet and should be track-walked at the completion of each slope such that the fill soils are uniformly compacted to at least 90 percent relative compaction to the face of the finished sloped. Alternatively, the fill slope may be over-built at least 3 feet and cut back to yield a properly compacted slope face.

7.4.5 Where fill slopes and fill-over-cut slopes are planned, following removal of the surficial soils, a 15-foot-wide, 2-foot-deep, undrained keyway should be constructed prior to placing compacted fill. The keyway should be constructed with a minimum 5 percent inclination away from the toe of slope.

7.4.6 All slopes should be landscaped with drought-tolerant vegetation, having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion.

7.5 Stability Fills

7.5.1 Cut slopes, if any, which will expose colluvium or Santiago Formation should be evaluated during grading. Cut slopes exposing fine grained soil (silt and clay) may require stability fills. Our experience with nearby projects indicates that a potential to encounter moderately to intensely jointed/fractured rock exists. Cut slopes in this material may also readily transmit seepage. The need for toe drains will be evaluated during grading based on the conditions encountered.

7.6 Toe Drains

7.6.1 Building pad areas adjacent to ascending cut or natural slopes (if proposed) may experience wet soil conditions due to water migration from natural or future irrigation sources. To reduce the potential for this to occur, consideration should be given to placing a toe drain along the base of the slopes to collect potential seepage and convey it to a suitable outlet. The drain should be sufficiently deep to intercept the seepage (on the order of 3 feet below finish grade) and constructed in accordance with Figure 6. The need for these drains can be evaluated during development of the grading plan

7.6.2 Prior to outletting, the toe drain should transition to non-perforated drainpipe with a seepage cut-off wall provided at this interface. The project civil engineer should be consulted for an appropriate outlet location.

7.6.3 The necessity for toe drains will be evaluated during grading. In addition, the project civil engineer should be consulted to evaluate the appropriate drain locations and necessary easements, building restriction zones or disclosure requirements that may be necessary. The drains should be surveyed for location and shown on the project as-built drawings.

7.7 Seismic Design Criteria

7.7.1 The seismic design criteria is presented for general and preliminary purposes. Geocon Incorporated should be contacted to provide specific seismic design criteria once project plans are developed. Table 7.7.1 summarizes site-specific design criteria obtained from the 2019 California Building Code (CBC; Based on the 2018 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. We used the computer program *U.S. Seismic Design Maps*, provided by the Structural Engineers Association (SEA) to calculate the seismic design parameters. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2019 CBC and Table 20.3-1 of ASCE 7-16. The values presented herein are for the risk-targeted maximum considered earthquake (MCE_R). Sites designated

as Site Class D, E and F may require additional analyses if requested by the project structural engineer and client.

TABLE 7.7.1
2019 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2019 CBC Reference
Site Class	C	Section 1613.2.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.92g	Figure 1613.2.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.34g	Figure 1613.2.1(2)
Site Coefficient, F_A	1.2	Table 1613.2.3(1)
Site Coefficient, F_V	1.5*	Table 1613.2.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.104g	Section 1613.2.3 (Eqn 16-36)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	0.51g*	Section 1613.2.3 (Eqn 16-37)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.736g	Section 1613.2.4 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.34g*	Section 1613.2.4 (Eqn 16-39)

***** Using the code-based values presented in this table, in lieu of a performing a ground motion hazard analysis, requires the exceptions outlined in ASCE 7-16 Section 11.4.8 be followed by the project structural engineer. Per Section 11.4.8 of ASCE/SEI 7-16, a ground motion hazard analysis should be performed for projects for Site Class "E" sites with Ss greater than or equal to 1.0g and for Site Class "D" and "E" sites with S1 greater than 0.2g. Section 11.4.8 also provides exceptions which indicates that the ground motion hazard analysis may be waived provided the exceptions are followed.

7.7.2 Table 7.7.2 presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

TABLE 7.7.2
ASCE 7-16 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.397g	Figure 22-7
Site Coefficient, F_{PGA}	1.2	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.477g	Section 11.8.3 (Eqn 11.8-1)

7.7.3 Conformance to the criteria in Tables 7.7.1 and 7.7.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur in the event of a large earthquake. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

7.7.4 The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category of II and resulting in a Seismic Design Category D. Table 7.7.3 presents a summary of the risk categories in accordance with ASCE 7-16.

TABLE 7.7.3
ASCE 7-16 RISK CATEGORIES

Risk Category	Building Use	Examples
I	Low risk to Human Life at Failure	Barn, Storage Shelter
II	Nominal Risk to Human Life at Failure (Buildings Not Designated as I, III or IV)	Residential, Commercial and Industrial Buildings
III	Substantial Risk to Human Life at Failure	Theaters, Lecture Halls, Dining Halls, Schools, Prisons, Small Healthcare Facilities, Infrastructure Plants, Storage for Explosives/Toxins
IV	Essential Facilities	Hazardous Material Facilities, Hospitals, Fire and Rescue, Emergency Shelters, Police Stations, Power Stations, Aviation Control Facilities, National Defense, Water Storage

7.8 Foundation and Concrete Slab-On-Grade Recommendations

7.8.1 The following foundation recommendations are for proposed one- to four-story residential structures. The foundation recommendations have been separated into three categories based on either the maximum and differential fill thickness or Expansion Index. The foundation category criteria are presented in Table 7.8.1.

TABLE 7.8.1
FOUNDATION CATEGORY CRITERIA

Foundation Category	Maximum Fill Thickness, T (feet)	Differential Fill Thickness, D (feet)	Expansion Index (EI)
I	$T<20$	--	$EI \leq 50$
II	$20 \leq T<50$	$10 \leq D<20$	$50<EI \leq 90$
III	$T \geq 50$	$D \geq 20$	$90<EI \leq 130$

7.8.2 We will provide the final foundation category for the buildings after finish pad grades have been achieved and laboratory testing of the finish grade soil has been completed.

7.8.3 Table 7.8.2 presents minimum foundation and interior concrete slab design criteria for conventional foundation systems.

TABLE 7.8.2
CONVENTIONAL FOUNDATION RECOMMENDATIONS BY CATEGORY

Foundation Category	Minimum Footing Embedment Depth (inches)	Continuous Footing Reinforcement	Interior Slab Reinforcement
I	12	Two No. 4 bars, one top and one bottom	6 x 6 - 10/10 welded wire mesh at slab mid-point
II	18	Four No. 4 bars, two top and two bottom	No. 3 bars at 24 inches on center, both directions
III	24	Four No. 5 bars, two top and two bottom	No. 3 bars at 18 inches on center, both directions

7.8.4 The embedment depths presented in Table 7.8.2 should be measured from the lowest adjacent pad grade for both interior and exterior footings. The conventional foundations should have a minimum width of 12 inches and 24 inches for continuous and isolated footings, respectively. A typical wall/column footing detail is presented on Figure 7.

7.8.5 The concrete slabs-on-grade should be a minimum of 4 inches thick for Foundation Categories I and II and 5 inches thick for Foundation Category III. The concrete slabs-on-grade should be underlain by 4 inches and 3 inches of clean sand for 4-inch- thick and 5-inch-thick slabs, respectively. Slabs expected to receive moisture sensitive floor coverings or used to store moisture sensitive materials should be underlain by a vapor inhibitor covered with at least 2 inches of clean sand or crushed rock. If crushed rock will be used, the thickness of the vapor inhibitor should be at least 10 mil to prevent possible puncturing.

7.8.6 As a substitute, the layer of clean sand (or crushed rock) beneath the vapor inhibitor recommended in the previous section can be omitted if a vapor inhibitor that meets or exceeds the requirements of ASTM E 1745-97 (Class A), and that exhibits permeance not greater than 0.012 perm (measured in accordance with ASTM E 96-95) is used. This vapor inhibitor may be placed directly on properly compacted fill or formational materials. The vapor inhibitor should be installed in general conformance with ASTM E 1643-98 and the manufacturer's recommendations. Two inches of clean sand should then be placed on top of the vapor inhibitor to reduce the potential for differential curing, slab curl, and cracking. Floor coverings should be installed in accordance with the manufacturer's recommendations.

7.8.7 As an alternative to the conventional foundation recommendations, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI) DC10.5 as required by the 2019 California Building Code (CBC Section 1808.6.2). Although this procedure was developed for expansive soil conditions, we understand it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented on Table 7.8.3. The parameters presented in Table 7.8.3 are based on the guidelines presented in the PTI, DC10.5 design manual.

TABLE 7.8.3
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI), Third Edition Design Parameters	Foundation Category		
	I	II	III
Thornthwaite Index	-20	-20	-20
Equilibrium Suction	3.9	3.9	3.9
Edge Lift Moisture Variation Distance, e_M (feet)	5.3	5.1	4.9
Edge Lift, y_M (inches)	0.61	1.10	1.58
Center Lift Moisture Variation Distance, e_M (feet)	9.0	9.0	9.0
Center Lift, y_M (inches)	0.30	0.47	0.66

7.8.8 Foundation systems for the lots that possess a foundation Category I and a “very low” expansion potential (expansion index of 20 or less) can be designed using the method described in Section 1808 of the 2019 CBC. If post-tensioned foundations are planned, an alternative, commonly accepted design method (other than PTI DC 10.5) can be used. However, the post-tensioned foundation system should be designed with a total and differential deflection of 1 inch. Geocon Incorporated should be contacted to review the plans and provide additional information, if necessary. This foundation category alternative is commonly referred to as CAT 1A.

7.8.9 If an alternate design method is contemplated, Geocon Incorporated should be contacted to evaluate if additional expansion index testing should be performed to identify the lots that possess a “very low” expansion potential (expansion index of 20 or less).

7.8.10 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is

planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

7.8.11 If the structural engineer proposes a post-tensioned foundation design method other than PTI DC 10.5:

- The deflection criteria presented in Table 7.8.3 are still applicable.
- Interior stiffener beams should be used for Foundation Categories II and III.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depths should be at least 12 inches, 18 inches and 24 inches for foundation categories I, II, and III, respectively. The embedment depths should be measured from the lowest adjacent pad grade.

7.8.12 Our experience indicates post-tensioned slabs may be susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

7.8.13 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints be allowed to form between the footings/grade beams and the slab during the construction of the post-tension foundation system unless designed by the structural engineer.

7.8.14 Category I, II, or III foundations may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load). This bearing pressure may be increased by one-third for transient

7.8.15 Isolated footings, if present, should have the minimum embedment depth and width recommended for conventional foundations for a particular Foundation Category. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended for Category III. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.

7.8.16 For Foundation Category III, consideration should be given to using interior stiffening beams and connecting isolated footings and/or increasing the slab thickness. In addition, consideration should be given to connecting patio slabs, which exceed 5 feet in width, to the building foundation to reduce the potential for future separation to occur.

7.8.17 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

7.8.18 Where buildings or other improvements are planned near the top of a slope 3:1 (horizontal:vertical) or steeper, special foundation and/or design considerations are recommended due to the tendency for lateral soil movement to occur.

- For fill slopes less than 20 feet high, building footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

- When located next to a descending 3:1 (horizontal:vertical) fill slope or steeper, the foundations should be extended to a depth where the minimum horizontal distance is equal to H/3 (where H equals the vertical distance from the top of the fill slope to the base of the fill soil) with a minimum of 7 feet but need not exceed 40 feet. The horizontal distance is measured from the outer, deepest edge of the footing to the face of the slope. A post-tensioned slab and foundation system or mat foundation system can be used to reduce the potential for distress in the structures associated with strain softening and lateral fill extension. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.

- If swimming pools are planned, Geocon Incorporated should be contacted for a review of specific site conditions.

- Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support. This recommendation applies to fill slopes up to 30 feet in height, and cut slopes regardless of height. For swimming pools located near the top of fill slopes greater than 30 feet in height, additional recommendations may be required and Geocon Incorporated should be contacted for a review of specific site conditions.

- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures, which would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

7.8.19 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein. Slab panels should be a minimum of 4 inches thick and, when in excess of 8 feet square, should be reinforced with 6 x 6 - W2.9/W2.9 (6 x 6 - 6/6) welded wire mesh or No. 3 reinforcing bars at 18 inches on center in both directions to reduce the potential for cracking. In addition, concrete flatwork should be

provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. A 4-inch-thick slab should have a maximum joint spacing of 10 feet. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be checked prior to placing concrete.

7.8.20 The recommendations of this report are intended to reduce the potential for cracking of slabs and foundations due to expansive soil (if present), differential settlement of fill soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.8.21 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute (ACI) when establishing crack-control spacing. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

7.8.22 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

7.9 Retaining Walls and Lateral Loads Recommendations

7.9.1 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid with a density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion Index $\leq$50. Geocon Incorporated should be consulted for additional recommendations if backfill materials have an EI >50.

7.9.2 Retaining walls shall be designed to ensure stability against overturning sliding, excessive foundation pressure and water uplift. Where a keyway is extended below the wall base with the intent to engage passive pressure and enhance sliding stability, it is not necessary to consider active pressure on the keyway.

7.9.3 Where walls are restrained from movement at the top, an additional uniform pressure of 8H psf (where H equals the height of the retaining wall portion of the wall in feet) should be added to the active soil pressure where the wall possesses a height of 8 feet or less and 12H where the wall is greater than 8 feet. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to two feet of fill soil should be added (total unit weight of soil should be taken as 130 pcf).

7.9.4 Soil contemplated for use as retaining wall backfill, including import materials, should be identified in the field prior to backfill. At that time Geocon Incorporated should obtain samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. County or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs will be used. However, imported soil will be needed to raise pad grades approximately 10 feet, therefore, the imported soil would meet the minimum soil values for regional standard wall design.

7.9.5 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The wall designer should provide appropriate lateral deflection quantities for planned retaining walls structures, if applicable. These lateral values should be considered when planning types of improvements above retaining wall structures.

7.9.6 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI $\leq$50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. A typical retaining wall drainage detail is presented on Figure 8. If conditions different than those described are expected, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.

7.9.7 In general, wall foundations having a minimum depth and width of one foot may be designed for an allowable soil bearing pressure of 2,000 psf, provided the soil within three feet below the base of the wall has an Expansion Index $\leq$ 90. The recommended allowable soil bearing pressure may be increased by 300 psf and 500 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable soil bearing pressure of 4,000 psf.

7.9.8 The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is anticipated. As a minimum, wall footings should be deepened such that the bottom outside edge of the footing is at least seven feet from the face of slope when located adjacent and/or at the top of descending slopes.

7.9.9 The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613.3.5 of the 2019 CBC or Section 11.6 of ASCE 7-16. For structures assigned to Seismic Design Category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2019 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall. A seismic load of 22H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.477g calculated from ASCE 7-16 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

7.9.10 For resistance to lateral loads, a passive earth pressure equivalent to a fluid density of 300 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soils or undisturbed formational materials. The passive pressure assumes a horizontal surface extending away from the base of the wall at least five feet or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance.

7.9.11 An ultimate friction coefficient of 0.35 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the passive earth pressure when determining resistance to lateral loads.

7.9.12 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 12 feet. In the event that

walls higher than 12 feet are planned, Geocon Incorporated should be consulted for additional recommendations.

7.10 Mechanically-Stabilized Earth (MSE) Retaining Walls

7.10.1 The geologic conditions for the proposed development are anticipated to consist of compacted fill over formational materials. The formational materials consist of Santiago Formation and granitic rock. The compacted fill soils in the foundation and retained zones should consist of silty sands derived from on-site excavations in the granitic rock or imported to the site if selective grading and stockpiling of granular soil for wall backfill is not performed. Clay soils are not considered suitable as wall backfill due to the high expansion potential. Based our experience with similar soil and geologic conditions, we recommend the following geotechnical parameters be used for design of the MSE retaining walls.

TABLE 7.10
MSE RETAINING WALL PARAMETERS

Parameter	Reinforced Zone	Retained Zone	Foundation Zone
Angle of Internal Friction	30 degrees	30 degrees	30 degrees
Cohesion	0 psf	0 psf	0 psf
Wet Unit Weight	125 pcf	125 pcf	125 pcf

7.10.2 The shear strength values used for the reinforced zone assume that predominately granular materials will be stockpiled for use as backfill. Geocon has no way of knowing whether these materials will actually be used as backfill behind the wall during construction. As such, once backfill materials have been selected and/or stockpiled, sufficient shear tests should be conducted on samples of the proposed backfill materials to verify they conform to actual design values. Results should be provided to the designer to re-evaluate stability of the walls. Dependent upon test results, the designer may require modifications to the original wall design (e.g., longer geogrid embedment lengths).

7.10.3 Backfill materials within the reinforced zone should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content in accordance with ASTM D 1557. This is applicable to the entire embedment length of the geogrid reinforcement. In addition, the wall designer has maximum particle size (typically 3-inches in size or less) and shape (angular/rounded) requirements for soil-rock fill within the reinforced zone. Typically, wall designers specify that heavy compaction equipment be excluded from within 3 feet of the face of the wall;

however, smaller equipment (e.g., walk-behind, self-driven compactors or hand whackers) should be used to compact the materials without causing deformation of the wall. If the designer specifies no compactive effort for this zone, the materials are essentially not properly compacted and the geogrid within the uncompacted zone should not be relied upon for reinforcement and overall embedment lengths should be increased to account for the difference.

7.10.4 The wall designer should provide a drainage system sufficient to dissipate hydrostatic pressure behind the wall and to mitigate seepage through and beneath the wall. As such, a subdrain system consisting of a minimum 4-inch diameter, Schedule 40, perforated pvc pipe surrounded by at least 1 cubic foot of ¾-inch open-graded gravel and wrapped in filter fabric (Mirafi 140N or equivalent) should be incorporated into the wall design, where feasible. In order to prevent soil piping into the open-graded gravel layer behind the wall, we recommend the filter fabric be extended to cover the entire gravel layer. The final segment of the subdrain should outlet into an approved drainage facility, such as storm drain or headwall structure. The final segment of the drain should consist of solid pvc pipe. At the transition between the solid and perforated pipe, a concrete cut-off wall should be added to direct the subsurface water into the solid pipe.

7.10.5 A peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.477g was calculated from ASCE 7-16 Section 11.8.3. The 2019 CBC seismic design parameters are provided in Section 7.7.1.

7.10.6 Geosynthetic reinforcement must elongate to develop full tensile resistance. This elongation generally results in movement at the top of the wall. The amount of movement is dependent upon the height of the wall (e.g., higher walls rotate more), construction, and the type of geosynthetic used. In addition, over time reinforced-earth retaining walls have been known to exhibit creep and can undergo additional movement. Given this condition, the owner should be aware that structures and pavement placed within the reinforced and retained zones of the wall may undergo movement and should be designed to accommodate this movement.

7.11 Preliminary Pavement Recommendations

7.11.1 We calculated the preliminary flexible pavement sections in general conformance with the *Caltrans Method of Flexible Pavement Design* (Highway Design Manual, Section 608.4) using estimated Traffic Indices (TI) of 4.5, 5.0, 6.0, 7.0 and 8.0 for light-duty parking stalls, light-duty driveways, medium-duty, and heavy-duty traffic areas, respectively. The project civil engineer, architect, and owner should review the pavement designations to determine appropriate locations for pavement thickness. The final pavement sections should be based

on the R-Value of the subgrade soil encountered at final subgrade elevation. For preliminary design purposes, we have utilized an assumed R-value of 5. Table 7.11.1 presents the preliminary flexible pavement sections for private parking lots and roadways.

TABLE 7.11.1
PRELIMINARY FLEXIBLE PAVEMENT SECTIONS

Location	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Light-duty vehicle parking stalls	4.5	5	3	8
Light-duty vehicle traffic areas	5.0	5	3	10
Medium-duty truck traffic areas	6.0	5	3.5	13
Heavy-duty truck traffic areas	7.0	5	4	16

7.11.2 Prior to placing base materials, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by ASTM D 1557. Similarly, the base material should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

7.11.3 Base materials should conform to Section 26-1.028 of the *Standard Specifications for The State of California Department of Transportation (Caltrans)* with a ¾-inch maximum size aggregate. The asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Greenbook).*

7.11.4 A rigid Portland Cement concrete (PCC) pavement section should be placed in driveway entrance aprons, trash bin loading/storage areas and loading dock areas. The concrete pad for trash truck areas should be large enough such that the truck wheels will be positioned on the concrete during loading. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R-08 *Guide for Design and Construction of Concrete Parking Lots* using the parameters presented in Table 7.11.2.

TABLE 7.11.2
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	50 pci
Modulus of rupture for concrete, M_R	500 psi
Traffic Category, TC	B and C
Average daily truck traffic, ADTT	25 and 100

7.11.5 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 7.11.3.

TABLE 7.11.3
RIGID PAVEMENT RECOMMENDATIONS

Location	Portland Cement Concrete (inches)
Light-Duty Vehicles (TC=B, ADTT = 25)	7.0
Medium-Duty Vehicles (TC=C, ADTT =100)	7.5

7.11.6 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,000 psi (pounds per square inch).

7.11.7 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., a 7-inch-thick slab would have a 9-inch-thick edge).

7.11.8 Reinforcing steel should consist of No. 3 rebar placed at 18 inches on center, both directions, or 6x6-6/6 welded wire mesh.

7.11.9 To control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. However, we recommend a spacing not to exceed

10 feet. The depth of the crack-control joints should be determined by the referenced ACI report.

7.11.10 The performance of pavement is highly dependent on providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement will likely result in pavement distress and subgrade failure. Drainage from landscaped areas should be directed to controlled drainage structures. Landscape areas adjacent to the edge of asphalt pavements are not recommended due to the potential for surface or irrigation water to infiltrate the underlying permeable aggregate base and cause distress. Where such a condition cannot be avoided, consideration should be given to incorporating measures that will significantly reduce the potential for subsurface water migration into the aggregate base. If planter islands are planned, the perimeter curb should extend at least 6 inches below the level of the base materials.

7.12 Storm Water Management

7.12.1 If low-impact development (LID) integrated management practices (IMP's) are being considered, Geocon should review the design and provide specific geotechnical recommendations to reduce the potential adverse impacts to both on and off-site properties.

7.12.2 If not property constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Down-gradient and adjacent properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other impacts as a result of water infiltration.

7.12.3 Due to the site soil and geologic conditions, full and partial infiltration of storm water is considered geotechnically infeasible. Liners and subdrains should be incorporated into the design and construction of any planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC) to prevent water migration. The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 4 inches in diameter and consist of Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. Seams and penetrations of the liners should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

7.12.4 Revised recommendations may be needed once site plans are available that show proposed storm water BMP types and locations.

7.13 Site Drainage and Moisture Protection

7.13.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2019 CBC 1803.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

7.13.2 In the case of basement walls or building walls retaining landscaping areas, a water-proofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

7.13.3 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

7.14 Grading and Foundation Plan Review

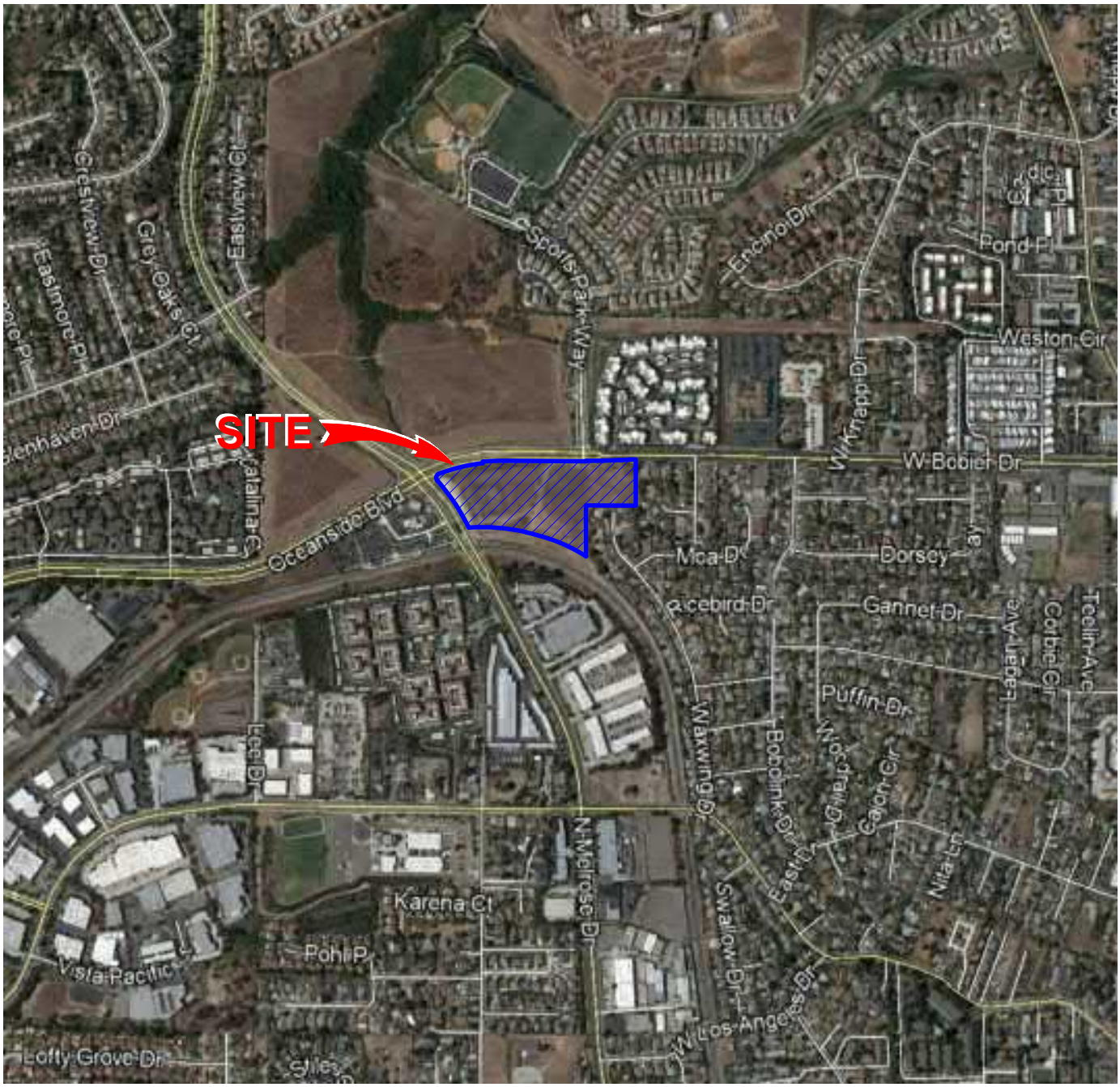
7.14.1 Geocon Incorporated should review the grading and foundation plans for the project prior to final design submittal to determine if additional analysis and/or recommendations are required.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

2. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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N

NO SCALE

VICINITY MAP

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MODERA MELROSE
OCEANSIDE, CALIFORNIA

RM / AML		DSK/GTYPD

DATE 01 - 26 - 2021	PROJECT NO. 07647 - 32 - 04	FIG. 1

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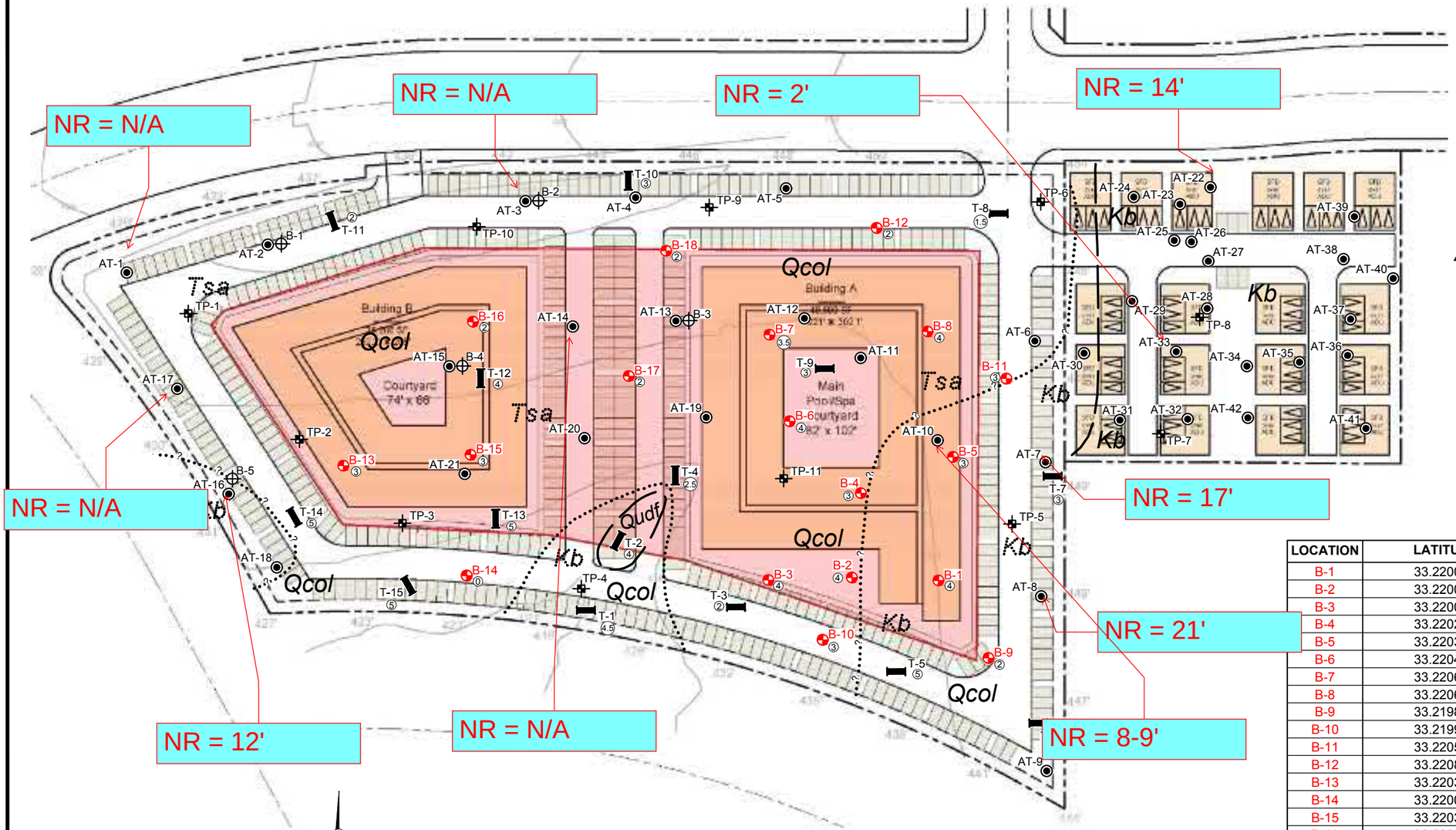

GEOCON LEGEND

- *Qudf* .....UNDOCUMENTED FILL
- *Qcol* .....COLLUVIUM
- *Tsa* .....SANTIAGO FORMATION (Dotted Where Buried)
- *Kb* .....BONSALL TONALITE (Dotted Where Buried)
- .....APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried,Queried Where Uncertain)
- B-18 .....APPROX. LOCATION OF EXPLORATORY BORING (2011)
- AT-21 .....APPROX. LOCATION OF AIR TRACK BORING
- B-5 .....APPROX. LOCATION OF VERIFICATION BORING
- T-15 .....APPROX. LOCATION OF EXPLORATORY TRENCH
- TP-11 .....APPROX. LOCATION OF EXPLORATORY TEST PIT (Performed by EEI)
- ⑤ .....ESTIMATED THICKNESS OF SURFICIAL DEPOSIT REQUIRING REMEDIAL GRADING

LOCATION	LATITUDE	LONGTITUDE	ELEVATION (ft. MSL)
B-1	33.220068°	-117.256252°	443'
B-2	33.220073°	-117.256494°	439'
B-3	33.220064°	-117.256728°	436'
B-4	33.220271°	-117.256471°	440'
B-5	33.220359°	-117.256215°	443'
B-6	33.220438°	-117.256673°	437'
B-7	33.220642°	-117.256732°	441'
B-8	33.220653°	-117.256289°	443'
B-9	33.219887°	-117.256110°	444'
B-10	33.219927°	-117.256574°	438'
B-11	33.220544°	-117.256068°	446'
B-12	33.220895°	-117.256435°	447'
B-13	33.220324°	-117.257920°	438'
B-14	33.220069°	-117.257573°	428'
B-15	33.220353°	-117.257565°	438'
B-16	33.220665°	-117.257562°	447'
B-17	33.220541°	-117.257124°	440'
B-18	33.220837°	-117.257023°	449'

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PROJECT NO. 07647 - 32 - 04
FIGURE 2
DATE 01 - 26 - 2021

GEOLOGIC MAP

Y:\PROJECTS\07647-32-04 (Modera Melrose)\SHEETS\07647-32-04 Geo Map.dwg

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	15 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)	
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	125 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	30 degrees
APPARENT COHESION	C	=	250 pounds per square foot
NO SEEPAGE FORCES			

ANALYSIS :

$\lambda_{c\phi}$	=	$\frac{\gamma_t H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\lambda_{c\phi}$	=	3.6	CALCULATED USING EQ. (3-3)
Ncf	=	16	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	2.6	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - FILL SLOPES

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ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	30 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)	
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	33 degrees
APPARENT COHESION	C	=	350 pounds per square foot
NO SEEPAGE FORCES			

ANALYSIS :

$\lambda_{c\phi}$	=	$\frac{\gamma_t H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{NcfC}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\lambda_{c\phi}$	=	7.2	CALCULATED USING EQ. (3-3)
Ncf	=	25	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	2.2	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - CUT SLOPES

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RM / AML		DSK/GTYPD	DATE 01 - 26 - 2021	PROJECT NO. 07647 - 32 - 04	FIG. 4

Plotted:01/26/2021 9:26AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\07647-32-04 (Modera Melrose)\DETAILS\Slope Stability Analyses-Cut (SSA-C).dwg

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	=	Infinite
DEPTH OF SATURATION	Z	=	3 feet
SLOPE INCLINATION	2 : 1		(Horizontal : Vertical)
SLOPE ANGLE	i	=	26.6 degrees
UNIT WEIGHT OF WATER	γ_w	=	62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t	=	125 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	=	30 degrees
APPARENT COHESION	C	=	250 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$FS = \frac{C + (\gamma_t - \gamma_w)\ Z\ cos^2\ i\ tan\ \phi}{\gamma_t\ Z\ sin\ i\ cos\ i} = 2.2$$

REFERENCES :

1.....Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62

2.....Skempton, A. W., and F.A. Delory, *Stability of Natural Slopes in London Clay*, Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81

SURFICIAL SLOPE STABILITY ANALYSIS

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RM / AML		DSK/GTYPD	DATE 01 - 26 - 2021	PROJECT NO. 07647 - 32 - 04	FIG. 5

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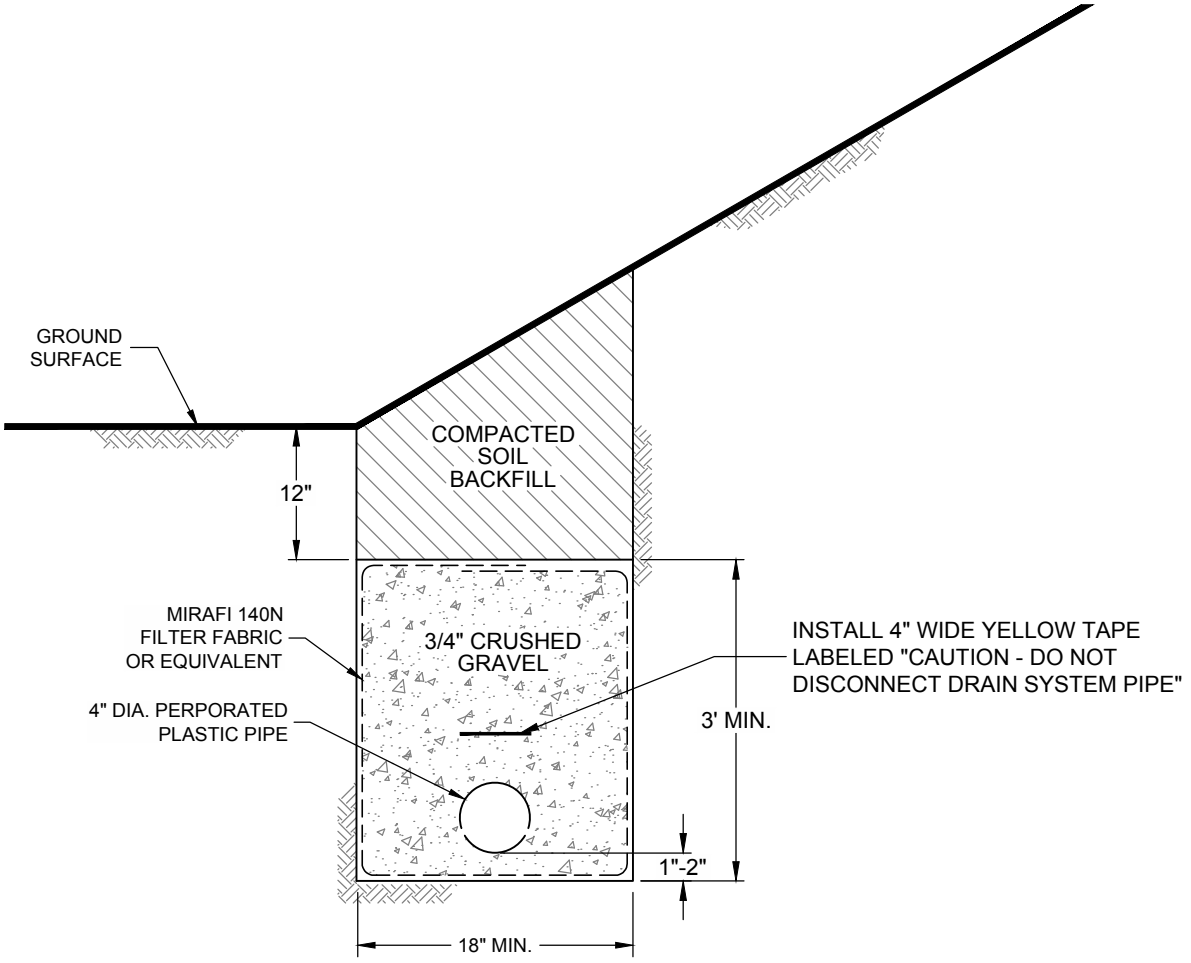

