APPENDIX F
Hydrology Report and WQMP

3rd review 5-9-19. Approved for conceptual grading, not for grading permit issuance

Hydrology Report

For:

Garg Residence
1 O'Hill Ridge
Laguna Niguel, CA

Prepared by:

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Project Number:
423.000

Supervising Engineer:
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RCE No. 53251

Date Prepared:
March 2019

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I. Introduction

Geographic Setting

The Study area consists of the existing natural hillside at 1 O'Hill Ridge in the City of Laguna Niguel. A proposed residence with landscaping will be constructed on the natural hillside. The project site's entire tributary drainage area is 6.44 acres.

Purpose of This Report

The purpose of this report is to accomplish the following objectives:

1. To determine the storm water discharges generated within local drainage areas within the project.
2. To support the design of "local" storm drains, consisting of laterals and catch basins, as submitted with this report.
3. To demonstrate that the "storm water" and "flood" protection goals as required by the City of Laguna Niguel have been met.

Project Site Location Map



Google Earth, 2017

II. Existing Topographic & Hydrologic Conditions

Existing Topography

The Study area consists of the existing natural hillside at 1 O'Hill Ridge in the City of Laguna Niguel. The project site's entire drainage area is 6.44 acres. It is a steep hillside lot that has 144' of fall from north to south.

Existing Drainage Pattern

The existing project site flows in two directions. The existing dirt road falls downhill back to O'Hill Street which consists of 0.43 acres. The remaining site, 6.01 acres flows from north to south down into an existing canyon below the property.

The existing canyon flows between two homes below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

Existing Storm Drain Facilities

There are no existing storm drain facilities onsite. All runoff sheet flows out to O'Hill Ridge or down into the natural ravine below.

Existing Conditions

Currently there are no signs of erosion on the site. All the surface areas are natural.

III. Proposed Storm Drain Facilities

The proposed storm drain system collects all the roof drain runoff and area drains and carries them through the project site to the proposed Lake.

The Lake captures all the site runoff and then overflow into at outlet which connects to a storm drain and drains the overflow down the hill toward the ravine. Near the bottom of the property, the pipe will

outlet into a rip rap energy dissipation structure which will distribute the flow and allow it to sheet flow into the ravine below.

IV. Hydrology Study

Storm Frequency

The storm frequency for this study is based on the 2, 10, 25 year and 100 year storm.

Methodology

This study was prepared in conformance with the Orange County Hydrology Manual and the calculations were performed with the CivilD software for the Peak Flow Hydrologic Analysis.

Soil Type D Per Plate C of Hydrologic Classification of Soil, County of Orange.


PROJECT SITE
Laguna Niguel
San Juan Capistrano
Dana Point

Using the CivilD software, the following flows were calculated based on the areas in the hydrology exhibit.

The hydraulic analysis was performed using the Civil Design computer program which uses Manning's formula $Q = A*1.486/n*R^{2/3} *S^{1/2}$. The roughness coefficient n=0.010 for the PVC pipe and n=0.013 for RCP pipe.

V. Local Area Drain Pipe Sizing

The onsite drain sizes will be designed during the construction document phase. All pipes will have a minimum 1% slope.

VI. Design Criteria

The proposed storm drain systems will be designed so as to be consistent with the following goals and guidelines:

A. All buildings shall be protected from flooding during a 100-year frequency storm because the site is not in a flood zone and overflow protection will be designed into the project.

B. 1. Onsite design storm is based on a 25-year frequency. In sump conditions for catch basins and the connecting storm drains also use a 25-year frequency.

2. Offsite design storm frequency, subject to individual review by the County, should be in accordance with the O.C. P.F.&R.D. Hydrology Manual.

C. 1. Velocity should not exceed 20 FPS in P.V.C pipe and standard wall R.C.P.

2. Where velocity exceeds 20 FPS, a special wall R.C.P. with a minimum of 1½-inch steel clearance on the inside surface shall be used.

3. Maximum velocity in special cover R.C.P. shall be 45 FPS.

D. On arterial highways, one (1) 12' lane each direction should be clear of water, with a 10-year storm. In sump conditions, a 25-year storm event shall be used.

E. On local streets, flow should not exceed top of curb, for a 10-year storm event, and in sump conditions, a 25-year storm event shall be used.

F. Cross gutter is not allowed at any through street.

G. Catch basins are to be constructed at all four corners of arterial highway intersections.

H. Open cut is not allowed at any existing arterial highway. Pipe must be jacked across street.

I. Maximum W.S. in CB's for design conditions shall be 0.5' below inlet (FL.) elevation.

J. Once water is picked up in a storm drain, it should remain in the system.

K. Pipe size may not be decreased downstream without the County's approval.

L. Branching of flow is not allowed.

M. Provide hydraulic and energy grade line calculations and plot of hydraulic grade line on plans with table of appropriate hydraulic data.

N. The ratio of normal velocity to critical velocity should be less than 0.9 or greater than 1.2.

O. All pipes and conduits laid parallel to the roadway shall be placed at least 30" below the roadway surface. However, when pipe depth is in excess of 10' (measured from top of pipe to ground surface), the County's approval is required prior to the initial design of the system.

P. Junction structures should be designed according to the O.C. P.F.&R.D. "Design Manual".

Q. Storm Drain Easement width shall be determined in the following manner:

1. D = 36" or smaller – Distance from top of pipe to ground level times 1.5 + diameter of pipe +2.0' (When cover exceeds 10', use 2 below.)

2. D = 39" or greater – a. Distance from bottom of pipe to ground level times 2.0 + diameter of pipe + 2.0'.

In any case, the width of easement shall not be less than 10.0' in width.

R. Storm drain shall be located at the center line of the easement.

S. Easement shall be exclusively for storm drain purposes.

T. Storm drain with high fills:

1. Fill Greater than 40 Feet

Storm drains which are installed with cover greater than 40 feet shall have a diameter a minimum of 12 inches larger than that

required for hydraulic adequacy and shall be constructed using pre-stressed concrete pipe.*

2. Fill between 30 and 40 Feet

   Storm drains which are installed with cover between 30 and 40 feet shall have a diameter a minimum of 12 inches larger than that required for hydraulic adequacy and shall be constructed using pre-stressed concrete pipe if the subgrade of the pipe is in a fill area.* If subgrade is in native soil, reinforced concrete pipe may be used.

3. Fill Between 20 and 30 Feet

   Storm drains which are installed with cover between 20 and 30 feet shall be constructed using reinforced concrete pipe. A pipe diameter greater than that required for hydraulic adequacy may be required if, in the opinion of the County Engineer's staff, the particular conditions involved warrant the larger size.

4. Fill Less Than 20 Feet

   Normal criteria for storm drain design shall be followed.

* Exceptions may be made for a roadway crossing of a natural watercourse which will remain undisturbed with future development.

VII. Results and Conclusions

This report's purpose determine if the existing drainage is sufficiently designed to handle the 2, 10, 25 and 100 year storm events.

The existing project site areas storm runoff in area A-1 that travels down the hillside in a sheet flow condition is 12.88, 9.94, 8.17 and 4.18 c.f.s. in a 100 year, 25 year 10 year, and 2 year storm event, respectively.

The existing project site areas storm runoff in area B-1 that travels down the existing dirt road to O'Hill Ridge is 1.84, 1.42, 1.17 and 0.60 c.f.s. in a 100 year, 25 year 10 year, and 2 year storm event, respectively.

The proposed project site has runoff the travels down the driveway in area D-1 to O'Hill Ridge. The runoff is 1.68, 1.30, 1.08 and 0.57 c.f.s. in a 100 year, 25 year 10 year, and 2 year storm event, respectively.

The remaining proposed site run off travels down the hillside and the driveway are collected by storm drains. The storm drains pick up all the landscape areas and roof drains and carry them to the proposed lake at the bottom of the building area. The site runoff enters the lake

at various points. The lake has been designed to capture the 100 year storm runoff increase so no additional water will exit the lake downstream into the ravine. When the lake begins to overflow in the in a 100 year or larger storm event, the runoff enters a overflow spillway and into a storm drain which runs down the hill into the energy disappation rip rap structure. The flow rate is are controlled by the lake (detention basin) size at the outlet based on the flood routing program for the 100 year storm event. The lake's normal water surface elevation is 510.50' with a surface edge of 510.83'. There is 1.67' of storage depth above the normal sufrace elevation prior to entrance to the overlow outlet at elevation 512.50'. The lake will contain 1' of freeboard above the outlet to 513.50'. The runoff entering the lake is 16.64 cfs, but only 11.1 cfs is leaving the lake's outlet at the peak of the 24 hour storm event for a 33% reduction in the 100 year storm event.

The driveway will decrease the flows travelling to O'hill Ridge by about 0.1 c.f.s in each storm event.

There will be a decrease in peak storm events up to the 100 year storm event as the peak runoff will be detained or stored in the lake and will be reused for irrigation.

The reduced flows that enter the overflow will have a redecued impact on the ravine below and we see no impacts on the existing canyon below, nor the 30" storm drain that travels under Peppertree Bend at the bottom of the canyon.

VIII. Appendices

Appendix 1 – 2, 10, 25 & 100 Year Hydrology Calculations

Appendix 2 – 4", 6", 8", 10",12", 18" & 24" Hydraulic Calculations

Appendix 3 – 100 Year Unit Hydrograph Analysis

Appendix 4 – 100 Year Flood Hydrograph Detention Basin Routing

Appendix 5 – Hydrology Exhibit

Appendix 1

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exa1.roc

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2 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 1.218(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.752
Subarea runoff = 4.186(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exb1.roc

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2 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 1.244(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.755
Subarea runoff = 0.601(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exa1.roc

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10 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 2.186(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.818
Subarea runoff = 8.168(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2exb1.roc

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10 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 2.233(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.819
Subarea runoff = 1.171(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exa1.roc

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25 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 2.617(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.831
Subarea runoff = 9.942(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exb1.roc

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25 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 2.673(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.833
Subarea runoff = 1.424(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exa1.roc

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100 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 3.332(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.846
Subarea runoff = 12.881(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exb1.roc

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100 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 3.403(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.847
Subarea runoff = 1.845(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propa.roc

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2 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 1.777(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.809
Subarea runoff = 0.819(CFS)
Total initial stream area = 0.570(Ac.)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.819(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.819(CFS)
Normal flow depth in pipe =    2.08(In.)
Flow top width inside pipe =    5.71(In.)
Critical Depth =    5.37(In.)
Pipe flow velocity =     13.56(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =     7.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.92 min.
Rainfall intensity =      1.738(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.807
Subarea runoff =      1.691(CFS) for    1.220(Ac.)
Total runoff =      2.510(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     2.510(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     2.510(CFS)
Normal flow depth in pipe =    3.40(In.)
Flow top width inside pipe =    5.95(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.87(Ft/s)
Travel time through pipe =    0.07 min.
```

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Time of concentration (TC) =     7.99 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.99 min.
Rainfall intensity =      1.730(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.806
Subarea runoff =      1.326(CFS) for    0.960(Ac.)
Total runoff =      3.835(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     3.835(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.835(CFS)
Normal flow depth in pipe =    4.90(In.)
Flow top width inside pipe =    8.96(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.60(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     8.19 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
```

Time of concentration = 8.19 min.
Rainfall intensity = 1.705(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.805
Subarea runoff = 0.681(CFS) for 0.540(Ac.)
Total runoff = 4.516(CFS) Total area = 3.29(Ac.)
Area averaged Fm value = 0.180(In/Hr)

++
Process from Point/Station 104.000 to Point/Station 105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 507.000(Ft.)
Downstream point/station elevation = 506.500(Ft.)
Pipe length = 10.00(Ft.) Manning's N = 0.010
No. of pipes = 1 Required pipe flow = 4.516(CFS)
Nearest computed pipe diameter = 9.00(In.)
Calculated individual pipe flow = 4.516(CFS)
Normal flow depth in pipe = 6.93(In.)
Flow top width inside pipe = 7.58(In.)
Critical depth could not be calculated.
Pipe flow velocity = 12.38(Ft/s)
Travel time through pipe = 0.01 min.
Time of concentration (TC) = 8.20 min.
End of computations, total study area = 3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propb.roc

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2 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 2.314(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.834
Subarea runoff = 0.347(CFS)
Total initial stream area = 0.180(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   571.500(Ft.)
Downstream point/station elevation =   530.000(Ft.)
Pipe length  =   289.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.347(CFS)
Nearest computed pipe diameter  =      3.00(In.)
Calculated individual pipe flow  =     0.347(CFS)
Normal flow depth in pipe =    2.03(In.)
Flow top width inside pipe =    2.81(In.)
Critical depth could not be calculated.
Pipe flow velocity =      9.85(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =     5.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     5.30 min.
Rainfall intensity =      2.189(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.827
Subarea runoff =      1.137(CFS) for    0.640(Ac.)
Total runoff =      1.484(CFS)    Total area =        0.82(Ac.)
Area averaged Fm value =    0.178(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   510.000(Ft.)
Downstream point/station elevation =   509.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     1.484(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.484(CFS)
Normal flow depth in pipe =    4.49(In.)
Flow top width inside pipe =    5.21(In.)
Critical depth could not be calculated.
Pipe flow velocity =      9.41(Ft/s)
Travel time through pipe =    0.02 min.
```

Time of concentration (TC) = 5.32 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propc.roc

---

2 year proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 1.930(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.821
Subarea runoff = 0.982(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

---

2 Year Proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 1.726(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.806
Subarea runoff = 0.571(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propa.roc

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10 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 3.187(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.849
Subarea runoff = 1.543(CFS)
Total initial stream area = 0.570(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     1.543(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.543(CFS)
Normal flow depth in pipe =    2.95(In.)
Flow top width inside pipe =    6.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.05(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     7.88 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.88 min.
Rainfall intensity =      3.128(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =      3.207(CFS) for    1.220(Ac.)
Total runoff =      4.750(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     4.750(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     4.750(CFS)
Normal flow depth in pipe =    3.93(In.)
Flow top width inside pipe =    8.93(In.)
Critical depth could not be calculated.
Pipe flow velocity =     25.66(Ft/s)
Travel time through pipe =    0.06 min.
```

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Time of concentration (TC) =     7.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.93 min.
Rainfall intensity =      3.116(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =      2.516(CFS) for    0.960(Ac.)
Total runoff =      7.266(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     7.266(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     7.266(CFS)
Normal flow depth in pipe =    6.05(In.)
Flow top width inside pipe =   12.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.31(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     8.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
```

```
Time of concentration =     8.11 min.
Rainfall intensity =      3.078(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.847
Subarea runoff =      1.315(CFS) for    0.540(Ac.)
Total runoff =      8.581(CFS)    Total area =        3.29(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   507.000(Ft.)
Downstream point/station elevation =   506.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     8.581(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     8.581(CFS)
Normal flow depth in pipe =    8.33(In.)
Flow top width inside pipe =   11.06(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.74(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.12 min.
End of computations, total study area =            3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) =  75.0
```

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propb.roc

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10 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 4.150(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff = 0.645(CFS)
Total initial stream area = 0.180(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   571.500(Ft.)
Downstream point/station elevation =   530.000(Ft.)
Pipe length  =   289.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.645(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.645(CFS)
Normal flow depth in pipe =    1.97(In.)
Flow top width inside pipe =    5.64(In.)
Critical Depth =    4.89(In.)
Pipe flow velocity =     11.48(Ft/s)
Travel time through pipe =    0.42 min.
Time of concentration (TC) =     5.23 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     5.23 min.
Rainfall intensity =      3.956(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.860
Subarea runoff =      2.143(CFS) for    0.640(Ac.)
Total runoff =      2.788(CFS)    Total area =        0.82(Ac.)
Area averaged Fm value =    0.178(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   510.000(Ft.)
Downstream point/station elevation =   509.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     2.788(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.788(CFS)
Normal flow depth in pipe =    4.92(In.)
Flow top width inside pipe =    8.96(In.)
Critical Depth =    8.53(In.)
Pipe flow velocity =     11.29(Ft/s)
Travel time through pipe =    0.01 min.
```

Time of concentration (TC) = 5.25 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

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10 year proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 3.463(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.856
Subarea runoff = 1.837(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

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10 Year Proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 3.097(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.848
Subarea runoff = 1.076(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propa.roc

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25 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 3.799(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.857
Subarea runoff = 1.856(CFS)
Total initial stream area = 0.570(Ac.)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     1.856(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.856(CFS)
Normal flow depth in pipe =    3.30(In.)
Flow top width inside pipe =    5.97(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.79(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     7.87 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.87 min.
Rainfall intensity =      3.732(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.857
Subarea runoff =      3.866(CFS) for    1.220(Ac.)
Total runoff =      5.723(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     5.723(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     5.723(CFS)
Normal flow depth in pipe =    4.37(In.)
Flow top width inside pipe =    9.00(In.)
Critical depth could not be calculated.
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Pipe flow velocity =     26.92(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     7.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.92 min.
Rainfall intensity =      3.718(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.856
Subarea runoff =      3.034(CFS) for    0.960(Ac.)
Total runoff =      8.757(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     8.757(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     8.757(CFS)
Normal flow depth in pipe =    6.78(In.)
Flow top width inside pipe =   11.90(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.15(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =     8.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
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```
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     8.08 min.
Rainfall intensity =      3.675(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.856
Subarea runoff =      1.593(CFS) for    0.540(Ac.)
Total runoff =     10.350(CFS)    Total area =        3.29(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   507.000(Ft.)
Downstream point/station elevation =   506.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =    10.350(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    10.350(CFS)
Normal flow depth in pipe =    9.83(In.)
Flow top width inside pipe =    9.24(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.03(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.09 min.
End of computations, total study area =            3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) =  75.0
```

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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25 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 4.930(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.869
Subarea runoff = 0.771(CFS)
Total initial stream area = 0.180(Ac.)

++
Process from Point/Station 201.000 to Point/Station 202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____
Upstream point/station elevation = 571.500(Ft.)
Downstream point/station elevation = 530.000(Ft.)
Pipe length = 289.00(Ft.) Manning's N = 0.010
No. of pipes = 1 Required pipe flow = 0.771(CFS)
Nearest computed pipe diameter = 6.00(In.)
Calculated individual pipe flow = 0.771(CFS)
Normal flow depth in pipe = 2.17(In.)
Flow top width inside pipe = 5.76(In.)
Critical Depth = 5.26(In.)
Pipe flow velocity = 12.06(Ft/s)
Travel time through pipe = 0.40 min.
Time of concentration (TC) = 5.21 min.

++
Process from Point/Station 202.000 to Point/Station 202.000
**** SUBAREA FLOW ADDITION ****
_____
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Time of concentration = 5.21 min.
Rainfall intensity = 4.712(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff = 2.575(CFS) for 0.640(Ac.)
Total runoff = 3.346(CFS) Total area = 0.82(Ac.)
Area averaged Fm value = 0.178(In/Hr)

++
Process from Point/Station 202.000 to Point/Station 203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____
Upstream point/station elevation = 510.000(Ft.)
Downstream point/station elevation = 509.500(Ft.)
Pipe length = 10.00(Ft.) Manning's N = 0.010
No. of pipes = 1 Required pipe flow = 3.346(CFS)
Nearest computed pipe diameter = 9.00(In.)
Calculated individual pipe flow = 3.346(CFS)
Normal flow depth in pipe = 5.53(In.)
Flow top width inside pipe = 8.76(In.)
Critical depth could not be calculated.
Pipe flow velocity = 11.76(Ft/s)
Travel time through pipe = 0.01 min.

Time of concentration (TC) = 5.23 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propc.roc

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25 Year Proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 4.123(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff = 2.206(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

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25 Year Proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 3.692(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.856
Subarea runoff = 1.296(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propa.roc

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100 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 4.858(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.867
Subarea runoff = 2.400(CFS)
Total initial stream area = 0.570(Ac.)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     2.400(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     2.400(CFS)
Normal flow depth in pipe =    3.90(In.)
Flow top width inside pipe =    5.72(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.77(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =     7.85 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.85 min.
Rainfall intensity =      4.777(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      5.006(CFS) for    1.220(Ac.)
Total runoff =      7.405(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     7.405(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     7.405(CFS)
Normal flow depth in pipe =    5.10(In.)
Flow top width inside pipe =    8.92(In.)
Critical depth could not be calculated.
Pipe flow velocity =     28.67(Ft/s)
Travel time through pipe =    0.05 min.
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Time of concentration (TC) =     7.90 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.90 min.
Rainfall intensity =      4.759(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      3.929(CFS) for    0.960(Ac.)
Total runoff =     11.334(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =    11.334(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    11.334(CFS)
Normal flow depth in pipe =    8.05(In.)
Flow top width inside pipe =   11.28(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.23(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =     8.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
```

```
Time of concentration =     8.06 min.
Rainfall intensity =      4.707(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      2.070(CFS) for    0.540(Ac.)
Total runoff =     13.404(CFS)    Total area =        3.29(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   507.000(Ft.)
Downstream point/station elevation =   506.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =    13.404(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    13.404(CFS)
Normal flow depth in pipe =    9.37(In.)
Flow top width inside pipe =   14.53(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.62(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.07 min.
End of computations, total study area =            3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) =  75.0
```

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propb.roc

---

100 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 6.325(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff = 0.997(CFS)
Total initial stream area = 0.180(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   571.500(Ft.)
Downstream point/station elevation =   530.000(Ft.)
Pipe length  =   289.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.997(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.997(CFS)
Normal flow depth in pipe =    2.49(In.)
Flow top width inside pipe =    5.91(In.)
Critical Depth =    5.66(In.)
Pipe flow velocity =     12.93(Ft/s)
Travel time through pipe =    0.37 min.
Time of concentration (TC) =     5.18 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     5.18 min.
Rainfall intensity =      6.060(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =      3.344(CFS) for    0.640(Ac.)
Total runoff =      4.341(CFS)    Total area =        0.82(Ac.)
Area averaged Fm value =    0.178(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   510.000(Ft.)
Downstream point/station elevation =   509.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     4.341(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     4.341(CFS)
Normal flow depth in pipe =    6.69(In.)
Flow top width inside pipe =    7.86(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.32(Ft/s)
Travel time through pipe =    0.01 min.
```

Time of concentration (TC) = 5.20 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propc.roc

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100 Year Proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 5.278(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.871
Subarea runoff = 2.850(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

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100 year proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 4.720(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.866
Subarea runoff = 1.675(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may

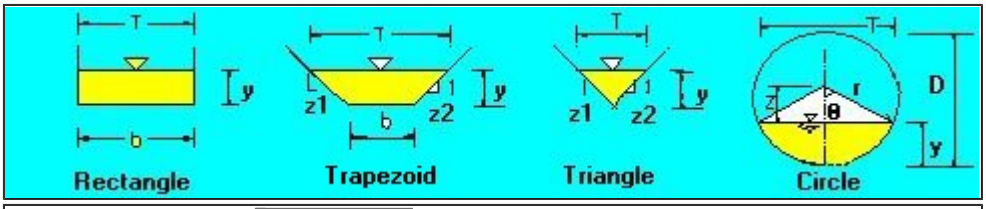
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) = 75.0

Appendix 2

The open channel flow calculator

Select Channel Type: Circle



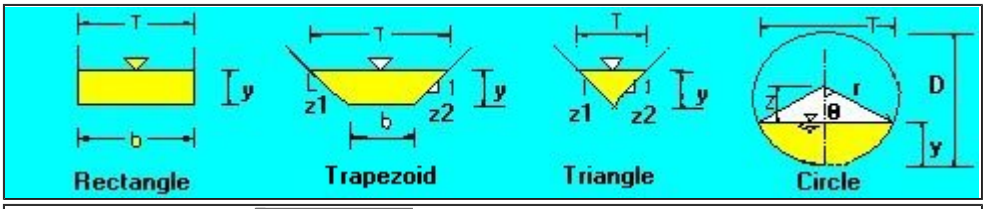
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.01 ft/ft	Water depth(y): .49999 ft	Radius (r) .25 ft
Flow velocity 3.7221 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 0.7308 ft^3/s	Input n value .01 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 1.57 ft	Flow area 0.2 ft^2	Top width(T) 0 ft
Specific energy 0.72 ft	Froude number 0.1	Flow status Subcritical flow
Critical depth 0.43 ft	Critical slope 0.0093 ft/ft	Velocity head 0.22 ft

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The open channel flow calculator

Select Channel Type: Circle



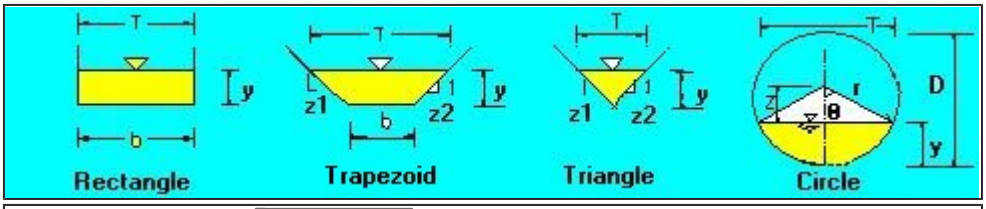
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): .66 ft	Radius (r) .333 ft
Flow velocity 4.684 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 1.6294 ft^3/s	Input n value .010 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 1.97 ft	Flow area 0.35 ft^2	Top width(T) 0.13 ft
Specific energy 1 ft	Froude number 0.5	Flow status Subcritical flow
Critical depth 0.59 ft	Critical slope 0.0096 ft/ft	Velocity head 0.34 ft

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The open channel flow calculator

Select Channel Type: Circle



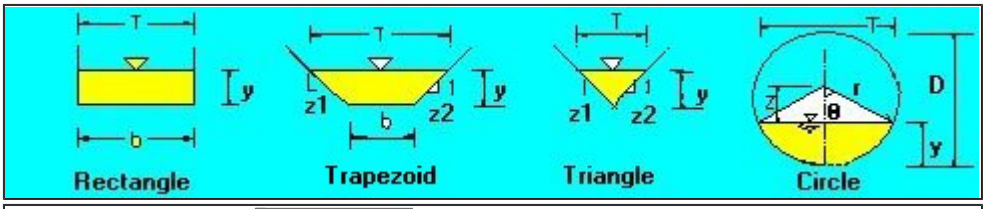
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): .8299 ft	Radius (r) .415 ft
Flow velocity 5.2327 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 2.8312 ft^3/s	Input n value .010 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.59 ft	Flow area 0.54 ft^2	Top width(T) 0.02 ft
Specific energy 1.26 ft	Froude number 0.17	Flow status Subcritical flow
Critical depth 0.74 ft	Critical slope 0.009 ft/ft	Velocity head 0.43 ft

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The open channel flow calculator

Select Channel Type: Circle



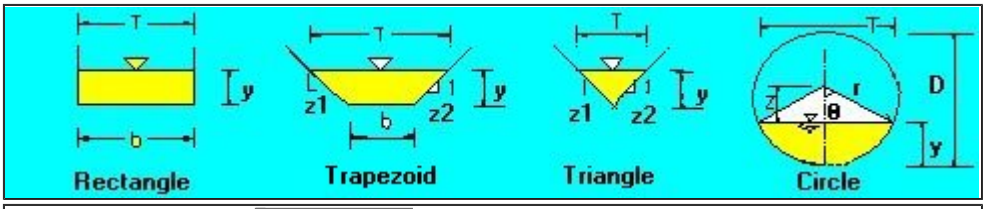
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): .9999 ft	Radius (r) .5 ft
Flow velocity 5.9224 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 4.6514 ft^3/s	Input n value .010 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.12 ft	Flow area 0.79 ft^2	Top width(T) 0.02 ft
Specific energy 1.54 ft	Froude number 0.17	Flow status Subcritical flow
Critical depth 0.9 ft	Critical slope 0.0089 ft/ft	Velocity head 0.54 ft

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The open channel flow calculator

Select Channel Type: Circle



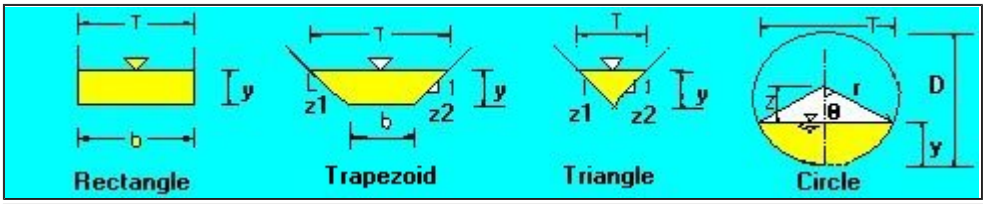
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.49 ft	Radius (r) .75 ft
Flow velocity 8.0029 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 14.1292 ft^3/s	Input n value .01 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.47 ft	Flow area 1.77 ft^2	Top width(T) 0.24 ft
Specific energy 2.48 ft	Froude number 0.52	Flow status Subcritical flow
Critical depth 1.39 ft	Critical slope 0.0093 ft/ft	Velocity head 0.99 ft

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The open channel flow calculator

Select Channel Type: Circle



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.99 ft	Radius (r) 1 ft
Flow velocity 9.6495 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 30.2967 ft^3/s	Input n value .01 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 6 ft	Flow area 3.14 ft^2	Top width(T) 0.28 ft
Specific energy 3.44 ft	Froude number 0.51	Flow status Subcritical flow
Critical depth 1.87 ft	Critical slope 0.0092 ft/ft	Velocity head 1.45 ft

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Appendix 3

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989-2004, Version 7.0

Study date 02/11/19 File Name garg100.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6004

Detention Basin Unit Hydrograph

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
75.0	4.7	1.00	D	0.200	0.810	0.162

Area-averaged adjusted loss rate Fm (In/Hr) = 0.162

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
3.83	0.810	75.0	91.0	0.99	0.816
0.90	0.190	98.0	98.0	0.20	0.958

Area-averaged catchment yield fraction, Y = 0.843
Area-averaged low loss fraction, Yb = 0.157
++
User entry of time of concentration = 0.135 (hours)
Watershed area = 4.73(Ac.)
Catchment Lag time = 0.108 hours
Unit interval = 5.000 minutes

Unit interval percentage of lag time = 77.4473
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.162(In/Hr)
Average low loss rate fraction (Yb) = 0.157 (decimal)
VALLEY DEVELOPED S-Graph proportion = 0.190
VALLEY UNDEVELOPED S-Graph proportion = 0.810
FOOTHILL S-Graph proportion = 0.000
MOUNTAIN S-Graph proportion = 0.000

Computed peak 5-minute rainfall = 0.520(In)
Computed peak 30-minute rainfall = 1.090(In)
Specified peak 1-hour rainfall = 1.450(In)
Computed peak 3-hour rainfall = 2.430(In)
Specified peak 6-hour rainfall = 3.360(In)
Specified peak 24-hour rainfall = 5.630(In)

Rainfall depth area reduction factors:
Using a total area of 4.73(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.520(In)
30-minute factor = 1.000 Adjusted rainfall = 1.090(In)
1-hour factor = 1.000 Adjusted rainfall = 1.450(In)
3-hour factor = 1.000 Adjusted rainfall = 2.430(In)
6-hour factor = 1.000 Adjusted rainfall = 3.360(In)
24-hour factor = 1.000 Adjusted rainfall = 5.630(In)

U n i t H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 57.20 (CFS))		
1	12.223	6.992
2	57.066	25.652
3	79.869	13.044
4	87.756	4.512
5	92.117	2.494
6	94.747	1.505
7	96.607	1.063
8	97.930	0.757
9	98.833	0.517
10	99.480	0.370
11	100.000	0.298

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.5199	0.5199
2	0.6922	0.1723
3	0.8184	0.1262
4	0.9217	0.1033
5	1.0107	0.0890

6	1.0898	0.0791
7	1.1612	0.0714
8	1.2268	0.0656
9	1.2877	0.0610
10	1.3448	0.0571
11	1.3987	0.0538
12	1.4497	0.0510
13	1.5053	0.0556
14	1.5586	0.0534
15	1.6100	0.0514
16	1.6596	0.0496
17	1.7076	0.0480
18	1.7541	0.0465
19	1.7993	0.0452
20	1.8432	0.0439
21	1.8860	0.0428
22	1.9277	0.0417
23	1.9684	0.0407
24	2.0082	0.0398
25	2.0471	0.0389
26	2.0852	0.0381
27	2.1225	0.0373
28	2.1591	0.0366
29	2.1950	0.0359
30	2.2303	0.0353
31	2.2650	0.0346
32	2.2990	0.0341
33	2.3325	0.0335
34	2.3655	0.0330
35	2.3980	0.0325
36	2.4299	0.0320
37	2.4613	0.0313
38	2.4921	0.0309
39	2.5226	0.0304
40	2.5526	0.0300
41	2.5823	0.0296
42	2.6115	0.0293
43	2.6404	0.0289
44	2.6689	0.0285
45	2.6971	0.0282
46	2.7250	0.0279
47	2.7525	0.0275
48	2.7798	0.0272
49	2.8067	0.0269
50	2.8333	0.0266
51	2.8597	0.0264
52	2.8857	0.0261
53	2.9116	0.0258
54	2.9371	0.0256
55	2.9624	0.0253
56	2.9875	0.0251
57	3.0123	0.0248
58	3.0369	0.0246
59	3.0613	0.0244

60	3.0854	0.0241
61	3.1094	0.0239
62	3.1331	0.0237
63	3.1566	0.0235
64	3.1799	0.0233
65	3.2031	0.0231
66	3.2260	0.0229
67	3.2488	0.0228
68	3.2714	0.0226
69	3.2938	0.0224
70	3.3160	0.0222
71	3.3381	0.0221
72	3.3600	0.0219
73	3.3773	0.0173
74	3.3944	0.0172
75	3.4114	0.0170
76	3.4283	0.0169
77	3.4450	0.0167
78	3.4616	0.0166
79	3.4781	0.0165
80	3.4944	0.0163
81	3.5106	0.0162
82	3.5267	0.0161
83	3.5426	0.0160
84	3.5584	0.0158
85	3.5742	0.0157
86	3.5898	0.0156
87	3.6052	0.0155
88	3.6206	0.0154
89	3.6359	0.0153
90	3.6510	0.0152
91	3.6661	0.0151
92	3.6810	0.0149
93	3.6959	0.0148
94	3.7106	0.0147
95	3.7253	0.0146
96	3.7398	0.0146
97	3.7543	0.0145
98	3.7687	0.0144
99	3.7829	0.0143
100	3.7971	0.0142
101	3.8112	0.0141
102	3.8252	0.0140
103	3.8391	0.0139
104	3.8530	0.0138
105	3.8667	0.0138
106	3.8804	0.0137
107	3.8940	0.0136
108	3.9075	0.0135
109	3.9209	0.0134
110	3.9343	0.0134
111	3.9476	0.0133
112	3.9608	0.0132
113	3.9739	0.0131

114	3.9870	0.0131
115	4.0000	0.0130
116	4.0129	0.0129
117	4.0257	0.0128
118	4.0385	0.0128
119	4.0512	0.0127
120	4.0638	0.0126
121	4.0764	0.0126
122	4.0889	0.0125
123	4.1014	0.0124
124	4.1138	0.0124
125	4.1261	0.0123
126	4.1383	0.0123
127	4.1505	0.0122
128	4.1627	0.0121
129	4.1748	0.0121
130	4.1868	0.0120
131	4.1987	0.0120
132	4.2106	0.0119
133	4.2225	0.0118
134	4.2343	0.0118
135	4.2460	0.0117
136	4.2577	0.0117
137	4.2693	0.0116
138	4.2809	0.0116
139	4.2924	0.0115
140	4.3039	0.0115
141	4.3153	0.0114
142	4.3267	0.0114
143	4.3380	0.0113
144	4.3493	0.0113
145	4.3605	0.0112
146	4.3717	0.0112
147	4.3828	0.0111
148	4.3939	0.0111
149	4.4049	0.0110
150	4.4159	0.0110
151	4.4269	0.0109
152	4.4377	0.0109
153	4.4486	0.0108
154	4.4594	0.0108
155	4.4702	0.0108
156	4.4809	0.0107
157	4.4915	0.0107
158	4.5022	0.0106
159	4.5128	0.0106
160	4.5233	0.0105
161	4.5338	0.0105
162	4.5443	0.0105
163	4.5547	0.0104
164	4.5651	0.0104
165	4.5754	0.0103
166	4.5857	0.0103
167	4.5960	0.0103

168	4.6062	0.0102
169	4.6164	0.0102
170	4.6266	0.0102
171	4.6367	0.0101
172	4.6468	0.0101
173	4.6568	0.0100
174	4.6668	0.0100
175	4.6768	0.0100
176	4.6867	0.0099
177	4.6966	0.0099
178	4.7065	0.0099
179	4.7163	0.0098
180	4.7261	0.0098
181	4.7359	0.0098
182	4.7456	0.0097
183	4.7553	0.0097
184	4.7649	0.0097
185	4.7746	0.0096
186	4.7842	0.0096
187	4.7937	0.0096
188	4.8032	0.0095
189	4.8127	0.0095
190	4.8222	0.0095
191	4.8316	0.0094
192	4.8410	0.0094
193	4.8504	0.0094
194	4.8598	0.0093
195	4.8691	0.0093
196	4.8784	0.0093
197	4.8876	0.0093
198	4.8968	0.0092
199	4.9060	0.0092
200	4.9152	0.0092
201	4.9243	0.0091
202	4.9334	0.0091
203	4.9425	0.0091
204	4.9516	0.0091
205	4.9606	0.0090
206	4.9696	0.0090
207	4.9786	0.0090
208	4.9875	0.0089
209	4.9964	0.0089
210	5.0053	0.0089
211	5.0142	0.0089
212	5.0230	0.0088
213	5.0318	0.0088
214	5.0406	0.0088
215	5.0493	0.0088
216	5.0581	0.0087
217	5.0668	0.0087
218	5.0755	0.0087
219	5.0841	0.0087
220	5.0928	0.0086
221	5.1014	0.0086

222	5.1099	0.0086
223	5.1185	0.0086
224	5.1270	0.0085
225	5.1355	0.0085
226	5.1440	0.0085
227	5.1525	0.0085
228	5.1609	0.0084
229	5.1694	0.0084
230	5.1777	0.0084
231	5.1861	0.0084
232	5.1945	0.0083
233	5.2028	0.0083
234	5.2111	0.0083
235	5.2194	0.0083
236	5.2276	0.0083
237	5.2359	0.0082
238	5.2441	0.0082
239	5.2523	0.0082
240	5.2605	0.0082
241	5.2686	0.0082
242	5.2767	0.0081
243	5.2848	0.0081
244	5.2929	0.0081
245	5.3010	0.0081
246	5.3090	0.0080
247	5.3171	0.0080
248	5.3251	0.0080
249	5.3331	0.0080
250	5.3410	0.0080
251	5.3490	0.0079
252	5.3569	0.0079
253	5.3648	0.0079
254	5.3727	0.0079
255	5.3805	0.0079
256	5.3884	0.0078
257	5.3962	0.0078
258	5.4040	0.0078
259	5.4118	0.0078
260	5.4196	0.0078
261	5.4273	0.0078
262	5.4351	0.0077
263	5.4428	0.0077
264	5.4505	0.0077
265	5.4582	0.0077
266	5.4658	0.0077
267	5.4735	0.0076
268	5.4811	0.0076
269	5.4887	0.0076
270	5.4963	0.0076
271	5.5039	0.0076
272	5.5114	0.0076
273	5.5189	0.0075
274	5.5265	0.0075
275	5.5340	0.0075

276	5.5415	0.0075
277	5.5489	0.0075
278	5.5564	0.0075
279	5.5638	0.0074
280	5.5712	0.0074
281	5.5786	0.0074
282	5.5860	0.0074
283	5.5934	0.0074
284	5.6007	0.0074
285	5.6081	0.0073
286	5.6154	0.0073
287	5.6227	0.0073
288	5.6300	0.0073

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0073	0.0011	0.0061
2	0.0073	0.0011	0.0062
3	0.0073	0.0012	0.0062
4	0.0074	0.0012	0.0062
5	0.0074	0.0012	0.0062
6	0.0074	0.0012	0.0062
7	0.0074	0.0012	0.0063
8	0.0075	0.0012	0.0063
9	0.0075	0.0012	0.0063
10	0.0075	0.0012	0.0063
11	0.0075	0.0012	0.0064
12	0.0076	0.0012	0.0064
13	0.0076	0.0012	0.0064
14	0.0076	0.0012	0.0064
15	0.0076	0.0012	0.0064
16	0.0077	0.0012	0.0065
17	0.0077	0.0012	0.0065
18	0.0077	0.0012	0.0065
19	0.0078	0.0012	0.0065
20	0.0078	0.0012	0.0066
21	0.0078	0.0012	0.0066
22	0.0078	0.0012	0.0066
23	0.0079	0.0012	0.0066
24	0.0079	0.0012	0.0066
25	0.0079	0.0012	0.0067
26	0.0079	0.0012	0.0067
27	0.0080	0.0013	0.0067
28	0.0080	0.0013	0.0067
29	0.0080	0.0013	0.0068
30	0.0081	0.0013	0.0068
31	0.0081	0.0013	0.0068
32	0.0081	0.0013	0.0069
33	0.0082	0.0013	0.0069
34	0.0082	0.0013	0.0069
35	0.0082	0.0013	0.0069
36	0.0083	0.0013	0.0070

37	0.0083	0.0013	0.0070
38	0.0083	0.0013	0.0070
39	0.0084	0.0013	0.0071
40	0.0084	0.0013	0.0071
41	0.0084	0.0013	0.0071
42	0.0085	0.0013	0.0071
43	0.0085	0.0013	0.0072
44	0.0085	0.0013	0.0072
45	0.0086	0.0013	0.0072
46	0.0086	0.0014	0.0073
47	0.0087	0.0014	0.0073
48	0.0087	0.0014	0.0073
49	0.0087	0.0014	0.0074
50	0.0088	0.0014	0.0074
51	0.0088	0.0014	0.0074
52	0.0088	0.0014	0.0074
53	0.0089	0.0014	0.0075
54	0.0089	0.0014	0.0075
55	0.0090	0.0014	0.0076
56	0.0090	0.0014	0.0076
57	0.0091	0.0014	0.0076
58	0.0091	0.0014	0.0077
59	0.0091	0.0014	0.0077
60	0.0092	0.0014	0.0077
61	0.0092	0.0014	0.0078
62	0.0093	0.0015	0.0078
63	0.0093	0.0015	0.0079
64	0.0093	0.0015	0.0079
65	0.0094	0.0015	0.0079
66	0.0094	0.0015	0.0080
67	0.0095	0.0015	0.0080
68	0.0095	0.0015	0.0080
69	0.0096	0.0015	0.0081
70	0.0096	0.0015	0.0081
71	0.0097	0.0015	0.0082
72	0.0097	0.0015	0.0082
73	0.0098	0.0015	0.0083
74	0.0098	0.0015	0.0083
75	0.0099	0.0016	0.0083
76	0.0099	0.0016	0.0084
77	0.0100	0.0016	0.0084
78	0.0100	0.0016	0.0085
79	0.0101	0.0016	0.0085
80	0.0102	0.0016	0.0086
81	0.0102	0.0016	0.0086
82	0.0103	0.0016	0.0087
83	0.0103	0.0016	0.0087
84	0.0104	0.0016	0.0088
85	0.0105	0.0016	0.0088
86	0.0105	0.0016	0.0089
87	0.0106	0.0017	0.0089
88	0.0106	0.0017	0.0090
89	0.0107	0.0017	0.0090
90	0.0108	0.0017	0.0091

91	0.0108	0.0017	0.0091
92	0.0109	0.0017	0.0092
93	0.0110	0.0017	0.0093
94	0.0110	0.0017	0.0093
95	0.0111	0.0017	0.0094
96	0.0112	0.0018	0.0094
97	0.0113	0.0018	0.0095
98	0.0113	0.0018	0.0095
99	0.0114	0.0018	0.0096
100	0.0115	0.0018	0.0097
101	0.0116	0.0018	0.0098
102	0.0116	0.0018	0.0098
103	0.0117	0.0018	0.0099
104	0.0118	0.0018	0.0099
105	0.0119	0.0019	0.0100
106	0.0120	0.0019	0.0101
107	0.0121	0.0019	0.0102
108	0.0121	0.0019	0.0102
109	0.0123	0.0019	0.0103
110	0.0123	0.0019	0.0104
111	0.0124	0.0020	0.0105
112	0.0125	0.0020	0.0105
113	0.0126	0.0020	0.0107
114	0.0127	0.0020	0.0107
115	0.0128	0.0020	0.0108
116	0.0129	0.0020	0.0109
117	0.0131	0.0020	0.0110
118	0.0131	0.0021	0.0111
119	0.0133	0.0021	0.0112
120	0.0134	0.0021	0.0113
121	0.0135	0.0021	0.0114
122	0.0136	0.0021	0.0115
123	0.0138	0.0022	0.0116
124	0.0138	0.0022	0.0117
125	0.0140	0.0022	0.0118
126	0.0141	0.0022	0.0119
127	0.0143	0.0022	0.0120
128	0.0144	0.0023	0.0121
129	0.0146	0.0023	0.0123
130	0.0146	0.0023	0.0124
131	0.0148	0.0023	0.0125
132	0.0149	0.0023	0.0126
133	0.0152	0.0024	0.0128
134	0.0153	0.0024	0.0129
135	0.0155	0.0024	0.0131
136	0.0156	0.0024	0.0132
137	0.0158	0.0025	0.0133
138	0.0160	0.0025	0.0135
139	0.0162	0.0025	0.0137
140	0.0163	0.0026	0.0138
141	0.0166	0.0026	0.0140
142	0.0167	0.0026	0.0141
143	0.0170	0.0027	0.0143
144	0.0172	0.0027	0.0145

145	0.0219	0.0034	0.0185
146	0.0221	0.0035	0.0186
147	0.0224	0.0035	0.0189
148	0.0226	0.0035	0.0190
149	0.0229	0.0036	0.0193
150	0.0231	0.0036	0.0195
151	0.0235	0.0037	0.0198
152	0.0237	0.0037	0.0200
153	0.0241	0.0038	0.0204
154	0.0244	0.0038	0.0205
155	0.0248	0.0039	0.0209
156	0.0251	0.0039	0.0211
157	0.0256	0.0040	0.0215
158	0.0258	0.0040	0.0218
159	0.0264	0.0041	0.0222
160	0.0266	0.0042	0.0225
161	0.0272	0.0043	0.0230
162	0.0275	0.0043	0.0232
163	0.0282	0.0044	0.0238
164	0.0285	0.0045	0.0241
165	0.0293	0.0046	0.0247
166	0.0296	0.0046	0.0250
167	0.0304	0.0048	0.0257
168	0.0309	0.0048	0.0260
169	0.0320	0.0050	0.0270
170	0.0325	0.0051	0.0274
171	0.0335	0.0053	0.0282
172	0.0341	0.0053	0.0287
173	0.0353	0.0055	0.0297
174	0.0359	0.0056	0.0303
175	0.0373	0.0059	0.0315
176	0.0381	0.0060	0.0321
177	0.0398	0.0062	0.0335
178	0.0407	0.0064	0.0343
179	0.0428	0.0067	0.0361
180	0.0439	0.0069	0.0370
181	0.0465	0.0073	0.0392
182	0.0480	0.0075	0.0405
183	0.0514	0.0081	0.0433
184	0.0534	0.0084	0.0450
185	0.0510	0.0080	0.0430
186	0.0538	0.0084	0.0454
187	0.0610	0.0096	0.0514
188	0.0656	0.0103	0.0553
189	0.0791	0.0124	0.0667
190	0.0890	0.0135	0.0755
191	0.1262	0.0135	0.1127
192	0.1723	0.0135	0.1588
193	0.5199	0.0135	0.5064
194	0.1033	0.0135	0.0898
195	0.0714	0.0112	0.0602
196	0.0571	0.0090	0.0481
197	0.0556	0.0087	0.0469
198	0.0496	0.0078	0.0418

199	0.0452	0.0071	0.0381
200	0.0417	0.0065	0.0352
201	0.0389	0.0061	0.0328
202	0.0366	0.0057	0.0309
203	0.0346	0.0054	0.0292
204	0.0330	0.0052	0.0278
205	0.0313	0.0049	0.0264
206	0.0300	0.0047	0.0253
207	0.0289	0.0045	0.0244
208	0.0279	0.0044	0.0235
209	0.0269	0.0042	0.0227
210	0.0261	0.0041	0.0220
211	0.0253	0.0040	0.0213
212	0.0246	0.0039	0.0207
213	0.0239	0.0038	0.0202
214	0.0233	0.0037	0.0197
215	0.0228	0.0036	0.0192
216	0.0222	0.0035	0.0187
217	0.0173	0.0027	0.0146
218	0.0169	0.0026	0.0142
219	0.0165	0.0026	0.0139
220	0.0161	0.0025	0.0136
221	0.0157	0.0025	0.0132
222	0.0154	0.0024	0.0130
223	0.0151	0.0024	0.0127
224	0.0147	0.0023	0.0124
225	0.0145	0.0023	0.0122
226	0.0142	0.0022	0.0120
227	0.0139	0.0022	0.0117
228	0.0137	0.0021	0.0115
229	0.0134	0.0021	0.0113
230	0.0132	0.0021	0.0111
231	0.0130	0.0020	0.0109
232	0.0128	0.0020	0.0108
233	0.0126	0.0020	0.0106
234	0.0124	0.0019	0.0104
235	0.0122	0.0019	0.0103
236	0.0120	0.0019	0.0101
237	0.0118	0.0019	0.0100
238	0.0117	0.0018	0.0099
239	0.0115	0.0018	0.0097
240	0.0114	0.0018	0.0096
241	0.0112	0.0018	0.0095
242	0.0111	0.0017	0.0093
243	0.0109	0.0017	0.0092
244	0.0108	0.0017	0.0091
245	0.0107	0.0017	0.0090
246	0.0105	0.0017	0.0089
247	0.0104	0.0016	0.0088
248	0.0103	0.0016	0.0087
249	0.0102	0.0016	0.0086
250	0.0101	0.0016	0.0085
251	0.0100	0.0016	0.0084
252	0.0099	0.0015	0.0083

253	0.0098	0.0015	0.0082
254	0.0097	0.0015	0.0081
255	0.0096	0.0015	0.0081
256	0.0095	0.0015	0.0080
257	0.0094	0.0015	0.0079
258	0.0093	0.0015	0.0078
259	0.0092	0.0014	0.0078
260	0.0091	0.0014	0.0077
261	0.0090	0.0014	0.0076
262	0.0089	0.0014	0.0075
263	0.0089	0.0014	0.0075
264	0.0088	0.0014	0.0074
265	0.0087	0.0014	0.0073
266	0.0086	0.0014	0.0073
267	0.0086	0.0013	0.0072
268	0.0085	0.0013	0.0072
269	0.0084	0.0013	0.0071
270	0.0083	0.0013	0.0070
271	0.0083	0.0013	0.0070
272	0.0082	0.0013	0.0069
273	0.0082	0.0013	0.0069
274	0.0081	0.0013	0.0068
275	0.0080	0.0013	0.0068
276	0.0080	0.0012	0.0067
277	0.0079	0.0012	0.0067
278	0.0078	0.0012	0.0066
279	0.0078	0.0012	0.0066
280	0.0077	0.0012	0.0065
281	0.0077	0.0012	0.0065
282	0.0076	0.0012	0.0064
283	0.0076	0.0012	0.0064
284	0.0075	0.0012	0.0063
285	0.0075	0.0012	0.0063
286	0.0074	0.0012	0.0063
287	0.0074	0.0012	0.0062
288	0.0073	0.0011	0.0062

Total soil rain loss = 0.79(In)
Total effective rainfall = 4.84(In)
Peak flow rate in flood hydrograph = 16.64(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

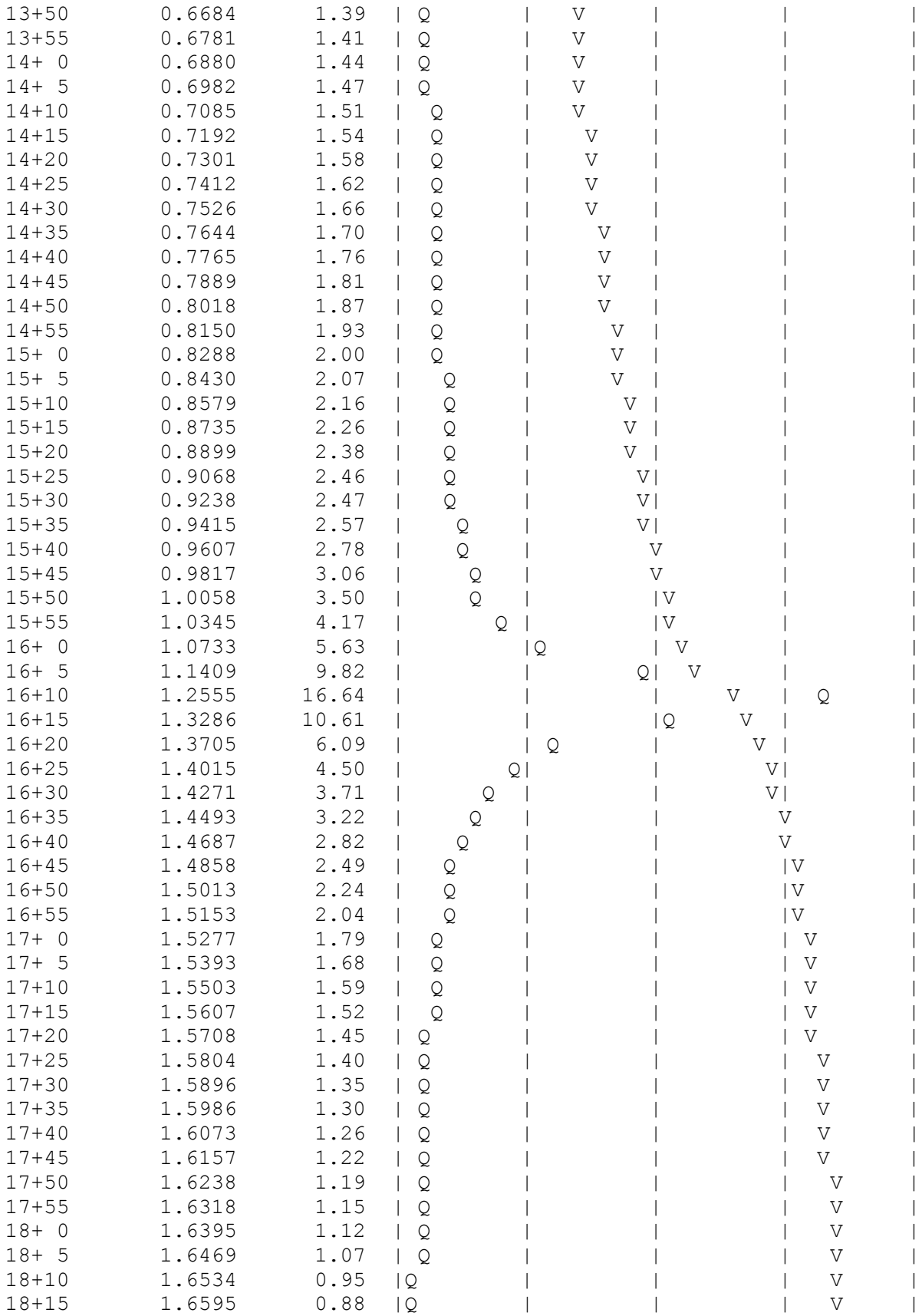
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0003	0.04	Q	|	|	|	|
0+10	0.0017	0.20	Q	|	|	|	|
0+15	0.0036	0.28	Q	|	|	|	|

0+20	0.0058	0.31	Q				
0+25	0.0080	0.33	Q				
0+30	0.0103	0.34	Q				
0+35	0.0127	0.34	Q				
0+40	0.0151	0.35	Q				
0+45	0.0175	0.35	Q				
0+50	0.0200	0.36	Q				
0+55	0.0225	0.36	Q				
1+ 0	0.0250	0.36	Q				
1+ 5	0.0275	0.36	Q				
1+10	0.0300	0.36	Q				
1+15	0.0325	0.37	Q				
1+20	0.0351	0.37	Q				
1+25	0.0376	0.37	Q				
1+30	0.0401	0.37	Q				
1+35	0.0427	0.37	Q				
1+40	0.0453	0.37	Q				
1+45	0.0478	0.37	QV				
1+50	0.0504	0.38	QV				
1+55	0.0530	0.38	QV				
2+ 0	0.0556	0.38	QV				
2+ 5	0.0582	0.38	QV				
2+10	0.0609	0.38	QV				
2+15	0.0635	0.38	QV				
2+20	0.0661	0.38	QV				
2+25	0.0688	0.39	QV				
2+30	0.0714	0.39	QV				
2+35	0.0741	0.39	QV				
2+40	0.0768	0.39	QV				
2+45	0.0795	0.39	QV				
2+50	0.0822	0.39	QV				
2+55	0.0849	0.39	QV				
3+ 0	0.0876	0.40	QV				
3+ 5	0.0904	0.40	QV				
3+10	0.0931	0.40	QV				
3+15	0.0959	0.40	Q V				
3+20	0.0986	0.40	Q V				
3+25	0.1014	0.40	Q V				
3+30	0.1042	0.41	Q V				
3+35	0.1070	0.41	Q V				
3+40	0.1098	0.41	Q V				
3+45	0.1127	0.41	Q V				
3+50	0.1155	0.41	Q V				
3+55	0.1184	0.41	Q V				
4+ 0	0.1212	0.42	Q V				
4+ 5	0.1241	0.42	Q V				
4+10	0.1270	0.42	Q V				
4+15	0.1299	0.42	Q V				
4+20	0.1328	0.42	Q V				
4+25	0.1357	0.42	Q V				
4+30	0.1387	0.43	Q V				
4+35	0.1416	0.43	Q V				
4+40	0.1446	0.43	Q V				
4+45	0.1476	0.43	Q V				

4+50	0.1506	0.43	Q V	|	|	|	|
4+55	0.1536	0.44	Q V	|	|	|	|
5+ 0	0.1566	0.44	Q V	|	|	|	|
5+ 5	0.1596	0.44	Q V	|	|	|	|
5+10	0.1627	0.44	Q V	|	|	|	|
5+15	0.1657	0.44	Q V	|	|	|	|
5+20	0.1688	0.45	Q V	|	|	|	|
5+25	0.1719	0.45	Q V	|	|	|	|
5+30	0.1750	0.45	Q V	|	|	|	|
5+35	0.1781	0.45	Q V	|	|	|	|
5+40	0.1813	0.46	Q V	|	|	|	|
5+45	0.1844	0.46	Q V	|	|	|	|
5+50	0.1876	0.46	Q V	|	|	|	|
5+55	0.1908	0.46	Q V	|	|	|	|
6+ 0	0.1940	0.47	Q V	|	|	|	|
6+ 5	0.1972	0.47	Q V	|	|	|	|
6+10	0.2004	0.47	Q V	|	|	|	|
6+15	0.2037	0.47	Q V	|	|	|	|
6+20	0.2070	0.47	Q V	|	|	|	|
6+25	0.2103	0.48	Q V	|	|	|	|
6+30	0.2136	0.48	Q V	|	|	|	|
6+35	0.2169	0.48	Q V	|	|	|	|
6+40	0.2202	0.49	Q V	|	|	|	|
6+45	0.2236	0.49	Q V	|	|	|	|
6+50	0.2270	0.49	Q V	|	|	|	|
6+55	0.2304	0.49	Q V	|	|	|	|
7+ 0	0.2338	0.50	Q V	|	|	|	|
7+ 5	0.2372	0.50	Q V	|	|	|	|
7+10	0.2407	0.50	|Q V	|	|	|	|
7+15	0.2442	0.50	|Q V	|	|	|	|
7+20	0.2476	0.51	|Q V	|	|	|	|
7+25	0.2512	0.51	|Q V	|	|	|	|
7+30	0.2547	0.51	|Q V	|	|	|	|
7+35	0.2583	0.52	|Q V	|	|	|	|
7+40	0.2618	0.52	|Q V	|	|	|	|
7+45	0.2655	0.52	|Q V	|	|	|	|
7+50	0.2691	0.53	|Q V	|	|	|	|
7+55	0.2727	0.53	|Q V	|	|	|	|
8+ 0	0.2764	0.53	|Q V	|	|	|	|
8+ 5	0.2801	0.54	|Q V	|	|	|	|
8+10	0.2838	0.54	|Q V	|	|	|	|
8+15	0.2876	0.54	|Q V	|	|	|	|
8+20	0.2913	0.55	|Q V	|	|	|	|
8+25	0.2951	0.55	|Q V	|	|	|	|
8+30	0.2989	0.55	|Q V	|	|	|	|
8+35	0.3028	0.56	|Q V	|	|	|	|
8+40	0.3067	0.56	|Q V	|	|	|	|
8+45	0.3106	0.57	|Q V	|	|	|	|
8+50	0.3145	0.57	|Q V	|	|	|	|
8+55	0.3184	0.57	|Q V	|	|	|	|
9+ 0	0.3224	0.58	|Q V	|	|	|	|
9+ 5	0.3264	0.58	|Q V	|	|	|	|
9+10	0.3305	0.59	|Q V	|	|	|	|
9+15	0.3346	0.59	|Q V	|	|	|	|

9+20	0.3387	0.60	Q	V			
9+25	0.3428	0.60	Q	V			
9+30	0.3470	0.61	Q	V			
9+35	0.3512	0.61	Q	V			
9+40	0.3554	0.61	Q	V			
9+45	0.3597	0.62	Q	V			
9+50	0.3640	0.62	Q	V			
9+55	0.3683	0.63	Q	V			
10+ 0	0.3727	0.64	Q	V			
10+ 5	0.3771	0.64	Q	V			
10+10	0.3815	0.65	Q	V			
10+15	0.3860	0.65	Q	V			
10+20	0.3906	0.66	Q	V			
10+25	0.3951	0.66	Q	V			
10+30	0.3997	0.67	Q	V			
10+35	0.4044	0.68	Q	V			
10+40	0.4091	0.68	Q	V			
10+45	0.4138	0.69	Q	V			
10+50	0.4186	0.70	Q	V			
10+55	0.4235	0.70	Q	V			
11+ 0	0.4284	0.71	Q	V			
11+ 5	0.4333	0.72	Q	V			
11+10	0.4383	0.72	Q	V			
11+15	0.4433	0.73	Q	V			
11+20	0.4484	0.74	Q	V			
11+25	0.4535	0.75	Q	V			
11+30	0.4587	0.76	Q	V			
11+35	0.4640	0.76	Q	V			
11+40	0.4693	0.77	Q	V			
11+45	0.4747	0.78	Q	V			
11+50	0.4802	0.79	Q	V			
11+55	0.4857	0.80	Q	V			
12+ 0	0.4913	0.81	Q	V			
12+ 5	0.4971	0.85	Q	V			
12+10	0.5037	0.95	Q	V			
12+15	0.5106	1.01	Q	V			
12+20	0.5178	1.04	Q	V			
12+25	0.5252	1.06	Q	V			
12+30	0.5326	1.08	Q	V			
12+35	0.5402	1.10	Q	V			
12+40	0.5479	1.12	Q	V			
12+45	0.5557	1.13	Q	V			
12+50	0.5636	1.15	Q	V			
12+55	0.5716	1.17	Q	V			
13+ 0	0.5798	1.18	Q	V			
13+ 5	0.5880	1.20	Q	V			
13+10	0.5964	1.22	Q	V			
13+15	0.6049	1.23	Q	V			
13+20	0.6135	1.25	Q	V			
13+25	0.6223	1.27	Q	V			
13+30	0.6312	1.29	Q	V			
13+35	0.6402	1.31	Q	V			
13+40	0.6494	1.34	Q	V			
13+45	0.6588	1.36	Q	V			



18+20	1.6652	0.84	|Q	|	|	|	V |
18+25	1.6708	0.81	|Q	|	|	|	V |
18+30	1.6762	0.79	|Q	|	|	|	V |
18+35	1.6815	0.76	|Q	|	|	|	V |
18+40	1.6866	0.74	|Q	|	|	|	V |
18+45	1.6916	0.73	|Q	|	|	|	V |
18+50	1.6965	0.71	|Q	|	|	|	V |
18+55	1.7013	0.70	|Q	|	|	|	V |
19+ 0	1.7060	0.68	|Q	|	|	|	V |
19+ 5	1.7106	0.67	|Q	|	|	|	V |
19+10	1.7152	0.66	|Q	|	|	|	V |
19+15	1.7196	0.65	|Q	|	|	|	V |
19+20	1.7240	0.64	|Q	|	|	|	V |
19+25	1.7283	0.63	|Q	|	|	|	V |
19+30	1.7326	0.62	|Q	|	|	|	V |
19+35	1.7367	0.61	|Q	|	|	|	V |
19+40	1.7408	0.60	|Q	|	|	|	V |
19+45	1.7449	0.59	|Q	|	|	|	V |
19+50	1.7489	0.58	|Q	|	|	|	V |
19+55	1.7528	0.57	|Q	|	|	|	V |
20+ 0	1.7567	0.56	|Q	|	|	|	V |
20+ 5	1.7605	0.56	|Q	|	|	|	V |
20+10	1.7643	0.55	|Q	|	|	|	V |
20+15	1.7680	0.54	|Q	|	|	|	V |
20+20	1.7717	0.53	|Q	|	|	|	V |
20+25	1.7753	0.53	|Q	|	|	|	V |
20+30	1.7789	0.52	|Q	|	|	|	V |
20+35	1.7824	0.51	|Q	|	|	|	V |
20+40	1.7859	0.51	|Q	|	|	|	V |
20+45	1.7894	0.50	|Q	|	|	|	V |
20+50	1.7928	0.50	Q	|	|	|	V |
20+55	1.7962	0.49	Q	|	|	|	V |
21+ 0	1.7995	0.49	Q	|	|	|	V |
21+ 5	1.8028	0.48	Q	|	|	|	V |
21+10	1.8061	0.48	Q	|	|	|	V |
21+15	1.8093	0.47	Q	|	|	|	V |
21+20	1.8125	0.47	Q	|	|	|	V |
21+25	1.8157	0.46	Q	|	|	|	V |
21+30	1.8188	0.46	Q	|	|	|	V |
21+35	1.8220	0.45	Q	|	|	|	V |
21+40	1.8250	0.45	Q	|	|	|	V |
21+45	1.8281	0.44	Q	|	|	|	V |
21+50	1.8311	0.44	Q	|	|	|	V |
21+55	1.8341	0.43	Q	|	|	|	V |
22+ 0	1.8371	0.43	Q	|	|	|	V |
22+ 5	1.8400	0.43	Q	|	|	|	V |
22+10	1.8429	0.42	Q	|	|	|	V |
22+15	1.8458	0.42	Q	|	|	|	V |
22+20	1.8487	0.42	Q	|	|	|	V |
22+25	1.8515	0.41	Q	|	|	|	V |
22+30	1.8543	0.41	Q	|	|	|	V |
22+35	1.8571	0.41	Q	|	|	|	V |
22+40	1.8599	0.40	Q	|	|	|	V|
22+45	1.8626	0.40	Q	|	|	|	V|

22+50	1.8654	0.40	Q	|	|	|	V|
22+55	1.8681	0.39	Q	|	|	|	V|
23+ 0	1.8708	0.39	Q	|	|	|	V|
23+ 5	1.8734	0.39	Q	|	|	|	V|
23+10	1.8761	0.38	Q	|	|	|	V|
23+15	1.8787	0.38	Q	|	|	|	V|
23+20	1.8813	0.38	Q	|	|	|	V|
23+25	1.8839	0.38	Q	|	|	|	V|
23+30	1.8864	0.37	Q	|	|	|	V|
23+35	1.8890	0.37	Q	|	|	|	V|
23+40	1.8915	0.37	Q	|	|	|	V|
23+45	1.8940	0.36	Q	|	|	|	V|
23+50	1.8965	0.36	Q	|	|	|	V|
23+55	1.8990	0.36	Q	|	|	|	V|
24+ 0	1.9015	0.36	Q	|	|	|	V|
24+ 5	1.9036	0.31	Q	|	|	|	V|
24+10	1.9047	0.15	Q	|	|	|	V|
24+15	1.9052	0.07	Q	|	|	|	V|
24+20	1.9055	0.04	Q	|	|	|	V|
24+25	1.9057	0.03	Q	|	|	|	V|
24+30	1.9058	0.02	Q	|	|	|	V|
24+35	1.9059	0.01	Q	|	|	|	V|
24+40	1.9059	0.01	Q	|	|	|	V|
24+45	1.9059	0.00	Q	|	|	|	V|
24+50	1.9060	0.00	Q	|	|	|	V|

Appendix 4

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2005
Study date: 03/17/19

Detention Basin 100 year

Program License Serial Number 6004

********** HYDROGRAPH INFORMATION **********

From study/file name: garg100.rte
**********HYDROGRAPH DATA**********
Number of intervals = 298
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 16.637 (CFS)
Total volume = 1.906 (Ac.Ft)
Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

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Process from Point/Station 105.000 to Point/Station 106.000
**** RETARDING BASIN ROUTING ****
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User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 298
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth	Storage	Outflow	(S-O*dt/2)	(S+O*dt/2)

(Ft.)	(Ac.Ft)	(CFS)	(Ac.Ft)	(Ac.Ft)
0.000	0.000	0.000	0.000	0.000
0.500	0.030	0.001	0.030	0.030
1.080	0.115	0.002	0.115	0.115
1.670	0.257	0.003	0.257	0.257
2.670	0.411	12.880	0.367	0.455

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0 4.2 8.32 12.48 16.64	Depth (Ft.)
0.083	0.04	0.00	0.000	O | | | |	0.00
0.167	0.20	0.00	0.001	O | | | |	0.02
0.250	0.28	0.00	0.003	O | | | |	0.04
0.333	0.31	0.00	0.005	O | | | |	0.08
0.417	0.33	0.00	0.007	O | | | |	0.11
0.500	0.34	0.00	0.009	O | | | |	0.15
0.583	0.34	0.00	0.011	O | | | |	0.19
0.667	0.35	0.00	0.014	O | | | |	0.23
0.750	0.35	0.00	0.016	O | | | |	0.27
0.833	0.36	0.00	0.019	O | | | |	0.31
0.917	0.36	0.00	0.021	O | | | |	0.35
1.000	0.36	0.00	0.024	O | | | |	0.40
1.083	0.36	0.00	0.026	O | | | |	0.44
1.167	0.36	0.00	0.029	O | | | |	0.48
1.250	0.37	0.00	0.031	O | | | |	0.51
1.333	0.37	0.00	0.034	O | | | |	0.53
1.417	0.37	0.00	0.036	O | | | |	0.54
1.500	0.37	0.00	0.039	O | | | |	0.56
1.583	0.37	0.00	0.041	O | | | |	0.58
1.667	0.37	0.00	0.044	O | | | |	0.59
1.750	0.37	0.00	0.046	O | | | |	0.61
1.833	0.38	0.00	0.049	O | | | |	0.63
1.917	0.38	0.00	0.052	O | | | |	0.65
2.000	0.38	0.00	0.054	O | | | |	0.67
2.083	0.38	0.00	0.057	O | | | |	0.68
2.167	0.38	0.00	0.059	O | | | |	0.70
2.250	0.38	0.00	0.062	O | | | |	0.72
2.333	0.38	0.00	0.065	O | | | |	0.74
2.417	0.39	0.00	0.067	O | | | |	0.75
2.500	0.39	0.00	0.070	O | | | |	0.77
2.583	0.39	0.00	0.073	O | | | |	0.79
2.667	0.39	0.00	0.075	O | | | |	0.81
2.750	0.39	0.00	0.078	O | | | |	0.83
2.833	0.39	0.00	0.081	O | | | |	0.85
2.917	0.39	0.00	0.083	O | | | |	0.86
3.000	0.40	0.00	0.086	O | | | |	0.88
3.083	0.40	0.00	0.089	O | | | |	0.90
3.167	0.40	0.00	0.091	O | | | |	0.92
3.250	0.40	0.00	0.094	O | | | |	0.94

3.333	0.40	0.00	0.097	O				0.96
3.417	0.40	0.00	0.100	O				0.98
3.500	0.41	0.00	0.103	O				0.99
3.583	0.41	0.00	0.105	O				1.01
3.667	0.41	0.00	0.108	O				1.03
3.750	0.41	0.00	0.111	O				1.05
3.833	0.41	0.00	0.114	O				1.07
3.917	0.41	0.00	0.117	O				1.09
4.000	0.42	0.00	0.119	O				1.10
4.083	0.42	0.00	0.122	O				1.11
4.167	0.42	0.00	0.125	O				1.12
4.250	0.42	0.00	0.128	O				1.13
4.333	0.42	0.00	0.131	O				1.15
4.417	0.42	0.00	0.134	O				1.16
4.500	0.43	0.00	0.137	O				1.17
4.583	0.43	0.00	0.140	O				1.18
4.667	0.43	0.00	0.143	O				1.19
4.750	0.43	0.00	0.146	O				1.21
4.833	0.43	0.00	0.149	O				1.22
4.917	0.44	0.00	0.152	O				1.23
5.000	0.44	0.00	0.155	O				1.24
5.083	0.44	0.00	0.158	O				1.26
5.167	0.44	0.00	0.161	O				1.27
5.250	0.44	0.00	0.164	O				1.28
5.333	0.45	0.00	0.167	O				1.29
5.417	0.45	0.00	0.170	O				1.31
5.500	0.45	0.00	0.173	O				1.32
5.583	0.45	0.00	0.176	O				1.33
5.667	0.46	0.00	0.179	O				1.35
5.750	0.46	0.00	0.182	O				1.36
5.833	0.46	0.00	0.185	O				1.37
5.917	0.46	0.00	0.188	O				1.39
6.000	0.47	0.00	0.192	O				1.40
6.083	0.47	0.00	0.195	O				1.41
6.167	0.47	0.00	0.198	O				1.42
6.250	0.47	0.00	0.201	O				1.44
6.333	0.47	0.00	0.204	O				1.45
6.417	0.48	0.00	0.208	O				1.47
6.500	0.48	0.00	0.211	O				1.48
6.583	0.48	0.00	0.214	O				1.49
6.667	0.49	0.00	0.218	O				1.51
6.750	0.49	0.00	0.221	O				1.52
6.833	0.49	0.00	0.224	O				1.53
6.917	0.49	0.00	0.228	O				1.55
7.000	0.50	0.00	0.231	O				1.56
7.083	0.50	0.00	0.234	O				1.58
7.167	0.50	0.00	0.238	O				1.59
7.250	0.50	0.00	0.241	O				1.61
7.333	0.51	0.00	0.245	O				1.62
7.417	0.51	0.00	0.248	O				1.63
7.500	0.51	0.00	0.252	O				1.65
7.583	0.52	0.00	0.255	O				1.66
7.667	0.52	0.13	0.258	OI				1.68
7.750	0.52	0.30	0.261	OI				1.69

7.833	0.53	0.40	0.262	OI	|	|	|	1.70
7.917	0.53	0.46	0.262	OI	|	|	|	1.71
8.000	0.53	0.49	0.263	OI	|	|	|	1.71
8.083	0.54	0.51	0.263	OI	|	|	|	1.71
8.167	0.54	0.52	0.263	|O	|	|	|	1.71
8.250	0.54	0.53	0.263	|O	|	|	|	1.71
8.333	0.55	0.54	0.263	|O	|	|	|	1.71
8.417	0.55	0.54	0.263	|O	|	|	|	1.71
8.500	0.55	0.55	0.264	|O	|	|	|	1.71
8.583	0.56	0.55	0.264	|O	|	|	|	1.71
8.667	0.56	0.56	0.264	|O	|	|	|	1.71
8.750	0.57	0.56	0.264	|O	|	|	|	1.71
8.833	0.57	0.56	0.264	|O	|	|	|	1.71
8.917	0.57	0.57	0.264	|O	|	|	|	1.71
9.000	0.58	0.57	0.264	|O	|	|	|	1.71
9.083	0.58	0.58	0.264	|O	|	|	|	1.71
9.167	0.59	0.58	0.264	|O	|	|	|	1.71
9.250	0.59	0.58	0.264	|O	|	|	|	1.72
9.333	0.60	0.59	0.264	|O	|	|	|	1.72
9.417	0.60	0.59	0.264	|O	|	|	|	1.72
9.500	0.61	0.60	0.264	|O	|	|	|	1.72
9.583	0.61	0.60	0.264	|O	|	|	|	1.72
9.667	0.61	0.61	0.264	|O	|	|	|	1.72
9.750	0.62	0.61	0.264	|O	|	|	|	1.72
9.833	0.62	0.62	0.264	|O	|	|	|	1.72
9.917	0.63	0.62	0.264	|O	|	|	|	1.72
10.000	0.64	0.63	0.264	|O	|	|	|	1.72
10.083	0.64	0.63	0.265	|O	|	|	|	1.72
10.167	0.65	0.64	0.265	|O	|	|	|	1.72
10.250	0.65	0.64	0.265	|O	|	|	|	1.72
10.333	0.66	0.65	0.265	|O	|	|	|	1.72
10.417	0.66	0.65	0.265	|O	|	|	|	1.72
10.500	0.67	0.66	0.265	|O	|	|	|	1.72
10.583	0.68	0.67	0.265	|O	|	|	|	1.72
10.667	0.68	0.67	0.265	|O	|	|	|	1.72
10.750	0.69	0.68	0.265	|O	|	|	|	1.72
10.833	0.70	0.68	0.265	|O	|	|	|	1.72
10.917	0.70	0.69	0.265	|O	|	|	|	1.72
11.000	0.71	0.70	0.265	|O	|	|	|	1.72
11.083	0.72	0.70	0.265	|O	|	|	|	1.72
11.167	0.72	0.71	0.265	|O	|	|	|	1.73
11.250	0.73	0.72	0.266	|O	|	|	|	1.73
11.333	0.74	0.73	0.266	|O	|	|	|	1.73
11.417	0.75	0.73	0.266	|O	|	|	|	1.73
11.500	0.76	0.74	0.266	|O	|	|	|	1.73
11.583	0.76	0.75	0.266	|O	|	|	|	1.73
11.667	0.77	0.76	0.266	|O	|	|	|	1.73
11.750	0.78	0.77	0.266	|O	|	|	|	1.73
11.833	0.79	0.78	0.266	|O	|	|	|	1.73
11.917	0.80	0.78	0.266	|O	|	|	|	1.73
12.000	0.81	0.79	0.266	|O	|	|	|	1.73
12.083	0.85	0.81	0.267	|O	|	|	|	1.73
12.167	0.95	0.85	0.267	|O	|	|	|	1.74
12.250	1.01	0.91	0.268	|O	|	|	|	1.74

12.333	1.04	0.96	0.268	OI				1.74
12.417	1.06	1.00	0.269	OI				1.75
12.500	1.08	1.03	0.269	OI				1.75
12.583	1.10	1.06	0.270	O				1.75
12.667	1.12	1.08	0.270	O				1.75
12.750	1.13	1.10	0.270	O				1.76
12.833	1.15	1.12	0.270	O				1.76
12.917	1.17	1.14	0.271	O				1.76
13.000	1.18	1.15	0.271	O				1.76
13.083	1.20	1.17	0.271	O				1.76
13.167	1.22	1.19	0.271	O				1.76
13.250	1.23	1.20	0.271	O				1.76
13.333	1.25	1.22	0.272	O				1.76
13.417	1.27	1.24	0.272	O				1.77
13.500	1.29	1.26	0.272	O				1.77
13.583	1.31	1.28	0.272	O				1.77
13.667	1.34	1.30	0.273	O				1.77
13.750	1.36	1.32	0.273	O				1.77
13.833	1.39	1.35	0.273	O				1.77
13.917	1.41	1.37	0.273	O				1.78
14.000	1.44	1.40	0.274	O				1.78
14.083	1.47	1.42	0.274	O				1.78
14.167	1.51	1.45	0.274	O				1.78
14.250	1.54	1.49	0.275	O				1.79
14.333	1.58	1.52	0.275	OI				1.79
14.417	1.62	1.56	0.276	OI				1.79
14.500	1.66	1.59	0.276	O				1.79
14.583	1.70	1.63	0.276	O				1.80
14.667	1.76	1.68	0.277	O				1.80
14.750	1.81	1.72	0.278	O				1.80
14.833	1.87	1.77	0.278	O				1.81
14.917	1.93	1.83	0.279	O				1.81
15.000	2.00	1.89	0.280	O				1.82
15.083	2.07	1.95	0.280	O				1.82
15.167	2.16	2.03	0.281	OI				1.83
15.250	2.26	2.11	0.282	O				1.83
15.333	2.38	2.20	0.283	O				1.84
15.417	2.46	2.30	0.284	O				1.85
15.500	2.47	2.37	0.285	O				1.85
15.583	2.57	2.44	0.286	O				1.86
15.667	2.78	2.54	0.287	OI				1.87
15.750	3.06	2.71	0.289	O				1.88
15.833	3.50	2.96	0.292	OI				1.90
15.917	4.17	3.35	0.297	O I				1.93
16.000	5.63	4.05	0.305	O I				1.98
16.083	9.82	5.69	0.325	O	I			2.11
16.167	16.64	9.06	0.365		O		I	2.37
16.250	10.61	11.10	0.390		IO			2.53
16.333	6.09	9.87	0.375	I	O			2.44
16.417	4.50	7.83	0.351	I O				2.28
16.500	3.71	6.16	0.331	I O				2.15
16.583	3.22	4.96	0.316	I O				2.05
16.667	2.82	4.09	0.306	I O				1.99
16.750	2.49	3.45	0.298	I O				1.94

16.833	2.24	2.96	0.292	IO				1.90
16.917	2.04	2.60	0.288	IO				1.87
17.000	1.79	2.29	0.284	IO				1.85
17.083	1.68	2.05	0.281	O				1.83
17.167	1.59	1.86	0.279	O				1.81
17.250	1.52	1.73	0.278	IO				1.80
17.333	1.45	1.62	0.276	IO				1.80
17.417	1.40	1.53	0.275	O				1.79
17.500	1.35	1.46	0.274	O				1.78
17.583	1.30	1.40	0.274	O				1.78
17.667	1.26	1.35	0.273	O				1.77
17.750	1.22	1.30	0.272	O				1.77
17.833	1.19	1.26	0.272	O				1.77
17.917	1.15	1.22	0.272	O				1.76
18.000	1.12	1.18	0.271	O				1.76
18.083	1.07	1.14	0.271	O				1.76
18.167	0.95	1.08	0.270	IO				1.75
18.250	0.88	1.01	0.269	O				1.75
18.333	0.84	0.94	0.268	O				1.74
18.417	0.81	0.89	0.268	O				1.74
18.500	0.79	0.85	0.267	O				1.74
18.583	0.76	0.82	0.267	O				1.73
18.667	0.74	0.79	0.266	O				1.73
18.750	0.73	0.76	0.266	O				1.73
18.833	0.71	0.74	0.266	O				1.73
18.917	0.70	0.73	0.266	O				1.73
19.000	0.68	0.71	0.265	O				1.72
19.083	0.67	0.70	0.265	O				1.72
19.167	0.66	0.68	0.265	O				1.72
19.250	0.65	0.67	0.265	O				1.72
19.333	0.64	0.66	0.265	O				1.72
19.417	0.63	0.64	0.265	O				1.72
19.500	0.62	0.63	0.265	O				1.72
19.583	0.61	0.62	0.264	O				1.72
19.667	0.60	0.61	0.264	O				1.72
19.750	0.59	0.60	0.264	O				1.72
19.833	0.58	0.59	0.264	O				1.72
19.917	0.57	0.59	0.264	O				1.72
20.000	0.56	0.58	0.264	O				1.71
20.083	0.56	0.57	0.264	O				1.71
20.167	0.55	0.56	0.264	O				1.71
20.250	0.54	0.55	0.264	O				1.71
20.333	0.53	0.55	0.263	O				1.71
20.417	0.53	0.54	0.263	O				1.71
20.500	0.52	0.53	0.263	O				1.71
20.583	0.51	0.53	0.263	IO				1.71
20.667	0.51	0.52	0.263	O				1.71
20.750	0.50	0.51	0.263	O				1.71
20.833	0.50	0.51	0.263	O				1.71
20.917	0.49	0.50	0.263	O				1.71
21.000	0.49	0.50	0.263	O				1.71
21.083	0.48	0.49	0.263	O				1.71
21.167	0.48	0.48	0.263	O				1.71
21.250	0.47	0.48	0.263	O				1.71

21.333	0.47	0.47	0.263	O	|	|	|	1.71
21.417	0.46	0.47	0.263	O	|	|	|	1.71
21.500	0.46	0.46	0.263	O	|	|	|	1.71
21.583	0.45	0.46	0.262	O	|	|	|	1.71
21.667	0.45	0.45	0.262	O	|	|	|	1.71
21.750	0.44	0.45	0.262	O	|	|	|	1.70
21.833	0.44	0.45	0.262	O	|	|	|	1.70
21.917	0.43	0.44	0.262	O	|	|	|	1.70
22.000	0.43	0.44	0.262	O	|	|	|	1.70
22.083	0.43	0.43	0.262	O	|	|	|	1.70
22.167	0.42	0.43	0.262	O	|	|	|	1.70
22.250	0.42	0.43	0.262	O	|	|	|	1.70
22.333	0.42	0.42	0.262	O	|	|	|	1.70
22.417	0.41	0.42	0.262	O	|	|	|	1.70
22.500	0.41	0.42	0.262	O	|	|	|	1.70
22.583	0.41	0.41	0.262	O	|	|	|	1.70
22.667	0.40	0.41	0.262	O	|	|	|	1.70
22.750	0.40	0.40	0.262	O	|	|	|	1.70
22.833	0.40	0.40	0.262	O	|	|	|	1.70
22.917	0.39	0.40	0.262	O	|	|	|	1.70
23.000	0.39	0.40	0.262	O	|	|	|	1.70
23.083	0.39	0.39	0.262	O	|	|	|	1.70
23.167	0.38	0.39	0.262	O	|	|	|	1.70
23.250	0.38	0.39	0.262	O	|	|	|	1.70
23.333	0.38	0.38	0.262	O	|	|	|	1.70
23.417	0.38	0.38	0.262	O	|	|	|	1.70
23.500	0.37	0.38	0.261	O	|	|	|	1.70
23.583	0.37	0.37	0.261	O	|	|	|	1.70
23.667	0.37	0.37	0.261	O	|	|	|	1.70
23.750	0.36	0.37	0.261	O	|	|	|	1.70
23.833	0.36	0.37	0.261	O	|	|	|	1.70
23.917	0.36	0.36	0.261	O	|	|	|	1.70
24.000	0.36	0.36	0.261	O	|	|	|	1.70
24.083	0.31	0.35	0.261	O	|	|	|	1.70
24.167	0.15	0.30	0.261	O	|	|	|	1.69
24.250	0.07	0.21	0.260	O	|	|	|	1.69
24.333	0.04	0.14	0.259	O	|	|	|	1.68
24.417	0.03	0.10	0.258	O	|	|	|	1.68
24.500	0.02	0.06	0.258	O	|	|	|	1.67
24.583	0.01	0.04	0.257	O	|	|	|	1.67
24.667	0.01	0.03	0.257	O	|	|	|	1.67
24.750	0.00	0.02	0.257	O	|	|	|	1.67
24.833	0.00	0.01	0.257	O	|	|	|	1.67
24.917	0.00	0.01	0.257	O	|	|	|	1.67
25.000	0.00	0.00	0.257	O	|	|	|	1.67
25.083	0.00	0.00	0.257	O	|	|	|	1.67
25.167	0.00	0.00	0.257	O	|	|	|	1.67
25.250	0.00	0.00	0.257	O	|	|	|	1.67
25.333	0.00	0.00	0.257	O	|	|	|	1.67
25.417	0.00	0.00	0.257	O	|	|	|	1.67
25.500	0.00	0.00	0.257	O	|	|	|	1.67
25.583	0.00	0.00	0.257	O	|	|	|	1.67
25.667	0.00	0.00	0.257	O	|	|	|	1.67
25.750	0.00	0.00	0.257	O	|	|	|	1.67

25.833	0.00	0.00	0.257	O				1.67
25.917	0.00	0.00	0.257	O				1.67
26.000	0.00	0.00	0.257	O				1.67
26.083	0.00	0.00	0.257	O				1.67
26.167	0.00	0.00	0.257	O				1.67
26.250	0.00	0.00	0.257	O				1.67
26.333	0.00	0.00	0.257	O				1.67
26.417	0.00	0.00	0.257	O				1.67
26.500	0.00	0.00	0.257	O				1.67
26.583	0.00	0.00	0.257	O				1.67
26.667	0.00	0.00	0.257	O				1.67
26.750	0.00	0.00	0.257	O				1.67
26.833	0.00	0.00	0.257	O				1.67
26.917	0.00	0.00	0.257	O				1.67
27.000	0.00	0.00	0.257	O				1.67
27.083	0.00	0.00	0.256	O				1.67
27.167	0.00	0.00	0.256	O				1.67
27.250	0.00	0.00	0.256	O				1.67
27.333	0.00	0.00	0.256	O				1.67
27.417	0.00	0.00	0.256	O				1.67
27.500	0.00	0.00	0.256	O				1.67
27.583	0.00	0.00	0.256	O				1.67
27.667	0.00	0.00	0.256	O				1.67
27.750	0.00	0.00	0.256	O				1.67
27.833	0.00	0.00	0.256	O				1.67
27.917	0.00	0.00	0.256	O				1.67
28.000	0.00	0.00	0.256	O				1.67
28.083	0.00	0.00	0.256	O				1.67
28.167	0.00	0.00	0.256	O				1.67
28.250	0.00	0.00	0.256	O				1.67
28.333	0.00	0.00	0.256	O				1.67
28.417	0.00	0.00	0.256	O				1.67
28.500	0.00	0.00	0.256	O				1.67
28.583	0.00	0.00	0.256	O				1.67
28.667	0.00	0.00	0.256	O				1.67
28.750	0.00	0.00	0.256	O				1.67
28.833	0.00	0.00	0.256	O				1.67
28.917	0.00	0.00	0.256	O				1.67
29.000	0.00	0.00	0.256	O				1.67
29.083	0.00	0.00	0.256	O				1.67
29.167	0.00	0.00	0.256	O				1.67
29.250	0.00	0.00	0.256	O				1.67
29.333	0.00	0.00	0.256	O				1.67
29.417	0.00	0.00	0.256	O				1.67
29.500	0.00	0.00	0.256	O				1.67
29.583	0.00	0.00	0.256	O				1.67
29.667	0.00	0.00	0.256	O				1.67
29.750	0.00	0.00	0.256	O				1.67
29.833	0.00	0.00	0.256	O				1.67
29.917	0.00	0.00	0.256	O				1.66
30.000	0.00	0.00	0.256	O				1.66
30.083	0.00	0.00	0.256	O				1.66
30.167	0.00	0.00	0.256	O				1.66
30.250	0.00	0.00	0.256	O				1.66

30.333	0.00	0.00	0.256	O	|	|	|	1.66
30.417	0.00	0.00	0.256	O	|	|	|	1.66
30.500	0.00	0.00	0.256	O	|	|	|	1.66
30.583	0.00	0.00	0.256	O	|	|	|	1.66
30.667	0.00	0.00	0.256	O	|	|	|	1.66
30.750	0.00	0.00	0.256	O	|	|	|	1.66
30.833	0.00	0.00	0.256	O	|	|	|	1.66
30.917	0.00	0.00	0.256	O	|	|	|	1.66
31.000	0.00	0.00	0.256	O	|	|	|	1.66
31.083	0.00	0.00	0.255	O	|	|	|	1.66
31.167	0.00	0.00	0.255	O	|	|	|	1.66
31.250	0.00	0.00	0.255	O	|	|	|	1.66
31.333	0.00	0.00	0.255	O	|	|	|	1.66
31.417	0.00	0.00	0.255	O	|	|	|	1.66
31.500	0.00	0.00	0.255	O	|	|	|	1.66
31.583	0.00	0.00	0.255	O	|	|	|	1.66
31.667	0.00	0.00	0.255	O	|	|	|	1.66
31.750	0.00	0.00	0.255	O	|	|	|	1.66
31.833	0.00	0.00	0.255	O	|	|	|	1.66
31.917	0.00	0.00	0.255	O	|	|	|	1.66
32.000	0.00	0.00	0.255	O	|	|	|	1.66
32.083	0.00	0.00	0.255	O	|	|	|	1.66
32.167	0.00	0.00	0.255	O	|	|	|	1.66
32.250	0.00	0.00	0.255	O	|	|	|	1.66
32.333	0.00	0.00	0.255	O	|	|	|	1.66
32.417	0.00	0.00	0.255	O	|	|	|	1.66
32.500	0.00	0.00	0.255	O	|	|	|	1.66
32.583	0.00	0.00	0.255	O	|	|	|	1.66
32.667	0.00	0.00	0.255	O	|	|	|	1.66
32.750	0.00	0.00	0.255	O	|	|	|	1.66
32.833	0.00	0.00	0.255	O	|	|	|	1.66
32.917	0.00	0.00	0.255	O	|	|	|	1.66
33.000	0.00	0.00	0.255	O	|	|	|	1.66
33.083	0.00	0.00	0.255	O	|	|	|	1.66
33.167	0.00	0.00	0.255	O	|	|	|	1.66
33.250	0.00	0.00	0.255	O	|	|	|	1.66
33.333	0.00	0.00	0.255	O	|	|	|	1.66
33.417	0.00	0.00	0.255	O	|	|	|	1.66
33.500	0.00	0.00	0.255	O	|	|	|	1.66
33.583	0.00	0.00	0.255	O	|	|	|	1.66
33.667	0.00	0.00	0.255	O	|	|	|	1.66
33.750	0.00	0.00	0.255	O	|	|	|	1.66
33.833	0.00	0.00	0.255	O	|	|	|	1.66
33.917	0.00	0.00	0.255	O	|	|	|	1.66
34.000	0.00	0.00	0.255	O	|	|	|	1.66
34.083	0.00	0.00	0.255	O	|	|	|	1.66
34.167	0.00	0.00	0.255	O	|	|	|	1.66
34.250	0.00	0.00	0.255	O	|	|	|	1.66
34.333	0.00	0.00	0.255	O	|	|	|	1.66
34.417	0.00	0.00	0.255	O	|	|	|	1.66
34.500	0.00	0.00	0.255	O	|	|	|	1.66
34.583	0.00	0.00	0.255	O	|	|	|	1.66
34.667	0.00	0.00	0.255	O	|	|	|	1.66
34.750	0.00	0.00	0.255	O	|	|	|	1.66

34.833	0.00	0.00	0.255	O	|	|	|	1.66
34.917	0.00	0.00	0.255	O	|	|	|	1.66
35.000	0.00	0.00	0.255	O	|	|	|	1.66
35.083	0.00	0.00	0.255	O	|	|	|	1.66
35.167	0.00	0.00	0.254	O	|	|	|	1.66
35.250	0.00	0.00	0.254	O	|	|	|	1.66
35.333	0.00	0.00	0.254	O	|	|	|	1.66
35.417	0.00	0.00	0.254	O	|	|	|	1.66
35.500	0.00	0.00	0.254	O	|	|	|	1.66
35.583	0.00	0.00	0.254	O	|	|	|	1.66
35.667	0.00	0.00	0.254	O	|	|	|	1.66
35.750	0.00	0.00	0.254	O	|	|	|	1.66
35.833	0.00	0.00	0.254	O	|	|	|	1.66
35.917	0.00	0.00	0.254	O	|	|	|	1.66
36.000	0.00	0.00	0.254	O	|	|	|	1.66
36.083	0.00	0.00	0.254	O	|	|	|	1.66
36.167	0.00	0.00	0.254	O	|	|	|	1.66
36.250	0.00	0.00	0.254	O	|	|	|	1.66
36.333	0.00	0.00	0.254	O	|	|	|	1.66
36.417	0.00	0.00	0.254	O	|	|	|	1.66
36.500	0.00	0.00	0.254	O	|	|	|	1.66
36.583	0.00	0.00	0.254	O	|	|	|	1.66
36.667	0.00	0.00	0.254	O	|	|	|	1.66
36.750	0.00	0.00	0.254	O	|	|	|	1.66
36.833	0.00	0.00	0.254	O	|	|	|	1.66
36.917	0.00	0.00	0.254	O	|	|	|	1.66
37.000	0.00	0.00	0.254	O	|	|	|	1.66
37.083	0.00	0.00	0.254	O	|	|	|	1.66
37.167	0.00	0.00	0.254	O	|	|	|	1.66
37.250	0.00	0.00	0.254	O	|	|	|	1.66
37.333	0.00	0.00	0.254	O	|	|	|	1.66
37.417	0.00	0.00	0.254	O	|	|	|	1.66
37.500	0.00	0.00	0.254	O	|	|	|	1.66
37.583	0.00	0.00	0.254	O	|	|	|	1.66
37.667	0.00	0.00	0.254	O	|	|	|	1.66
37.750	0.00	0.00	0.254	O	|	|	|	1.66
37.833	0.00	0.00	0.254	O	|	|	|	1.66
37.917	0.00	0.00	0.254	O	|	|	|	1.66
38.000	0.00	0.00	0.254	O	|	|	|	1.66
38.083	0.00	0.00	0.254	O	|	|	|	1.66
38.167	0.00	0.00	0.254	O	|	|	|	1.66
38.250	0.00	0.00	0.254	O	|	|	|	1.66
38.333	0.00	0.00	0.254	O	|	|	|	1.66
38.417	0.00	0.00	0.254	O	|	|	|	1.66
38.500	0.00	0.00	0.254	O	|	|	|	1.66
38.583	0.00	0.00	0.254	O	|	|	|	1.66
38.667	0.00	0.00	0.254	O	|	|	|	1.66
38.750	0.00	0.00	0.254	O	|	|	|	1.66
38.833	0.00	0.00	0.254	O	|	|	|	1.66
38.917	0.00	0.00	0.254	O	|	|	|	1.66
39.000	0.00	0.00	0.254	O	|	|	|	1.66
39.083	0.00	0.00	0.254	O	|	|	|	1.66
39.167	0.00	0.00	0.254	O	|	|	|	1.66
39.250	0.00	0.00	0.253	O	|	|	|	1.66

39.333	0.00	0.00	0.253	O	|	|	|	1.66
39.417	0.00	0.00	0.253	O	|	|	|	1.66
39.500	0.00	0.00	0.253	O	|	|	|	1.66
39.583	0.00	0.00	0.253	O	|	|	|	1.66
39.667	0.00	0.00	0.253	O	|	|	|	1.65
39.750	0.00	0.00	0.253	O	|	|	|	1.65
39.833	0.00	0.00	0.253	O	|	|	|	1.65
39.917	0.00	0.00	0.253	O	|	|	|	1.65
40.000	0.00	0.00	0.253	O	|	|	|	1.65
40.083	0.00	0.00	0.253	O	|	|	|	1.65
40.167	0.00	0.00	0.253	O	|	|	|	1.65
40.250	0.00	0.00	0.253	O	|	|	|	1.65
40.333	0.00	0.00	0.253	O	|	|	|	1.65
40.417	0.00	0.00	0.253	O	|	|	|	1.65
40.500	0.00	0.00	0.253	O	|	|	|	1.65
40.583	0.00	0.00	0.253	O	|	|	|	1.65
40.667	0.00	0.00	0.253	O	|	|	|	1.65
40.750	0.00	0.00	0.253	O	|	|	|	1.65
40.833	0.00	0.00	0.253	O	|	|	|	1.65
40.917	0.00	0.00	0.253	O	|	|	|	1.65
41.000	0.00	0.00	0.253	O	|	|	|	1.65
41.083	0.00	0.00	0.253	O	|	|	|	1.65
41.167	0.00	0.00	0.253	O	|	|	|	1.65
41.250	0.00	0.00	0.253	O	|	|	|	1.65
41.333	0.00	0.00	0.253	O	|	|	|	1.65
41.417	0.00	0.00	0.253	O	|	|	|	1.65
41.500	0.00	0.00	0.253	O	|	|	|	1.65
41.583	0.00	0.00	0.253	O	|	|	|	1.65
41.667	0.00	0.00	0.253	O	|	|	|	1.65
41.750	0.00	0.00	0.253	O	|	|	|	1.65
41.833	0.00	0.00	0.253	O	|	|	|	1.65
41.917	0.00	0.00	0.253	O	|	|	|	1.65
42.000	0.00	0.00	0.253	O	|	|	|	1.65
42.083	0.00	0.00	0.253	O	|	|	|	1.65
42.167	0.00	0.00	0.253	O	|	|	|	1.65
42.250	0.00	0.00	0.253	O	|	|	|	1.65
42.333	0.00	0.00	0.253	O	|	|	|	1.65
42.417	0.00	0.00	0.253	O	|	|	|	1.65
42.500	0.00	0.00	0.253	O	|	|	|	1.65
42.583	0.00	0.00	0.253	O	|	|	|	1.65
42.667	0.00	0.00	0.253	O	|	|	|	1.65
42.750	0.00	0.00	0.253	O	|	|	|	1.65
42.833	0.00	0.00	0.253	O	|	|	|	1.65
42.917	0.00	0.00	0.253	O	|	|	|	1.65
43.000	0.00	0.00	0.253	O	|	|	|	1.65
43.083	0.00	0.00	0.253	O	|	|	|	1.65
43.167	0.00	0.00	0.253	O	|	|	|	1.65
43.250	0.00	0.00	0.253	O	|	|	|	1.65
43.333	0.00	0.00	0.252	O	|	|	|	1.65
43.417	0.00	0.00	0.252	O	|	|	|	1.65
43.500	0.00	0.00	0.252	O	|	|	|	1.65
43.583	0.00	0.00	0.252	O	|	|	|	1.65
43.667	0.00	0.00	0.252	O	|	|	|	1.65
43.750	0.00	0.00	0.252	O	|	|	|	1.65

43.833	0.00	0.00	0.252	O	|	|	|	1.65
43.917	0.00	0.00	0.252	O	|	|	|	1.65
44.000	0.00	0.00	0.252	O	|	|	|	1.65
44.083	0.00	0.00	0.252	O	|	|	|	1.65
44.167	0.00	0.00	0.252	O	|	|	|	1.65
44.250	0.00	0.00	0.252	O	|	|	|	1.65
44.333	0.00	0.00	0.252	O	|	|	|	1.65
44.417	0.00	0.00	0.252	O	|	|	|	1.65
44.500	0.00	0.00	0.252	O	|	|	|	1.65
44.583	0.00	0.00	0.252	O	|	|	|	1.65
44.667	0.00	0.00	0.252	O	|	|	|	1.65
44.750	0.00	0.00	0.252	O	|	|	|	1.65
44.833	0.00	0.00	0.252	O	|	|	|	1.65
44.917	0.00	0.00	0.252	O	|	|	|	1.65
45.000	0.00	0.00	0.252	O	|	|	|	1.65
45.083	0.00	0.00	0.252	O	|	|	|	1.65
45.167	0.00	0.00	0.252	O	|	|	|	1.65
45.250	0.00	0.00	0.252	O	|	|	|	1.65
45.333	0.00	0.00	0.252	O	|	|	|	1.65
45.417	0.00	0.00	0.252	O	|	|	|	1.65