NOTES:

1. SOIL CAP COMPACTED TO 90% RELATIVE COMPACTION
2. PERMEABLE MATERIAL SHALL BE ¾" CRUSHED GRAVEL WRAPPED IN FILTER FABRIC (MIRAFI 140N OR EQUIVALENT)
3. 4" DIAMETER PERFORATED PIPE (SDR-35 OR EQUIVALENT) WITH PERFORATIONS DOWN
4. PIPE TO MAINTAIN A MINIMUM 1 PERCENT FALL
5. CONCRETE CUTOFF WALL TO BE PROVIDED AT TRANSITION TO SOLID OUTLET PIPE
6. SOLID OUTLET PIPE TO DRAIN TO APPROVED AREA
7. CLEANOUTS SHOULD BE PROVIDED

SLOPE TOE DRAIN

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DATE 01 - 26 - 2021	PROJECT NO. 07647 - 32 - 04	FIG. 6

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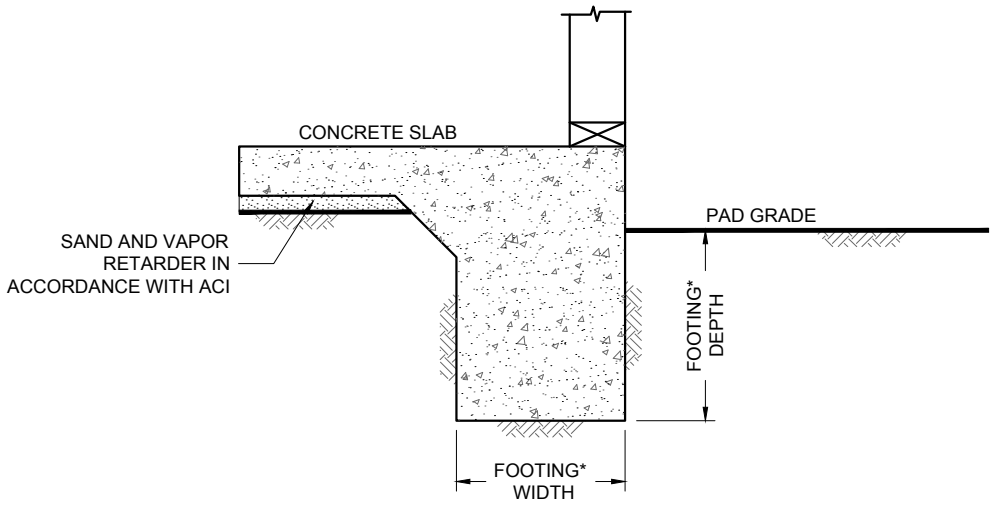

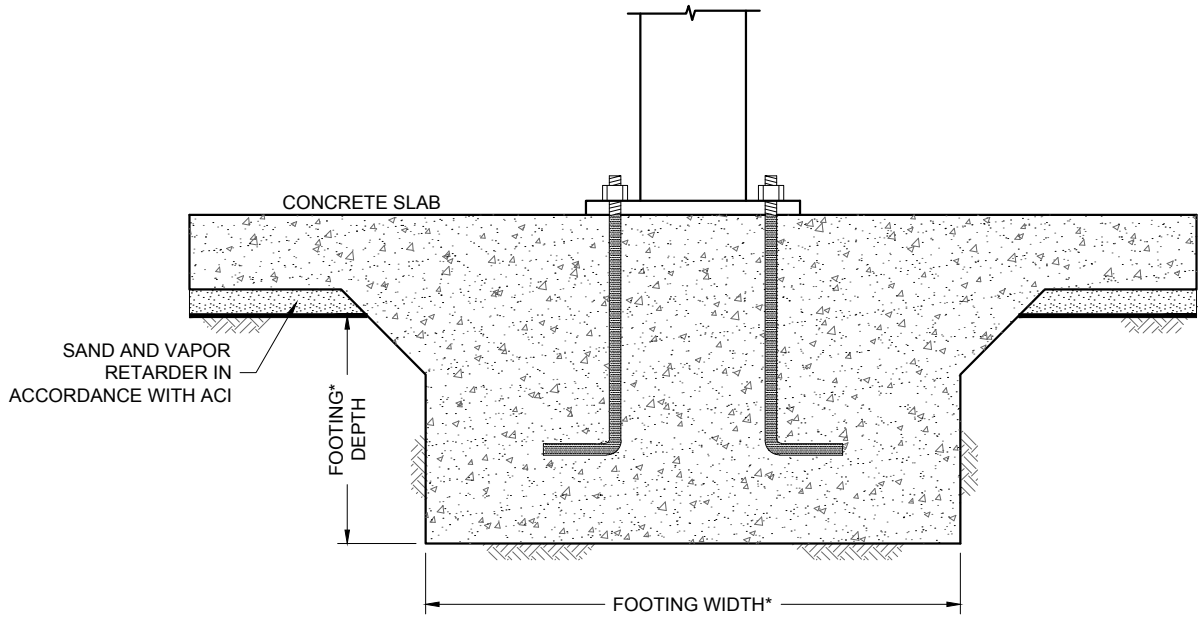

*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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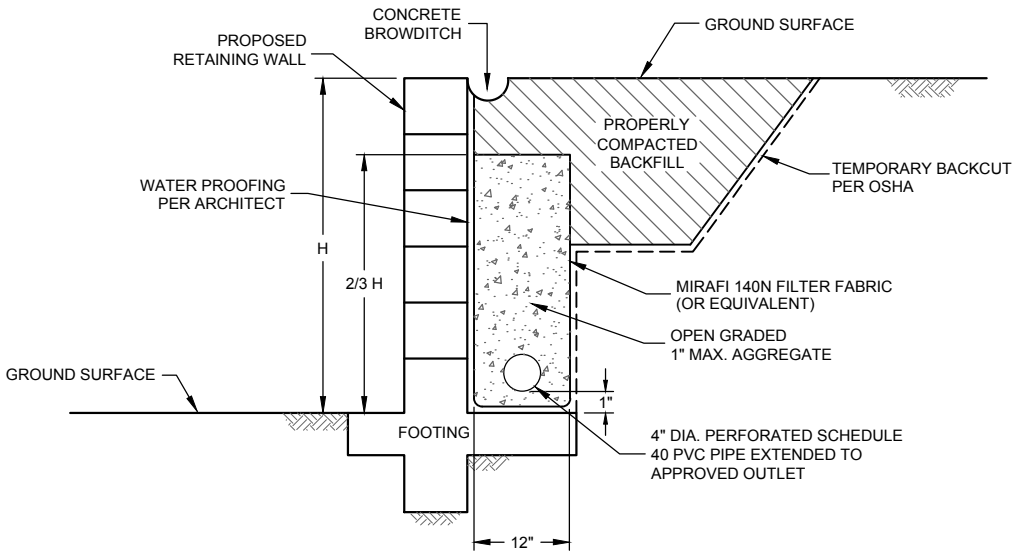
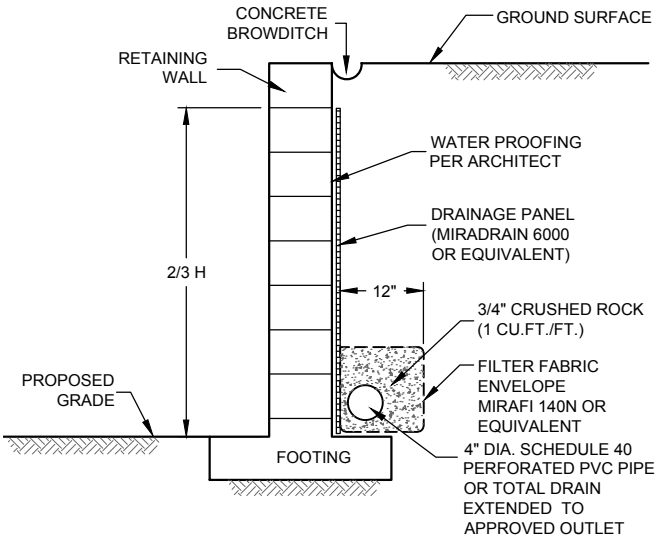
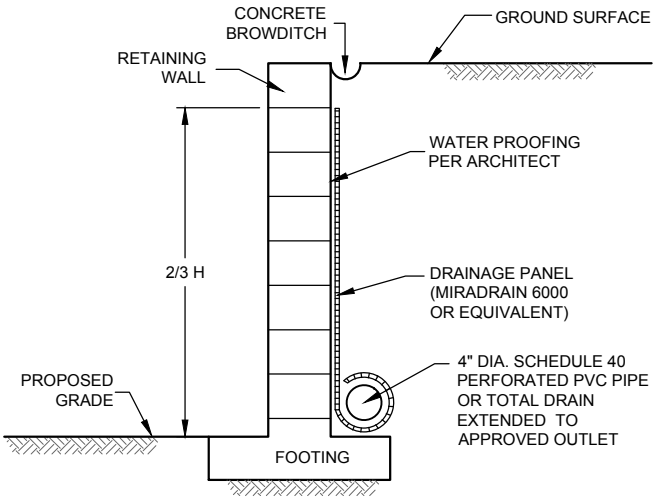
RM / AML		DSK/GTYPD	DATE 01 - 26 - 2021	PROJECT NO. 07647 - 32 - 04	FIG. 7

Plotted:01/26/2021 9:30AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\07647-32-04 (Modera Melrose)\DETAILS\Wall-Column Footing Dimension Detail (COLFOOT2).dwg







NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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DATE 01 - 26 - 2021	PROJECT NO. 07647 - 32 - 04	FIG. 8

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APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The most recent field investigation was performed on June 28 and 29, 2011, and consisted of a site reconnaissance and the drilling of 18 small-diameter borings. The approximate locations of the exploratory borings are shown on the Geologic Map, Figure 2.

The borings were drilled to depths ranging from approximately 10 feet to 19.5 feet below existing grade using CME 75 drill rig, equipped with 6-inch-diameter, hollow-stem augers. Relatively undisturbed samples were obtained by driving a 3-inch-diameter, split-tube sampler 12 inches into the undisturbed soil mass with blows from a hammer weighing 140 pounds, dropped from a height of 30 inches. The sampler was equipped with 1-inch-by-2.5-inch brass sampler rings to facilitate removal and testing of the soil. Bulk samples were also obtained.

The soil conditions encountered in the borings were visually examined, classified, and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual-Manual Procedure D 2488). Logs of the exploratory borings are presented on Figures A-1 through A-18. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained.

Additional field investigations were performed to further evaluate the soil and geologic conditions on the property, including air-track drilling, exploratory trenching and hollow-stem auger drilling. The logs of these borings and trenches, as well as the laboratory test results, are presented in Appendix C.

PROJECT NO. 07647-42-03

BORING B 1

ELEV. (MSL.) **443'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B1-1			SC	**COLLUVIUM** Medium dense, damp to moist, brown to dark brown, Clayey, fine to medium SAND; trace clay			
2	B1-2				-Becomes brown to grayish brown	25	117.5	16.1
4	B1-3			SM	**BONSALL TONALITE** Highly weathered, mottled gray and brown to yellowish brown, fine- to coarse-grained, weak, ROCK	24	120.2	14.6
6	B1-4							
8	B1-5					81/9"		
10	B1-6				-Becomes slightly weathered, mottled light gray and brown and black, strong	78/11"		
12								
14								
16	B1-7				-Becomes mottled light greenish gray and black, very strong	50/4"		
18	B1-8				-Poor recovery	50/3.5"		
					BORING TERMINATED AT 19 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-1,
Log of Boring B 1, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-42-03

BORING B 2

ELEV. (MSL.) **439'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SC	**COLLUVIUM** Medium dense, damp to moist, olive brown to grayish brown, Clayey, fine to coarse SAND			
2	B2-1					30		
4				SM	**SANTIAGO FORMATION** Dense, damp, mottled yellowish brown and light grayish brown, Silty, fine to coarse SAND			
	B2-2					63	122.7	7.8
6	B2-3							
	B2-4					50/5.5"	111.3	6.9
8					-Becomes very dense, light yellowish brown			
10	B2-5					100/7"		
12					-Becomes moist, yellowish brown			
14								
	B2-6				-No recovery	50/5"		
16								
18					-Becomes dry to damp, mottled light gray, brown, light green, and pink. fine to medium SAND			
	B2-7					88/8"		
					BORING TERMINATED AT 19.7 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-2,
Log of Boring B 2, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 3

ELEV. (MSL.) **436'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B3-1			SM	**COLLUVIUM** Medium dense, damp to moist, brown to grayish brown, Silty, fine to medium SAND			
2	B3-2			SC	Dense, moist, brown to reddish brown, Clayey, fine to coarse SAND	54	127.5	8.6
4	B3-3			SM	**SANTIAGO FORMATION** Very dense, damp, light yellowish brown, Silty, fine to coarse SAND	50/4"	107.0	6.2
6								
8	B3-4				-Becomes light yellowish brown to yellowish brown	50/3.5"	105.3	7.3
10	B3-5				-No recovery	50/3.5"		
12					-Becomes moist, light gray			
14								
16	B3-6				-Disturbed sample	50/3"		
18					-Becomes light gray			
	B3-6				-Poor recovery	50/1.5"		
					BORING TERMINATED AT 19.1 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-3,
Log of Boring B 3, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 4

ELEV. (MSL.) **440'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**COLLUVIUM** Medium dense, damp, brown to reddish brown, Silty, fine to medium SAND			
2	B4-1					77		
				SM	**SANTIAGO FORMATION** Very dense, damp to moist, light yellowish brown to brown, Silty, fine to coarse SAND			
4	B4-2							
	B4-3					34	115.5	14.4
6				CH	Stiff, damp, mottled light gray and light green, Silty, fine-grained CLAYSTONE; moderately cemented			
	B4-4					81/9"	124.0	12.9
8					-Becomes hard			
10	B4-5				-Becomes mottled light gray and reddish brown	93/8"		
	B4-6							
12					-Becomes mottled light and gray and brown to yellowish brown			
14								
	B4-7					90/8"		
16								
18					-Becomes mottled light gray, brown, and dark reddish brown			
	B4-8					80/9"		
					BORING TERMINATED AT 19.8 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-4,
Log of Boring B 4, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 5

ELEV. (MSL.) **443'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SM	**COLLUVIUM** Medium dense, moist, dark brown to grayish brown, Silty, fine to medium SAND; trace clay			
2	B5-1					40		
				SM	**BONSALL TONALITE** Highly weathered, mottled brown to olive brown and gray, fine- to coarse-grained, weak, ROCK			
4								
	B5-2				-Becomes mottled light gray and yellowish brown to reddish brown	21	120.4	12.5
6								
	B5-3					64	126.9	10.1
8								
					-Becomes mottled gray, yellowish brown and pink, moderately weak			
10	B5-4					78		
12								
					-Becomes slightly weathered, mottled light gray, gray, and black, strong			
14								
	B5-5					71/11"		
16								
18	B5-6				-No recovery	50/2"		
					BORING TERMINATED AT 18.3 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-5,
Log of Boring B 5, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-42-03

BORING B 6

ELEV. (MSL.) **437'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B6-1			CL	**COLLUVIUM** Very stiff, damp to moist, brown to grayish brown, Sandy CLAY			
2	B6-2					40	120.5	12.4
4				CL	**SANTIAGO FORMATION** Hard, damp, mottled yellowish brown and brown, Sandy CLAY			
	B6-3					72/11"	124.7	11.0
6				SC	Dense, damp, light gray, Clayey, fine- to medium-grained SANDSTONE			
8	B6-4				-Becomes dense to very dense, mottled light gray, brown, and pink	73/8"		
10	B6-5				-Becomes very dense, reddish brown	50/5"		
12								
14					-Becomes mottled brown, light gray, and light purple			
	B6-6					50/5"		
16								
18								
	B6-7					50/5"		
					BORING TERMINATED AT 19.5 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-6,
Log of Boring B 6, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 7

ELEV. (MSL.) **441'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
	B7-1			CH	**COLLUVIUM** Stiff, moist, dark brown to dark grayish brown, Silty fat CLAY			
2	B7-2					22	105.6	21.9
4				CL	**SANTIAGO FORMATION** Very stiff, moist, gray to grayish brown, Sandy CLAY			
	B7-3					50	117.3	16.2
6								
	B7-4			CL	Very dense, damp, gray, Silty, fine- to medium-grained CLAYSTONE; weakly cemented	80/9"		
8								
10	B7-5				-Becomes grayish brown to light olive brown	88/9"		
12								
14					-Becomes gray, fine-grained; moderately cemented			
	B7-6					50/5"		
16								
18								
	B7-7				-No recovery	50/4"		
					BORING TERMINATED AT 19.3 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-7,
Log of Boring B 7, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 8

ELEV. (MSL.) **443'** DATE COMPLETED **06-28-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**COLLUVIUM** Medium dense, damp to moist, brown, Clayey, fine to medium SAND; trace clay			
2	B8-1				-Becomes mottled reddish brown and gray, fine to coarse	20		
4	B8-2			CL	**SANTIAGO FORMATION** Very stiff, mottle reddish brown, brown and light gray, Silty, fine- to medium-grained CLAYSTONE; weakly cemented			
6	B8-3					42	120.4	12.4
8	B8-4				-Becomes dense to very dense, mottled light gray and light green	78/11"	130.4	9.6
10	B8-5				-Becomes very dense, mottled reddish brown, yellowish brown, and light gray; moderately cemented	83/9"		
12								
14					-Becomes mottle dark reddish brown and yellowish brown, and light gray			
16	B8-6					85/8"		
18								
	B8-7					50/5"		
					BORING TERMINATED AT 19.5 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-8,
Log of Boring B 8, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 9

ELEV. (MSL.) **444'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B9-1			SC/CL	**COLLUVIUM** Medium dense, damp to moist, dark brown, Clayey, fine to medium SAND to Sandy CLAY			
2	B9-2			SM	**BONSALL TONALITE** Highly weathered, mottled yellowish brown and brown and light gray, fine- to coarse-grained, weak, ROCK	41	123.5	13.4
4	B9-3				-Becomes strong	87/9"	117.6	5.6
6	B9-4					92/11.5"		
8	B9-5				-No recovery	50/5"		
10					BORING TERMINATED AT 10.5 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-9,
Log of Boring B 9, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 10

ELEV. (MSL.) **438'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Medium dense, damp to moist, brown, Silty, fine to medium SAND; trace clay			
2	B10-1					31		
4				SC	**SANTIAGO FORMATION** Medium dense, moist, mottled yellowish brown and light gray, Clayey, fine to medium SAND			
6	B10-2			CL	Stiff, moist, mottled yellowish brown and light gray, Sandy CLAY	18		
8	B10-3			SM	Very dense, damp, light yellowish brown, Silty, fine to coarse SAND	50/4"		
10	B10-4					50/3"		
					BORING TERMINATED AT 10.2 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-10,
Log of Boring B 10, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 11

ELEV. (MSL.) **446'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B11-1			SM	**COLLUVIUM** Medium dense, damp, brown to dark brown, Silty, fine to medium SAND; trace clay			
2	B11-2					32		
4				SM	**BONSALL TONALITE** Highly weathered, mottled yellowish brown to brown and light gray, fine- to coarse-grained, weak, ROCK			
	B11-3				-Becomes mottled light gray to light green and black	43		
6								
8	B11-4				-Becomes moderately weak	50/4.5"		
10	B11-5				-No recovery	50/3"		
					BORING TERMINATED AT 10.2 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-11,
Log of Boring B 11, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-42-03

BORING B 12

ELEV. (MSL.) **447'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Medium dense, damp, dark grayish brown, Silty, fine to medium SAND; trace clay			
2	B12-1			SC	**SANTIAGO FORMATION** Stiff, moist, mottled yellowish brown and light gray, Sandy CLAY	31		
4	B12-2					75/9"		
6				SM	Very dense, damp, mottled reddish brown and light gray, Silty, fine- to medium-grained SANDSTONE; weakly cemented			
8	B12-3				-Becomes reddish brown	50/3"		
10	B12-4					50/5"		
					BORING TERMINATED AT 10.5 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-12,
Log of Boring B 12, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 13

ELEV. (MSL.) **438'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B13-1			SC	**COLLUVIUM** Stiff, moist, dark brown to dark gray, Sandy CLAY			
2	B13-2					15	98.1	24.1
4				CL	**SANTIAGO FORMATION** Stiff, moist, gray, Silty CLAY			
6	B13-3				-Excavates with approx. 1/2 inch thick lense of white caliche	27		
8	B13-4			CH	Stiff, damp to moist, light gray to light greenish gray, Silty, FAT CLAY; trace caliche staining; weakly cemented	34		
10	B13-5			CL	Damp, light gray to gray, Sandy, fine- to medium-grained CLAYSTONE; weakly cemented	70		
12								
14					-Becomes very dense			
16	B13-6					95/9"		
18					-Becomes light gray to light greenish gray			
	B13-7					50/5.5"		
					BORING TERMINATED AT 19.5 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-13,
Log of Boring B 13, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 14

ELEV. (MSL.) **428'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B14-1			SM	**SANTIAGO FORMATION** Very dense, damp, light gray, Silty, fine- to medium-grained SANDSTONE; weakly cemented; highly weathered			
2	B14-2					70/9"		
4	B14-3				-Becomes fine- to coarse-grained	85/8"		
6					-Becomes white to light gray, fine- to medium-grained			
8	B14-4					50/5.5"		
10	B14-5					50/5.5"		
					BORING TERMINATED AT 10.5 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-14,
Log of Boring B 14, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. 07647-42-03

BORING B 15

ELEV. (MSL.) **438'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				SC	**COLLUVIUM** Medium dense, damp, dark grayish brown, Clayey, fine to medium SAND			
2	B15-1					18		
				CH	**SANTIAGO FORMATION** Stiff, moist, gray, Silty CLAYSTONE; weakly cemented			
4								
	B15-2			SM	Medium dense, damp, gray, Silty, fine- to medium-grained SANDSTONE; veins of caliche	46		
6								
	B15-3				-Becomes white to light gray, fine- to coarse-grained	90/9"		
8								
10	B15-4					50/5"		
					BORING TERMINATED AT 10.5 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-15,
Log of Boring B 15, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-42-03

BORING B 16

ELEV. (MSL.) **447'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B16-1			SM	**COLLUVIUM** Medium dense, damp, dark brown to grayish brown, Silty, fine to medium SAND; trace clay			
2	B16-2			SM	**SANTIAGO FORMATION** Dense, moist, mottled light gray and yellowish brown, Silty, fine to coarse SAND	54		
4	B16-3			SM	Dense, damp, mottled gray and yellowish brown, Silty, fine-grained SANDSTONE; weakly cemented	63		
6	B16-4				-Becomes gray to light yellowish brown	62		
8								
10	B16-5					72/10"		
					BORING TERMINATED AT 10.8 FEET Groundwater not encountered Backfilled with cuttings			

Figure A-16,
Log of Boring B 16, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-42-03

BORING B 17

ELEV. (MSL.) **440'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B17-1			SC	**COLLUVIUM** Medium dense, damp, dark grayish brown, Clayey, fine to medium SAND			
2	B17-2			SM	**SANTIAGO FORMATION** Medium dense, damp to moist, mottled light gray and light brown, Silty, fine- to medium-grained SANDSTONE; weakly cemented	33		
4	B17-3			ML	Stiff, moist, light gray to gray, Sandy SILTSTONE; weakly cemented	33		
6	B17-4			SM	Dense, damp, light gray to gray, Silty, fine- to medium-grained SANDSTONE; weakly cemented	71		
8								
10	B17-5					72		
					BORING TERMINATED AT 11 FEET Groundwater not encountered Backfill with cuttings			

Figure A-17,
Log of Boring B 17, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-42-03

BORING B 18

ELEV. (MSL.) **449'** DATE COMPLETED **06-29-2011**

EQUIPMENT **CME 75** BY: **N. BORJA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B18-1			SM	**COLLUVIUM** Medium dense, damp, dark grayish brown, Silty, fine to medium SAND			
2	B18-2			CL	**SANTIAGO FORMATION** Stiff, moist, mottled light gray and brown, Sandy CLAY; highly cemented	17		
4	B18-3			SM	Medium dense, damp to moist, mottled light gray to light yellowish brown and brown, Silty, fine- to medium-grained SANDSTONE; weakly cemented	29		
6	B18-4				-Becomes damp, light gray, fine- to medium-grained	54		
8				ML	Very stiff, damp, gray to light gay, Sandy SILTSTONE; weakly cemented			
10	B18-5					44		
					BORING TERMINATED AT 11 FEET Groundwater not encountered Backfill with cuttings			

Figure A-18,
Log of Boring B 18, Page 1 of 1

07647-32-04 (FROM 07647-42-03).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in general accordance with the test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. We tested selected samples to evaluate in-place dry density and moisture content, maximum dry density and optimum moisture content, expansion index, shear strength, water-soluble sulfate, chloride ion content, pH and resistivity, Atterberg Limits, hydraulic conductivity, resistance value (R-Value), gradation, and consolidation characteristics. The results of our laboratory tests are presented in the following tables and graphs. The in-place dry density and moisture content test results are presented on the exploratory boring logs in Appendices A and C.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY
AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
B7-1	Dark olive brown, Sandy CLAY	120.5	12.6
B16-1	Dark olive brown, Clayey, fine to medium SAND	128.6	9.3

TABLE B-II
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	2019 CBC Classification
	Before Test	After Test			
B6-1	10.2	21.2	109.9	64	Medium
B7-1	11.8	25.9	105.5	115	High
B13-1	12.5	25.5	104.6	86	Medium

TABLE B-III
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

Sample No.	Dry Density (pcf)	Moisture Content (%)		Angle of Shear Resistance (degrees)	Unit Cohesion (psf)
		Initial	Final		
B4-3	115.5	14.4	20.1	33	350
B5-2	120.4	12.5	19.7	38	0

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

Sample No.	Water Soluble Sulfate Content (%)	Sulfate Rating
B6-1	0.036	Not Applicable
B7-1	0.028	Not Applicable
B13-1	0.014	Not Applicable

TABLE B-V
SUMMARY OF LABORATORY CHLORIDE ION TEST RESULTS
AASHTO T 291

Sample No.	Chloride Ion Content (ppm)	Chloride Ion Content (%)
B6-1	89	0.009
B7-1	220	0.022
B13-1	126	0.013

TABLE B-VI
SUMMARY OF LABORATORY POTENTIAL OF
HYDROGEN (PH) AND RESISTIVITY TEST RESULTS
CALIFORNIA TEST NO. 643

Sample No.	pH	Minimum Resistivity (ohm-centimeters)
B6-1	7.3	800
B7-1	7.7	470
B13-1	7.5	530

TABLE B-VII
SUMMARY OF LABORATORY ATTERBERG LIMITS TEST RESULTS
ASTM D 4318

Sample No.	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index
B7-1	51	17	34
B13-2	8	19	29
B13-4	55	21	34

TABLE B-VIII
SUMMARY OF LABORATORY HYDRAULIC CONDUCTIVITY TEST RESULTS
ASTM D 5084

Sample No.	Moisture Content (%)		Dry Density (pcf)	Average Hydraulic Conductivity (cm/sec)	Average Hydraulic Conductivity (inches/hr)
	Before Test	After Test			
*B16-1	9.3	20.1	115.4	3.30E-7	4.68E-4

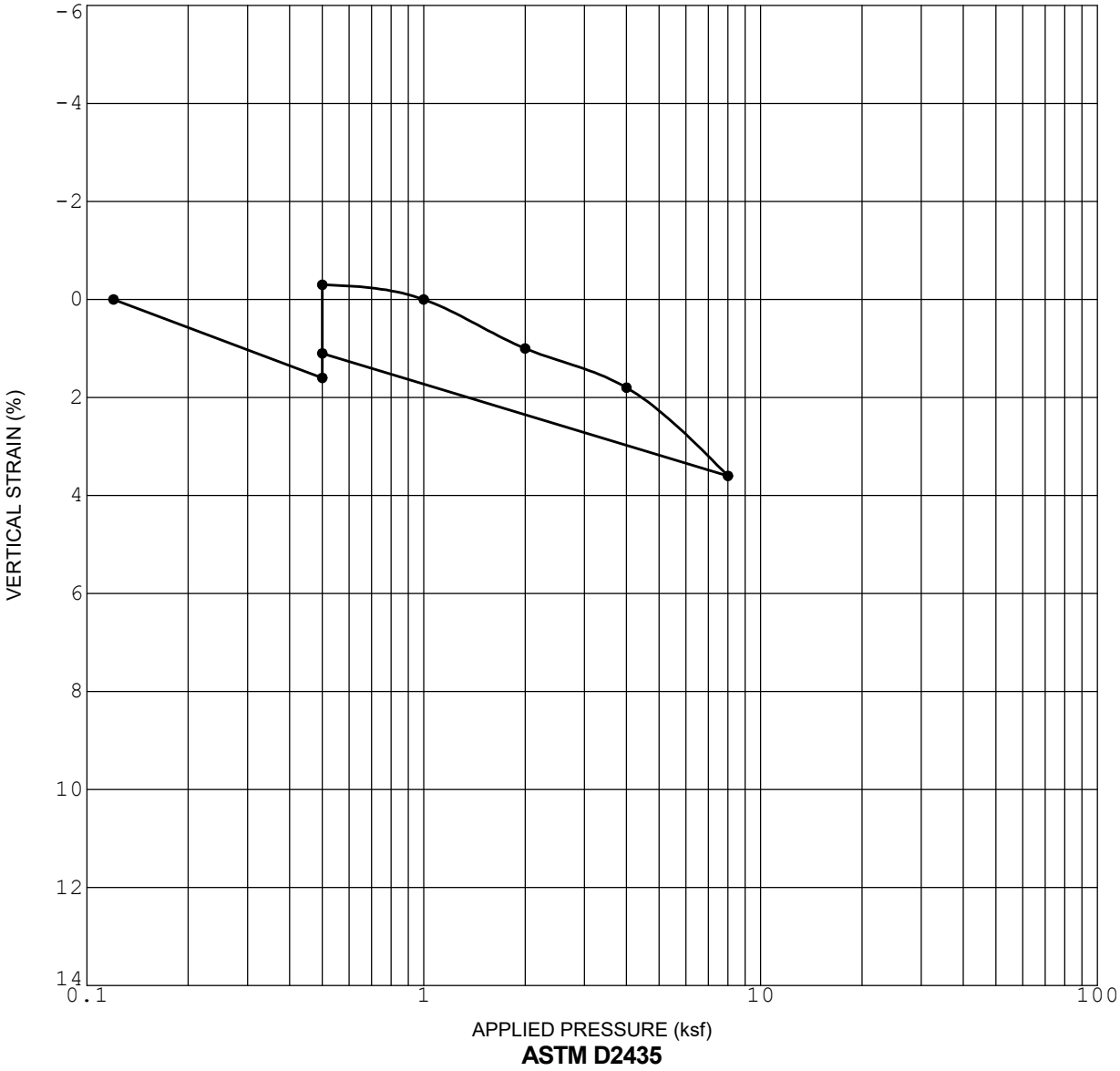
* Sample remolded to 90 percent of the laboratory maximum dry density.

TABLE B-IX
SUMMARY OF LABORATORY RESISTANCE VALUE (R-VALUE) TEST RESULTS
ASTM D 2844

Sample No.	R-Value
B9-1	12
B17-1	5

PROJECT NO. 07647-42-03

SAMPLE NO. B1-2



ASTM D2435

Initial Dry Density (pcf)	117.5	**Initial Saturation (%)**	90
Initial Water Content (%)	16.1	**Sample Saturated at (ksf)**	0.5

CONSOLIDATION CURVE

MODERA MELROSE

OCEANSIDE, CALIFORNIA

07647-32-04 (FROM 07647-42-03).GPJ

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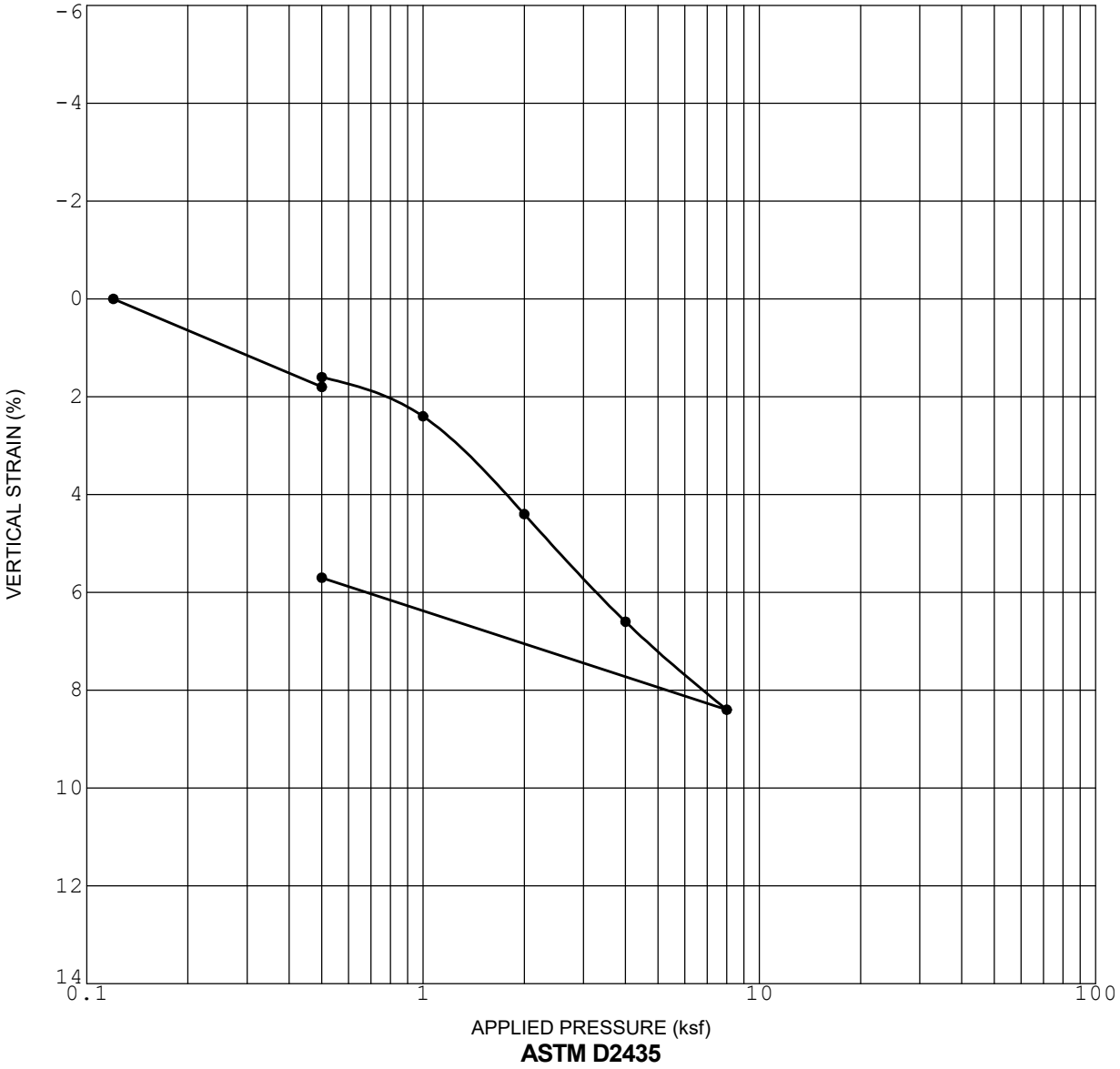
PROJECT NO. 07647-42-03

SAMPLE NO. B5-2



ASTM D2435

Initial Dry Density (pcf)	113.5	**Initial Saturation (%)**	84
Initial Water Content (%)	14.7	**Sample Saturated at (ksf)**	0.5