45.500	0.00	0.00	0.252	O	|	|	|	1.65
45.583	0.00	0.00	0.252	O	|	|	|	1.65
45.667	0.00	0.00	0.252	O	|	|	|	1.65
45.750	0.00	0.00	0.252	O	|	|	|	1.65
45.833	0.00	0.00	0.252	O	|	|	|	1.65
45.917	0.00	0.00	0.252	O	|	|	|	1.65
46.000	0.00	0.00	0.252	O	|	|	|	1.65
46.083	0.00	0.00	0.252	O	|	|	|	1.65
46.167	0.00	0.00	0.252	O	|	|	|	1.65
46.250	0.00	0.00	0.252	O	|	|	|	1.65
46.333	0.00	0.00	0.252	O	|	|	|	1.65
46.417	0.00	0.00	0.252	O	|	|	|	1.65
46.500	0.00	0.00	0.252	O	|	|	|	1.65
46.583	0.00	0.00	0.252	O	|	|	|	1.65
46.667	0.00	0.00	0.252	O	|	|	|	1.65
46.750	0.00	0.00	0.252	O	|	|	|	1.65
46.833	0.00	0.00	0.252	O	|	|	|	1.65
46.917	0.00	0.00	0.252	O	|	|	|	1.65
47.000	0.00	0.00	0.252	O	|	|	|	1.65
47.083	0.00	0.00	0.252	O	|	|	|	1.65
47.167	0.00	0.00	0.252	O	|	|	|	1.65
47.250	0.00	0.00	0.252	O	|	|	|	1.65
47.333	0.00	0.00	0.252	O	|	|	|	1.65
47.417	0.00	0.00	0.251	O	|	|	|	1.65
47.500	0.00	0.00	0.251	O	|	|	|	1.65
47.583	0.00	0.00	0.251	O	|	|	|	1.65
47.667	0.00	0.00	0.251	O	|	|	|	1.65
47.750	0.00	0.00	0.251	O	|	|	|	1.65
47.833	0.00	0.00	0.251	O	|	|	|	1.65
47.917	0.00	0.00	0.251	O	|	|	|	1.65
48.000	0.00	0.00	0.251	O	|	|	|	1.65
48.083	0.00	0.00	0.251	O	|	|	|	1.65
48.167	0.00	0.00	0.251	O	|	|	|	1.65
48.250	0.00	0.00	0.251	O	|	|	|	1.65

48.333	0.00	0.00	0.251	O	|	|	|	1.65
48.417	0.00	0.00	0.251	O	|	|	|	1.65
48.500	0.00	0.00	0.251	O	|	|	|	1.65
48.583	0.00	0.00	0.251	O	|	|	|	1.65
48.667	0.00	0.00	0.251	O	|	|	|	1.65
48.750	0.00	0.00	0.251	O	|	|	|	1.65
48.833	0.00	0.00	0.251	O	|	|	|	1.65
48.917	0.00	0.00	0.251	O	|	|	|	1.65
49.000	0.00	0.00	0.251	O	|	|	|	1.65
49.083	0.00	0.00	0.251	O	|	|	|	1.65
49.167	0.00	0.00	0.251	O	|	|	|	1.65
49.250	0.00	0.00	0.251	O	|	|	|	1.65
49.333	0.00	0.00	0.251	O	|	|	|	1.65
49.417	0.00	0.00	0.251	O	|	|	|	1.65
49.500	0.00	0.00	0.251	O	|	|	|	1.64
49.583	0.00	0.00	0.251	O	|	|	|	1.64
49.667	0.00	0.00	0.251	O	|	|	|	1.64
49.750	0.00	0.00	0.251	O	|	|	|	1.64
49.833	0.00	0.00	0.251	O	|	|	|	1.64
49.917	0.00	0.00	0.251	O	|	|	|	1.64
50.000	0.00	0.00	0.251	O	|	|	|	1.64
50.083	0.00	0.00	0.251	O	|	|	|	1.64
50.167	0.00	0.00	0.251	O	|	|	|	1.64
50.250	0.00	0.00	0.251	O	|	|	|	1.64
50.333	0.00	0.00	0.251	O	|	|	|	1.64
50.417	0.00	0.00	0.251	O	|	|	|	1.64
50.500	0.00	0.00	0.251	O	|	|	|	1.64
50.583	0.00	0.00	0.251	O	|	|	|	1.64
50.667	0.00	0.00	0.251	O	|	|	|	1.64
50.750	0.00	0.00	0.251	O	|	|	|	1.64
50.833	0.00	0.00	0.251	O	|	|	|	1.64
50.917	0.00	0.00	0.251	O	|	|	|	1.64
51.000	0.00	0.00	0.251	O	|	|	|	1.64
51.083	0.00	0.00	0.251	O	|	|	|	1.64
51.167	0.00	0.00	0.251	O	|	|	|	1.64
51.250	0.00	0.00	0.251	O	|	|	|	1.64
51.333	0.00	0.00	0.251	O	|	|	|	1.64
51.417	0.00	0.00	0.251	O	|	|	|	1.64
51.500	0.00	0.00	0.250	O	|	|	|	1.64
51.583	0.00	0.00	0.250	O	|	|	|	1.64
51.667	0.00	0.00	0.250	O	|	|	|	1.64
51.750	0.00	0.00	0.250	O	|	|	|	1.64
51.833	0.00	0.00	0.250	O	|	|	|	1.64
51.917	0.00	0.00	0.250	O	|	|	|	1.64
52.000	0.00	0.00	0.250	O	|	|	|	1.64
52.083	0.00	0.00	0.250	O	|	|	|	1.64
52.167	0.00	0.00	0.250	O	|	|	|	1.64
52.250	0.00	0.00	0.250	O	|	|	|	1.64
52.333	0.00	0.00	0.250	O	|	|	|	1.64
52.417	0.00	0.00	0.250	O	|	|	|	1.64
52.500	0.00	0.00	0.250	O	|	|	|	1.64
52.583	0.00	0.00	0.250	O	|	|	|	1.64
52.667	0.00	0.00	0.250	O	|	|	|	1.64
52.750	0.00	0.00	0.250	O	|	|	|	1.64

52.833	0.00	0.00	0.250	O	|	|	|	1.64
52.917	0.00	0.00	0.250	O	|	|	|	1.64
53.000	0.00	0.00	0.250	O	|	|	|	1.64
53.083	0.00	0.00	0.250	O	|	|	|	1.64
53.167	0.00	0.00	0.250	O	|	|	|	1.64
53.250	0.00	0.00	0.250	O	|	|	|	1.64
53.333	0.00	0.00	0.250	O	|	|	|	1.64
53.417	0.00	0.00	0.250	O	|	|	|	1.64
53.500	0.00	0.00	0.250	O	|	|	|	1.64
53.583	0.00	0.00	0.250	O	|	|	|	1.64
53.667	0.00	0.00	0.250	O	|	|	|	1.64
53.750	0.00	0.00	0.250	O	|	|	|	1.64
53.833	0.00	0.00	0.250	O	|	|	|	1.64
53.917	0.00	0.00	0.250	O	|	|	|	1.64
54.000	0.00	0.00	0.250	O	|	|	|	1.64
54.083	0.00	0.00	0.250	O	|	|	|	1.64
54.167	0.00	0.00	0.250	O	|	|	|	1.64
54.250	0.00	0.00	0.250	O	|	|	|	1.64
54.333	0.00	0.00	0.250	O	|	|	|	1.64
54.417	0.00	0.00	0.250	O	|	|	|	1.64
54.500	0.00	0.00	0.250	O	|	|	|	1.64
54.583	0.00	0.00	0.250	O	|	|	|	1.64
54.667	0.00	0.00	0.250	O	|	|	|	1.64
54.750	0.00	0.00	0.250	O	|	|	|	1.64
54.833	0.00	0.00	0.250	O	|	|	|	1.64
54.917	0.00	0.00	0.250	O	|	|	|	1.64
55.000	0.00	0.00	0.250	O	|	|	|	1.64
55.083	0.00	0.00	0.250	O	|	|	|	1.64
55.167	0.00	0.00	0.250	O	|	|	|	1.64
55.250	0.00	0.00	0.250	O	|	|	|	1.64
55.333	0.00	0.00	0.250	O	|	|	|	1.64
55.417	0.00	0.00	0.250	O	|	|	|	1.64
55.500	0.00	0.00	0.250	O	|	|	|	1.64
55.583	0.00	0.00	0.249	O	|	|	|	1.64
55.667	0.00	0.00	0.249	O	|	|	|	1.64
55.750	0.00	0.00	0.249	O	|	|	|	1.64
55.833	0.00	0.00	0.249	O	|	|	|	1.64
55.917	0.00	0.00	0.249	O	|	|	|	1.64
56.000	0.00	0.00	0.249	O	|	|	|	1.64
56.083	0.00	0.00	0.249	O	|	|	|	1.64
56.167	0.00	0.00	0.249	O	|	|	|	1.64
56.250	0.00	0.00	0.249	O	|	|	|	1.64
56.333	0.00	0.00	0.249	O	|	|	|	1.64
56.417	0.00	0.00	0.249	O	|	|	|	1.64
56.500	0.00	0.00	0.249	O	|	|	|	1.64
56.583	0.00	0.00	0.249	O	|	|	|	1.64
56.667	0.00	0.00	0.249	O	|	|	|	1.64
56.750	0.00	0.00	0.249	O	|	|	|	1.64
56.833	0.00	0.00	0.249	O	|	|	|	1.64
56.917	0.00	0.00	0.249	O	|	|	|	1.64
57.000	0.00	0.00	0.249	O	|	|	|	1.64
57.083	0.00	0.00	0.249	O	|	|	|	1.64
57.167	0.00	0.00	0.249	O	|	|	|	1.64
57.250	0.00	0.00	0.249	O	|	|	|	1.64

57.333	0.00	0.00	0.249	O	|	|	|	1.64
57.417	0.00	0.00	0.249	O	|	|	|	1.64
57.500	0.00	0.00	0.249	O	|	|	|	1.64
57.583	0.00	0.00	0.249	O	|	|	|	1.64
57.667	0.00	0.00	0.249	O	|	|	|	1.64
57.750	0.00	0.00	0.249	O	|	|	|	1.64
57.833	0.00	0.00	0.249	O	|	|	|	1.64
57.917	0.00	0.00	0.249	O	|	|	|	1.64
58.000	0.00	0.00	0.249	O	|	|	|	1.64
58.083	0.00	0.00	0.249	O	|	|	|	1.64
58.167	0.00	0.00	0.249	O	|	|	|	1.64
58.250	0.00	0.00	0.249	O	|	|	|	1.64
58.333	0.00	0.00	0.249	O	|	|	|	1.64
58.417	0.00	0.00	0.249	O	|	|	|	1.64
58.500	0.00	0.00	0.249	O	|	|	|	1.64
58.583	0.00	0.00	0.249	O	|	|	|	1.64
58.667	0.00	0.00	0.249	O	|	|	|	1.64
58.750	0.00	0.00	0.249	O	|	|	|	1.64
58.833	0.00	0.00	0.249	O	|	|	|	1.64
58.917	0.00	0.00	0.249	O	|	|	|	1.64
59.000	0.00	0.00	0.249	O	|	|	|	1.64
59.083	0.00	0.00	0.249	O	|	|	|	1.64
59.167	0.00	0.00	0.249	O	|	|	|	1.64
59.250	0.00	0.00	0.249	O	|	|	|	1.64
59.333	0.00	0.00	0.249	O	|	|	|	1.64
59.417	0.00	0.00	0.249	O	|	|	|	1.63
59.500	0.00	0.00	0.249	O	|	|	|	1.63
59.583	0.00	0.00	0.249	O	|	|	|	1.63
59.667	0.00	0.00	0.248	O	|	|	|	1.63
59.750	0.00	0.00	0.248	O	|	|	|	1.63
59.833	0.00	0.00	0.248	O	|	|	|	1.63
59.917	0.00	0.00	0.248	O	|	|	|	1.63
60.000	0.00	0.00	0.248	O	|	|	|	1.63
60.083	0.00	0.00	0.248	O	|	|	|	1.63
60.167	0.00	0.00	0.248	O	|	|	|	1.63
60.250	0.00	0.00	0.248	O	|	|	|	1.63
60.333	0.00	0.00	0.248	O	|	|	|	1.63
60.417	0.00	0.00	0.248	O	|	|	|	1.63
60.500	0.00	0.00	0.248	O	|	|	|	1.63
60.583	0.00	0.00	0.248	O	|	|	|	1.63
60.667	0.00	0.00	0.248	O	|	|	|	1.63
60.750	0.00	0.00	0.248	O	|	|	|	1.63
60.833	0.00	0.00	0.248	O	|	|	|	1.63
60.917	0.00	0.00	0.248	O	|	|	|	1.63
61.000	0.00	0.00	0.248	O	|	|	|	1.63
61.083	0.00	0.00	0.248	O	|	|	|	1.63
61.167	0.00	0.00	0.248	O	|	|	|	1.63
61.250	0.00	0.00	0.248	O	|	|	|	1.63
61.333	0.00	0.00	0.248	O	|	|	|	1.63
61.417	0.00	0.00	0.248	O	|	|	|	1.63
61.500	0.00	0.00	0.248	O	|	|	|	1.63
61.583	0.00	0.00	0.248	O	|	|	|	1.63
61.667	0.00	0.00	0.248	O	|	|	|	1.63
61.750	0.00	0.00	0.248	O	|	|	|	1.63

61.833	0.00	0.00	0.248	O	|	|	|	1.63
61.917	0.00	0.00	0.248	O	|	|	|	1.63
62.000	0.00	0.00	0.248	O	|	|	|	1.63
62.083	0.00	0.00	0.248	O	|	|	|	1.63
62.167	0.00	0.00	0.248	O	|	|	|	1.63
62.250	0.00	0.00	0.248	O	|	|	|	1.63
62.333	0.00	0.00	0.248	O	|	|	|	1.63
62.417	0.00	0.00	0.248	O	|	|	|	1.63
62.500	0.00	0.00	0.248	O	|	|	|	1.63
62.583	0.00	0.00	0.248	O	|	|	|	1.63
62.667	0.00	0.00	0.248	O	|	|	|	1.63
62.750	0.00	0.00	0.248	O	|	|	|	1.63
62.833	0.00	0.00	0.248	O	|	|	|	1.63
62.917	0.00	0.00	0.248	O	|	|	|	1.63
63.000	0.00	0.00	0.248	O	|	|	|	1.63
63.083	0.00	0.00	0.248	O	|	|	|	1.63
63.167	0.00	0.00	0.248	O	|	|	|	1.63
63.250	0.00	0.00	0.248	O	|	|	|	1.63
63.333	0.00	0.00	0.248	O	|	|	|	1.63
63.417	0.00	0.00	0.248	O	|	|	|	1.63
63.500	0.00	0.00	0.248	O	|	|	|	1.63
63.583	0.00	0.00	0.248	O	|	|	|	1.63
63.667	0.00	0.00	0.248	O	|	|	|	1.63
63.750	0.00	0.00	0.248	O	|	|	|	1.63
63.833	0.00	0.00	0.247	O	|	|	|	1.63
63.917	0.00	0.00	0.247	O	|	|	|	1.63
64.000	0.00	0.00	0.247	O	|	|	|	1.63
64.083	0.00	0.00	0.247	O	|	|	|	1.63
64.167	0.00	0.00	0.247	O	|	|	|	1.63
64.250	0.00	0.00	0.247	O	|	|	|	1.63
64.333	0.00	0.00	0.247	O	|	|	|	1.63
64.417	0.00	0.00	0.247	O	|	|	|	1.63
64.500	0.00	0.00	0.247	O	|	|	|	1.63
64.583	0.00	0.00	0.247	O	|	|	|	1.63
64.667	0.00	0.00	0.247	O	|	|	|	1.63
64.750	0.00	0.00	0.247	O	|	|	|	1.63
64.833	0.00	0.00	0.247	O	|	|	|	1.63
64.917	0.00	0.00	0.247	O	|	|	|	1.63
65.000	0.00	0.00	0.247	O	|	|	|	1.63
65.083	0.00	0.00	0.247	O	|	|	|	1.63
65.167	0.00	0.00	0.247	O	|	|	|	1.63
65.250	0.00	0.00	0.247	O	|	|	|	1.63
65.333	0.00	0.00	0.247	O	|	|	|	1.63
65.417	0.00	0.00	0.247	O	|	|	|	1.63
65.500	0.00	0.00	0.247	O	|	|	|	1.63
65.583	0.00	0.00	0.247	O	|	|	|	1.63
65.667	0.00	0.00	0.247	O	|	|	|	1.63
65.750	0.00	0.00	0.247	O	|	|	|	1.63
65.833	0.00	0.00	0.247	O	|	|	|	1.63
65.917	0.00	0.00	0.247	O	|	|	|	1.63
66.000	0.00	0.00	0.247	O	|	|	|	1.63
66.083	0.00	0.00	0.247	O	|	|	|	1.63
66.167	0.00	0.00	0.247	O	|	|	|	1.63
66.250	0.00	0.00	0.247	O	|	|	|	1.63

66.333	0.00	0.00	0.247	O	|	|	|	| 1.63
66.417	0.00	0.00	0.247	O	|	|	|	| 1.63
66.500	0.00	0.00	0.247	O	|	|	|	| 1.63
66.583	0.00	0.00	0.247	O	|	|	|	| 1.63
66.667	0.00	0.00	0.247	O	|	|	|	| 1.63
66.750	0.00	0.00	0.247	O	|	|	|	| 1.63
66.833	0.00	0.00	0.247	O	|	|	|	| 1.63
66.917	0.00	0.00	0.247	O	|	|	|	| 1.63
67.000	0.00	0.00	0.247	O	|	|	|	| 1.63
67.083	0.00	0.00	0.247	O	|	|	|	| 1.63
67.167	0.00	0.00	0.247	O	|	|	|	| 1.63
67.250	0.00	0.00	0.247	O	|	|	|	| 1.63
67.333	0.00	0.00	0.247	O	|	|	|	| 1.63
67.417	0.00	0.00	0.247	O	|	|	|	| 1.63
67.500	0.00	0.00	0.247	O	|	|	|	| 1.63
67.583	0.00	0.00	0.247	O	|	|	|	| 1.63
67.667	0.00	0.00	0.247	O	|	|	|	| 1.63
67.750	0.00	0.00	0.247	O	|	|	|	| 1.63
67.833	0.00	0.00	0.247	O	|	|	|	| 1.63
67.917	0.00	0.00	0.246	O	|	|	|	| 1.63
68.000	0.00	0.00	0.246	O	|	|	|	| 1.63
68.083	0.00	0.00	0.246	O	|	|	|	| 1.63
68.167	0.00	0.00	0.246	O	|	|	|	| 1.63
68.250	0.00	0.00	0.246	O	|	|	|	| 1.63
68.333	0.00	0.00	0.246	O	|	|	|	| 1.63
68.417	0.00	0.00	0.246	O	|	|	|	| 1.63
68.500	0.00	0.00	0.246	O	|	|	|	| 1.63
68.583	0.00	0.00	0.246	O	|	|	|	| 1.63
68.667	0.00	0.00	0.246	O	|	|	|	| 1.63
68.750	0.00	0.00	0.246	O	|	|	|	| 1.63
68.833	0.00	0.00	0.246	O	|	|	|	| 1.63
68.917	0.00	0.00	0.246	O	|	|	|	| 1.63
69.000	0.00	0.00	0.246	O	|	|	|	| 1.63
69.083	0.00	0.00	0.246	O	|	|	|	| 1.63
69.167	0.00	0.00	0.246	O	|	|	|	| 1.63
69.250	0.00	0.00	0.246	O	|	|	|	| 1.63
69.333	0.00	0.00	0.246	O	|	|	|	| 1.62
69.417	0.00	0.00	0.246	O	|	|	|	| 1.62
69.500	0.00	0.00	0.246	O	|	|	|	| 1.62
69.583	0.00	0.00	0.246	O	|	|	|	| 1.62
69.667	0.00	0.00	0.246	O	|	|	|	| 1.62
69.750	0.00	0.00	0.246	O	|	|	|	| 1.62
69.833	0.00	0.00	0.246	O	|	|	|	| 1.62
69.917	0.00	0.00	0.246	O	|	|	|	| 1.62
70.000	0.00	0.00	0.246	O	|	|	|	| 1.62
70.083	0.00	0.00	0.246	O	|	|	|	| 1.62
70.167	0.00	0.00	0.246	O	|	|	|	| 1.62
70.250	0.00	0.00	0.246	O	|	|	|	| 1.62
70.333	0.00	0.00	0.246	O	|	|	|	| 1.62
70.417	0.00	0.00	0.246	O	|	|	|	| 1.62
70.500	0.00	0.00	0.246	O	|	|	|	| 1.62
70.583	0.00	0.00	0.246	O	|	|	|	| 1.62
70.667	0.00	0.00	0.246	O	|	|	|	| 1.62
70.750	0.00	0.00	0.246	O	|	|	|	| 1.62

70.833	0.00	0.00	0.246	O	|	|	|	| 1.62
70.917	0.00	0.00	0.246	O	|	|	|	| 1.62
71.000	0.00	0.00	0.246	O	|	|	|	| 1.62
71.083	0.00	0.00	0.246	O	|	|	|	| 1.62
71.167	0.00	0.00	0.246	O	|	|	|	| 1.62
71.250	0.00	0.00	0.246	O	|	|	|	| 1.62
71.333	0.00	0.00	0.246	O	|	|	|	| 1.62
71.417	0.00	0.00	0.246	O	|	|	|	| 1.62
71.500	0.00	0.00	0.246	O	|	|	|	| 1.62
71.583	0.00	0.00	0.246	O	|	|	|	| 1.62
71.667	0.00	0.00	0.246	O	|	|	|	| 1.62
71.750	0.00	0.00	0.246	O	|	|	|	| 1.62
71.833	0.00	0.00	0.246	O	|	|	|	| 1.62
71.917	0.00	0.00	0.246	O	|	|	|	| 1.62
72.000	0.00	0.00	0.246	O	|	|	|	| 1.62
72.083	0.00	0.00	0.245	O	|	|	|	| 1.62
72.167	0.00	0.00	0.245	O	|	|	|	| 1.62
72.250	0.00	0.00	0.245	O	|	|	|	| 1.62
72.333	0.00	0.00	0.245	O	|	|	|	| 1.62
72.417	0.00	0.00	0.245	O	|	|	|	| 1.62
72.500	0.00	0.00	0.245	O	|	|	|	| 1.62
72.583	0.00	0.00	0.245	O	|	|	|	| 1.62
72.667	0.00	0.00	0.245	O	|	|	|	| 1.62
72.750	0.00	0.00	0.245	O	|	|	|	| 1.62
72.833	0.00	0.00	0.245	O	|	|	|	| 1.62
72.917	0.00	0.00	0.245	O	|	|	|	| 1.62
73.000	0.00	0.00	0.245	O	|	|	|	| 1.62
73.083	0.00	0.00	0.245	O	|	|	|	| 1.62
73.167	0.00	0.00	0.245	O	|	|	|	| 1.62
73.250	0.00	0.00	0.245	O	|	|	|	| 1.62
73.333	0.00	0.00	0.245	O	|	|	|	| 1.62
73.417	0.00	0.00	0.245	O	|	|	|	| 1.62
73.500	0.00	0.00	0.245	O	|	|	|	| 1.62
73.583	0.00	0.00	0.245	O	|	|	|	| 1.62
73.667	0.00	0.00	0.245	O	|	|	|	| 1.62
73.750	0.00	0.00	0.245	O	|	|	|	| 1.62
73.833	0.00	0.00	0.245	O	|	|	|	| 1.62
73.917	0.00	0.00	0.245	O	|	|	|	| 1.62
74.000	0.00	0.00	0.245	O	|	|	|	| 1.62
74.083	0.00	0.00	0.245	O	|	|	|	| 1.62
74.167	0.00	0.00	0.245	O	|	|	|	| 1.62
74.250	0.00	0.00	0.245	O	|	|	|	| 1.62
74.333	0.00	0.00	0.245	O	|	|	|	| 1.62
74.417	0.00	0.00	0.245	O	|	|	|	| 1.62
74.500	0.00	0.00	0.245	O	|	|	|	| 1.62
74.583	0.00	0.00	0.245	O	|	|	|	| 1.62
74.667	0.00	0.00	0.245	O	|	|	|	| 1.62
74.750	0.00	0.00	0.245	O	|	|	|	| 1.62
74.833	0.00	0.00	0.245	O	|	|	|	| 1.62
74.917	0.00	0.00	0.245	O	|	|	|	| 1.62
75.000	0.00	0.00	0.245	O	|	|	|	| 1.62
75.083	0.00	0.00	0.245	O	|	|	|	| 1.62
75.167	0.00	0.00	0.245	O	|	|	|	| 1.62
75.250	0.00	0.00	0.245	O	|	|	|	| 1.62

75.333	0.00	0.00	0.245	O	|	|	|	| 1.62
75.417	0.00	0.00	0.245	O	|	|	|	| 1.62
75.500	0.00	0.00	0.245	O	|	|	|	| 1.62
75.583	0.00	0.00	0.245	O	|	|	|	| 1.62
75.667	0.00	0.00	0.245	O	|	|	|	| 1.62
75.750	0.00	0.00	0.245	O	|	|	|	| 1.62
75.833	0.00	0.00	0.245	O	|	|	|	| 1.62
75.917	0.00	0.00	0.245	O	|	|	|	| 1.62
76.000	0.00	0.00	0.245	O	|	|	|	| 1.62
76.083	0.00	0.00	0.245	O	|	|	|	| 1.62
76.167	0.00	0.00	0.245	O	|	|	|	| 1.62
76.250	0.00	0.00	0.244	O	|	|	|	| 1.62
76.333	0.00	0.00	0.244	O	|	|	|	| 1.62
76.417	0.00	0.00	0.244	O	|	|	|	| 1.62
76.500	0.00	0.00	0.244	O	|	|	|	| 1.62
76.583	0.00	0.00	0.244	O	|	|	|	| 1.62
76.667	0.00	0.00	0.244	O	|	|	|	| 1.62
76.750	0.00	0.00	0.244	O	|	|	|	| 1.62
76.833	0.00	0.00	0.244	O	|	|	|	| 1.62
76.917	0.00	0.00	0.244	O	|	|	|	| 1.62
77.000	0.00	0.00	0.244	O	|	|	|	| 1.62
77.083	0.00	0.00	0.244	O	|	|	|	| 1.62
77.167	0.00	0.00	0.244	O	|	|	|	| 1.62
77.250	0.00	0.00	0.244	O	|	|	|	| 1.62
77.333	0.00	0.00	0.244	O	|	|	|	| 1.62
77.417	0.00	0.00	0.244	O	|	|	|	| 1.62
77.500	0.00	0.00	0.244	O	|	|	|	| 1.62
77.583	0.00	0.00	0.244	O	|	|	|	| 1.62
77.667	0.00	0.00	0.244	O	|	|	|	| 1.62
77.750	0.00	0.00	0.244	O	|	|	|	| 1.62
77.833	0.00	0.00	0.244	O	|	|	|	| 1.62
77.917	0.00	0.00	0.244	O	|	|	|	| 1.62
78.000	0.00	0.00	0.244	O	|	|	|	| 1.62
78.083	0.00	0.00	0.244	O	|	|	|	| 1.62
78.167	0.00	0.00	0.244	O	|	|	|	| 1.62
78.250	0.00	0.00	0.244	O	|	|	|	| 1.62
78.333	0.00	0.00	0.244	O	|	|	|	| 1.62
78.417	0.00	0.00	0.244	O	|	|	|	| 1.62
78.500	0.00	0.00	0.244	O	|	|	|	| 1.62
78.583	0.00	0.00	0.244	O	|	|	|	| 1.62
78.667	0.00	0.00	0.244	O	|	|	|	| 1.62
78.750	0.00	0.00	0.244	O	|	|	|	| 1.62
78.833	0.00	0.00	0.244	O	|	|	|	| 1.62
78.917	0.00	0.00	0.244	O	|	|	|	| 1.62
79.000	0.00	0.00	0.244	O	|	|	|	| 1.62
79.083	0.00	0.00	0.244	O	|	|	|	| 1.62
79.167	0.00	0.00	0.244	O	|	|	|	| 1.62
79.250	0.00	0.00	0.244	O	|	|	|	| 1.62
79.333	0.00	0.00	0.244	O	|	|	|	| 1.61
79.417	0.00	0.00	0.244	O	|	|	|	| 1.61
79.500	0.00	0.00	0.244	O	|	|	|	| 1.61
79.583	0.00	0.00	0.244	O	|	|	|	| 1.61
79.667	0.00	0.00	0.244	O	|	|	|	| 1.61
79.750	0.00	0.00	0.244	O	|	|	|	| 1.61

79.833	0.00	0.00	0.244	O	|	|	|	1.61
79.917	0.00	0.00	0.244	O	|	|	|	1.61
80.000	0.00	0.00	0.244	O	|	|	|	1.61
80.083	0.00	0.00	0.244	O	|	|	|	1.61
80.167	0.00	0.00	0.244	O	|	|	|	1.61
80.250	0.00	0.00	0.244	O	|	|	|	1.61
80.333	0.00	0.00	0.244	O	|	|	|	1.61
80.417	0.00	0.00	0.243	O	|	|	|	1.61
80.500	0.00	0.00	0.243	O	|	|	|	1.61
80.583	0.00	0.00	0.243	O	|	|	|	1.61
80.667	0.00	0.00	0.243	O	|	|	|	1.61
80.750	0.00	0.00	0.243	O	|	|	|	1.61
80.833	0.00	0.00	0.243	O	|	|	|	1.61
80.917	0.00	0.00	0.243	O	|	|	|	1.61
81.000	0.00	0.00	0.243	O	|	|	|	1.61
81.083	0.00	0.00	0.243	O	|	|	|	1.61
81.167	0.00	0.00	0.243	O	|	|	|	1.61
81.250	0.00	0.00	0.243	O	|	|	|	1.61
81.333	0.00	0.00	0.243	O	|	|	|	1.61
81.417	0.00	0.00	0.243	O	|	|	|	1.61
81.500	0.00	0.00	0.243	O	|	|	|	1.61
81.583	0.00	0.00	0.243	O	|	|	|	1.61
81.667	0.00	0.00	0.243	O	|	|	|	1.61
81.750	0.00	0.00	0.243	O	|	|	|	1.61
81.833	0.00	0.00	0.243	O	|	|	|	1.61
81.917	0.00	0.00	0.243	O	|	|	|	1.61
82.000	0.00	0.00	0.243	O	|	|	|	1.61
82.083	0.00	0.00	0.243	O	|	|	|	1.61
82.167	0.00	0.00	0.243	O	|	|	|	1.61
82.250	0.00	0.00	0.243	O	|	|	|	1.61
82.333	0.00	0.00	0.243	O	|	|	|	1.61
82.417	0.00	0.00	0.243	O	|	|	|	1.61
82.500	0.00	0.00	0.243	O	|	|	|	1.61
82.583	0.00	0.00	0.243	O	|	|	|	1.61
82.667	0.00	0.00	0.243	O	|	|	|	1.61
82.750	0.00	0.00	0.243	O	|	|	|	1.61
82.833	0.00	0.00	0.243	O	|	|	|	1.61
82.917	0.00	0.00	0.243	O	|	|	|	1.61
83.000	0.00	0.00	0.243	O	|	|	|	1.61
83.083	0.00	0.00	0.243	O	|	|	|	1.61
83.167	0.00	0.00	0.243	O	|	|	|	1.61
83.250	0.00	0.00	0.243	O	|	|	|	1.61
83.333	0.00	0.00	0.243	O	|	|	|	1.61
83.417	0.00	0.00	0.243	O	|	|	|	1.61
83.500	0.00	0.00	0.243	O	|	|	|	1.61
83.583	0.00	0.00	0.243	O	|	|	|	1.61
83.667	0.00	0.00	0.243	O	|	|	|	1.61
83.750	0.00	0.00	0.243	O	|	|	|	1.61
83.833	0.00	0.00	0.243	O	|	|	|	1.61
83.917	0.00	0.00	0.243	O	|	|	|	1.61
84.000	0.00	0.00	0.243	O	|	|	|	1.61
84.083	0.00	0.00	0.243	O	|	|	|	1.61
84.167	0.00	0.00	0.243	O	|	|	|	1.61
84.250	0.00	0.00	0.243	O	|	|	|	1.61

84.333	0.00	0.00	0.243	O	|	|	|	1.61
84.417	0.00	0.00	0.243	O	|	|	|	1.61
84.500	0.00	0.00	0.243	O	|	|	|	1.61
84.583	0.00	0.00	0.242	O	|	|	|	1.61
84.667	0.00	0.00	0.242	O	|	|	|	1.61
84.750	0.00	0.00	0.242	O	|	|	|	1.61
84.833	0.00	0.00	0.242	O	|	|	|	1.61
84.917	0.00	0.00	0.242	O	|	|	|	1.61
85.000	0.00	0.00	0.242	O	|	|	|	1.61
85.083	0.00	0.00	0.242	O	|	|	|	1.61
85.167	0.00	0.00	0.242	O	|	|	|	1.61
85.250	0.00	0.00	0.242	O	|	|	|	1.61
85.333	0.00	0.00	0.242	O	|	|	|	1.61
85.417	0.00	0.00	0.242	O	|	|	|	1.61
85.500	0.00	0.00	0.242	O	|	|	|	1.61
85.583	0.00	0.00	0.242	O	|	|	|	1.61
85.667	0.00	0.00	0.242	O	|	|	|	1.61
85.750	0.00	0.00	0.242	O	|	|	|	1.61
85.833	0.00	0.00	0.242	O	|	|	|	1.61
85.917	0.00	0.00	0.242	O	|	|	|	1.61
86.000	0.00	0.00	0.242	O	|	|	|	1.61
86.083	0.00	0.00	0.242	O	|	|	|	1.61
86.167	0.00	0.00	0.242	O	|	|	|	1.61
86.250	0.00	0.00	0.242	O	|	|	|	1.61
86.333	0.00	0.00	0.242	O	|	|	|	1.61
86.417	0.00	0.00	0.242	O	|	|	|	1.61
86.500	0.00	0.00	0.242	O	|	|	|	1.61
86.583	0.00	0.00	0.242	O	|	|	|	1.61
86.667	0.00	0.00	0.242	O	|	|	|	1.61
86.750	0.00	0.00	0.242	O	|	|	|	1.61
86.833	0.00	0.00	0.242	O	|	|	|	1.61
86.917	0.00	0.00	0.242	O	|	|	|	1.61
87.000	0.00	0.00	0.242	O	|	|	|	1.61
87.083	0.00	0.00	0.242	O	|	|	|	1.61
87.167	0.00	0.00	0.242	O	|	|	|	1.61
87.250	0.00	0.00	0.242	O	|	|	|	1.61
87.333	0.00	0.00	0.242	O	|	|	|	1.61
87.417	0.00	0.00	0.242	O	|	|	|	1.61
87.500	0.00	0.00	0.242	O	|	|	|	1.61
87.583	0.00	0.00	0.242	O	|	|	|	1.61
87.667	0.00	0.00	0.242	O	|	|	|	1.61
87.750	0.00	0.00	0.242	O	|	|	|	1.61
87.833	0.00	0.00	0.242	O	|	|	|	1.61
87.917	0.00	0.00	0.242	O	|	|	|	1.61
88.000	0.00	0.00	0.242	O	|	|	|	1.61
88.083	0.00	0.00	0.242	O	|	|	|	1.61
88.167	0.00	0.00	0.242	O	|	|	|	1.61
88.250	0.00	0.00	0.242	O	|	|	|	1.61
88.333	0.00	0.00	0.242	O	|	|	|	1.61
88.417	0.00	0.00	0.242	O	|	|	|	1.61
88.500	0.00	0.00	0.242	O	|	|	|	1.61
88.583	0.00	0.00	0.242	O	|	|	|	1.61
88.667	0.00	0.00	0.242	O	|	|	|	1.61
88.750	0.00	0.00	0.241	O	|	|	|	1.61

88.833	0.00	0.00	0.241	O	|	|	|	1.61
88.917	0.00	0.00	0.241	O	|	|	|	1.61
89.000	0.00	0.00	0.241	O	|	|	|	1.61
89.083	0.00	0.00	0.241	O	|	|	|	1.61
89.167	0.00	0.00	0.241	O	|	|	|	1.61
89.250	0.00	0.00	0.241	O	|	|	|	1.61
89.333	0.00	0.00	0.241	O	|	|	|	1.60
89.417	0.00	0.00	0.241	O	|	|	|	1.60
89.500	0.00	0.00	0.241	O	|	|	|	1.60
89.583	0.00	0.00	0.241	O	|	|	|	1.60
89.667	0.00	0.00	0.241	O	|	|	|	1.60
89.750	0.00	0.00	0.241	O	|	|	|	1.60
89.833	0.00	0.00	0.241	O	|	|	|	1.60
89.917	0.00	0.00	0.241	O	|	|	|	1.60
90.000	0.00	0.00	0.241	O	|	|	|	1.60
90.083	0.00	0.00	0.241	O	|	|	|	1.60
90.167	0.00	0.00	0.241	O	|	|	|	1.60
90.250	0.00	0.00	0.241	O	|	|	|	1.60
90.333	0.00	0.00	0.241	O	|	|	|	1.60
90.417	0.00	0.00	0.241	O	|	|	|	1.60
90.500	0.00	0.00	0.241	O	|	|	|	1.60
90.583	0.00	0.00	0.241	O	|	|	|	1.60
90.667	0.00	0.00	0.241	O	|	|	|	1.60
90.750	0.00	0.00	0.241	O	|	|	|	1.60
90.833	0.00	0.00	0.241	O	|	|	|	1.60
90.917	0.00	0.00	0.241	O	|	|	|	1.60
91.000	0.00	0.00	0.241	O	|	|	|	1.60
91.083	0.00	0.00	0.241	O	|	|	|	1.60
91.167	0.00	0.00	0.241	O	|	|	|	1.60
91.250	0.00	0.00	0.241	O	|	|	|	1.60
91.333	0.00	0.00	0.241	O	|	|	|	1.60
91.417	0.00	0.00	0.241	O	|	|	|	1.60
91.500	0.00	0.00	0.241	O	|	|	|	1.60
91.583	0.00	0.00	0.241	O	|	|	|	1.60
91.667	0.00	0.00	0.241	O	|	|	|	1.60
91.750	0.00	0.00	0.241	O	|	|	|	1.60
91.833	0.00	0.00	0.241	O	|	|	|	1.60
91.917	0.00	0.00	0.241	O	|	|	|	1.60
92.000	0.00	0.00	0.241	O	|	|	|	1.60
92.083	0.00	0.00	0.241	O	|	|	|	1.60
92.167	0.00	0.00	0.241	O	|	|	|	1.60
92.250	0.00	0.00	0.241	O	|	|	|	1.60
92.333	0.00	0.00	0.241	O	|	|	|	1.60
92.417	0.00	0.00	0.241	O	|	|	|	1.60
92.500	0.00	0.00	0.241	O	|	|	|	1.60
92.583	0.00	0.00	0.241	O	|	|	|	1.60
92.667	0.00	0.00	0.241	O	|	|	|	1.60
92.750	0.00	0.00	0.241	O	|	|	|	1.60
92.833	0.00	0.00	0.241	O	|	|	|	1.60
92.917	0.00	0.00	0.240	O	|	|	|	1.60
93.000	0.00	0.00	0.240	O	|	|	|	1.60
93.083	0.00	0.00	0.240	O	|	|	|	1.60
93.167	0.00	0.00	0.240	O	|	|	|	1.60
93.250	0.00	0.00	0.240	O	|	|	|	1.60

93.333	0.00	0.00	0.240	O	|	|	|	1.60
93.417	0.00	0.00	0.240	O	|	|	|	1.60
93.500	0.00	0.00	0.240	O	|	|	|	1.60
93.583	0.00	0.00	0.240	O	|	|	|	1.60
93.667	0.00	0.00	0.240	O	|	|	|	1.60
93.750	0.00	0.00	0.240	O	|	|	|	1.60
93.833	0.00	0.00	0.240	O	|	|	|	1.60
93.917	0.00	0.00	0.240	O	|	|	|	1.60
94.000	0.00	0.00	0.240	O	|	|	|	1.60
94.083	0.00	0.00	0.240	O	|	|	|	1.60
94.167	0.00	0.00	0.240	O	|	|	|	1.60
94.250	0.00	0.00	0.240	O	|	|	|	1.60
94.333	0.00	0.00	0.240	O	|	|	|	1.60
94.417	0.00	0.00	0.240	O	|	|	|	1.60
94.500	0.00	0.00	0.240	O	|	|	|	1.60
94.583	0.00	0.00	0.240	O	|	|	|	1.60
94.667	0.00	0.00	0.240	O	|	|	|	1.60
94.750	0.00	0.00	0.240	O	|	|	|	1.60
94.833	0.00	0.00	0.240	O	|	|	|	1.60
94.917	0.00	0.00	0.240	O	|	|	|	1.60
95.000	0.00	0.00	0.240	O	|	|	|	1.60
95.083	0.00	0.00	0.240	O	|	|	|	1.60
95.167	0.00	0.00	0.240	O	|	|	|	1.60
95.250	0.00	0.00	0.240	O	|	|	|	1.60
95.333	0.00	0.00	0.240	O	|	|	|	1.60
95.417	0.00	0.00	0.240	O	|	|	|	1.60
95.500	0.00	0.00	0.240	O	|	|	|	1.60
95.583	0.00	0.00	0.240	O	|	|	|	1.60
95.667	0.00	0.00	0.240	O	|	|	|	1.60
95.750	0.00	0.00	0.240	O	|	|	|	1.60
95.833	0.00	0.00	0.240	O	|	|	|	1.60
95.917	0.00	0.00	0.240	O	|	|	|	1.60
96.000	0.00	0.00	0.240	O	|	|	|	1.60
96.083	0.00	0.00	0.240	O	|	|	|	1.60
96.167	0.00	0.00	0.240	O	|	|	|	1.60
96.250	0.00	0.00	0.240	O	|	|	|	1.60
96.333	0.00	0.00	0.240	O	|	|	|	1.60
96.417	0.00	0.00	0.240	O	|	|	|	1.60
96.500	0.00	0.00	0.240	O	|	|	|	1.60
96.583	0.00	0.00	0.240	O	|	|	|	1.60
96.667	0.00	0.00	0.240	O	|	|	|	1.60
96.750	0.00	0.00	0.240	O	|	|	|	1.60
96.833	0.00	0.00	0.240	O	|	|	|	1.60
96.917	0.00	0.00	0.240	O	|	|	|	1.60
97.000	0.00	0.00	0.240	O	|	|	|	1.60
97.083	0.00	0.00	0.240	O	|	|	|	1.60
97.167	0.00	0.00	0.239	O	|	|	|	1.60
97.250	0.00	0.00	0.239	O	|	|	|	1.60
97.333	0.00	0.00	0.239	O	|	|	|	1.60
97.417	0.00	0.00	0.239	O	|	|	|	1.60
97.500	0.00	0.00	0.239	O	|	|	|	1.60
97.583	0.00	0.00	0.239	O	|	|	|	1.60
97.667	0.00	0.00	0.239	O	|	|	|	1.60
97.750	0.00	0.00	0.239	O	|	|	|	1.60

97.833	0.00	0.00	0.239	O	|	|	|	1.60
97.917	0.00	0.00	0.239	O	|	|	|	1.60
98.000	0.00	0.00	0.239	O	|	|	|	1.60
98.083	0.00	0.00	0.239	O	|	|	|	1.60
98.167	0.00	0.00	0.239	O	|	|	|	1.60
98.250	0.00	0.00	0.239	O	|	|	|	1.60
98.333	0.00	0.00	0.239	O	|	|	|	1.60
98.417	0.00	0.00	0.239	O	|	|	|	1.60
98.500	0.00	0.00	0.239	O	|	|	|	1.60
98.583	0.00	0.00	0.239	O	|	|	|	1.60
98.667	0.00	0.00	0.239	O	|	|	|	1.60
98.750	0.00	0.00	0.239	O	|	|	|	1.60
98.833	0.00	0.00	0.239	O	|	|	|	1.60
98.917	0.00	0.00	0.239	O	|	|	|	1.60
99.000	0.00	0.00	0.239	O	|	|	|	1.60
99.083	0.00	0.00	0.239	O	|	|	|	1.60
99.167	0.00	0.00	0.239	O	|	|	|	1.60
99.250	0.00	0.00	0.239	O	|	|	|	1.60
99.333	0.00	0.00	0.239	O	|	|	|	1.60
99.417	0.00	0.00	0.239	O	|	|	|	1.59
99.500	0.00	0.00	0.239	O	|	|	|	1.59
99.583	0.00	0.00	0.239	O	|	|	|	1.59
99.667	0.00	0.00	0.239	O	|	|	|	1.59
99.750	0.00	0.00	0.239	O	|	|	|	1.59
99.833	0.00	0.00	0.239	O	|	|	|	1.59
99.917	0.00	0.00	0.239	O	|	|	|	1.59
100.000	0.00	0.00	0.239	O	|	|	|	1.59
100.083	0.00	0.00	0.239	O	|	|	|	1.59
100.167	0.00	0.00	0.239	O	|	|	|	1.59
100.250	0.00	0.00	0.239	O	|	|	|	1.59
100.333	0.00	0.00	0.239	O	|	|	|	1.59
100.417	0.00	0.00	0.239	O	|	|	|	1.59
100.500	0.00	0.00	0.239	O	|	|	|	1.59
100.583	0.00	0.00	0.239	O	|	|	|	1.59
100.667	0.00	0.00	0.239	O	|	|	|	1.59
100.750	0.00	0.00	0.239	O	|	|	|	1.59
100.833	0.00	0.00	0.239	O	|	|	|	1.59
100.917	0.00	0.00	0.239	O	|	|	|	1.59
101.000	0.00	0.00	0.239	O	|	|	|	1.59
101.083	0.00	0.00	0.239	O	|	|	|	1.59
101.167	0.00	0.00	0.239	O	|	|	|	1.59
101.250	0.00	0.00	0.239	O	|	|	|	1.59
101.333	0.00	0.00	0.238	O	|	|	|	1.59
101.417	0.00	0.00	0.238	O	|	|	|	1.59
101.500	0.00	0.00	0.238	O	|	|	|	1.59
101.583	0.00	0.00	0.238	O	|	|	|	1.59
101.667	0.00	0.00	0.238	O	|	|	|	1.59
101.750	0.00	0.00	0.238	O	|	|	|	1.59
101.833	0.00	0.00	0.238	O	|	|	|	1.59
101.917	0.00	0.00	0.238	O	|	|	|	1.59
102.000	0.00	0.00	0.238	O	|	|	|	1.59
102.083	0.00	0.00	0.238	O	|	|	|	1.59
102.167	0.00	0.00	0.238	O	|	|	|	1.59
102.250	0.00	0.00	0.238	O	|	|	|	1.59

102.333	0.00	0.00	0.238	O	|	|	|	1.59
102.417	0.00	0.00	0.238	O	|	|	|	1.59
102.500	0.00	0.00	0.238	O	|	|	|	1.59
102.583	0.00	0.00	0.238	O	|	|	|	1.59
102.667	0.00	0.00	0.238	O	|	|	|	1.59
102.750	0.00	0.00	0.238	O	|	|	|	1.59
102.833	0.00	0.00	0.238	O	|	|	|	1.59
102.917	0.00	0.00	0.238	O	|	|	|	1.59
103.000	0.00	0.00	0.238	O	|	|	|	1.59
103.083	0.00	0.00	0.238	O	|	|	|	1.59
103.167	0.00	0.00	0.238	O	|	|	|	1.59
103.250	0.00	0.00	0.238	O	|	|	|	1.59
103.333	0.00	0.00	0.238	O	|	|	|	1.59
103.417	0.00	0.00	0.238	O	|	|	|	1.59
103.500	0.00	0.00	0.238	O	|	|	|	1.59
103.583	0.00	0.00	0.238	O	|	|	|	1.59
103.667	0.00	0.00	0.238	O	|	|	|	1.59
103.750	0.00	0.00	0.238	O	|	|	|	1.59
103.833	0.00	0.00	0.238	O	|	|	|	1.59
103.917	0.00	0.00	0.238	O	|	|	|	1.59
104.000	0.00	0.00	0.238	O	|	|	|	1.59
104.083	0.00	0.00	0.238	O	|	|	|	1.59
104.167	0.00	0.00	0.238	O	|	|	|	1.59
104.250	0.00	0.00	0.238	O	|	|	|	1.59
104.333	0.00	0.00	0.238	O	|	|	|	1.59
104.417	0.00	0.00	0.238	O	|	|	|	1.59
104.500	0.00	0.00	0.238	O	|	|	|	1.59
104.583	0.00	0.00	0.238	O	|	|	|	1.59
104.667	0.00	0.00	0.238	O	|	|	|	1.59
104.750	0.00	0.00	0.238	O	|	|	|	1.59
104.833	0.00	0.00	0.238	O	|	|	|	1.59
104.917	0.00	0.00	0.238	O	|	|	|	1.59
105.000	0.00	0.00	0.238	O	|	|	|	1.59
105.083	0.00	0.00	0.238	O	|	|	|	1.59
105.167	0.00	0.00	0.238	O	|	|	|	1.59
105.250	0.00	0.00	0.238	O	|	|	|	1.59
105.333	0.00	0.00	0.238	O	|	|	|	1.59
105.417	0.00	0.00	0.238	O	|	|	|	1.59
105.500	0.00	0.00	0.238	O	|	|	|	1.59
105.583	0.00	0.00	0.237	O	|	|	|	1.59
105.667	0.00	0.00	0.237	O	|	|	|	1.59
105.750	0.00	0.00	0.237	O	|	|	|	1.59
105.833	0.00	0.00	0.237	O	|	|	|	1.59
105.917	0.00	0.00	0.237	O	|	|	|	1.59
106.000	0.00	0.00	0.237	O	|	|	|	1.59
106.083	0.00	0.00	0.237	O	|	|	|	1.59
106.167	0.00	0.00	0.237	O	|	|	|	1.59
106.250	0.00	0.00	0.237	O	|	|	|	1.59
106.333	0.00	0.00	0.237	O	|	|	|	1.59
106.417	0.00	0.00	0.237	O	|	|	|	1.59
106.500	0.00	0.00	0.237	O	|	|	|	1.59
106.583	0.00	0.00	0.237	O	|	|	|	1.59
106.667	0.00	0.00	0.237	O	|	|	|	1.59
106.750	0.00	0.00	0.237	O	|	|	|	1.59

106.833	0.00	0.00	0.237	O	|	|	|	1.59
106.917	0.00	0.00	0.237	O	|	|	|	1.59
107.000	0.00	0.00	0.237	O	|	|	|	1.59
107.083	0.00	0.00	0.237	O	|	|	|	1.59
107.167	0.00	0.00	0.237	O	|	|	|	1.59
107.250	0.00	0.00	0.237	O	|	|	|	1.59
107.333	0.00	0.00	0.237	O	|	|	|	1.59
107.417	0.00	0.00	0.237	O	|	|	|	1.59
107.500	0.00	0.00	0.237	O	|	|	|	1.59
107.583	0.00	0.00	0.237	O	|	|	|	1.59
107.667	0.00	0.00	0.237	O	|	|	|	1.59
107.750	0.00	0.00	0.237	O	|	|	|	1.59
107.833	0.00	0.00	0.237	O	|	|	|	1.59
107.917	0.00	0.00	0.237	O	|	|	|	1.59
108.000	0.00	0.00	0.237	O	|	|	|	1.59
108.083	0.00	0.00	0.237	O	|	|	|	1.59
108.167	0.00	0.00	0.237	O	|	|	|	1.59
108.250	0.00	0.00	0.237	O	|	|	|	1.59
108.333	0.00	0.00	0.237	O	|	|	|	1.59
108.417	0.00	0.00	0.237	O	|	|	|	1.59
108.500	0.00	0.00	0.237	O	|	|	|	1.59
108.583	0.00	0.00	0.237	O	|	|	|	1.59
108.667	0.00	0.00	0.237	O	|	|	|	1.59
108.750	0.00	0.00	0.237	O	|	|	|	1.59
108.833	0.00	0.00	0.237	O	|	|	|	1.59
108.917	0.00	0.00	0.237	O	|	|	|	1.59
109.000	0.00	0.00	0.237	O	|	|	|	1.59
109.083	0.00	0.00	0.237	O	|	|	|	1.59
109.167	0.00	0.00	0.237	O	|	|	|	1.59
109.250	0.00	0.00	0.237	O	|	|	|	1.59
109.333	0.00	0.00	0.237	O	|	|	|	1.59
109.417	0.00	0.00	0.237	O	|	|	|	1.59
109.500	0.00	0.00	0.237	O	|	|	|	1.59
109.583	0.00	0.00	0.237	O	|	|	|	1.58
109.667	0.00	0.00	0.237	O	|	|	|	1.58
109.750	0.00	0.00	0.237	O	|	|	|	1.58
109.833	0.00	0.00	0.236	O	|	|	|	1.58
109.917	0.00	0.00	0.236	O	|	|	|	1.58
110.000	0.00	0.00	0.236	O	|	|	|	1.58
110.083	0.00	0.00	0.236	O	|	|	|	1.58
110.167	0.00	0.00	0.236	O	|	|	|	1.58
110.250	0.00	0.00	0.236	O	|	|	|	1.58
110.333	0.00	0.00	0.236	O	|	|	|	1.58
110.417	0.00	0.00	0.236	O	|	|	|	1.58
110.500	0.00	0.00	0.236	O	|	|	|	1.58
110.583	0.00	0.00	0.236	O	|	|	|	1.58
110.667	0.00	0.00	0.236	O	|	|	|	1.58
110.750	0.00	0.00	0.236	O	|	|	|	1.58
110.833	0.00	0.00	0.236	O	|	|	|	1.58
110.917	0.00	0.00	0.236	O	|	|	|	1.58
111.000	0.00	0.00	0.236	O	|	|	|	1.58
111.083	0.00	0.00	0.236	O	|	|	|	1.58
111.167	0.00	0.00	0.236	O	|	|	|	1.58
111.250	0.00	0.00	0.236	O	|	|	|	1.58

111.333	0.00	0.00	0.236	O	|	|	|	|	1.58
111.417	0.00	0.00	0.236	O	|	|	|	|	1.58
111.500	0.00	0.00	0.236	O	|	|	|	|	1.58
111.583	0.00	0.00	0.236	O	|	|	|	|	1.58
111.667	0.00	0.00	0.236	O	|	|	|	|	1.58
111.750	0.00	0.00	0.236	O	|	|	|	|	1.58
111.833	0.00	0.00	0.236	O	|	|	|	|	1.58
111.917	0.00	0.00	0.236	O	|	|	|	|	1.58
112.000	0.00	0.00	0.236	O	|	|	|	|	1.58
112.083	0.00	0.00	0.236	O	|	|	|	|	1.58
112.167	0.00	0.00	0.236	O	|	|	|	|	1.58
112.250	0.00	0.00	0.236	O	|	|	|	|	1.58
112.333	0.00	0.00	0.236	O	|	|	|	|	1.58
112.417	0.00	0.00	0.236	O	|	|	|	|	1.58
112.500	0.00	0.00	0.236	O	|	|	|	|	1.58
112.583	0.00	0.00	0.236	O	|	|	|	|	1.58
112.667	0.00	0.00	0.236	O	|	|	|	|	1.58
112.750	0.00	0.00	0.236	O	|	|	|	|	1.58
112.833	0.00	0.00	0.236	O	|	|	|	|	1.58
112.917	0.00	0.00	0.236	O	|	|	|	|	1.58
113.000	0.00	0.00	0.236	O	|	|	|	|	1.58
113.083	0.00	0.00	0.236	O	|	|	|	|	1.58
113.167	0.00	0.00	0.236	O	|	|	|	|	1.58
113.250	0.00	0.00	0.236	O	|	|	|	|	1.58
113.333	0.00	0.00	0.236	O	|	|	|	|	1.58
113.417	0.00	0.00	0.236	O	|	|	|	|	1.58
113.500	0.00	0.00	0.236	O	|	|	|	|	1.58
113.583	0.00	0.00	0.236	O	|	|	|	|	1.58
113.667	0.00	0.00	0.236	O	|	|	|	|	1.58
113.750	0.00	0.00	0.236	O	|	|	|	|	1.58
113.833	0.00	0.00	0.236	O	|	|	|	|	1.58
113.917	0.00	0.00	0.236	O	|	|	|	|	1.58
114.000	0.00	0.00	0.236	O	|	|	|	|	1.58
114.083	0.00	0.00	0.235	O	|	|	|	|	1.58
114.167	0.00	0.00	0.235	O	|	|	|	|	1.58
114.250	0.00	0.00	0.235	O	|	|	|	|	1.58
114.333	0.00	0.00	0.235	O	|	|	|	|	1.58
114.417	0.00	0.00	0.235	O	|	|	|	|	1.58
114.500	0.00	0.00	0.235	O	|	|	|	|	1.58
114.583	0.00	0.00	0.235	O	|	|	|	|	1.58
114.667	0.00	0.00	0.235	O	|	|	|	|	1.58
114.750	0.00	0.00	0.235	O	|	|	|	|	1.58
114.833	0.00	0.00	0.235	O	|	|	|	|	1.58
114.917	0.00	0.00	0.235	O	|	|	|	|	1.58
115.000	0.00	0.00	0.235	O	|	|	|	|	1.58
115.083	0.00	0.00	0.235	O	|	|	|	|	1.58
115.167	0.00	0.00	0.235	O	|	|	|	|	1.58
115.250	0.00	0.00	0.235	O	|	|	|	|	1.58
115.333	0.00	0.00	0.235	O	|	|	|	|	1.58
115.417	0.00	0.00	0.235	O	|	|	|	|	1.58
115.500	0.00	0.00	0.235	O	|	|	|	|	1.58
115.583	0.00	0.00	0.235	O	|	|	|	|	1.58
115.667	0.00	0.00	0.235	O	|	|	|	|	1.58
115.750	0.00	0.00	0.235	O	|	|	|	|	1.58

115.833	0.00	0.00	0.235	O	|	|	|	1.58
115.917	0.00	0.00	0.235	O	|	|	|	1.58
116.000	0.00	0.00	0.235	O	|	|	|	1.58
116.083	0.00	0.00	0.235	O	|	|	|	1.58
116.167	0.00	0.00	0.235	O	|	|	|	1.58
116.250	0.00	0.00	0.235	O	|	|	|	1.58
116.333	0.00	0.00	0.235	O	|	|	|	1.58
116.417	0.00	0.00	0.235	O	|	|	|	1.58
116.500	0.00	0.00	0.235	O	|	|	|	1.58
116.583	0.00	0.00	0.235	O	|	|	|	1.58
116.667	0.00	0.00	0.235	O	|	|	|	1.58
116.750	0.00	0.00	0.235	O	|	|	|	1.58
116.833	0.00	0.00	0.235	O	|	|	|	1.58
116.917	0.00	0.00	0.235	O	|	|	|	1.58
117.000	0.00	0.00	0.235	O	|	|	|	1.58
117.083	0.00	0.00	0.235	O	|	|	|	1.58
117.167	0.00	0.00	0.235	O	|	|	|	1.58
117.250	0.00	0.00	0.235	O	|	|	|	1.58
117.333	0.00	0.00	0.235	O	|	|	|	1.58
117.417	0.00	0.00	0.235	O	|	|	|	1.58
117.500	0.00	0.00	0.235	O	|	|	|	1.58
117.583	0.00	0.00	0.235	O	|	|	|	1.58
117.667	0.00	0.00	0.235	O	|	|	|	1.58
117.750	0.00	0.00	0.235	O	|	|	|	1.58
117.833	0.00	0.00	0.235	O	|	|	|	1.58
117.917	0.00	0.00	0.235	O	|	|	|	1.58
118.000	0.00	0.00	0.235	O	|	|	|	1.58
118.083	0.00	0.00	0.235	O	|	|	|	1.58
118.167	0.00	0.00	0.235	O	|	|	|	1.58
118.250	0.00	0.00	0.235	O	|	|	|	1.58
118.333	0.00	0.00	0.234	O	|	|	|	1.58
118.417	0.00	0.00	0.234	O	|	|	|	1.58
118.500	0.00	0.00	0.234	O	|	|	|	1.58
118.583	0.00	0.00	0.234	O	|	|	|	1.58
118.667	0.00	0.00	0.234	O	|	|	|	1.58
118.750	0.00	0.00	0.234	O	|	|	|	1.58
118.833	0.00	0.00	0.234	O	|	|	|	1.58
118.917	0.00	0.00	0.234	O	|	|	|	1.58
119.000	0.00	0.00	0.234	O	|	|	|	1.58
119.083	0.00	0.00	0.234	O	|	|	|	1.58
119.167	0.00	0.00	0.234	O	|	|	|	1.58
119.250	0.00	0.00	0.234	O	|	|	|	1.58
119.333	0.00	0.00	0.234	O	|	|	|	1.58
119.417	0.00	0.00	0.234	O	|	|	|	1.58
119.500	0.00	0.00	0.234	O	|	|	|	1.58
119.583	0.00	0.00	0.234	O	|	|	|	1.58
119.667	0.00	0.00	0.234	O	|	|	|	1.58
119.750	0.00	0.00	0.234	O	|	|	|	1.58
119.833	0.00	0.00	0.234	O	|	|	|	1.57
119.917	0.00	0.00	0.234	O	|	|	|	1.57
120.000	0.00	0.00	0.234	O	|	|	|	1.57
120.083	0.00	0.00	0.234	O	|	|	|	1.57
120.167	0.00	0.00	0.234	O	|	|	|	1.57
120.250	0.00	0.00	0.234	O	|	|	|	1.57

120.333	0.00	0.00	0.234	O	|	|	|	|	1.57
120.417	0.00	0.00	0.234	O	|	|	|	|	1.57
120.500	0.00	0.00	0.234	O	|	|	|	|	1.57
120.583	0.00	0.00	0.234	O	|	|	|	|	1.57
120.667	0.00	0.00	0.234	O	|	|	|	|	1.57
120.750	0.00	0.00	0.234	O	|	|	|	|	1.57
120.833	0.00	0.00	0.234	O	|	|	|	|	1.57
120.917	0.00	0.00	0.234	O	|	|	|	|	1.57
121.000	0.00	0.00	0.234	O	|	|	|	|	1.57
121.083	0.00	0.00	0.234	O	|	|	|	|	1.57
121.167	0.00	0.00	0.234	O	|	|	|	|	1.57
121.250	0.00	0.00	0.234	O	|	|	|	|	1.57
121.333	0.00	0.00	0.234	O	|	|	|	|	1.57
121.417	0.00	0.00	0.234	O	|	|	|	|	1.57
121.500	0.00	0.00	0.234	O	|	|	|	|	1.57
121.583	0.00	0.00	0.234	O	|	|	|	|	1.57
121.667	0.00	0.00	0.234	O	|	|	|	|	1.57
121.750	0.00	0.00	0.234	O	|	|	|	|	1.57
121.833	0.00	0.00	0.234	O	|	|	|	|	1.57
121.917	0.00	0.00	0.234	O	|	|	|	|	1.57
122.000	0.00	0.00	0.234	O	|	|	|	|	1.57
122.083	0.00	0.00	0.234	O	|	|	|	|	1.57
122.167	0.00	0.00	0.234	O	|	|	|	|	1.57
122.250	0.00	0.00	0.234	O	|	|	|	|	1.57
122.333	0.00	0.00	0.234	O	|	|	|	|	1.57
122.417	0.00	0.00	0.234	O	|	|	|	|	1.57
122.500	0.00	0.00	0.234	O	|	|	|	|	1.57
122.583	0.00	0.00	0.233	O	|	|	|	|	1.57
122.667	0.00	0.00	0.233	O	|	|	|	|	1.57
122.750	0.00	0.00	0.233	O	|	|	|	|	1.57
122.833	0.00	0.00	0.233	O	|	|	|	|	1.57
122.917	0.00	0.00	0.233	O	|	|	|	|	1.57
123.000	0.00	0.00	0.233	O	|	|	|	|	1.57
123.083	0.00	0.00	0.233	O	|	|	|	|	1.57
123.167	0.00	0.00	0.233	O	|	|	|	|	1.57
123.250	0.00	0.00	0.233	O	|	|	|	|	1.57
123.333	0.00	0.00	0.233	O	|	|	|	|	1.57
123.417	0.00	0.00	0.233	O	|	|	|	|	1.57
123.500	0.00	0.00	0.233	O	|	|	|	|	1.57
123.583	0.00	0.00	0.233	O	|	|	|	|	1.57
123.667	0.00	0.00	0.233	O	|	|	|	|	1.57
123.750	0.00	0.00	0.233	O	|	|	|	|	1.57
123.833	0.00	0.00	0.233	O	|	|	|	|	1.57
123.917	0.00	0.00	0.233	O	|	|	|	|	1.57
124.000	0.00	0.00	0.233	O	|	|	|	|	1.57
124.083	0.00	0.00	0.233	O	|	|	|	|	1.57
124.167	0.00	0.00	0.233	O	|	|	|	|	1.57
124.250	0.00	0.00	0.233	O	|	|	|	|	1.57
124.333	0.00	0.00	0.233	O	|	|	|	|	1.57
124.417	0.00	0.00	0.233	O	|	|	|	|	1.57
124.500	0.00	0.00	0.233	O	|	|	|	|	1.57
124.583	0.00	0.00	0.233	O	|	|	|	|	1.57
124.667	0.00	0.00	0.233	O	|	|	|	|	1.57
124.750	0.00	0.00	0.233	O	|	|	|	|	1.57

124.833	0.00	0.00	0.233	O	|	|	|	1.57
124.917	0.00	0.00	0.233	O	|	|	|	1.57
125.000	0.00	0.00	0.233	O	|	|	|	1.57
125.083	0.00	0.00	0.233	O	|	|	|	1.57
125.167	0.00	0.00	0.233	O	|	|	|	1.57
125.250	0.00	0.00	0.233	O	|	|	|	1.57
125.333	0.00	0.00	0.233	O	|	|	|	1.57
125.417	0.00	0.00	0.233	O	|	|	|	1.57
125.500	0.00	0.00	0.233	O	|	|	|	1.57
125.583	0.00	0.00	0.233	O	|	|	|	1.57
125.667	0.00	0.00	0.233	O	|	|	|	1.57
125.750	0.00	0.00	0.233	O	|	|	|	1.57
125.833	0.00	0.00	0.233	O	|	|	|	1.57
125.917	0.00	0.00	0.233	O	|	|	|	1.57
126.000	0.00	0.00	0.233	O	|	|	|	1.57
126.083	0.00	0.00	0.233	O	|	|	|	1.57
126.167	0.00	0.00	0.233	O	|	|	|	1.57
126.250	0.00	0.00	0.233	O	|	|	|	1.57
126.333	0.00	0.00	0.233	O	|	|	|	1.57
126.417	0.00	0.00	0.233	O	|	|	|	1.57
126.500	0.00	0.00	0.233	O	|	|	|	1.57
126.583	0.00	0.00	0.233	O	|	|	|	1.57
126.667	0.00	0.00	0.233	O	|	|	|	1.57
126.750	0.00	0.00	0.233	O	|	|	|	1.57
126.833	0.00	0.00	0.232	O	|	|	|	1.57
126.917	0.00	0.00	0.232	O	|	|	|	1.57
127.000	0.00	0.00	0.232	O	|	|	|	1.57
127.083	0.00	0.00	0.232	O	|	|	|	1.57
127.167	0.00	0.00	0.232	O	|	|	|	1.57
127.250	0.00	0.00	0.232	O	|	|	|	1.57
127.333	0.00	0.00	0.232	O	|	|	|	1.57
127.417	0.00	0.00	0.232	O	|	|	|	1.57
127.500	0.00	0.00	0.232	O	|	|	|	1.57
127.583	0.00	0.00	0.232	O	|	|	|	1.57
127.667	0.00	0.00	0.232	O	|	|	|	1.57
127.750	0.00	0.00	0.232	O	|	|	|	1.57
127.833	0.00	0.00	0.232	O	|	|	|	1.57
127.917	0.00	0.00	0.232	O	|	|	|	1.57
128.000	0.00	0.00	0.232	O	|	|	|	1.57
128.083	0.00	0.00	0.232	O	|	|	|	1.57
128.167	0.00	0.00	0.232	O	|	|	|	1.57
128.250	0.00	0.00	0.232	O	|	|	|	1.57
128.333	0.00	0.00	0.232	O	|	|	|	1.57
128.417	0.00	0.00	0.232	O	|	|	|	1.57
128.500	0.00	0.00	0.232	O	|	|	|	1.57
128.583	0.00	0.00	0.232	O	|	|	|	1.57
128.667	0.00	0.00	0.232	O	|	|	|	1.57
128.750	0.00	0.00	0.232	O	|	|	|	1.57
128.833	0.00	0.00	0.232	O	|	|	|	1.57
128.917	0.00	0.00	0.232	O	|	|	|	1.57
129.000	0.00	0.00	0.232	O	|	|	|	1.57
129.083	0.00	0.00	0.232	O	|	|	|	1.57
129.167	0.00	0.00	0.232	O	|	|	|	1.57
129.250	0.00	0.00	0.232	O	|	|	|	1.57

129.333	0.00	0.00	0.232	O	|	|	|	|	1.57
129.417	0.00	0.00	0.232	O	|	|	|	|	1.57
129.500	0.00	0.00	0.232	O	|	|	|	|	1.57
129.583	0.00	0.00	0.232	O	|	|	|	|	1.57
129.667	0.00	0.00	0.232	O	|	|	|	|	1.57
129.750	0.00	0.00	0.232	O	|	|	|	|	1.57
129.833	0.00	0.00	0.232	O	|	|	|	|	1.57
129.917	0.00	0.00	0.232	O	|	|	|	|	1.57
130.000	0.00	0.00	0.232	O	|	|	|	|	1.57
130.083	0.00	0.00	0.232	O	|	|	|	|	1.57
130.167	0.00	0.00	0.232	O	|	|	|	|	1.56
130.250	0.00	0.00	0.232	O	|	|	|	|	1.56
130.333	0.00	0.00	0.232	O	|	|	|	|	1.56
130.417	0.00	0.00	0.232	O	|	|	|	|	1.56
130.500	0.00	0.00	0.232	O	|	|	|	|	1.56
130.583	0.00	0.00	0.232	O	|	|	|	|	1.56
130.667	0.00	0.00	0.232	O	|	|	|	|	1.56
130.750	0.00	0.00	0.232	O	|	|	|	|	1.56
130.833	0.00	0.00	0.232	O	|	|	|	|	1.56
130.917	0.00	0.00	0.232	O	|	|	|	|	1.56
131.000	0.00	0.00	0.232	O	|	|	|	|	1.56
131.083	0.00	0.00	0.231	O	|	|	|	|	1.56
131.167	0.00	0.00	0.231	O	|	|	|	|	1.56
131.250	0.00	0.00	0.231	O	|	|	|	|	1.56
131.333	0.00	0.00	0.231	O	|	|	|	|	1.56
131.417	0.00	0.00	0.231	O	|	|	|	|	1.56
131.500	0.00	0.00	0.231	O	|	|	|	|	1.56
131.583	0.00	0.00	0.231	O	|	|	|	|	1.56
131.667	0.00	0.00	0.231	O	|	|	|	|	1.56
131.750	0.00	0.00	0.231	O	|	|	|	|	1.56
131.833	0.00	0.00	0.231	O	|	|	|	|	1.56
131.917	0.00	0.00	0.231	O	|	|	|	|	1.56
132.000	0.00	0.00	0.231	O	|	|	|	|	1.56
132.083	0.00	0.00	0.231	O	|	|	|	|	1.56
132.167	0.00	0.00	0.231	O	|	|	|	|	1.56
132.250	0.00	0.00	0.231	O	|	|	|	|	1.56
132.333	0.00	0.00	0.231	O	|	|	|	|	1.56
132.417	0.00	0.00	0.231	O	|	|	|	|	1.56
132.500	0.00	0.00	0.231	O	|	|	|	|	1.56
132.583	0.00	0.00	0.231	O	|	|	|	|	1.56
132.667	0.00	0.00	0.231	O	|	|	|	|	1.56
132.750	0.00	0.00	0.231	O	|	|	|	|	1.56
132.833	0.00	0.00	0.231	O	|	|	|	|	1.56
132.917	0.00	0.00	0.231	O	|	|	|	|	1.56
133.000	0.00	0.00	0.231	O	|	|	|	|	1.56
133.083	0.00	0.00	0.231	O	|	|	|	|	1.56
133.167	0.00	0.00	0.231	O	|	|	|	|	1.56
133.250	0.00	0.00	0.231	O	|	|	|	|	1.56
133.333	0.00	0.00	0.231	O	|	|	|	|	1.56
133.417	0.00	0.00	0.231	O	|	|	|	|	1.56
133.500	0.00	0.00	0.231	O	|	|	|	|	1.56
133.583	0.00	0.00	0.231	O	|	|	|	|	1.56
133.667	0.00	0.00	0.231	O	|	|	|	|	1.56
133.750	0.00	0.00	0.231	O	|	|	|	|	1.56

133.833	0.00	0.00	0.231	O	|	|	|	1.56
133.917	0.00	0.00	0.231	O	|	|	|	1.56
134.000	0.00	0.00	0.231	O	|	|	|	1.56
134.083	0.00	0.00	0.231	O	|	|	|	1.56
134.167	0.00	0.00	0.231	O	|	|	|	1.56
134.250	0.00	0.00	0.231	O	|	|	|	1.56
134.333	0.00	0.00	0.231	O	|	|	|	1.56
134.417	0.00	0.00	0.231	O	|	|	|	1.56
134.500	0.00	0.00	0.231	O	|	|	|	1.56
134.583	0.00	0.00	0.231	O	|	|	|	1.56
134.667	0.00	0.00	0.231	O	|	|	|	1.56
134.750	0.00	0.00	0.231	O	|	|	|	1.56
134.833	0.00	0.00	0.231	O	|	|	|	1.56
134.917	0.00	0.00	0.231	O	|	|	|	1.56
135.000	0.00	0.00	0.231	O	|	|	|	1.56
135.083	0.00	0.00	0.231	O	|	|	|	1.56
135.167	0.00	0.00	0.231	O	|	|	|	1.56
135.250	0.00	0.00	0.231	O	|	|	|	1.56
135.333	0.00	0.00	0.231	O	|	|	|	1.56
135.417	0.00	0.00	0.230	O	|	|	|	1.56
135.500	0.00	0.00	0.230	O	|	|	|	1.56
135.583	0.00	0.00	0.230	O	|	|	|	1.56
135.667	0.00	0.00	0.230	O	|	|	|	1.56
135.750	0.00	0.00	0.230	O	|	|	|	1.56
135.833	0.00	0.00	0.230	O	|	|	|	1.56
135.917	0.00	0.00	0.230	O	|	|	|	1.56
136.000	0.00	0.00	0.230	O	|	|	|	1.56
136.083	0.00	0.00	0.230	O	|	|	|	1.56
136.167	0.00	0.00	0.230	O	|	|	|	1.56
136.250	0.00	0.00	0.230	O	|	|	|	1.56
136.333	0.00	0.00	0.230	O	|	|	|	1.56
136.417	0.00	0.00	0.230	O	|	|	|	1.56
136.500	0.00	0.00	0.230	O	|	|	|	1.56
136.583	0.00	0.00	0.230	O	|	|	|	1.56
136.667	0.00	0.00	0.230	O	|	|	|	1.56
136.750	0.00	0.00	0.230	O	|	|	|	1.56
136.833	0.00	0.00	0.230	O	|	|	|	1.56
136.917	0.00	0.00	0.230	O	|	|	|	1.56
137.000	0.00	0.00	0.230	O	|	|	|	1.56
137.083	0.00	0.00	0.230	O	|	|	|	1.56
137.167	0.00	0.00	0.230	O	|	|	|	1.56
137.250	0.00	0.00	0.230	O	|	|	|	1.56
137.333	0.00	0.00	0.230	O	|	|	|	1.56
137.417	0.00	0.00	0.230	O	|	|	|	1.56
137.500	0.00	0.00	0.230	O	|	|	|	1.56
137.583	0.00	0.00	0.230	O	|	|	|	1.56
137.667	0.00	0.00	0.230	O	|	|	|	1.56
137.750	0.00	0.00	0.230	O	|	|	|	1.56
137.833	0.00	0.00	0.230	O	|	|	|	1.56
137.917	0.00	0.00	0.230	O	|	|	|	1.56
138.000	0.00	0.00	0.230	O	|	|	|	1.56
138.083	0.00	0.00	0.230	O	|	|	|	1.56
138.167	0.00	0.00	0.230	O	|	|	|	1.56
138.250	0.00	0.00	0.230	O	|	|	|	1.56

138.333	0.00	0.00	0.230	O	|	|	|	1.56
138.417	0.00	0.00	0.230	O	|	|	|	1.56
138.500	0.00	0.00	0.230	O	|	|	|	1.56
138.583	0.00	0.00	0.230	O	|	|	|	1.56
138.667	0.00	0.00	0.230	O	|	|	|	1.56
138.750	0.00	0.00	0.230	O	|	|	|	1.56
138.833	0.00	0.00	0.230	O	|	|	|	1.56
138.917	0.00	0.00	0.230	O	|	|	|	1.56
139.000	0.00	0.00	0.230	O	|	|	|	1.56
139.083	0.00	0.00	0.230	O	|	|	|	1.56
139.167	0.00	0.00	0.230	O	|	|	|	1.56
139.250	0.00	0.00	0.230	O	|	|	|	1.56
139.333	0.00	0.00	0.230	O	|	|	|	1.56
139.417	0.00	0.00	0.230	O	|	|	|	1.56
139.500	0.00	0.00	0.230	O	|	|	|	1.56
139.583	0.00	0.00	0.230	O	|	|	|	1.56
139.667	0.00	0.00	0.230	O	|	|	|	1.56
139.750	0.00	0.00	0.229	O	|	|	|	1.56
139.833	0.00	0.00	0.229	O	|	|	|	1.56
139.917	0.00	0.00	0.229	O	|	|	|	1.56
140.000	0.00	0.00	0.229	O	|	|	|	1.56
140.083	0.00	0.00	0.229	O	|	|	|	1.56
140.167	0.00	0.00	0.229	O	|	|	|	1.56
140.250	0.00	0.00	0.229	O	|	|	|	1.56
140.333	0.00	0.00	0.229	O	|	|	|	1.56
140.417	0.00	0.00	0.229	O	|	|	|	1.56
140.500	0.00	0.00	0.229	O	|	|	|	1.55
140.583	0.00	0.00	0.229	O	|	|	|	1.55
140.667	0.00	0.00	0.229	O	|	|	|	1.55
140.750	0.00	0.00	0.229	O	|	|	|	1.55
140.833	0.00	0.00	0.229	O	|	|	|	1.55
140.917	0.00	0.00	0.229	O	|	|	|	1.55
141.000	0.00	0.00	0.229	O	|	|	|	1.55
141.083	0.00	0.00	0.229	O	|	|	|	1.55
141.167	0.00	0.00	0.229	O	|	|	|	1.55
141.250	0.00	0.00	0.229	O	|	|	|	1.55
141.333	0.00	0.00	0.229	O	|	|	|	1.55
141.417	0.00	0.00	0.229	O	|	|	|	1.55
141.500	0.00	0.00	0.229	O	|	|	|	1.55
141.583	0.00	0.00	0.229	O	|	|	|	1.55
141.667	0.00	0.00	0.229	O	|	|	|	1.55
141.750	0.00	0.00	0.229	O	|	|	|	1.55
141.833	0.00	0.00	0.229	O	|	|	|	1.55
141.917	0.00	0.00	0.229	O	|	|	|	1.55
142.000	0.00	0.00	0.229	O	|	|	|	1.55
142.083	0.00	0.00	0.229	O	|	|	|	1.55
142.167	0.00	0.00	0.229	O	|	|	|	1.55
142.250	0.00	0.00	0.229	O	|	|	|	1.55
142.333	0.00	0.00	0.229	O	|	|	|	1.55
142.417	0.00	0.00	0.229	O	|	|	|	1.55
142.500	0.00	0.00	0.229	O	|	|	|	1.55
142.583	0.00	0.00	0.229	O	|	|	|	1.55
142.667	0.00	0.00	0.229	O	|	|	|	1.55
142.750	0.00	0.00	0.229	O	|	|	|	1.55

142.833	0.00	0.00	0.229	O	|	|	|	1.55
142.917	0.00	0.00	0.229	O	|	|	|	1.55
143.000	0.00	0.00	0.229	O	|	|	|	1.55
143.083	0.00	0.00	0.229	O	|	|	|	1.55
143.167	0.00	0.00	0.229	O	|	|	|	1.55
143.250	0.00	0.00	0.229	O	|	|	|	1.55
143.333	0.00	0.00	0.229	O	|	|	|	1.55
143.417	0.00	0.00	0.229	O	|	|	|	1.55
143.500	0.00	0.00	0.229	O	|	|	|	1.55
143.583	0.00	0.00	0.229	O	|	|	|	1.55
143.667	0.00	0.00	0.229	O	|	|	|	1.55
143.750	0.00	0.00	0.229	O	|	|	|	1.55
143.833	0.00	0.00	0.229	O	|	|	|	1.55
143.917	0.00	0.00	0.229	O	|	|	|	1.55
144.000	0.00	0.00	0.228	O	|	|	|	1.55
144.083	0.00	0.00	0.228	O	|	|	|	1.55
144.167	0.00	0.00	0.228	O	|	|	|	1.55
144.250	0.00	0.00	0.228	O	|	|	|	1.55
144.333	0.00	0.00	0.228	O	|	|	|	1.55
144.417	0.00	0.00	0.228	O	|	|	|	1.55
144.500	0.00	0.00	0.228	O	|	|	|	1.55
144.583	0.00	0.00	0.228	O	|	|	|	1.55
144.667	0.00	0.00	0.228	O	|	|	|	1.55
144.750	0.00	0.00	0.228	O	|	|	|	1.55
144.833	0.00	0.00	0.228	O	|	|	|	1.55
144.917	0.00	0.00	0.228	O	|	|	|	1.55
145.000	0.00	0.00	0.228	O	|	|	|	1.55
145.083	0.00	0.00	0.228	O	|	|	|	1.55
145.167	0.00	0.00	0.228	O	|	|	|	1.55
145.250	0.00	0.00	0.228	O	|	|	|	1.55
145.333	0.00	0.00	0.228	O	|	|	|	1.55
145.417	0.00	0.00	0.228	O	|	|	|	1.55
145.500	0.00	0.00	0.228	O	|	|	|	1.55
145.583	0.00	0.00	0.228	O	|	|	|	1.55
145.667	0.00	0.00	0.228	O	|	|	|	1.55
145.750	0.00	0.00	0.228	O	|	|	|	1.55
145.833	0.00	0.00	0.228	O	|	|	|	1.55
145.917	0.00	0.00	0.228	O	|	|	|	1.55
146.000	0.00	0.00	0.228	O	|	|	|	1.55
146.083	0.00	0.00	0.228	O	|	|	|	1.55
146.167	0.00	0.00	0.228	O	|	|	|	1.55
146.250	0.00	0.00	0.228	O	|	|	|	1.55
146.333	0.00	0.00	0.228	O	|	|	|	1.55
146.417	0.00	0.00	0.228	O	|	|	|	1.55
146.500	0.00	0.00	0.228	O	|	|	|	1.55
146.583	0.00	0.00	0.228	O	|	|	|	1.55
146.667	0.00	0.00	0.228	O	|	|	|	1.55
146.750	0.00	0.00	0.228	O	|	|	|	1.55
146.833	0.00	0.00	0.228	O	|	|	|	1.55
146.917	0.00	0.00	0.228	O	|	|	|	1.55
147.000	0.00	0.00	0.228	O	|	|	|	1.55
147.083	0.00	0.00	0.228	O	|	|	|	1.55
147.167	0.00	0.00	0.228	O	|	|	|	1.55
147.250	0.00	0.00	0.228	O	|	|	|	1.55

147.333	0.00	0.00	0.228	O	|	|	|	1.55
147.417	0.00	0.00	0.228	O	|	|	|	1.55
147.500	0.00	0.00	0.228	O	|	|	|	1.55
147.583	0.00	0.00	0.228	O	|	|	|	1.55
147.667	0.00	0.00	0.228	O	|	|	|	1.55
147.750	0.00	0.00	0.228	O	|	|	|	1.55
147.833	0.00	0.00	0.228	O	|	|	|	1.55
147.917	0.00	0.00	0.228	O	|	|	|	1.55
148.000	0.00	0.00	0.228	O	|	|	|	1.55
148.083	0.00	0.00	0.228	O	|	|	|	1.55
148.167	0.00	0.00	0.228	O	|	|	|	1.55
148.250	0.00	0.00	0.228	O	|	|	|	1.55
148.333	0.00	0.00	0.227	O	|	|	|	1.55
148.417	0.00	0.00	0.227	O	|	|	|	1.55
148.500	0.00	0.00	0.227	O	|	|	|	1.55
148.583	0.00	0.00	0.227	O	|	|	|	1.55
148.667	0.00	0.00	0.227	O	|	|	|	1.55
148.750	0.00	0.00	0.227	O	|	|	|	1.55
148.833	0.00	0.00	0.227	O	|	|	|	1.55
148.917	0.00	0.00	0.227	O	|	|	|	1.55
149.000	0.00	0.00	0.227	O	|	|	|	1.55
149.083	0.00	0.00	0.227	O	|	|	|	1.55
149.167	0.00	0.00	0.227	O	|	|	|	1.55
149.250	0.00	0.00	0.227	O	|	|	|	1.55
149.333	0.00	0.00	0.227	O	|	|	|	1.55
149.417	0.00	0.00	0.227	O	|	|	|	1.55
149.500	0.00	0.00	0.227	O	|	|	|	1.55
149.583	0.00	0.00	0.227	O	|	|	|	1.55
149.667	0.00	0.00	0.227	O	|	|	|	1.55
149.750	0.00	0.00	0.227	O	|	|	|	1.55
149.833	0.00	0.00	0.227	O	|	|	|	1.55
149.917	0.00	0.00	0.227	O	|	|	|	1.55
150.000	0.00	0.00	0.227	O	|	|	|	1.55
150.083	0.00	0.00	0.227	O	|	|	|	1.55
150.167	0.00	0.00	0.227	O	|	|	|	1.55
150.250	0.00	0.00	0.227	O	|	|	|	1.55
150.333	0.00	0.00	0.227	O	|	|	|	1.55
150.417	0.00	0.00	0.227	O	|	|	|	1.55
150.500	0.00	0.00	0.227	O	|	|	|	1.55
150.583	0.00	0.00	0.227	O	|	|	|	1.55
150.667	0.00	0.00	0.227	O	|	|	|	1.55
150.750	0.00	0.00	0.227	O	|	|	|	1.55
150.833	0.00	0.00	0.227	O	|	|	|	1.55
150.917	0.00	0.00	0.227	O	|	|	|	1.54
151.000	0.00	0.00	0.227	O	|	|	|	1.54
151.083	0.00	0.00	0.227	O	|	|	|	1.54
151.167	0.00	0.00	0.227	O	|	|	|	1.54
151.250	0.00	0.00	0.227	O	|	|	|	1.54
151.333	0.00	0.00	0.227	O	|	|	|	1.54
151.417	0.00	0.00	0.227	O	|	|	|	1.54
151.500	0.00	0.00	0.227	O	|	|	|	1.54
151.583	0.00	0.00	0.227	O	|	|	|	1.54
151.667	0.00	0.00	0.227	O	|	|	|	1.54
151.750	0.00	0.00	0.227	O	|	|	|	1.54

151.833	0.00	0.00	0.227	O	|	|	|	|	1.54
151.917	0.00	0.00	0.227	O	|	|	|	|	1.54
152.000	0.00	0.00	0.227	O	|	|	|	|	1.54
152.083	0.00	0.00	0.227	O	|	|	|	|	1.54
152.167	0.00	0.00	0.227	O	|	|	|	|	1.54
152.250	0.00	0.00	0.227	O	|	|	|	|	1.54
152.333	0.00	0.00	0.227	O	|	|	|	|	1.54
152.417	0.00	0.00	0.227	O	|	|	|	|	1.54
152.500	0.00	0.00	0.227	O	|	|	|	|	1.54
152.583	0.00	0.00	0.227	O	|	|	|	|	1.54
152.667	0.00	0.00	0.226	O	|	|	|	|	1.54
152.750	0.00	0.00	0.226	O	|	|	|	|	1.54
152.833	0.00	0.00	0.226	O	|	|	|	|	1.54
152.917	0.00	0.00	0.226	O	|	|	|	|	1.54
153.000	0.00	0.00	0.226	O	|	|	|	|	1.54
153.083	0.00	0.00	0.226	O	|	|	|	|	1.54
153.167	0.00	0.00	0.226	O	|	|	|	|	1.54
153.250	0.00	0.00	0.226	O	|	|	|	|	1.54
153.333	0.00	0.00	0.226	O	|	|	|	|	1.54
153.417	0.00	0.00	0.226	O	|	|	|	|	1.54
153.500	0.00	0.00	0.226	O	|	|	|	|	1.54
153.583	0.00	0.00	0.226	O	|	|	|	|	1.54
153.667	0.00	0.00	0.226	O	|	|	|	|	1.54
153.750	0.00	0.00	0.226	O	|	|	|	|	1.54
153.833	0.00	0.00	0.226	O	|	|	|	|	1.54
153.917	0.00	0.00	0.226	O	|	|	|	|	1.54
154.000	0.00	0.00	0.226	O	|	|	|	|	1.54
154.083	0.00	0.00	0.226	O	|	|	|	|	1.54
154.167	0.00	0.00	0.226	O	|	|	|	|	1.54
154.250	0.00	0.00	0.226	O	|	|	|	|	1.54
154.333	0.00	0.00	0.226	O	|	|	|	|	1.54
154.417	0.00	0.00	0.226	O	|	|	|	|	1.54
154.500	0.00	0.00	0.226	O	|	|	|	|	1.54
154.583	0.00	0.00	0.226	O	|	|	|	|	1.54
154.667	0.00	0.00	0.226	O	|	|	|	|	1.54
154.750	0.00	0.00	0.226	O	|	|	|	|	1.54
154.833	0.00	0.00	0.226	O	|	|	|	|	1.54
154.917	0.00	0.00	0.226	O	|	|	|	|	1.54
155.000	0.00	0.00	0.226	O	|	|	|	|	1.54
155.083	0.00	0.00	0.226	O	|	|	|	|	1.54
155.167	0.00	0.00	0.226	O	|	|	|	|	1.54
155.250	0.00	0.00	0.226	O	|	|	|	|	1.54
155.333	0.00	0.00	0.226	O	|	|	|	|	1.54
155.417	0.00	0.00	0.226	O	|	|	|	|	1.54
155.500	0.00	0.00	0.226	O	|	|	|	|	1.54
155.583	0.00	0.00	0.226	O	|	|	|	|	1.54
155.667	0.00	0.00	0.226	O	|	|	|	|	1.54
155.750	0.00	0.00	0.226	O	|	|	|	|	1.54
155.833	0.00	0.00	0.226	O	|	|	|	|	1.54
155.917	0.00	0.00	0.226	O	|	|	|	|	1.54
156.000	0.00	0.00	0.226	O	|	|	|	|	1.54
156.083	0.00	0.00	0.226	O	|	|	|	|	1.54
156.167	0.00	0.00	0.226	O	|	|	|	|	1.54
156.250	0.00	0.00	0.226	O	|	|	|	|	1.54

156.333	0.00	0.00	0.226	O	|	|	|	1.54
156.417	0.00	0.00	0.226	O	|	|	|	1.54
156.500	0.00	0.00	0.226	O	|	|	|	1.54
156.583	0.00	0.00	0.226	O	|	|	|	1.54
156.667	0.00	0.00	0.226	O	|	|	|	1.54
156.750	0.00	0.00	0.226	O	|	|	|	1.54
156.833	0.00	0.00	0.226	O	|	|	|	1.54
156.917	0.00	0.00	0.226	O	|	|	|	1.54
157.000	0.00	0.00	0.226	O	|	|	|	1.54
157.083	0.00	0.00	0.225	O	|	|	|	1.54
157.167	0.00	0.00	0.225	O	|	|	|	1.54
157.250	0.00	0.00	0.225	O	|	|	|	1.54
157.333	0.00	0.00	0.225	O	|	|	|	1.54
157.417	0.00	0.00	0.225	O	|	|	|	1.54
157.500	0.00	0.00	0.225	O	|	|	|	1.54
157.583	0.00	0.00	0.225	O	|	|	|	1.54
157.667	0.00	0.00	0.225	O	|	|	|	1.54
157.750	0.00	0.00	0.225	O	|	|	|	1.54
157.833	0.00	0.00	0.225	O	|	|	|	1.54
157.917	0.00	0.00	0.225	O	|	|	|	1.54
158.000	0.00	0.00	0.225	O	|	|	|	1.54
158.083	0.00	0.00	0.225	O	|	|	|	1.54
158.167	0.00	0.00	0.225	O	|	|	|	1.54
158.250	0.00	0.00	0.225	O	|	|	|	1.54
158.333	0.00	0.00	0.225	O	|	|	|	1.54
158.417	0.00	0.00	0.225	O	|	|	|	1.54
158.500	0.00	0.00	0.225	O	|	|	|	1.54
158.583	0.00	0.00	0.225	O	|	|	|	1.54
158.667	0.00	0.00	0.225	O	|	|	|	1.54
158.750	0.00	0.00	0.225	O	|	|	|	1.54
158.833	0.00	0.00	0.225	O	|	|	|	1.54
158.917	0.00	0.00	0.225	O	|	|	|	1.54
159.000	0.00	0.00	0.225	O	|	|	|	1.54
159.083	0.00	0.00	0.225	O	|	|	|	1.54
159.167	0.00	0.00	0.225	O	|	|	|	1.54
159.250	0.00	0.00	0.225	O	|	|	|	1.54
159.333	0.00	0.00	0.225	O	|	|	|	1.54
159.417	0.00	0.00	0.225	O	|	|	|	1.54
159.500	0.00	0.00	0.225	O	|	|	|	1.54
159.583	0.00	0.00	0.225	O	|	|	|	1.54
159.667	0.00	0.00	0.225	O	|	|	|	1.54
159.750	0.00	0.00	0.225	O	|	|	|	1.54
159.833	0.00	0.00	0.225	O	|	|	|	1.54
159.917	0.00	0.00	0.225	O	|	|	|	1.54
160.000	0.00	0.00	0.225	O	|	|	|	1.54
160.083	0.00	0.00	0.225	O	|	|	|	1.54
160.167	0.00	0.00	0.225	O	|	|	|	1.54
160.250	0.00	0.00	0.225	O	|	|	|	1.54
160.333	0.00	0.00	0.225	O	|	|	|	1.54
160.417	0.00	0.00	0.225	O	|	|	|	1.54
160.500	0.00	0.00	0.225	O	|	|	|	1.54
160.583	0.00	0.00	0.225	O	|	|	|	1.54
160.667	0.00	0.00	0.225	O	|	|	|	1.54
160.750	0.00	0.00	0.225	O	|	|	|	1.54

160.833	0.00	0.00	0.225	O	|	|	|	1.54
160.917	0.00	0.00	0.225	O	|	|	|	1.54
161.000	0.00	0.00	0.225	O	|	|	|	1.54
161.083	0.00	0.00	0.225	O	|	|	|	1.54
161.167	0.00	0.00	0.225	O	|	|	|	1.54
161.250	0.00	0.00	0.225	O	|	|	|	1.54
161.333	0.00	0.00	0.225	O	|	|	|	1.54
161.417	0.00	0.00	0.224	O	|	|	|	1.53
161.500	0.00	0.00	0.224	O	|	|	|	1.53
161.583	0.00	0.00	0.224	O	|	|	|	1.53
161.667	0.00	0.00	0.224	O	|	|	|	1.53
161.750	0.00	0.00	0.224	O	|	|	|	1.53
161.833	0.00	0.00	0.224	O	|	|	|	1.53
161.917	0.00	0.00	0.224	O	|	|	|	1.53
162.000	0.00	0.00	0.224	O	|	|	|	1.53
162.083	0.00	0.00	0.224	O	|	|	|	1.53
162.167	0.00	0.00	0.224	O	|	|	|	1.53
162.250	0.00	0.00	0.224	O	|	|	|	1.53
162.333	0.00	0.00	0.224	O	|	|	|	1.53
162.417	0.00	0.00	0.224	O	|	|	|	1.53
162.500	0.00	0.00	0.224	O	|	|	|	1.53
162.583	0.00	0.00	0.224	O	|	|	|	1.53
162.667	0.00	0.00	0.224	O	|	|	|	1.53
162.750	0.00	0.00	0.224	O	|	|	|	1.53
162.833	0.00	0.00	0.224	O	|	|	|	1.53
162.917	0.00	0.00	0.224	O	|	|	|	1.53
163.000	0.00	0.00	0.224	O	|	|	|	1.53
163.083	0.00	0.00	0.224	O	|	|	|	1.53
163.167	0.00	0.00	0.224	O	|	|	|	1.53
163.250	0.00	0.00	0.224	O	|	|	|	1.53
163.333	0.00	0.00	0.224	O	|	|	|	1.53
163.417	0.00	0.00	0.224	O	|	|	|	1.53
163.500	0.00	0.00	0.224	O	|	|	|	1.53
163.583	0.00	0.00	0.224	O	|	|	|	1.53
163.667	0.00	0.00	0.224	O	|	|	|	1.53
163.750	0.00	0.00	0.224	O	|	|	|	1.53
163.833	0.00	0.00	0.224	O	|	|	|	1.53
163.917	0.00	0.00	0.224	O	|	|	|	1.53
164.000	0.00	0.00	0.224	O	|	|	|	1.53
164.083	0.00	0.00	0.224	O	|	|	|	1.53
164.167	0.00	0.00	0.224	O	|	|	|	1.53
164.250	0.00	0.00	0.224	O	|	|	|	1.53
164.333	0.00	0.00	0.224	O	|	|	|	1.53
164.417	0.00	0.00	0.224	O	|	|	|	1.53
164.500	0.00	0.00	0.224	O	|	|	|	1.53
164.583	0.00	0.00	0.224	O	|	|	|	1.53
164.667	0.00	0.00	0.224	O	|	|	|	1.53
164.750	0.00	0.00	0.224	O	|	|	|	1.53
164.833	0.00	0.00	0.224	O	|	|	|	1.53
164.917	0.00	0.00	0.224	O	|	|	|	1.53
165.000	0.00	0.00	0.224	O	|	|	|	1.53
165.083	0.00	0.00	0.224	O	|	|	|	1.53
165.167	0.00	0.00	0.224	O	|	|	|	1.53
165.250	0.00	0.00	0.224	O	|	|	|	1.53

165.333	0.00	0.00	0.224	O	|	|	|	1.53
165.417	0.00	0.00	0.224	O	|	|	|	1.53
165.500	0.00	0.00	0.224	O	|	|	|	1.53
165.583	0.00	0.00	0.224	O	|	|	|	1.53
165.667	0.00	0.00	0.224	O	|	|	|	1.53
165.750	0.00	0.00	0.223	O	|	|	|	1.53
165.833	0.00	0.00	0.223	O	|	|	|	1.53
165.917	0.00	0.00	0.223	O	|	|	|	1.53
166.000	0.00	0.00	0.223	O	|	|	|	1.53
166.083	0.00	0.00	0.223	O	|	|	|	1.53
166.167	0.00	0.00	0.223	O	|	|	|	1.53
166.250	0.00	0.00	0.223	O	|	|	|	1.53
166.333	0.00	0.00	0.223	O	|	|	|	1.53
166.417	0.00	0.00	0.223	O	|	|	|	1.53
166.500	0.00	0.00	0.223	O	|	|	|	1.53
166.583	0.00	0.00	0.223	O	|	|	|	1.53
166.667	0.00	0.00	0.223	O	|	|	|	1.53

Remaining water in basin = 0.22 (Ac.Ft)

**********HYDROGRAPH DATA**********

Number of intervals = 2001
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 11.101 (CFS)
Total volume = 1.683 (Ac.Ft)

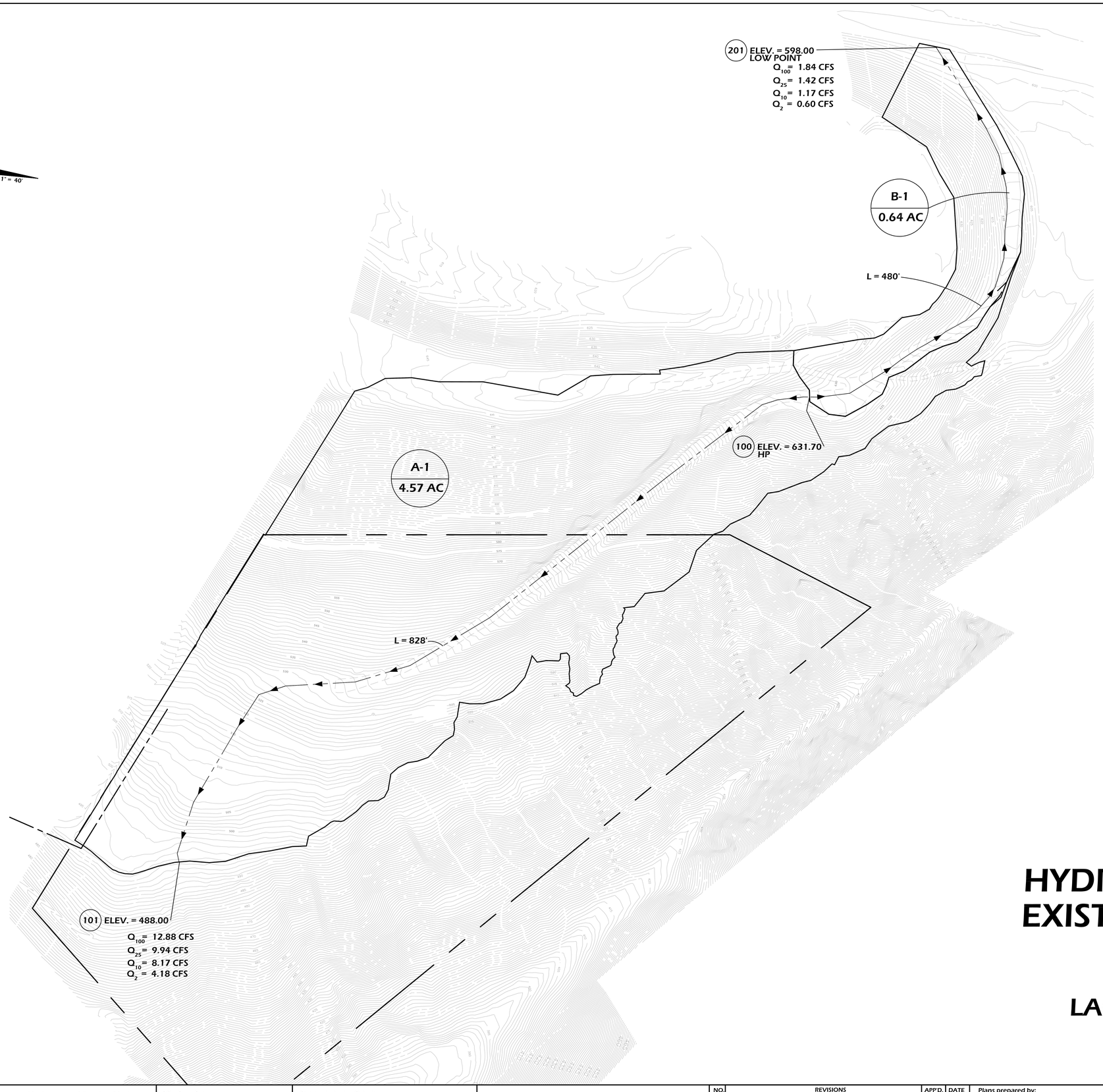
Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

Appendix 5

SCALE: 1" = 40'



GARG RESIDENCE
HYDROLOGY STUDY

03-17-19

HYDROLOGY EXHIBIT
EXISTING CONDITION
FOR
1 O'HILL DRIVE
IN
LAGUNA NIGUEL, CA

Underground Service Alert
Call: TOLL FREE
811
TWO WORKING DAYS BEFORE YOU DIG

SOILS ENGINEER:

OWNER/DEVELOPER:

MR. AND MRS. GARG

27261 HIDDEN TRAILS ROAD
LAGUNA HILLS, CA 92653

NO.	REVISIONS	APP'D.	DATE

Plans prepared by:
GILBERT
ENGINEERING & ASSOCIATES, INC.
CIVIL ENGINEERING, SURVEYING AND LAND DEVELOPMENT SERVICES
2 MERRIWEATHER PLACE LADERA RANCH, CA 92694
PH. (949) 218-8075
www.gilbert-engineering.com

REGISTERED PROFESSIONAL ENGINEER
WILLIAM G. GILBERT
No. C-60384
Exp. 06/30/19
CIVIL
STATE OF CALIFORNIA

EXISTING CONDITION
FOR
1 O'HILL RIDGE
LAGUNA NIGUEL, CA

DRAWN:	R.W.G.
DESIGN:	R.W.G.
CHECKED:	R.W.G.
SCALE:	1" = 40'
JOB NO.:	423.000

SCALE: 1" = 40'

401 ELEV. = 598.0
Q_{100}= 1.68 CFS
Q_{25}= 1.30 CFS
Q_{10}= 1.08 CFS
Q_2 = 0.57 CFS

O HILL RIDGE

UPPER VINTAGE RD.

D-1
0.41 AC

L = 274'

100 ELEV. = 615.0

L = 252'

ELEV. = 642.5 200

L= 191'

B-1
0.18 AC

A-3
0.96 AC

A-2
1.22 AC

A-1
0.57 AC

ELEV. = 571.5 201

ELEV. = 557.0 300

101 ELEV. = 598.0

102 ELEV. = 552.0

103 ELEV. = 525.0

C-1
0.62 AC

202
ELEV. = 510.0

106 ELEV. = 506.0

309 LF

A-4
0.54 AC

104 ELEV. = 507.0

B-2
0.64 AC

105 ELEV. = 506.5
Q_{100}= 13.40 CFS
Q_{25}= 10.35 CFS
Q_{10}= 8.58 CFS
Q_2 = 4.52 CFS

PROPOSED LAKE

301
ELEV. = 495.0
Q_{100}= 2.85 CFS
Q_{25}= 2.21 CFS
Q_{10}= 1.84 CFS
Q_2 = 0.98 CFS

MODULAR WETLAND
MODEL NO. MWS-L-6-8
W/ HIGH FLOW BYPASS

203
ELEV. = 506.0
Q_{100}= 4.34 CFS
Q_{25}= 3.35 CFS
Q_{10}= 2.79 CFS
Q_2 = 1.48 CFS

MATCHLINE - SEE RIGHT

MATCH LINE - SEE LEFT

C-1
0.62 AC

202
ELEV. = 510.0

106 ELEV. = 506.0

309 LF

B-2
0.64 AC

PROPOSED LAKE

301
ELEV. = 495.0
Q_{100}= 2.85 CFS
Q_{25}= 2.21 CFS
Q_{10}= 1.84 CFS
Q_2 = 0.98 CFS

MODULAR WETLAND
MODEL NO. MWS-L-6-8
W/ HIGH FLOW BYPASS

203
ELEV. = 506.0
Q_{100}= 4.34 CFS
Q_{25}= 3.35 CFS
Q_{10}= 2.79 CFS
Q_2 = 1.48 CFS

10' x 10' DISSAPATION STRUCTURE

107
ELEV. = 356.00
Q_{100}= 12.88 CFS
Q_{25}= 9.94 CFS
Q_{10}= 8.17 CFS
Q_2 = 4.18 CFS

GARG RESIDENCE
HYDROLOGY STUDY
03-17-19

HYDROLOGY EXHIBIT
PROPOSED CONDITION
FOR
1 O'HILL DRIVE
IN
LAGUNA NIGUEL, CA

Underground Service Alert
Call: TOLL FREE
811
TWO WORKING DAYS BEFORE YOU DIG

SOILS ENGINEER:

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27261 HIDDEN TRAILS ROAD
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NO.	REVISIONS	APP'D.	DATE

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REGISTERED PROFESSIONAL ENGINEER
WILLIAM E. GILBERT
NO. C-053591
Exp. 06/30/18
CIVIL
STATE OF CALIFORNIA

PROPOSED CONDITION
FOR
1 O'HILL RIDGE
LAGUNA NIGUEL, CA

DRAWN:	R.W.G.
DESIGN:	R.W.G.
CHECKED:	R.W.G.
SCALE:	1" = 40'
JOB NO.:	423.000

SHEET 2 OF 2

Preliminary Water Quality Management Plan (WQMP)

Project Name:

SP 17-03

Garg Residence, 1 O'Hill Ridge, Laguna Niguel, CA

Prepared for:

Sushil & Lorene Garg

27621 Hidden Trail Road

Laguna Niguel, CA 92653

skg3737@msn.com / (949) 510-3566

Prepared by:

Gilbert Engineering & Associates, Inc.

Engineer: R. William Gilbert, P.E

Registration No. 53051

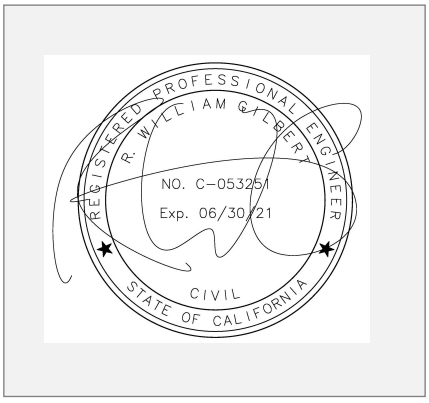
2 Merriweather Place

Ladera Ranch, CA 92694

bill@gilbert-engineering.com /

(949) 218-8075

Engineer's Seal



Prepared on: September 2017

Revised on: September 2018

Revised on: July 18, 2019

Project Owner's Certification			
Permit/Application No.	SP 17-03	Grading Permit No.	
Tract/Parcel Map No.	83-128	Building Permit No.	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract)			

This Water Quality Management Plan (WQMP) has been prepared for Sushil & Lorene Garg by Gilbert Engineering & Associates, Inc. The WQMP is intended to comply with the requirements of the local NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the San Diego Region (South Orange County). Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

Owner:			
Title	Sushil and Lorene Garg		
Company			
Address	27621 Hidden Trail Road, Laguna Niguel, CA 92653		
Email	skg3737@msn.com		
Telephone #	(949) 510-3566		
Signature		Date	7-18-2019

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Section 1 Discretionary Permit(s) and Water Quality Conditions

Project Infomation			
Permit/Application No.	Site Development Permit No. SP 17-03 Minor Use Permit No. UP 17-01	Site Address or Tract/Parcel Map No.	Parcel 1 or Parcel Map 85-128
Additional Information/ Comments:	Undeveloped Sloping Residential RS-1, District of Laguna Niguel Zoning Code (LNZC). High Priority Project – Hillside Development Greater than 5,000 sq ft		
Water Quality Conditions			
Water Quality Conditions from prior approvals or applicable watershed-based plans	*Pending City action*		

Location Map, Site Plan, and BMP Details



Section 2 Project Description

2.1 General Description

Description of Proposed Project		
Site Location	Parcel 1 or Parcel Map 85-128, Profile area 12 – Bear Brand Ranch 1 O'Hill Ridge, Laguna Niguel, CA	
Project Area (ft^2): Property= 6.00 acres Access Easement=0.34 acres	Number of Dwelling Units: 2	SIC Code: 8811
Narrative Project Description:	Project Description: The proposed project will include a new 2-story plus basement single family residence (approximately 29,270 square feet) with an attached 4,935 square foot 11-car garage, including mechanical space, 6 bedrooms and 11 bathrooms. A guest house of 2,932 square feet with 3 bedrooms and 3 bathrooms is also proposed. Exterior improvements include, but are not limited to, walkways, terraced gardens, patios, pool and spa, landscaping, a lake, and a long access drive from O' Hill Ridge via an easement from the HOA and a vehicular turnaround. Potential Storm Water Pollutants: List expected pollutants, Suspended Solids/Sediments, Nutrients, Pesticides, Oil & Grease, Trash & Debris Hydrologic Conditions of Concern: 2 Year Existing Condition - TC = 14.73 minutes, Q = 4.2 cfs, 2 Year Proposed Condition - TC = 8.20 minutes, Q = 4.5 cfs Percentage Change in Impermeable Surfaces: 19.5% increase including driveway	

Project Area	Pervious		Impervious	
	Area (acres or sq ft)	Percentage	Area (acres or sq ft)	Percentage
Pre-Project Conditions	261,551 sq ft	100%	0 sq ft	0%
Post-Project Conditions	261,551 sq ft	80.5%	50,614 sq ft	19.3%

2.2 Post Development Drainage Characteristics

The proposed storm drain system collects all the roof drain runoff, area drain runoff and driveway runoff and carries them through the project site to the down to the proposed Lake. The runoff will enter sediment chambers prior to the lake entrance

The Lake captures all the site runoff. The Lake has been designed to detain the peak flows during a 100 year storm event.

During high volume storm events the lake will overflow into an inlet which connects to a storm drain and passes through a Modular Wetland with a high flow bypass. The storm drain will run all the way to the bottom of the ravine where it will exist into the ravine through an energy dissipation structure with rip rap.

The existing canyon flows between two private residence properties below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend Road. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

There will be no impact on the downstream systems.

2.3 Property Ownership/Management

The homeowners, Sushil & Lorene Garg, will be responsible for long-term maintenance.

Section 3 Site & Watershed Characterization

3.1 Site Conditions

3.1.1 Existing Site Conditions

The existing project site flows in two directions. The existing dirt road falls downhill back to O'Hill Street which consists of 0.34 acres. The remaining site, 6.01 acres flows from north to south down into an existing canyon below the property.

The existing canyon flows between two homes below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

The site is covered with natural occuring coastal vegetation and is on a steep hillside. The average slope is roughly 2:1 in most places with a flat area midway down the property where the residence is being constructed.

A Geotechnical Study has been performed and the results are in the appendix.

Infiltration is not recommended on the property do to the steep hillside as it can promote landslides.

The only existing utilities are in the street right of way above the property.

Existing Land Uses

Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
Residential Property	6.01	0	6.01	0%
Driveway	0.43	0	0.43	0%
Total	6.44	0	6.43	0%

3.1.2 Infiltration-Related Characteristics

3.1.2.1 Hydrogeologic Conditions

Hydrologic Conditions of Concern:

2 Year Existing Condition - TC = 14.73 minutes, Q = 4.2 cfs,

2 Year Proposed Condition - TC = 8.20 minutes, Q = 4.5 cfs

3.1.2.2 Soil and Geologic Infiltration Characteristics

Predominant Soil type: D

A soils study has been performed and the results are in the appendix.

Infiltration is not recommended on the property do to the steep hillside as it can promote landslides.

3.1.2.3 Geotechnical Conditions

See Geotechnical Report in Appendix

3.1.2.4 Summary of Infiltration Opportunities and Constraints of Existing Site

Infiltration is not recommended on the property do to the steep hillside as it can promote landslides.

3.2 Proposed Site Development Activities

3.2.1 Overview of Site Development Activities

The proposed project will include a new 2-story plus basement single family residence (approximately 29,270 square feet) with an attached 4,935 square foot 11-car garage, including mechanical space, 6 bedrooms and 11 bathrooms. A guest house of 2,932 square feet with 3 bedrooms and 3 bathrooms is also proposed.

Exterior improvements include, but are not limited to, walkways, terraced gardens, patios, pool and spa, landscaping, a lake, and a long access drive from O' Hill Ridge via an easement from the HOA and a vehicular turnaround.

3.2.2 Project Attributes Influencing Stormwater Management

The proposed storm drain system collects all the roof drain runoff, area drain runoff and driveway runoff and carries them through the project site to the down to the proposed Lake. The runoff will enter sediment chambers prior to the lake entrance

The Lake captures all the site runoff. The Lake has been designed to detain the peak flows during a 100 year storm event.

During high volume storm events the lake will overflow into an inlet which connects to a storm drain and passes through a Modular Wetland with a high flow bypass. The storm drain will run all the way to the bottom of the ravine where it will exist into the ravine through an energy dissipation structure with rip rap.

The existing canyon flows between two private residence properties below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend Road. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

There will be no impact on the downstream systems.

Proposed Land Uses

Land Use Description	Total Area (acres)	Impervious Area (acres)	Pervious Area (acres)	Imperviousness (%)
DMA-1 Residential Property	6.01	1.15	4.85	19.1%
DMA -2 Driveway	0.43	0.13	0.30	30.2%
Total	6.44	1.13	5.17	17.5%

3.2.3 Effects on Infiltration and Harvest and Use Feasibility

3.3 Receiving Waterbodies

The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

There will be no impact on the downstream systems.

Watershed Characteristics

Watershed: San Deigo

Downstream Receiving Waters: San Juan Creek

Water Quality Impairments (if applicable): DDE, Indicator Bacteria, Nitrogen, Oxygen Dissolved, Phosphorus, Selenium, Toxicity

Identify hydromodification susceptibility: None

Identify watershed management priorities: Not applicable to project

3.4 Stormwater Pollutants or Conditions of Concern

Pollutants or Conditions of Concern				
Pollutant	Expected from Proposed Land Uses/Activities (Yes or No)	Receiving Waterbody Impaired (Yes or No)	Priority Pollutant from WQIP or other Water Quality Condition? (Yes or No)	**Pollutant of Concern (Primary, Other, or No)**
Suspended-Solids	No	No	No	No
Nutrients	Yes	Yes	Yes	Primary
Heavy Metals	No	No	No	No
Bacteria/Virus/Pathogens	No	No	No	No
Pesticides	Yes	Yes	Yes	Primary

Oil and Grease	Yes	Yes	Yes	Primary
Toxic Organic Compounds	No	No	No	No
Trash and Debris	Yes	Yes	Yes	Primary
Dry Weather Runoff	No	No	No	No

3.5 Hydrologic Conditions of Concern

Hydrologic Conditions of Concern:

2 Year Existing Condition - TC = 14.73 minutes, Q = 4.2 cfs,

2 Year Proposed Condition - TC = 8.20 minutes, Q = 4.5 cfs

Does a hydrologic condition of concern exist for this project?

☐ No – An HCOC does not exist for this receiving water because:

- ☐ Project discharges directly to a protected conveyance (bed and bank are concrete lined the entire way from the point(s) of discharge to a receiving lake, reservoir, embayment, or the Ocean
- ☐ Project discharges directly to storm drains which discharge directly to a reservoir, lake, embayment, ocean or protected conveyance (as described above)
- ☐ The project discharges to an area identified in the WMAA as exempt from hydromodification concerns

☒ Yes – An HCOC does exist for this receiving water because none of the above are applicable.

Repeat this checklist for each different receiving water to which the project would discharge.

3.6 Critical Course Sediment Yield Areas

Not applicable.

Section 4 Site Plan and Drainage Plan

4.1 Drainage Management Area Delineation

Entire site is being treated as one DMA because the entire site drains into the proposed lake.

4.2 Overall Site Design BMPs

The design control volume runoff will be captured by the lake and reused for irrigation re-harvesting, but the lake has been designed to detain the 100 year peak flow increase. The overflow from the lake will drain to a Modular Wetland for treatment before it travels down into the ravine below. This method was chosen because of the availability of the proposed lake and the inability to infiltrate because of the steepness of the hillside and the potential for landslides by adding water to the soil.

Minimize Impervious Area - Impervious area has been maximized

Maximize Natural Infiltration Capacity - Natural infiltration has been maximized, but we are not using infiltration as a BMP do to the nature of the steep hillside

Preserve Existing Drainage Patterns and Time of Concentration - Drainage patterns are consistent with the natural condition

Disconnect Impervious Areas - Impervious areas are disconnected where feasible

Protect Existing Vegetation and Sensitive Areas - Sensitive areas are remaining intact

Revegetate Disturbed Areas - All disturbed areas will be landscape or revegated with natural plant material

Soil Stockpiling and Site Generated Organics - This is an export site

Firescaping- Fuel modification is in effect

Water Efficient Landscaping- Landscaping has been minimized as much as possible and the natural hillside areas have been maximized to remain natural. All design control runoff will drain to the lake and will be reused for irrigation.

Slopes and Channel Buffers - Slopes are being protected where feasible

4.3 DMA Characteristics and Site Design BMPs

4.3.1 DMA A

DMA 1 contains the entire project site of 6.01 acres as all the runoff drains to the proposed lake.

The proposed storm drain system collects all the roof drain runoff, area drain runoff and driveway runoff and carries them through the project site to the down to the proposed Lake. The runoff will enter sediment chambers prior to the lake entrance.

The Lake captures all the site runoff. The Lake has been designed to detain the peak flows during a 100 year storm event.

During high volume storm events the lake will overflow into an inlet which connects to a storm drain and passes through a Modular Wetland with a high flow bypass. The storm drain will run all the way to the bottom of the ravine where it will exist into the ravine through an energy dissipation structure with rip rap.

The existing canyon flows between two private residence properties below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend Road. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

There will be no impact on the downstream.

The design control volume runoff will be captured by the lake and reused for irrigation re-harvesting but the lake will detain the 85th percentile storm event along with the 100 year peak storm. Any overflow from the lake will be treated by the Modular Wetland prior to entering the ravine below. This method was chosen because of the availability of the proposed lake and the inability to infiltrate because of the steepness of the hillside and the potential for landslides by adding water to the soil.

Design Capture Volume = V=c*d*A (acres)*43560 s.f./acre*1/12 in/ft

Pre-project:

V = (0% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr* 6.01ac*43560 * 1/12

= 2,683 c.f.

Post-project:

V = (19.1% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr * 6.01ac*43560 * 1/12

= 5,246 c.f.

The design control volume will be contained in the proposed lake for rain water harvest but that is not the primary treatment. The runoff will be used for irrigation across the entire project site. The lake has a storage volume above the normal water surface level of 6700 c.f. at elevation 512.50' plus a 1' freeboard above that at elevation 513.50' which contains and

addition 6700 c.f. of storage as the water is going into the overflow. The normal storage is 33% larger than the design control volume. At elevation 512.50' there is a storm drain inlet to allow the lake to overflow. With one foot of freeboard the lake has a capacity of 15,246 c.f. of storage.

In the event the lake does go into the overflow, a proposed Modular Wetland (Model MWS-L-6-8) will capture the low flows and treat the runoff. The proposed Modular Wetland can treat 6328 c.f. of runoff in a 48 hour draw down period. Low flows will pass through the wetland for treatment and a highflow bypass will be provided for larger flows. The proposed site runoff will have a 33% reduction in runoff during the 100 year storm event.

In addition the lake will be used for rain water harvest. An irrigation pump will send the irrigation water back to the top of the property to irrigate the driveway and house landscape areas. Once the lake level drops to elevation 510.5', the irrigation will switch back to City water for irrigation needs.

This proposed design will eliminate runoff below in the canyon from 85th percentile storms and will detain any increases up to the 100 year storm event. It will also save City water use for irrigation.

The lake will be regularly maintained for vector control.

4.3.2 DMA B

DMA 2 is a alternative compliance area. The area consists of 0.43 acres of proposed driveway and existing landscaped slope. 0.13 acres will be a proposed impervious pavement driveway and the other 0.3 acres are existing landscaped slope which is pervious. All the runof in DMA 2 flows away from the project site to O'hill Ridge, a private street in the community. The runoff flows to a 3.5' wide storm drain catch basin in the north eastern intersection of O'hill Ridge and Old Ranch Road which enters a storm drain system.

In order to treat the runoff, we will install a BioClean Kraken Type Curb Inlet Media Filter that will remove the Pollutants of Concern from the DMA area runoff. Maintenance of this filter will follow the manufacturer's recommendations and will be paid for by the project owner. The owner and the City will come to an agreement over who is responsible for the maintenance.

We are asking for this alternative compliance because we are treating an additional 0.3 acres more than the 0.13 acres area required for treatment. This will result in a larger

treatment volume than required and will result in a less polluted downstream runoff volume.

Pre-project:

V = (0% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr* 0.43ac*43560 * 1/12

= 192 c.f.

Post-project:

V = (30.2% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr * 0.43ac*43560 * 1/12

= 481 c.f.

4.3.3 DMA Summary

Drainage Management Areas				
DMA (Number/Description)	Total Area (acres)	Imperviousness (%)	Infiltration Feasibility Category (Full, Partial, or No Infiltration)	Hydrologic Source Controls Used
DMA 1	6.01	17.5%	No Infiltration	Impervious area dispersion Drains to Lake and reused for rain water harvesting
DMA 2	0.43	30.2%	No Infiltration	Impervious area dispersion Drains to street catch basin in O'hill Ridge Proposed Bio Clean Kraken Type Curb Inlet Media Filter placed in existing street catch basin

4.4 Source Control BMPs

Non-Structural Source Control BMPs				
Identifier	**Name**	**Check One**		**Reason Source Control is Not Applicable**
		Included	**Not Applicable**	
N1	Education for Property Owners, Tenants and Occupants	☒	☐	

N2	Activity Restrictions	☐	☒	Does not apply to residential project
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Does not apply to residential project
N6	Local Industrial Permit Compliance	☐	☒	Does not apply to residential project
N7	Spill Contingency Plan	☐	☒	Does not apply to residential project
N8	Underground Storage Tank Compliance	☐	☒	Does not apply to residential project
N9	Hazardous Materials Disclosure Compliance	☐	☒	Does not apply to residential project
N10	Uniform Fire Code Implementation	☐	☒	Does not apply to residential project
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☐	☒	Does not apply to residential project
N13	Housekeeping of Loading Docks	☐	☒	Does not apply to residential project
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☐	☒	Does not apply to residential project
N16	Retail Gasoline Outlets	☐	☒	Does not apply to residential project

N1 - Education for Property Owners, Tenants and Occupants

Practical information materials will be provided by the developer to the residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially developed and provided to first residents/occupants/tenants by the developer. Thereafter such materials will be available through the Permitees' education program. See Appendix B for materials.

N3 - Common Area Landscape Management

The Developer will make sure the landscape and pest control companies shall follow Landscape Maintenance Requirements, including fertilizing and pest control shall be consistent with those in the County Water Conservation Resolution or City of Orange Equivalent that include fertilizer and/or pesticide usage consistent with the Management Guidelines for Use of Fertilizers (County of Orange DAMP Section 5.5)

N4 - BMP Maintenance

The Developer shall be responsible for weekly, monthly or annual maintenance of the lake and the pump for stormwater harvesting for irrigation. The devices shall be inspected and cleaned prior to and after the rainy season.

N11 - Common Area Litter Control

The developer shall be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The developer may contract with their landscape maintenance firms to provide this service during regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles.

N14 - Common Area Catch Basin Inspection

The Developer shall have the drainage facilities inspected, cleaned and maintained on an annual basis. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. Drainage facilities include catch basins (storm drain inlets), storm drains, lake, irrigation rainwater harvest pump and energy dissipation structure. Records should be kept to document the annual maintenance.

Structural Source Control BMPs

Identifier	Name	Check One		Reason Source Control is Not Applicable
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage	☒	☐	
S2	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	Does not apply to residential project

S3	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	Does not apply to residential project
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☒	☐	
	Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit)	☐	☒	Does not apply to residential project
S6	Dock areas	☐	☒	Does not apply to residential project
S7	Maintenance bays	☐	☒	Does not apply to residential project
S8	Vehicle wash areas	☐	☒	Does not apply to residential project
S9	Outdoor processing areas	☐	☒	Does not apply to residential project
S10	Equipment wash areas	☐	☒	Does not apply to residential project
S11	Fueling areas	☐	☒	Does not apply to residential project
S12	Hillside landscaping	☐	☒	Does not apply to residential project
S13	Wash water control for food preparation areas	☐	☒	Does not apply to residential project
S14	Community car wash racks	☐	☒	Does not apply to residential project

S1 - Provide Storm Drain System Stenciling and Signage

Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language (such as: “NO DUMPINGDRAINS TO OCEAN”) and/or graphical icons to discourage illegal dumping.

Maintain legibility of stencils and signs.

S4 - Use Efficient Irrigation Systems and Landscape Design

Projects shall design the timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the municipal storm drain system.

The following methods to reduce excessive irrigation runoff shall be considered, and incorporated on common areas of development and other areas where determined applicable and feasible by the Permittee:

1. Employing rain shutoff devices to prevent irrigation after precipitation.

2. Designing irrigation systems to each landscape area's specific water requirements.

3. Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

4. Implementing landscape plan consistent with County Water Conservation Resolution or city equivalent, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

5. The timing and application methods of irrigation water shall be designed to minimize the runoff of excess irrigation water into the municipal storm drain system.

6. Employing other comparable, equally effective, methods to reduce irrigation water runoff.

7. Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider other design features, such as:

• Use mulches (such as wood chips or shredded wood products) in planter areas without ground cover to minimize sediment in runoff.

• Install appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant material where possible and/or as recommended by the landscape architect.

• Leave a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible.

• Choose plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth.

Irrigation practices shall comply with local and statewide ordinances related to irrigation efficiency.

S5 - Protect Slopes and Channels

Owner shall monitor slope erosion on an monthly basis and repair any slope erosion. Owner shall also monitor the energy dissipation structure monthly during the rainy season to ensure no erosion is taking place. Owner shall repair slopes in areas of erosion.

Section 5 Low Impact Development BMPs

5.1 LID BMPs in DMA 1

5.1.1 Hydrologic Source Controls for DMA 1

There are no HSC's

5.1.2 Structural LID BMP for DMA 1

DMA 1 contains the entire project site of 6.01 acres as all the runoff drains to the proposed lake.

The proposed storm drain system collects all the roof drain runoff, area drain runoff and driveway runoff and carries them through the project site to the down to the proposed Lake. The runoff will enter sediment chambers prior to the lake entrance.

The Lake captures all the site runoff. The Lake has been designed to detain the peak flows during a 100 year storm event.

During high volume storm events the lake will overflow into an inlet which connects to a storm drain and passes through a Modular Wetland with a high flow bypass. The storm drain will run all the way to the bottom of the ravine where it will exist into the ravine through an energy dissipation structure with rip rap.

The existing canyon flows between two private residence properties below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend Road. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

There will be no impact on the downstream.

The design control volume runoff will be captured by the lake and reused for irrigation re-harvesting but the lake will detain the 85th percentile storm event along with the 100 year peak storm. Any overflow from the lake will be treated by the Modular Wetland prior to entering the ravine below. This method was chosen because of the availability of the proposed lake and the inability to infiltrate because of the steepness of the hillside and the potential for landslides by adding water to the soil.

Design Capture Volume = V=c*d*A (acres)*43560 s.f./acre*1/12 in/ft

Pre-project:

V = (0% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr* 6.01ac*43560 * 1/12

= 2,683 c.f.

Post-project:

V = (19.1% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr * 6.01ac*43560 * 1/12

= 5,246 c.f.

The design control volume will be contained in the proposed lake for rain water harvest but that is not the primary treatment. The runoff will be used for irrigation across the entire project site. The lake has a storage volume above the normal water surface level of 6700 c.f. at elevation 512.50' plus a 1' freeboard above that at elevation 513.50' which contains and addition 6700 c.f. of storage as the water is going into the overflow. The normal storage is 33% larger than the design control volume. At elevation 512.50' there is a storm drain inlet to allow the lake to overflow. With one foot of freeboard the lake has a capacity of 15,246 c.f. of storage.

In the event the lake does go into the overflow, a proposed Modular Wetland (Model MWS-L-6-8) will capture the low flows and treat the runoff. The proposed Modular Wetland can treat 6328 c.f. of runoff in a 48 hour draw down period. Low flows will pass through the wetland for treatment and a highflow bypass will be provided for larger flows. The proposed site runoff will have a 33% reduction in runoff during the 100 year storm event.

In addition the lake will be used for rain water harvest. An irrigation pump will send the irrigation water back to the top of the property to irrigate the driveway and house landscape areas. Once the lake level drops to elevation 510.5', the irrigation will switch back to City water for irrigation needs.

This proposed design will eliminate runoff below in the canyon from 85th percentile storms and will detain any increases up to the 100 year storm event. It will also save City water use for irrigation.

The lake will be regularly maintained for vector control.

5.2 LID BMPs in DMA 2

Alternative Compliance

DMA 2 is a alternative compliance area. The area consists of 0.43 acres of proposed driveway and existing landscaped slope. 0.13 acres will be a proposed impervious pavement driveway and the other 0.3 acres are existing landscaped slope which is

pervious. All the runof in DMA 2 flows away from the project site to O'hill Ridge, a private street in the community. The runoff flows to a 3.5' wide storm drain catch basin in the north eastern intersection of O'hill Ridge and Old Ranch Road which enters a storm drain system.

In order to treat the runoff, we will install a BioClean Kraken Type Curb Inlet Media Filter that will remove the Pollutants of Concern from the DMA area runoff. Maintenance of this filter will follow the manufacturer's recommendations and will be paid for by the project owner. The owner and the City will come to an agreement over who is responsible for the maintenance.

We are asking for this alternative compliance because we are treating an additional 0.3 acres more than the 0.13 acres area required for treatment. This will result in a larger treatment volume than required and will result in a less polluted downstream runoff volume.

Pre-project:

V = (0% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr* 0.43ac*43560 * 1/12

= 192 c.f.

Post-project:

V = (30.2% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr * 0.43ac*43560 * 1/12

= 481 c.f.

Section 6 Hydromodification BMPs

6.1 Points of Compliance

The Proposed Lake/Detention Basin is the point of compliance

6.2 Pre-Development (Natural) Conditions

See Hydrology Exhibit - Existing Condition for natural condition exhibit in Appendix E

Existing soils is Type D per plate C of the Hydrologic Classification of Soil, County of Orange

6.3 Post-Development Conditions and Hydromodification BMPs

See WQMP Exhibit in Appendix H for Post Development Condition.

DMA 1 contains the entire project site of 6.01 acres as all the runoff drains to the proposed lake.

The proposed storm drain system collects all the roof drain runoff, area drain runoff and driveway runoff and carries them through the project site to the down to the proposed Lake. The runoff will enter sediment chambers prior to the lake entrance.

The Lake captures all the site runoff. The Lake has been designed to detain the peak flows during a 100 year storm event.

During high volume storm events the lake will overflow into an inlet which connects to a storm drain and passes through a Modular Wetland with a high flow bypass. The storm drain will run all the way to the bottom of the ravine where it will exist into the ravine through an energy dissipation structure with rip rap.

The existing canyon flows between two private residence properties below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend Road. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

There will be no impact on the downstream.

The design control volume runoff will be captured by the lake and reused for irrigation re-harvesting but the lake will detain the 85th percentile storm event along with the 100 year peak storm. Any overflow from the lake will be treated by the Modular Wetland prior to entering the ravine below. This method was chosen because of the availability of the proposed lake and the inability to infiltrate because of the steepness of the hillside and the potential for landslides by adding water to the soil.

Design Capture Volume = V=c*d*A (acres)*43560 s.f./acre*1/12 in/ft

Pre-project:

V = (0% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr* 6.01ac*43560 * 1/12

= 2,683 c.f.

Post-project:

V = (17.5% imp *0.75 +0.15) *0.82 inches per 85th percentile 24-hr * 6.01ac*43560 * 1/12

= 5,031 c.f.

The design control volume will be contained in the proposed lake for rain water harvest but that is not the primary treatment. The runoff will be used for irrigation across the entire project site. The lake has a storage volume above the normal water surface level of 6700 c.f. at elevation 512.50' plus a 1' freeboard above that at elevation 513.50' which contains and addition 6700 c.f. of storage as the water is going into the overflow. The normal storage is 33% larger than the design control volume. At elevation 512.50' there is a storm drain inlet to allow the lake to overflow. With one foot of freeboard the lake has a capacity of 15,246 c.f. of storage.

In the event the lake does go into the overflow, a proposed Modular Wetland (Model MWS-L-6-8) will capture the low flows and treat the runoff. The proposed Modular Wetland can treat 6328 c.f. of runoff in a 48 hour draw down period. Low flows will pass through the wetland for treatment and a highflow bypass will be provided for larger flows. The proposed site runoff will have a 33% reduction in runoff during the 100 year storm event.

In addition the lake will be used for rain water harvest. An irrigation pump will send the irrigation water back to the top of the property to irrigate the driveway and house landscape areas. Once the lake level drops to elevation 510.5', the irrigation will switch back to City water for irrigation needs.

This proposed design will eliminate runoff below in the canyon from 85th percentile storms and will detain any increases up to the 100 year storm event. It will also save City water use for irrigation.

The lake will be regularly maintained for vector control.

6.4 Measures for Avoidance of Critical Coarse Sediment Yield Areas

No Areas on project site.

6.5 Hydrologic Modeling and Hydromodification Compliance

See Appendix F for South Orange County Hydrologic Model (SOHM) Results.

The program was modeled with a basin in the predeveloped condition and a basin, trapezoidal pond and modular wetland in the mitigated condition. The proposed condition using the detention basin as the point of compliance passed the model run. With one foot of freeboard the lake has a capacity of 15,246 c.f. of storage which exceeds the design control volume of 5,031 c.f.

Section 7 Educational Materials Index

Educational Materials			
Residential Material (http://www.ocwatersheds.com)	**Check If Applicable**	**Business Material (http://www.ocwatersheds.com)**	**Check If Applicable**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☒	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☒	Proper Maintenance Practices for Your Business	☐
Household Tips	☒	Compliance BMPs for Mobile Businesses	☐
Proper Disposal of Household Hazardous Waste	☒	**Other Material**	**Check If Attached**
Recycle at Your Local Used Oil Collection Center (North County)	☐		
Recycle at Your Local Used Oil Collection Center (Central County)	☐		☐
Recycle at Your Local Used Oil Collection Center (South County)	☒		☐
Tips for Maintaining a Septic Tank System	☐		☐
Responsible Pest Control	☒		☐
Sewer Spill	☒		☐
Tips for the Home Improvement Projects	☒		☐
Tips for Horse Care	☐		☐
Tips for Landscaping and Gardening	☒		☐
Tips for Pet Care	☒		☐
Tips for Projects Using Paint	☒		☐

Attachment A: Educational Materials

The Ocean Begins at Your Front Door



Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate- free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

The Ocean Begins at Your Front Door



Never allow pollutants to enter the street, gutter or storm drain!

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called “non-point source” pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.



The Effect on the Ocean



Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.



For More Information

Orange County Stormwater Program

California Environmental Protection Agency
www.calepa.ca.gov

- **Air Resources Board**
  www.arb.ca.gov
- **Department of Pesticide Regulation**
  www.cdpr.ca.gov
- **Department of Toxic Substances Control**
  www.dtsc.ca.gov
- **Integrated Waste Management Board**
  www.ciwmb.ca.gov
- **Office of Environmental Health Hazard Assessment**
  www.oehha.ca.gov
- **State Water Resources Control Board**
  www.waterboards.ca.gov

Earth 911 - Community-Specific Environmental Information 1-800-cleanup or visit www.1800cleanup.org

Health Care Agency's Ocean and Bay Water Closure and Posting Hotline
(714) 433-6400 or visit www.ocbeachinfo.com

Integrated Waste Management Dept. of Orange County (714) 834-6752 or visit www.oclandfills.com for information on household hazardous waste collection centers, recycling centers and solid waste collection

O.C. Agriculture Commissioner
(714) 447-7100 or visit www.ocagcomm.com

Stormwater Best Management Practice Handbook
Visit www.cabmphandbooks.com

UC Master Gardener Hotline
(714) 708-1646 or visit www.uccemg.com

The Orange County Stormwater Program has created and moderates an electronic mailing list to facilitate communications, take questions and exchange ideas among its users about issues and topics related to stormwater and urban runoff and the implementation of program elements. To join the list, please send an email to ocstormwaterinfo-join@list.ocwatersheds.com

Aliso Viejo	(949)	425-2535
Anaheim Public Works Operations	(714)	765-6860
Brea Engineering	(714)	990-7666
Buena Park Public Works	(714)	562-3655
Costa Mesa Public Services	(714)	754-5323
Cypress Public Works	(714)	229-6740
Dana Point Public Works	(949)	248-3584
Fountain Valley Public Works	(714)	593-4441
Fullerton Engineering Dept.	(714)	738-6853
Garden Grove Public Works	(714)	741-5956