CONSOLIDATION CURVE

MODERA MELROSE

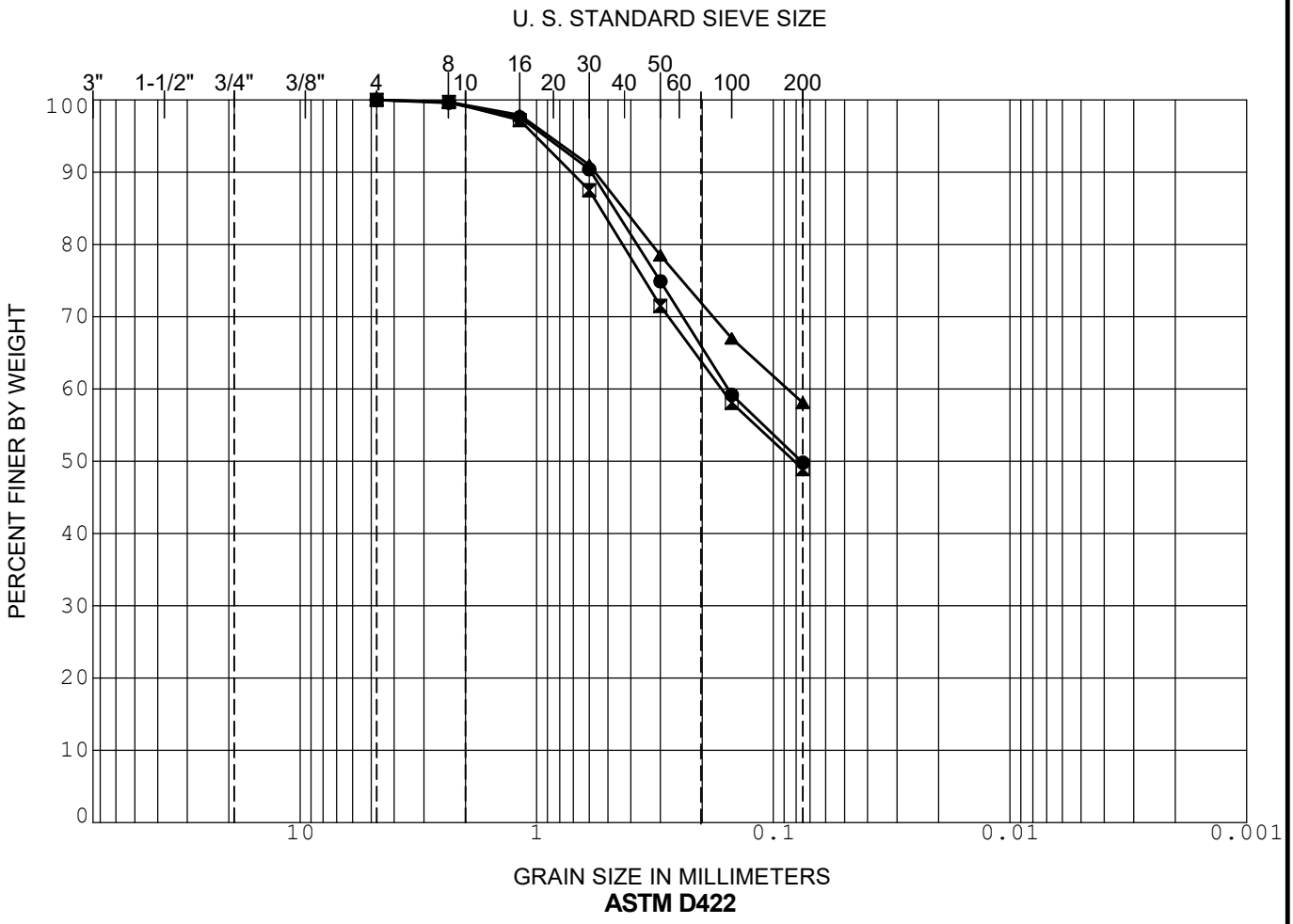
OCEANSIDE, CALIFORNIA

07647-32-04 (FROM 07647-42-03).GPJ

GEOCON

PROJECT NO. 07647-42-03

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



ASTM D422

	SAMPLE	DEPTH (ft)	CLASSIFICATION	NAT WC	LL	PL	PI
●	B6-1	0.0	SC - Clayey SAND				
⊠	B7-1	1.0	SC - Clayey SAND		51	17	34
▲	B15-1	2.5	CL - Sandy, lean CLAY				

GRADATION CURVE

MODERA MELROSE

OCEANSIDE, CALIFORNIA

07647-32-04 (FROM 07647-42-03).GPJ

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APPENDIX C

APPENDIX C

PREVIOUS LOGS OF AIR TRACK AND VERIFICATION BORINGS, EXPLORATORY TRENCHES, AND LABORATORY TESTING PERFORMED BY GEOCON INCORPORATED

FOR

MODERA MELROSE
OCEANSIDE, CALIFORNIA

PROJECT NO. 07647-32-04

PROJECT NO. 07647-32-04

TRENCH T 1

ELEV. (MSL.) **422'** DATE COMPLETED **01-11-2006**

EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T1-1			SM	**COLLUVIUM** Stiff, moist, brown, Silty, fine to medium SAND; porous			
2				SC	Medium dense, moist, dark olive-brown, Clayey, fine to coarse SAND			
4	T1-2				**BONSALL TONALITE** Highly weathered, white, moderately weak GRANITIC ROCK			
					TRENCH TERMINATED AT 5 FEET No groundwater encountered			

Figure C-1,
Log of Trench T 1, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2 ELEV. (MSL.) **424'** DATE COMPLETED **01-11-2006** EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**UNDOCUMENTED FILL / ORGANIC DEBRIS** Loose, moist, grayish brown, Clayey, fine to coarse SAND; abundant organics (straw, tree branches, plastic bags)			
2				SM	Loose, damp, mottled orange and white, Silty, fine to coarse SAND; abundant organics			
4				SM	**COLLUVIUM** Loose, damp, olive-brown, Silty, fine to medium SAND			
6								
		+ + + + + +			**BONSALL TONALITE** Highly weathered, white, moderately weak GRANITIC ROCK			
8					TRENCH TERMINATED AT 8 FEET No groundwater encountered			

Figure C-2,
Log of Trench T 2, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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PROJECT NO. 07647-32-04

TRENCH T 3

ELEV. (MSL.) **435'** DATE COMPLETED **01-11-2006**

EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T3-1			CL	**COLLUVIUM** Stiff, very moist, fine to coarse, Sandy CLAY with some silt; pinhole porosity, rootlets			
2	T3-2			SC	**SANTIAGO FORMATION** Dense, moist, mottled orange, gray and white, Clayey, fine to coarse SANDSTONE; massive			
4	T3-3							
6					-Change to gray-brown			
8								
					TRENCH TERMINATED AT 9 FEET No groundwater encountered			

Figure C-3,
Log of Trench T 3, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 4 ELEV. (MSL.) **430'** DATE COMPLETED **01-11-2006** EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**COLLUVIUM** Loose, moist, dark brown, Clayey, fine to medium SAND			
2				SM	**SANTIAGO FORMATION** Very dense, damp, Silty, fine to medium SANDSTONE; massive			
4								
6					TRENCH TERMINATED AT 6½ FEET No groundwater encountered			

Figure C-4,
Log of Trench T 4, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 5 ELEV. (MSL.) 440' DATE COMPLETED 01-11-2006 EQUIPMENT JD 510 BACKHOE BY: T. MYERS MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, damp to slightly moist, brown, Silty, fine to medium SAND			
2				SC	Medium dense, moist, brown, Clayey, fine to medium SAND			
4				SM	Dense, moist, orange-brown, Silty, fine to medium SAND			
6	T5-1				**BONSALL TONALITE** Moderately weathered, mottled, orange, black and gray, moderately strong GRANITIC ROCK			
8					TRENCH TERMINATED AT 8 FEET No groundwater encountered			

Figure C-5,
Log of Trench T 5, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07647-32-04

TRENCH T 6

ELEV. (MSL.) **447'** DATE COMPLETED **01-11-2006**

EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, damp, brown, Silty, fine to medium SAND; rootlets			
				SC	Dense, moist, dark brown, Clayey, fine to medium SAND			
2								
	T6-1				**BONSALL TONALITE** Moderately weathered, mottled, black and gray, moderately strong GRANITIC ROCK			
4								
6								
					TRENCH TERMINATED AT 7 FEET No groundwater encountered			

Figure C-6,
Log of Trench T 6, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL | ... STANDARD PENETRATION TEST | ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE | ... CHUNK SAMPLE | ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 7 ELEV. (MSL.) **447'** DATE COMPLETED **01-11-2006** EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM** Loose, moist, dark brown, Silty, fine to medium SAND; rootlets			
				SC	Medium dense to dense, moist, dark brown, Clayey, fine to coarse SAND; rootlets			
2								
					BONSALL TONALITE Completely weathered, grayish brown, weak GRANITIC ROCK			
4								
					Moderately weathered, mottled black, orange and gray, moderately strong GRANITIC ROCK			
6								
					TRENCH TERMINATED AT 6½ FEET No groundwater encountered			

Figure C-7,
Log of Trench T 7, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

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PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 8 ELEV. (MSL.) 447' DATE COMPLETED 01-11-2006 EQUIPMENT JD 510 BACKHOE BY: T. MYERS MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, damp, Silty, fine to medium SAND; rootlets, pinhole porosity			
2	T8-1 T8-2			ML	**SANTIAGO FORMATION** Very dense, damp to slightly moist, mottled white, orange, red, Sandy SILTSTONE; cemented; massive			
4								
6								
8					TRENCH TERMINATED AT 8 FEET No groundwater encountered			

Figure C-8,
Log of Trench T 8, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9 ELEV. (MSL.) **440'** DATE COMPLETED **01-11-2006** EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**COLLUVIUM** Loose, damp, olive-brown, Clayey, fine to medium SAND; rootlets -Medium dense, moist			
2								
				ML/CL	**SANTIAGO FORMATION** Very dense, damp, mottled orange, white, Clayey SILTSTONE/Silty CLAYSTONE; cemented; massive			
4								
6								
					TRENCH TERMINATED AT 7 FEET No groundwater encountered			

Figure C-9,
Log of Trench T 9, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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PROJECT NO. 07647-32-04

TRENCH T 10

ELEV. (MSL.) **455'** DATE COMPLETED **01-11-2006**

EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, damp, dark olive-brown, Silty, fine to medium SAND			
2				SC	medium dense, moist, olive-brown, Clayey, fine to medium SAND			
4				ML/CL	**SANTIAGO FORMATION** Dense, moist, greenish brown, Clayey SILTSTONE/Silty CLAYSTONE; massive			
				SP	Dense, damp to slightly moist, orangish brown, fine to coarse SAND			
6	T10-1			ML/CL	Dense, moist, greenish brown, Clayey SILTSTONE/Silty CLAYSTONE; massive			
				SP	Dense damp, gray, fine to coarse SAND			
8				ML/CL	Very dense, moist, greenish brown, Clayey SILTSTONE/Silty CLAYSTONE; massive			
10					TRENCH TERMINATED AT 10 FEET No groundwater encountered			

Figure C-10,
Log of Trench T 10, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 11 ELEV. (MSL.) **455'** DATE COMPLETED **01-11-2006** EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM** Loose, damp, olive-brown, Silty, fine to medium SAND			
2	T11-1			ML	**SANTIAGO FORMATION** Dense, damp to moist, orange and tan, fine to medium, Sandy SILTSTONE; massive			
4								
6	T11-2			SM	Very dense, damp to moist, light greenish brown, Silty, fine SANDSTONE; massive			
8								
					TRENCH TERMINATED AT 9 FEET No groundwater encountered			

Figure C-11,
Log of Trench T 11, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 12 ELEV. (MSL.) **443'** DATE COMPLETED **01-11-2006** EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM** Loose, damp, olive-brown, Silty, fine to medium SAND			
				CL	Medium dense, moist, olive-brown, Sandy CLAY			
2								
4				ML	**SANTIAGO FORMATION** Very dense, damp, light greenish brown, Sandy SILTSTONE; massive			
6								
8					TRENCH TERMINATED AT 8 FEET No groundwater encountered			

Figure C-12,
Log of Trench T 12, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 13 ELEV. (MSL.) 433' DATE COMPLETED 01-11-2006 EQUIPMENT JD 510 BACKHOE BY: T. MYERS	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM** Loose, damp, dark olive-brown, Silty, fine to medium SAND			
				CL	Loose to medium dense, moist, dark olive-brown, Sandy CLAY			
2								
4								
				SM	**SANTIAGO FORMATION** Very dense, moist, mottled orange and gray, Silty, fine to medium SANDSTONE; massive			
6				ML/CL	Very dense, damp, light greenish brown, Clayey SILTSTONE/Silty CLAYSTONE; massive			
					TRENCH TERMINATED AT 7½ FEET No groundwater encountered			

Figure C-13,
Log of Trench T 13, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-04

TRENCH T 14

ELEV. (MSL.) **435'** DATE COMPLETED **01-11-2006**

EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, damp, dark brown, Silty, fine to medium SAND			
				CL	Medium dense, moist, dark olive-brown, fine to medium, Sandy CLAY with some silt			
2	T14-1							
4								
				SM	**SANTIAGO FORMATION** Very dense, damp, light greenish brown, Silty, fine to medium SANDSTONE; massive			
6	T14-2							
8								
					TRENCH TERMINATED AT 9 FEET No groundwater encountered			

Figure C-14,
Log of Trench T 14, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-04

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 15 ELEV. (MSL.) **428'** DATE COMPLETED **01-11-2006** EQUIPMENT **JD 510 BACKHOE** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SC	**COLLUVIUM** Loose, moist to very moist, Clayey, fine to medium SAND			
2					-Medium dense			
4								
6				ML	**SANTIAGO FORMATION** Very dense, damp to moist, light greenish brown, Sandy SILTSTONE; cemented; massive			
					TRENCH TERMINATED AT 6½ FEET No groundwater encountered			

Figure C-15,
Log of Trench T 15, Page 1 of 1

07647-32-04 (FROM 07647-32-01).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

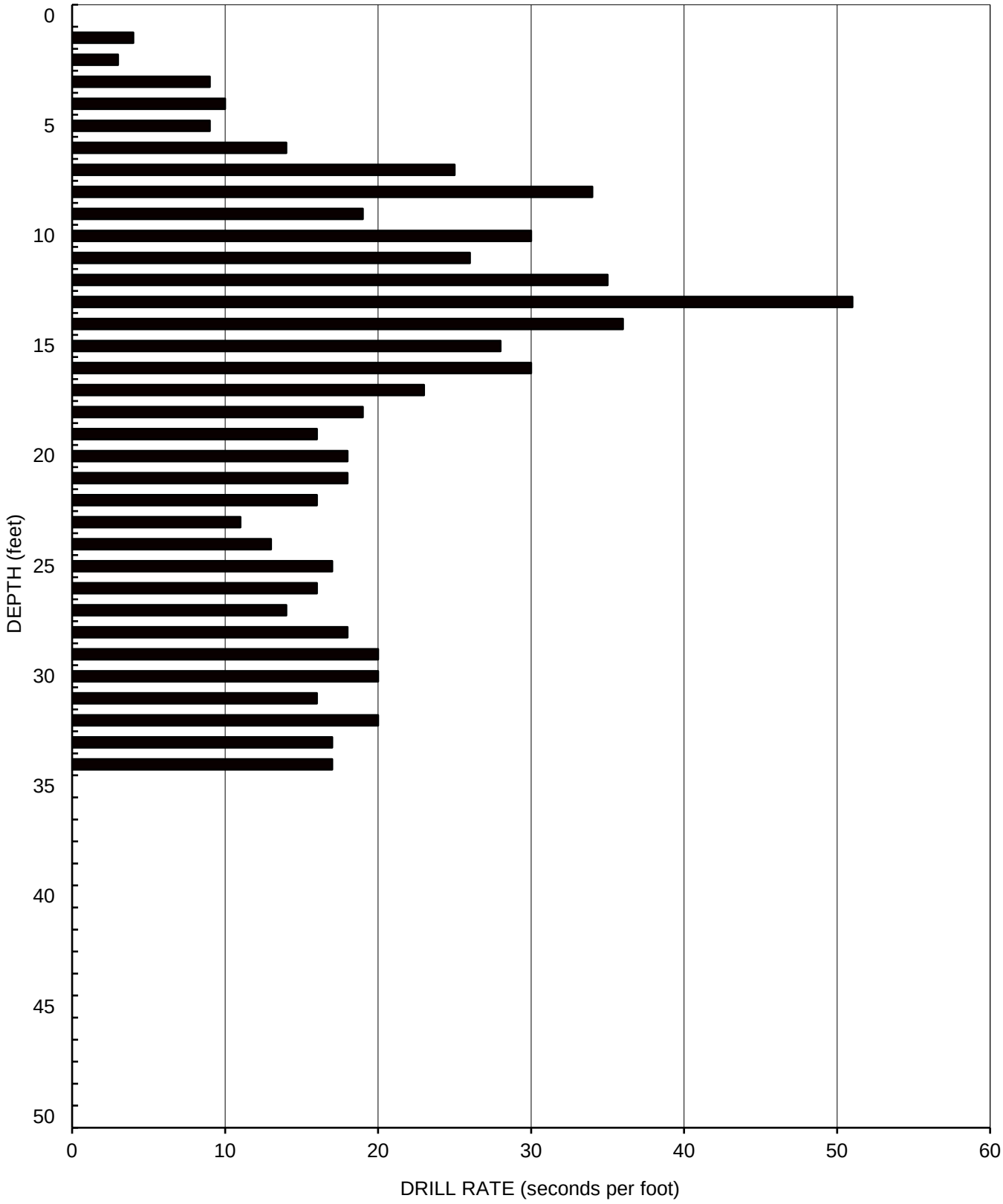
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-1

Elevation - 445 Feet (MSL)

GEOCON
INCORPORATED



AT001.xls

FIGURE C-16

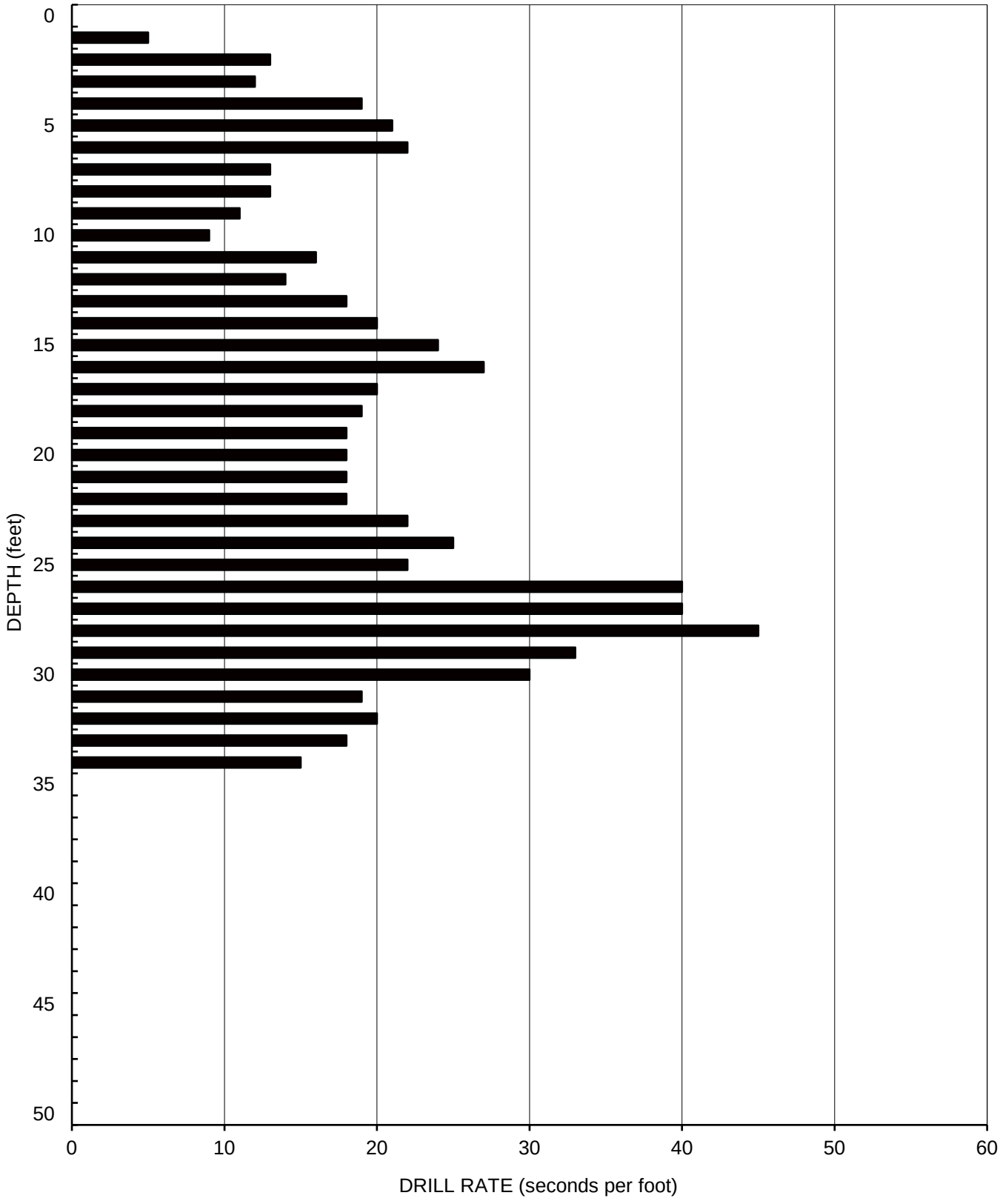
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-2

Elevation - 453 Feet (MSL)

GEOCON
INCORPORATED



AT002.xls

FIGURE C-17

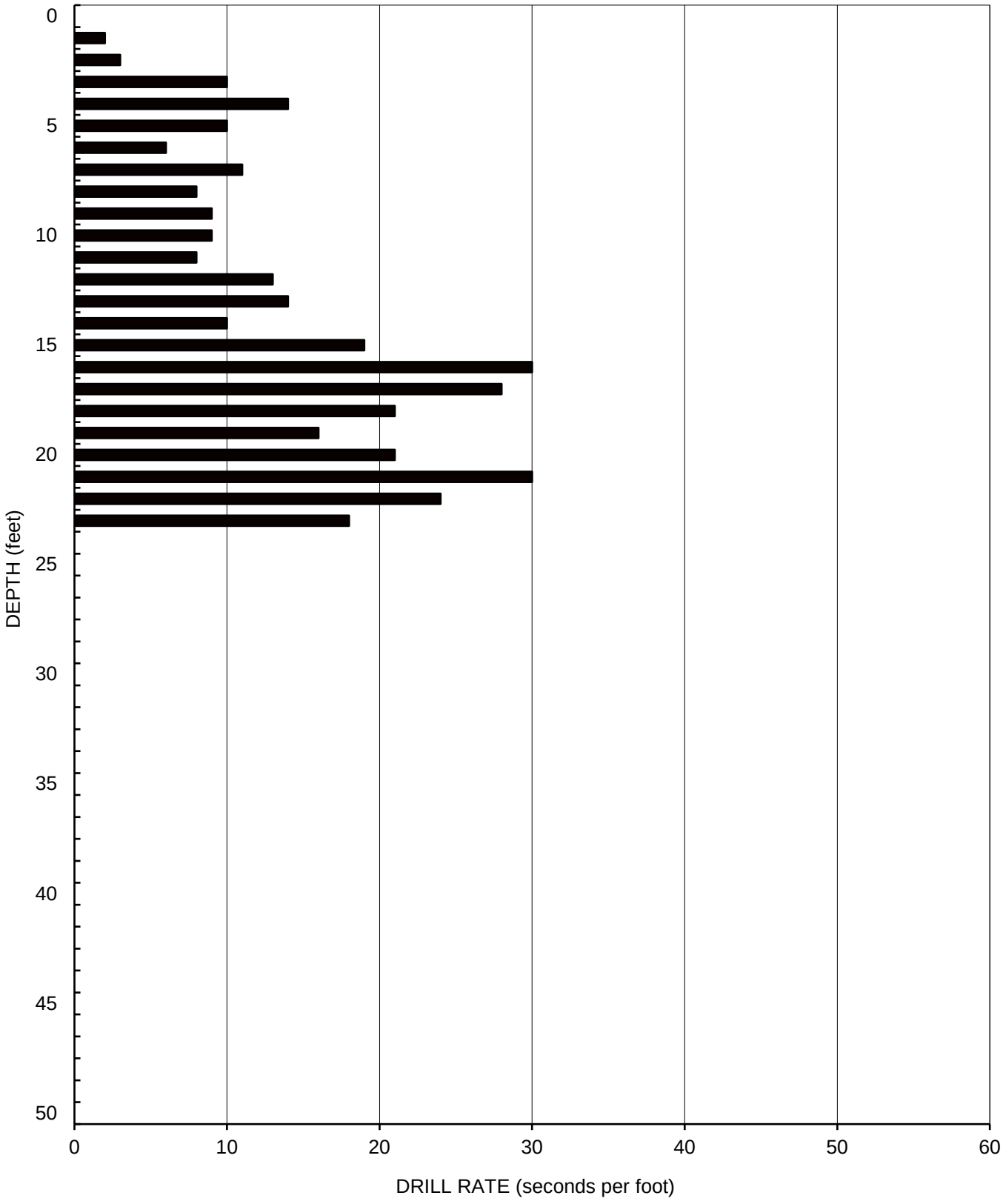
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-3

Elevation - 455 Feet (MSL)

GEOCON
INCORPORATED



AT003.xls

FIGURE C-18

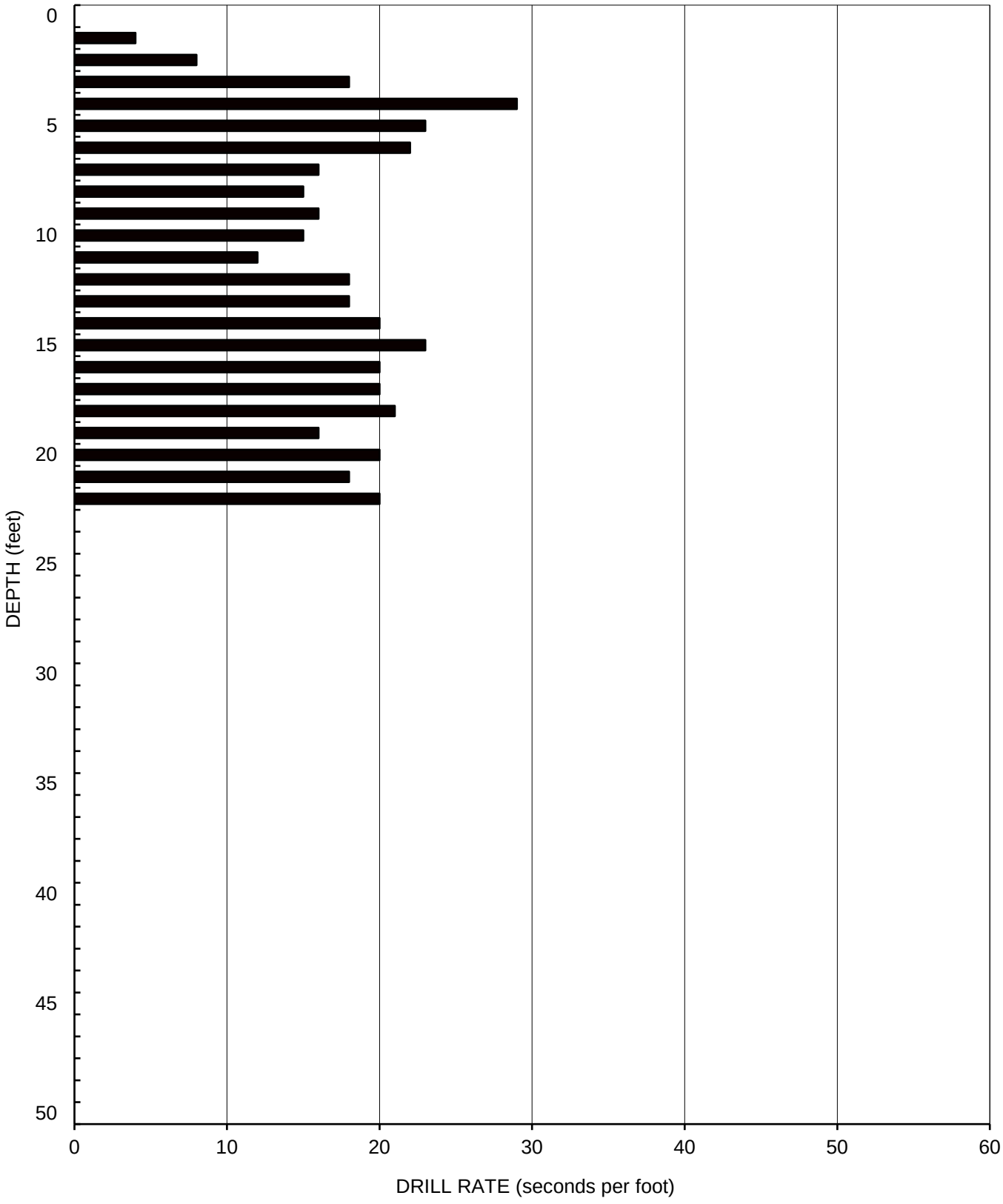
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-4

Elevation - 454 Feet (MSL)

GEOCON
INCORPORATED



AT004.xls

FIGURE C-19

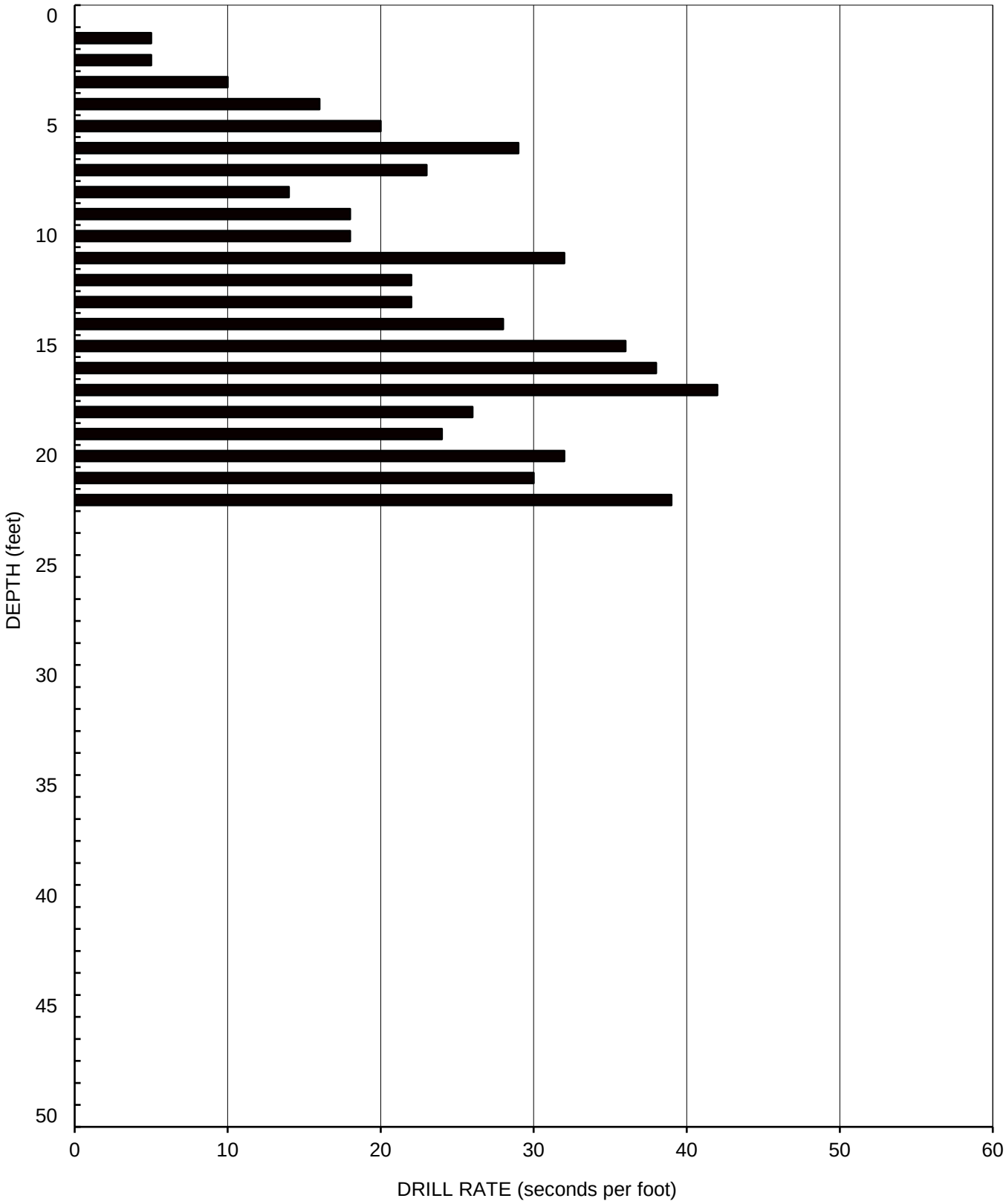
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-5

Elevation - 450 Feet (MSL)

GEOCON
INCORPORATED



AT005.xls

FIGURE C-20

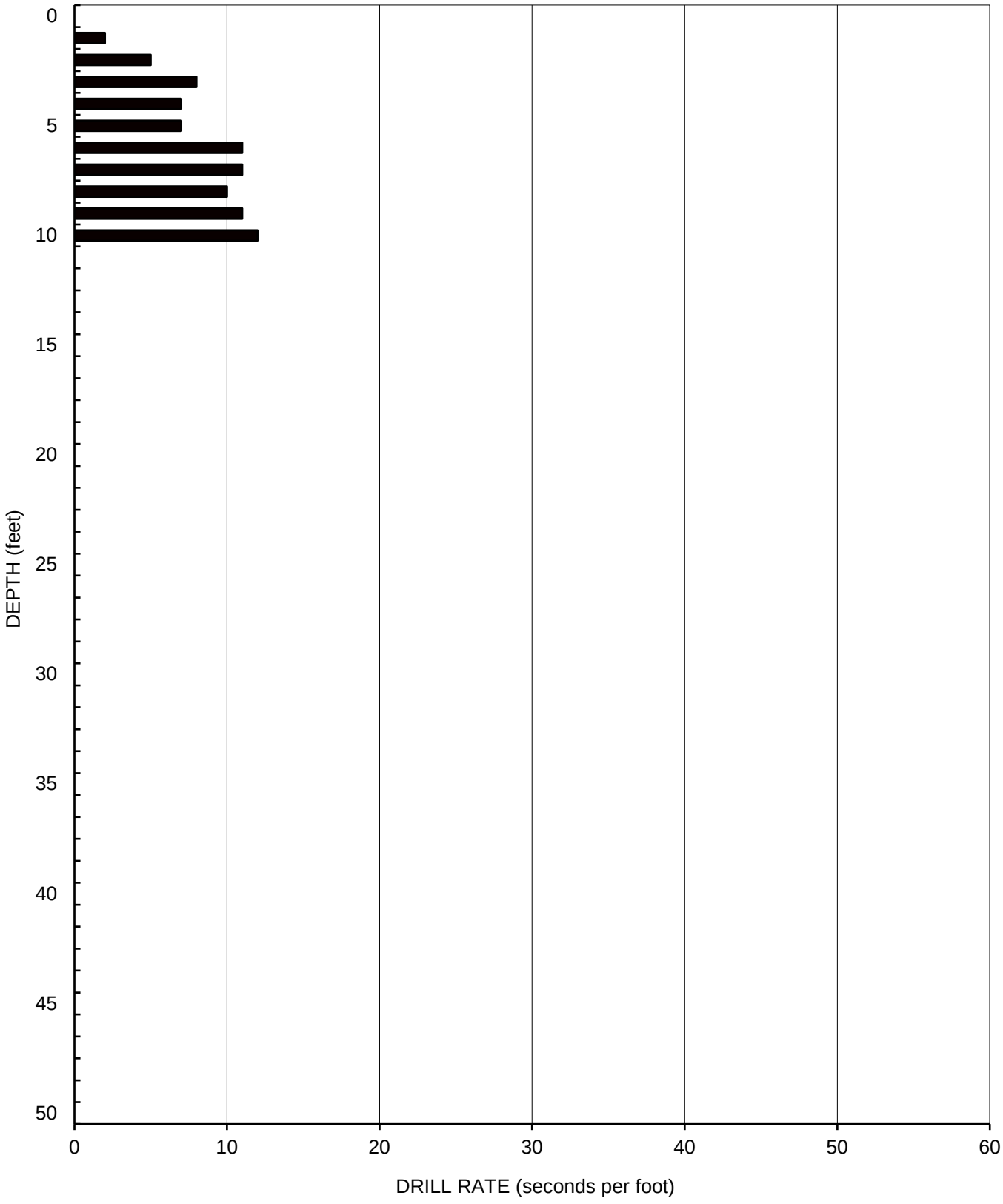
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-6

Elevation - 447 Feet (MSL)