Huntington Beach Public Works	(714)	536-5431
Irvine Public Works	(949)	724-6315
La Habra Public Services	(562)	905-9792
La Palma Public Works	(714)	690-3310
Laguna Beach Water Quality	(949)	497-0378
Laguna Hills Public Services	(949)	707-2650
Laguna Niguel Public Works	(949)	362-4337
Laguna Woods Public Works	(949)	639-0500
Lake Forest Public Works	(949)	461-3480
Los Alamitos Community Dev.	(562)	431-3538
Mission Viejo Public Works	(949)	470-3056
Newport Beach, Code & Water Quality Enforcement	(949)	644-3215
Orange Public Works	(714)	532-6480
Placentia Public Works	(714)	993-8245
Rancho Santa Margarita	(949)	635-1800
San Clemente Environmental Programs	(949)	361-6143
San Juan Capistrano Engineering	(949)	234-4413
Santa Ana Public Works	(714)	647-3380
Seal Beach Engineering	(562)	431-2527 x317
Stanton Public Works	(714)	379-9222 x204
Tustin Public Works/Engineering	(714)	573-3150
Villa Park Engineering	(714)	998-1500
Westminster Public Works/Engineering	(714)	898-3311 x446
Yorba Linda Engineering	(714)	961-7138
Orange County Stormwater Program	(877)	897-7455

Orange County 24-Hour
Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

On-line Water Pollution Problem Reporting Form
www.ocwatersheds.com

Printed on Recycled Paper

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of used oil is illegal and can lead to fines. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain.

Help prevent water pollution by taking your used oil and oil filters to a used oil collection center. Most major automotive maintenance centers will accept up to five gallons of used motor oil at no cost. For a list of locations, please visit www.cleanup.org.



For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL (1-877-897-7455)** or visit **www.ocwatersheds.com.**

For information about the proper disposal of household hazardous waste, call the **Household Waste Hotline** at **1-877-89-SPILL (1-877-897-7455)** or visit **www.oclandfills.com.**

For additional information about the nearest oil recycling center, call the **Used Oil Program** at **1-800-CLEANUP** or visit **www.cleanup.org.**

RECYCLE USED OIL

emc/rev9/08

Help Prevent Ocean Pollution:

Tips for the Home Mechanic



PROJECT Pollution PREVENTION

The Ocean Begins at Your Front Door

Tips for the Home Mechanic

WORK SITE

- Locate the storm drains on or near your property. Do not allow used oil or any materials to flow into these drains.
- Examine your home for sources of pollution.
- Perform automotive projects under cover and in a controlled area to prevent stormwater runoff.
- Sweep or vacuum your automotive workspace regularly
- Use a damp mop to clean work areas. Never hose down surfaces into the street, gutter or storm drain.



- Pour mop water into a sink or toilet. Never dispose of water in a parking lot, street, gutter or storm drain.

PREVENT LEAKS AND SPILLS

- Keep absorbent materials such as rags and/or cat litter in the work area
- Empty drip pans into a labeled, seal container before they are full
- Wipe up any spills or repair leaks as they happen. Don't let them sit.
- Place large pans under any wrecked cars until all fluids are drained.
- Promptly dispose of collected fluids into a hazardous waste drum or deliver them to an oil recycling center. Used oil recycling locations can be found at http://www.ochealthinfo.com/regulatory/usedoil.htm

CLEANING SPILLS

- Clean up spills immediately by using absorbent material such as rags, cat litter or sand. If the material spilled is hazardous, dispose of the rag, litter or sand in the same manner as hazardous waste. If the material spill is non-hazardous, dispose of it in the trash.



- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455) or visit www.ocwatersheds.com to fill out an incident report.
- Report emergencies to 911.

VEHICLE FLUID MANAGEMENT

- Vehicle fluids are hazardous waste and must be stored and disposed of in accordance with all local, state and federal laws.
- Designate an area to drain vehicle fluids away from storm drains and sanitary drains.
- When possible, drain vehicle fluids indoors or within covered areas, and only over floors that are constructed of a non-porous material such as concrete. Asphalt and dirt floors absorb spilled or leaked fluids, making the cleanup extremely difficult.



PROJECT Pollution PREVENTION

The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

1 Pesticides and Fertilizer



- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.

- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.

- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.

- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

DID YOU KNOW?

Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community

4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.

- **Solution:** Pick up after your pets!

5 Trash and Debris



- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.

- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.



- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.



A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

Thank you for making water protection a priority!

For more information, please visit www.ocwatersheds.com/publiced/

www.mwdoc.com

www.uccemg.com



To report a spill, call the Orange County 24-Hour Water Pollution Prevention Reporting Hotline at 1-877-89-SPILL \(1-877-897-7455)

Special Thanks to
The City of Los Angeles Stormwater Program for the use of its artwork

The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos



Homeowners Guide for Sustainable Water Use

Low Impact Development, Water Conservation & Pollution Prevention



The Ocean Begins at Your Front Door







RUNOFF, RAINWATER AND REUSE

Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

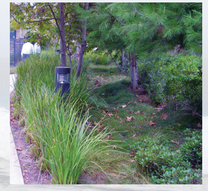




Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.



What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.



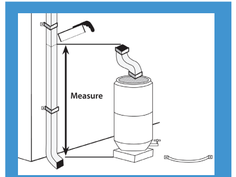
Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

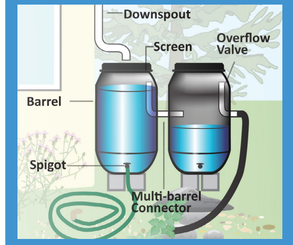
Downspout Disconnection/Redirection

Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.



Rain Barrels

Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.



Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.

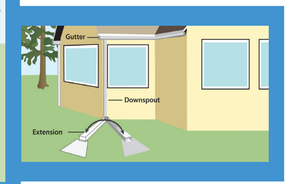




Rain Gardens

Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid climate of Southern California, require less water and can reduce your water bill.

Before modifying your yard to install a rain garden, please consult your local building and/or planning departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered slopes, please seek professional advice before proceeding with changes.



For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home, please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How-To" Guide, November 2009 at www.larainwaterharvesting.org/

OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.

Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.



Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal booms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

IRRIGATE EFFICIENTLY



Water runoff from sprinklers left on too long will carry pollutants into our waterways.

Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common household activities can lead to water pollution if you're not careful.

Remember the Water in Your Storm Drain is Not Treated BEFORE It Enters Our Waterways

Litter, oil, chemicals and other substances that are left on your yard or driveway can be blown or washed into storm drains that flow to the ocean. Over-watering your lawn and washing your car can also flush materials into the storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated.

You would never pour soap, fertilizers or oil into the ocean, so don't let them enter streets, gutters or storm drains. Follow the easy tips in this brochure to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while performing everyday household activities. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

GENUINE RECYCLED PAPER
50% PRE-CONSUMER AND 15% POST-CONSUMER

RECYCLE USED OIL

Help Prevent Ocean Pollution:

Household Tips



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Pollution Prevention

Household Activities

- **Do not rinse spills with water!** Sweep outdoor spills and dispose of in the trash. For wet spills like oil, apply cat litter or another absorbent material, then sweep and bring to a household hazardous waste collection center (HHWCC).
- Securely cover trash cans.
- Take household hazardous waste to a household hazardous waste collection center.
- Store household hazardous waste in closed, labeled containers inside or under a cover.
- Do not hose down your driveway, sidewalk or patio. Sweep up debris and dispose of in trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of in the trash.
- Bathe pets indoors or have them professionally groomed.

Household Hazardous Wastes include:

- ▲ **Batteries**
- ▲ **Paint thinners, paint strippers and removers**
- ▲ **Adhesives**
- ▲ **Drain openers**
- ▲ **Oven cleaners**
- ▲ **Wood and metal cleaners and polishes**
- ▲ **Herbicides and pesticides**
- ▲ **Fungicides/wood preservatives**
- ▲ **Automotive fluids and products**
- ▲ **Grease and rust solvents**
- ▲ **Thermometers and other products containing mercury**
- ▲ **Fluorescent lamps**
- ▲ **Cathode ray tubes, e.g. TVs, computer monitors**
- ▲ **Pool and spa chemicals**

Gardening Activities

- Follow directions on pesticides and fertilizers, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Water your lawn and garden by hand to control the amount of water you use. Set irrigation systems to reflect seasonal water needs. If water flows off your yard and onto your driveway or sidewalk, your system is over-watering.
- Mulch clippings or leave them on the lawn. If necessary, dispose in a green waste container.
- Cultivate your garden often to control weeds.

Washing and Maintaining Your Car

- Take your car to a commercial car wash whenever possible.
- Choose soaps, cleaners, or detergents labeled "non-toxic," "phosphate free" or "biodegradable." Vegetable and citrus-based products are typically safest for the environment, **but even these should not be allowed into the storm drain.**
- Shake floor mats into a trash can or vacuum to clean.
- Do not use acid-based wheel cleaners and "hose off" engine degreasers at home. They can be used at a commercial facility, which can properly process the washwater.
- **Do not dump washwater onto your driveway, sidewalk, street, gutter or storm drain.** Excess washwater should be disposed of in the sanitary sewers (through a sink, or toilet) or onto an absorbent surface like your lawn.
- Use a nozzle to turn off water when not actively washing down automobile.
- Monitor vehicles for leaks and place pans under leaks. Keep your car well maintained to stop and prevent leaks.
- Use cat litter or other absorbents and sweep to remove any materials deposited by vehicles. Contain sweepings and dispose of at a HHWCC.
- Perform automobile repair and maintenance under a covered area and use drip pans or plastic sheeting to keep spills and waste material from reaching storm drains.
- **Never pour oil or antifreeze in the street, gutter or storm drains.** Recycle these substances at a service station, HHWCC, or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.ciwmb.ca.gov/UsedOil.

For locations and hours of Household Hazardous Waste Collection Centers in Anaheim, Huntington Beach, Irvine and San Juan Capistrano, call (714)834-6752 or visit www.oclandfills.com.



Do your part to prevent water pollution in our creeks, rivers, bays and ocean.

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of household hazardous waste can lead to water pollution. Batteries, electronics, paint, oil, gardening chemicals, cleaners and other hazardous materials cannot be thrown in the trash. They also must never be poured or thrown into yards, sidewalks, driveways, gutters or streets. Rain or other water could wash the materials into the storm drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured in the sanitary sewers (sinks and toilets).

NEVER DISPOSE OF HOUSEHOLD HAZARDOUS WASTE IN THE TRASH, STREET, GUTTER, STORM DRAIN OR SEWER.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To Report Illegal Dumping of Household Hazardous Waste call 1-800-69-TOXIC

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

RECYCLE USED OIL

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Help Prevent Ocean Pollution:

Proper Disposal of Household Hazardous Waste



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

ORANGE COUNTY

Pollution Prevention

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be "household hazardous waste" or "HHW." HHW can be found throughout your home, including the bathroom, kitchen, laundry room and garage.

WHEN POSSIBLE, USE NON-HAZARDOUS OR LESS-HAZARDOUS PRODUCTS.

Disposal of HHW down the drain, on the ground, into storm drains, or in the trash is illegal and unsafe.

Proper disposal of HHW is actually easy. Simply drop them off at a Household Hazardous Waste Collection Center (HHWCC) for free disposal and recycling. Many materials including anti-freeze, latex-based paint, motor oil and batteries can be recycled. Some centers have a "Stop & Swap" program that lets you take partially used home, garden, and automobile products free of charge. There are four HHWCCs in Orange County:

Anaheim:.....1071 N. Blue Gum St
Huntington Beach:.....17121 Nichols St
Irvine:..... 6411 Oak Canyon
San Juan Capistrano:... 32250 La Pata Ave

Centers are open Tuesday-Saturday, 9 a.m.-3 p.m. Centers are closed on rainy days and major holidays. For more information, call **(714) 834-6752** or visit **www.oclandfills.com.**

Common household hazardous wastes

- Batteries
- Paint and paint products
- Adhesives
- Drain openers
- Household cleaning products
- Wood and metal cleaners and polishes
- Pesticides
- Fungicides/wood preservatives
- Automotive products (antifreeze, motor oil, fluids)
- Grease and rust solvents
- Fluorescent lamps
- Mercury (thermometers & thermostats)
- All forms of electronic waste including computers and microwaves
- Pool & spa chemicals
- Cleaners
- Medications
- Propane (camping & BBQ)
- Mercury-containing lamps
- Television & monitors (CRTs, flatscreens)

Tips for household hazardous waste

- Never dispose of HHW in the trash, street, gutter, storm drain or sewer.
- Keep these materials in closed, labeled containers and store materials indoors or under a cover.
- When possible, use non-hazardous products.
- Reuse products whenever possible or share with family and friends.
- Purchase only as much of a product as you'll need. Empty containers may be disposed of in the trash.
- HHW can be harmful to humans, pets and the environment. Report emergencies to 911.





Did you know that just one quart of oil can pollute 250,000 gallons of water?

A clean ocean and healthy creeks, rivers, bays and beaches are important to Orange County. However, not properly disposing of used oil can lead to water pollution. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering the ocean. Help prevent water pollution by taking your used oil to a used oil collection center.

Included in this brochure is a list of locations that will accept up to five gallons of used motor oil at no cost. Many also accept used oil filters. Please contact the facility before delivering your used oil. This listing of companies is for your reference and does not constitute a recommendation or endorsement of the company.

Please note that used oil filters may not be disposed of with regular household trash. They must be taken to a household hazardous waste collection or recycling center in Anaheim, Huntington Beach, Irvine or San Juan Capistrano. For information about these centers, visit www.oclandfills.com.

Please do not mix your oil with other substances!

For more information, please call the Orange County Stormwater Program at 1-877-89-SPILL (1-877-897-7455) or visit www.watersheds.com.

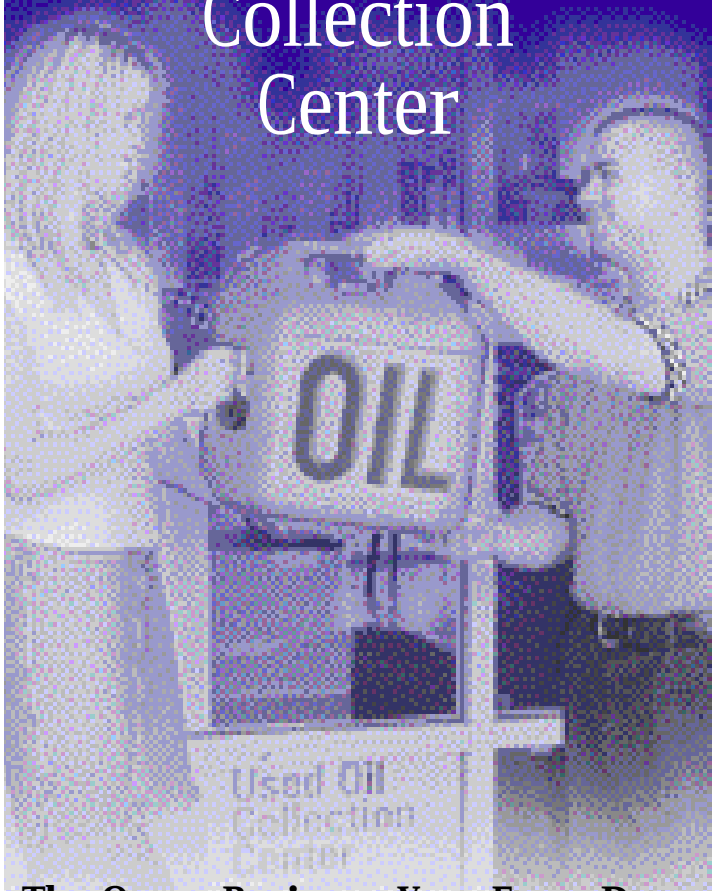
For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

RECYCLE USED OIL

For additional information about the nearest oil recycling center, call the Used Oil Program at 1-800-CLEANUP or visit www.cleanup.org.

Help Prevent Ocean Pollution:

Recycle at Your Local Used Oil Collection Center



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

SOUTH COUNTY

Used Oil Collection Centers

ALISO VIEJO

Big O Tires
27812 Aliso Creek Rd, Suite E-100
(949) 362-4225

Econo Lube N' Tune
22932 Glenwood Dr.
(949) 643-9667

Jiffy Lube
27832 Aliso Creek Road
(949) 362-0005

Pep Boys
26881 Aliso Creek Road
(949) 362-9254

DANA POINT

Dana Point Fuel Dock
34661 Puerto Pl. (949) 496-6113

EZ Lube Inc.
34242 Doheny Park Rd.
(949) 477-1223

FOOTHILL RANCH

USA Express Tire & Service
26492 Town Center Dr.
(714) 826-1001

LAGUNA BEACH

USA Express Tire & Service Inc.
350 Broadway (949) 494-7111

LAKE FOREST

Big O Tires
20742 Lake Forest Dr.
(949) 443-4155

EZ Lube
26731 Rancho Parkway
(949) 465-9912

Firestone Store
24421 Rockfield Blvd.
(949) 581-2660

Jiffy Lube
20781 Lake Forest Dr.
(949) 583-0470

Kragen Auto Parts
24601 Raymond Way
(949) 829-8292

Pep Boys
22671 Lake Forest Dr.
(949) 855-9593

Ryan's Foothill Ranch Transmission
20622 Pascal Way (949) 770-6888

USA Express Tire & Service
24561 Trabuco Rd (949) 454-8001

LAGUNA NIGUEL

Econo Lube N Tune
27912 Forbes Rd. (949) 364-5833

Laguna Niguel Auto Center
26042 Cape Dr. #12
(949) 582-2191

LAGUNA HILLS

David J Phillips Buick
24888 Alicia Pkwy.
(949) 831-0434

EZ Lube
24281 Moulton Pkwy.
(949) 830-9840

EZ Lube
26921 Moulton Pkwy.
(949) 751-3436

Kragen Auto Parts
26562 Moulton Ave.
(949) 831-0434

Firestone Store
24196 Laguna Hills Mall
(949) 581-4700

MISSION VIEJO

AAA Complete Auto Care & Tire
27913 Center Street
(949) 347-8200

Autobahn West
25800 Jeronimo Rd. Suite 401
(949) 770-2312

Auto Zone
22942 Los Alisos (949) 830-8181

Econo Lube & Tune
25902 El Paseo (949) 582-5483

Jiffy Lube
27240 La Paz Rd. (949) 455-0470

Kragen Auto Parts
24510 Alicia Pkwy. (949) 951-9175

Mission Viejo Chevron
27742 Crown Vly. Pkwy.
(949) 364-0137

Oilmax 10 Minute Lube
25800 Jeronimo Rd. #300
(949) 859-9271

Ramona Auto Service
27210 La Paz Rd. (949) 583-1233

RANCHO SANTA MARGARITA

Jiffy Lube
23401 Antonio Parkway
(949) 589-7447

SAN CLEMENTE

EZ Lube
525 Avenida Pico (949) 940-1850

Kragen Auto Parts
1113 S. El Camino Real
(949) 492-9850

Kragen Auto Parts
400 Camino de Estrella
(949) 240-9195

San Clemente Car Wash & Oil
1731 N. El Camino Real
(949) 847-4924

SAN JUAN CAPISTRANO

Saturn of San Juan Capistrano
33033 Camino Capistrano
(949) 248-5411

Texaco Xpress Lube
27201 Ortega Hwy.
(949) 489-8008

This information was provided by the County of Orange Integrated Waste Management Department and the California Integrated Waste Management Board (CIWMB).

HOMEOWNER TIPS
PROTECTING WATER

Before Buying Pest Control Products

- Identify the pest.
- Decide if pest control products are the best control measure or if there are alternatives available.
- Are integrated pest management guidelines available for this pest?
- Read the product label:
  Is the pest listed on the label?
  Is it the best product for the pest?

Before Mixing Your Sprayer



- Read the label carefully.
- Buy only enough pesticide to treat the area affected by the pest.
- Check the weather and don't apply if it's windy or about to rain
- Measure the area you're treating.
- Calculate how much spray to mix.
- Wear long sleeve shirt, long pants, shoes and any other protective equipment listed on the label and follow all the label precautions.
- Be prepared for spills and know how to clean them up.

When You're Ready To Spray

- Mix and load spray in an area where any spilled pesticide will not be able to drain or be washed away into storm drains, ditches, streams, ponds or other bodies of water.
- Mix sprayer on grass, not the sidewalk or driveway.
- Mix only as much as needed.

When You're Spraying

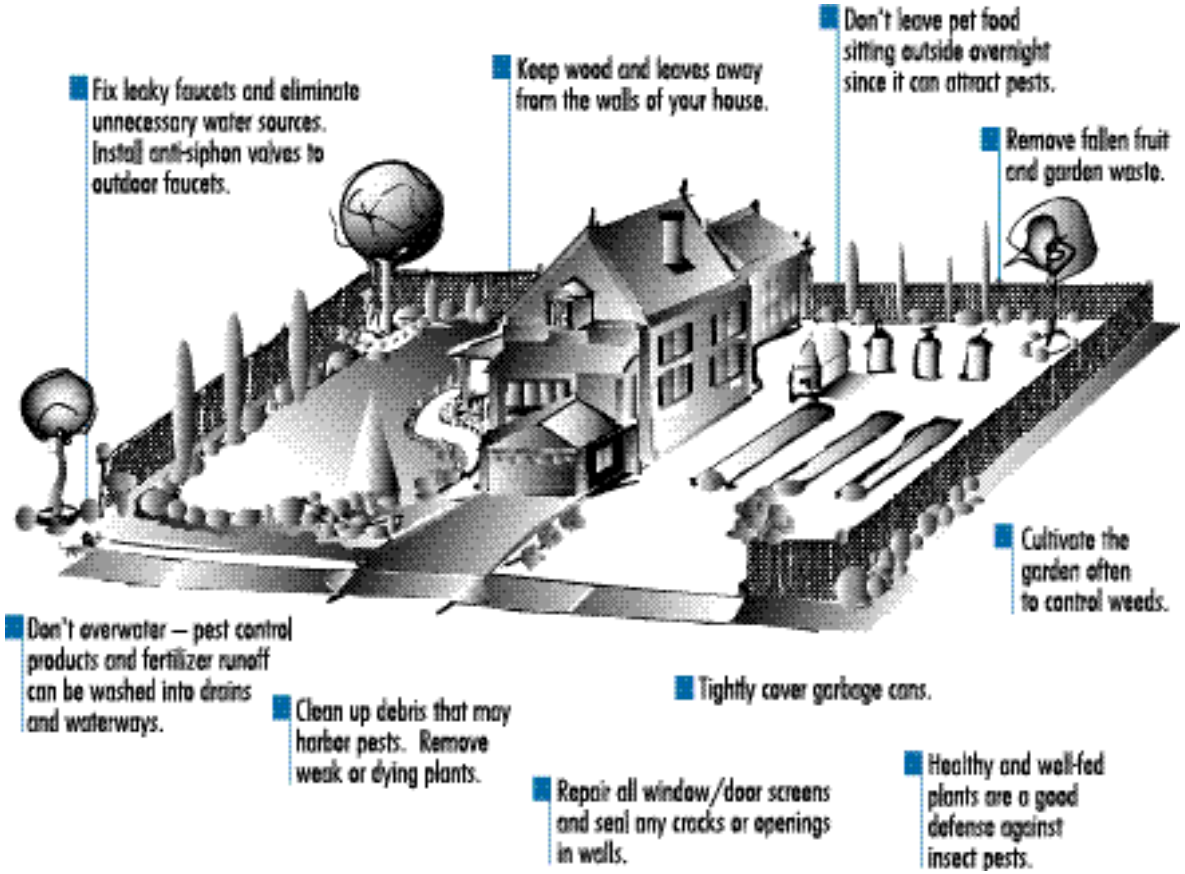
- AVOID spraying in or near storm drains, ditches, streams, and ponds!
- Leave an untreated strip around these areas to protect the water.

When You're done

- Never dump leftovers down any drain; Save for a future application.
- Triple-rinse sprayer and apply rinsewater to treated area.
- Take any old or unwanted pesticides to a Household Hazardous Waste Collection Center (714) 834-6752.

Using Pest Control Products. It's Your Responsibility To Do It Right!





IPM... Outsmarting Pests While Protecting Water

With Integrated Pest Management (IPM), homeowners use common sense and nature to make it difficult for pests to survive. IPM techniques include cultural practices (such as mulching to prevent weeds), encouraging natural enemies (good bugs), and judicious use of pest control products.

- First, identify your pest problem. To find the best solution, you need to pin down the problem. Consult gardening books, your county cooperative extension office or your local nursery.
- Decide how much pest control is necessary. If you can live with some pest damage, you can avoid intensive pest control product treatments.
- Choose an effective option. Try various types of controls first: washing bugs off plants, pruning diseased parts of plants. If you need to use pest control products, choose one that targets the problem and poses the least hazard.
- Finally, it's easier to prevent pests than to control them.

Think ahead.



This brochure is being distributed in order to reduce the impacts of pesticides on water quality. It was produced with support from the Orange County Storm Water Program, the Coalition for Urban/Rural Environmental Stewardship (CURES) and a 319(h) grant from the State Water Resources Control Board.

Orange County Storm Water Program Participants:

Anaheim Public Works/Engineering	(714) 765-5176
Brea Engineering	(714) 990-7666
Buena Park Public Works	(714) 562-3655
Costa Mesa Public Services	(714) 754-5248
Cypress Engineering	(714) 229-6752
Dana Point Public Works	(949) 248-3562
Fountain Valley Public Works	(714) 593-4400 x347
Fullerton Engineering Dept	(714) 738-6853
Garden Grove Development Services	(714) 741-5554
Huntington Beach Public Works	(714) 536-5432
Irvine Public Works	(949)724-6515
La Habra Public Services	(562) 905-9792
La Palma Public Works	(714) 523-1140 x102
Laguna Beach Municipal Services	(949) 497-0711
Laguna Hills Engineering	(949) 707-2600
Laguna Niguel Public Works	(949) 362-4337
Lake Forest Public Works	(949) 461-3480
Los Alamitos Community Dev	(562) 431-3538 x301
Mission Viejo Public Works	(949) 470-3095
Newport Beach Public works	(949) 644-3311
Orange Public Works	(714) 744-5551
Placentia Engineering	(714) 993-8131
San Clemente Engineering	(949) 361-6100
San Juan Capistrano Engineering	(949) 493-1171
Santa Ana Public Works	(714) 647-3380
Seal Beach Engineering	(562) 431-2527 x318
Stanton Public Works	(714) 379-9222 x204
Tustin Public Works Engineering	(714) 573-3150
Villa Park Engineering	(714) 998-1500
Westminster Public Works Eng.	(714) 898-3311 x215
Yorba Linda Engineering	(714) 961-7170 x174
O.C. Storm Water Program	1-877-89-SPILL (1-877-897-7455)
24 Hour Water Pollution Hotline	(714) 567-6363 or ashbyk@pfrd.co.orange.ca.us
Chemical and Hazardous Material Spill Emergencies	911

Other Important Phone Numbers:

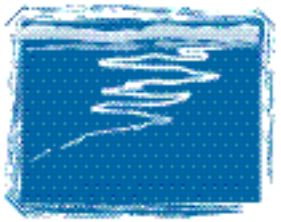
For Additional Brochures	1-877-89-SPILL (1-877-897-7455)
UC Masters & Coop Extension	(714) 708-1646 ucmastergardeners@yahoo.com
O.C. Household Hazardous Waste Information	(714) 834-6752 or www.oc.ca.gov/IWMD
Information on agriculture chemicals, pesticides and possible alternatives, O.C. Agriculture Commissioner	(714) 447-7115

Original graphics developed with support from:
Coalition For Urban/Rural Environmental Stewardship (CURES)
Western Crop Protection Association (WCPA)
Responsible Industry for a Sound Environment (RISE)





Keeping Pest Control Products Out of Creeks, Rivers and The Ocean







HOMEOWNER TIPS

PROTECTING WATER

Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

Orange County Stormwater Program
24 Hour Water Pollution Reporting Hotline
1-877-89-SPILL (1-877-897-7455)

- County and city water quality ordinances prohibit discharges containing pollutants.

Orange County Health Care Agency Environmental Health
(714) 433-6419

California Health and Safety Code, Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between $500–$1,000) and/or imprisonment for less than one year.

Regional Water Quality Control Board
Santa Ana Region (951) 782-4130
San Diego Region (858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

California Office of Emergency Services
(800) 852-7550

California Water Code, Article 4, Chapter 4, Sections 13268-13271
California Code of Regulations, Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than $20,000) and/or imprisonment for not more than one year.

DTP113 Rev 4/06
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Sewage Spill
Reference Guide

Your Responsibilities as a Private Property Owner

Residences
Businesses
Homeowner/Condominium Associations
Federal and State Complexes
Military Facilities



Orange County Sanitation District

Health Care Agency
Environmental Health

PROJECT Pollution PREVENTION
www.ocwatersheds.com

This brochure was designed courtesy of the Orange County Sanitation District (OCSD). For additional information, call (714) 962-2411, or visit their website at www.ocsd.com

What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

Common Causes of Sewage Spills

Grease builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

Structure problems caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

Infiltration and inflow (I/I) impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

Time is of the essence in dealing with sewage spills. You are required to **immediately**:

Control and minimize the spill. Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

Use sandbags, dirt and/or plastic sheeting to prevent sewage from entering the storm drain system.

Clear the sewer blockage. Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

Always notify your city sewer/public works department or public sewer district of sewage spills. If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.



Overflowing cleanout pipe located on private property

You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

Caution

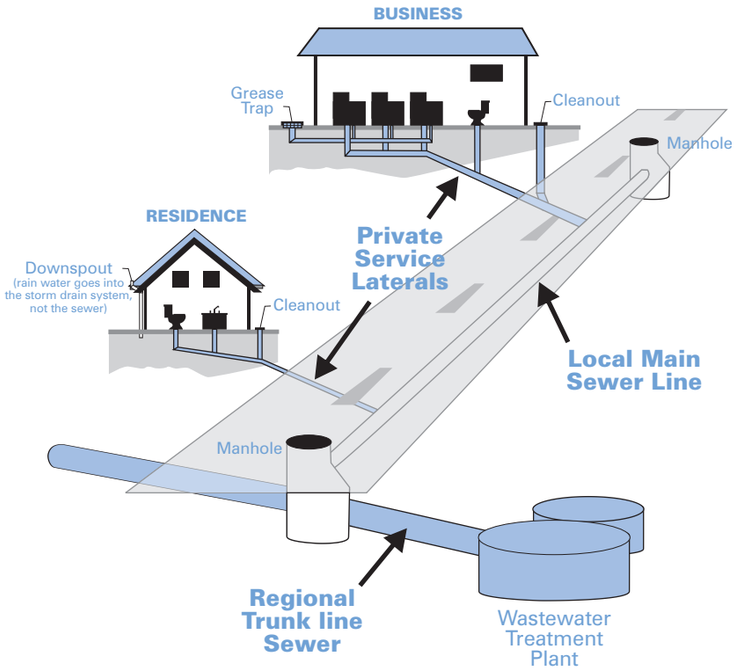
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!

How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.



How You Can Prevent Sewage Spills

1. **Never put grease down garbage disposals, drains or toilets.**
2. **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**
3. **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**



Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

Orange County Agency Responsibilites

- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

A property owner may be charged for costs incurred by these agencies responding to spills from private properties.



Report Sewage Spills!

City Sewer/Public Works Departments

Aliso Viejo	(949) 425-2500
Anaheim	(714) 765-6860
Brea	(714) 990-7691
Buena Park	(714) 562-3655
Costa Mesa	(949) 645-8400
Cypress	(714) 229-6760
Dana Point	(949) 248-3562
Fountain Valley	(714) 593-4600
Fullerton	(714) 738-6897
Garden Grove	(714) 741-5375
Huntington Beach	(714) 536-5921
Irvine	(949) 453-5300
Laguna Beach	(949) 497-0765
Laguna Hills	(949) 707-2650
Laguna Niguel	(949) 362-4337
Laguna Woods	(949) 639-0500
La Habra	(562) 905-9792
Lake Forest	(949) 461-3480
La Palma	(714) 690-3310
Los Alamitos	(562) 431-3538
Mission Viejo	(949) 831-2500
Newport Beach	(949) 644-3011
Orange	(714) 532-6480
Orange County	(714) 567-6363
Placentia	(714) 993-8245
Rancho Santa Margarita	(949) 635-1800
San Clemente	(949) 366-1553
San Juan Capistrano	(949) 443-6363
Santa Ana	(714) 647-3380
Seal Beach	(562) 431-2527
Stanton	(714) 379-9222
Tustin	(714) 962-2411
Villa Park	(714) 998-1500
Westminster	(714) 893-3553
Yorba Linda	(714) 961-7170

Public Sewer/Water Districts

Costa Mesa Sanitary District	(714) 393-4433/ (949) 645-8400
El Toro Water District	(949) 837-0660
Emerald Bay Service District	(949) 494-8571
Garden Grove Sanitary District	(714) 741-5375
Irvine Ranch Water District	(949) 453-5300
Los Alamitos/Rossmoor Sewer District	(562) 431-2223
Midway City Sanitary District (Westminster)	(714) 893-3553
Moulton Niguel Water District	(949) 831-2500
Orange County Sanitation District	(714) 962-2411
Santa Margarita Water District	(949) 459-6420
South Coast Water District	(949) 499-4555
South Orange County Wastewater Authority	(949) 234-5400
Sunset Beach Sanitary District	(562) 493-9932
Trabuco Canyon Sanitary District	(949) 858-0277
Yorba Linda Water District	(714) 777-3018

Other Agencies

Orange County Health Care Agency	(714) 433-6419
Office of Emergency Services	(800) 852-7550



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Home improvement projects and work sites must be maintained to ensure that building materials do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump building materials into the ocean, so don't let them enter the storm drains. Follow these tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour
Water Pollution Problem
Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while performing home improvement projects. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

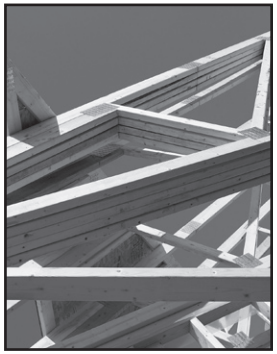
Tips for Home Improvement Projects



Tips for Home Improvement Projects

Home improvement projects can cause significant damage to the environment. Whether you hire a contractor or work on the house yourself, it is important to follow these simple tips while renovating, remodeling or improving your home:

General Construction



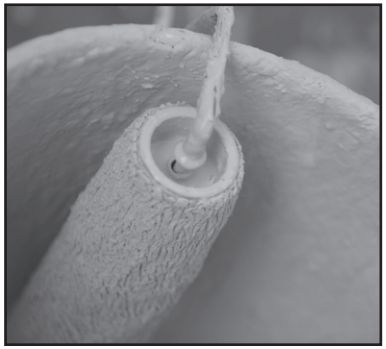
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the street, storm drain or adjacent properties.

Building Materials

- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.
- Wash concrete mixers and equipment in a designated washout area where the water can flow into a containment area or onto dirt.
- Dispose of small amounts of dry excess materials in the trash. Powdery waste, such as dry concrete, must be properly contained within a box or bag prior to disposal. Call your local trash hauler for weight and size limits.

Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Place the lid on firmly and store the paint can upside-down in a dry location away from the elements.
- Tools such as brushes, buckets and rags should never be washed where excess water can drain into the street, gutter or storm drain. All tools should be rinsed in a sink connected to the sanitary sewer.
- When disposing of paint, never put wet paint in the trash.
- Dispose of water-based paint by removing the lid and letting it dry in the can. Large amounts must be taken to a Household Hazardous Waste Collection Center (HHWCC).



- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

Erosion Control

- Schedule grading and excavation projects for dry weather.
- When temporarily removing soil, pile it in a contained, covered area where it cannot spill into the street, or obtain the required temporary encroachment or street closure permit and follow the conditions instructed by the permit.
- When permanently removing large quantities of soil, a disposal location must be found prior to excavation. Numerous businesses are available to handle disposal needs. For disposal options, visit **www.ciwmb.ca.gov/SWIS**.
- Prevent erosion by planting fast-growing annual and perennial grasses. They will shield and bind the soil.

Recycle

- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry (bricks, concrete, etc.), carpet, plastic, pipes (plastic, metal and clay), drywall, rocks, dirt and green waste.



- For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**

Spills

- Clean up spills immediately by using an absorbent material such as cat litter, then sweep it up and dispose of it in the trash.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

UCCE Master Gardener Hotline:
(714) 708-1646

To report a spill,
call the
Orange County 24-Hour
Water Pollution Problem
Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

Tips for Landscape & Gardening



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.



- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.



- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.



- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

Household Hazardous Waste Collection Centers

Anaheim:	1071 N. Blue Gum St.
Huntington Beach:	17121 Nichols St.
Irvine:	6411 Oak Canyon
San Juan Capistrano:	32250 La Pata Ave.

For more information, call (714) 834-6752 or visit www.oclandfills.com



Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Pet waste and pet care products can be washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never put pet waste or pet care products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

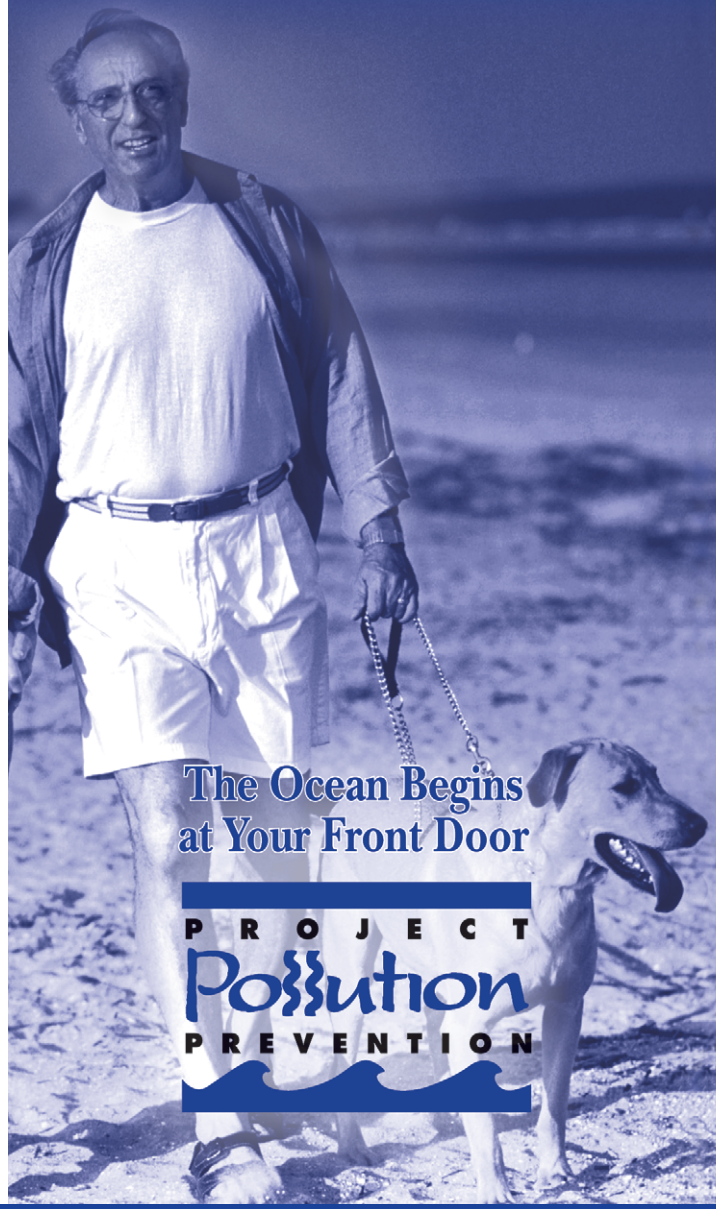
For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while caring for your pet. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

Tips for Pet Care



Tips for Pet Care

Never let any pet care products or washwater run off your yard and into the street, gutter or storm drain.

Washing Your Pets

Even biodegradable soaps and shampoos can be harmful to marine life and the environment.

- If possible, bathe your pets indoors using less-toxic shampoos or have your pet professionally groomed. Follow instructions on the products and clean up spills.

- If you bathe your pet outside, wash it on your lawn or another absorbent/ permeable surface to keep the washwater from running into the street, gutter or storm drain.



Flea Control

- Consider using oral or topical flea control products.

- If you use flea control products such as shampoos, sprays or collars, make sure to dispose of any unused products at a Household Hazardous Waste Collection Center. For location information, call **(714) 834-6752**.



Why You Should Pick Up After Your Pet

It's the law! Every city has an ordinance requiring you to pick up after your pet. Besides being a nuisance, pet waste can lead to water pollution, even if you live inland. During rainfall, pet waste left outdoors can wash into storm drains. This waste flows directly into our waterways and the ocean where it can harm human health, marine life and the environment.



As it decomposes, pet waste demands a high level of oxygen from water. This decomposition can contribute to killing marine life by reducing the amount of dissolved oxygen available to them.



Have fun with your pets, but please be a responsible pet owner by taking care of them and the environment.

- Take a bag with you on walks to pick up after your pet.

- Dispose of the waste in the trash or in a toilet.

PROJECT Pollution PREVENTION



Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Swimming pools and spas are common in Orange County, but they must be maintained properly to guarantee that chemicals aren't allowed to enter the street, where they can flow into the storm drains and then into the waterways. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump pool chemicals into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

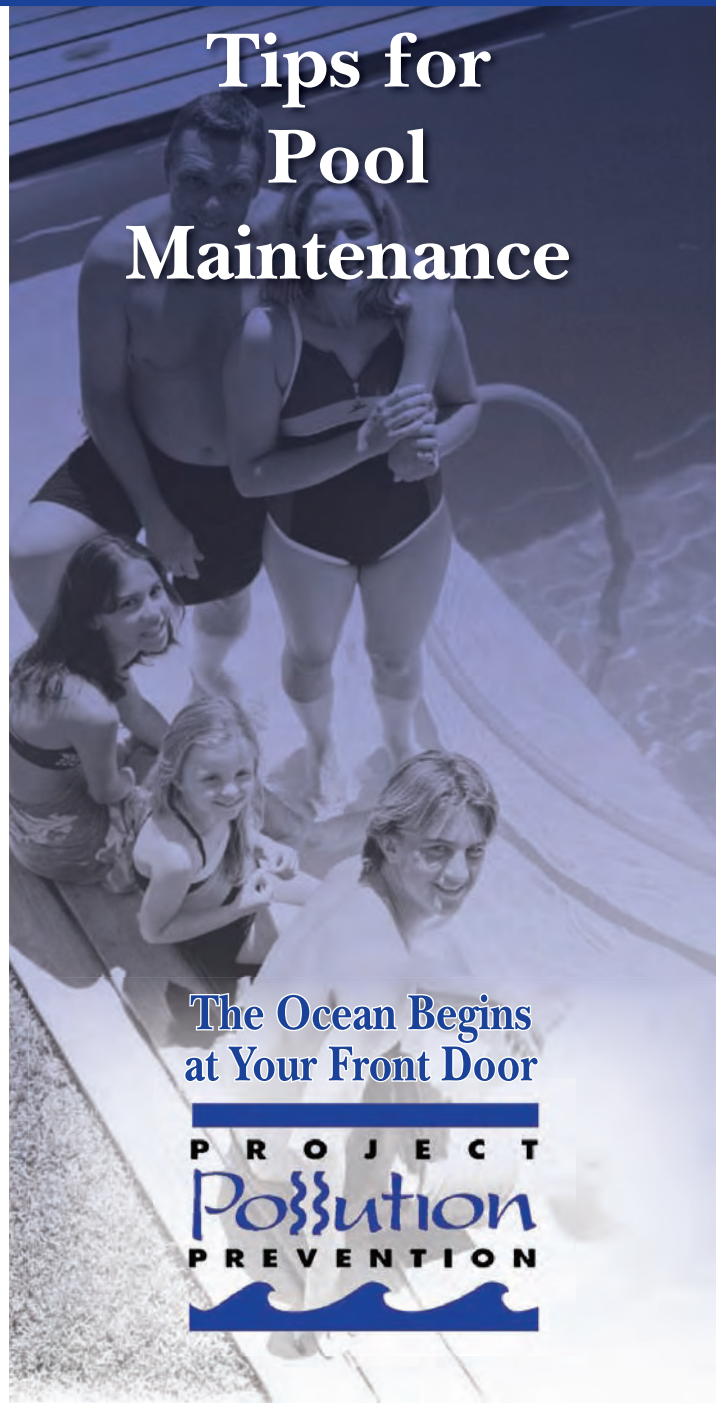
To report a spill,
call the
Orange County 24-Hour
Water Pollution Reporting Hotline
1-877-89-SPILL (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while maintaining your pool. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

Help Prevent Ocean Pollution:

Tips for Pool Maintenance



The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

Tips for Pool Maintenance

Many pools are plumbed to allow the pool to drain directly to the sanitary sewer. If yours is not, follow these instructions for disposing of pool and spa water.



Acceptable and Preferred Method of Disposal

When you cannot dispose of pool water in the sanitary sewer, the release of dechlorinated swimming pool water is allowed if all of these tips are followed:

- The residual chlorine does not exceed 0.1 mg/l (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration, dirt or algae.
- There is no discharge of filter media.
- There is no discharge of acid cleaning wastes.
- Some cities may have ordinances that do not allow pool water to be disposed into a storm drain. Check with your city.

How to Know if You're Following the Standards

You can find out how much chlorine is in your water by using a pool testing kit. Excess chlorine can be removed by discontinuing the use of chlorine for a few days prior to discharge or by purchasing dechlorinating chemicals from a local pool supply company. Always make sure to follow the instructions that come with any products you use.





Doing Your Part

By complying with these guidelines, you will make a significant contribution toward keeping pollutants out of Orange County's creeks, streams, rivers, bays and the ocean. This helps to protect organisms that are sensitive to pool chemicals, and helps to maintain the health of our environment.

PROJECT Pollution PREVENTION



For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

Tips for Residential Pool, Landscape and Hardscape Drains



The Ocean Begins at Your Front Door

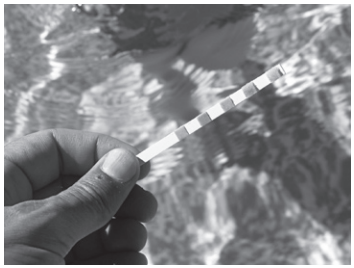
PROJECT Pollution PREVENTION

Tips for Residential Pool, Landscape and Hardscape Drains

Pool Maintenance

All pool water discharged to the curb, gutter or permitted pool drain from your property must meet the following water quality criteria:

- The residual chlorine does not exceed 0.1 mg/L (parts per million).
- The pH is between 6.5 and 8.5.
- The water is free of any unusual coloration.
- There is no discharge of filter media or acid cleaning wastes.



Some cities have ordinances that do not allow pool water to be discharged to the storm drain. Check with your city.

Landscape and Hardscape Drains

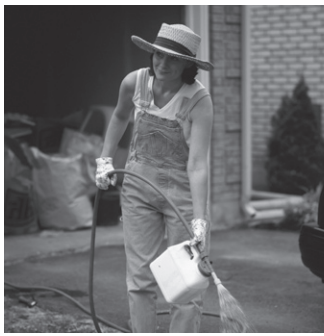
The following recommendations will help reduce or prevent pollutants from your landscape and hardscape drains from entering the street, gutter or storm drain. Unlike water that enters the sewer (from sinks and toilets), water that enters a landscape or hardscape drain is not treated before entering our creeks, rivers, bays and ocean.

Household Activities

- Do not rinse spills of materials or chemicals to any drain.
- Use dry cleanup methods such as applying cat litter or another absorbent material, then sweep it up and dispose of it in the trash. If the material is hazardous, dispose of it at a Household Hazardous Waste Collection Center (HHWCC). For locations, call **(714) 834-6752** or visit **www.oclandfills.com**.
- Do not hose down your driveways, sidewalks or patios to your landscape or hardscape drain. Sweep up debris and dispose of it in the trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash.
- Do not store items such as cleaners, batteries, automotive fluids, paint products, TVs, or computer monitors uncovered outdoors. Take them to a HHWCC for disposal.

Yard Maintenance

- Do not overwater. Water by hand or set automated irrigation systems to reflect seasonal water needs.
- Follow directions on pesticides and fertilizers (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Cultivate your garden often to control weeds and reduce the need to use chemicals.



Vehicle Maintenance

- Never pour oil or antifreeze down your landscape or hardscape drain. Recycle these substances at a service station, a waste collection center or used oil recycling center. For locations, contact the Used Oil Program at **1-800-CLEANUP** or visit **www.CLEANUP.org**.
- Whenever possible, take your vehicle to a commercial car wash.
- If you do wash your vehicle at home, do not allow the washwater to go down your landscape or hardscape drain. Instead, dispose of it in the sanitary sewer (a sink or toilet) or onto an absorbent surface such as your lawn.
- Use a spray nozzle that will shut off the water when not in use.





Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.

You would never dump paint into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.

For more information,
please call the
Orange County Stormwater Program
at **1-877-89-SPILL** (1-877-897-7455)
or visit
www.ocwatersheds.com

To report a spill,
call the
Orange County 24-Hour Water Pollution Problem Reporting Hotline
at **1-877-89-SPILL** (1-877-897-7455).

For emergencies, dial 911.

The tips contained in this brochure provide useful information to help prevent water pollution while using, storing and disposing of paint. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

Tips for Projects Using Paint



Tips for Projects Using Paint

Paint can cause significant damage to our environment. Whether you hire a contractor or do it yourself, it is important to follow these simple tips when purchasing, using, cleaning, storing and disposing of paint.

Purchasing Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Whenever possible, use water-based paint since it usually does not require hazardous solvents such as paint thinner for cleanup.

Painting

- Use only one brush or roller per color of paint to reduce the amount of water needed for cleaning.
- Place open paint containers or trays on a stable surface and in a position that is unlikely to spill.
- Always use a tarp under the area or object being painted to collect paint drips and contain spills.

Cleaning

- Never clean brushes or rinse paint containers in the street, gutter or storm drain.
- For oil-based products, use as much of the paint on the brushes as possible. Clean brushes with thinner. To reuse thinner, pour it through a fine filter (e.g. nylon, metal gauze or filter paper) to remove solids such as leftover traces of paint.
- For water-based products, use as much of the paint on the brushes as possible, then rinse in the sink.
- Collect all paint chips and dust. Chips and dust from marine paints or paints containing lead, mercury or tributyl tin are hazardous waste. Sweep up and dispose of at a Household Hazardous Waste Collection Center (HHWCC).

Storing Paint

- Store paint in a dry location away from the elements.
- Store leftover water-based paint, oil-based paint and solvents separately in original or clearly marked containers.
- Avoid storing paint cans directly on cement floors. The bottom of the can will rust much faster on cement.
- Place the lid on firmly and store the paint can upside-down to prevent air from entering. This will keep the paint usable longer. Oil-based paint is usable for up to 15 years. Water-based paint remains usable for up to 10 years.

Alternatives to Disposal

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.



Disposing of Paint

- Never put wet paint in the trash.

For water-based paint:

- If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

For oil-based paint:

- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.

Aerosol paint:

- Dispose of aerosol paint cans at a HHWCC.

Spills

- Never hose down pavement or other impermeable surfaces where paint has spilled.
- Clean up spills immediately by using an absorbent material such as cat litter. Cat litter used to clean water-based paint spills can be disposed of in the trash. When cleaning oil-based paint spills with cat litter, it must be taken to a HHWCC.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **(714) 567-6363** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

Attachment B: Operations and Maintenance Plan

Attachment C: Conditions of Approval

Attachment D: Geotechnical Report

GeoFirm
801 Glenneyre St. • Suite F • Laguna Beach • CA 92651
(949) 494-2122 • FAX (949) 497-0270

PRELIMINARY GEOTECHNICAL INVESTIGATION
FOR NEW SINGLE-FAMILY RESIDENCE
1 O'Hill Ridge, Bear Brand Ranch
Laguna Niguel, California

VOLUME 1 of 2
(Text, Appendices A through D-8.2

Prepared for:

Mr. and Ms. Garg

Project No: 72266-01
Report No: 18-8346

August 17, 2018

GeoFirm
801 Glenneyre St. • Suite F • Laguna Beach • CA 92651
(949) 494-2122 • FAX (949) 497-0270

August 17, 2018

Mr. and Ms. Garg
c/o Brion Jeannette Architecture
470 Old Newport Boulevard
Newport Beach, California 92663

Project No. 72266-01
Report No. 18-8346

Subject: **Preliminary Geotechnical Investigation**
For New Single-Family Residence
1 O' Hill Ridge, Bear Brand Ranch
Laguna Niguel, California

INTRODUCTION

This report presents results and recommendations of a preliminary investigation undertaken to determine site and certain regional geotechnical conditions pertinent to the design and construction of a new single-family residence at the subject site. Analysis for this investigation is based upon review of preliminary architectural drawings prepared by Brion Jeannette Architecture, project architect. This report is considered preliminary until final foundation plans are available, the formulation of which is partially dependent upon the findings presented herein.

Scope of Investigation

This investigation included the following:

1. Analysis of pertinent reports, maps, aerial photographs, and published literature pertaining to the site and nearby areas, in order to relate geotechnical conditions to proposed construction.
2. Review our previously reported information, Reference 18, with regard to the redesign of the subject property and improvements, including updated slope stability analyses. Where relevant we have also addressed the review comments from the City of Laguna Niguel, prepared by GMU Geotechnical.
3. Preparation of an updated geologic map and cross-sections depicting the material distributions and subsurface conditions of the underlying soil or rock. This information was utilized to develop criteria for slope stabilization and foundation design, as required.
4. Preparation of our report containing conclusions and recommendations regarding foundation design criteria, in accordance with the 2016 CBC, for the use by Structural and Civil Engineers, the City Building Official, and Contractors.

Accompanying Illustrations and Appendices

Figure 1 - CDMG Seismic Hazards Location Map
Figure 2 - Typical Retaining Wall Subdrain Detail
Appendix A - References
Appendix B - Boring Logs
Appendix C - Field Exploration and Laboratory Testing with Petra Excerpts
Appendix D - Slope Stability Analysis
Appendix E - Seismic Refraction Study (Subsurface Survey, Inc.)
Appendix F - Standard Grading Specifications
Appendix G - Utility Trench Backfill Guidelines
Appendix H - Geotechnical Response
Appendix I - Specifications for Cement-Treated Soils
Appendix J - Geotechnical Review Sheet
Plate 1 - Geotechnical Map
Plate 2 - Geotechnical Cross Sections 1-1' and 2-2'
Plate 3 - Geotechnical Cross Sections E-E' and F-F'
Plate 4 - Geotechnical Cross Sections D-D' and 3-3'

Site Description

The subject property consists of generally natural hillside terrain that is downslope of residences located in a previously rough graded tract as a portion of the Bear Brand Ranch, developed between1987 and 1989. The irregularly-shaped 6± acre hillside property is accessed from an unpaved road located between residences located at 2 O' Hill Ridge and 2 Upper Vintage, Laguna Niguel. The western property boundary ascends to a ridge adjacent Upper Vintage and shares a border with the residence located at 1 Upper Vintage. To the south the property abuts 31975 Peppertree Bend, San Juan Capistrano. Slopes of the east-west trending natural canyon form the northeasterly property boundary.

Topographically, the site can be characterized as relatively gently sloping, with a relatively level mid-lot ungraded pad area at elevation of about 530± feet. This flatter area of the site is flanked to the west by an ascending hillside to an elevation of about 645 feet and to the east/southeast by a hillside that descends as much as 150 feet. There is an area of graded fill slope to the southeast of 1 Upper Vintage. The location of the pad does not appear to have been part of a rough grading operation, although a dirt access road was excavated into the hillside in the past. Our borings, (see BA-1), located on the hillside descending to the east, encountered engineered fill associated with the original hillside earthwork for the offsite earthfill buttress.

Proposed Development

The proposed development will consist of a new tri-level single-family residence with underground parking, and two detached guest houses to the south of the main residence. It is our understanding that new construction will occur at or slightly below existing grades, with the grade changes stepping up into the ascending hillside with a sequence of retaining walls. The residence is proposed to be supported on conventional foundations and may utilize a slab-on-grade floor. Exterior improvements will include walkways, patios, two-level pool with water fall, spa with pool cabana, and driveway access from O'Hill Ridge via an easement down the hillside and across the property to the front of the residence. Other peripheral improvements will include a pond and multiple terraced yards and landscape areas yet to be determined.

GEOTECHNICAL CONDITIONS

Geologic Setting

The site is situated on the eastern flank of a ridge within the southwesterly margin of the San Joaquin Hills. These hills are generally underlain by marine sedimentary bedrock, which has been uplifted by tectonic forces acting on this region of southern California. Subsequent tectonic uplift combined with sea level variations led to the formation of easterly draining canyons carved deeply into the rock during periods of higher rainfall. This erosion left intervening ridgelines between the canyons, as seen throughout the area of Bear Brand Ranch.

Portions of the natural hillside terrain surrounding the site have been altered by grading within Bear Brand Ranch. The subject property consists of a relatively un-graded lot located on the eastern flank of a former ridgeline that was partially graded in the construction of Upper Vintage Road. This grading was reportedly completed in 1989. The property appears to have remained vacant since that time. The only grading in the vicinity of the proposed residence consisted of a dirt access road, with minor cuts on the order of 10 feet in vertical height on the uphill side. Slopes of up to 150 feet descend into the easterly draining canyon immediately adjacent to this access road.

Earth Materials

The property is underlain at depth by bedrock strata of the Capistrano Formation, which is locally overlain by colluvium/slopewash, landslide materials, possibly terrace deposits, and engineered fill.

All earth materials onsite should excavate readily with standard earth-moving equipment and compact to produce suitable fill. Onsite soils reportedly exhibit a high expansion potential and contain severe concentrations of soluble sulfates based on laboratory testing as performed by others. Additionally, electrical resistivity tests in this vicinity indicate a moderate to high

potential for corrosion of buried metals. Additional testing may be recommended after completion of grading.

Engineered Fill

Fill associated with the original rough grading operations for Bear Brand Ranch was encountered in our boring BA-1 to a depth of 6 feet, and is believed to be the fill materials in the backslope of the buttress located on the adjacent property to the east. P.A. & Associates, Inc. boring PA-B-5 encountered fill materials to a depth of about 22 feet easterly of BA-1. The engineered fill deposits overlie landslide material and consist of firm to stiff slightly sandy clayey SILT and silty CLAY. This previously engineered fill is located outside the area for currently proposed structural improvements for the proposed residential construction.

Colluvium/Slopewash

The colluvium consists primarily of dark brown and black organic silty Clay/clayey Silt with minor sand. Desiccation cracks are present to depths of 3 to 4 feet. Slopewash materials are primarily sandy Silt, consisting of a silt matrix with abundant angular silt and sand fragments suspended in the silt matrix. BA-2 encountered a 4-inch thick sandy gravel at the basal contact with the underlying landslide material. In BA-3, an accumulation of 31 feet of slopewash or graben infill material was encountered. This material is locally soft and exhibited low dry densities.

Landslide Materials

Landslide materials are interpreted to underlie the majority of the building pad area. These materials consist of sandy Silt to silty Clay, are locally highly weathered, and are medium stiff to stiff. The landslide materials are derived from the Capistrano Bedrock formation. Portions of these materials are not suitable for structural support. Open fractures were observed in boring BA-2 to a depth of 14 feet.

Capistrano Formation Bedrock

The bedrock strata encountered in the exploratory borings consists of moderately hard to hard, very thickly bedded to massive clayey siltstone. Localized clay and sand beds ranging from ½ inch to 6 inches in thickness were encountered in BA-1. Concretion layers were present in all three of the borings excavated for this investigation. The concretion encountered in BA-3 at a depth of about 90 feet resulted in the inability to advance the boring. Bedrock encountered in all the borings exhibited a halo of oxidized light gray to brown Siltstone or Claystone that transitions at depth to unoxidized dark gray to black in color. The bedrock is not likely to be encountered within the residential building pad area, except in the cut areas for the western retaining walls. Bedrock is considered suitable for structural support of footings and slabs.

Slope Stability

Geotechnical reports by others indicated former slope instability adjacent to the site. A two tiered buttress was constructed to stabilize the properties to the south/southeast. Additionally, our field investigation, literature-map review and stereoscopic aerial photograph review indicate the presence of ancient landslides underlying the site and canyon side slopes.

- Temporary Slope Stability; The preliminary architectural design depicts the construction of retaining walls into the natural slope ascending from the building pad. All temporary cuts for the retaining walls with a maximum height over 5 feet will need to utilize a temporary shoring system or integrated shoring-retention system No grading plan is available at this time; however, all designed permanent slopes should possess a factor of safety equal to or in excess of the engineering required minimum for static and pseudostatic conditions. Preliminary remedial grading recommendations for graded slopes and retaining wall cuts have been provided based on the architectural plans. They will be revised, as necessary, when the grading plans are completed.

- Natural Slope Stability; The descending slopes on the eastern property boundary have terrain features indicative of both recent and ancient landslides. Based on our analyses these slopes do not possess adequate permanent or pseudostatic factors of safety, as required. We are providing preliminary remedial recommendations, as indicated on the Geotechnical Map, Plate 1, to be finalized once the grading plans are available. The proposed grading will not adversely affect the stability of these natural slopes as no grading is proposed in these areas.

  Natural slopes ascending from the location of the building pad have not exhibited signs of distress based on the available historic aerial photographs.

- Landslides; The proposed development is significantly impacted by the identified landslides within and adjacent to this residential building pad and improvements. Our interpretations are based primarily on our subsurface data but also supplemented by the available information for the tract to the north of the east west trending canyon. The designated landslides indicated on Plate 1 that were not investigated by subsurface borings are based on our review of historic aerial photographs and other published studies.

  It is our opinion that two types of landslides impact the site; a) relatively shallow (on the order of 10 to 25 feet) translational landslides flank the canyon sidewall, with failure surfaces that mimic the existing topography, and b) the landslide impacting the building area, which is hanging on the canyon sidewall well above the elevation of the existing canyon bottom. This landslide most likely initially activated when the canyon bottom was close to the elevation of the toe of landslide and the sea level elevation was in decline.

Recommendations for the partial removal, shear key, shear pins, and a tieback and caisson system are provided. All the presently identified landslides are addressed in the recommendations section of this report.

The deeper ancient landslide beneath the building area is composed of blocks of the Capistrano Formation that have translated along low angle to near horizontal weakened clay bedding planes or rupture surfaces. All three borings encountered sheared and remolded clay materials at about the same elevation. Due to the competency of the ancient slide block material, once the disturbed debris and colluvial materials are removed, these deposits are considered to be suitable for the support of structural fill. The proposed design will require grading that further enhances the stability of these deposits. Based on our review the landslides will possess adequate factors of safety for the proposed design provided the recommendations presented herein are implemented during design and construction.

Landslide Qls 6, previously designated by PA and Associates, is reportedly stable due to the offsite grading discussed elsewhere in this report. We did not encounter landslide Qls 6 in our boring BA-1. We were unable to obtain the reports addressing this sequence of stabilization keys, and have therefore relied on the reported stability of the adjacent property in this review. Qls 6 is reportedly sufficiently east of the design limits of the residential construction and is not anticipated to impact the proposed design.

Groundwater

Groundwater in the form of seepage was observed during drilling for BA-3 at a depth of 88 feet along a sandstone bed overlying a concretion layer. The canyon easterly of the site and the location of numerous trenches/test pits reported no groundwater observations in exposures onsite. However, wet soils and seepage may occur seasonally. Groundwater will not likely be a construction issue and dewatering should not be anticipated. Subdrain systems will be required in the retaining wall and slope stabilization designs.

Surficial Runoff

No evidence of significant uncontrolled, concentrated, erosive runoff onto or from the property has been observed. Future development will modify and increase post-development surficial discharge that must be controlled and conducted offsite by appropriate engineering design to preclude potentially damaging erosion or soil saturation.

Geologic Structures

No faults are mapped within close proximity of the site, and the area is not zoned for investigation within the Alquist-Priolo Act. Bedding structure observed within the bedrock is generally flat to dipping at shallow angles of up to 10 degrees from horizontal to the east/ southeast. This is consistent with those observed within the property to the north, and results in a neutral to slightly unsupported slope condition.

Seismic Considerations

Published Studies

One of the principals of seismic analyses and prediction is the premise that earthquakes are more likely to occur on geologically younger faults, and less likely to occur on older faults. For many years studies have described faults with Holocene movement (within the last 11,000 years) as "Active", and faults with documented Pleistocene movement (within the last 1.6 million years) and with undetermined Holocene movement as "Potentially Active". Informally, many studies have described faults documented to have no Holocene movement as "Inactive". Recent geologic and seismic publications are attempting to clarify the nomenclature describing faults to more accurately represent the potential affects from earthquakes.

Reports by the California Division of Mines and Geology indicate faults with documented Holocene or Historic (within the last 200 years) movement should be considered Active. However, Potentially Active faults are more appropriately characterized in terms of the last period of documented movement. The Fault Activity Map of California (Jennings, C.W.; 1994) defines four categories for onshore Potentially Active faults. The categories are associated with the time of the last displacement evidenced on a given fault and are summarized in Table 1.

Table 1, Definitions of Fault Activity in California

Activity	Category	Recency of Movement
Active	Historic	Within the last 200 years
	Holocene	Within the last 11,000 years
Potentially Active	Late Quaternary	Within the last 700,000 years
	Quaternary	Within the last 1.6 million years
	Late Cenozoic	Possibly within the last 1.6 million years
	Pre-Quaternary	Before the last 1.6 million years

It is important to note these categories embrace all Pre-Holocene faults as Potentially Active, and provide no methodology to designate a given fault as "Inactive". Although the likelihood of an earthquake or movement to occur on a given fault significantly decreases with inactivity over geologic time, the potential for such events to occur on any fault cannot be completely eliminated within the current level of understanding.

Local and Regional Faults

The closest published active fault to the site is the offshore extension of the Newport-Inglewood Fault Zone, approximately 5.0 miles west, (Blake, T.F., 2000, CDMG/2000). Other active faults in the vicinity of the site include the San Joaquin Hills Fault, approximately 5.2 miles from the site, the Palos Verdes Fault, approximately 20.6 miles to the northwest, the Coronado Bank Fault, approximately 21.4 miles to the south, and the San Andreas Fault, approximately 52.0 miles to the northeast.

The Newport-Inglewood Fault zone is indicated in published reports as being a Potentially Active and Quaternary fault, (Jennings, C.W.; 1994). This interpretation is not universally shared, as portions of the Newport-Inglewood Fault are included as a potential seismic source in the computer programs utilized to model ground motions for this study, (Blake, T.F.; 2000). With the fault's location approximately 5.0 miles to the west, it is, in our opinion, appropriate to include this portion of the fault as a causative seismic feature.

Recently, the California Geological Survey updated the Fault Parameters and Earthquake Catalog for the probabilistic Seismic Hazards Maps, (Cao, T., et.al, 2002). This update included the addition of the "San Joaquin Hills" blind thrust fault, theorized to exist from Newport Beach to Dana Point, and ramping up inland to the Irvine area, immediately underlying the site. Earthquakes of significant magnitude (M6.6) are presently postulated for this structure and, based on seismological computer data files, it is calculated as the most significant seismic source to affect this site.

Historic Ground Motion Analyses

The potential ground motions from earthquakes that could impact the sites were analyzed through probabilistic methods. The probabilistic method considers the regional seismic history and the slip rates of faults within a 100-mile radius of the subject site. Utilizing attenuation relationships (Bozorgnia, et al.; 1999, unconstrained/Pleist. Soil), one can estimate the ground motion history of the site and attempt to predict the probability of future accelerations within a given period of time. The study indicates the maximum site acceleration from 1800 to 2014 was approximately 0.101g and occurred during a magnitude 6.3 Long Beach Earthquake 18.1 miles from the site on March 11, 1933.

It is noted that the estimation of peak ground accelerations presented above is provided for the interest of the client and is required by local (City or County) review agencies. The values derived are not directly utilized in structural design of residential structures. Seismic parameters for use by the structural engineer in accordance with 2016 California Building Code in design of the proposed structure(s) are presented in the recommendations portion of this report.

Site Classification for Seismic Design

For the purposes of determining seismic design parameters provided in the Recommendations portion of this report for use by the structural engineer, the upper 100 feet of soil underlying the subject site has been classified in accordance with Section 1613.3.2 of the 2016 CBC and Section 20.1 of ASCE 7-10. Given the results of our onsite and nearby field investigations, which indicates new foundations will be supported in new engineered fill or competent landslide deposits with average blow counts between 15 and 50, the site classifies as D.

Secondary Seismic Hazards

Secondary seismic hazards can include deep rupture and shallow ground cracking, liquefaction, seismic settlement, and landsliding. The potential for shallow ground cracking to occur during an earthquake is a possibility at any site, but does not pose a significant hazard to site development. The potential for seismically induced surface fault rupture, seismic landsliding, liquefaction, or seismic settlement to occur is considered remote for this site, following recommended remedial construction. The areas identified as a "Zone of Required Investigation" for liquefaction or seismically induced landsliding are indicated on Figure 2.

CONCLUSIONS

1. Proposed development of the property is considered feasible and safe from a geotechnical viewpoint providing the recommendations herein are integrated into design and construction. The proposed development should not adversely affect adjacent properties.

2. Evidence of former gross bedrock instability has been observed and our stability analyses indicate inadequate existing gross stability. Surficial instability in the form of soil creep is also occurring in and adjacent to sloping soil, and must be addressed in design. Landslides present at the site will require stabilization measures. The stabilization measures in the residential area consist of partial removal of unsuitable landslide materials and stabilization with a shear key and shear pins. These measures are detailed in Appendix D. Tiebacks and caissons are recommended for the access road to minimize grading in this area.

3. The site is underlain at depth by bedrock strata that are in turn overlain by landslide deposits. Native unweathered bedrock deposits are suitable for structural support. These materials may be used for compacted fill; however, select free-draining, granular, and non-expansive import material should be used behind retaining walls.

4. Structural foundation design can anticipate using footing elements embedded in recompacted fill. Bedrock overexcavation is anticipated at the northern corner of the

residence and proposed retaining wall. For improvements near the top of the back slope, caissons may be required locally in the foundation design.

5. Based upon testing and observations reported by others, the expansion potential of onsite earth materials is high and soil soluble sulfate levels are severe. Corrosivity results indicate a moderate to high potential for corrosion of buried metal. Additional testing may be recommended following grading.

6. No potentially active faults are known to transect the site and therefore the site is not expected to be adversely affected by surface rupturing. It will however, be affected by earthquake ground motions during the design life of the residence. As no groundwater is present and the materials are dense, the liquefaction potential is nil.

7. The natural slope descending from the entry access road is the location of a recent shallow landslide based on the fresh headscarp and disturbance of vegetation. Stabilization of this area to achieve adequate factors of safety for static and pseudostatic conditions for emergency access requirements will include caissons and tieback construction.

RECOMMENDATIONS

Site Preparation and Grading

1. General

Grading is anticipated to consist of cut and fill operations required to construct the new building pad and site grades. Remedial grading is recommended to consist of a minimum of ± 20 feet of overexcavation and recompaction to remove unsuitable surficial material and provide a uniform fill blanket beneath the areas of proposed fill or structural improvements. In areas of the proposed residence, overexcavation should extend to the depth required to provide a minimum of five feet of compacted beneath residence footings. Locally deeper removal may be required and such should be evaluated by the geologist during grading. The zone of overexcavation should extend laterally 20 feet beyond the proposed building footprint and five feet beyond proposed hardscape improvements.

All grading should be performed in accordance with the Standard Grading Specifications in Appendix D. All processing, overexcavation and recompaction should be observed, tested and approved in writing by a representative of this firm.

2. Removal of Existing Improvements

Any existing litter, organic materials and/or construction debris in structural areas should be removed and disposed of offsite.

3. Compaction Standard

All onsite soil materials are anticipated to be suitable for re-use as compacted fill. Such materials should be placed at 120 percent of optimum moisture content and compacted under the observation and testing of the soil engineer to at least 90 percent of the maximum dry density as determined by ASTM D 1557.

4. Imported Soils

Onsite soils are not recommended for retaining wall backfill. Imported soils for walls should be granular, free-draining, and nonexpansive (gravel, pea-gravel, or clean sand) and should be approved by Geofirm prior to transport to the site.

Soil Cement Shear Keys

The shear keys should be constructed with soil cement, consisting of Type 5 Portland Cement at 8 percent of the dry weight of soil, mixed and placed with the specifications provided in Appendix I. It is recommended that dry cement be added to the soil. The percentage of moisture in the soil, at the time of cement application, shall be the amount that assures a uniform and intimate mixture of soil and cement during mixing operations. It shall not exceed the specified optimum moisture content for the mixture.

The procedure for the confirmation of the cement-treated soil shear strength will consist of unconfined compression testing. Testing will be performed on a regular basis to verify the strength of the soil cement.

Large bag samples of the in-placed material will be collected and remolded to 90 percent relative compaction and tested for unconfined compressive strength. A minimum of five unconfined compressive tests are recommended. The unconfined compressive tests should be performed in accordance with ASTM D1633.

Structural Design of Shear Pin System

Stability analyses for the proposed slope stability shear pins are presented in Appendix D and indicate factor of safety of over 1.5 for static conditions and 1.1 for pseudo-static conditions. The shear pins are recommended at the lower edge of the shear key excavation and behind building retaining walls, as shown on Plates 1 through 3.

The design criteria are presented on the following Tables:

SHEAR PIN SYSTEM NEAR SHEAR KEY

Location	See Plan
Type	Shear Pin
Shear Strength (lbs/lineal ft)	140,000
Out-of-Plane Spacing (ft)	To be designed by structural
Minimum Diameter (ft)	2
Length (ft)	72, Tip Elevation 419 ft amsl (min.)

STRUCTURE AREA SHEAR PIN SYSTEM

Type	Sections E-E' and 1-1'(at retaining wall)	Section D-D' (at retaining wall)
Shear Pin - Shear Strength (lbs/lineal ft)	10,000	15,000
Shear Pin - Out-of-Plane Spacing (ft)	To be designed by structural	To be designed by structural
Shear Pin - Minimum Diameter (ft)	2	2
Shear Pin - Length (ft)	Extends 10 ft below lowest adjacent grade (min.)	Extends 20 ft below lowest adjacent grade (min.)

Structural Design of Caisson and Tieback System

The recommended systems are designed to achieve a 1.5 factor of safety under static conditions and 1.1 factor of safety for seismic conditions for the access road. The caisson-tieback system should be designed by the structural engineer.

Tiebacks should be unbonded through landslide debris; unbonded lengths may be modified during construction pending field verification by the geologist. Minimum bonded lengths in bedrock should be 30 foot. The actual bond length should be determined by the structural engineer. An allowable bond stress of 25 pounds per square inch (psi) may be used in the preliminary design for pressure-grouted anchors between the Capistrano Formation bedrock and the grout. This value is based upon literature recommendations and successful experience in past projects; although it is noted multiple post-grouting phases will likely be required. The tieback anchors should be inclined downward at a nominal 30 degrees below horizontal.

ACCESS ROAD TIEBACK/CAISSON DESIGN

Location	Downslope of Access Road – Lower Row	Within Access Road – Upper Row
Type	Caisson	Caisson
Shear Strength (lbs/lineal ft)	370,000	270,000
Out-of-Plane Spacing (ft)	To be designed by structural	To be designed by structural
Minimum Diameter (ft)	2	2
Length (ft)	125, Tip Elevation 457 ft amsl (min.)	130, Tip Elevation 470 ft amsl (min.)

Tieback Anchor Installation

We recommend that design, construction, and testing criteria published within the Post-Tensioning Institute's "*Recommendations for Prestressed Rock and Soil Anchors*," manual (PTI, 2014), be incorporated into the tieback anchor specifications and details. We have referenced portions of the manual in the following sections where appropriate.

We recommend that the design include pressure grouting throughout the bonded length of the tieback. If post-grouting is employed, no more than three post-grouting phases should be performed.

Corrosion Protection

Considering the potentially corrosive nature of the site soil and bedrock materials, we recommend that, at a minimum, all anchors be designed as encapsulated Class I anchors as set forth in the latest edition of the Post-Tensioning Institute (PTI) manual for prestressed rock and soil anchors (PTI, 2014). In lieu of retaining a grouting/concrete expert, it is recommended that PTI recommendations be utilized, which requires Type V cement, a maximum water cement ratio of 0.45, and a minimum compressive strength of 3000 psi. In addition, it is our recommendation that all anchor blocks and anchorages be properly sealed against corrosion.

Performance Testing

Performance testing shall be done for 10 percent of the anchors. Testing will be done in general accordance with the criteria set forth in the PTI Recommendations for Pre-stressed Rock and Soil Anchors, 2014 edition, and subject to observation by our firm. Just prior to testing, the hydraulic jack, pump, and gauge system should be calibrated by an independent testing laboratory. The test load (TL) for these anchors will be 150 percent of the design load (DL). Alignment load (AL) may be taken as 10 percent of the DL. During performance testing the AL should be applied and then the loading sequence of 0.25 DL, 0.50 DL, 0.75 DL, 1.00 DL, 1.25 DL and then 1.50 DL. The test load at 1.50 DL shall not exceed 80 percent of the minimum tensile strength.

Extended Creep Tests

We recommend that 5 percent of the anchors be subjected to extended creep testing. Extended creep testing should conform to the cyclic loading pattern for performance testing except that the loads shall be held constant as follows:

Extended Creep Testing

Load	Time, Minutes
AL	
0.25 DL	10
0.50 DL	30
0.75 DL	30
1.00 DL	45
1.25 DL	60
1.50 DL	300

Creep movement readings are to be made at the following time intervals: 1, 2, 3, 4, 5, 6, 10, 15, 20, 25, 30, 45, 60, 75, 90, 100, 120, 150, 180, 210, 240, 270, and 300 minutes.

If the creep rate exceeds 0.08-inch over any logarithmic cycle, the time of observation may be extended to establish if the creep rate diminishes to the 0.08-inch per logarithmic cycle of time.

Proof Testing

All other anchors shall be proof tested to 1.50 DL, with the load being maintained constant for at least 10 minutes. Total movement readings are to be the same as for performance testing at the Total Load. At the conclusion of the proof loading, the anchors may then be reduced to the DL and locked off.

If the total creep movement exceeds 0.04-inch between 1 and 10 minutes, the TL shall be maintained for an additional 50 minutes with movement readings taken every 10 minutes. The total creep movement shall not exceed 0.10-inch over a 10-minute period in order for the anchor to be approved for the design load.

Structural Design of Foundations and Slabs

Earth materials to be exposed at finish grades are anticipated to exhibit a high expansion potential. We recommend that the foundation and slabs be designed to resist the effects of expansive soils in accordance with Section 1806.6 of the 2016 California Building Code, utilizing a conventional foundation system with a deepened perimeter footing. Foundations and slabs should be designed for the intended use and loading by the Structural Engineer. The design should consider the expansion potential of the subgrade soils and other appropriate soil related criteria.

Our recommendations are considered to be generally consistent with the standards of practice. They are based on both analytical methods and empirical methods derived from experience with similar geotechnical conditions. These recommendations are considered the minimum necessary for the likely soil conditions and are not intended to supersede the design of the Structural Engineer or criteria of governing agencies.

Although there is no known economical method of totally preventing movement due to expansive soils, current state-of-the-practice in the Southern California area dictates substantial reinforcement, slab thickening, moisture barriers, and pre-soaking of subgrade soils as methods of minimizing the effects of expansive soils. Reasonable mitigation of expansive soil effects is considered feasible from a geotechnical viewpoint utilizing such methods, although it is noted that some future distress cannot be precluded when building on expansive soils.

1. Conventional Foundations and Slabs-on-Grade

Conventional foundations and slabs-on-grade should be designed in accordance with Section 1808.6 of the 2016 California Building Code utilizing an effective plasticity index of 50. The minimum recommended slab thickness is 5 inches, with No. 4 bars at a spacing of 12 inches, placed in both directions. It is recommended that interior footings be interconnected so that the structure will respond relatively monolithically to differential soil movement. Slab underlayment is deferred to the project architect; however, in accordance with the American Concrete Institute, we suggest that slabs be underlain by a 15-mil thick vapor retarder/barrier (Stego Wrap or equivalent) placed over 4 inches of open graded, ½ inch gravel in accordance with the requirements of ASTM E:1745 and E:1643.

Conventional spread footings in competent fill may be designed for an allowable bearing value of 1500 pounds per square foot with a minimum width of 15 inches, and a minimum embedment of 30 inches below the lowest adjacent grade. The design value may be increased one-third for short duration wind or seismic loading. Total and differential structural settlements are anticipated to be ¾ and ½ inch, respectively.

Lateral loads may be resisted by passive pressure forces and by friction acting on the bottom of footings. The allowable passive pressure forces may be computed using an equivalent fluid density of 150 pounds per cubic foot, and a coefficient of friction of 0.25 may be used in computing the frictional resistance. Friction resistance and passive pressure may be combined without reduction.

2. Moisture Content of Slab Subgrade Soils

Presoaking of slab subgrade soils is required prior to construction of slabs. We recommend that subgrade soils be soaked to at least 140 percent of optimum moisture content to a minimum depth of 18 inches prior to placing gravel.

3. Comments Pertaining to Soil Creep

It is generally accepted that soil creep is a surficial slope condition which is progressive in character and caused in this climatic environment by expansion and contraction of sloping earth materials under the influence of moisture changes and gravity. The potential for structural distress of shallow foundation systems placed in or adjacent to creeping materials is high, as the creep process removes downslope support for conventional footings.

Potential distress associated with creep-induced foundation deformations should be anticipated and minimized with appropriate design which considers that most of the downslope movement of creep-prone materials occurs in the first 10± feet of depth of sloping earth material.

Additionally, deformations caused by creep movement cannot be entirely precluded, and it is the intent of these recommendations only to minimize their perception. Other design considerations which will minimize the perception of movement include use of flexible surfacing materials such as wood rather than frangible materials such as tile, brick and stucco.

4. Footing Reinforcement

To resist adverse effects of tension cracking due to seismic shaking and expansive soils, a minimum of two No. 5 bars should be placed at the top and bottom of continuous footings.

5. Caissons

Twenty-four inch diameter caissons with a minimum embedment of 10 feet may be designed for a dead plus live load end bearing value of 4500 and 6000 pounds per square foot and skin friction of 250 and 500 pounds per square foot for competent landslide material and bedrock, respectively below the creep zone only. These values may be increased by one-third for wind and seismic forces. Lateral resistance may be computed utilizing 250 and 400 pounds per square foot per foot of depth for landslide material and bedrock, respectively, acting on a tributary area of twice the caisson diameter. The 24-inch

diameter is required in order to assure proper cleanout by the contractor and to allow visual inspection and cleanout confirmation by the engineering geologist.

Caisson design in the creep zone should recognize that soil/rock creep movement will remove downslope support and that the caissons will therefore act as retaining structures. Caissons adjacent to or on the slope, within 2:1sloping terrain, should therefore be designed to resist active pressure loading to a depth of 10± feet based upon 100 pounds per cubic foot equivalent fluid pressure, acting on a tributary area of twice the caisson diameter. Passive resistance may be taken only below the potential creep zone, herein considered to be 10± feet deep as measured vertically from the face of the slope. Final caisson design and locations must be accomplished by joint consultation between the geotechnical engineer and structural engineer in order to assure cost effective design.

Drilled, cast-in-place concrete caissons shall be installed by a contractor experienced in drilled shaft work. Shafts shall be drilled to the embedment required to resist loads as designed by the Structural Engineer. Excavation shall be advanced in a manner that will not adversely affect the integrity and performance of completed caissons or damage adjacent facilities and property. Shafts should not be excavated within 10 feet of previously completed caissons until the concrete has been allowed to cure for at least seven days. If high early strength concrete is utilized, the set time should be defined by the Structural Engineer.

As caving conditions may occur locally within the fill or landslide deposits, casing of the shafts may be required in some areas above the basal landslide rupture surface. Care should be taken to minimize the extent of caving within the drilled shafts. Ground water seepage into open shafts may also occur. Shaft excavations shall be maintained in an essentially dry condition, by pumping if necessary, until just prior to concreting.

The bottom surface must be relatively clean of loose or softened materials, debris or other substances. The Geotechnical Consultant will provide on-site observation during the duration of the pier excavation. The Contractor shall cooperate with the Consultant during this process and assist in securing the construction documentation specified herein.

Drilled, cast-in-place concrete caissons shall be installed by a contractor experienced in drilled shaft work. Shafts shall be drilled to the embedment required to resist loads as designed by the Structural Engineer. Excavation shall be advanced in a manner that will not adversely affect the integrity and performance of completed caissons or damage adjacent facilities and property. Shafts should not be excavated within 10 feet of previously completed caissons until the concrete has been allowed to cure for at least seven days. If high early strength concrete is utilized, the set time should be defined by the Structural Engineer.

Design of Conventional Retaining Walls

1. Structural Design of Retaining Walls

Active pressure forces acting on walls retaining level backfill may be designed using an equivalent fluid density of 30 pounds per cubic foot if backfilled with geotechnically approved, granular non-cohesive soils and free to rotate during backfilling (refer to Figure 2 for backcut and backfill geometry). Active pressures for site soils with level condition may be designed using an equivalent fluid density of 60 pounds per cubic foot. Walls supporting 2:1 ascending onsite expansive fill or bedrock should be designed for 100 pounds per cubic foot equivalent fluid pressure. Wall rotation on the order of 0.1 percent of the wall height should be anticipated and considered in design of walls and adjacent hardscaping. Restrained walls should be designed for a pressure of 50 percent greater than that for unrestrained walls.

2. Subdrains

The drainage scheme depicted on Figure 2, or a geotechnically approved alternative, should be used to control seepage forces behind retaining walls. Waterproofing of retaining walls is recommended and should be applied in accordance with the architect's specifications or those of a waterproofing consultant.

Other structural surcharges, such as foundation loads, should be addressed by the structural engineer.

Seismic design of retaining walls was analyzed based on the Monomobe-Okabe method, as updated by Atik and Sitar (2010), (for two-thirds of PGAm as recommended in NEHRP Recommended Seismic Provisions, 2009, Commentary to Section 11.8.3), and indicates no seismic loading is required. However, it is conservatively recommended that an additional dynamic load of 15 pounds per cubic foot equivalent fluid pressure for both flexible and stiff walls acting at 1/3H above the base of the wall. Final design requirements should be determined by the structural engineer. Based on slope stability analyses (Appendix D), no additional loading is required for sloping conditions.

3. Wall Excavations

Wall excavations may be laidback at 1:1. Temporary shoring may be required where space limitations preclude slope layback.

Concrete

Onsite derived soils have a severe soluble sulfate content. It is recommended that a concrete expert be retained to design an appropriate concrete mix to address soil soluble sulfate content and the structural requirements. In lieu of retaining a concrete expert, the 2016 California Building Code, Section 1904.1 should be utilized, which refers to ACI 318, Table 4.3.1.

Seismic Structural Design

Based on the geotechnical data and site parameters, the following is provided by the USGS (ASCE 7-10) to satisfy the 2016 CBC design criteria:

Site and Seismic Design Criteria for 2016 CBC

Design Parameters	Recommended Values
Site Class	D
Site Longitude (degrees)	-117.68553
Site Latitude (degrees)	33.501
Ss (g) B	1.388
S_1 (g) B	0.516
SMs (g) D	1.388
SM_1 (g) D	0.774
SDs (g) D	0.925
SD_1 (g) D	0.516
F_A	1.0
F_V	1.5
PGA_M (g)	0.544
Seismic Design Category	D

Hardscape Design and Construction

Concrete flatwork should be divided into as nearly square panels as possible. Joints should be provided at maximum 6 feet intervals to give articulation to the concrete panels. Landscaping and planters adjacent to concrete flatwork should be designed in such a manner as to direct drainage away from concrete areas to approved outlets. Planters located adjacent to principle foundation elements should be sealed and drained.
Flatwork elements should be a minimum 5 inches thick (actual) and reinforced with No. 4 bars 16 inches on center both ways. Thickened edges to depths of 12 inches are also recommended. Subgrade pre-saturation is also recommended.

All hardscape subgrade must be approved by the geotechnical consultant prior to placement of concrete.

Utility Trench Backfill

Utility trench backfill should be placed in accordance with Appendix E, Utility Trench Backfill Guidelines. It is the owners and contractors responsibility to inform subcontractors of these requirements and to notify Geofirm when backfill placement is to begin. The owner or their representative should prepare a map on an ongoing basis which depicts the location and depth of all underground utilities for inclusion in the as-built geotechnical report. Density testing of all utility and service trench backfill is required by the City of Laguna Hills.

Finished Grade and Surface Drainage

All finished grades should assure that no ponding of water occurs in the vicinity of footings. Drainage gradients should conform to CBC requirements. All roofs should be gutted and discharge conducted offsite in a non-erosive manner as specified by the project civil engineer or landscape architect.

Grading and Foundation Plan Review

In order to help assure conformance with recommendations of this report and as a condition of the use of this report, the undersigned should review grading and final foundation plans and specifications prior to submission of such to the building official for issuance of permits. Such review is to be performed only for the limited purpose of checking for conformance with the design concept and the information provided herein. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. Geofirm's review shall be conducted with reasonable promptness while allowing sufficient time in our judgment to permit adequate review. Review of a specific item shall not indicate that Geofirm has reviewed the entire system of which the item is a component. Geofirm shall not be responsible for any deviation from the Construction Documents not brought to our attention in writing by the Contractor. Geofirm shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

Pre-Grade Meeting

A pre-job conference should be held with representative of the owner, contractor, architect, civil engineer, soils engineer, engineering geologist, and building official prior to commencement of construction to clarify any questions relating to the intent of these recommendations or additional recommendations.

Jobsite Safety

Neither the professional activities of Geofirm, nor the presence of Geofirm's employees and subconsultants at a construction/project site, shall relieve the General Contractor of its obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordination the work in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. Geofirm and its personnel have no authority to exercise any control over any construction contractor or its employees in connection with their work or any health or safety programs or procedures. The General Contractor shall be solely responsible for jobsite safety.

Observation and Testing

The 2016 California Building Code, Section 1705.6 requires geotechnical observation and testing during construction to verify proper removal of unsuitable materials, that foundation excavations are clean and founded in competent material, to test for proper moisture content and proper degree of compaction of fill, to test and observe placement of wall and trench backfill materials, and to confirm geotechnical design assumptions. It is noted that the CBC requires continuous geologic observation during the drilling of deep foundation elements and observation and testing during placement of fill.

A Geofirm representative shall visit the site at intervals appropriate to the stage of construction, as notified by the Contractor, in order to observe the progress and quality of the work completed by the Contractor. Such visits and observation are not intended to be an exhaustive check or a detailed inspection of the Contractor's work but rather are to allow Geofirm, as an experienced professional, to become generally familiar with the work in progress and to evaluate, in general, if the work is proceeding in accordance with the recommendations of this report.

Geofirm shall not supervise, direct, or have control over the Contractor's work nor have any responsibility for the construction means, methods, techniques, sequences, or procedures selected by the Contractor nor the Contractor's safety precautions or programs in connection with the work. These rights and responsibilities are solely those of the Contractor.