GEOCON
INCORPORATED



AT006.xls

FIGURE C-21

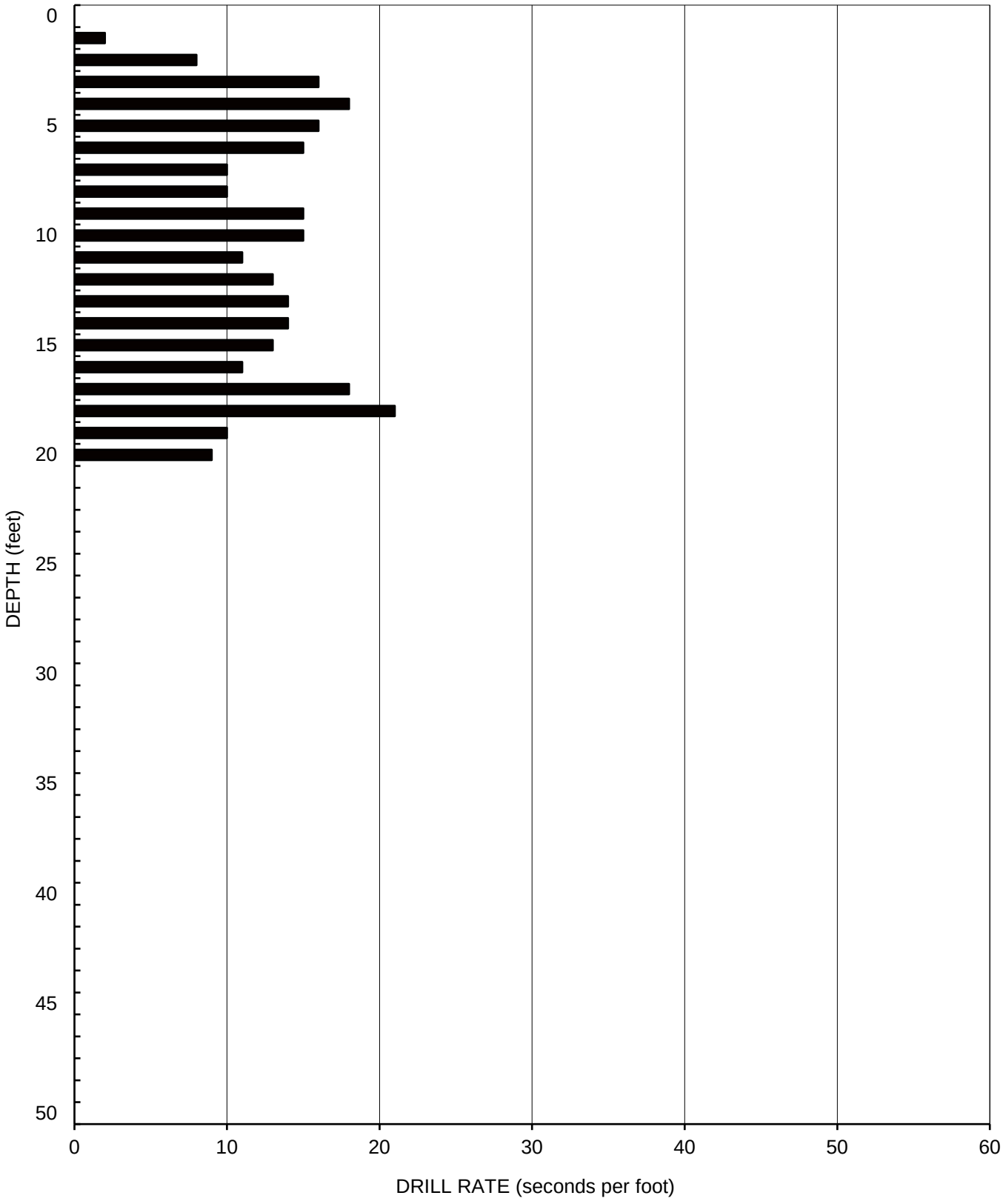
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-7

Elevation - 447 Feet (MSL)

GEOCON
INCORPORATED



AT007.xls

FIGURE C-22

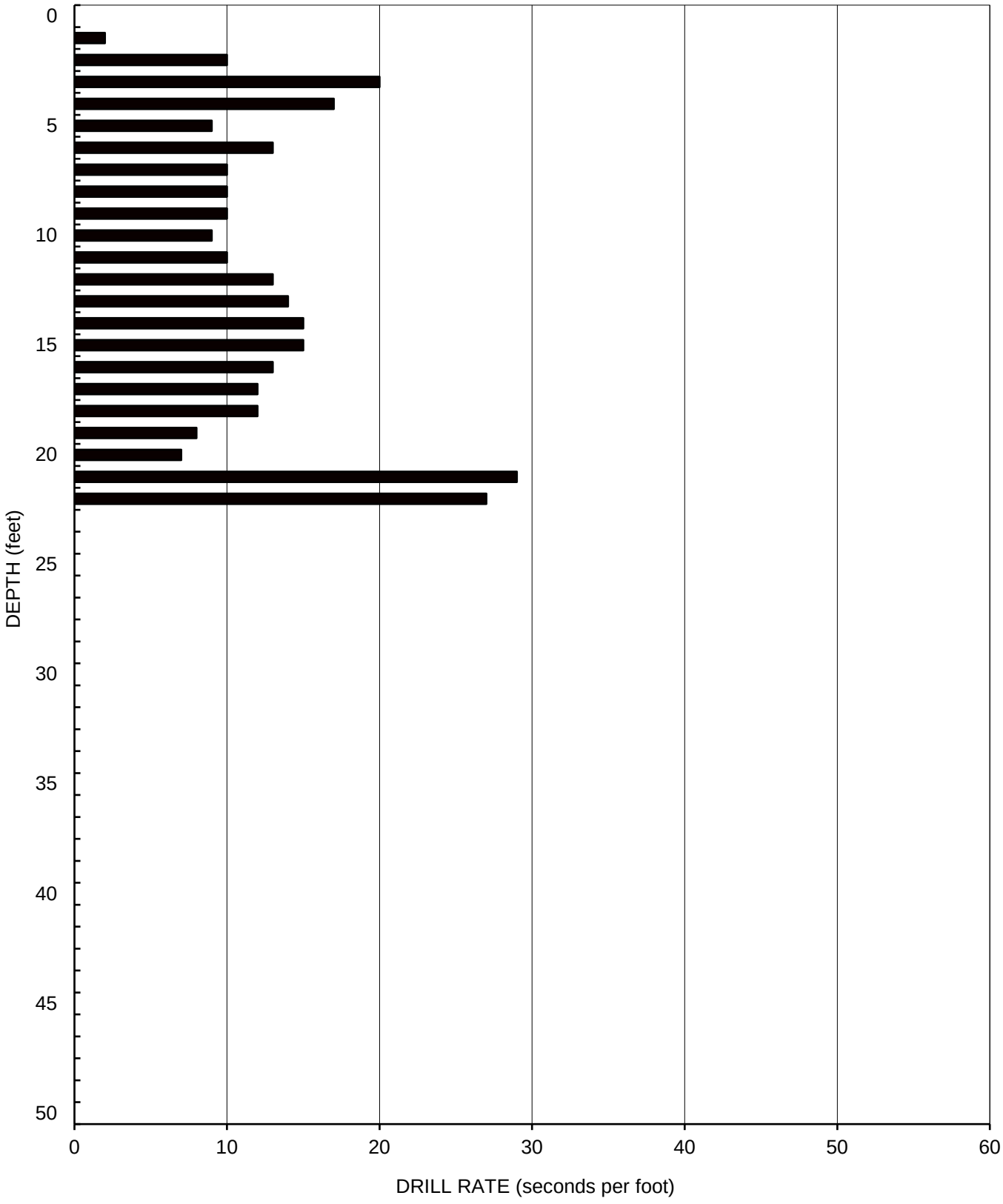
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-8

Elevation - 447 Feet (MSL)

GEOCON
INCORPORATED



AT008.xls

FIGURE C-23

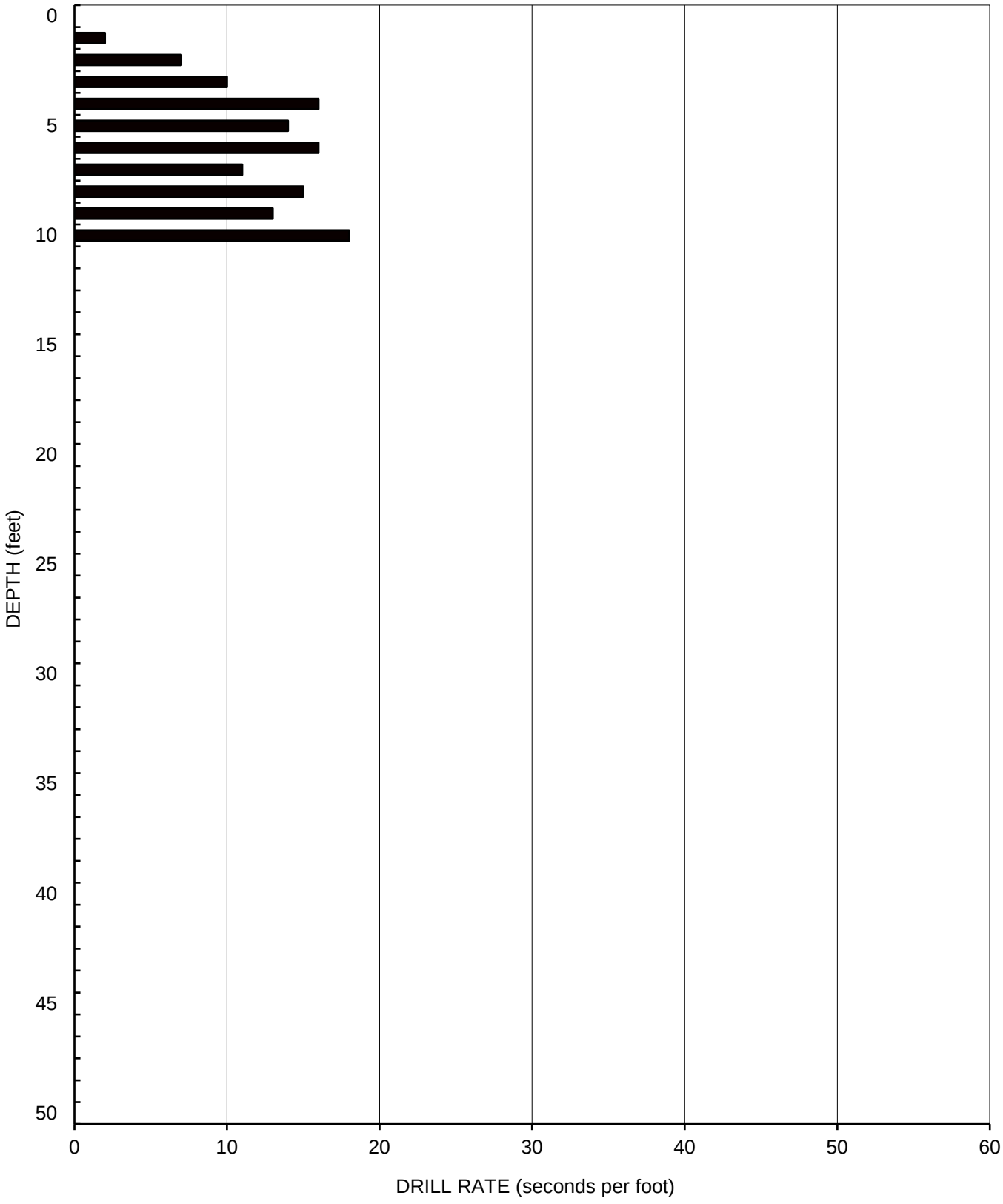
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-9

Elevation - 446 Feet (MSL)

GEOCON
INCORPORATED



AT009.xls

FIGURE C-24

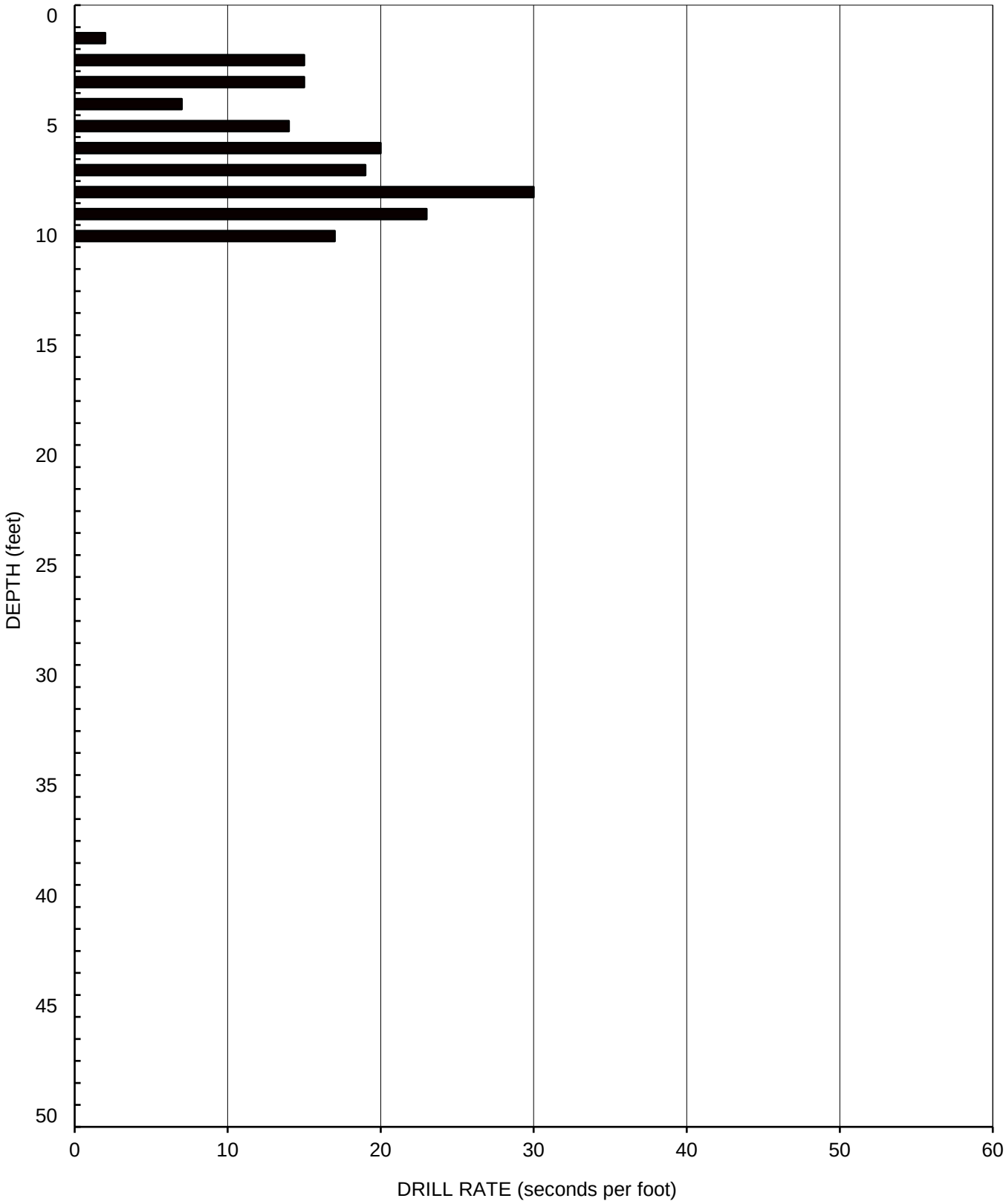
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-10

Elevation - 443 Feet (MSL)

GEOCON
INCORPORATED



AT0010.xls

FIGURE C-25

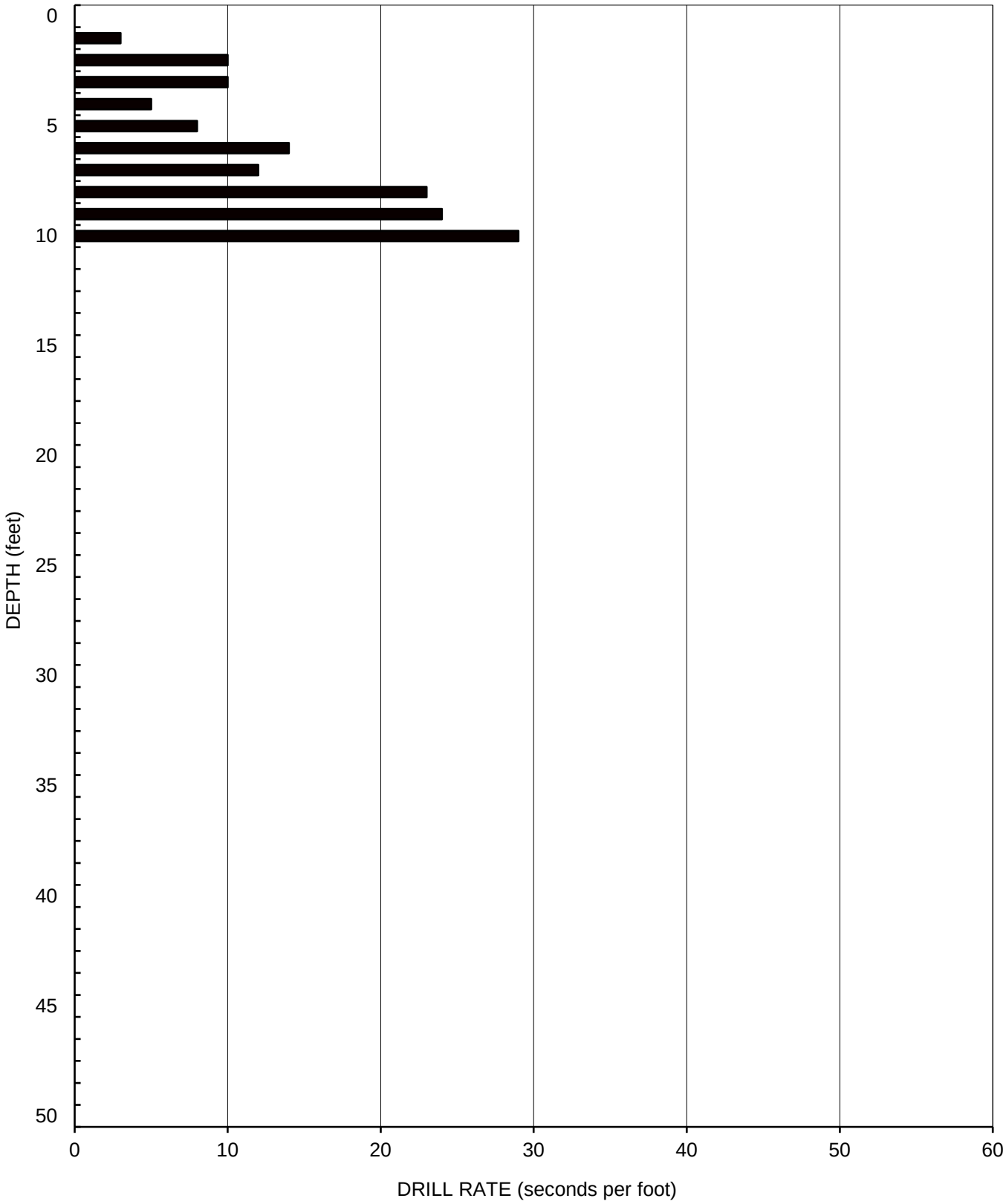
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-11

Elevation - 441 Feet (MSL)

GEOCON
INCORPORATED



AT0011.xls

FIGURE C-26

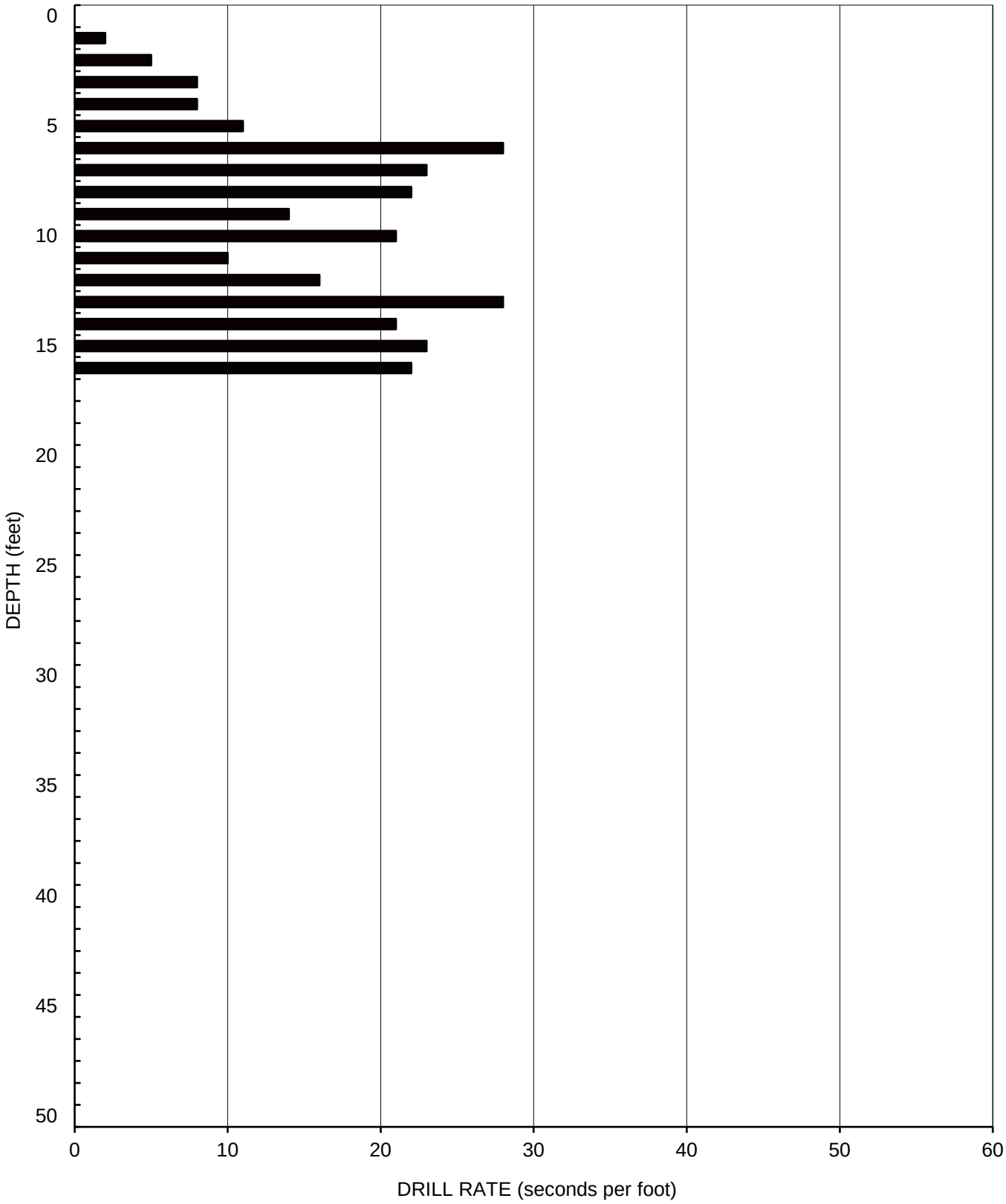
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-12

Elevation - 443 Feet (MSL)

GEOCON
INCORPORATED



AT0012.xls

FIGURE C-27

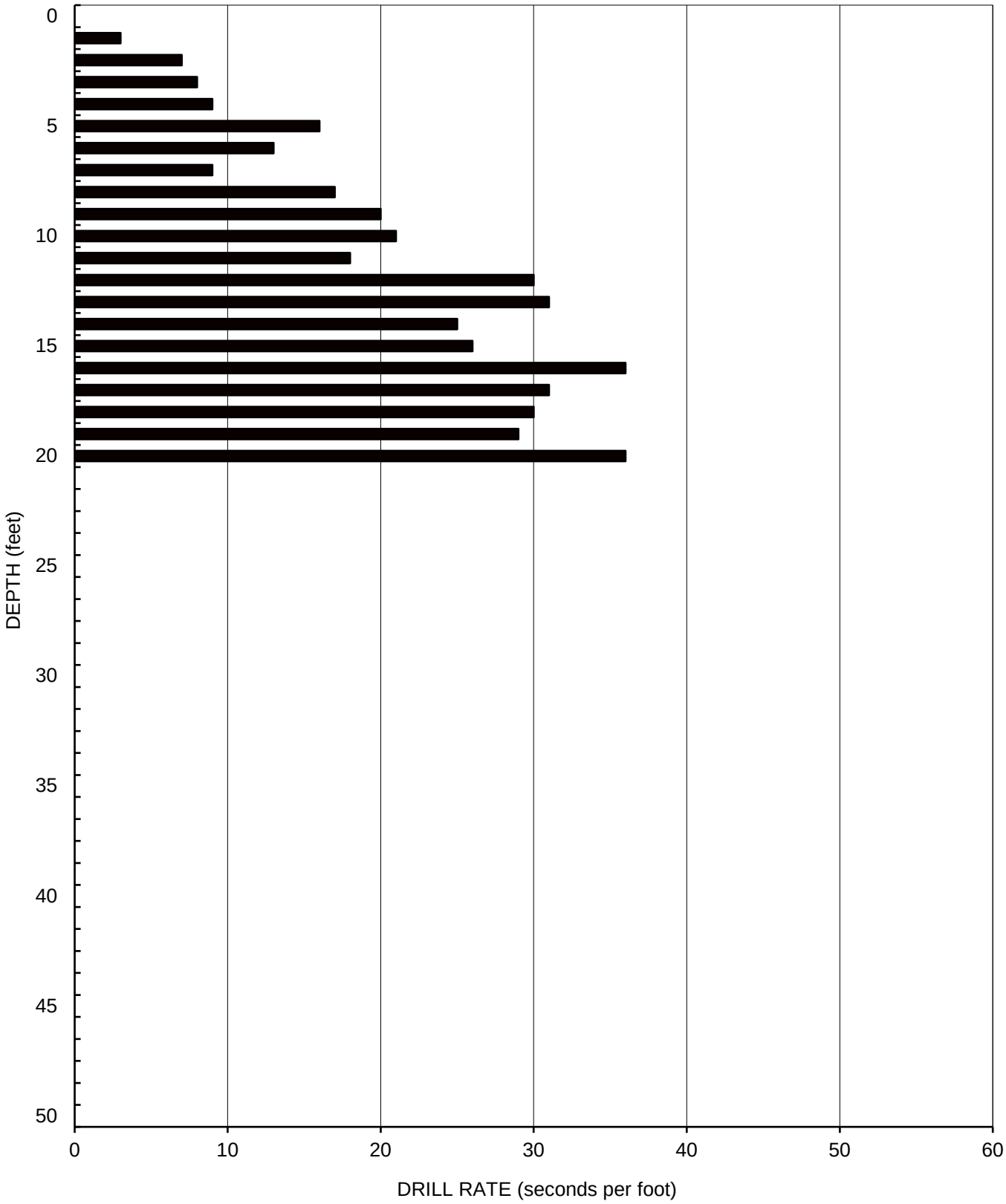
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-13

Elevation - 443 Feet (MSL)

GEOCON
INCORPORATED



AT0013.xls

FIGURE C-28

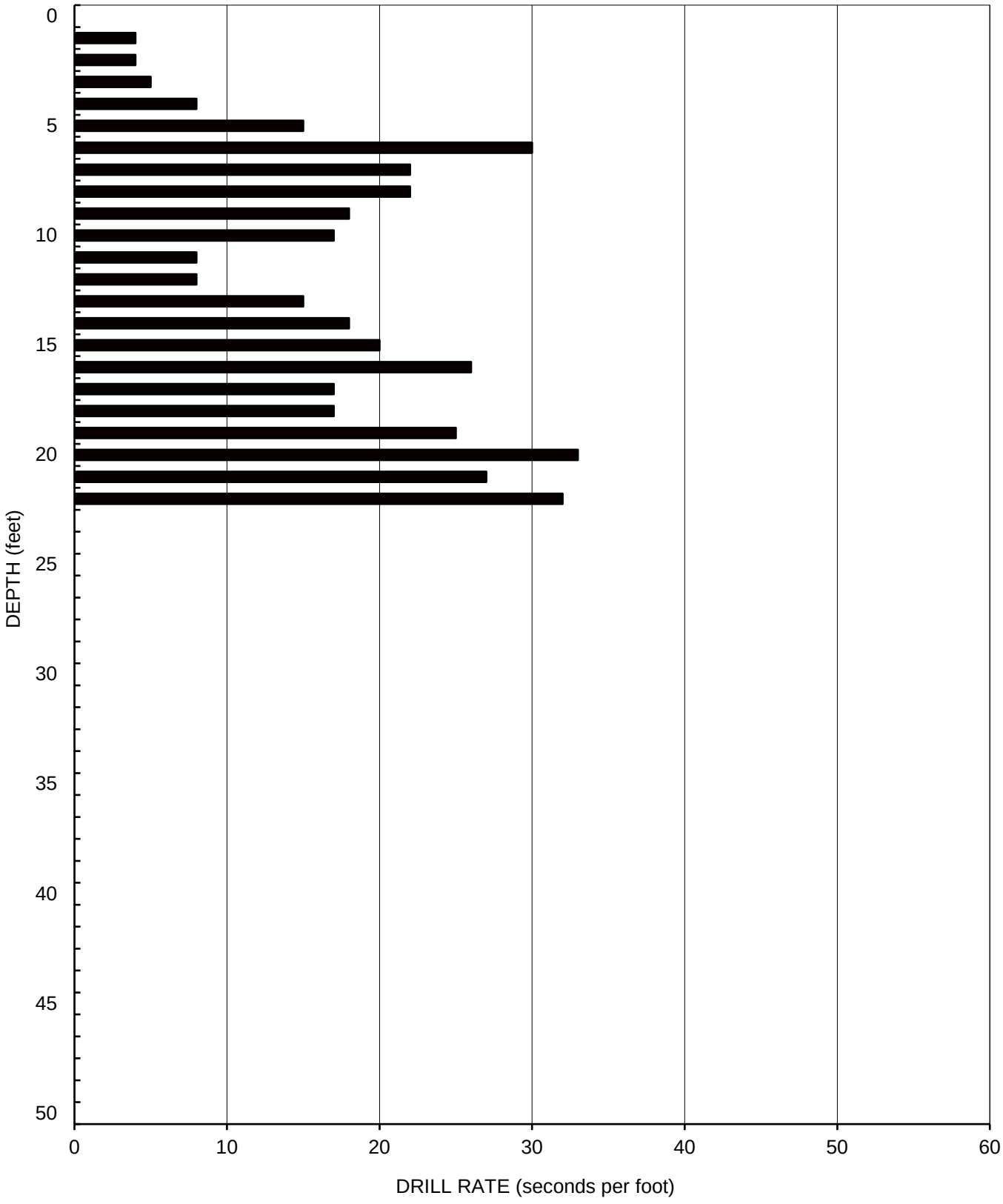
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-14

Elevation - 446 Feet (MSL)

GEOCON
INCORPORATED



AT0014.xls

FIGURE C-29

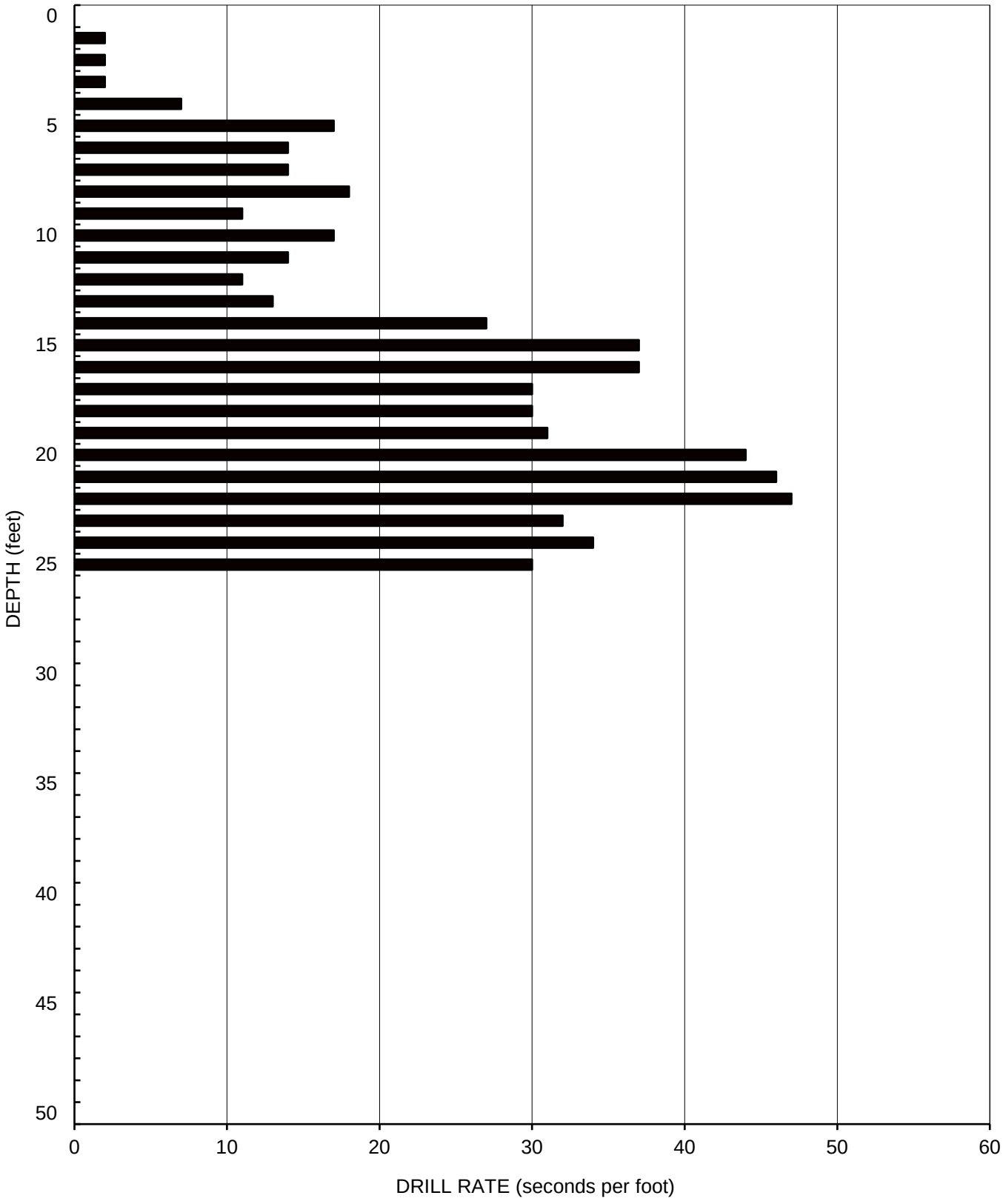
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-15

Elevation - 444 Feet (MSL)

GEOCON
INCORPORATED



AT0015.xls

FIGURE C-30

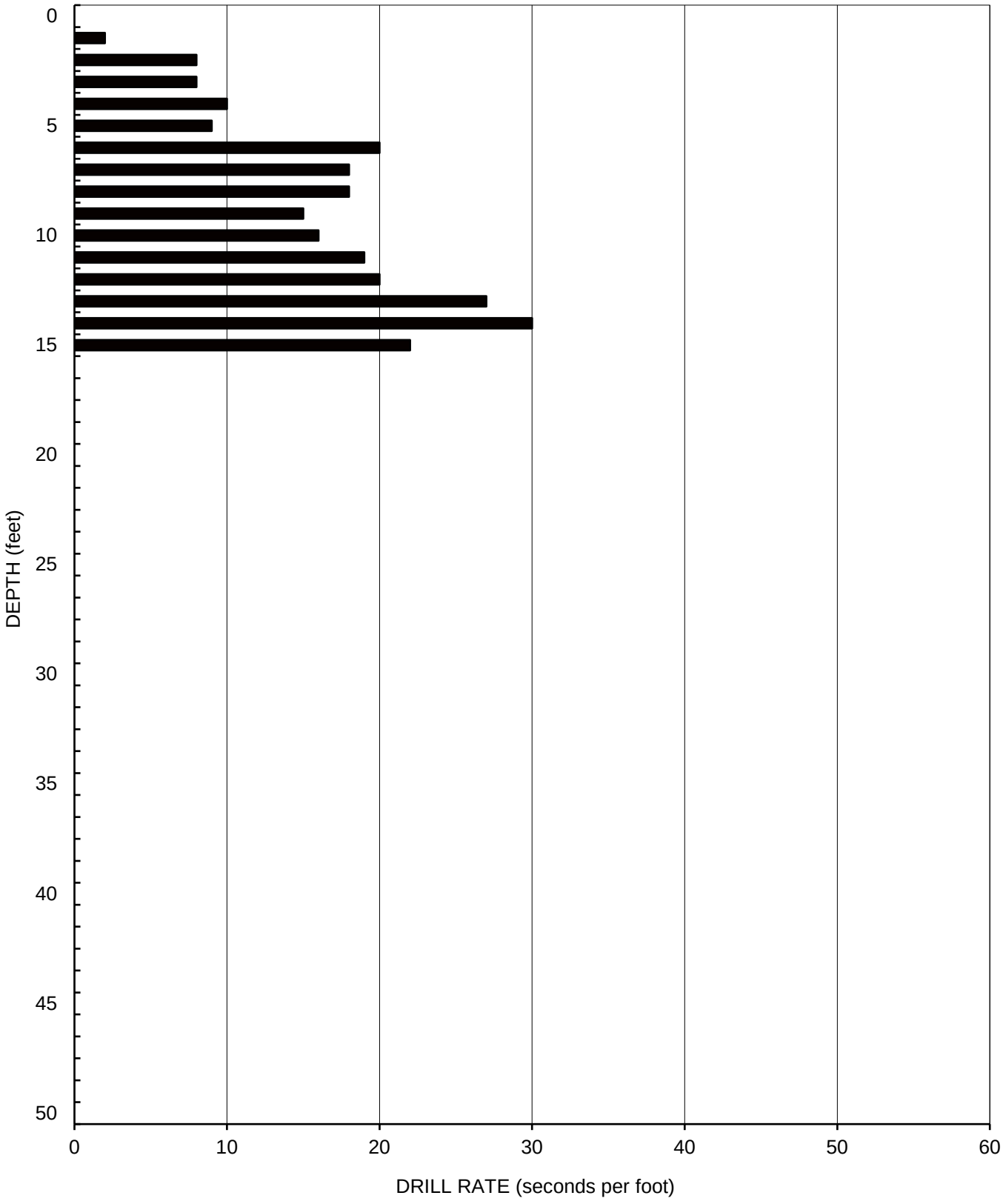
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-16

Elevation - 436 Feet (MSL)