Geofirm shall not be responsible for any acts or omission of the Contractor, subcontractor, any entity performing any portion of the work, or any agents or employees of any of them. Geofirm does not guarantee the performance of the Contractor and shall not be responsible for the Contractor's failure to perform its work in accordance with the Contractor documents or any applicable law, codes, rules or regulations.

These observations are beyond the scope of this investigation and budget and are conducted on a time and material basis. The responsibility for timely notification of the start of construction and ongoing geotechnically involved phases of construction is that of the owner and his contractor. Typically, at least 24 hours' notice is required.

LIMITATIONS

This investigation has been conducted in accordance with generally accepted practice in the engineering geologic and soils engineering field. No further warranty is offered or implied. Conclusions and recommendations presented are based on subsurface conditions encountered, and are not meant to imply a control of nature. As site geotechnical conditions may alter with time, the recommendations presented herein are considered valid for a time period of one year from the report date. The recommendations are also specific to the current proposed development. Changes in proposed land use or development may require supplemental investigation or recommendations. Also, independent use of this report in any form cannot be approved unless specific written verification of the applicability of the recommendations is obtained from this firm.

If you have any questions, please contact this office.

Sincerely,

GEOFIRM



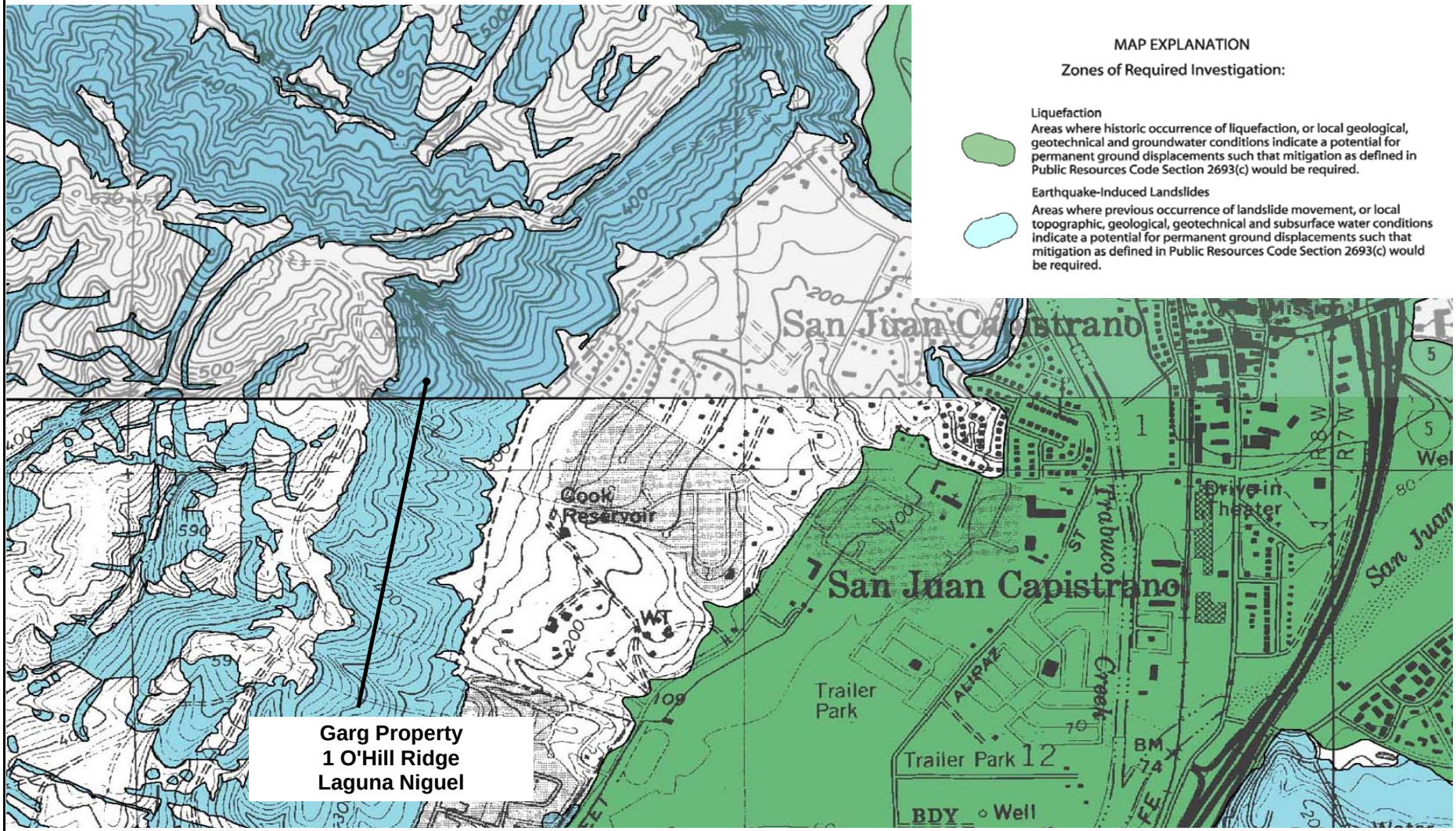


Dwight R. Haggard
Senior Engineering Geologist, E.G. 1178
Registration Expires 11-30-18

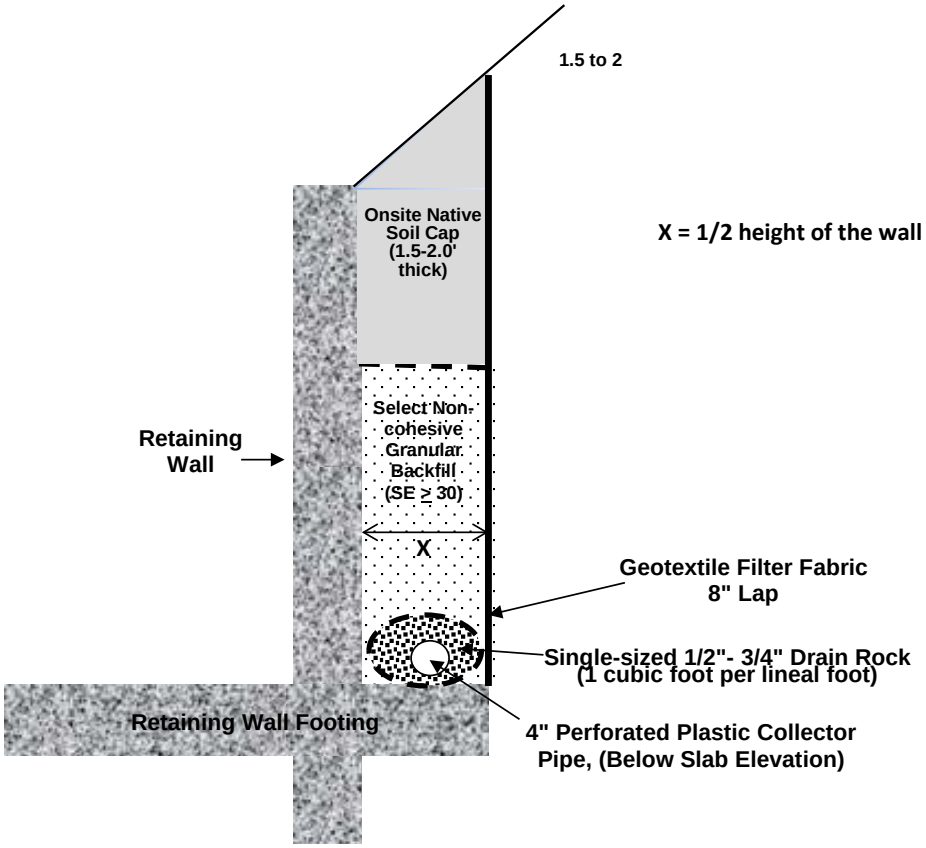
Hannes H. Richter, P.E.
Principal Geotechnical Engineer, G.E. 717
Registration Expires 3-31-20
Date Signed / /

DRH/HHR:fp

Distribution: Addressee (3)



GeoFirm	CDMG Seismic Hazards Location Map, San Juan Capistrano and Dana Point Quadrangles		
	JOB NO.: 72266-01	DATE: August 2018	FIGURE: 1



Notes: This system consists of a geotextile fabric-wrapped gravel envelope. Collection is with a 4-inch diameter perforated plastic pipe embedded in the gravel envelope and tied to a 4-inch diameter non-perforated plastic pipe which discharges at convenient locations. The outlet pipe should be placed such that the flow gradient is not less than 2.0 percent. The geotextile fabric-wrapped gravel envelope should be placed at a similar gradient

All drain pipes should be Schedule 40 PVC or ABS SDR-35. Perforations may be either bored 1/4-inch diameter holes or 3/16-inch slots placed on the bottom one-third of the pipe perimeter. If the pipe is to be bored, a minimum of 10 holes should be uniformly placed per foot of length. If slots are made, they should not exceed 2-1/2 inches in length and should not be closer than 2 inches. Total length of slots should not be less than 50 percent of the pipe length and should be uniformly spaced.

The fabric pore spaces should not exceed equivalent 30 mesh openings or be less than equivalent 100 mesh openings. The fabric should be placed such that a minimum lap of 8-inches exists at all splices.

GeoFirm	Retaining Wall Subdrain Detail - Sloping Backfill		
	JOB NO.: 72266-01	DATE: August 2018	FIGURE: 2

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

BORING LOGS

Date(s) Logged: 10/15/2014 - 10/16/2014

Logged By: DRH

Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger

Drilling Company: Dave's Drilling

Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,

Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-1

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
0							**Drill Pad Fill**		0
1							**4"-5'11"<u>Old Engineered Fill:</u>**(Af)		
2							4"-4'2" SILT, medium dense, damp to dry, mottled brown and olive. Fill contains blocks of black colluvium with some clay. The fill is desicated and open fractures are present. Blocks of slightly sandy SILTSTONE, stiff, damp, yellowish brown are also part of the fill.		
3									
4									
5		1	X		12.2	96.9	Silty fine grained SAND; loose, dry, yellowish brown.		5
6							**5'11"-31'<u>Landslide:</u>(Qls)**		
7							@5' 11" Weathered Sandy SILTSTONE, medium stiff, damp, mottled gray and yellowish brown. Soil filled animal burrows below the contact. Material is derived from the Capistrano Formation bedrock.		
8									
9									
10			X		14.1	97.0	@7' Caliche stringers and fractures with roots aligning poorly defined joints/fractures to 9 ft.		10
11							@10' Silty fine grained SAND; loose, dry, yellowish brown.		
12							@11' Zone of weathered fossil shells about 8 inches thick and near horizontal in orientation. Near the base there is an irregular sand lens.		
13									
14									
15									15
16							@15'9" Irregular contact with underlying Clayey SILTSTONE, gray with yellowish brown sand lenses. There is a weathered shear either slide or intra-slide with an offset contact.	S: N10-15W, 35-38E	
17									
18							@16'5" Continuous shear surface, generalized attitude.	J: N62W, 85N	
19							@17'4"Joint	J: N71E, 59S	
20		1	X		18.2	102.3	@17'6" Joint @18' Abundant gypsum crystals in pockets and fractures.	J: N65E, 61N	20
21							@20' Silty CLAYSTONE/Clayey SILTSTONE; medium stiff, very moist, olive and gray/mottled brown from iron staining.		
22							Joint		
23							@20'7" Rupture surface with justaposed materials and the orientation is similar to those above.		
24									
25							@22' Heavily iron stained zone and throughout there are discontinuous gypsum filled joints and fractures up to 3/8" thick.		25
26									
27							@27' Concretion about 10" thick with pockets of silt containing fish scales.		
28									
29							@29' Rupture Surface on well developed clay that is discontinuous around the borehole.	RS: N3OE, 10SE	
30		1	X		25.0	98.1	@ 30' SILTSTONE, soft, moist, brown oxidized.		30
31							@31' Possible basal rupture surface. Well developed continuous clay with joint and fracture truncations from above. The surface is wavy but basically horizontal.	RS: HORIZONTAL	
32							**@31'<u>Bedrock:</u> Capistrano Formation (Tc)**		
33							Predominantly silty SAND; dense, moist, brown oxidized. Materials below appear intact unlike the materials above the rupture surface at 31'.		
34									
35							@32'7" to 33'2" There is a continuous near horizontal cemented zone.	B: HORIZONTAL	35
36									
37							@35' Horizontal layer of bioturbation with infilled clam burrows and sand lenses.		
38									
39									
40									40

Project No.: 72145-00

LOG OF BORING

Figure No.: B-1

Geofirm

Date(s) Logged: 10/15/2014 - 10/16/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-1

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
40									40
41		2	X		25.1	97.8	@39' SILTSTONE, stiff, moist, gray with yellowish brown and light gray infilled clam burrows. The burrows are both vertical and near horizontal.		
42							@41'6" Gradational color change to Unoxidized SILTSONE that contains minor discontinuous sand partings. Sand partings yellow brown in unoxidized siltstone.	B: N8E, 9SE	
43									
44									
45							@45'2" SANDSTONE, Gray, 4" to 6" thick near horizontal.		45
46									
47									
48									
49									
50		5	X		21.2	101.8	SILTSTONE, firm, moist, black oxidized.		50
51									
52									
53							@52'7" Sandstone bed, yellowish gray, friable 3-5 inches thick. Horizontal	B: HORIZONTAL	
54									
55									55
56									
57									
58									
59							@58'10" SAND, bed that is near horizontal.		
60		7	X		19.7	104.1	SILTSTONE, firm, moist, black.		60
61									
62									
63									
64									
65									65
66							@65'10" to 68' Concretion Zone that is near horizontal.		
67									
68									
69									
70		10	X		22.3	104.1	SILTSTONE, stiff, moist, grey.		70
71									
72									
73									
74									
75									75
76							@75'8" Gray layer of lensic sand. Horizontal	B: HORIZONTAL	
77									
78									
79									
80									80

Project No.: 72145-00

LOG OF BORING

Figure No.: B-2

Geofirm

Date(s) Logged: 10/15/2014 - 10/16/2014

Logged By: DRH

Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger

Drilling Company: Dave's Drilling

Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,

Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-1

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
80									80
81		20	X		20.3	107.9	SILTSTONE, stiff, moist, grey.		
82									
83							Total Depth = 81'		
84							No grounwater encountered		
85							Backfilled with cuttings		85
86									
87									
88									
89									
90									90
91									
92									
93									
94									
95									95
96									
97									
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100									100
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115									115
116									
117									
118									
119									
120									120

Project No.: 72145-00

LOG OF BORING

Figure No.: B-3

Geofirm

Date(s) Logged: 10/17/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-2

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
0							**Undocumented Fill:(Afu)**		0
1							0-3'2" Clayey SILT, medium stiff to loose, dry, brown. Moisture increase with depth.		
2									
3									
4							**3'2"-8'9"Slopewash:(Qsw)**		
5		1	X		13.1	104.1	@3'2"- 8'5" Silty CLAY, stiff, moist, dark gray and brown. Root hairs and no bedrock fabric.		5
6							Fine grained sandy SILT; soft, dry, yellow brown.		
7							@5'6" Caliche Stringers		
8							@6'2"Color change to brown mottled drak gray, less cohesive and more friable.		
9							@8'5" Sandy GRAVEL layer about 4" thick. Below weathered SILTSTONE landslide material.		
10		1	X		17.6	103.4	**8'9"-68'Landslide Material: (Qls)**		10
11							SILTSTONE, stiff, moist, yellowish brown.		
12							Very fine grained sandy SILT; soft, dry, brown.		
13									
14							@14' Open fractures up to 1/8" in material as above, massive.		
15									15
16									
17							@16'8" Gray Siltstone Boulder suspended in matrix as above.		
18									
19									
20		2	X		16.0	102.4	SILTSTONE, firm, moist, grey oxidized.		20
21							@21' Angular weathered concretion 6-8" in diameter. Below @21'3" shears with offset of gray SILTSTONE.	S: N51W, 60-70N	
22									
23								J: N60E, 90	
24									
25									25
26							@25'7" Shear with truncated gypsum filled joints. Below the SILTSTONE/QLS is more competent but only medium stiff, moist to very moist, gray mottled orange.	S: N65-75E, 52N	
27									
28							@28'1" Top OF CLAY Shear Zone, soft, very moist to wet, olive. Highly plastic but discontinuous and associated with a concretion layer/boulder.	S: N-S, 42E	
29									
30		3	X		20.6	104.9	SILTSTONE, soft, moist, grey brown oxidized.		30
31									
32									
33									
34									
35									35
36									
37							@36'6" Joint with calcite	J: N42E, 90	
38							@37' Caliche stringers and Joints/Fractures.		
39									
40							@39' 2 Steep subparallel shears.	S: N8W, 54W	40

Project No.: 72145-00

LOG OF BORING

Figure No.: B-4

Geofirm

Date(s) Logged: 10/17/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-2

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
40									40
41		3	X		23.4	101.7	SILTSTONE, soft, moist, brown oxidized.		
42									
43									
44									
45							@44' Hackley partings less steep and approaching horizontal.		45
46									
47									
48									
49									
50									50
51		4	X		17.2	134.1	SILTSTONE, firm, moist, black oxidized.		
52									
53									
54									
55							@54'3" Zone of Concretion nodules 3-4" diameter and increasing in size with depth.		55
56									
57							@56'4" Gradational change to Unoxidized with halos of oxidized material down to 62'5".		
58									
59									
60									60
61		10	X		22.9	104.1	SILTSTONE, hard, moist, black.		
62									
63									
64									
65									65
66							@66' Conreation layer		
67									
68							@67'7" Potential Basal Rupture Surface, highly sheared clay up to 1.5 inches thick. Horizontal	RS: N50E, 3-4E	
69									
70							**@68' <u>BEDROCK:</u> Capistrano Formation (Tc)**		70
71		12	X		21.0	103.9	Clayey SILTSTONE/Silty CLAYSTONE, hard, moist, dark gray/black.		
72							@ 69'7" Conreation Layer near horizontal and below the material very hard and massive.		
73							SILTSTONE, hard, moist, grey.		
74									
75									75
76									
77							Total Depth = 76'		
78							No grounwater encountered		
79							Backfilled with cuttings		
80									80

Project No.: 72145-00

LOG OF BORING

Figure No.: B-5

Geofirm

Date(s) Logged: 10/20/2014 - 10/21/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-3

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
0							**0-6' Colluvium: (Col)**		0
1							@1'8" Clayey SILT, stiff, dry, dark brown. Open dessication cracks to 3 feet.		
2									
3									
4							@3'5" Caliche soil horizon with abundant root hairs.		
5			X		16.2	97.9	Fine grained sandy SILT; soft, dry, brown.		5
6							**@6' -30'Slopewash: (Qsw)**		
7							Sandy SILT, stiff, moist to very moist, brown. This is a weathered transition to the underlying slopewash.		
8									
9									
10			X		15.8	91.9	Predominatley very fine grained sandy SILT with minor decompossed Capistrano Formation; soft, dry, brown.		10
11							@10' The texture of this material suggests this is a terrace or other type of accumulation deposit due to the abundance of angular SS fragments suspended in SILT matrix.		
12									
13									
14									
15									15
16									
17									
18									
19									
20		2	X		18.5	102.9	@19'3" Transition to a mix of Sandstone and Siltstone blocks, yellowish brown and light gray to white with dark brown fracture surfaces.		20
21							SILT, soft, moist, brown.		
22									
23							@23' Material still has the appearance of an accumulation deposit such as a mass wasting depositional environment or potentially a weathering profile.		
24									
25							@25' Gradational to gray and light yellowish brown SILTSTONE/SANDSTONE very fine.		25
26									
27									
28									
29									
30									30
31		3	X		15.3	106.3	SILTSTONE, soft, moist, grey brown oxidized.	J: N22E, 75W	
32							**30'-?90'? Landslide: (Qls)**	J: N9E, 49W	
33							SILTSTONE, medium stiff, moist, gray with white mineral lining of joints/fractures. This is the first appearance of a bedrock-like fabric or structure.		
34							First signs of bedrock structures, Joint		
35							Joint		35
36							@36' Sand Partings dipping easterly at greater than 45 degrees.		
37									
38							@38-39' Subtle indications of more high angle east dipping discontinuous sand partings.		
39									
40									40

Project No.: 72145-00

LOG OF BORING

Figure No.: B-6

Geofirm

Date(s) Logged: 10/20/2014 - 10/21/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-3

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
40									40
41		2	X		14.7	106.1	SILTSTONE, soft, moist, brown oxidized.		
42									
43									
44									
45									45
46									
47									
48									
49							@48'4" Clay infilled fracture, discontinuous.	FR: N32E, 51W	
50									50
51		3	X		19.2	104.2	SILTSTONE, soft, moist, grey oxidized.		
52									
53									
54							@53'7" Clay infilled fracture	FR: N39E, 43E	
55							SILTSTONE, hard, moist, grey oxidized.		55
56									
57							@57' Irregular Joint face but continuous with depth.	J: N55E, 90	
58									
59									
60									60
61		7	X		21.0	103.5	SILTSTONE, soft, moist, grey oxidized.		
62									
63									
64									
65									65
66									
67									
68									
69									
70									70
71		10	X		25.6	96.1	SILTSTONE/CLAYSTONE, hard, moist, black.		
72									
73							@72' Start of a zone of irregular/wavy shear surfaces in Unoxidized CLAYSTONE. All the shear or rupture surfaces in the zone below are hairline thickness, clayey, polished surfaces. to the depth of 88ft.	S: N14W, 15E S: N42W, 22W S: N51W, 20S	
74									
75							@72'3" Shears	S: N5W, 74E	75
76							Shear		
77							Shear		
78									
79									
80									80

Project No.: 72145-00

LOG OF BORING

Figure No.: B-7

Geofirm

Date(s) Logged: 10/20/2014 - 10/21/2014
Logged By: DRH
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel

Method of Drilling: 30' 30-inch Bucket Auger
Drilling Company: Dave's Drilling
Drop: 12 inch drop for 0 to 25' = 4,900 lbs., 25 to 50' = 3,400 lbs.,
Weight(s): 0-27' (4500); 27-52' (3500); 52-80 (2500); 80-104' (1000)

BORING NO.: BA-3

Depth (feet)	USCS	Blows/6"	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Geologic Attitude	Depth (feet)
80									80
81		25	X		23.2	101.2	@79'8" Gray sand lens layer, low angle Bedding? In massive SILTSTONE, hard, moist, black.	J: N15W, 64N S: N14W, 43W B: N30-40E, 6-8E	
82							@80'8" Shear surface		
83							@81' Shear/Rupture Surface	S: N57W, 36E	
84									
85									85
86							@85'6" Rupture Surfaces/Shears: The zone continuing from 72' contains numerous shears or rupture surfaces all sharply defined with polished/shiney planar surfaces. Some slightly wavy.	S: N29E, 14E	
87								S: N15W, 20E	
88							@88' There is a tight anticline fold axis with bedding or shearing on each limb. It is very difficult to observe whether this is Bedding? or Shearing? due to the proximity of the bottom of the boring. Seepage is coming in from the Sandstone blocks that are associated with the feature otherwise surrounded with CLAYSTONE.	BPS: N35-40W, 43S	
89									
90								BPS: N35-40W, 35NE	90
91							Fold with bedding on eastern limb, Bedding? or Shearing?		
92							**@90' ?Bedrock?: Capistrano Formation (Tc)** SILTSONE/CLAYSTONE with concreation layer @91' but could not drill beyond with coring bucket.		
93							Total Depth = 91'		
94							Seepage @ 89		
95							Backfilled with cuttings		95
96									
97									
98									
99									
100									100
101									
102									
103									
104									
105									105
106									
107									
108									
109									
110									110
111									
112									
113									
114									
115									115
116									
117									
118									
119									
120									120

Project No.: 72145-00

LOG OF BORING

Figure No.: B-8

Geofirm

APPENDIX C

FIELD EXPLORATION AND LABORATORY TESTING

APPENDIX C

FIELD EXPLORATION AND LABORATORY TESTING

I. Field Exploration Procedures

A. Field Exploration

A truck mounted 24-inch diameter bucket auger was utilized to drill the exploratory borings.

B. Sampling

1. Core samples of subsurface materials were obtained from the boring by driving a steel barrel drive sampler with an effective weight as indicated on the boring logs that is raised and permitted to fall 12 inches. The sampler has an outside diameter of 3.0 inches and is lined with a series of 1-inch high brass rings having an inside diameter of 2.43 inches. A drive shoe is placed on the tip of the sampler to hold the liners in place during sampling.

   The samples were removed from the sample barrel in the brass rings, placed in moisture tight containers and transported to the laboratory for testing. Records of the number of blows required to effect each 6 inches of penetration were made.

2. A large bulk sample of typical soil type was bagged from the drill cuttings and was transported to the laboratory for classification and physical testing.

II. Laboratory Testing Procedures

A. In-Situ Moisture and Density Tests

The dry unit weights and field moisture contents were determined from core specimens obtained from the test sampler by measuring the volume and weight of the specimen. The moisture determination was made in accordance with ASTM test methods. The results are summarized on the Boring Logs in Appendix B.

B. Atterberg Limits Test

Atterberg limits tests were performed in accordance with ASTM Standard No. 4318. The results of the tests are presented in Figures C-1 and C-2 and are tabulated below:

Sample Designation	-	BA-1 @ 32’	BA-2 @ 67.5’
Liquid Limit	-	40	75
Plastic Limit	-	19	23
Plasticity Index	-	21	52
Soil Type	-	CL	CH

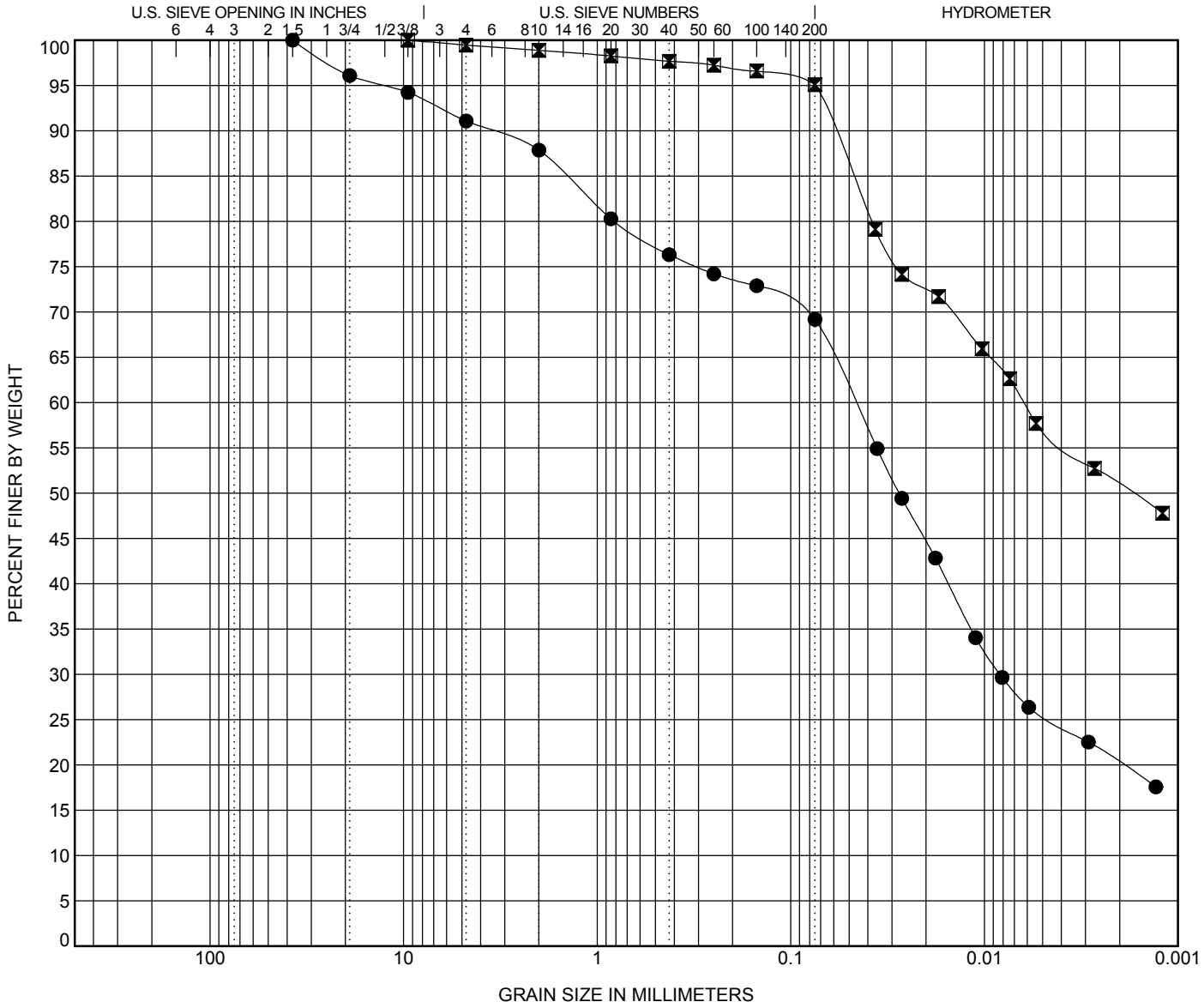
C. Shear Strength Testing

Direct shear tests were performed in general accordance with ASTM D 3080 on a specimen of site soil, inundated before and during testing. The total normal stress range used was 2000 to 8000 pounds per square foot. The shear strength test results are presented on Figures C-3 thru C-6.

GRAIN SIZE DISTRIBUTION

Client: Scott J. Ferrell
Project Number: 72145-00

Project Name: Ferrell
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	**BA-1**	**32.0**	**SANDY LEAN CLAY(CL)**	**40**	**19**	**21**		
⧓	**BA-2**	**68.0**						

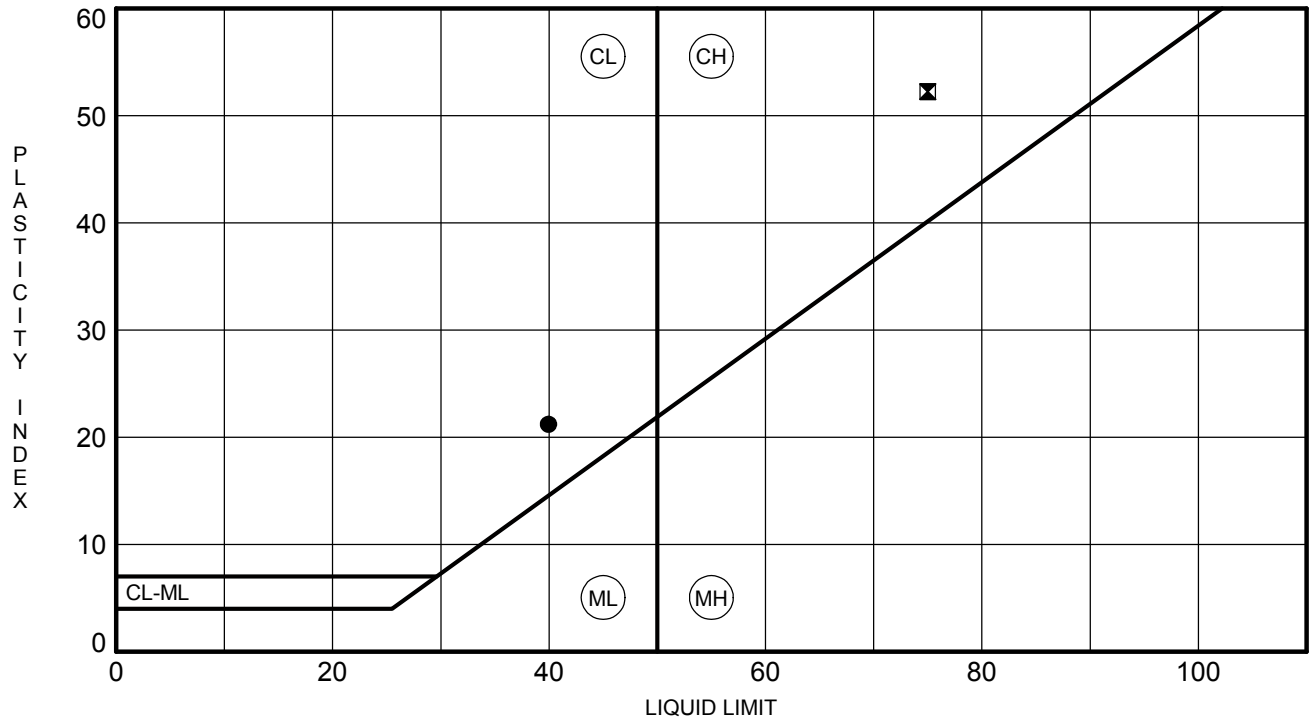
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BA-1**	**32.0**	**37.5**	**0.047**	**0.008**		**8.9**	**21.9**	**43.7**	**25.5**
⧓	**BA-2**	**68.0**	**9.5**	**0.006**			**0.5**	**4.4**	**38.0**	**57.1**

Figure No. C-1

ATTERBERG LIMITS' RESULTS

Client: Scott J. Ferrell
Project Number: 72145-00

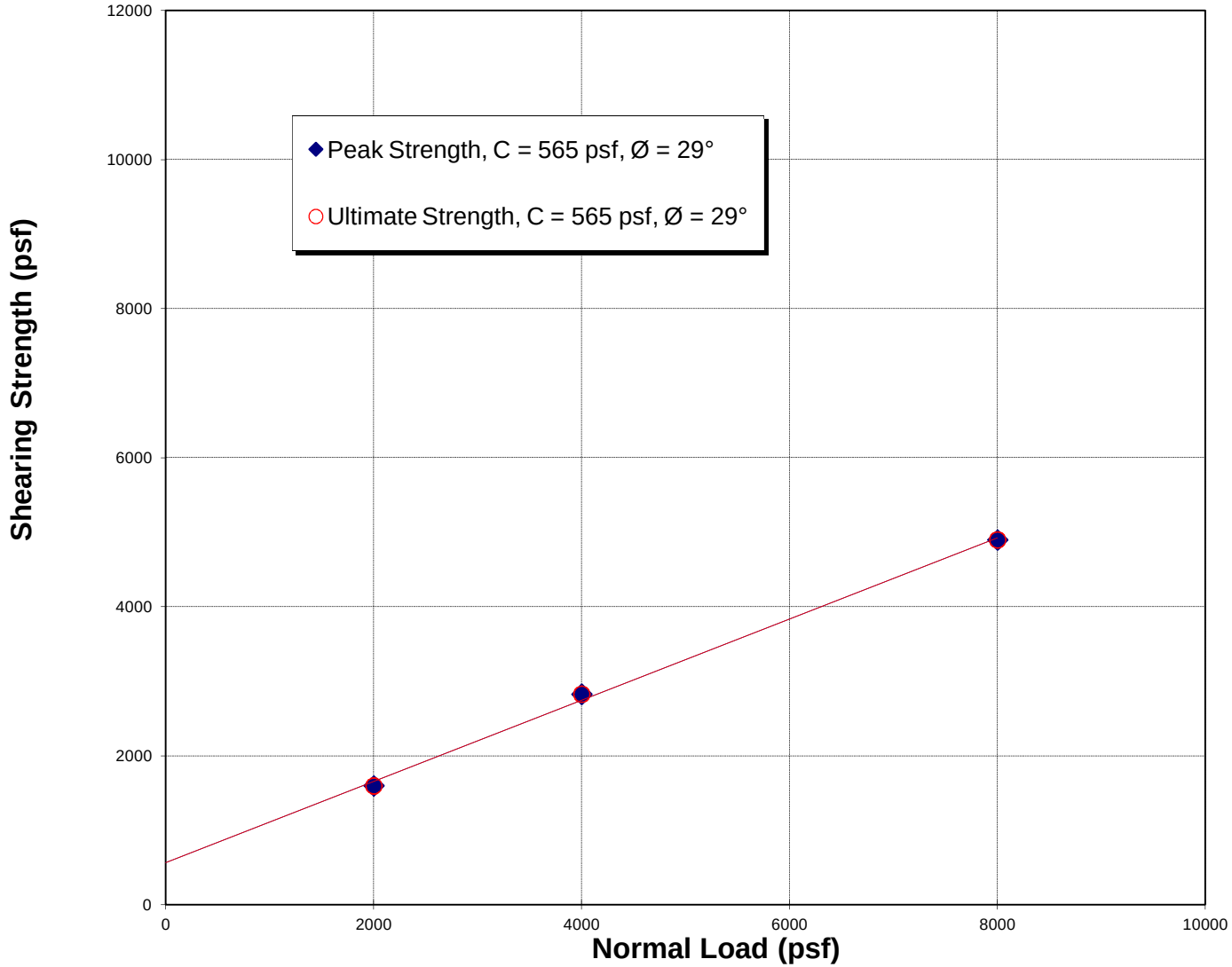
Project Name: Ferrell
Address: 1 O'Hill Ridge, Bear Brand Ranch;Laguna Niguel



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**BA-1**	**32.0**	**40**	**19**	**21**	**69**	**SANDY LEAN CLAY(CL)**
⧓	**BA-2**	**67.5**	**75**	**23**	**52**		

Figure No. C-2

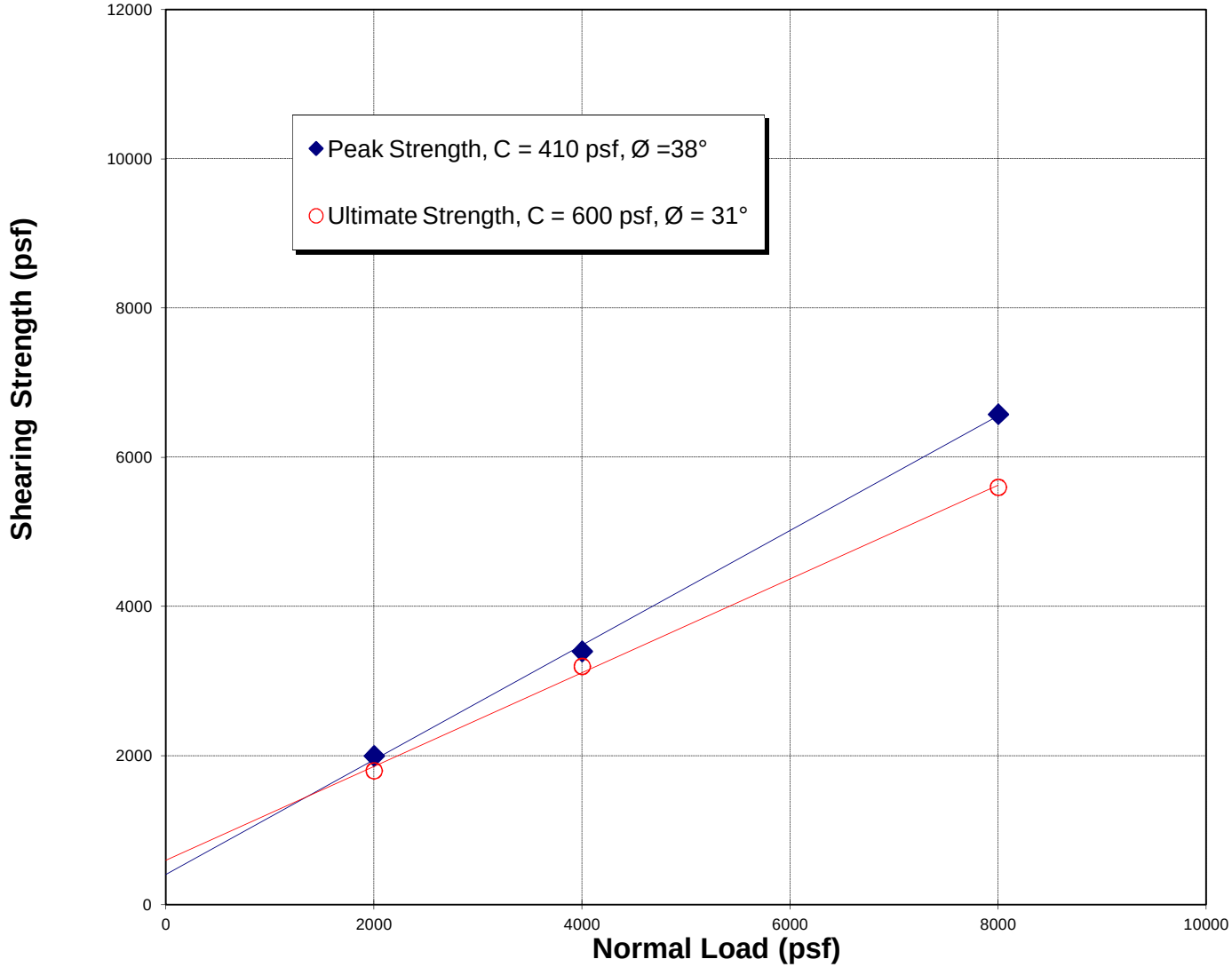
Shear Strength Test Results



B-1 at 32 to 34 ft - Remolded to 123 pcf wet densisty (Shear rate: 0.0004 in/min)

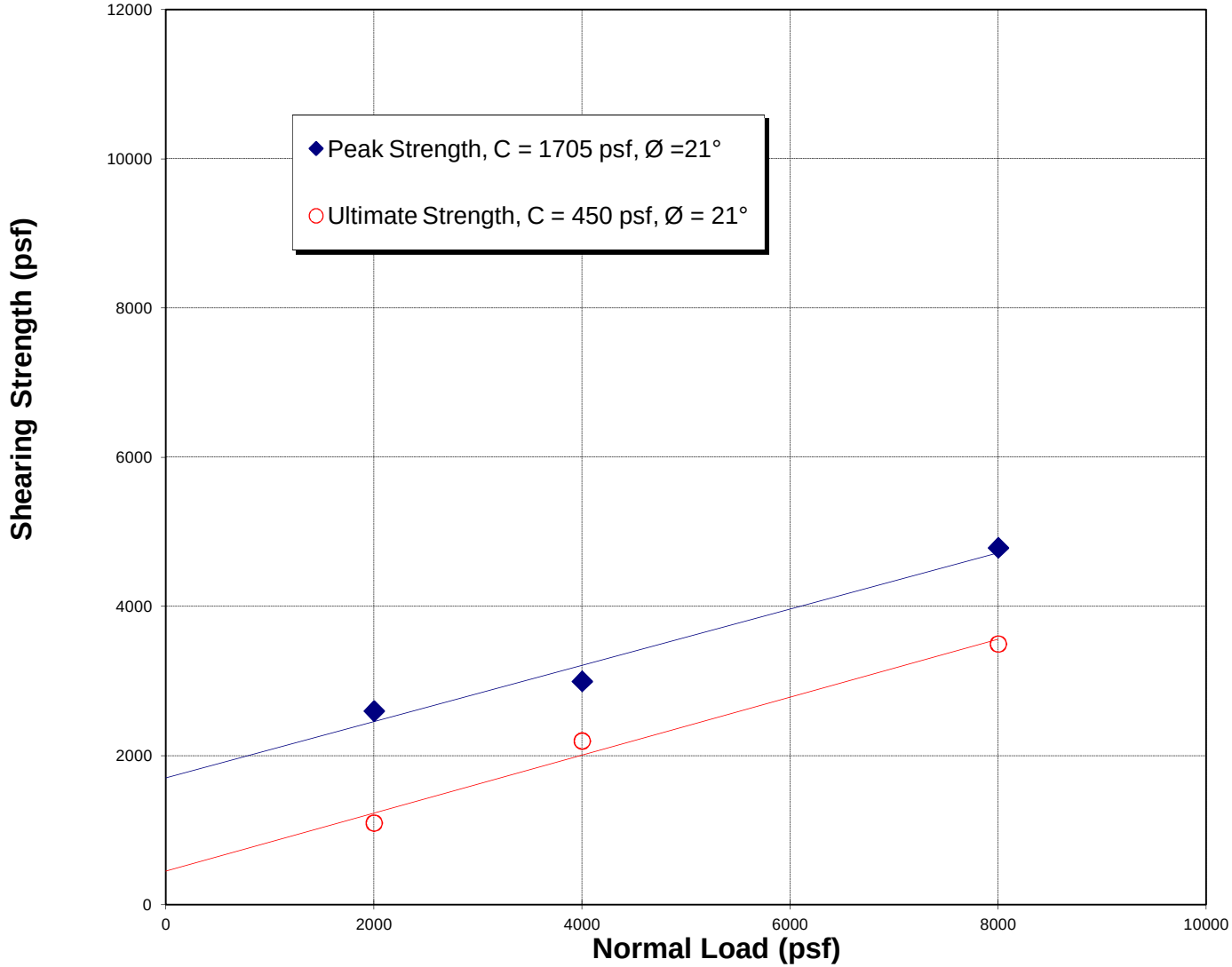
JOB NO.:	DATE:	FIGURE:
72266-00	**September 2017**	**C-3**

Shear Strength Test Results



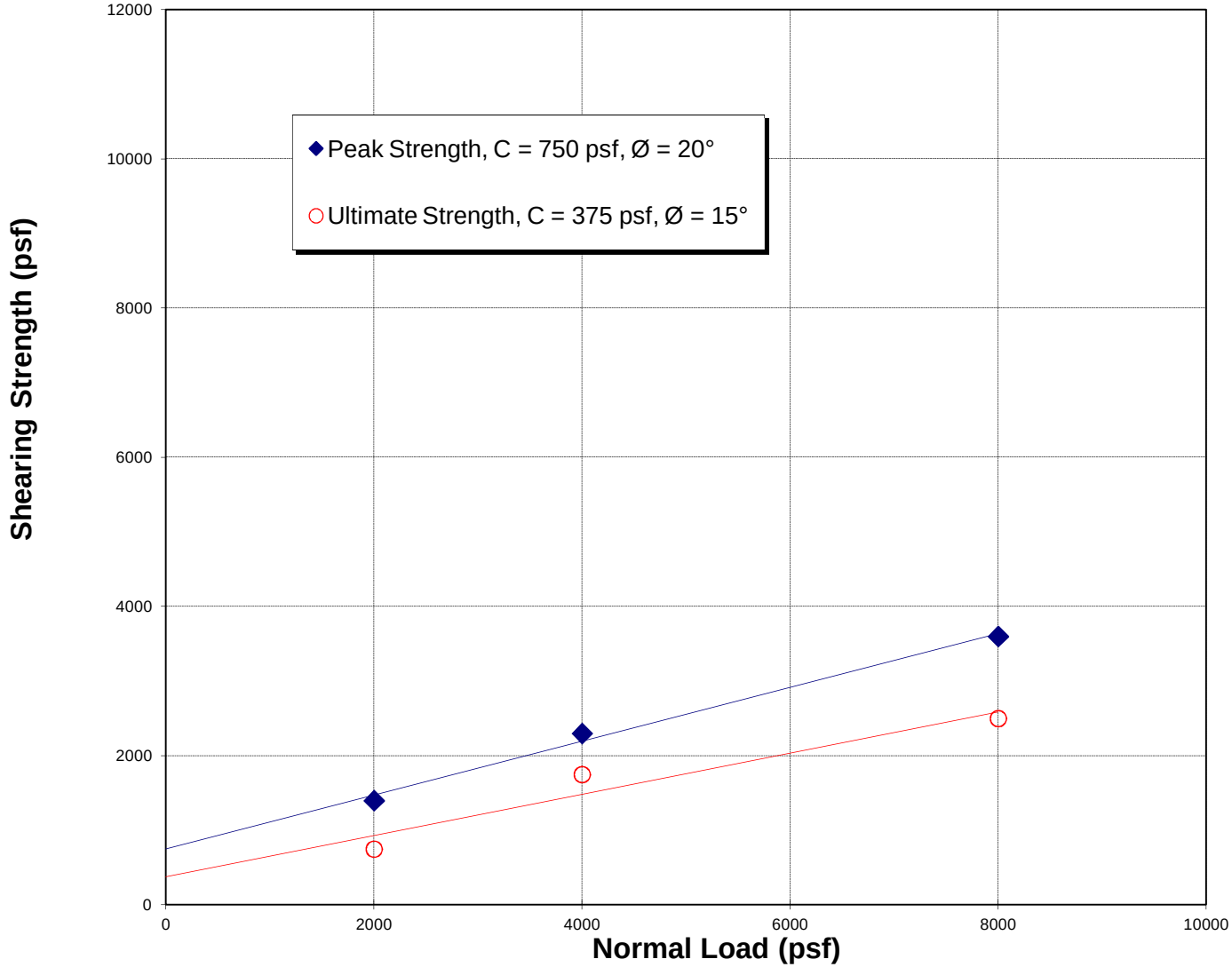
Geofirm	**B-3 at 30 ft - Undisturbed (Shear rate: 0.001 in/min)**		
	JOB NO.: **72266-00**	DATE: **September 2017**	FIGURE: **C-4**

Shear Strength Test Results



GeoFirm	**B-3 at 80 ft - Undisturbed (Shear rate: 0.001 in/min)**		
	JOB NO.: **72266-00**	DATE: **September 2017**	FIGURE: **C-5**

Shear Strength Test Results

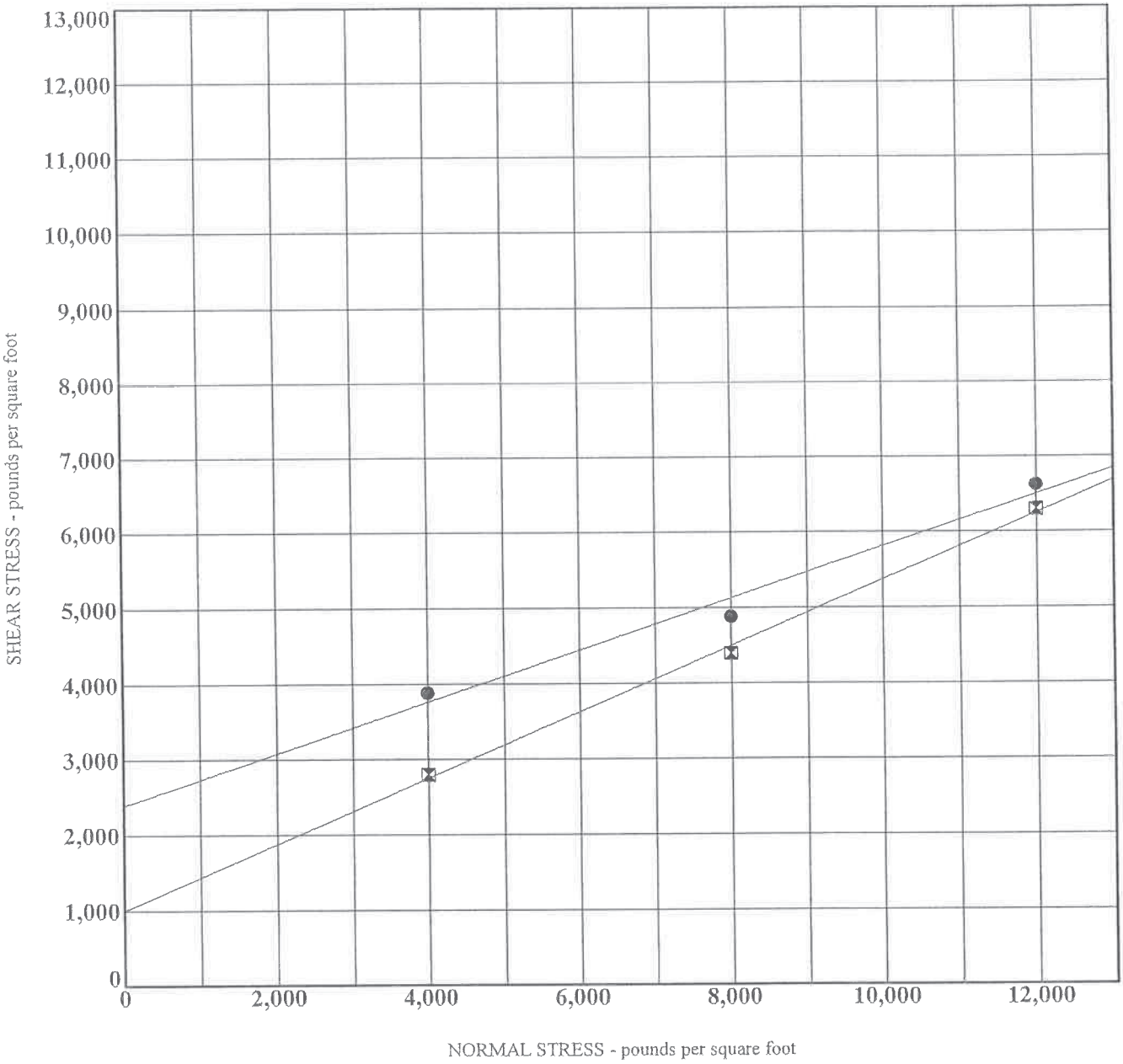


B-2 at 68 ft - Remolded to 125 pcf wet densisty (Shear rate: 0.0004 in/min)

JOB NO.:	DATE:	FIGURE:
72266-00	**September 2017**	**C-6**

EXCERPTS FROM REPORTS BY PETRA GEOTECHNICAL, INC.

SHEAR TESTS RESULTS FROM REFERENCES 14 & 15



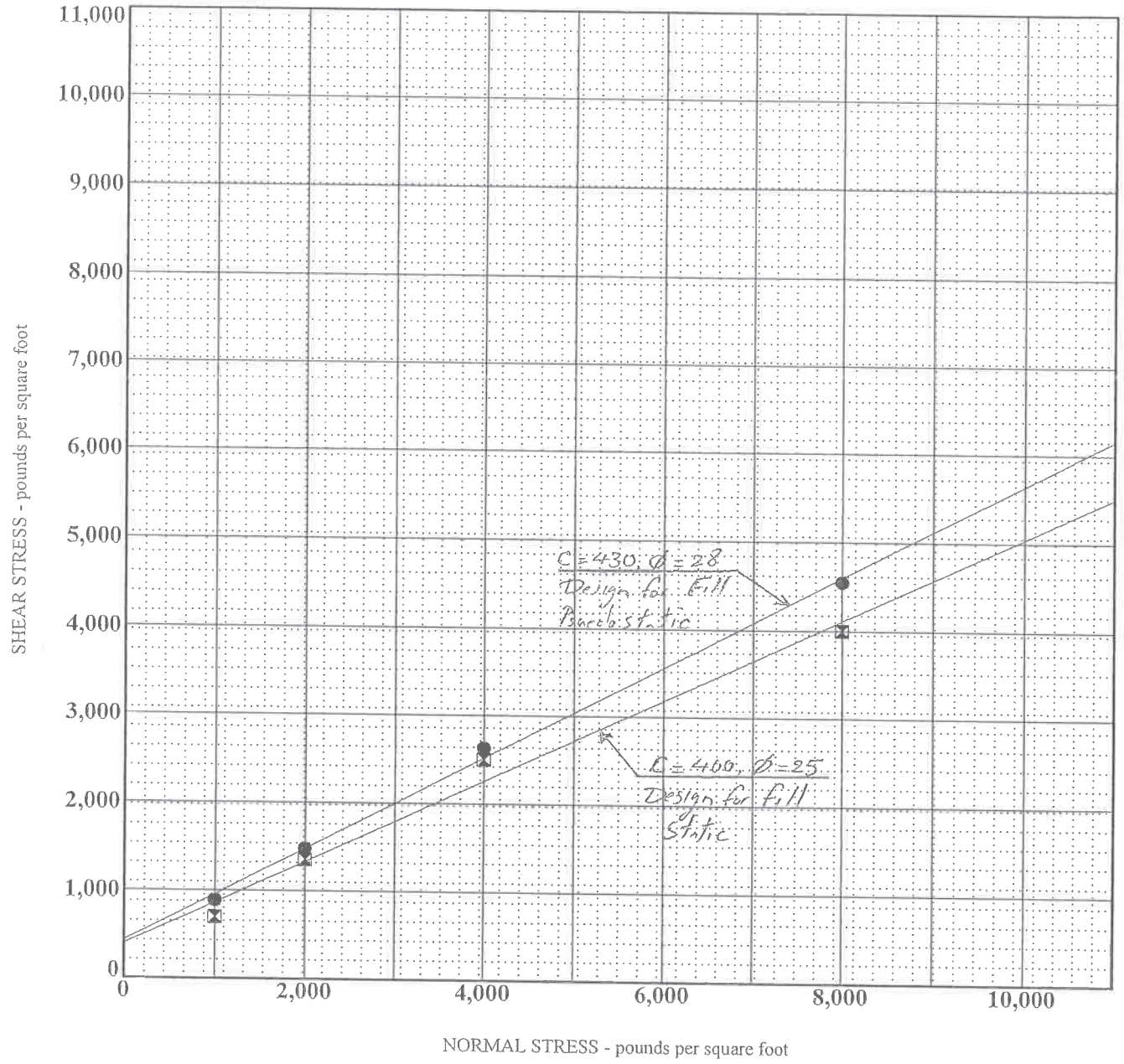
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-1 @ 60.0	Tc: Clayey Siltstone - Peak	19	2390
⊠ B-1 @ 60.0	Tc: Clayey Siltstone - Ultimate	25	1000

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-2

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



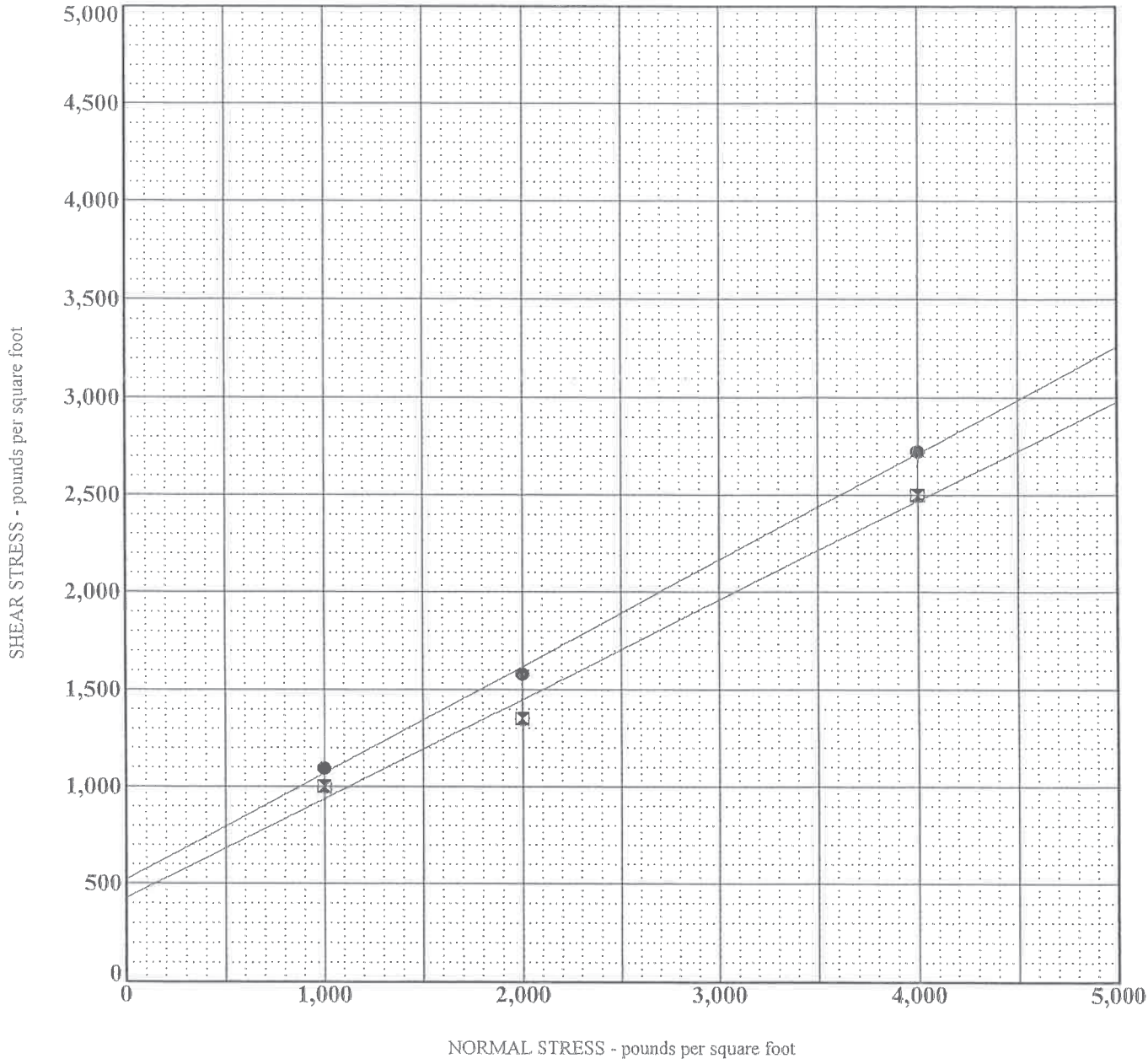
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-2 @ 10.0	Tc: Sandy Sitstone - Peak	28	430
⊠ B-2 @ 10.0	Tc: Sandy Siltstone - Ultimate	25	400

NOTES:

Samples Remolded to 90% of Maximum Dry Density
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	REMOLDED TEST SAMPLES	PLATE B-3

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



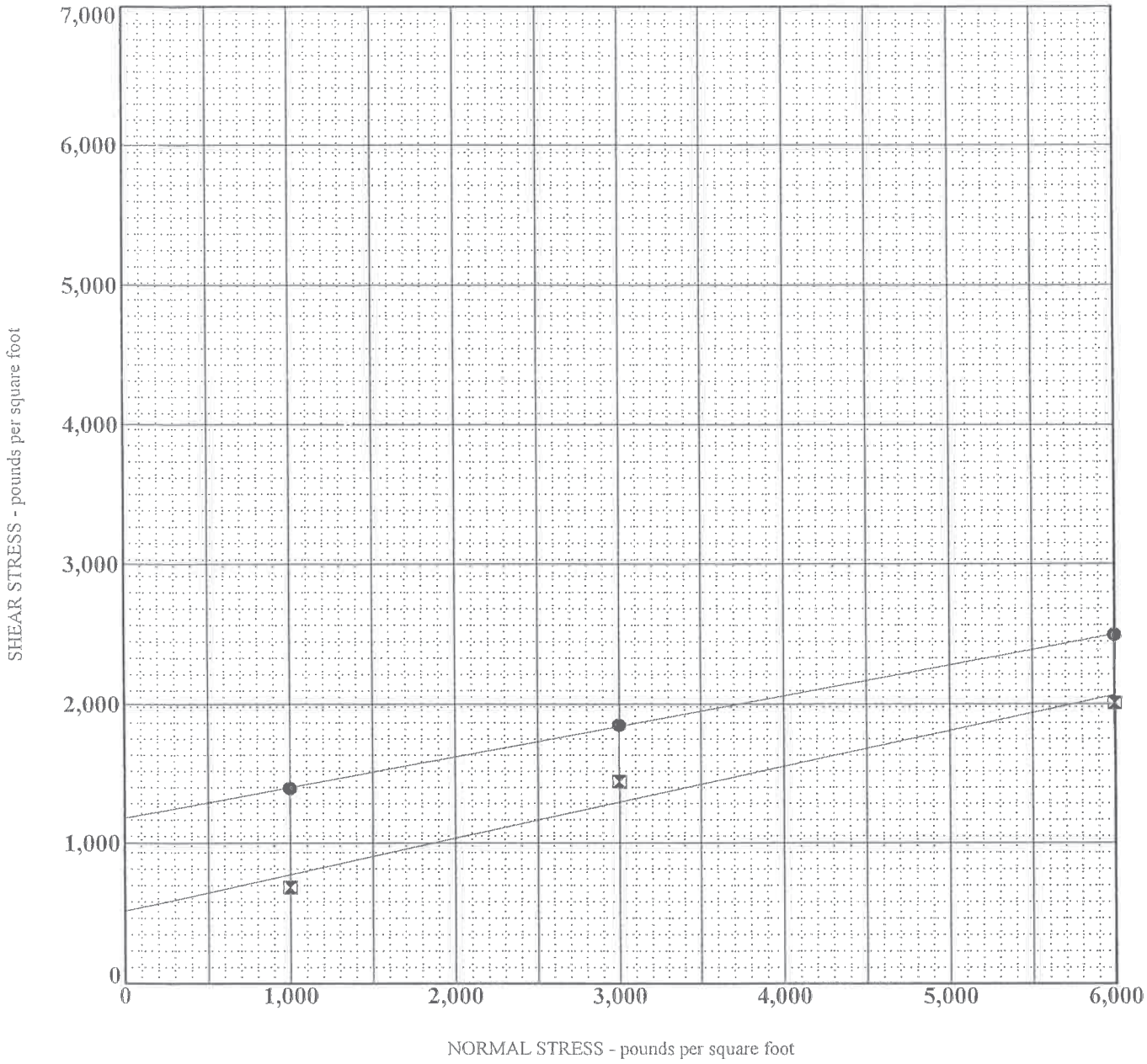
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-2 @ 30.0	Tc: Silty Sandstone - Peak	29	520
⊠ B-2 @ 30.0	Tc: Silty Sandstone - Ultimate	27	430

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-4

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



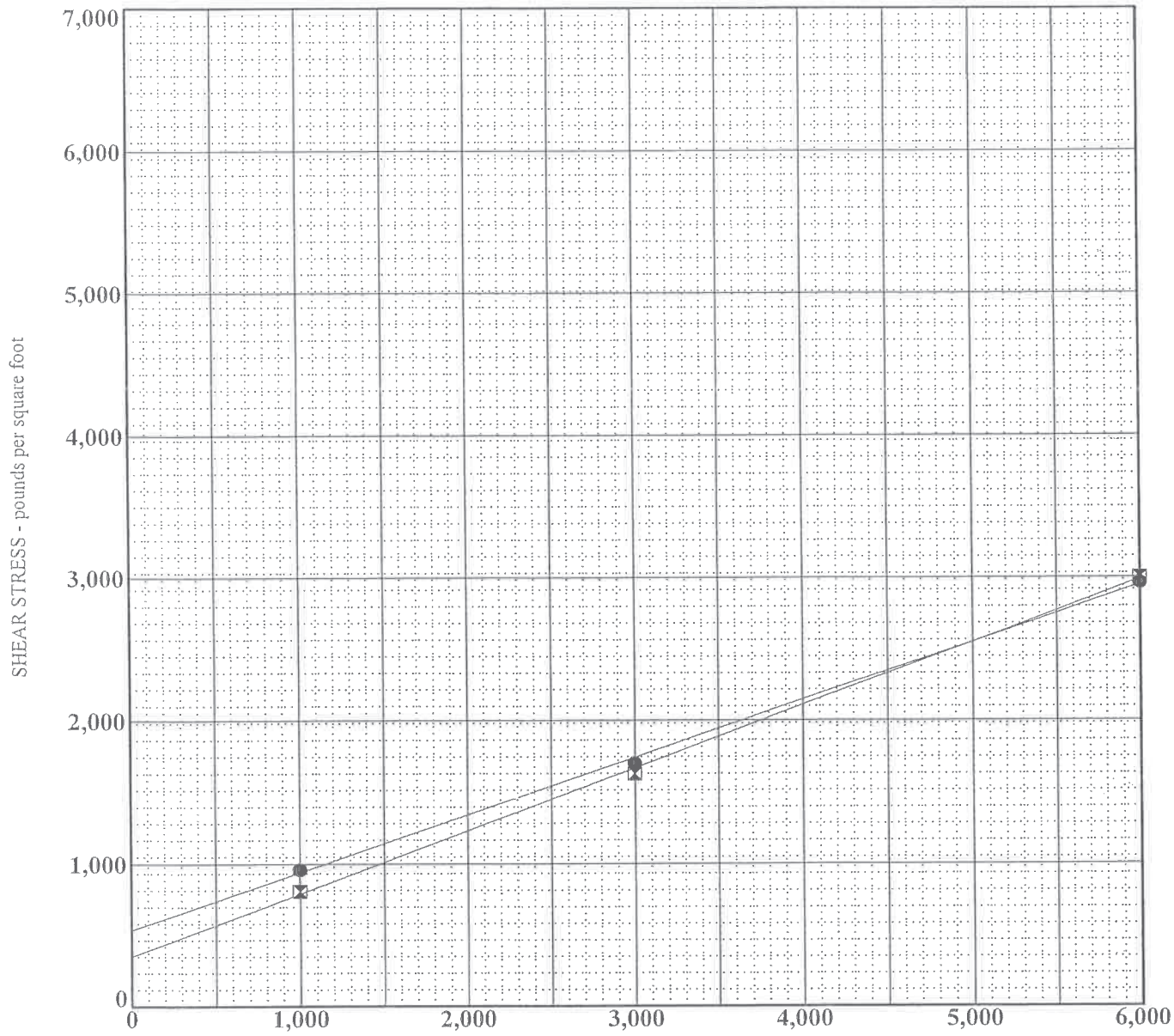
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-4 @ 30.0	Tc: Clayey Siltstone - Peak	12	1000
⊠ B-4 @ 30.0	Tc: Clayey Siltstone - Ultimate	15	510

NOTES:

Remolded Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	November, 2004
PETRA GEOTECHNICAL, INC.	REMOLDED TEST SAMPLES	PLATE B-5

DIRECT SHEAR 227-00.GPJ PETRA.GDT 11/10/04



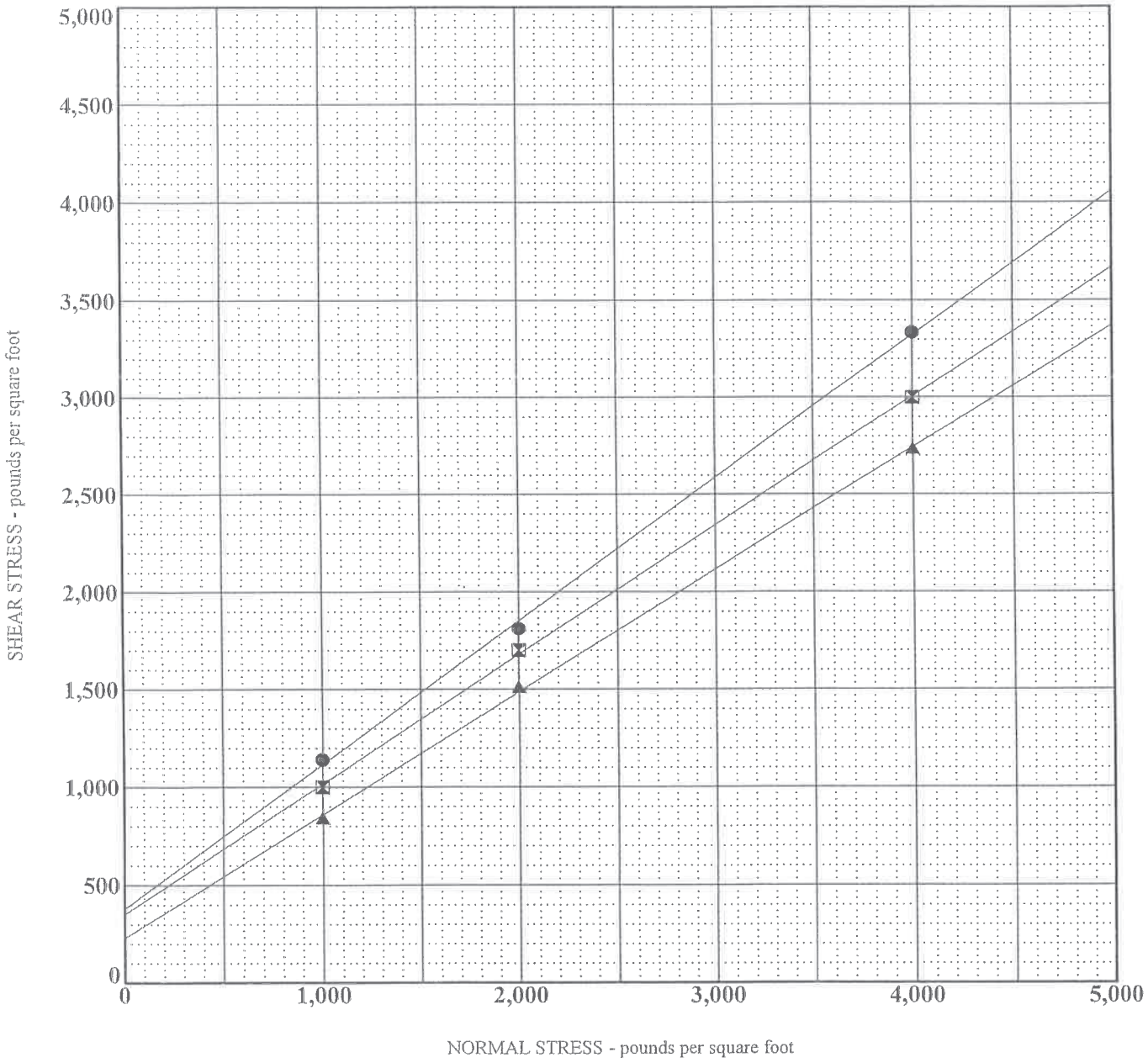
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-6 @ 10.0	Tc: Clayey Siltstone - Peak	22	535
⊠ B-6 @ 10.0	Tc: Clayey Siltstone - Ultimate	24	500

NOTES:

Samples Remolded to 90% of Maximum Dry Density
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	November, 2004
PETRA GEOTECHNICAL, INC.	REMOLDED TEST SAMPLES	PLATE B-6

DIRECT SHEAR 227-00.GPJ PETRA GDT 11/10/04



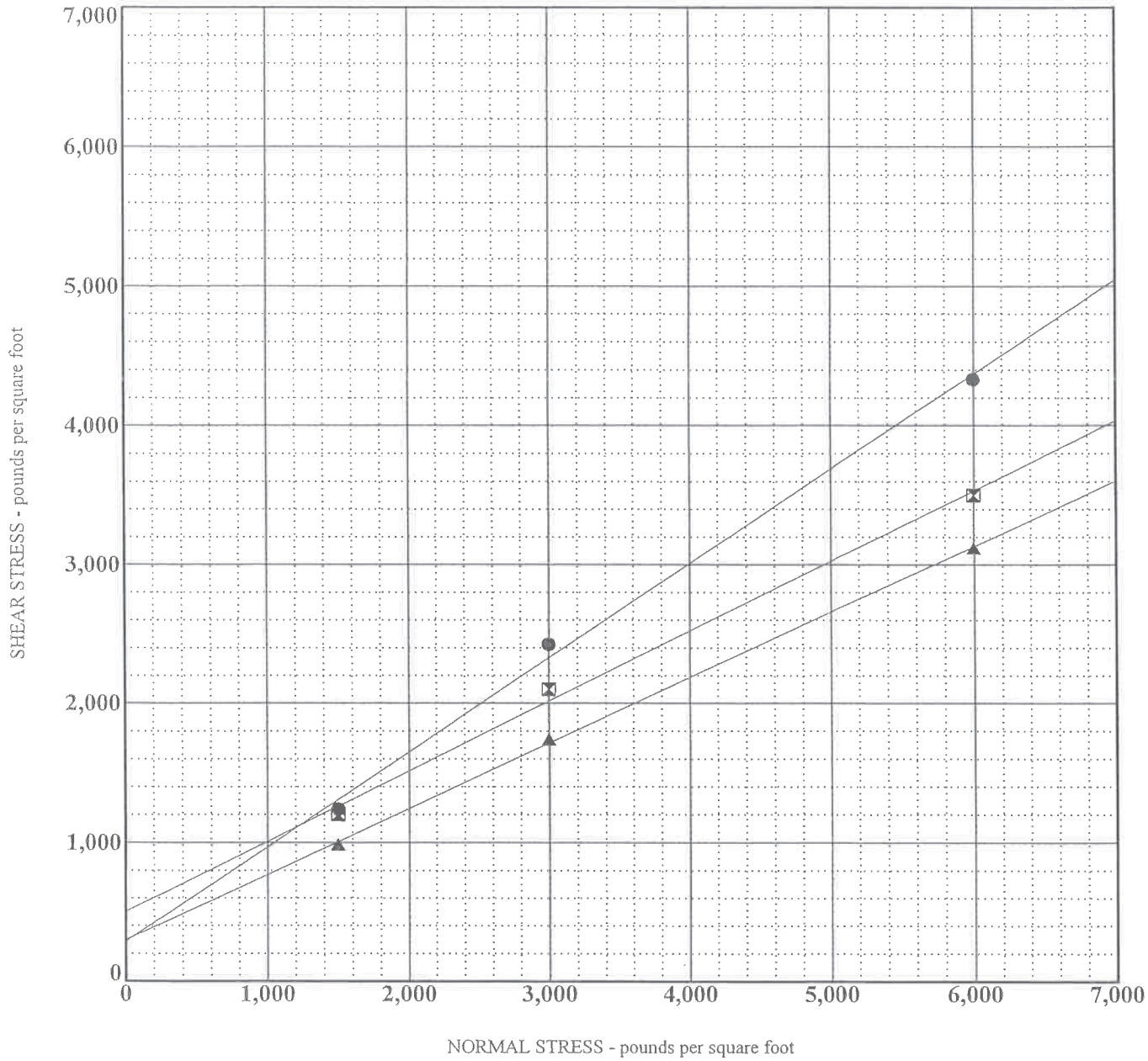
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-7 @ 20.0	Sandy Silt (ML) - Peak	36	380
⊠ B-7 @ 20.0	Sandy Silt (ML) - Ultimate	34	350
▲ B-7 @ 20.0	Sandy Silt (ML) - Reshear	32	230

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-7

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



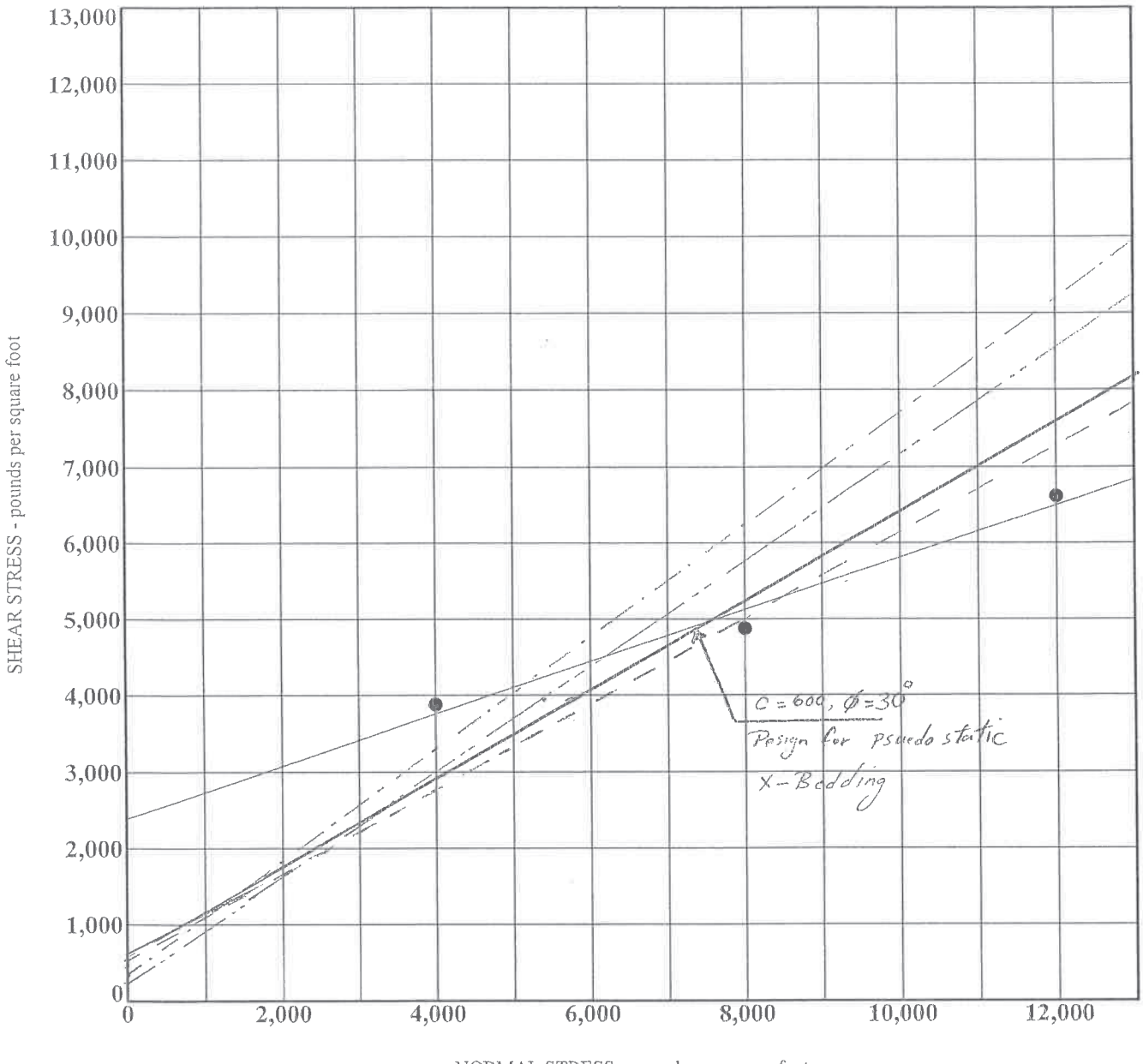
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-8 @ 30.0	Sandy Silt (ML) - Peak	34	280
⊠ B-8 @ 30.0	Sandy Silt (ML) - Ultimate	27	500
▲ B-8 @ 30.0	Sandy Silt (ML) - Reshear	25	290

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-8

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



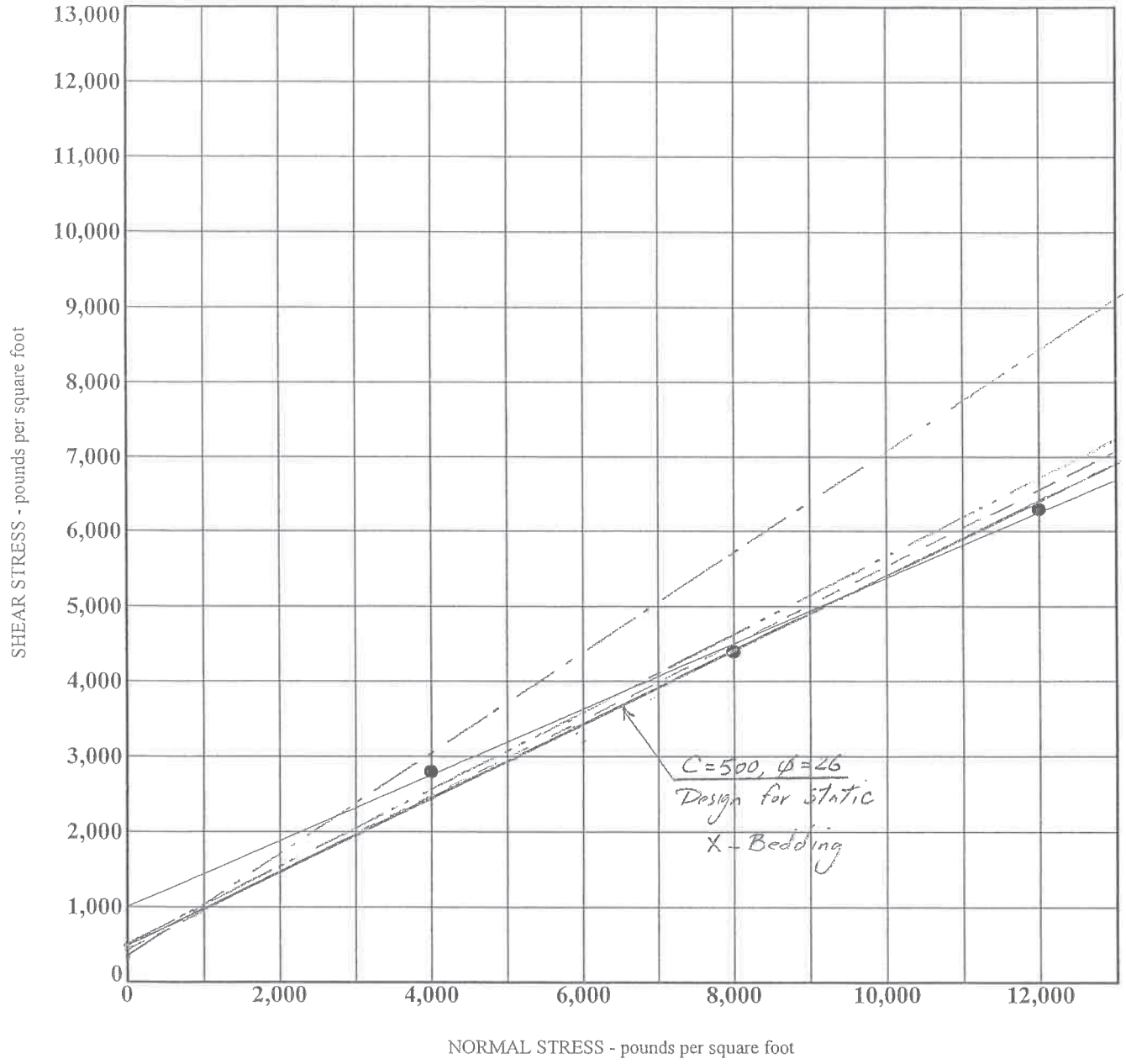
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-1 @ 60.0	Tc: Clayey Siltstone - Peak	19	2390
- - - B-2 @30'	Tc: Silty Sandstone, Peak	29	520
— · — B-7 @ 20'	Tc: Silty Sandstone, Peak	36	380
— - - - B-8 @ 30'	Tc: Silty Sandstone, Peak	34	280

NOTES:

Undisturbed Test Samples
All Samples Were Inundated During Test

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-9

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



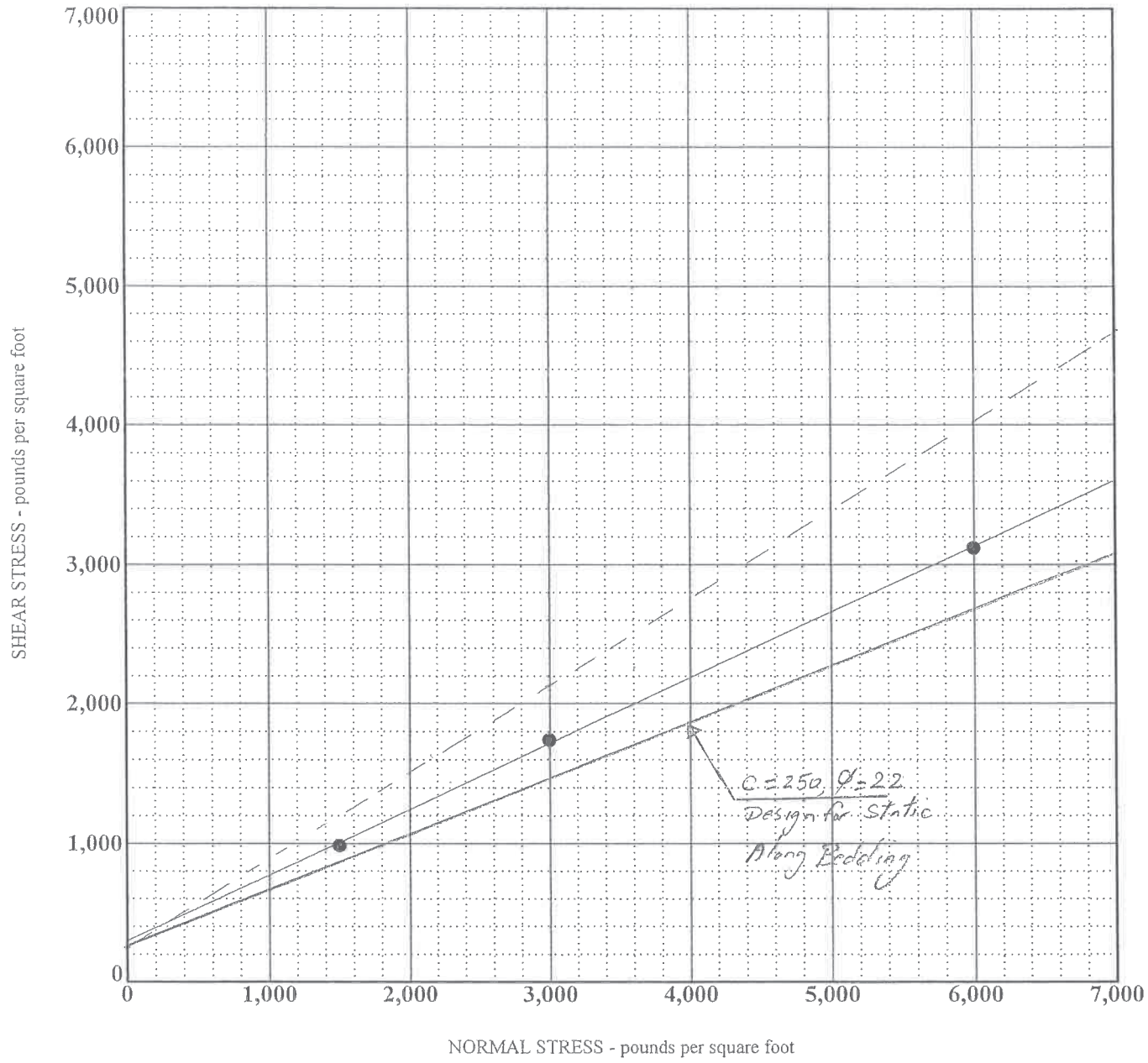
SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-1 @ 60.0	Tc: Clayey Siltstone - Ultimate	25	1000
– – B-2 @ 30	Tc: Silty Sandstone - Ultimate	27	430
— · — B-7 @ 20	Tc: Silty Sandstone, Ultimate	34	350
— · · — B-8 @ 30	Tc: Silty Sandstone, Ultimate	27	500

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-10

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05



SAMPLE LOCATION	DESCRIPTION	FRICTION ANGLE (°)	COHESION (PSF)
● B-8 @ 30.0	Sandy Silt (ML) - Reshear	25	290
-- B-7@20	Tc: Silty Sandstone - Reshear	32	230

NOTES:

Undisturbed Test Samples
All Samples Were Inundated Prior to Shearing

J.N. 227-00	DIRECT SHEAR TEST DATA	July, 2005
PETRA GEOTECHNICAL, INC.	UNDISTURBED TEST SAMPLES	PLATE B-11

DIRECT SHEAR 227-00.GPJ PETRA.GDT 6/17/05

APPENDIX B-2

LABORATORY TEST SUMMARY (Continued)

Direct Shear Strength (Reshear)

Location	Depth (Feet)	Soil Type	Internal Friction Angle	Cohesion (psf)
B-2	1.5	Silty fine Sandstone/Silty Sandstone* olive yellow	26 degrees	650
B-3	35	Silty Clayey Sandstone (fine)** very dark gray	21 degrees	1250
B-3	63	Clayey Sandy Siltstone** very dark gray (unoxidized)	21 degrees	1300
B-1	71.5	Clay (Claystone)** very dark gray	13 degrees	880

*Ring obtained in drill pad cut with hand sampler
**Ring obtained from grab samples (chunks)

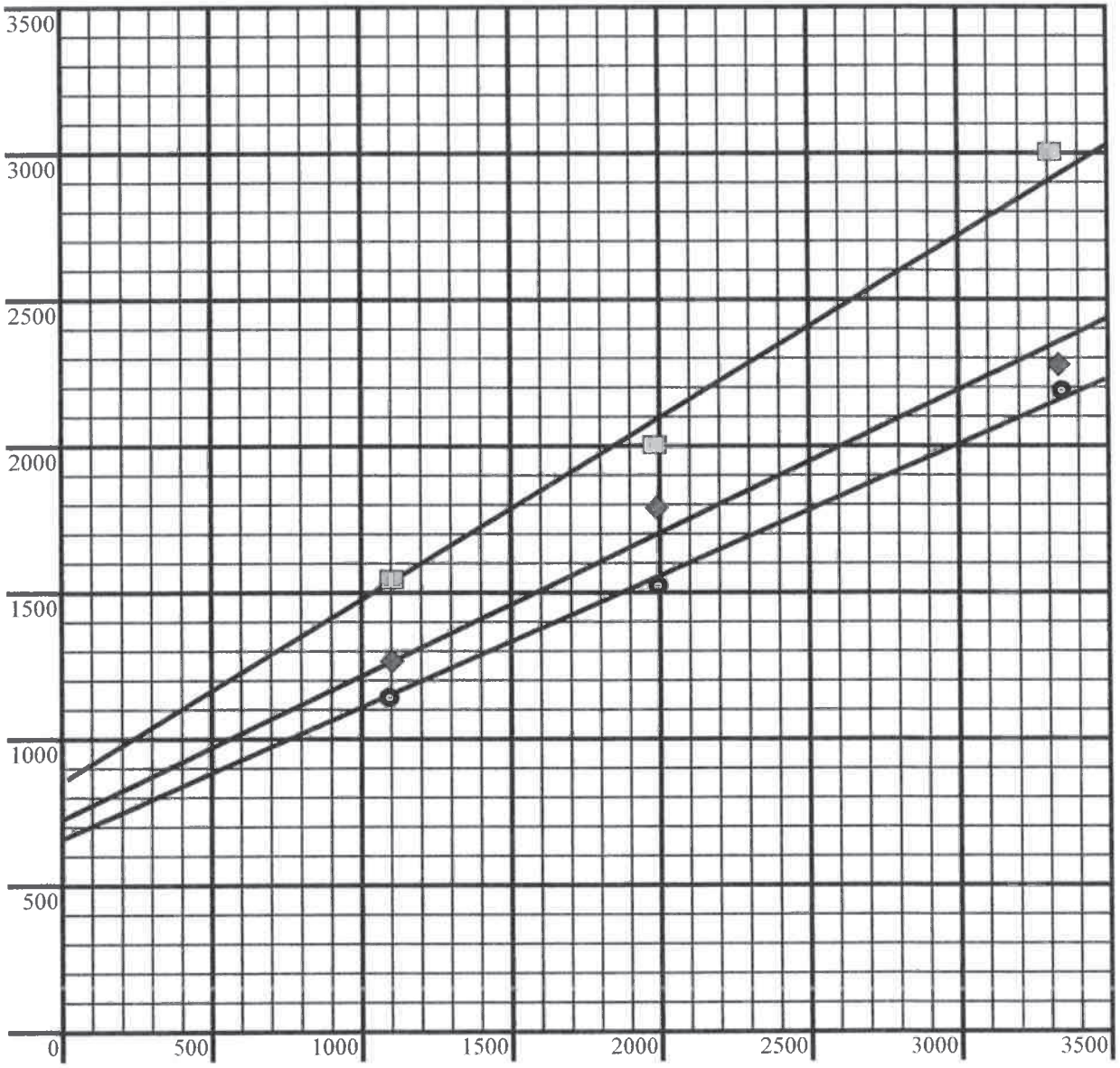
Direct Shear Strength (Ultimate)

Location	Depth (Feet)	Soil Type	Internal Friction Angle	Cohesion (psf)
B-3	15	Silty fine Sandstone/Silty Sandstone olive yellow	28 degrees	720
B-3	35	Silty Clayey Sandstone (fine) very dark gray	23 degrees	1300

P. A. & ASSOCIATES, INC.

PLATE B-3

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-2
DEPTH	1.5 ft.
SATURATED	NO YES x
UNDISTURBED	in-place
REMOLDED TO	%

RESIDUAL FRICTION ANGLE 26 °
COHESION 670 **P.S.F.**

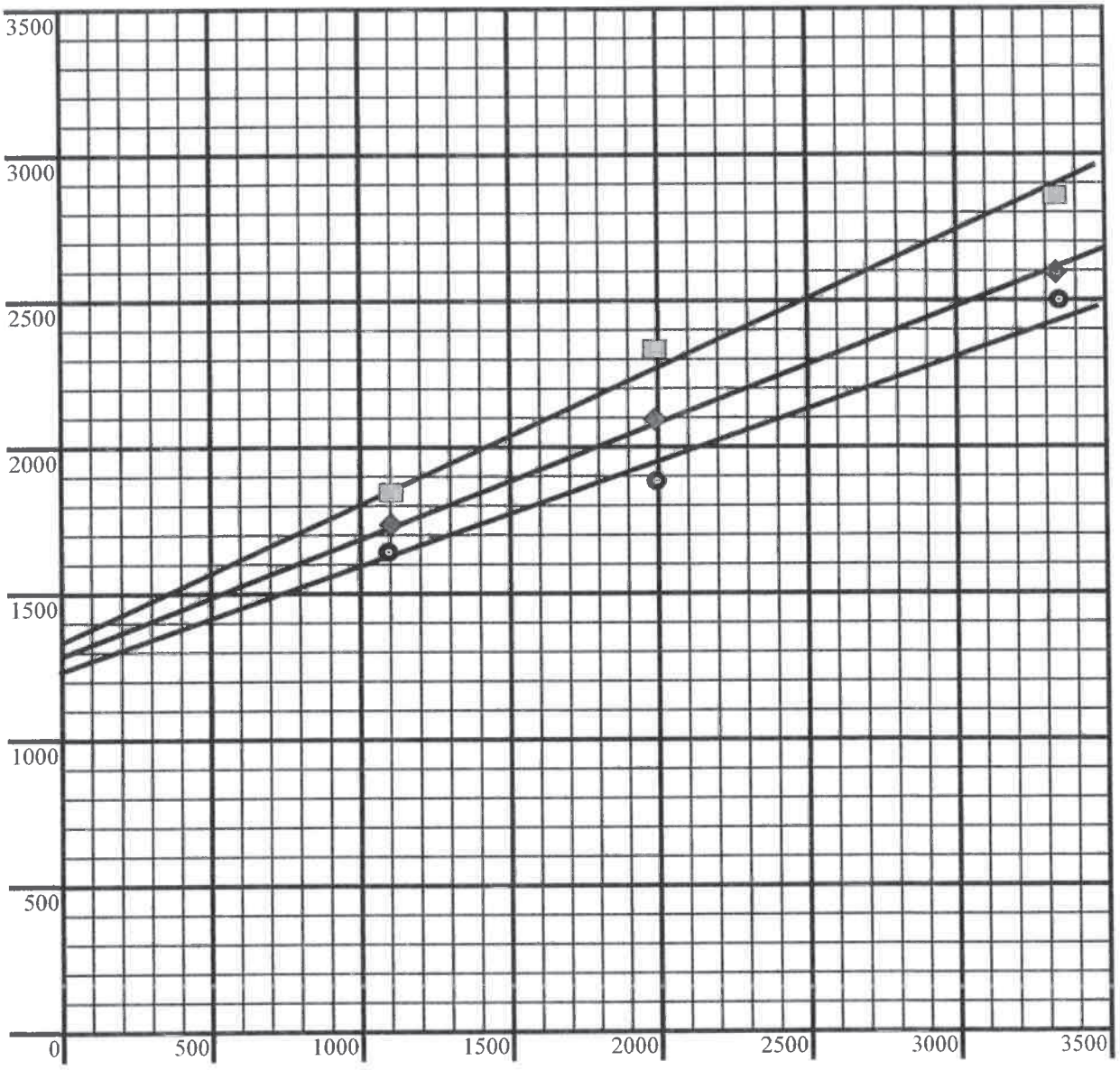
ULTIMATE FRICTION ANGLE 28 °
COHESION 720 **P.S.F.**

PEAK FRICTION ANGLE 34 °
COHESION 880 **P.S.F.**

P. A. & ASSOCIATES, INC.

PLATE B-4

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-3
DEPTH	35 ft.
SATURATED	NO YES x
UNDISTURBED	Ring from grab sample
REMOLDED TO	%

⊙ **RESIDUAL FRICTION ANGLE** 21 °
COHESION 1250 **P.S.F.**

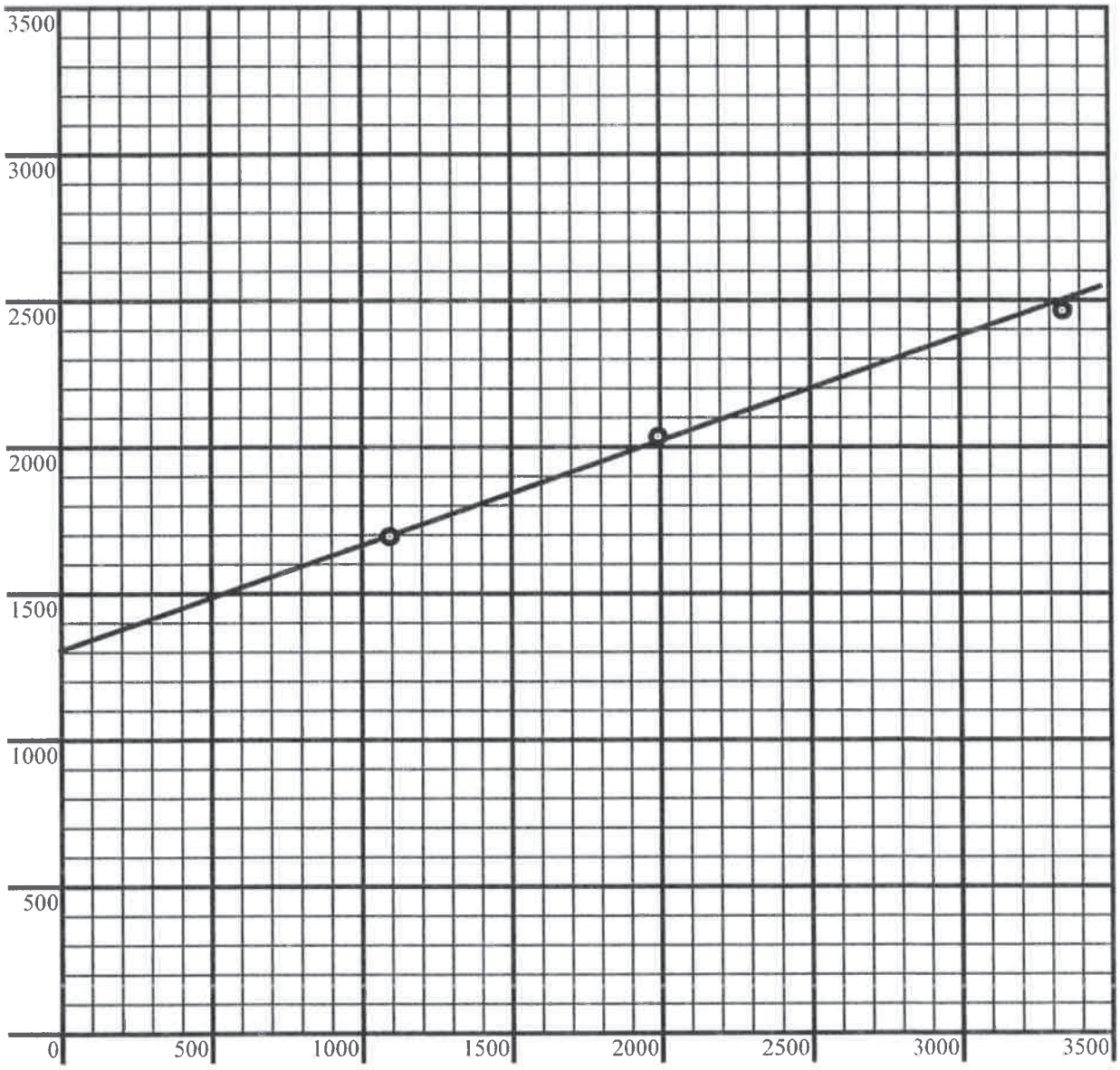
◆ **ULTIMATE FRICTION ANGLE** 23 °
COHESION 1300 **P.S.F.**

□ **PEAK FRICTION ANGLE** 27 °
COHESION 1350 **P.S.F.**

P. A. & ASSOCIATES, INC.

PLATE B-5

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-3
DEPTH	63 ft.
SATURATED	NO YES x
UNDISTURBED	Ring from grab sample
REMOLDED TO	%

⊙ **RESIDUAL FRICTION ANGLE** 21 °
COHESION 1300 **P.S.F.**

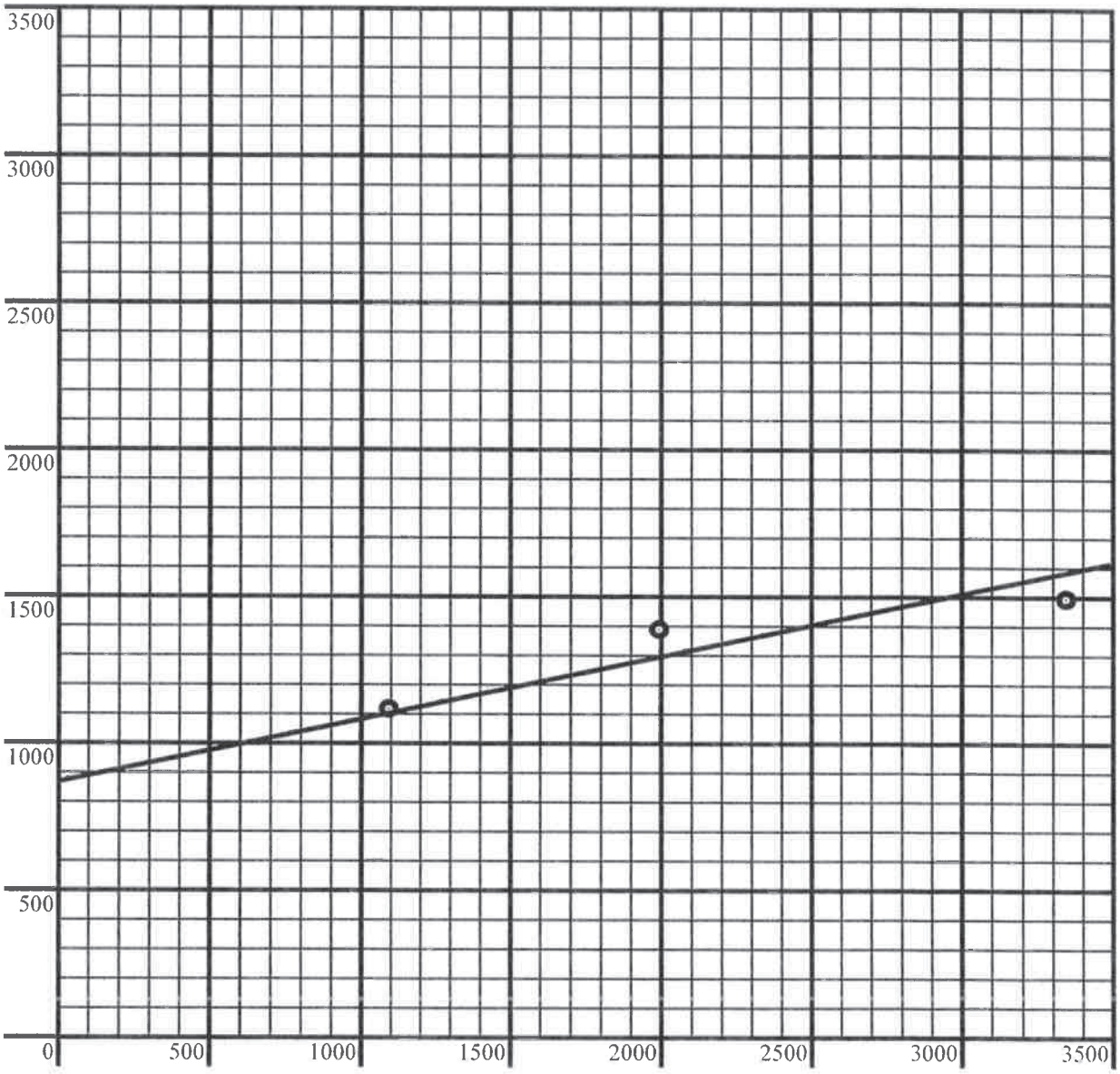
◆ **ULTIMATE FRICTION ANGLE** ____ °
COHESION ____ **P.S.F.**

▢ **PEAK FRICTION ANGLE** ____ °
COHESION ____ **P.S.F.**

P. A. & ASSOCIATES, INC.

PLATE B-6

DIRECT SHEAR SUMMARY



PROJECT NO.	26109-101
CLIENT NAME	Schlereth
BORING NO.	B-1
DEPTH	70-72 ft.
SATURATED	NO YES X
UNDISTURBED	RING FROM GRAB SAMPLE
REMOLDED TO	%

● **RESIDUAL FRICTION ANGLE** 13 °
COHESION 880 **P.S.F.**

◆ **ULTIMATE FRICTION ANGLE** °
COHESION P.S.F.

□ **PEAK FRICTION ANGLE** °
COHESION P.S.F.

APPENDIX D

SLOPE STABILITY ANALYSIS

APPENDIX D

ENGINEERING STABILITY ANALYSES

GENERAL

Engineering stability analyses were performed to assess the minimum Factors of Safety (FS) against future movement of the descending slope located within the subject property. The analyses were performed with the interpreted geologic conditions as described in the body of this report.

The "GSTABL7" slope stability program (developed by Gary H. Gregory, P.E. of Gregory Geotechnical Software) in conjunction with STEDwin (a graphical User Interface developed by Harald W. Van Aller, P.E.) were utilized for the stability analyses of the slope mass. The computer program utilizes the limit equilibrium theory for the calculation of the minimum Factory of Safety (FS).

SHEAR STRENGTH PARAMETERS

The shear strength parameters utilized in our stability analyses are presented in Table D-1, below. These values were based on laboratory test results, on local experience in similar soils, engineering judgment and back-calculations, and are considered reasonable and representative of the on-site materials.

TABLE D-1

SUMMARY OF STRENGTH PARAMETERS

Material Type	Bulk Density γ (pcf)	Cohesion C (psf)	Friction Angle ϕ (deg)
Engineered Fill	125	300	26
Landslide Rupture Surface	---	300	17
Capistrano Bedrock – Across Bedding	125	850	25
Capistrano Bedrock – Along Bedding	---	300	20
Landslide Block	125	300	20
Alluvium	125	300	20

ANALYSES

Slope stability analyses were performed for the slopes located within the property using Cross Sections D-D', E-E', 1-1' and 3-3'. Analyses were made with the proposed grades to determine the required remedial measures and with existing grade to perform back-calculations. The analyses were conducted using block or circular surface trials, for both static and pseudo-static conditions. The analyses indicated that remedial stabilization, consisting of shear pins, caissons with optional tiebacks, piers for retaining walls, and shear key partially backfilled with soil cement, are necessary to achieve the required factors of safety.

The following conditions were considered in the analyses:

1. Gross static and seismic stability analyses with the proposed grades for specific landslide rupture surfaces. The proposed remedial measures were included in the analyses.

2. Gross static and seismic stability analyses with the proposed grades using box-searches at different elevations. The proposed remedial measures were included in the analyses.

3. Gross static and seismic stability analyses with the proposed grades using circular searches originating across the site and beyond, and exiting at different elevations. The proposed remedial measures were included in the analyses.

4. The analyses were conservatively done assuming that the lower landslides now perched on the slope below the site have slumped, making the slope slightly steeper and the slope stability analyses more conservative.

5. Gross static stability analyses (back-calculations) were performed for specific landslide rupture surfaces, with the existing grades, to determine the shear strength along the rupture surface for a factor of safety of approximately 1.0. Conservatively, a groundwater table/phreatic surface was not used for these analyses. These analyses indicated that a cohesion of 300 psf and a friction angle of 17 degrees were needed for a FS of 1.

6. Boundary loads of 100 psf, 200 psf and 300 psf were used in the analyses for the proposed structures with 1-story, 2-story and 3-story, respectively.

7. Surficial stability analysis for engineered fill slope with a slope ratio of 2:1 (horizontal:vertical).

8. Slope stability analyses were performed to determine the lateral force necessary for wall loading with a 2:1 sloping backfill within landslide materials for both static and seismic.

Based on the results of slope stability analyses, the recommendations are listed below:

- Section E-E': Shear key 20-ft wide at elevation 460 feet amsl, partially backfilled with soil cement to elevation 490 feet amsl; 1 row of shear pins at retaining wall (rear of

building), extending at least 10 ft below lowest adjacent grade, providing resisting lateral force of 10,000 lbs per lineal foot.

- Section D-D': Shear key 25-ft wide at elevation 464 feet amsl, partially backfilled with soil cement to elevation 491 feet amsl; 1 row of shear pins placed downslope of the shear key, extending at least 72 ft from elevation 491 to 419 ft amsl, providing resisting lateral force of 140,000 lbs per lineal foot; 1 row of shear pins at retaining wall (rear of building), extending at least 30 ft from elevation 540 to 510 ft amsl, providing resisting lateral force of 15,000 lbs per lineal foot.
- Section 3-3': 2 rows of caissons placed within the road area: 1 row on the downslope side of the proposed road, extending at least 125 ft from elevation 582 to 457 ft amsl, providing resisting lateral force of 370,000 lbs per lineal foot; 1 upper row of caissons placed within the road, extending at least 130 ft from elevation 600 to 470 ft amsl, providing resisting lateral force of 270,000 lbs per lineal foot.
- Section F-F': No remedial measures are required for the landslide. A shear key was constructed during previous grading by others.
- The approximate locations of the recommended remedial measures are shown on the Cross Sections and on the Geotechnical Map, Plates 1 through 4.
- It should be noted that removal of all unsuitable materials within the area of grading will be necessary and was included in the analyses.
- Shear pins and caissons should be designed by the structural engineer based on recommendations presented herein and within the text portion of the report. Tiebacks will be necessary in some areas due to the high loading.

The required factors of safety (FS) were achieved with the inclusion of the remedial measures.

The Factor of Safety (FS) criteria adopted for verifying the adequacy of the stability of the slopes for the final design are as follows:

Static Conditions	–	$FS \geq 1.5$
Pseudostatic Conditions	–	$FS \geq 1.1$
Surficial Stability	–	$FS \geq 1.5$
Assumed Lateral Force (Seismic)	–	0.15g

The results of the analyses are presented in Table D-2 and Figures D-1 through D-23. Any revisions to the grading plans may require additional analyses and revisions to the recommendations presented herein.

TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
D-D'	2.5 1.6		d-18a d-18s	D-1.1 D-1.2	Landside rupture surface, searches exiting through & below key – 25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of the shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D'	1.5 1.1		d-18b d-18bs	D-2.1 D-2.2	Block searches exiting through and below shear/soil cement key & through and below shear pin – 25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D'	1.5 1.1		d-23 d-23s	D-3.1 D-3.2	Block searches exiting through and below upper retaining wall/shear pin – 25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D'	1.6 1.1		d-24 d-24s	D-4.1 D-4.2	Block searches exiting between the 2 shear pins – 25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D'	1.5 1.1		d-21 d-21s	D-5.1 D-5.2	Circular searches exiting through and below shear pin for upper retaining wall – 25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.

TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
D-D'	1.5	1.1	d-22 d-22s	D-6.1 D-6.2	Circular searches exiting upslope of shear pin for upper retaining wall – 25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D'	1.6	1.1	d-20 d-20s	D-7.1 D-7.2	Circular searches exiting between upper & lower shear pins – 25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
D-D'	1.6	1.1	d-19 d-19s	D-8.1 D-8.2	Circular searches exiting at toe of slope below all shear pins –25' W Shear key partially backfilled with soil cement; 2 rows of shear pins, one downslope of shear key and other at retaining wall, extending 30-72 ft, as shown on the cross section, providing resisting lateral force of 15,000 to 140,000 lbs per lineal foot.
E-E'	2.7	1.7	e-12 e-12s	D-9.1 D-9.2	Landside rupture surface, searches exiting through & below key – 20' W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E'	1.6	1.1	e-14 e-14s	D-10.1 D-10.2	Block searches exiting below and through shear pin for upper retaining wall – 20' W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E'	1.6	1.1	e-13 e-13s	D-11.1 D-11.2	Block searches exiting below and through shear key – 20' W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.

TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
E-E'	1.6 1.2		e-16 e-16s	D-12.1 D-12.2	Circular searches exiting through shear pin for upper retaining wall – 20' W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E'	1.6 1.2		e-15 e-15s	D-13.1 D-13.2	Circular searches exiting below shear pin for upper retaining wall – 20' W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
E-E'	1.7 1.1		e-17 e-17s	D-14.1 D-14.2	Circular searches exiting below shear key – 20' W Shear key partially backfilled with soil cement; 1 row of shear pins at retaining wall, extending 10 ft below lowest grade, as shown on the cross section, providing resisting lateral force of 10,000 lbs per lineal foot.
3-3'	1.7 1.3		3-27-nw 3-27s-nw	D-15.1 D-15.2	Landside rupture surface – 2 rows of caissons (with tiebacks), extending 125 & 130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
3-3'	1.5 1.1		3-28-nw 3-28s-nw	D-16.1 D-16.2	Portion of landside in front of upper caisson. – 2 rows of caissons (with tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
3-3'	1.5 1.2		3-29-nw 3-29s-nw	D-17.1 D-17.2	Circular mode. Surfaces through and below caissons – 2 rows of caissons(tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.

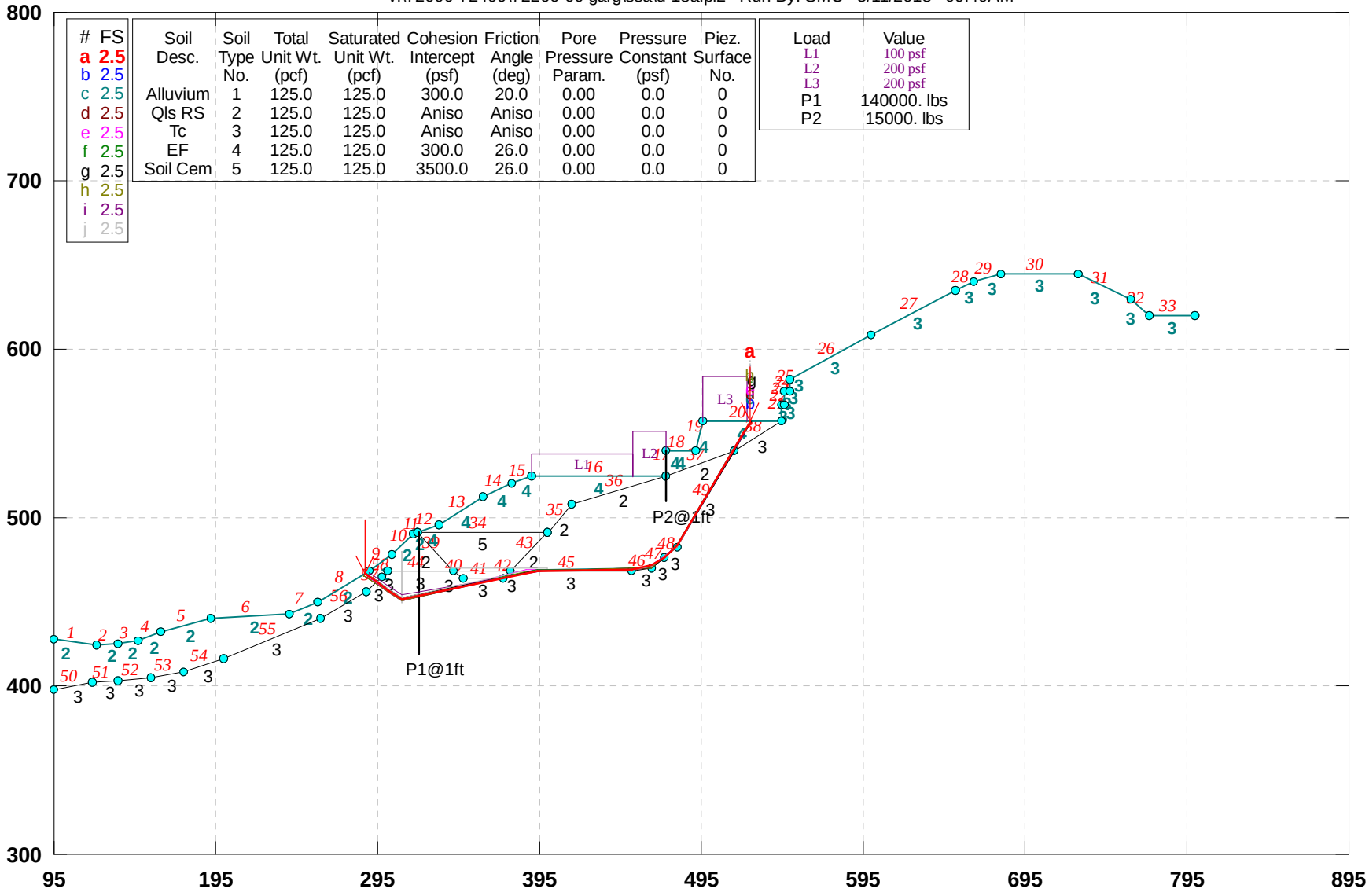
TABLE D-2

SUMMARY OF STABILITY ANALYSES

Section	Static FOS	Seismic FOS	File Name	Figure No.	Comments – Remedial Measures
3-3'	1.5	1.1	3-30c-nw 3-30cs-nw	D-18.1 D-18.2	Block mode. Surfaces through and below caissons – 2 rows of caissons (with tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
3-3'	1.6	1.2	3-30d-nw 3-30ds-nw	D-19.1 D-19.2	Block mode. Surfaces between caissons – 2 rows of caissons (with tiebacks) extending 125 &130 ft (10 feet minimum into bedrock) as shown on the cross section, providing resisting lateral force of 270,000 to 370,000 lbs per lineal foot.
BACK-CALCULATION					
3-3'	1.0	---	3-1a	D-20	Back-calculation of landslide rupture surface – Existing grades – no water - C = 300 psf; Ø = 17 º
1.1'	1.0	---	1-5a	D-21	Back-calculation of lower landslide rupture surface – Existing grades – no water - C = 300 psf; Ø = 17 º
SURFICIAL STABILITY					
---	2.0	---	---	D-22	Engineered fill slope at 2:1 (h:v) slope ratio
DYNAMIC LOADING EVALUATION					
---	1.3	1.0	rws rw	D23.1 D-23.2	Retaining wall 10 feet high with 2:1 sloping backfill, seismic condition with kh = 0.36g, 2100 lbs per lineal foot needed for FS of 1.0 This is equivalent to EFP of 42 pcf, which is less than the recommended static value, No additional loading required for seismic condition.

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18a.pl2 Run By: SMC 5/11/2018 09:49AM



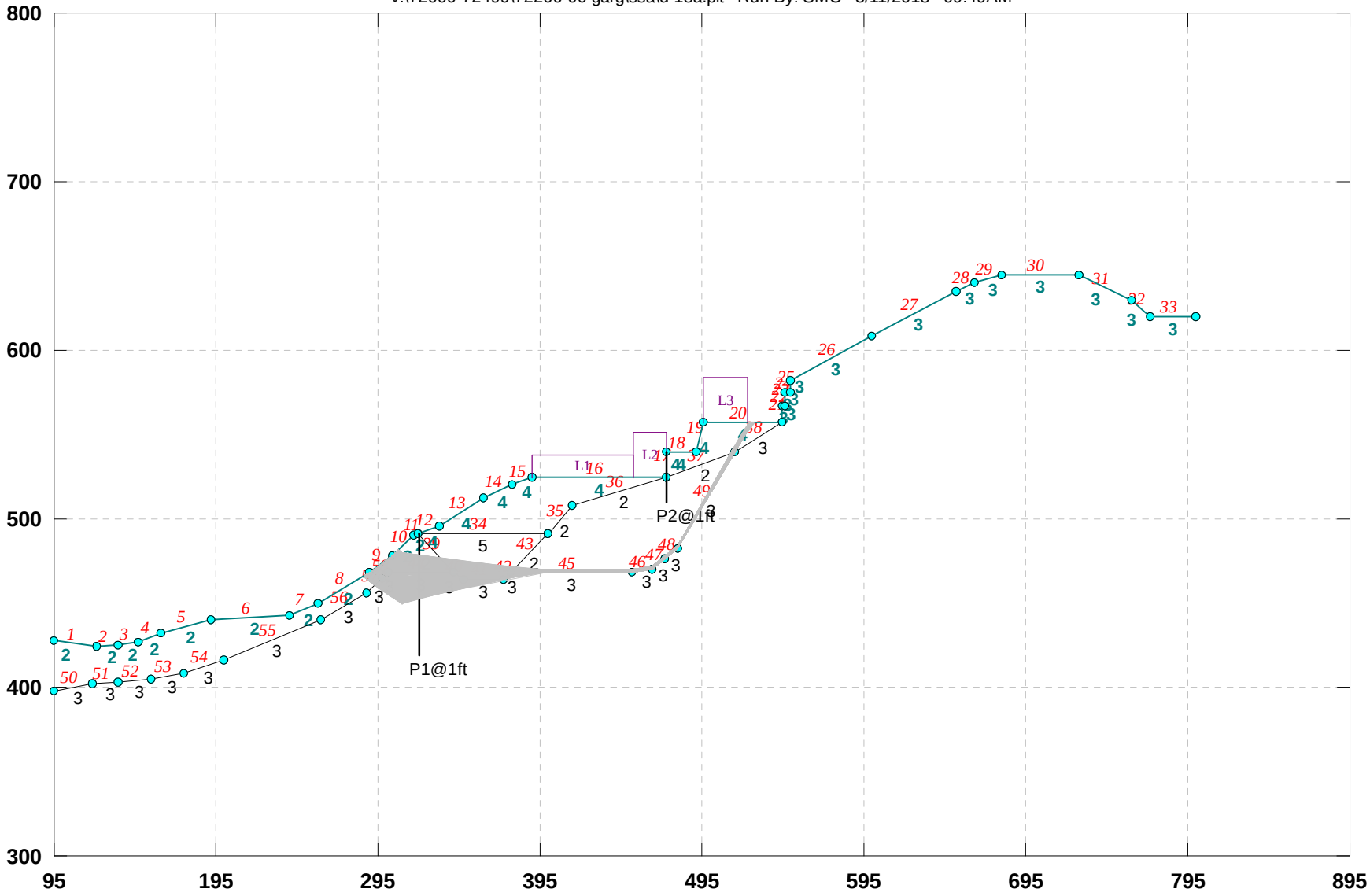
GSTABL7 v.2 FSmin=2.5

Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2)

Figure D-1.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18a.plt Run By: SMC 5/11/2018 09:49AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 09:49AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-18a.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18a.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18a.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3

43	377.00	468.00	400.00	491.00	2
44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between

Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
The Active And Passive Portions Of The Sliding Surfaces
Are Generated According To The Rankine Theory.
1000 Trial Surfaces Have Been Generated.
7 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	310.00	465.00	310.00	465.00	30.00
2	340.00	469.00	400.00	469.00	2.00
3	452.00	469.00	452.00	469.00	2.00
4	464.00	471.00	464.00	471.00	2.00
5	472.00	477.00	472.00	477.00	2.00
6	480.00	483.00	480.00	483.00	2.00
7	514.00	540.00	515.00	540.00	1.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2) * *
Selected ki function = Bi-linear
Selected Lambda Coefficient = 1.00
Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.
Specified Tension Crack Water Force Factor = 0.000
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 3.663 FS Min = 2.451 FS Ave = 2.847
Standard Deviation = 0.226 Coefficient of Variation = 7.94 %
((Simplified Janbu FS for Critical Surface = 2.111))
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.529	466.610
2	294.424	461.782
3	301.566	457.232
4	310.000	451.859
5	393.829	468.588
6	452.000	469.419
7	464.000	471.805
8	472.000	476.432
9	480.000	483.490
10	514.512	539.832
11	519.811	548.313
12	525.110	556.793
13	525.239	557.000

*** FOS = 2.451 Theta (ki=1.0) = 17.20 ***
Lambda = 0.309
Individual data on the 38 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.5	482.1	0.0	0.0	0.	0.	0.0	0.0	0.0
2	4.4	3456.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	3.6	5272.3	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.0	6089.2	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.6	1319.5	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.4	6290.0	0.0	0.0	0.	0.	0.0	0.0	0.0
7	6.0	20249.6	0.0	0.0	0.	0.	0.0	0.0	0.0
8	7.0	29935.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	3.0	13854.4	0.0	0.0	0.	0.	0.0	0.0	0.0
10	13.0	62316.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	9.0	46485.2	0.0	0.0	0.	0.	0.0	0.0	0.0

12	6.0	33200.9	0.0	0.0	0.	0.	0.0	0.0	0.0
13	12.0	71707.7	0.0	0.0	0.	0.	0.0	0.0	0.0
14	10.8	69771.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	2.7	17925.2	0.0	0.0	0.	0.	0.0	0.0	0.0
16	3.5	23323.2	0.0	0.0	0.	0.	0.0	0.0	0.0
17	1.0	6806.1	0.0	0.0	0.	0.	0.0	0.0	0.0
18	12.0	83810.7	0.0	0.0	0.	0.	0.0	0.0	0.0
19	0.9	6308.7	0.0	0.0	0.	0.	0.0	0.0	88.4
20	2.9	20876.9	0.0	0.0	0.	0.	0.0	0.0	294.5
21	6.2	43478.6	0.0	0.0	0.	0.	0.0	0.0	617.1
22	15.0	105406.7	0.0	0.0	0.	0.	0.0	0.0	1500.0
23	37.0	258285.4	0.0	0.0	0.	0.	0.0	0.0	3700.0
24	1.0	6935.2	0.0	0.0	0.	0.	0.0	0.0	100.0
25	0.1	692.2	0.0	0.0	0.	0.	0.0	0.0	0.0
26	10.9	73955.0	0.0	0.0	0.	0.	0.0	0.0	2180.0
27	8.0	50881.5	0.0	0.0	0.	0.	0.0	0.0	1600.0
28	1.0	6015.8	0.0	0.0	0.	0.	0.0	0.0	200.0
29	0.1	689.3	0.0	0.0	0.	0.	0.0	0.0	0.0
30	6.9	51364.8	0.0	0.0	0.	0.	0.0	0.0	0.0
31	12.0	70071.9	0.0	0.0	0.	0.	0.0	0.0	0.0
32	4.0	21077.1	0.0	0.0	0.	0.	0.0	0.0	0.0
33	18.5	74680.2	0.0	0.0	0.	0.	0.0	0.0	3701.3
34	0.0	11.4	0.0	0.0	0.	0.	0.0	0.0	1.1
35	5.3	8563.0	0.0	0.0	0.	0.	0.0	0.0	1059.8
36	3.2	2445.7	0.0	0.0	0.	0.	0.0	0.0	637.8
37	2.1	499.9	0.0	0.0	0.	0.	0.0	0.0	0.0
38	0.1	1.7	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.287	466.474
2	294.233	461.610
3	301.566	456.939
4	310.000	451.566
5	397.462	469.037
6	452.000	469.087
7	464.000	471.441
8	472.000	476.788
9	480.000	483.314
10	514.057	539.854
11	519.356	548.334
12	524.655	556.815
13	524.771	557.000

*** FOS = 2.457 Theta (ki=1.0) = 17.31 ***
Lambda = 0.312

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.623	466.100
2	293.709	461.138
3	301.566	456.133
4	310.000	450.760
5	392.452	468.772
6	452.000	469.674
7	464.000	470.442
8	472.000	476.266
9	480.000	483.831
10	514.805	540.163
11	520.105	548.643
12	525.326	557.000

*** FOS = 2.467 Theta (ki=1.0) = 17.47 ***
Lambda = 0.315

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.381	465.964
2	293.519	460.967
3	301.566	455.840
4	310.000	450.467
5	396.085	469.222

6	452.000	469.342
7	464.000	470.079
8	472.000	476.621
9	480.000	483.655
10	514.350	540.185
11	519.649	548.665
12	524.858	557.000

*** FOS = 2.474 Theta (ki=1.0) = 17.57 ***
Lambda = 0.317
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.780	466.189
2	293.833	461.250
3	301.566	456.323
4	310.000	450.950
5	387.091	468.980
6	452.000	469.390
7	464.000	471.478
8	472.000	476.934
9	480.000	482.945
10	514.501	539.599
11	514.709	539.896
12	520.008	548.377
13	525.308	556.857
14	525.397	557.000

*** FOS = 2.487 Theta (ki=1.0) = 17.36 ***
Lambda = 0.313
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.939	466.841
2	294.748	462.073
3	301.566	457.730
4	310.000	452.357
5	393.654	468.824
6	452.000	468.983
7	464.000	470.822
8	472.000	476.028
9	480.000	483.789
10	514.486	539.896
11	519.785	548.376
12	525.084	556.857
13	525.173	557.000

*** FOS = 2.492 Theta (ki=1.0) = 17.25 ***
Lambda = 0.310
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.770	466.746
2	294.615	461.953
3	301.566	457.524
4	310.000	452.151
5	390.197	468.139
6	452.000	469.751
7	464.000	470.168
8	472.000	476.077
9	480.000	483.666
10	514.967	539.811
11	515.140	540.082
12	520.439	548.562
13	525.711	557.000

*** FOS = 2.494 Theta (ki=1.0) = 17.12 ***
Lambda = 0.308
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.369	465.958
2	293.509	460.958
3	301.566	455.825

4	310.000	450.452
5	387.267	468.744
6	452.000	469.825
7	464.000	470.461
8	472.000	477.339
9	480.000	482.646
10	514.528	539.536
11	514.804	539.930
12	520.103	548.410
13	525.402	556.891
14	525.470	557.000

*** FOS =   2.497   Theta (ki=1.0) =   17.55 ***
Lambda =   0.316

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	289.340	467.629
2	295.853	463.068
3	301.566	459.429
4	310.000	454.056
5	396.583	468.219
6	452.000	468.909
7	464.000	470.529
8	472.000	476.766
9	480.000	482.808
10	514.925	540.171
11	520.224	548.652
12	525.441	557.000

*** FOS =   2.510   Theta (ki=1.0) =   17.03 ***
Lambda =   0.306

Failure Surface Specified By 12 Coordinate Points

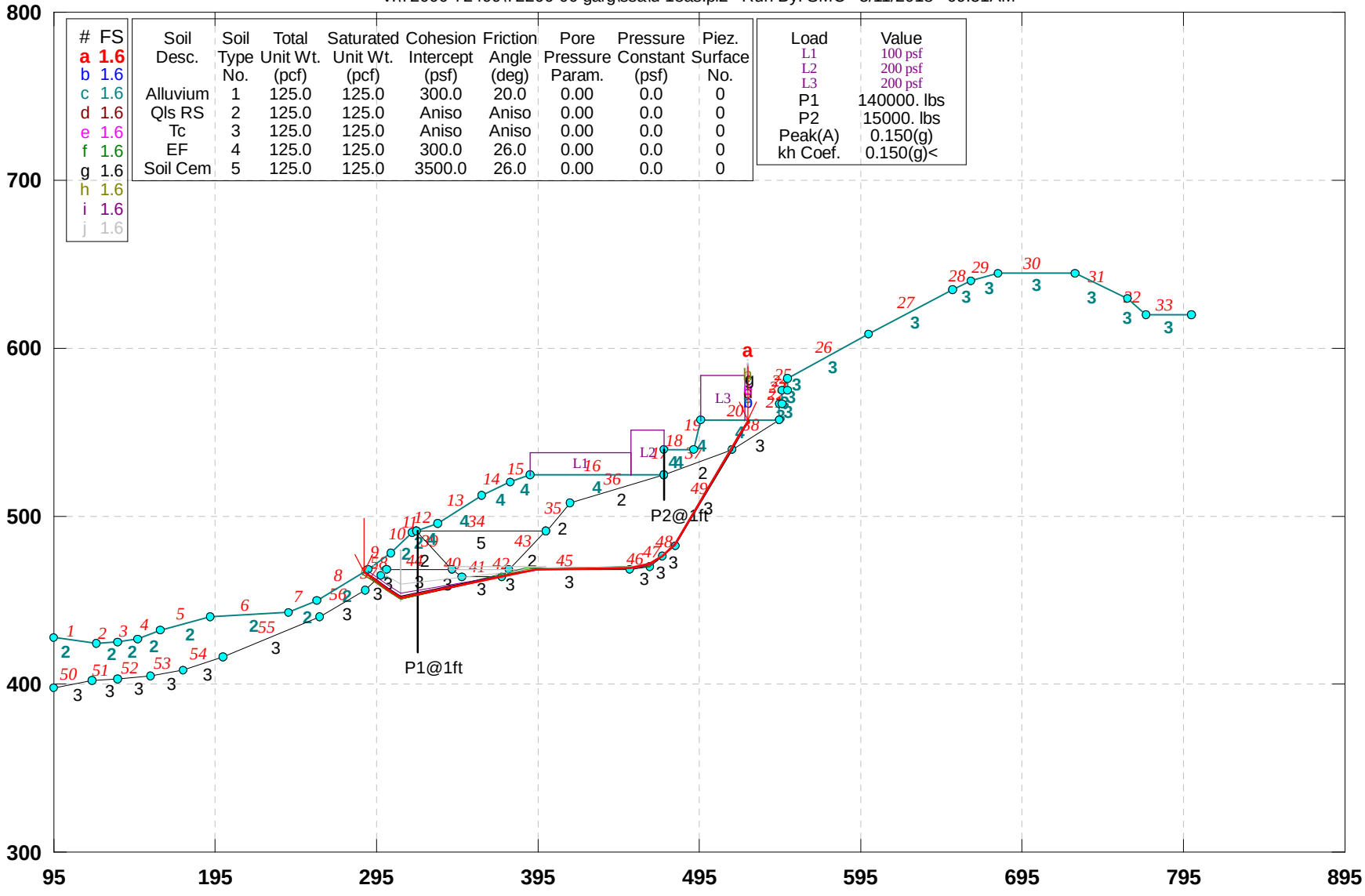
Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.927	466.834
2	294.738	462.065
3	301.566	457.715
4	310.000	452.342
5	384.835	468.347
6	452.000	469.467
7	464.000	471.204
8	472.000	476.746
9	480.000	482.780
10	514.663	540.247
11	519.962	548.727
12	525.131	557.000

*** FOS =   2.512   Theta (ki=1.0) =   17.20 ***
Lambda =   0.310

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18as.pl2 Run By: SMC 5/11/2018 09:51AM



GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2)

Figure D-1.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 09:51AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-18as.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18as.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18as.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0