GEOCON
INCORPORATED



AT0016.xls

FIGURE C-31

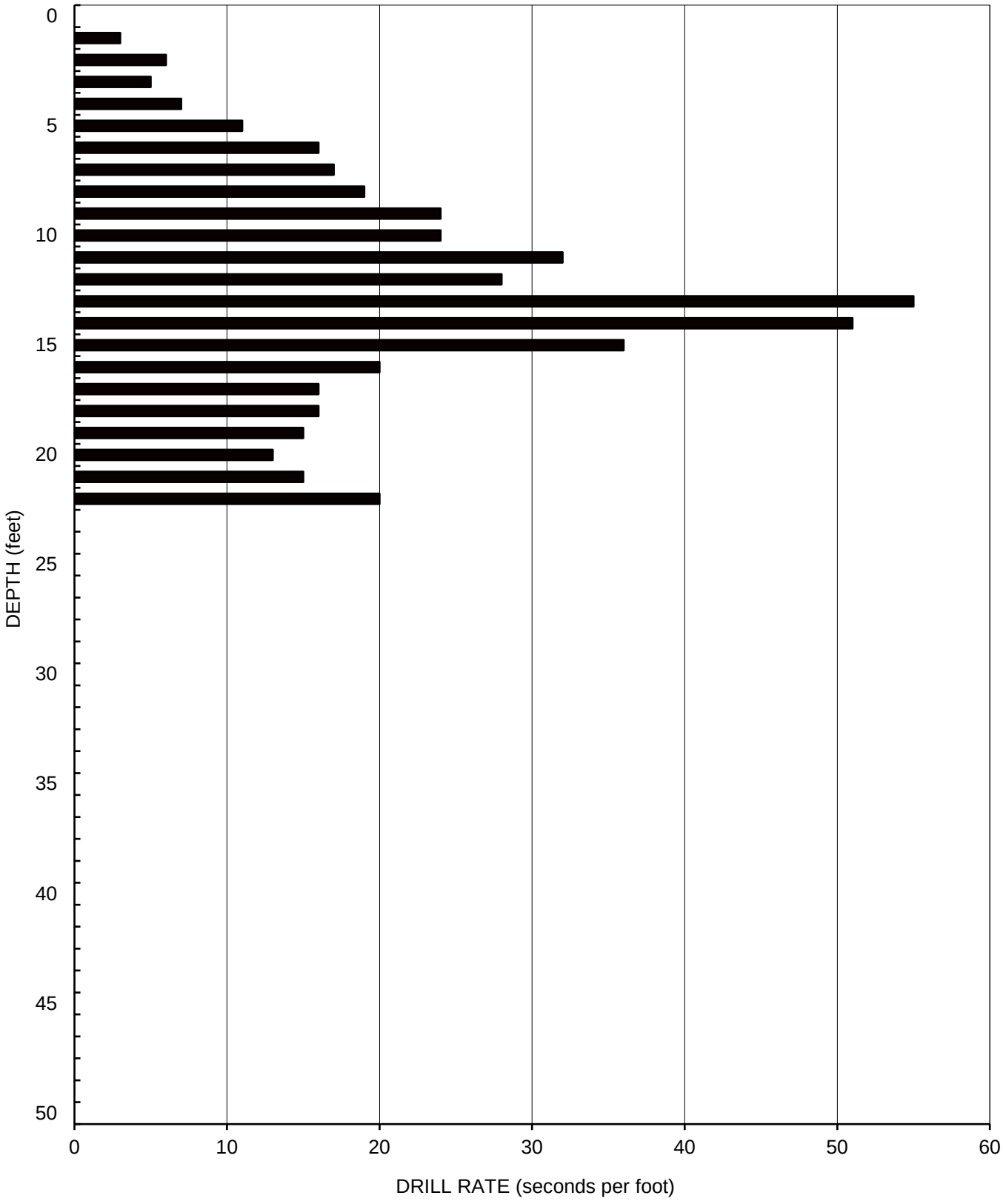
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-17

Elevation - 442 Feet (MSL)

GEOCON
INCORPORATED



AT0017.xls

FIGURE C-32

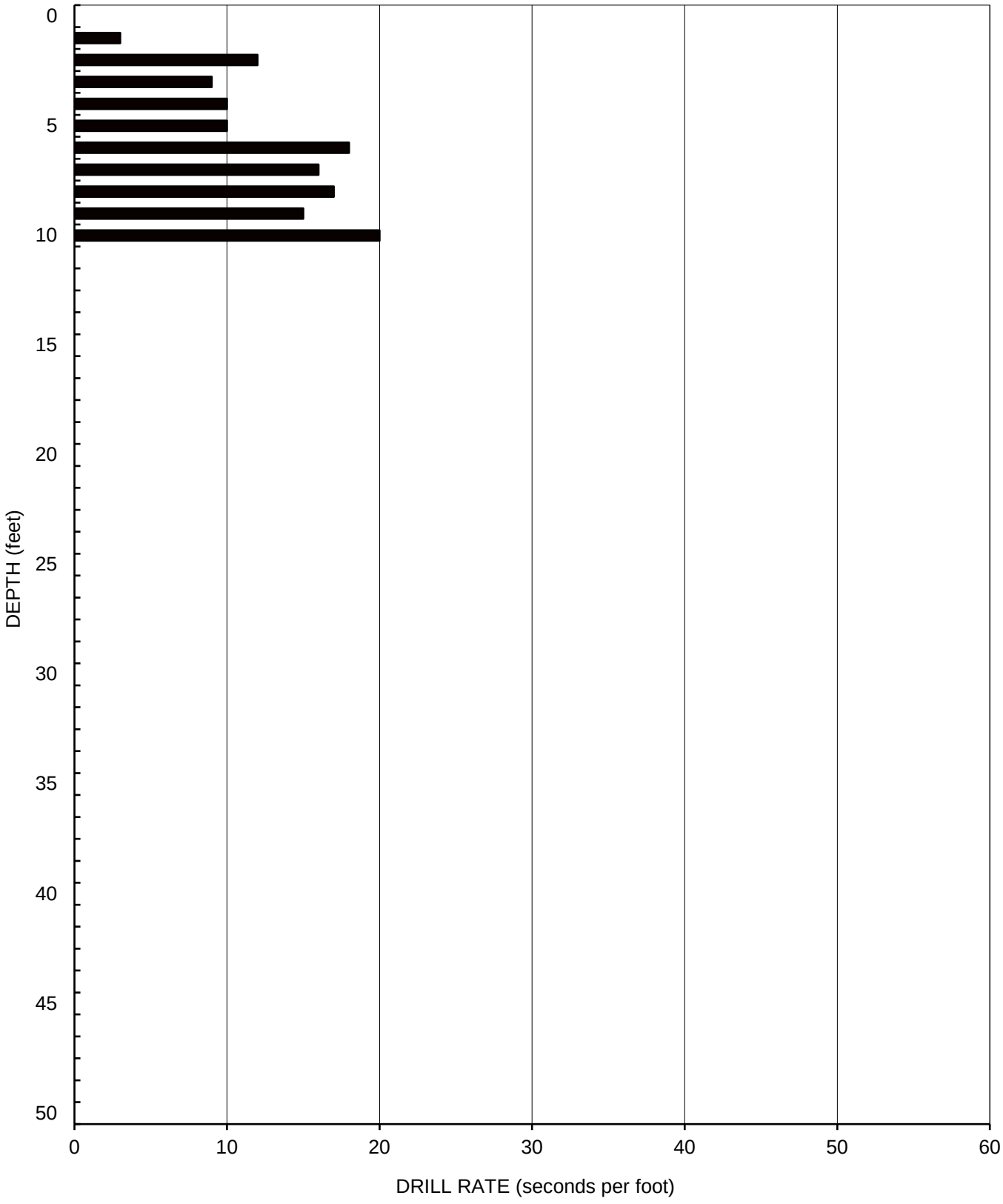
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-18

Elevation - 433 Feet (MSL)

GEOCON
INCORPORATED



AT0018.xls

FIGURE C-33

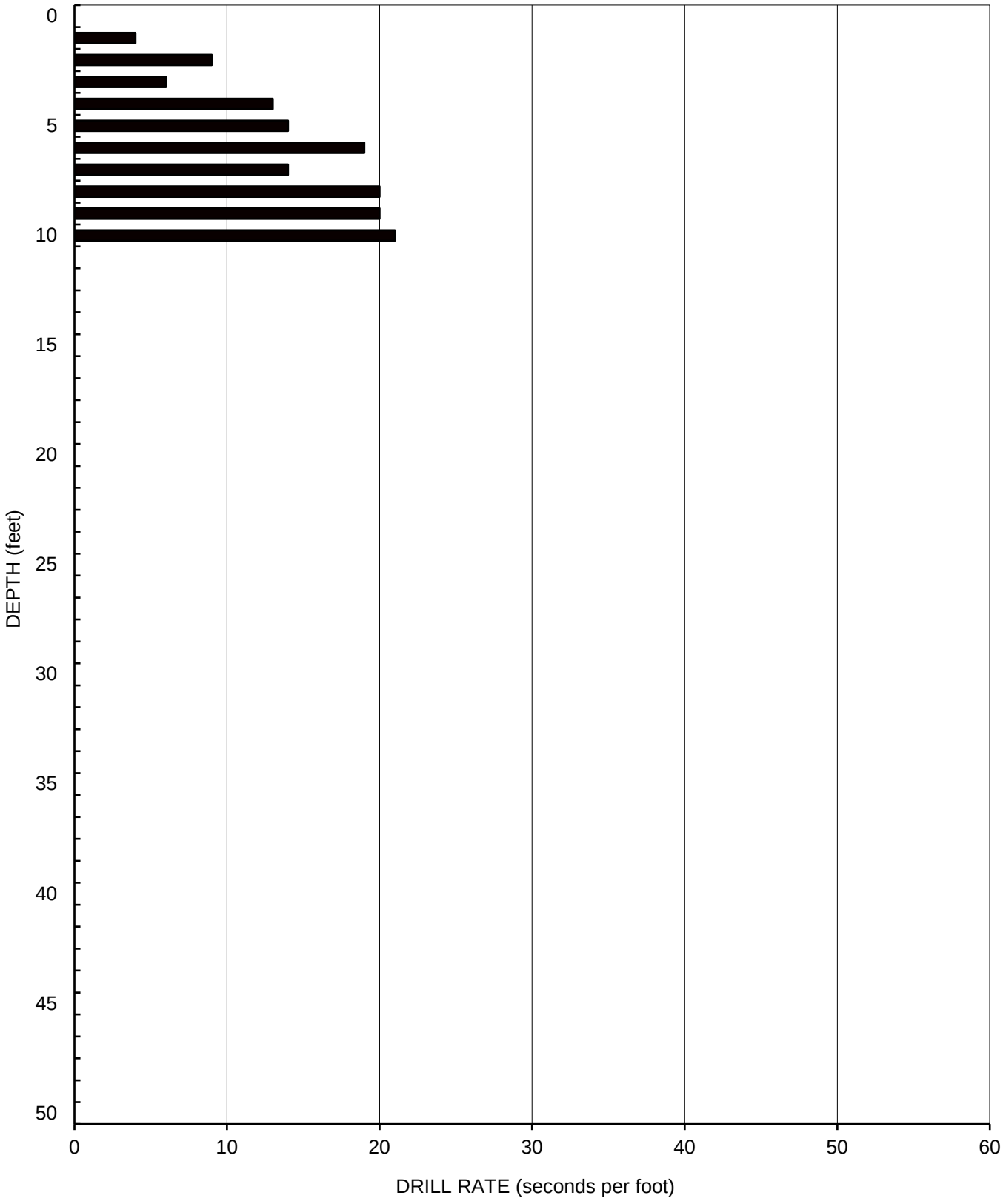
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-19

Elevation - 436 Feet (MSL)

GEOCON
INCORPORATED



AT0019.xls

FIGURE C-34

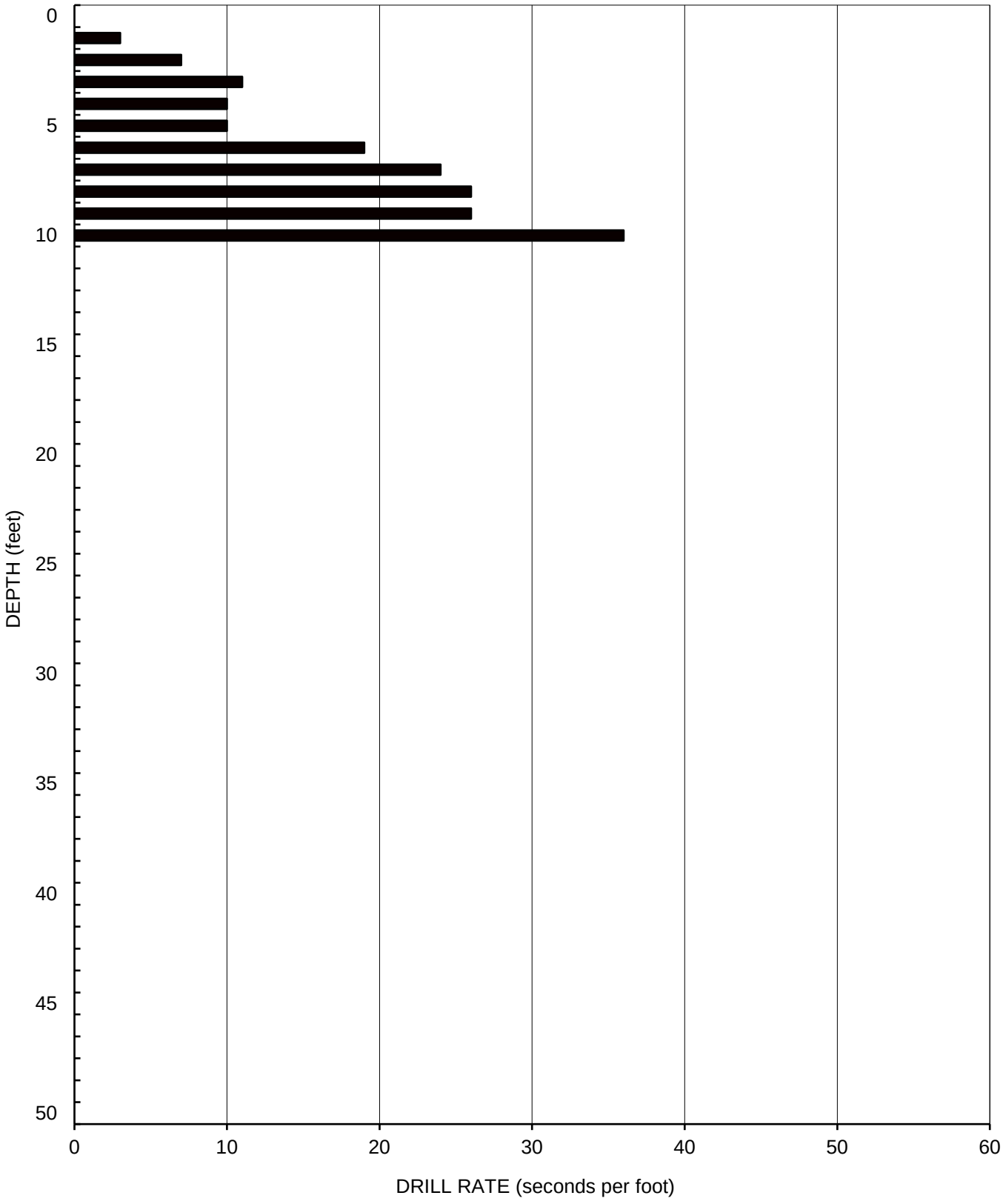
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-20

Elevation - 437 Feet (MSL)

GEOCON
INCORPORATED



AT0020.xls

FIGURE C-35

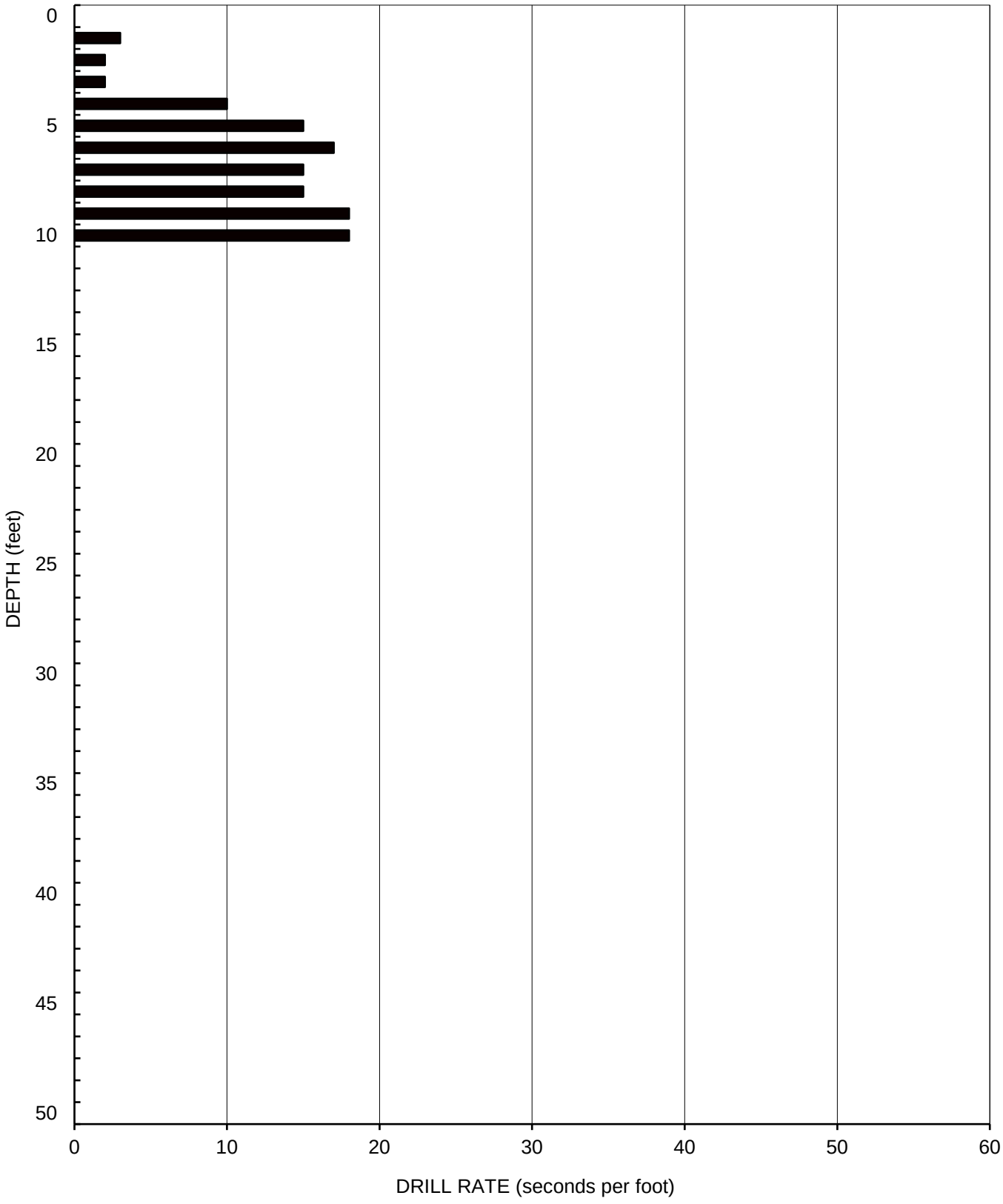
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-21

Elevation - 437 Feet (MSL)

GEOCON
INCORPORATED



AT0021.xls

FIGURE C-36

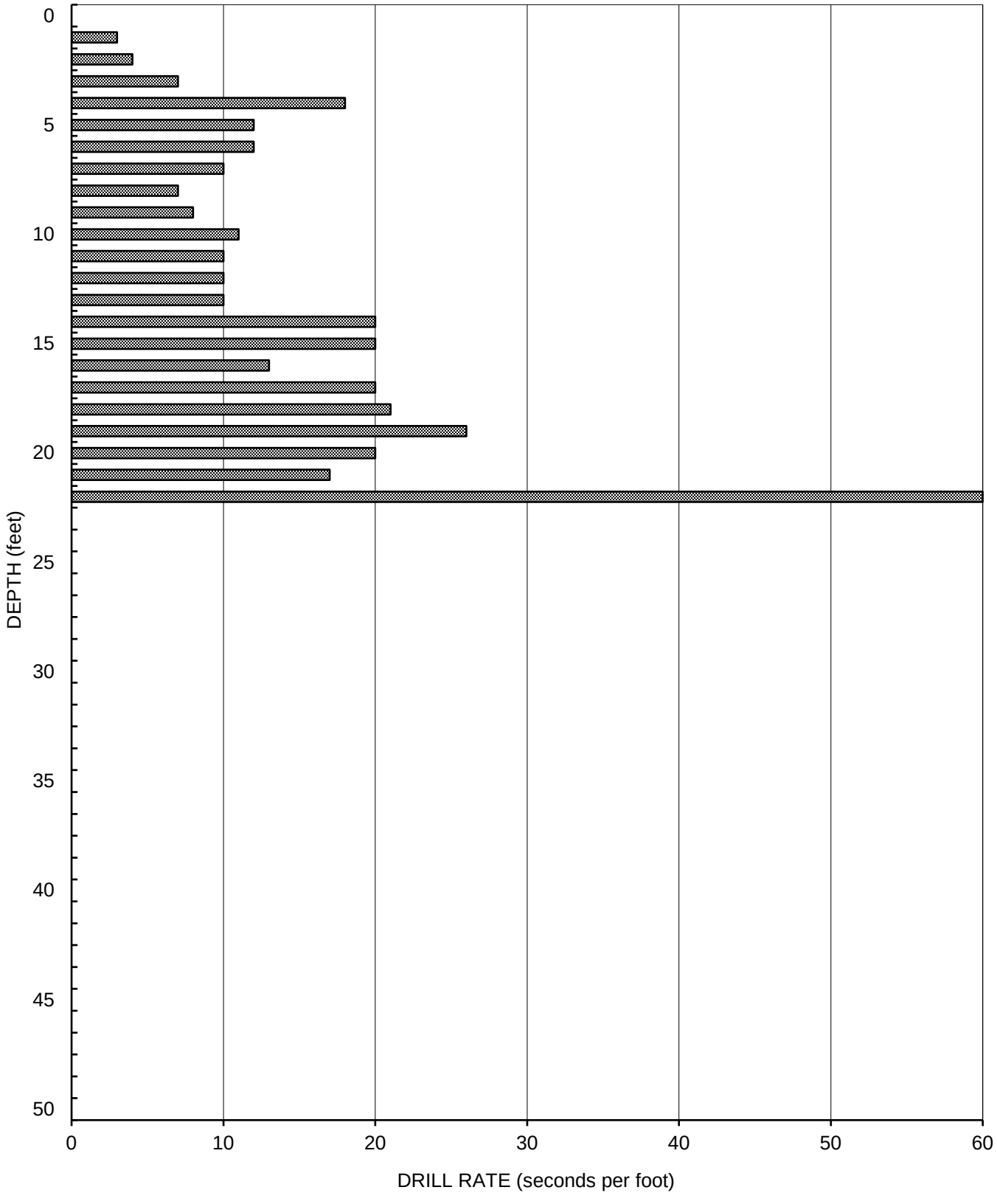
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-22

Elevation - 467 Feet (MSL)

GEOCON
INCORPORATED



AT0022.xls

FIGURE C-37

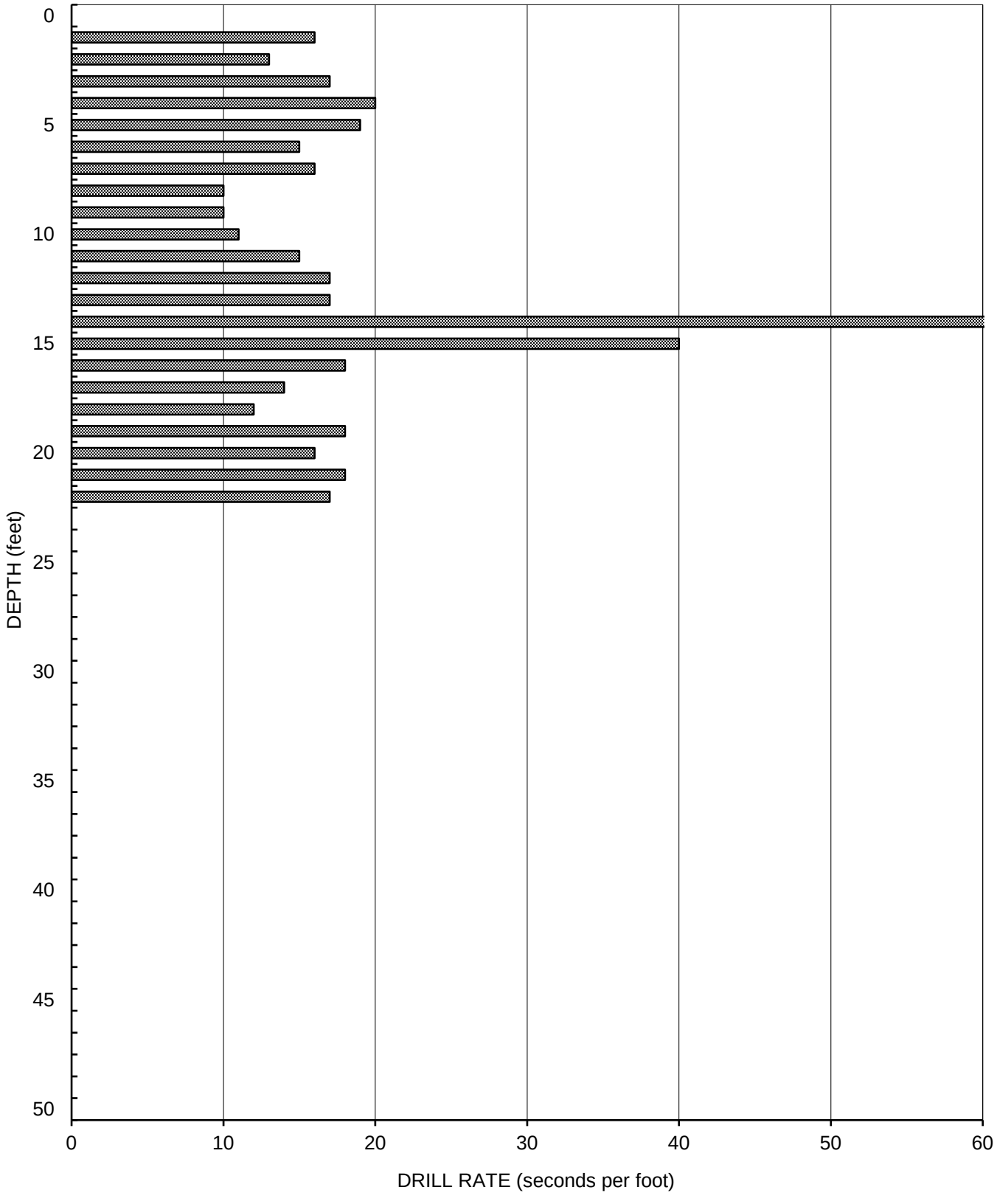
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-23

Elevation - 464 Feet (MSL)

GEOCON INCORPORATED



AT0023.xls

FIGURE C-38

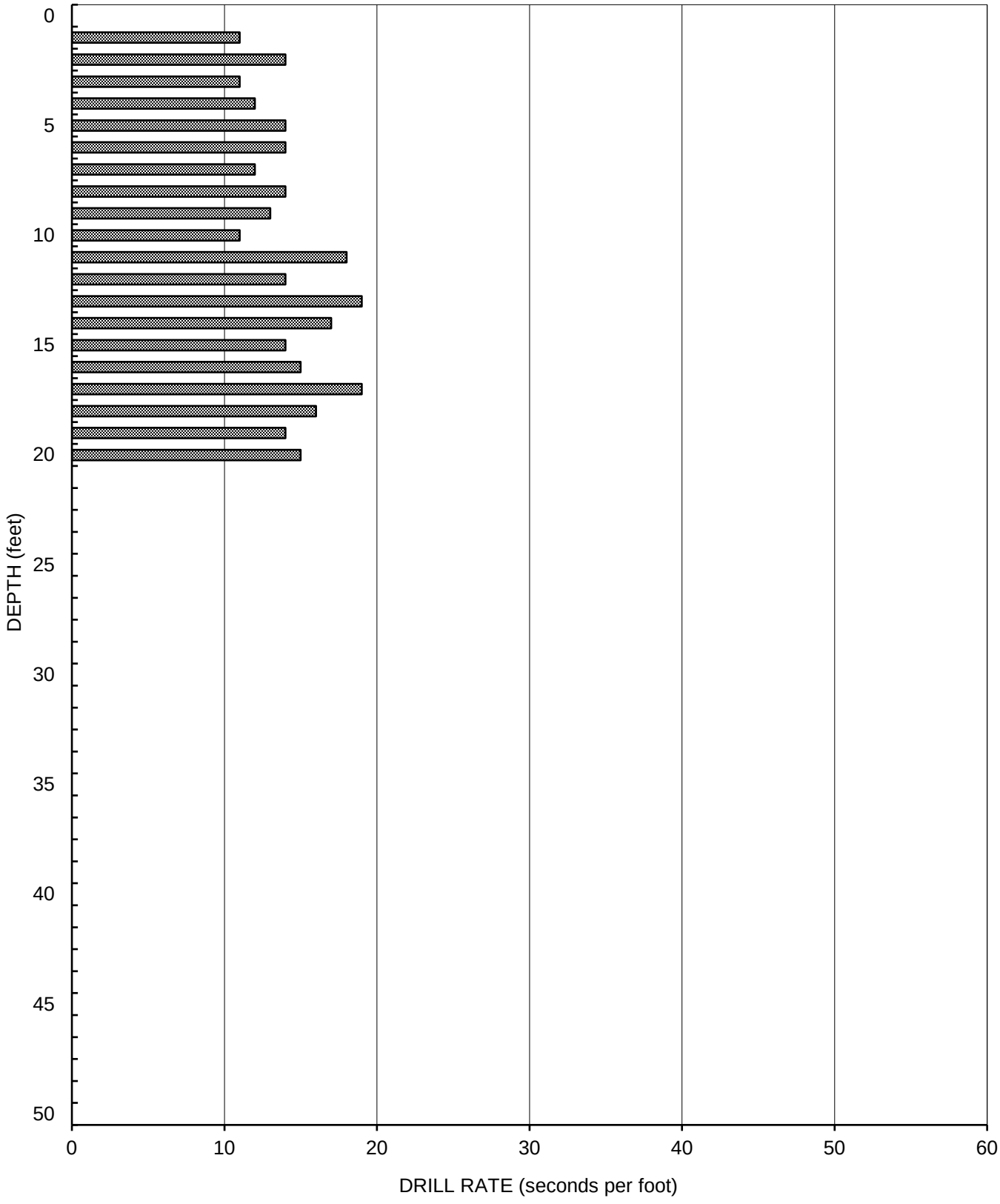
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-24

Elevation - 455 Feet (MSL)

GEOCON
INCORPORATED



AT0024.xls

FIGURE C-39

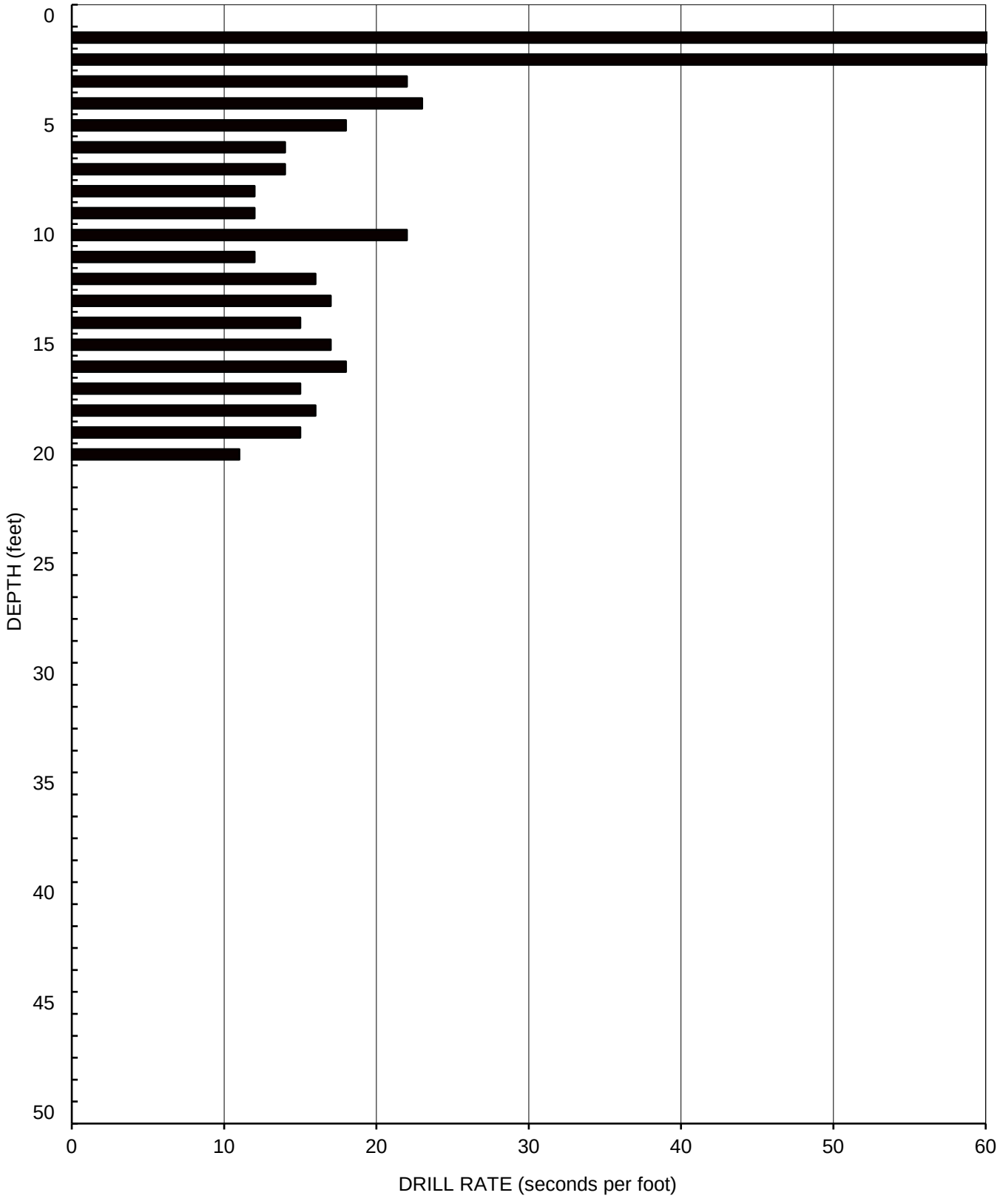
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-25

Elevation - 462 Feet (MSL)

GEOCON
INCORPORATED



AT0025.xls

FIGURE C-40

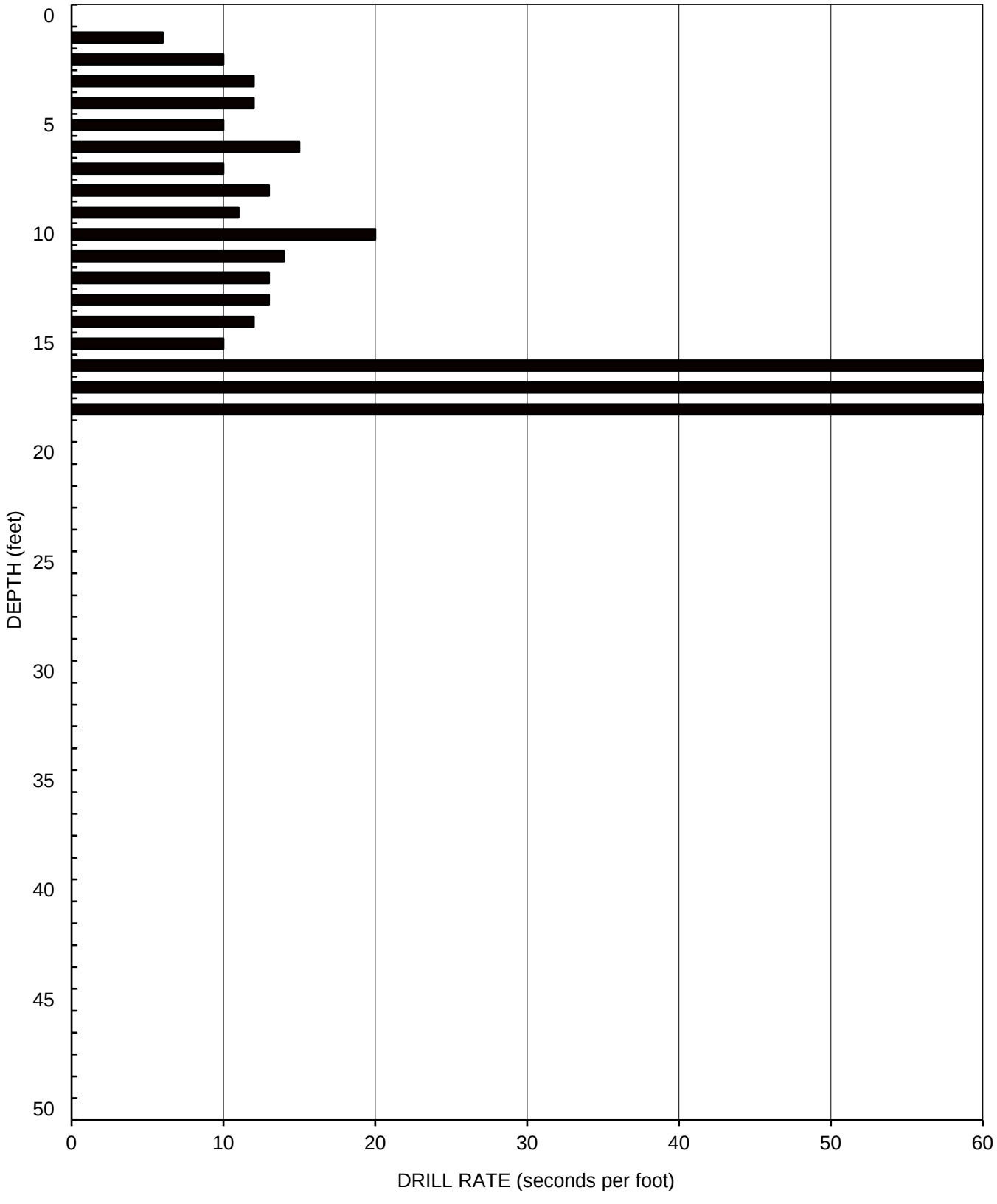
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-26

Elevation - 466 Feet (MSL)

GEOCON
INCORPORATED



AT0026.xls

FIGURE C-41

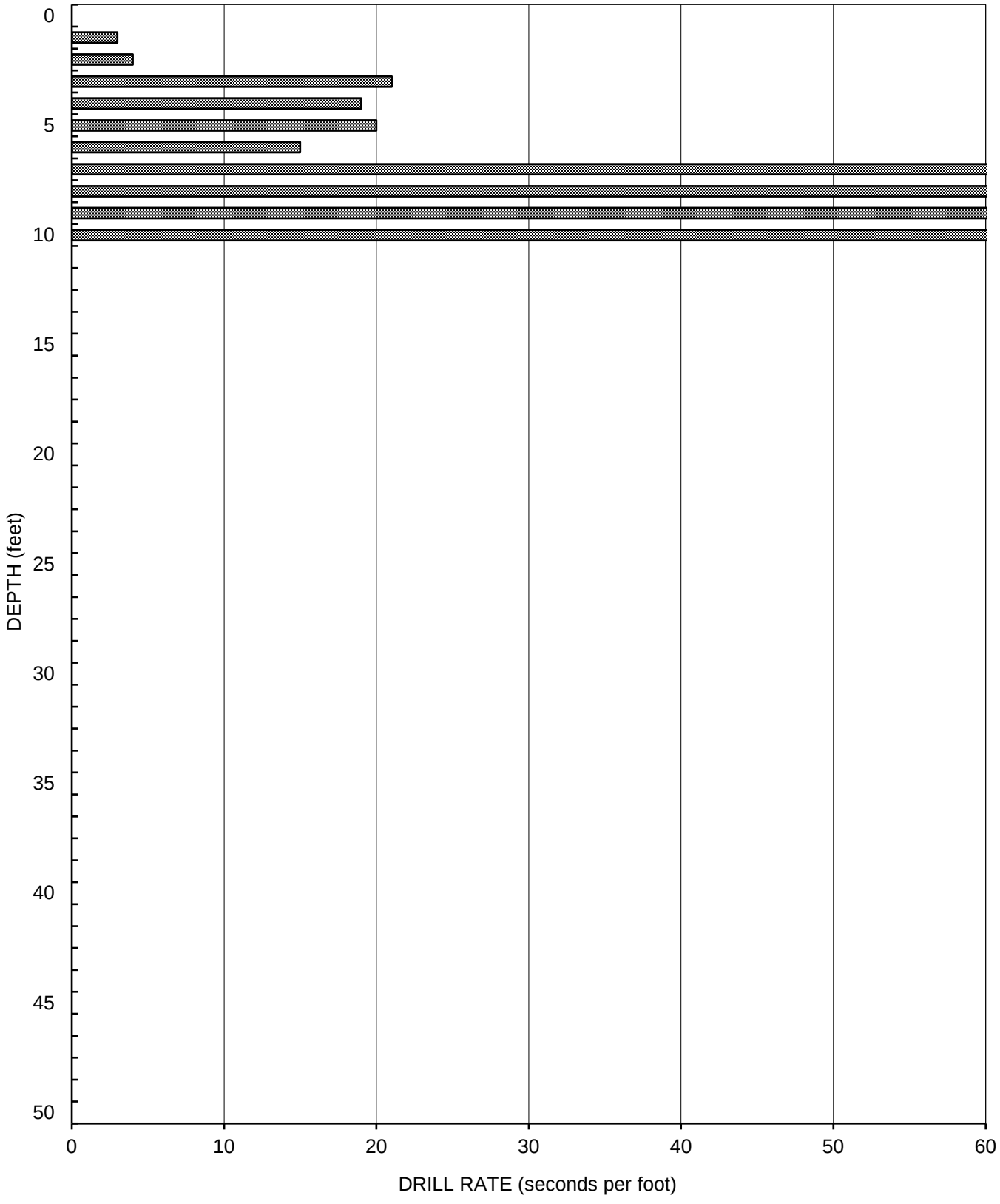
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-27

Elevation - 465 Feet (MSL)

GEOCON
INCORPORATED



AT0027.xls

FIGURE C-42

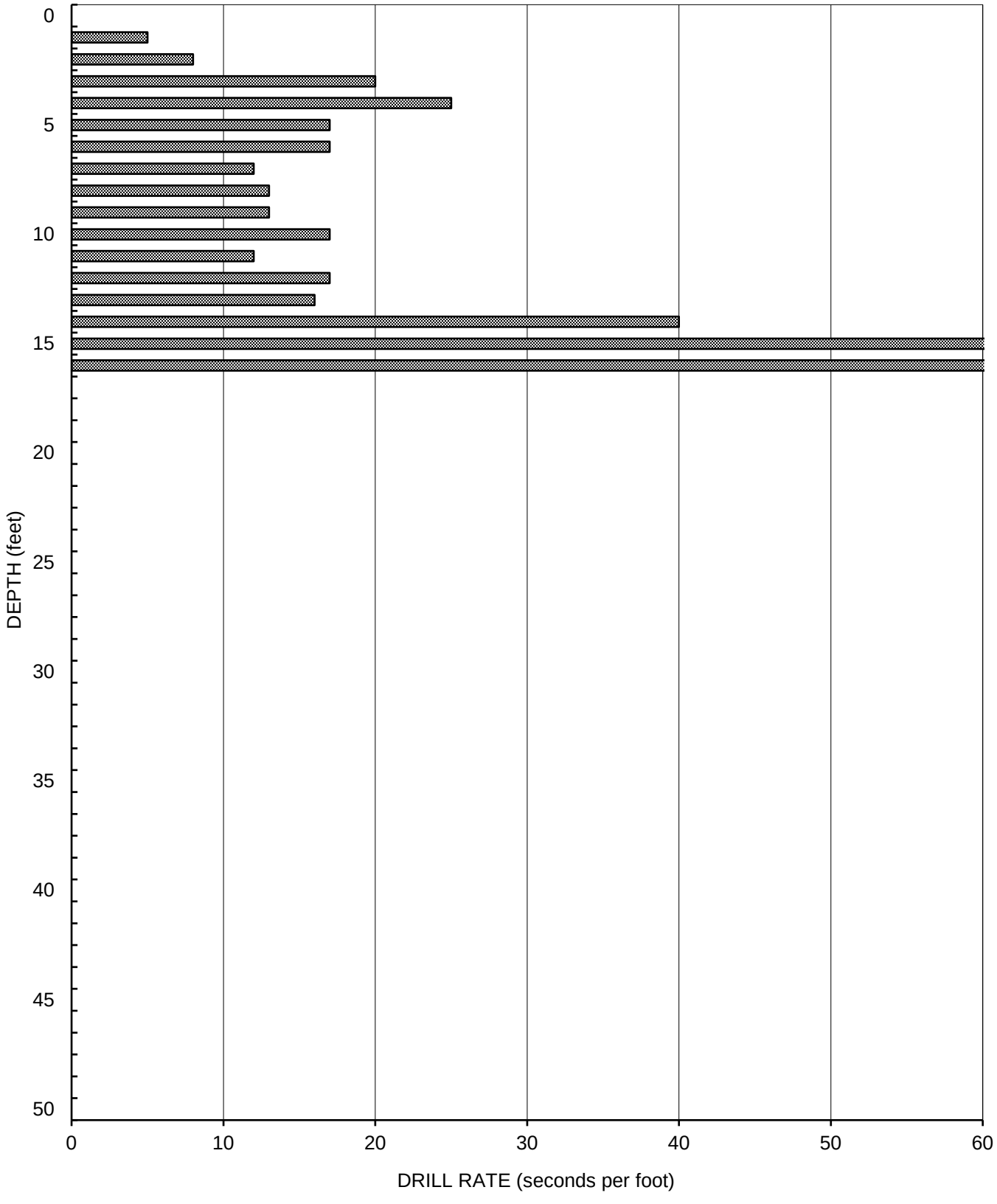
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-28

Elevation - 463 Feet (MSL)

GEOCON
INCORPORATED



AT0028.xls

FIGURE C-43

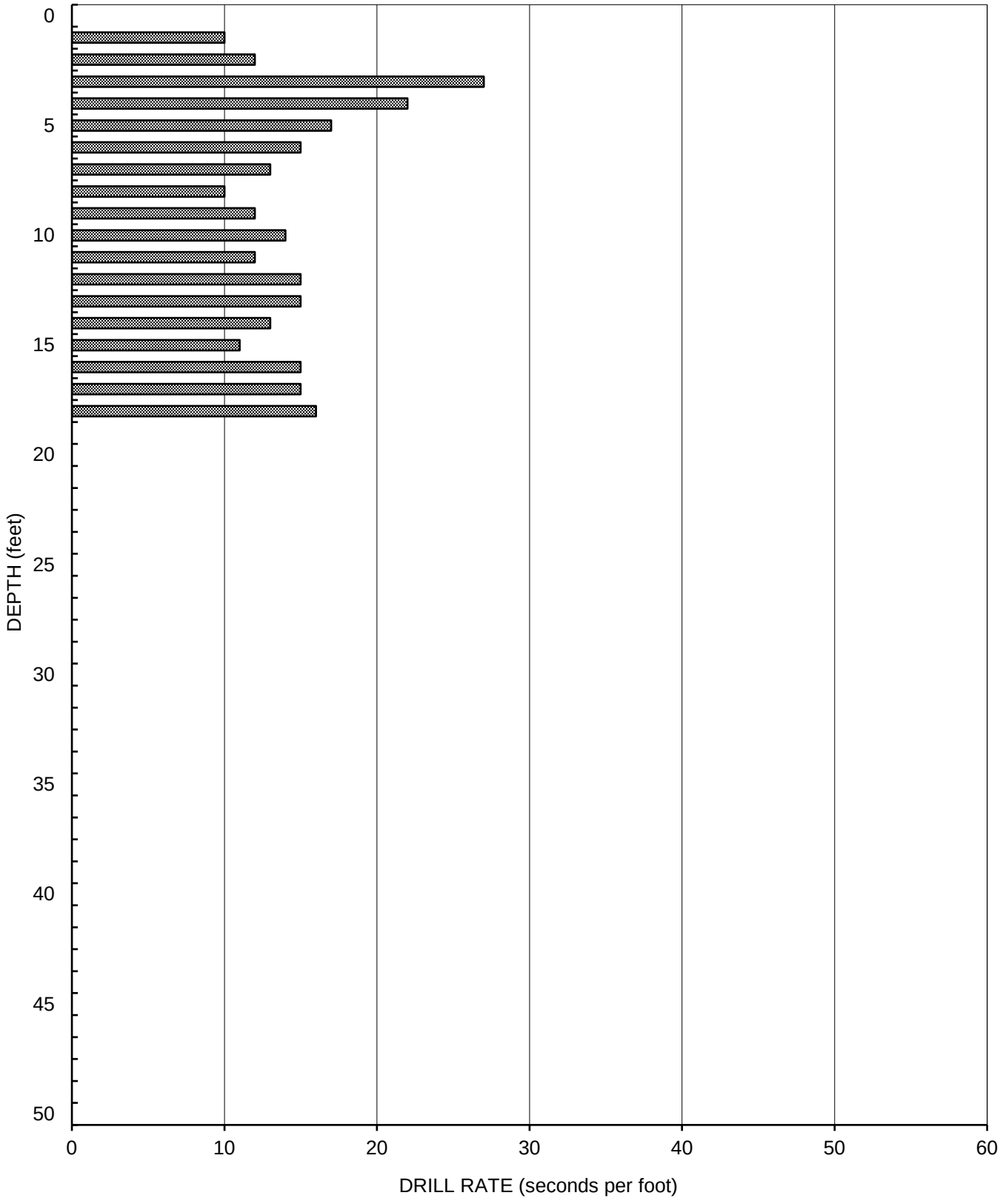
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-29

Elevation - 455 Feet (MSL)

GEOCON
INCORPORATED



AT0029.xls

FIGURE C-45

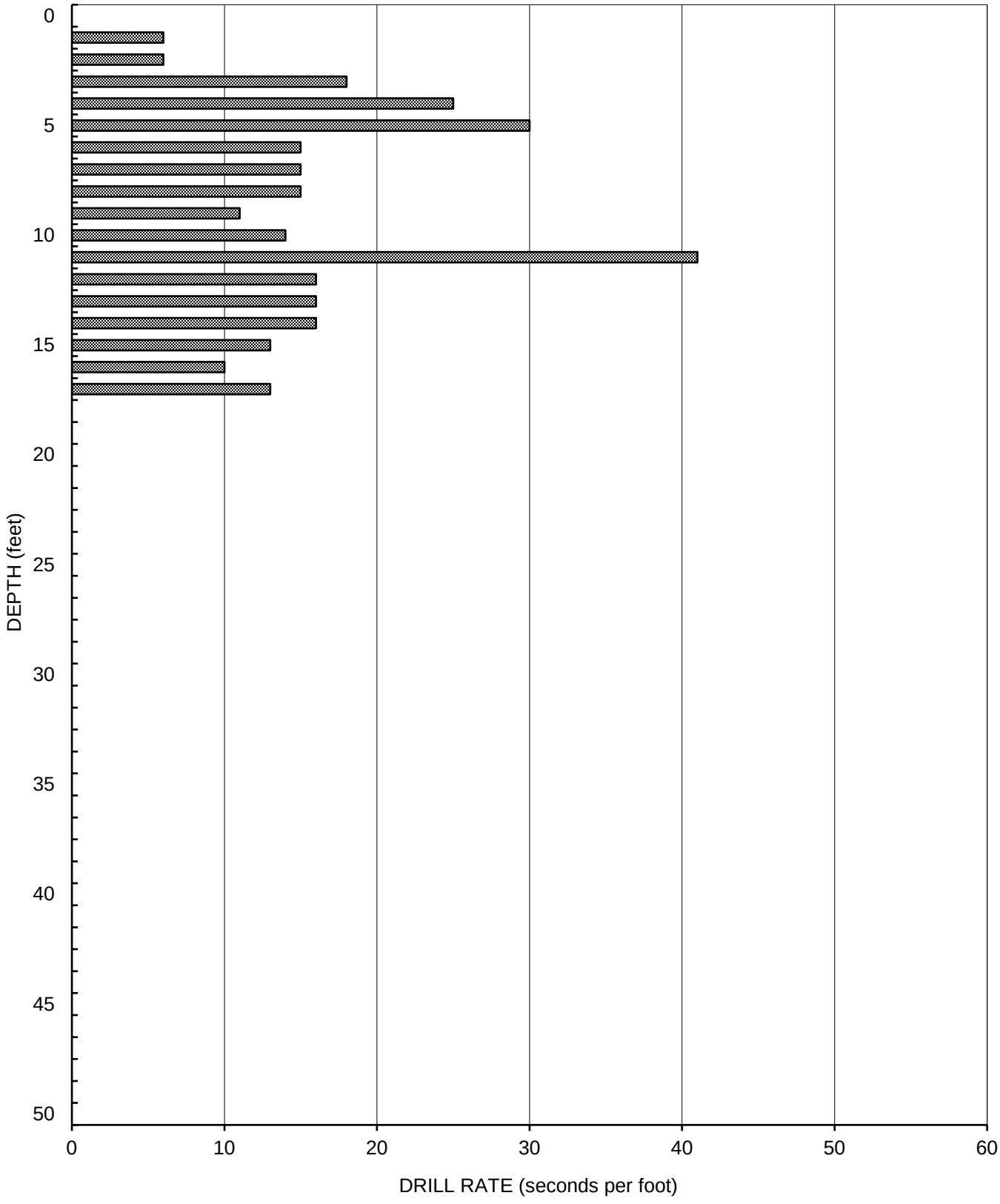
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-30

Elevation - 451 Feet (MSL)

GEOCON
INCORPORATED



AT0030.xls

FIGURE C-45

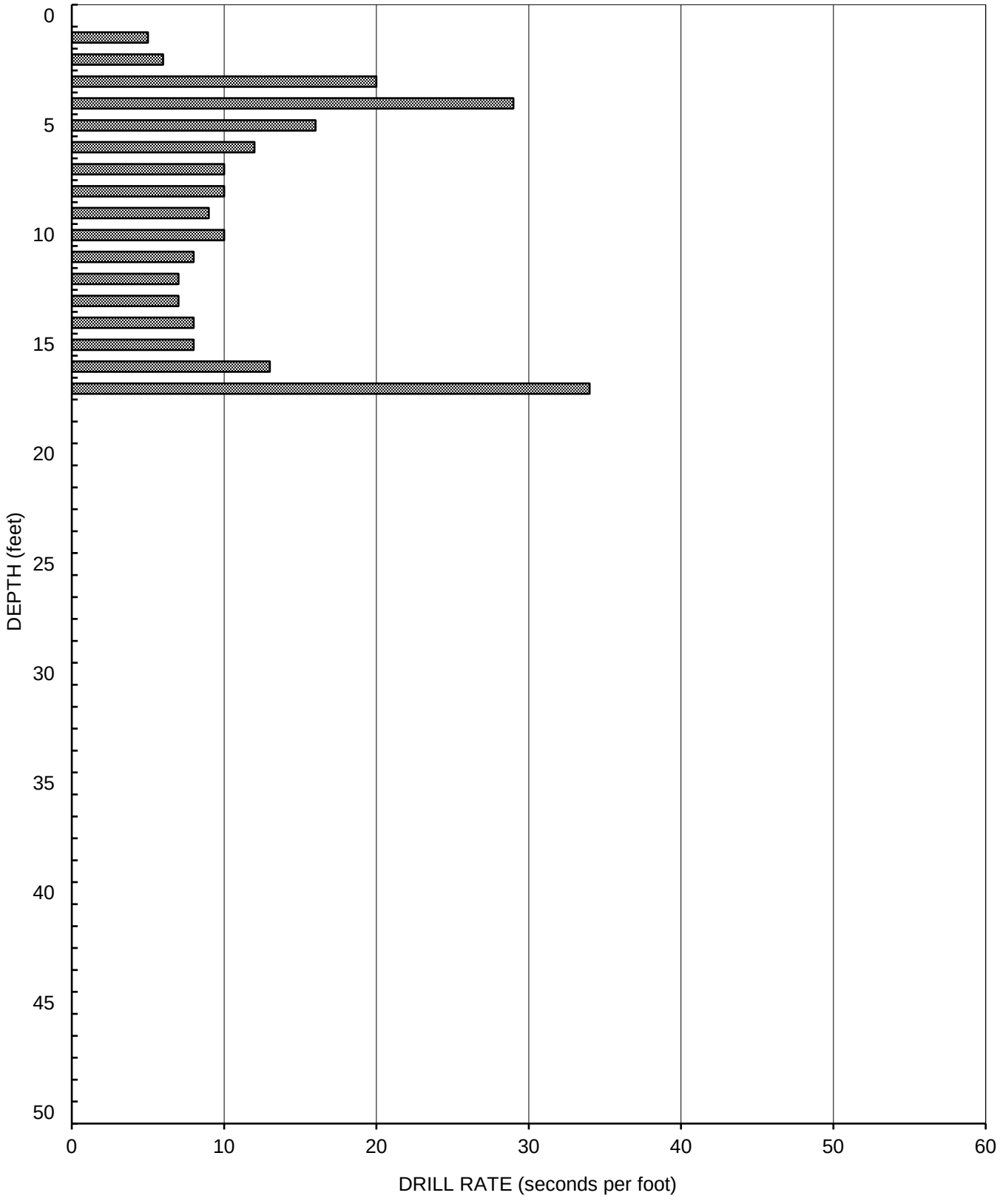
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-31

Elevation - 454 Feet (MSL)

GEOCON
INCORPORATED



AT0031.xls

FIGURE C-46

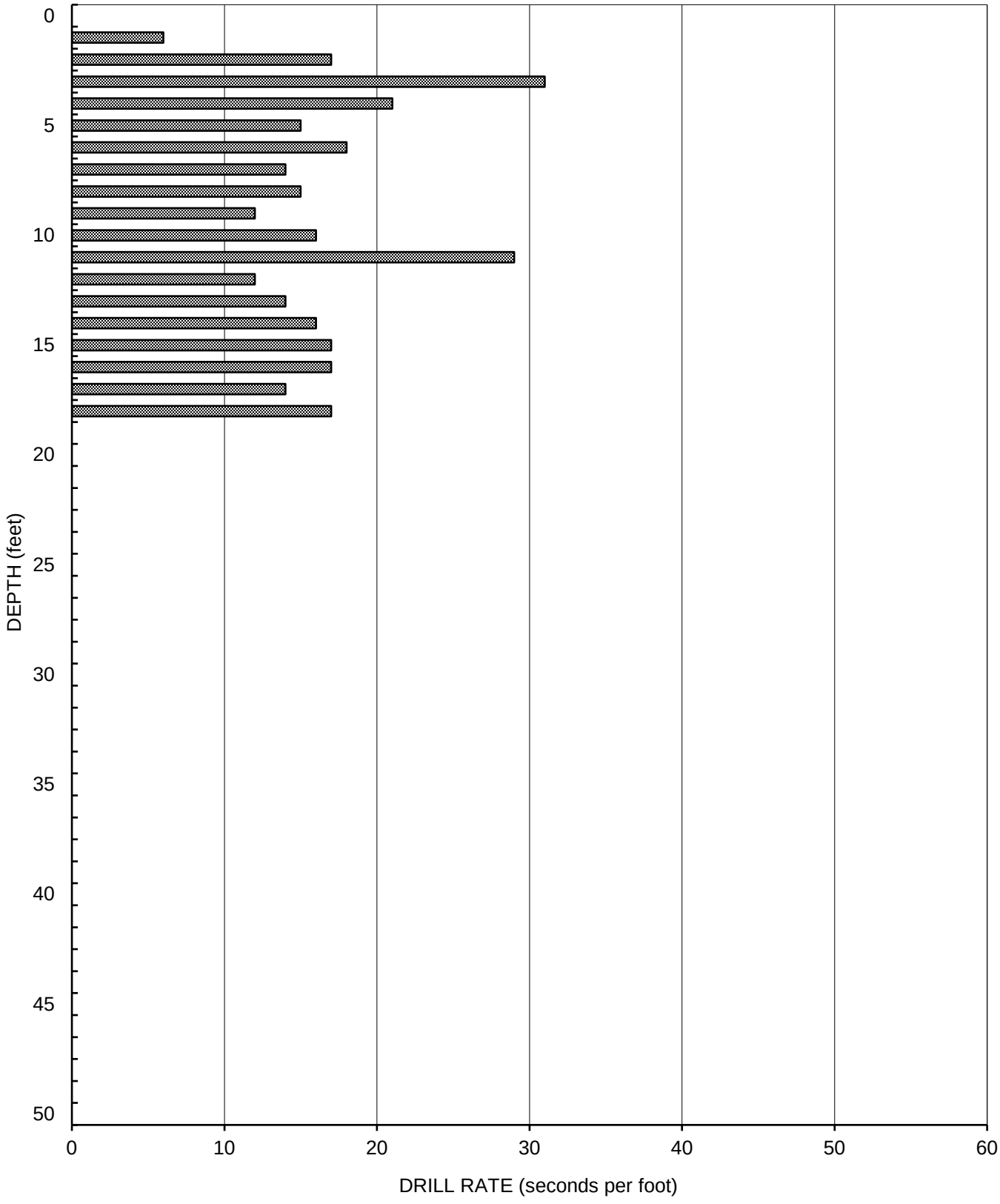
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-32

Elevation - 458 Feet (MSL)

GEOCON
INCORPORATED



AT0032.xls

FIGURE C-47

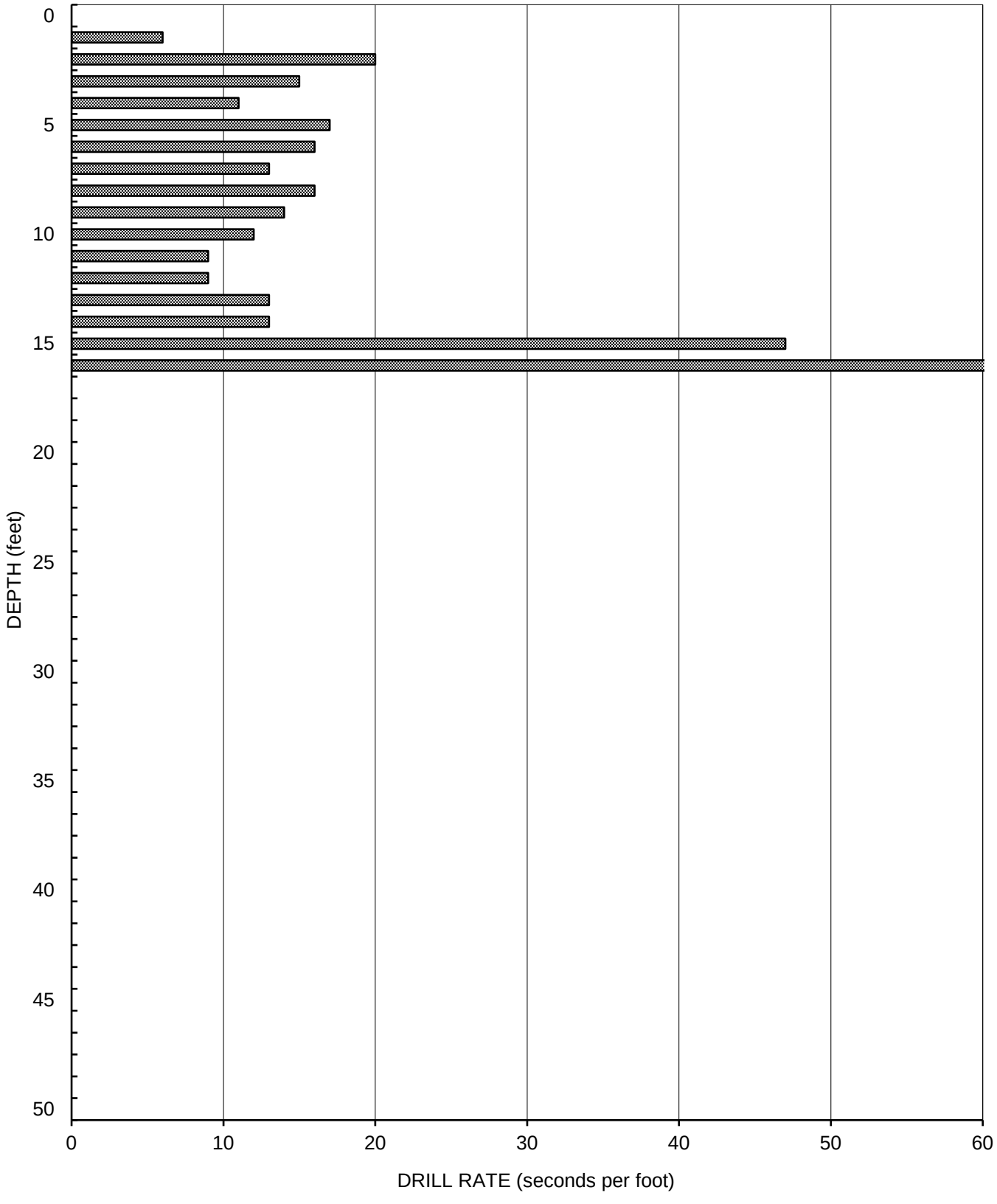
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-33

Elevation - 459 Feet (MSL)

GEOCON
INCORPORATED



AT0033.xls

FIGURE C-48

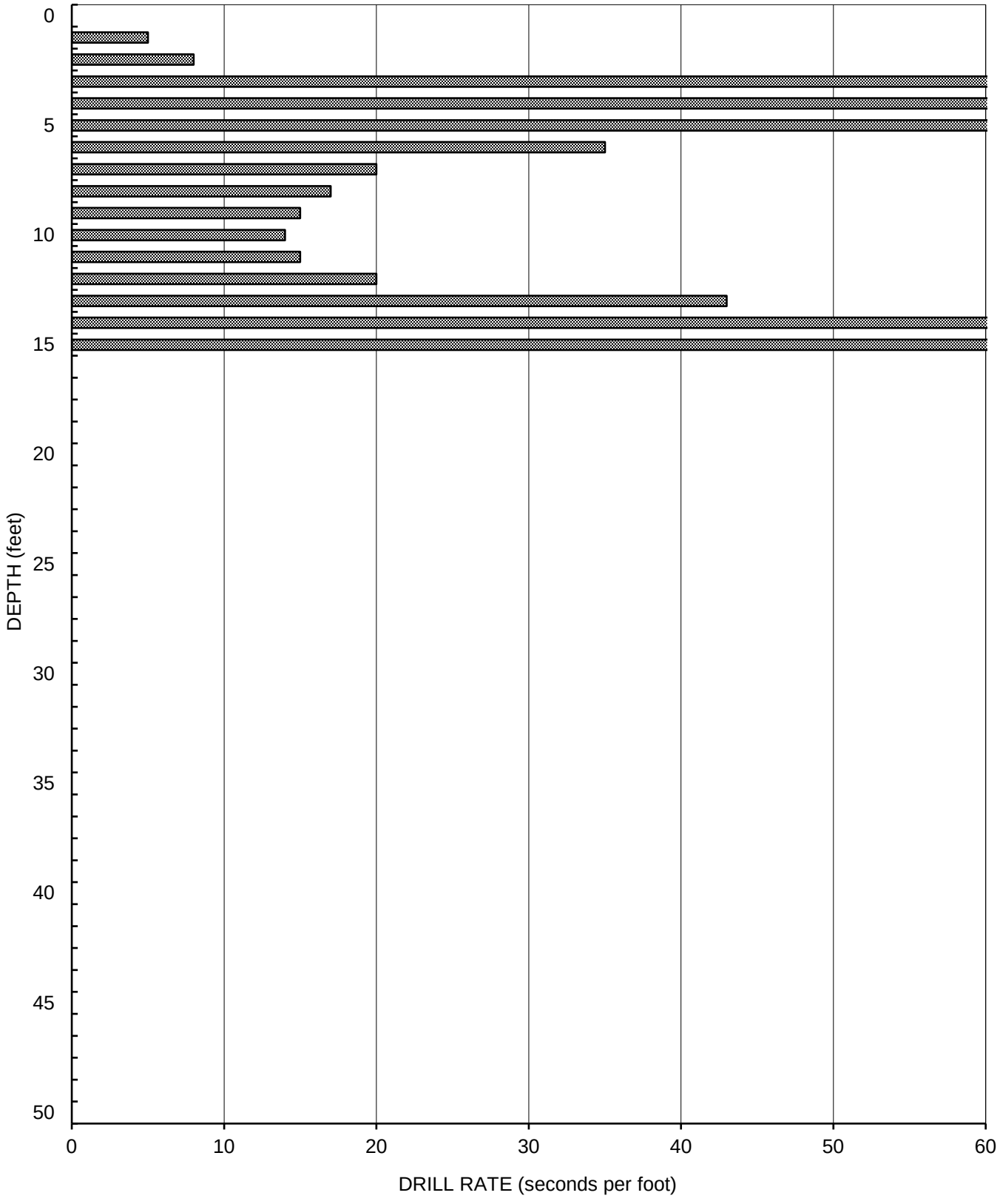
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-34

Elevation - 462 Feet (MSL)

GEOCON
INCORPORATED



AT0034.xls

FIGURE C-49

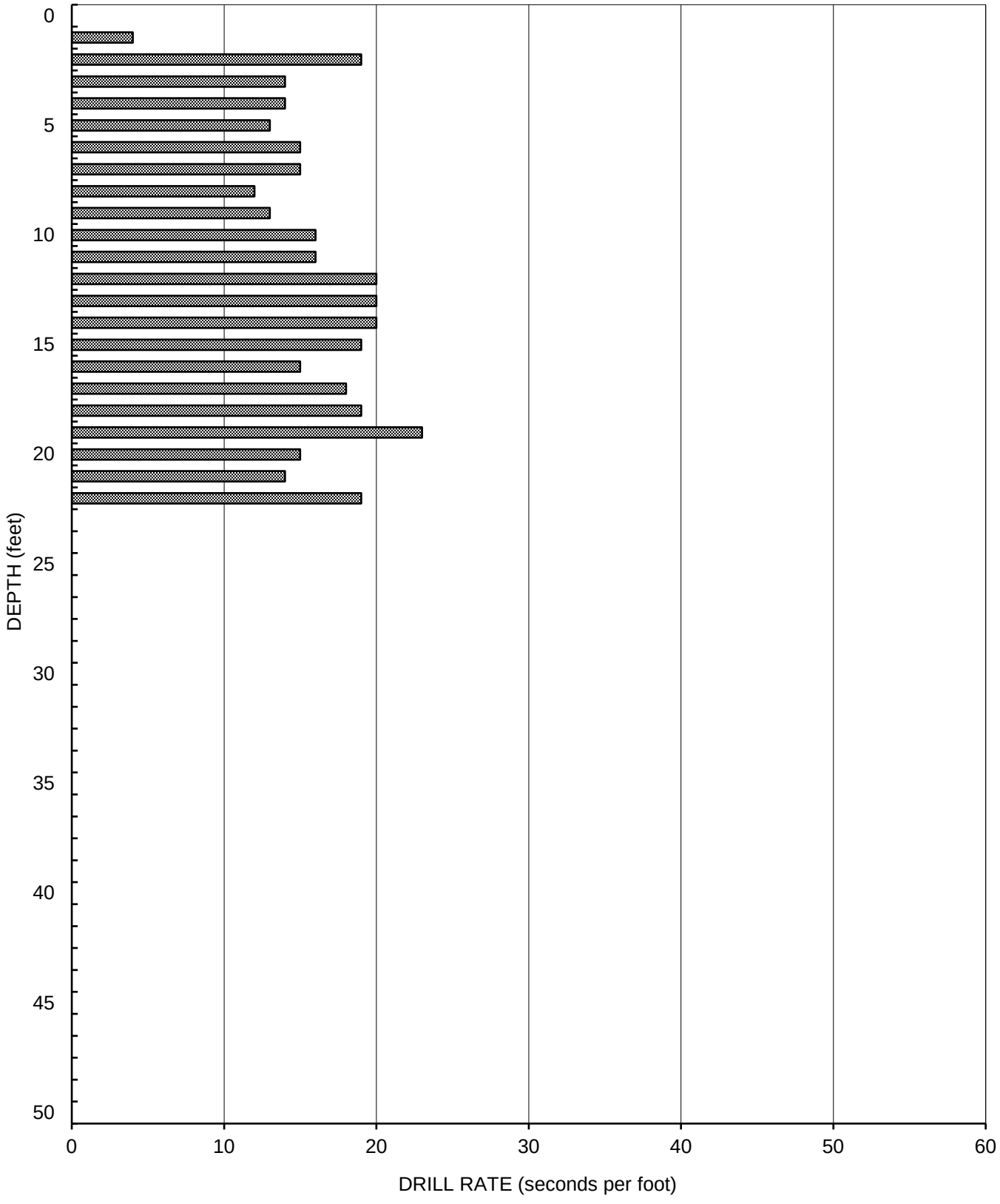
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-35

Elevation - 461 Feet (MSL)

GEOCON
INCORPORATED



AT0035.xls

FIGURE C-50

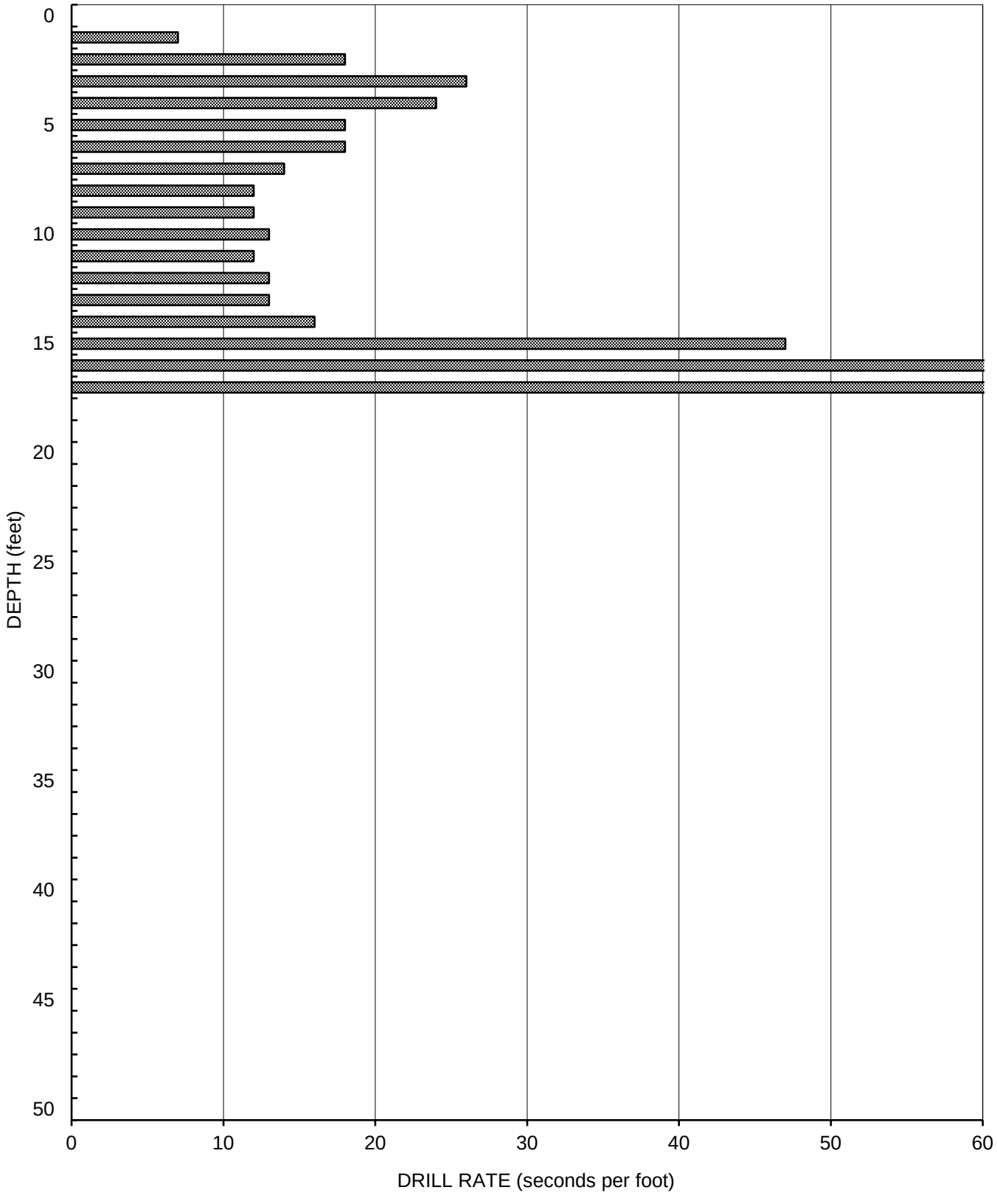
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-36

Elevation - 457 Feet (MSL)

GEOCON
INCORPORATED



AT0036.xls

FIGURE C-51

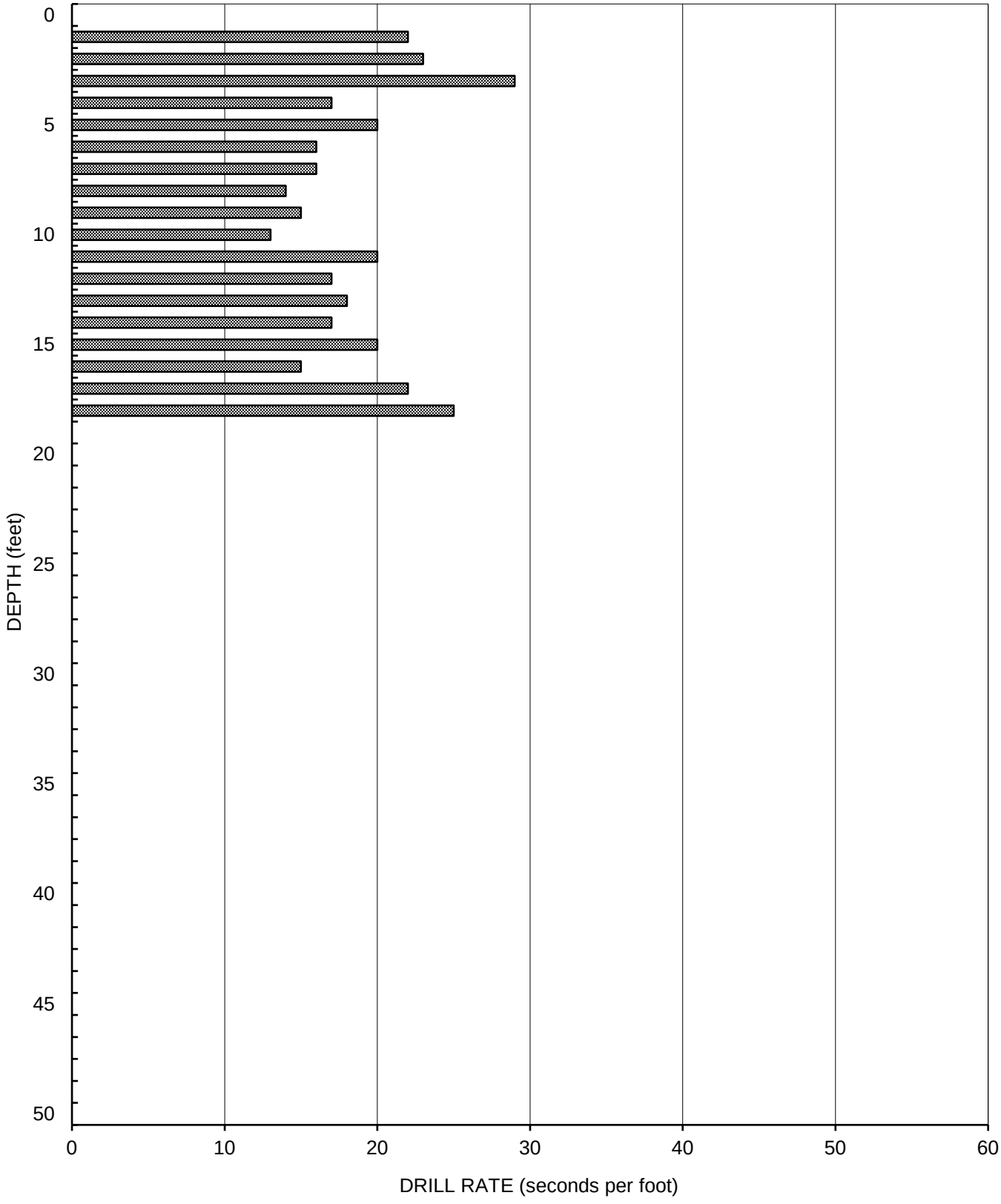
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-37

Elevation - 459 Feet (MSL)

GEOCON
INCORPORATED



AT0037.xls

FIGURE C-52

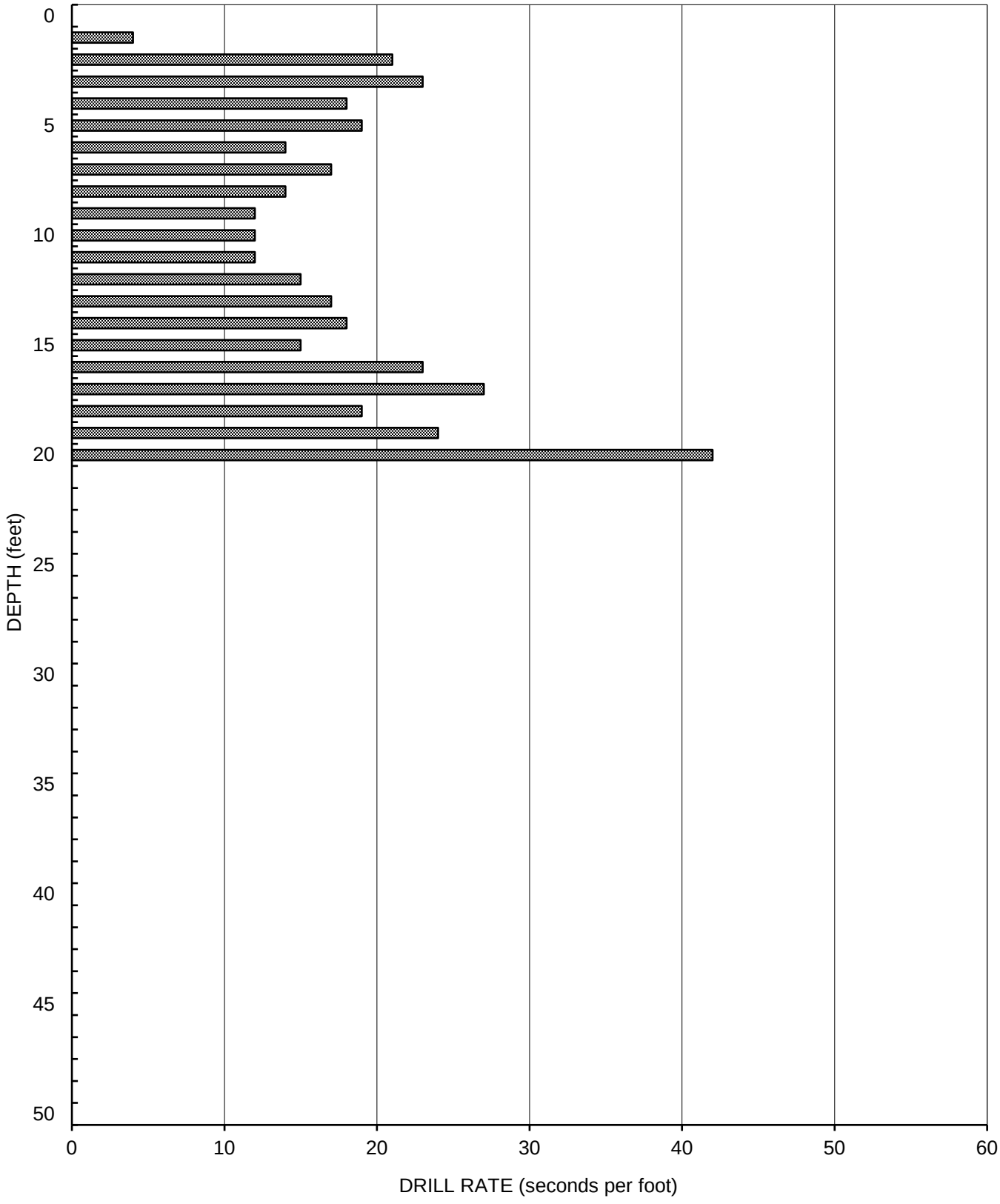
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-38

Elevation - 462 Feet (MSL)

GEOCON
INCORPORATED



AT0038.xls

FIGURE C-53

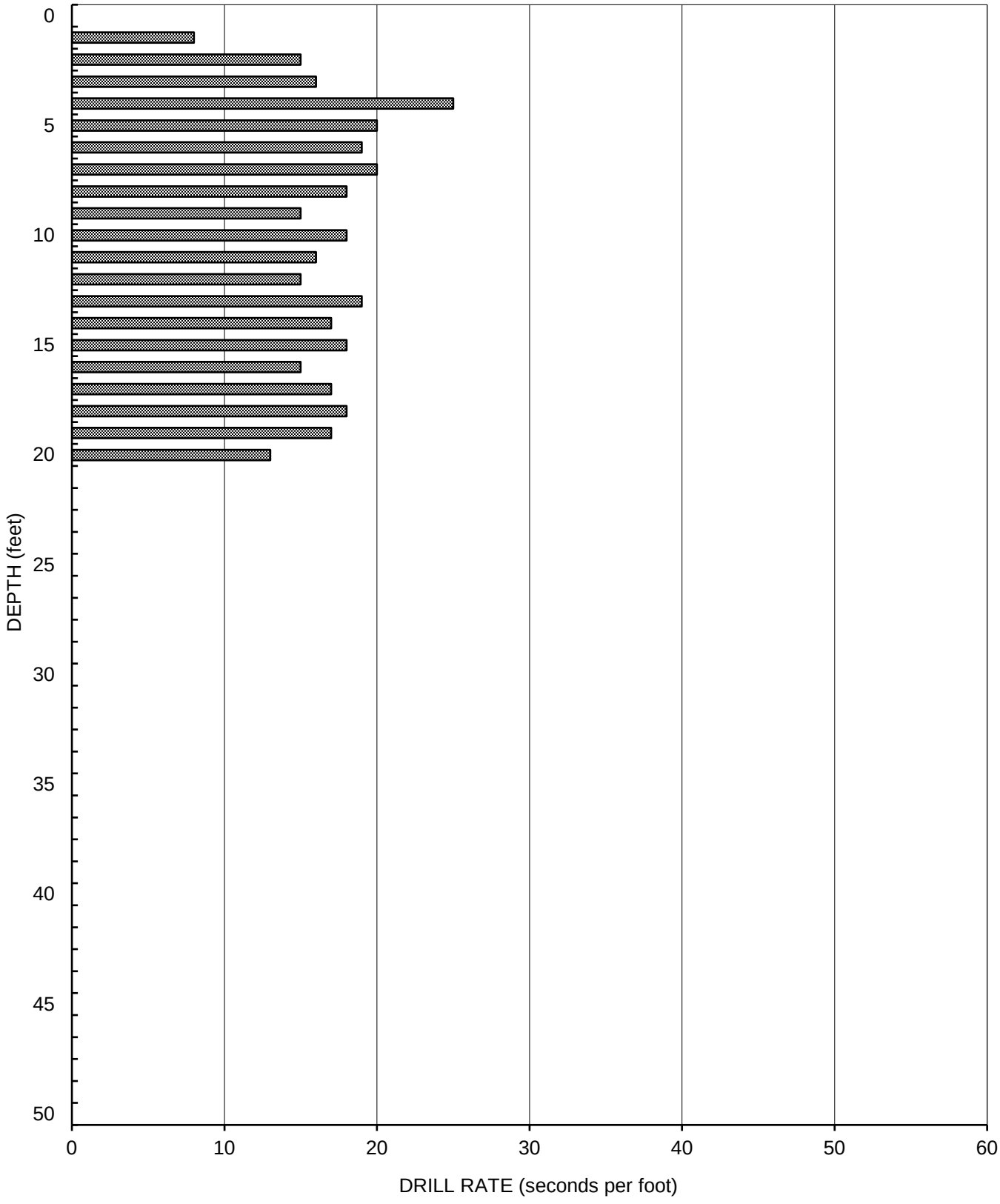
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-39

Elevation - 462 Feet (MSL)

GEOCON
INCORPORATED



AT0039.xls

FIGURE C-54

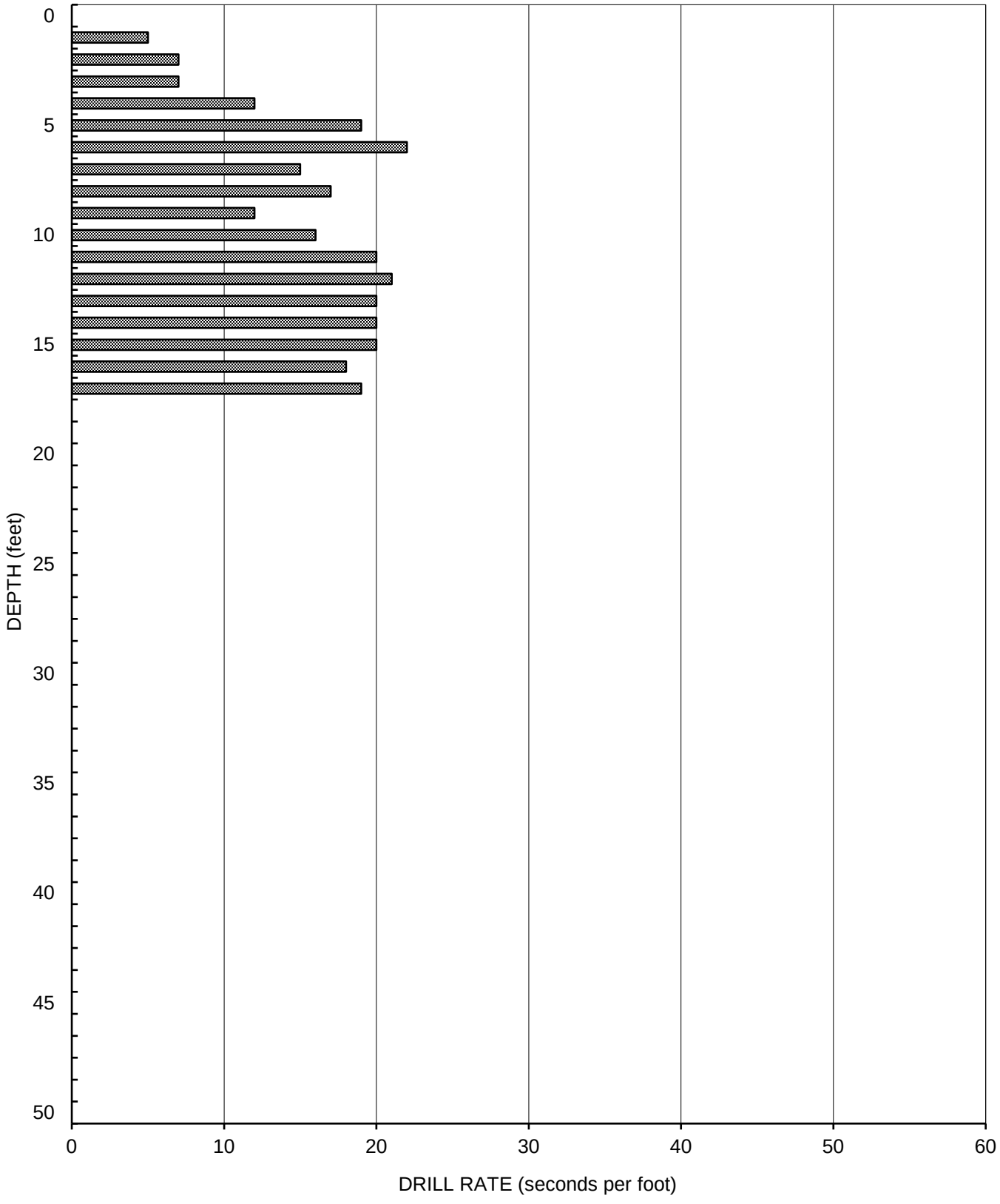
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-40

Elevation - 457 Feet (MSL)

GEOCON
INCORPORATED



AT0040.xls

FIGURE C-55

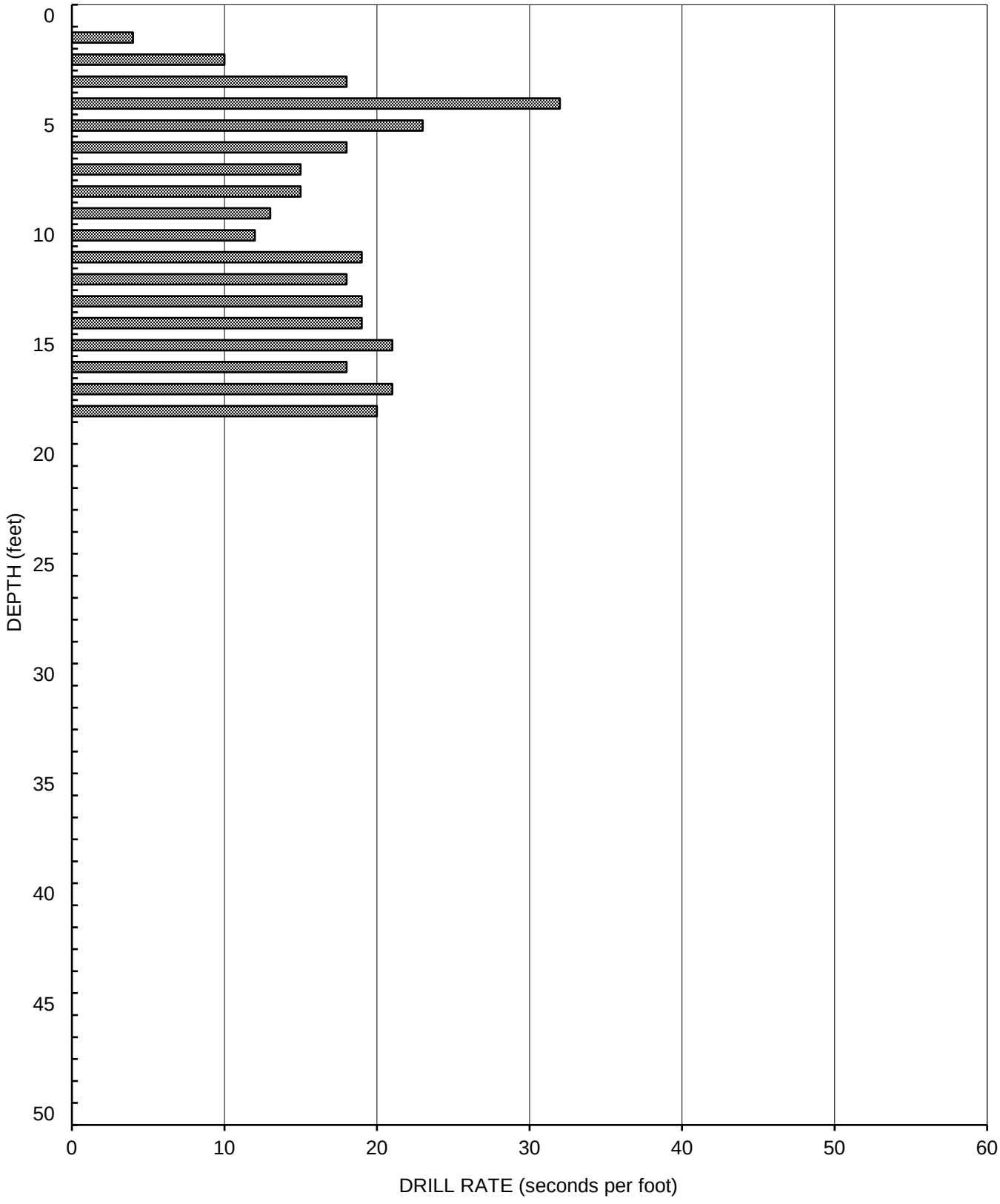
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-41

Elevation - 454 Feet (MSL)

GEOCON INCORPORATED



AT0041.xls

FIGURE C-56

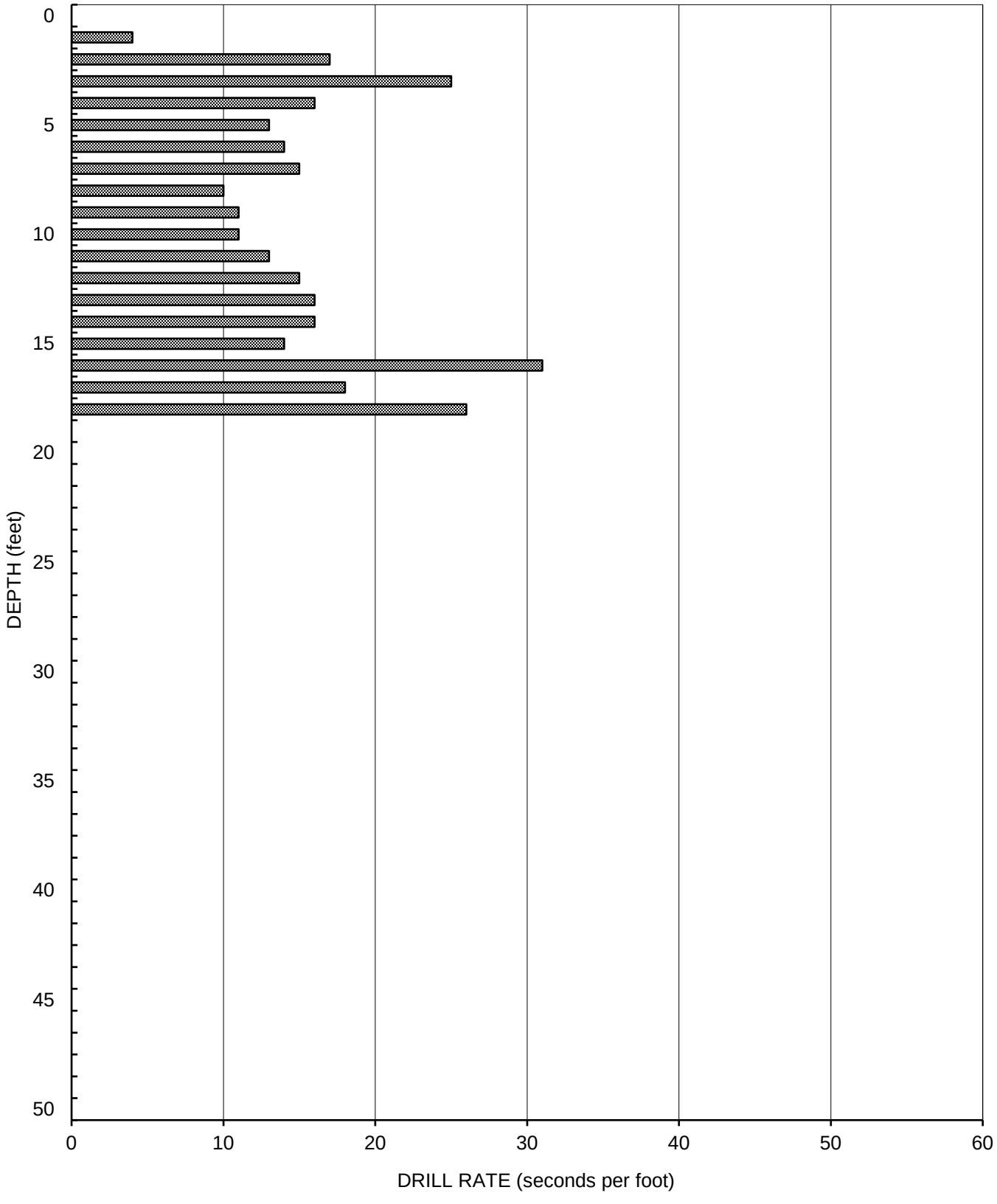
PROJECT NO. 07647 - 32 - 04

MODERA MELROSE

AIR TRACK BORING AT-42

Elevation - 461 Feet (MSL)

GEOCON
INCORPORATED



AT0042.xls

FIGURE C-57

PROJECT NO. 07647-32-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING B 1** ELEV. (MSL.) **454'** DATE COMPLETED **10-10-2006** EQUIPMENT **A-300** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM** Loose, humid, dark brown, Silty, fine to medium SAND			
2					**SANTIAGO FORMATION** Dense, moist, greenish-brown, Sandy SILTSTONE / Silty SANDSTONE			
4								
6								
8								
10								
12								
14								
16								
18								
20								
22								
24								
26	B1-1							
28					TOTAL DEPTH AT 28½ FEET			

Figure C-58,
Log of Boring B 1, Page 1 of 1

07647-32-04 (FROM 07647-32-02).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-02

BORING B 2

ELEV. (MSL.) **455'** DATE COMPLETED **10-10-2006**

EQUIPMENT **A-300** BY: **T. MYERS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, humid, brown, Silty, fine to medium SAND			
2					**SANTIAGO FORMATION** Dense, moist, greenish-brown, Clayey SANDSTONE			
4								
6								
8					-Dense, moist, yellowish-brown, fine to coarse SANDSTONE			
10	B2-1							
12								
14								
16								
18					-Dense, moist, greenish-brown, Clayey SANDSTONE			
20	B2-2							
22								
24								
26								
28					TOTAL DEPTH AT 28½ FEET			

Figure C-59,
Log of Boring B 2, Page 1 of 1

07647-32-04 (FROM 07647-32-02).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING B 3** ELEV. (MSL.) **443'** DATE COMPLETED **10-10-2006** EQUIPMENT **A-300** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				SM	**COLLUVIUM** Loose, humid, brown, Silty, fine to medium SAND			
2								
4					**SANTIAGO FORMATION** Dense, moist, greenish-brown, Silty CLAYSTONE			
6								
8	B3-1							
10								
12								
14								
16								
18								
					TOTAL DEPTH AT 19½ FEET			

Figure C-60,
Log of Boring B 3, Page 1 of 1

07647-32-04 (FROM 07647-32-02).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**BORING B 4** ELEV. (MSL.) **444'** DATE COMPLETED **10-10-2006** EQUIPMENT **A-300** BY: **T. MYERS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**COLLUVIUM** Loose, humid, dark olive-brown, Silty CLAY			
2								
4					**SANTIAGO FORMATION** Dense, moist, light greenish-brown, Clayey SANDSOTNE			
6								
8								
10					-Dense, moist, light greenish-brown, Silty CLAYSTONE			
12								
14								
16	B4-1							
18								
					TOTAL DEPTH AT 19 FEET			

Figure C-61,
Log of Boring B 4, Page 1 of 1

07647-32-04 (FROM 07647-32-02).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07647-32-02

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 5 ELEV. (MSL.) 437' DATE COMPLETED 10-10-2006 EQUIPMENT A-300 BY: T. MYERS MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**COLLUVIUM** Loose, humid, dark brown, Silty, fine to medium SAND			
2				CL	Medium dense, moist, dark olive-brown, Sandy CLAY			
4					**SANTIAGO FORMATION** Dense, damp, light reddish-brown, Sandy CLAYSTONE			
6								
8								
10								
12					Dense, damp, light greenish-brown, Sandy SILTSTONE			
14	B5-1				-Silty SANDSTONE			
					TOTAL DEPTH AT 15 FEET			

Figure C-62,
Log of Boring B 5, Page 1 of 1

07647-32-04 (FROM 07647-32-02).GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR ... SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

APPENDIX D

APPENDIX D

PREVIOUS LOGS OF TRENCHES AND LABORATORY TESTING PERFORMED BY EEI

FOR

MODERA MELROSE
OCEANSIDE, CALIFORNIA

PROJECT NO. 07647-32-04

BACKHOE LOG

(Equipment- John Deer 510SC Backhoe)
August 02, 2007

TP-1

0-1 ½'	**TOPSOIL**– clayey SAND (SC), olive gray, slightly moist to moist, loose, fine to coarse sand, minor organics (dry grass and roots).
1 ½'-12'	**SANTIAGO FORMATION**- silty CLAYSTONE (CL), greenish gray, moist soft to medium stiff, fine sand, some yellowish orange color with minor iron staining.
@ 8'	greenish gray, CLAYSTONE (CL), well indurated, waxy luster, some calcium carbonate stringers, moist.
@ 10'	formational material became very dense

T.D. @ 12'
No groundwater
Hole backfilled with native soils

TP- 2

0-1'	**TOPSOIL**- clayey SAND (SC), loose, dry to slightly moist, olive gray, organics (roots and dry grass, root hairs), fine to coarse grained.
1'-3 ½'	**COLLUVIUM**- sandy CLAY (SC), soft, moist, minor fine to medium sand, minor calcium carbonate nodules.
3 ½'-11 ½'	**SANTIAGO FORMATION**- silty CLAYSTONE (SC), minor fine sand, moist, soft to medium, stiff, greenish gray, minor yellowish brown iron staining.
@ 6 ½'	Calcium carbonate (i.e., caliche) layer with white CLAYSTONE (SC), crumbly.
@ 10 ½'	increasing waxy luster and indurated.
11 ½'-12 ½'	green CLAYSTONE (SC) with slickensides.

T.D. @ 12 ½'
No groundwater
Hole backfilled with native soils

TP-3

0- ½'	**TOPSOIL**- silty SAND (SM), common dry roots and dry root hairs, brown, dry.
½'-3'	**COLLUVIUM**- silty CLAY (CL), minor fine to coarse sand, slightly moist to moist, minor calcium carbonate modules(white) from 1.5' to 3'with ¼-inch in largest diameter, root hairs to 2' bgs, brown.
4 ½ '-6'	**SANTIAGO FORMATION**- SANDSTONE (SC), greenish gray, moist, soft, clayey with minor fine to coarse-grained, highly weathered, increasing sand content at 5'.

T.D. @ 6'
No groundwater
Hole backfilled with native soils

TP-4

0-1'	**TOPSOIL/FILL**- Silty SAND (SM), common surface debris, loose, dry, organics consisting of dry grasses and root hairs.
1'-4'	**ALLUVIUM**- silty SAND (SM), brown with yellowish orange iron stains, slightly moist to moist, fine to medium-grained, soft to medium dense, minor calcium carbonate modules.
4'-5 ½'	**SANTIAGO FORMATION**- silty SANSTONE (SM), white to light gray, some yellowish orange and brown, brown sandy inclusions with traces of green claystone inclusion, very dense, fine to medium-grained with some coarse, slightly moist.

T.D. @ 5 ½'
No groundwater
Hole backfilled with native soils

TP-5

0- ½'	**TOPSOIL/SLOPEWASH**- silty SAND (SM), brown, dry, loose, common organics (dry grasses and roots).
½-2 ½ '	**COLLUVIUM**- sandy CLAY (CL), slightly moist to moist, soft to medium, stiff, fine to medium grained.
2½'-4'	**GRANITIC BEDROCK** -completely weathered, excavates to sandy clay (SC), moist, medium stiff, brown, yellowish orange gray, fine to medium, gravelly slickenside, waxy appearance, micaceous.
4'-5'	highly weathered/decomposed GRANITE (DG), excavates to silty sand (SM), fine to coarse, dense, greenish gray, gray, yellowish orange, slightly moist, micaceous.

T.D. @ 5'
No groundwater
Hole backfilled with native soils

TP-6

0-1'	**TOPSOIL**- Silty SAND (SM), loose, brown, dry, organics (grasses, roots, root hairs) fine to medium-grained with some coarse grain.
1'-4 ½'	**SANTIAGO FORMATION**- sandy CLAY (SC), slightly moist to moist, medium stiff to stiff, reddish brown, gray, red, with yellowish orange iron staining, fine to medium grained.

T.D. @ 4 ½'
No groundwater
Hole backfilled with native soils

TP-7

0-1 ½'	**TOPSOIL**- Silty sand, brown, dry, loose, fine to coarse grained, high in organics, hay and wood chips.
1 ½'-2 ½'	**GRANITIC BEDROCK**-completely weathered silty sand, fine to coarse, dense, brown, slightly moist to moist.
2 ½'-3 ½'	highly weathered/decomposed GRANITE (DG), very dense, excavates to silty sand (SM) with to 6- to 12-inch fragments, fine to coarse grained, yellowish orange, brown, minor root hairs, slightly moist to moist, micaceous.

T.D. @ 3 ½'
No groundwater
Hole backfilled with native soils

TP-8

0-1'	**TOPSOIL**- 4" of mulch, wood chips, roots, organics, dry, loose, silty sand, fine to coarse, brown.
1'-2'	**GRANITIC BEDROCK**- Completely weathered, silty sand, fine to coarse, brown, dense, dry to slightly moist, minor root hairs.
2'-3'	highly weathered/decomposed, excavates to silty sand (SM) with 8- to 12-inch fragments, fine to coarse grained, very dense, minor small gravels, brown, yellowish orange, slightly moist to moist, minor root hairs.

T.D. @ 3'
No groundwater
Hole backfilled with native soils

TP-9

0-1'	**TOPSOIL**- Loose, dry, brown, silty SAND (SM), fine to coarse, organics (dry grasses, root hairs).
1'-3'	**COLLUVIUM**- sandy CLAY (CL) to clayey SAND (SC), light gray, brown, yellowish orange, fine to coarse-grained, soft to medium stiff.
3'-5'	**SANTIAGO FORMATION**- clayey SANDSTONE (SC), light gray, slightly moist, medium dense, fine to coarse-grained, minor fine gravels, iron staining.

T.D. @ 5'
No groundwater
Hole backfilled with native soils

TP-10

0-1'	**TOPSOIL**- Silty SAND (SM), brown, fine to coarse-grained, minor organics/root hairs, loose, dry.
1'-3'	**COLLUVIUM**- sandy CLAY (CL), moist, fine to coarse-grained sand, minor root hairs, soft to medium stiff, brown.
3'-5'	**SANTIAGO FORMATION**- sandy CLAYSTONE (CL), greenish gray, slightly moist to moist, dense, minor fine sand.

T.D. @ 5'
No groundwater
Hole backfilled with native soils

TP-11

0-1'	**TOPSOIL**- dry, loose, silty SAND (SM), fine to coarse-grained, minor organics (i.e., root hairs), brown.
1'-3'	**COLLUVIUM**- 1'-2' dry/2'-3' slightly moist, clayey SAND (SC), brown, medium hard, fine to coarse-grained.
3'-4'	**SANTIAGO FORMATION**- SANDSTONE, excavates to silty sand (SM), light gray, yellowish orange, fine to coarse-grained, dense, minor fine gravels, common 8- to 12-inch fragments, white inclusions.

T.D. @ 4'
No groundwater
Hole backfilled with native soils

APPENDIX B
LABORATORY TEST DATA

Table 1 - Laboratory Tests on Soil Samples

EEI
Gatlin Deveolpment, Oceanside, CA
Your #GAT- 70622, SA #07-1071LAB
6-Aug-07

Sample ID			TP2 @ 6-7' CL	TP6 @ 1-4.5' CL
Resistivity		**Units**		
as-received		ohm-cm	14,400	23,200
saturated		ohm-cm	920	640
pH			8.5	7.9
Electrical Conductivity		mS/cm	0.32	0.53
Chemical Analyses				
Cations				
calcium	Ca^{2+}	mg/kg	43	53
magnesium	Mg^{2+}	mg/kg	8.6	30
sodium	Na^{1+}	mg/kg	386	555
potassium	K^{1+}	mg/kg	1.8	6.4
Anions				
carbonate	CO_3^{2-}	mg/kg	53	ND
bicarbonate	HCO_3^{1-}	mg/kg	366	287
flouride	F^{1-}	mg/kg	13	4.9
chloride	Cl^{1-}	mg/kg	23	338
sulfate	SO_4^{2-}	mg/kg	278	372
phosphate	PO_4^{3-}	mg/kg	ND	ND
Other Tests				
ammonium	NH_4^{1+}	mg/kg	ND	ND
nitrate	NO_3^{1-}	mg/kg	6.2	ND
sulfide	S^{2-}	qual	na	na
Redox		mV	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

• ANALYSIS
• DESIGN

LaBelle • Marvin

• SOILS, ASPHALT TECHNOLOGY

PROFESSIONAL PAVEMENT ENGINEERING
A CALIFORNIA CORPORATION

August 24, 2007

Mr. Andy Webb
EEI
2195 Faraday Avenue, Suite K
Carlsbad, California 92008

Awebb@eeitiger.com

Project No. 34817- R1

Dear Mr. Webb:

Testing of the bulk soil sample delivered to our laboratory on 8/6/2007 has been completed.

Reference: ***GAT -70622***
Oceanside, CA
Sample: ***TP-1 @ 1 ½'-4'***

R-Value data sheets are attached for your use and file. The opportunity to be of service is sincerely appreciated and should you have any questions, kindly call.

Respectfully Submitted,

REGISTERED PROFESSIONAL ENGINEER
STEVEN R. MARVIN
No. 30659
Exp. 3/31/2
CIVIL
STATE OF CALIFORNIA

Steven R. Marvin
RCE 30659

SRM:lg

2700 S. GRAND AVENUE • SANTA ANA, CA 92705-5404 • (714) 546-3468 • FAX (714) 546-5841
INFO@LABELLEMARVIN.COM

R - VALUE DATA SHEET

P.N. GAT 70622
Nasland, Oceanside

PROJECT NUMBER 34817 BORING NUMBER: TP-1 @ 1.5'-4'

SAMPLE DESCRIPTION: Brown Silty Clay

Item	SPECIMEN		
	a	b	c
Mold Number	7	8	9
Water added, grams	96	146	67
Initial Test Water, %	25.0	29.8	22.2
Compact Gage Pressure,psi	50	30	120
Exudation Pressure, psi	283	155	693
Height Sample, Inches	2.56	2.70	2.56
Gross Weight Mold, grams	3017	3020	2859
Tare Weight Mold, grams	1968	1964	1789
Sample Wet Weight, grams	1049	1056	1070
Expansion, Inches x 10exp-4	31	0	133
Stability 2,000 lbs (160psi)	65 / 143	77 / 160	47 / 121
Turns Displacement	3.59	4.33	2.71
R-Value Uncorrected	8	0	23
R-Value Corrected	8	0	23
Dry Density, pcf	99.3	91.3	103.7
DESIGN CALCULATION DATA			
Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.94	1.02	0.79
G. E. by Expansion	1.03	0.00	4.43

Equilibrium R-Value 7 by EXPANSION

Examined & Checked: 8 /7/ 07

REMARKS:
Gf = 1.25
0.0% Retained on the 3/4" Sieve.

Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

LaBelle • Marvin

R-VALUE GRAPHICAL PRESENTATION

PROJECT NO. 34817
P.N. NAS 70622

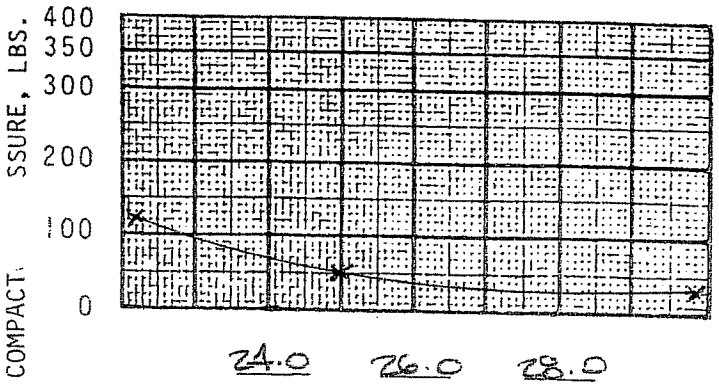
BORING NO. TP-1 @ 1½'-4'
Nasland, Oceanside, CA

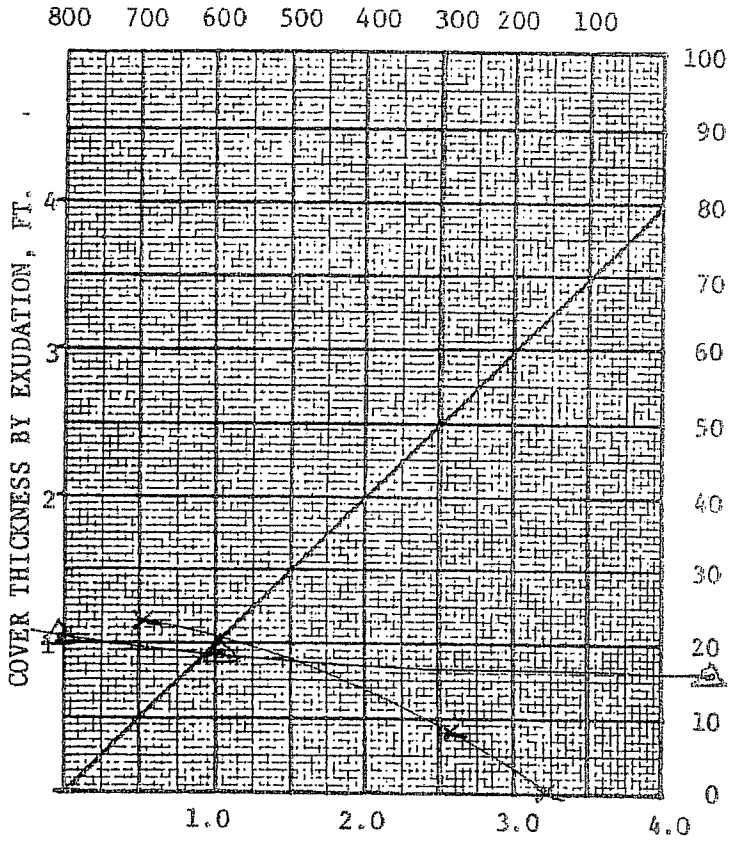
DATE 8-7-07

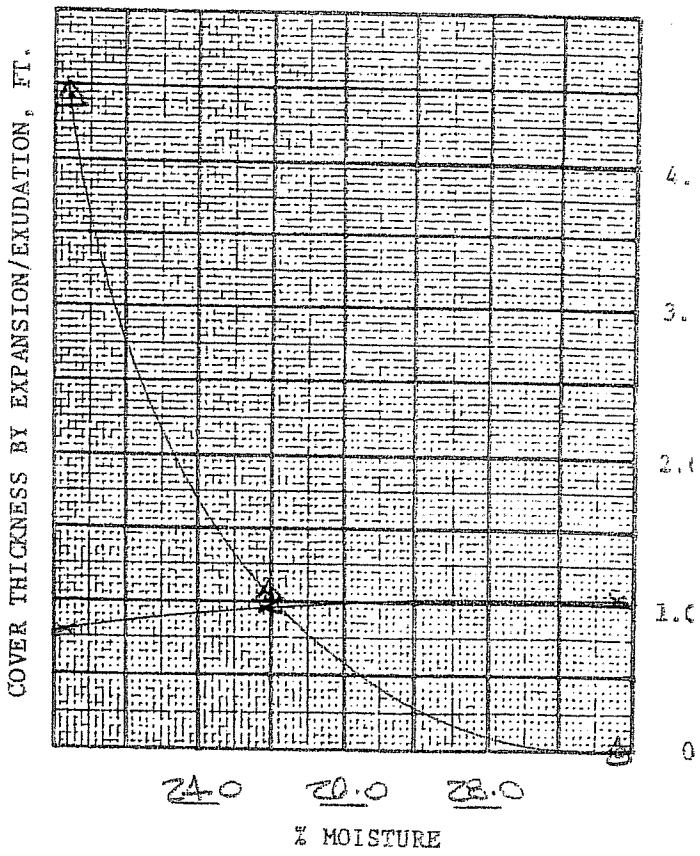
TRAFFIC INDEX Assume 4.0

R-VALUE BY EXUDATION 9

R-VALUE BY EXPANSION 7







R-VALUE vs. EXUD. PRES.

T by EXUDATION

EXUD. T vs. EXPAN. T

T by EXPANSION

REMARKS

GF = 1.25

EXPANSION INDEX TEST

ASTM METHOD D 4829

Sample:

Moisture Content of Initial Sample		% Saturation of Re-molded Sample		Moisture Content of Final Sample	
Tare No. -		Wt. of Soil and Ring (g) -	579.2	Wt. of Soil and Ring (g) -	634.9
Wet Weight and Tare (g) -	131.9	Ring Weight (g) -	207.3	Ring Weight (g) -	207.3
Dry Weight and Tare (g) -	119.5	Wet Weight of Soil (g) -	371.9	Wet Weight of Soil (g) -	427.6
Tare Weight (g) -	0.0	Dry Weight of Soil (g) -	336.8	Dry Weight of Soil (g) -	336.8
Water Loss (g) -	12.4	Volume of Ring (ft^3) -	0.0073	Weight of Water (g) -	90.8
Dry Weight (g) -	119.5	Dry Density (pcf) -	101.7	*Final Moisture (%)*	*26.9*
Initial Moisture (%) -	*10.4*	*Inititial Saturation (%) -*	*42.8*	*Final Saturation (%) -*	*110.9*

	Expansion Test - UBC (144 PSF)			
	Date	Time	Reading	
Add Weight	8/10/2007	14:58	0.648	
10 Minutes		15:08	0.648	Initial Reading
Add Water		16:40	0.750	
	8/14/2007	9:20	0.757	
		12:01	0.757	Final Reading

EImeasured	=	109
EI_{50}	=	**102**

Expansion Index, EI_{50}	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client: Nasland Engineering

Project Name: Oceanside, CA

Job Number: GAT-70622

Date: 8-14-07

Boring Number: TP2

Depth: 11.5-12.5 Feet

Soil Description: Clay, CL

Tested by: AW

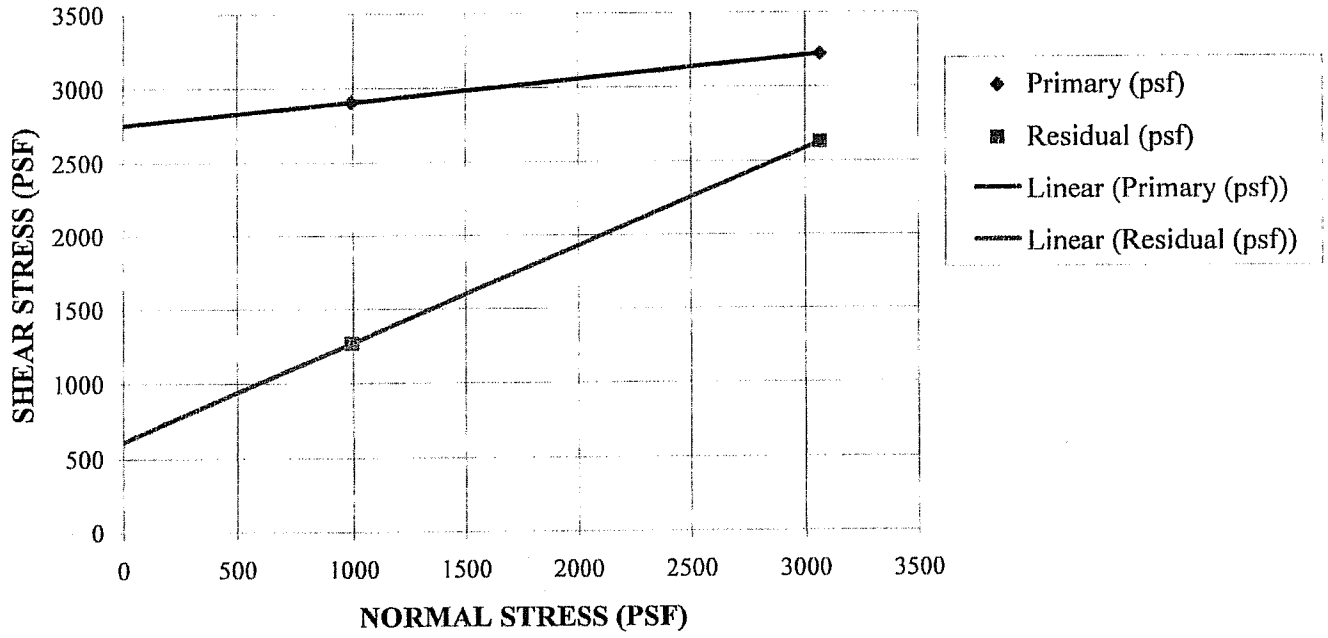
DIRECT SHEAR TEST ASTM D 3080

Job Data	
Job No.:	GAT-70622
Client:	Nasland Engineering
Date:	8/14/07
Sample Data	
Sample:	TP2@11.5-12.5'
Remolded To:	Natural
Remarks:	Sample Innundated Prior to Testing
Soil Description:	Clay, CL

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

SHEAR TEST DIAGRAM



Test Results

	Phi		Cohesion	
Primary (psf)	9	degrees	2756	psf
Residual (psf)	33	degrees	613	psf

Average Initial Moisture	11.2%
Average Dry Density	117.4 pcf
Average Final Moisture	15.1%

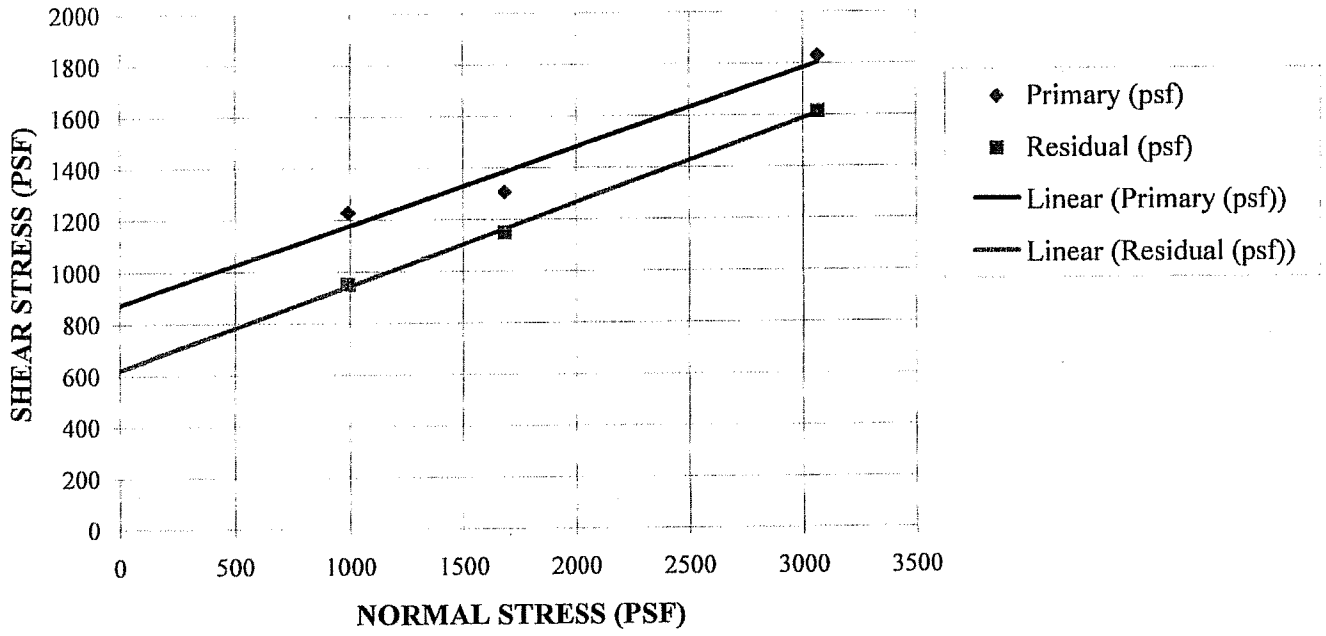
DIRECT SHEAR TEST ASTM D 3080

Job Data	
Job No.:	GAT-70622
Client:	Nasland Engineering
Date:	8/14/07
Sample Data	
Sample:	TP2@11.5-12.5'
Remolded To:	90% of max
Remarks:	Sample Innundated Prior to Testing
Soil Description:	Clay, CL

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

SHEAR TEST DIAGRAM



Test Results

	Phi		Cohesion	
Primary (psf)	17	degrees	874	psf
Residual (psf)	18	degrees	621	psf

Average Initial Moisture	16.0%
Average Dry Density	99.4 pcf
Average Final Moisture	28.0%

APPENDIX E

APPENDIX E

RECOMMENDED GRADING SPECIFICATIONS

FOR

MODERA MELROSE
OCEANSIDE, CALIFORNIA

PROJECT NO. 07647-32-04

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9

and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

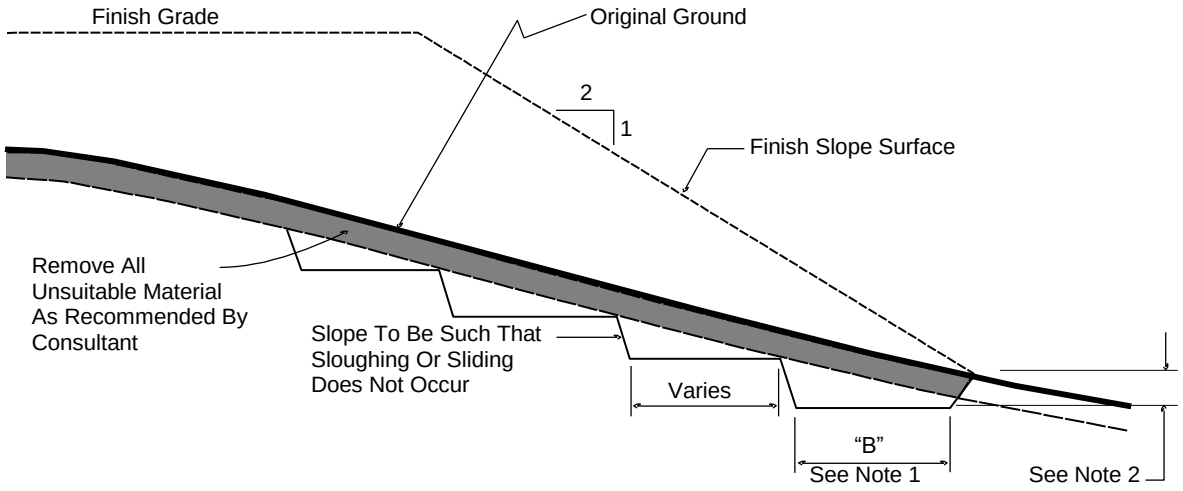
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection

variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

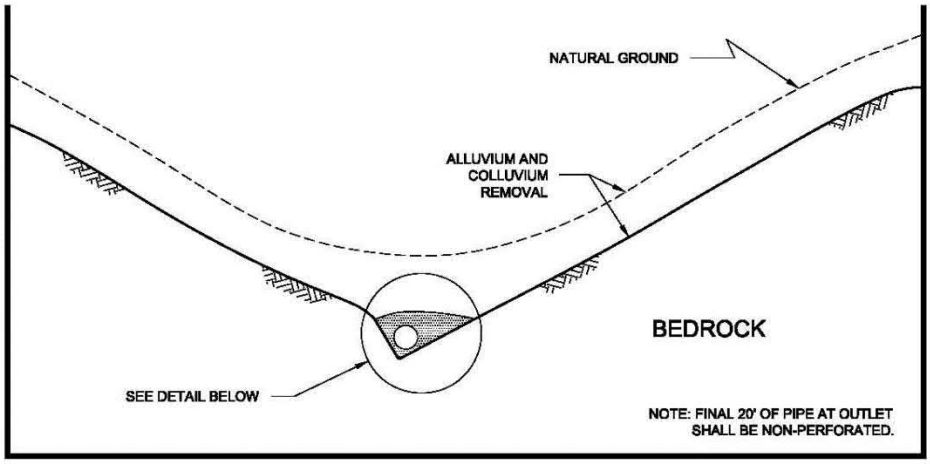
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

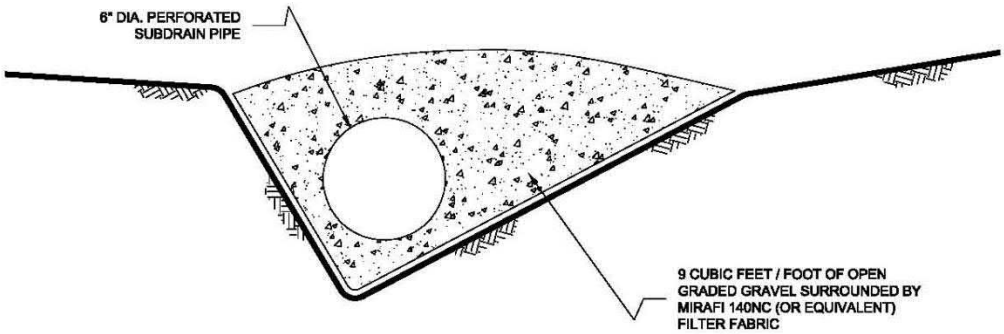
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

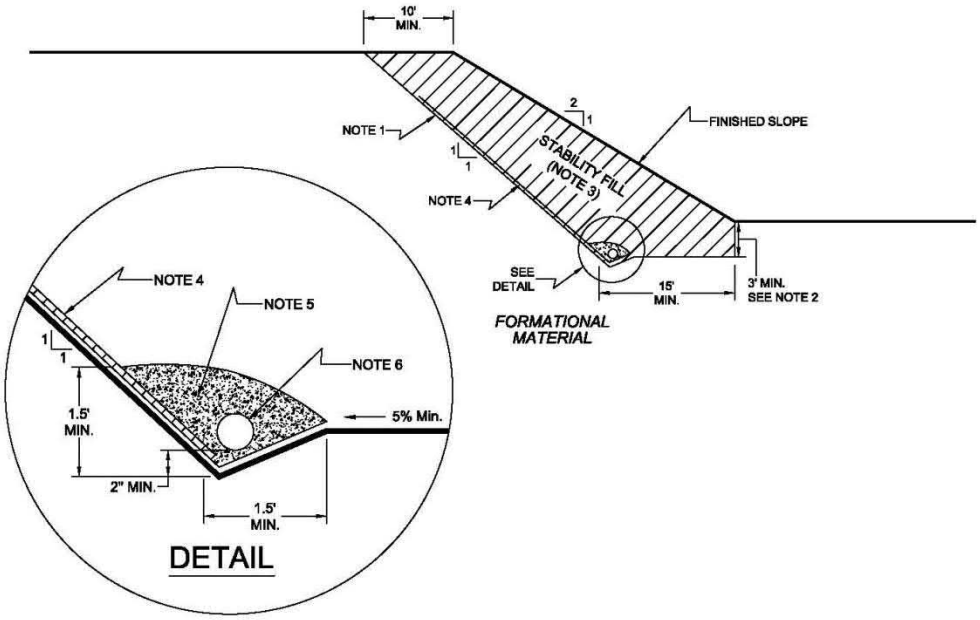
1.....6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS
IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS
LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

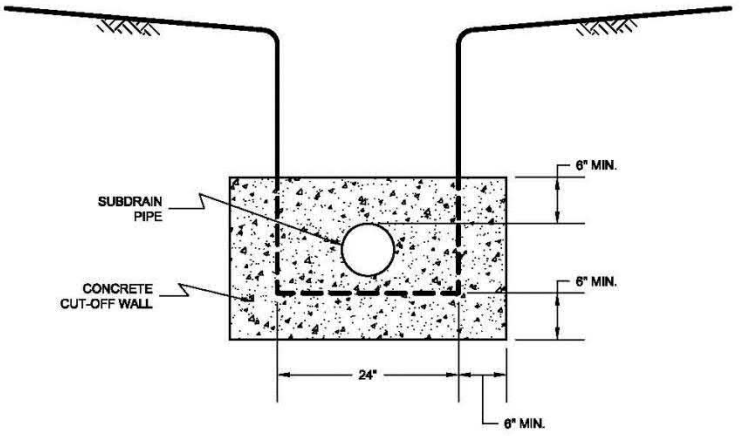
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

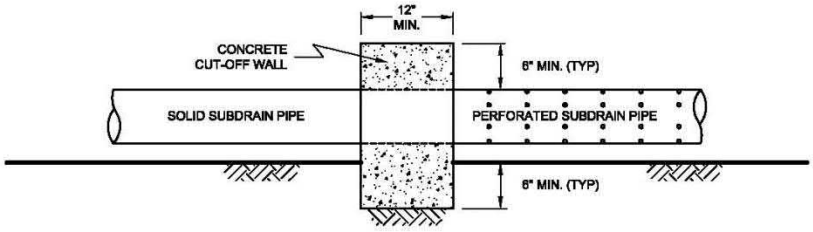
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW

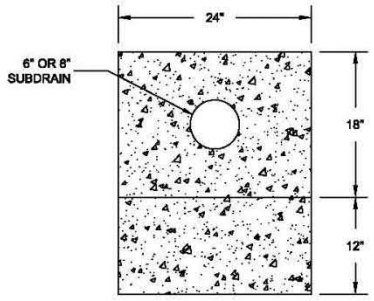


NO SCALE

7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

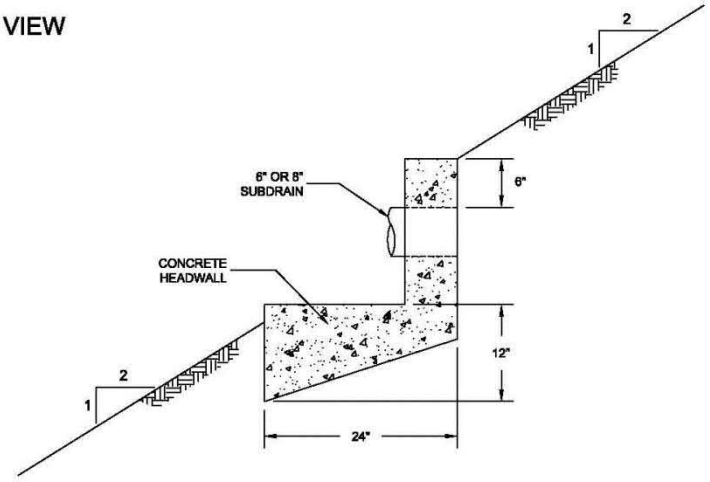
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

1. *California Highway Design Manual, State of Californian Department of Transportation,* Fifth Edition, July 1, 1995.

2. California Geological Survey, *Seismic Shaking Hazards in California,* Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003). 10% probability of being exceeded in 50 years. http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html

3. *Fault Activity Map of California and Adjacent Areas*, California Division of Mines and Geology, Map No. 6 (1994)

4. *Geotechnical Investigation, Melrose & Bobier Property, Oceanside, California,* prepared by Geocon Incorporated dated February 9, 2006 (Project No. 07647-32-01).

5. *Geotechnical Update for 2007 California Building Code, Melrose Station Market Commercial Development, Southeast Corner of Melrose Drive and Oceanside Boulevard, Oceanside, San Diego County, California*, prepared by EEI, dated July 29, 2008 (Project No. GAT-70622).

6. Kennedy, M. P. and S. S. Tan, 2005, *Geologic Map of the Oceanside 30'x60' Quadrangle, California*, USGS Regional Map Series Map No. 2, Scale 1:100,000.

7. *Preliminary Geotechnical Evaluation, Melrose Station Market, Southeast Corner of Melrose Drive and Oceanside Boulevard, Oceanside and Future Residential Parcel, 552 West Bobier Avenue, Vista, San Diego County, California*, prepared by EEI, dated September 18, 2007 (Project No. GAT-70622).

8. Structural Engineers Association (SEAOC) and OSHPD, Seismic Design Maps, http://seismicmaps.org

9. *Supplemental Rippability Study, Melrose Gateway Shopping Center, Oceanside, California,* prepared by Geocon Incorporated, dated October 23, 2006 (Project No. 07647-42-02).

10. *Transmittal of Supplemental Rippability Information, Melrose Gateway Shopping Center (Multi-Family Portion), Vista, California,* prepared by Geocon Incorporated, dated February 6, 2007 (Project No. 07647-42-02)

11. Unpublished reports and maps on file with Geocon Incorporated.

12. *Updated Geotechnical Considerations, Melrose Station Market Commercial Development, Southeast Corner of Melrose Drive and Oceanside Boulevard, Oceanside, San Diego County, California*, prepared by EEI, dated October 31, 2008 (Project No. GAT-70622).

13. USGS computer program, *Seismic Hazard Curves and Uniform Hazard Response Spectra (version 5.1.0,), February 10, 2011.*

ATTACHMENT 7
Storm Water Quality Assessment Form

This is the cover sheet for Attachment 7.

City of Oceanside – Engineering Division – Clean Water Program

STORM WATER QUALITY ASSESSMENT FOR PLANNING, ENGINEERING, AND BUILDING PERMIT APPLICATIONS

All applications for Planning, Engineering, or Building Division permits are required to complete this assessment form and include it as part of the initial permit application submittal. Staff will review the permit application content to determine the applicability of State and City storm water requirements. Please note a storm water assessment cannot be provided without a complete permit application package.

Section 1 – Project Information	
Applicant Name: Bryan Nord	Phone Number: 619.452.2203
Project Name: Modera Melrose	Project Site Address: SEC Melrose Drive and Oceanside Blvd
Permit Applications Number(s): D21-00011	Assessor Parcel Number(s): 161-030-23 & 161-030-24
Project Description: New Development - Mixed-Use	Project Disturbed Area (square feet): 319,919
Existing Impervious Area (square feet): 0	Created or Replaced Impervious Area (square feet): 240,257

	Section 2 – Identify Applicable Priority Development Project Categories (Check All Boxes that Apply)
☑	**New Development Project** – A project that creates 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☐	**Redevelopment Project** – A project that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☐	**Restaurants** – Category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812); where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☑	**Hillside Development** – Category includes development on any natural slope that is twenty-five percent or greater; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Parking Lots** – Category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Streets, Roads, Highways, Freeways, and Driveways** – Category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles; where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Water Quality Environmentally Sensitive Area** – New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharge directly to a Water Quality Environmentally Sensitive Area (WQESA). "Discharge directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the WQESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).
☐	**Automotive Repair Shop** – Category is defined as a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539, where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Retail Gasoline Outlet (RGOs)** – Category includes RGOs that meet the following criteria (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☑	**Development Projects greater than one acre** – New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.

STORM WATER QUALITY ASSESSMENT FOR PLANNING, ENGINEERING, AND BUILDING PERMIT APPLICATIONS

Section 3 – Identify Projects Not Subject to Permanent Stormwater Requirements (Check All Boxes that Apply)	
☐	The project consists of work entirely within an existing structure.
☐	The project consists of construction of overhead or underground utilities (no new impervious surfaces).
☐	The project consists of routine maintenance.
☐	The project consists of less than 50 yards of grading and presents no opportunities to improve water quality.
Section 4 – Project Category Determination	
☑	**Priority Development Project**: If any item in Section 2 is applicable, the project is a Priority Development Project. **Please prepare a PDP SWQMP for the project.**
☐	**Standard Development Project**: If none of the items in Section 2 or 3 are applicable, the project is a Standard Development Project. **Please prepare an SDP SWQMP.**
☐	**Project Not Subject to Permanent Stormwater Requirements:** If any item in Section 3 is applicable, the project is not subject to Permanent Stormwater Requirements. **Please submit the project plans with this form.** **Note:** Projects in this category are subject to typical pollution prevention measures outlined by the pollution prevention checklist on the following page.

Section 5 – Applicant Certification	
Name of Responsible Party: Bryan Nord	Title: Civil Engineer
Email Address (optional)	Phone Number: 619.452.2203
I understand and acknowledge the City of Oceanside has adopted minimum requirements, as mandated by the San Diego Regional Water Quality Control Board – Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100 (NPDES NO. CAS0109266) for mitigating impacts associated with urban runoff, including storm water from construction and land development activities. I certify this assessment has been accurately completed to the best of my knowledge and is consistent with the proposed project. I acknowledge that non-compliance with the City Best Management Practice (BMP) Design Manual, Grading Ordinance, and Erosion Control Ordinance may result in enforcement action by the City, the California State Water Resources Control Board, and/or the San Diego Regional Water Quality Control Board. Enforcement action may include stop work orders, notice of violation, fines, or other actions.	
Applicant Signature: 	Date: 12/20/2021

Stormwater Pollution Prevention Measures for Projects Not Subject to Permanent Stormwater Requirements

Project Activity	Yes	No	Required Pollution Prevention
Trash & Waste Generation *****REQUIRED FOR ALL PROJECTS*****	☐	☐	• Train/inform all employees of pollution prevention requirements • Collect and contain all construction trash, waste, and debris • Promptly contain and clean any spill on site • Routinely inspect site, remove loose trash and prevent spills • Properly dispose of any hazardous materials • Do not wash down surfaces unless water is collected or directed to landscape • Permanent trash collection areas require full structure/enclosure
Digging of Dirt – excavation, trenching, or grading	☐	☐	• Do not allow dirt to migrate into street, sidewalk, or storm drain • Preserve existing vegetation where feasible • Perimeter site controls such as silt fence or straw wattles • Cover exposed dirt using mulch, tarps, or erosion control devices • Install and secure tarps over dirt piles • Routinely sweep site to remove dirt
Landscaping and Irrigation Systems	☐	☐	• Do not store landscape materials in street • Do not allow dirt to migrate into street, sidewalk, or storm drain • Test irrigation system and prevent runoff/overspray • Install and secure tarps over piles of mulch or soil • Routinely sweep site to remove mulch or soil • Do not wash down surfaces unless water is collected or directed to landscape
Concrete, Paint, Mortar, or Stucco Work	☐	☐	• Contain wet mixing areas within confined area • Do not allow material to travel into site soil, street, or storm drain • Properly dispose of waste material
Temporary Storage of Materials Outside	☐	☐	• Elevate material off ground where possible, such as on pallets • Install and secure tarps over materials
Demolition of Structures	☐	☐	• Follow Required Pollution Prevention for “Digging of Dirt”
New Structure – house addition, shed, etc.	☐	☐	• Follow Required Pollution Prevention for “Digging of Dirt” • Direct downspouts to landscape, where feasible • Consider rainwater harvesting • Preserve existing vegetation and drainage patterns, where feasible
Patio, Driveway, or Sidewalk	☐	☐	• Consider use of pervious pavers or pervious concrete (refer to Section 3 of page 4 for routine maintenance information) • Direct runoff to landscape areas, where feasible
Re-Roofing	☐	☐	• Contain removed roof debris in waste containers • Follow Required Pollution Prevention for “Temporary Storage of Materials Outside”
Washing of Material, Equipment, or Surface	☐	☐	• Do not wash down surfaces unless water is collected or directed to landscape
Draining of Water Heater, Pool, or Spa	☐	☐	• Direct drain water to landscape areas where possible • Contact Stormwater Division if considering draining to sanitary system cleanout or storm drain system (760-643-2804)
Storm Drain at Industrial or Commercial Property	☐	☐	• Install “No Dumping” or similar signage at each storm drain inlet

Completion Guidance

Please note – the Applicant is required to complete and submit this form as part of the project application. For definitions and additional information, please refer to the City of Oceanside BMP Design Manual. For assistance, please contact Development Services Staff at (760) 435-4373.

Section 1 – Project Information

1. Applicant Name – provide name of Individual completing form, i.e. Owner or Owner Representative
2. Phone Number – provide phone number of Individual completing form, i.e. Owner or Owner Representative
3. Project Name – provide project name (consistent with project application)
4. Project Site Address – provide a physical address for the proposed project, or nearest cross street
5. Permit Application Number(s) – provide all applicable permit application numbers
6. Assessor Parcel Number(s) – provide Assessor Parcel Number(s); refer to title documents or contact City Staff for assistance
7. Project Description – provide a brief project description (e.g. single-family dwelling, retail business, repair shop, etc)
8. Project Disturbed Area – provide the disturbed area for the entire project, including onsite and offsite work
9. Existing Impervious Area – provide the total existing impervious area within the property and project boundary
10. Created or Replaced Impervious Area – provide the total area of all newly created or replaced impervious surfaces within the project area

Section 2 – Identify Applicable Priority Development Project Categories

1. Review each category and check the appropriate boxes that apply to your project.
2. General identification of Automotive Repair Shop SIC (Standard Industrial Classifications) as follows:
   5013 – Motor vehicle supplies and new parts, 5014 – Tires and tubes, 5541 – Gasoline service stations, 7532 – Top and body repair, and paint shops, 7533 – Auto exhaust system repair shops, 7534 – Tire retreading and repair shops, 7536 – Automotive glass replacement shops, 7537 – Automotive transmission repair shops, 7538 – General automotive repair shops, 7539 – Automotive repair shops-not elsewhere classified
3. Contact Staff for assistance in determining applicability of the Water Quality Environmentally Sensitive Area (WQESA) category

Section 3 – Identify Projects Not Subject to Permanent Stormwater Requirements

1. Please refer to Page 1-6 of the City of Oceanside BMP Design Manual for a complete list of routine maintenance activities.
2. Activities that expose native subgrade in the process of replacing impervious surfaces, are not considered routine maintenance.

Section 4 – Project Category Determination

1. PDP SWQMP – Priority Development Project Stormwater Quality Management Plan
2. SDP SWQMP – Standard Development Project Stormwater Quality Management Plan
3. Contact Staff for assistance in determining the Project Category

Section 5 – Applicant Certification

1. Name of Responsible Party – provide name of Owner
2. Title of Responsible Party – provide responsible party's title, if applicable
3. Phone Number – provide phone number of Owner
4. Email Address (Optional) – provide email address
5. Applicant Signature – provide signature of Individual completing form, i.e. Owner or Owner Representative
6. Date – provide date current date