```
   2     473.20   540.00    15000.0     1.0      90.00       30.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of  c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
The Active And Passive Portions Of The Sliding Surfaces
Are Generated According To The Rankine Theory.
1000 Trial Surfaces Have Been Generated.
7 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is  10.0
Box        X-Left     Y-Left    X-Right    Y-Right      Height
No.         (ft)       (ft)       (ft)       (ft)        (ft)
 1         310.00     465.00     310.00     465.00      30.00
 2         340.00     469.00     400.00     469.00       2.00
 3         452.00     469.00     452.00     469.00       2.00
 4         464.00     471.00     464.00     471.00       2.00
 5         472.00     477.00     472.00     477.00       2.00
 6         480.00     483.00     480.00     483.00       2.00
 7         514.00     540.00     515.00     540.00       1.00
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2) * *
      Selected ki function = Bi-linear
      Selected Lambda Coefficient =  1.00
      Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
      (if applicable) have been applied to the slice base(s)
      on which they intersect.
      Specified Tension Crack Water Force Factor =   0.000
      Total Number of Trial Surfaces Attempted =  1000
      Number of Trial Surfaces With Valid FS = 1000
      Statistical Data On All Valid FS Values:
         FS Max =   2.166   FS Min =   1.565   FS Ave =   1.748
         Standard Deviation =    0.115   Coefficient of Variation =    6.58 %
               ((Simplified Janbu FS for Critical Surface =  1.459))
      Failure Surface Specified By 13 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1        287.529     466.610
          2        294.424     461.782
          3        301.566     457.232
          4        310.000     451.859
          5        393.829     468.588
          6        452.000     469.419
          7        464.000     471.805
          8        472.000     476.432
          9        480.000     483.490
         10        514.512     539.832
         11        519.811     548.313
         12        525.110     556.793
         13        525.239     557.000
      ***  FOS =     1.565   Theta (ki=1.0) =    15.57  ***
                          Lambda =   0.279
           Individual data on the    38  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      2.5     482.1     0.0     0.0       0.      0.    72.3     0.0      0.0
  2      4.4    3456.0     0.0     0.0       0.      0.   518.4     0.0      0.0
  3      3.6    5272.3     0.0     0.0       0.      0.   790.8     0.0      0.0
  4      3.0    6089.2     0.0     0.0       0.      0.   913.4     0.0      0.0
  5      0.6    1319.5     0.0     0.0       0.      0.   197.9     0.0      0.0
  6      2.4    6290.0     0.0     0.0       0.      0.   943.5     0.0      0.0
  7      6.0   20249.6     0.0     0.0       0.      0.  3037.4     0.0      0.0
  8      7.0   29935.7     0.0     0.0       0.      0.  4490.4     0.0      0.0
```

9	3.0	13854.4	0.0	0.0	0.	0.	2078.2	0.0	0.0
10	13.0	62316.6	0.0	0.0	0.	0.	9347.5	0.0	0.0
11	9.0	46485.2	0.0	0.0	0.	0.	6972.8	0.0	0.0
12	6.0	33200.9	0.0	0.0	0.	0.	4980.1	0.0	0.0
13	12.0	71707.7	0.0	0.0	0.	0.	10756.2	0.0	0.0
14	10.8	69771.7	0.0	0.0	0.	0.	10465.8	0.0	0.0
15	2.7	17925.2	0.0	0.0	0.	0.	2688.8	0.0	0.0
16	3.5	23323.2	0.0	0.0	0.	0.	3498.5	0.0	0.0
17	1.0	6806.1	0.0	0.0	0.	0.	1020.9	0.0	0.0
18	12.0	83810.7	0.0	0.0	0.	0.	12571.6	0.0	0.0
19	0.9	6308.7	0.0	0.0	0.	0.	946.3	0.0	88.4
20	2.9	20876.9	0.0	0.0	0.	0.	3131.5	0.0	294.5
21	6.2	43478.6	0.0	0.0	0.	0.	6521.8	0.0	617.1
22	15.0	105406.7	0.0	0.0	0.	0.	15811.0	0.0	1500.0
23	37.0	258285.4	0.0	0.0	0.	0.	38742.8	0.0	3700.0
24	1.0	6935.2	0.0	0.0	0.	0.	1040.3	0.0	100.0
25	0.1	692.2	0.0	0.0	0.	0.	103.8	0.0	0.0
26	10.9	73955.0	0.0	0.0	0.	0.	11093.3	0.0	2180.0
27	8.0	50881.5	0.0	0.0	0.	0.	7632.2	0.0	1600.0
28	1.0	6015.8	0.0	0.0	0.	0.	902.4	0.0	200.0
29	0.1	689.3	0.0	0.0	0.	0.	103.4	0.0	0.0
30	6.9	51364.8	0.0	0.0	0.	0.	7704.7	0.0	0.0
31	12.0	70071.9	0.0	0.0	0.	0.	10510.8	0.0	0.0
32	4.0	21077.1	0.0	0.0	0.	0.	3161.6	0.0	0.0
33	18.5	74680.2	0.0	0.0	0.	0.	11202.0	0.0	3701.3
34	0.0	11.4	0.0	0.0	0.	0.	1.7	0.0	1.1
35	5.3	8563.0	0.0	0.0	0.	0.	1284.5	0.0	1059.8
36	3.2	2445.7	0.0	0.0	0.	0.	366.9	0.0	637.8
37	2.1	499.9	0.0	0.0	0.	0.	75.0	0.0	0.0
38	0.1	1.7	0.0	0.0	0.	0.	0.3	0.0	0.0

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.287	466.474
2	294.233	461.610
3	301.566	456.939
4	310.000	451.566
5	397.462	469.037
6	452.000	469.087
7	464.000	471.441
8	472.000	476.788
9	480.000	483.314
10	514.057	539.854
11	519.356	548.334
12	524.655	556.815
13	524.771	557.000

*** FOS = 1.566 Theta (ki=1.0) = 15.63 ***
Lambda = 0.280

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.623	466.100
2	293.709	461.138
3	301.566	456.133
4	310.000	450.760
5	392.452	468.772
6	452.000	469.674
7	464.000	470.442
8	472.000	476.266
9	480.000	483.831
10	514.805	540.163
11	520.105	548.643
12	525.326	557.000

*** FOS = 1.571 Theta (ki=1.0) = 15.83 ***
Lambda = 0.283

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.381	465.964
2	293.519	460.967

3	301.566	455.840
4	310.000	450.467
5	396.085	469.222
6	452.000	469.342
7	464.000	470.079
8	472.000	476.621
9	480.000	483.655
10	514.350	540.185
11	519.649	548.665
12	524.858	557.000

*** FOS = 1.574 Theta (ki=1.0) = 15.94 ***
Lambda = 0.286
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.939	466.841
2	294.748	462.073
3	301.566	457.730
4	310.000	452.357
5	393.654	468.824
6	452.000	468.983
7	464.000	470.822
8	472.000	476.028
9	480.000	483.789
10	514.486	539.896
11	519.785	548.376
12	525.084	556.857
13	525.173	557.000

*** FOS = 1.582 Theta (ki=1.0) = 15.55 ***
Lambda = 0.278
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	286.780	466.189
2	293.833	461.250
3	301.566	456.323
4	310.000	450.950
5	387.091	468.980
6	452.000	469.390
7	464.000	471.478
8	472.000	476.934
9	480.000	482.945
10	514.501	539.599
11	514.709	539.896
12	520.008	548.377
13	525.308	556.857
14	525.397	557.000

*** FOS = 1.584 Theta (ki=1.0) = 15.71 ***
Lambda = 0.281
Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.770	466.746
2	294.615	461.953
3	301.566	457.524
4	310.000	452.151
5	390.197	468.139
6	452.000	469.751
7	464.000	470.168
8	472.000	476.077
9	480.000	483.666
10	514.967	539.811
11	515.140	540.082
12	520.439	548.562
13	525.711	557.000

*** FOS = 1.584 Theta (ki=1.0) = 15.40 ***
Lambda = 0.275
Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	286.369	465.958
2	293.509	460.958
3	301.566	455.825
4	310.000	450.452
5	387.267	468.744
6	452.000	469.825
7	464.000	470.461
8	472.000	477.339
9	480.000	482.646
10	514.528	539.536
11	514.804	539.930
12	520.103	548.410
13	525.402	556.891
14	525.470	557.000

*** FOS = 1.586 Theta (ki=1.0) = 15.88 ***
Lambda = 0.284
Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	289.340	467.629
2	295.853	463.068
3	301.566	459.429
4	310.000	454.056
5	396.583	468.219
6	452.000	468.909
7	464.000	470.529
8	472.000	476.766
9	480.000	482.808
10	514.925	540.171
11	520.224	548.652
12	525.441	557.000

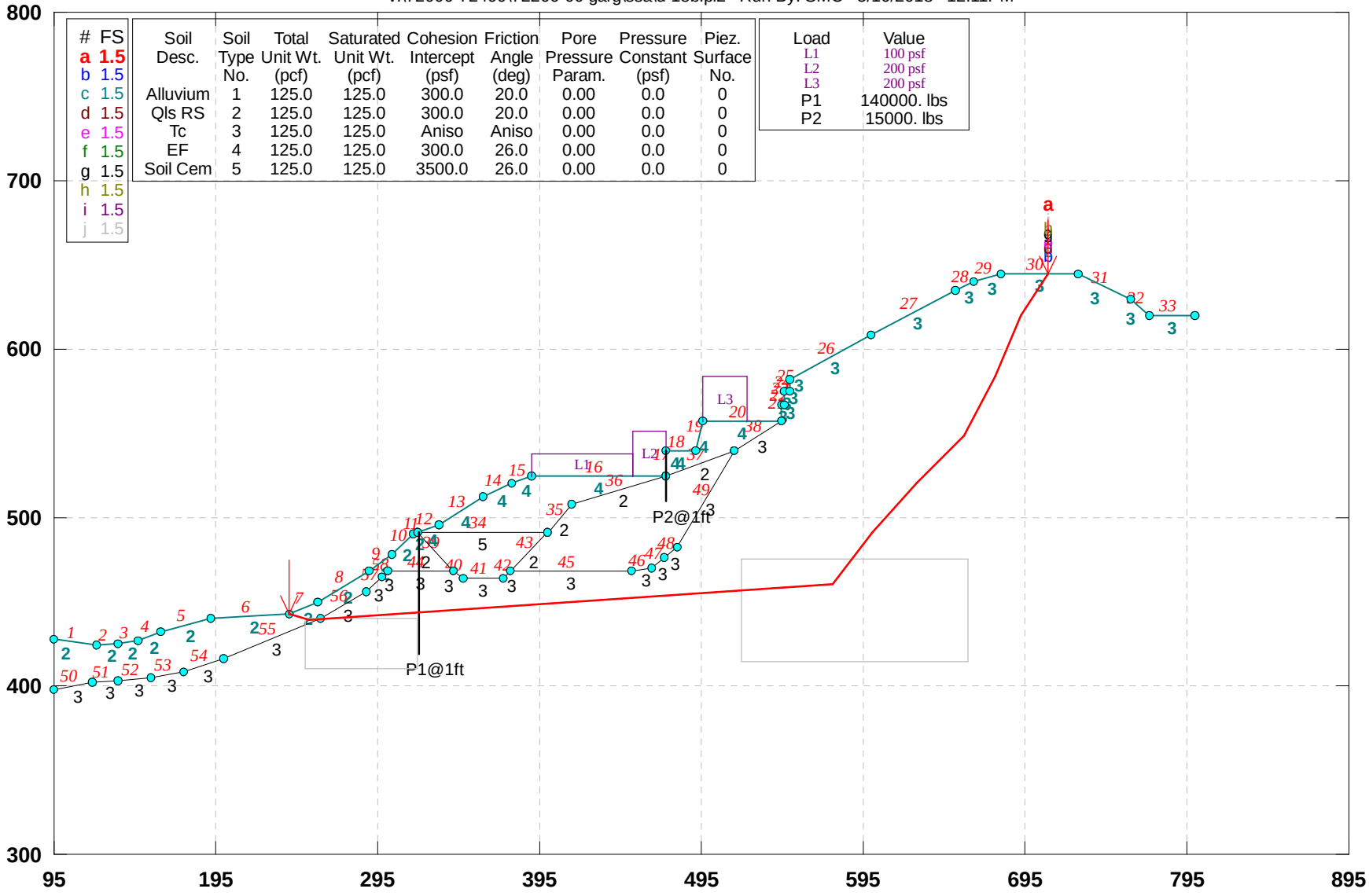
*** FOS = 1.590 Theta (ki=1.0) = 15.32 ***
Lambda = 0.274
Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	293.665	470.618
2	299.519	466.519
3	301.566	465.215
4	310.000	459.842
5	399.835	468.847
6	452.000	469.967
7	464.000	471.704
8	472.000	477.246
9	480.000	483.280
10	514.913	540.497
11	520.212	548.977
12	525.225	557.000

*** FOS = 1.594 Theta (ki=1.0) = 14.63 ***
Lambda = 0.261
**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18b.pl2 Run By: SMC 5/16/2018 12:11PM



#	FS
a	1.5
b	1.5
c	1.5
d	1.5
e	1.5
f	1.5
g	1.5
h	1.5
i	1.5
j	1.5

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls RS	2	125.0	125.0	300.0	20.0	0.00	0.0	0
Tc	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
EF	4	125.0	125.0	300.0	26.0	0.00	0.0	0
Soil Cem	5	125.0	125.0	3500.0	26.0	0.00	0.0	0

Load	Value
L1	100 psf
L2	200 psf
L3	200 psf
P1	140000. lbs
P2	15000. lbs

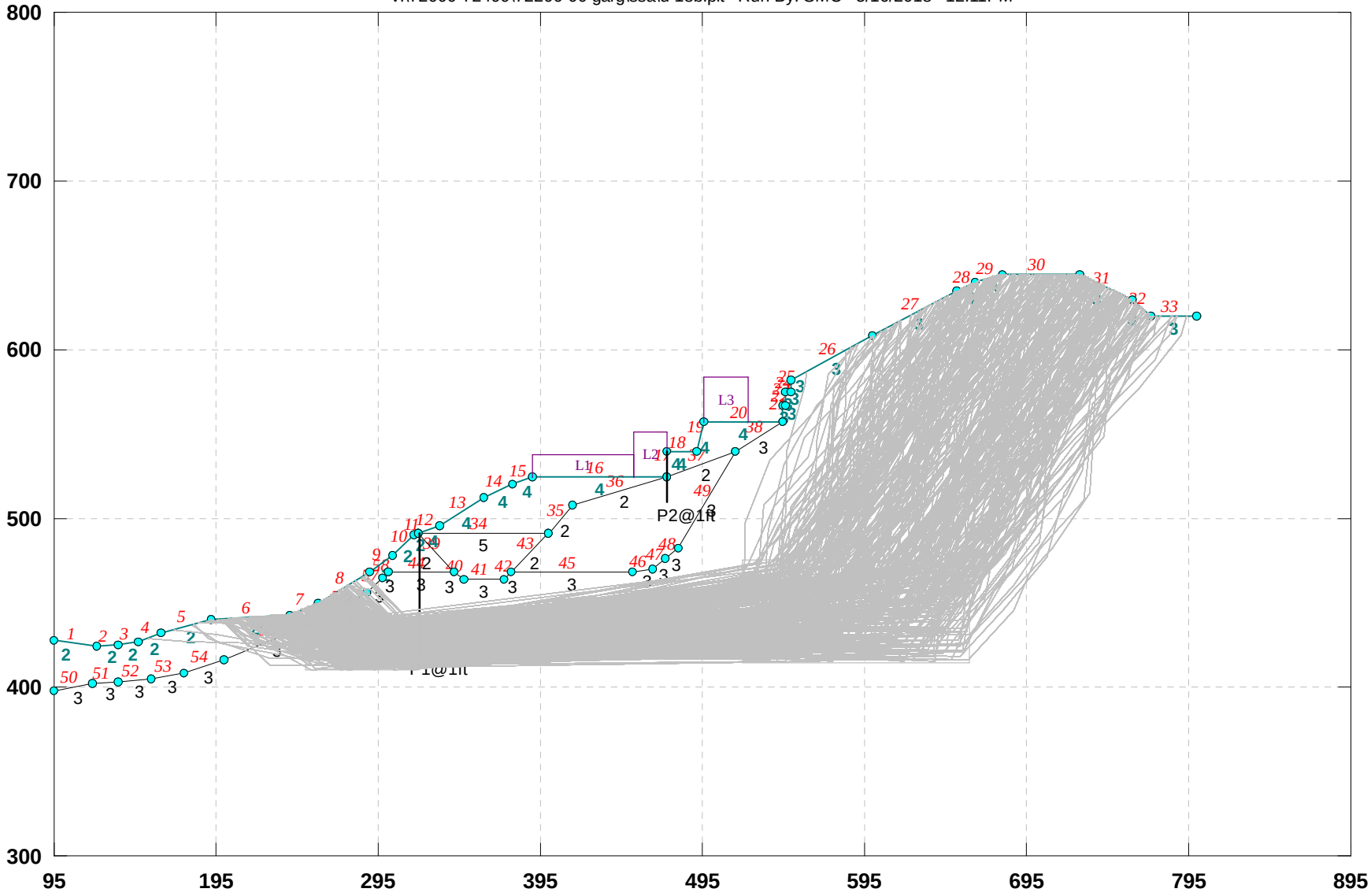
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-2.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18b.plt Run By: SMC 5/16/2018 12:11PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:11PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-18b.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18b.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18b.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of

Sliding Block Is 40.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	250.00	425.00	320.00	425.00	30.00
2	520.00	445.00	660.00	445.00	60.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 9999

Number of Trial Failure Surfaces is Greater Than 5000.

Statistical Data on FS Values are Not Generated.

To Generate Stastical Data, Reduce Number of Trial Failure Surfaces to 5000 or less.

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	240.140	443.054
2	252.491	438.819
3	576.046	459.952
4	601.275	490.993
5	628.545	520.256
6	656.822	548.548
7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

Factor of Safety

*** 1.502 ***

Individual data on the 50 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.4	6977.2	0.0	0.0	0.	0.	0.0	0.0	0.0
2	5.4	6752.6	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	85.6	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.0	2829.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	28.0	65716.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	2.0	6558.5	0.0	0.0	0.	0.	0.0	0.0	0.0
7	8.0	29327.0	0.0	0.0	0.	0.	0.0	0.0	0.0
8	3.0	12336.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	3.0	13066.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	13.0	67262.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	3.0	17763.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	13.0	81001.4	0.0	0.0	0.	0.	0.0	0.0	0.0
13	9.0	61082.1	0.0	0.0	0.	0.	0.0	0.0	0.0
14	6.0	43687.3	0.0	0.0	0.	0.	0.0	0.0	0.0
15	12.0	94493.0	0.0	0.0	0.	0.	0.0	0.0	0.0
16	13.0	111512.8	0.0	0.0	0.	0.	0.0	0.0	0.0
17	4.0	35922.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.0	9099.2	0.0	0.0	0.	0.	0.0	0.0	0.0
19	12.0	112637.0	0.0	0.0	0.	0.	0.0	0.0	0.0
20	10.0	96091.1	0.0	0.0	0.	0.	0.0	0.0	1000.0
21	15.0	142605.8	0.0	0.0	0.	0.	0.0	0.0	1500.0
22	37.0	343906.6	0.0	0.0	0.	0.	0.0	0.0	3700.0
23	1.0	9139.6	0.0	0.0	0.	0.	0.0	0.0	100.0
24	0.1	913.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	10.9	99083.7	0.0	0.0	0.	0.	0.0	0.0	2180.0
26	8.0	72104.8	0.0	0.0	0.	0.	0.0	0.0	1600.0
27	1.0	8976.4	0.0	0.0	0.	0.	0.0	0.0	200.0
28	0.1	991.0	0.0	0.0	0.	0.	0.0	0.0	0.0
29	6.9	74646.1	0.0	0.0	0.	0.	0.0	0.0	0.0
30	12.0	128893.6	0.0	0.0	0.	0.	0.0	0.0	0.0
31	4.0	46953.3	0.0	0.0	0.	0.	0.0	0.0	0.0
32	19.0	241431.6	0.0	0.0	0.	0.	0.0	0.0	3800.0
33	8.0	100773.6	0.0	0.0	0.	0.	0.0	0.0	1600.0
34	21.0	262044.7	0.0	0.0	0.	0.	0.0	0.0	0.0
35	0.1	1301.4	0.0	0.0	0.	0.	0.0	0.0	0.0
36	1.9	25905.0	0.0	0.0	0.	0.	0.0	0.0	0.0
37	0.1	1412.2	0.0	0.0	0.	0.	0.0	0.0	0.0

38	3.8	55518.5	0.0	0.0	0.	0.	0.0	0.0	0.0
39	0.1	1502.8	0.0	0.0	0.	0.	0.0	0.0	0.0
40	26.0	422176.1	0.0	0.0	0.	0.	0.0	0.0	0.0
41	24.0	380517.8	0.0	0.0	0.	0.	0.0	0.0	0.0
42	1.3	18823.4	0.0	0.0	0.	0.	0.0	0.0	0.0
43	27.3	375359.8	0.0	0.0	0.	0.	0.0	0.0	0.0
44	23.5	284162.9	0.0	0.0	0.	0.	0.0	0.0	0.0
45	4.8	54223.9	0.0	0.0	0.	0.	0.0	0.0	0.0
46	6.2	65237.5	0.0	0.0	0.	0.	0.0	0.0	0.0
47	13.2	116223.4	0.0	0.0	0.	0.	0.0	0.0	0.0
48	3.8	26767.3	0.0	0.0	0.	0.	0.0	0.0	0.0
49	12.4	60338.7	0.0	0.0	0.	0.	0.0	0.0	0.0
50	16.4	25532.7	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	240.140	443.054
2	252.491	438.819
3	576.046	459.952
4	601.275	490.993
5	628.545	520.256
6	656.822	548.548
7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

Factor of Safety
*** 1.502 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	240.140	443.054
2	252.491	438.819
3	576.046	459.952
4	601.275	490.993
5	628.545	520.256
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5	628.545	520.256
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7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

Factor of Safety
*** 1.502 ***

Failure Surface Specified By 9 Coordinate Points

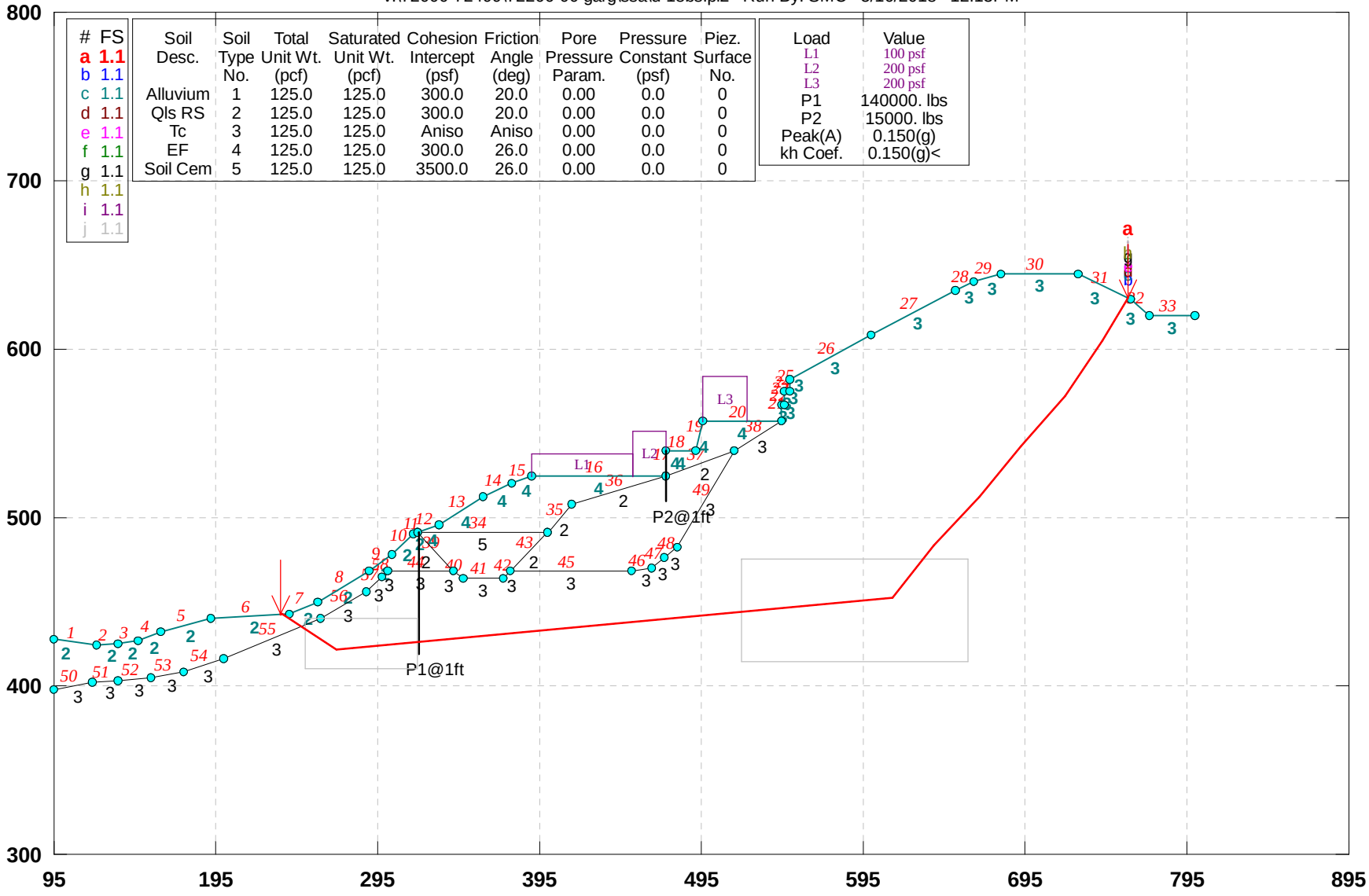
Point No.	X-Surf (ft)	Y-Surf (ft)
1	240.140	443.054
2	252.491	438.819
3	576.046	459.952
4	601.275	490.993
5	628.545	520.256
6	656.822	548.548
7	676.219	583.530
8	692.406	620.108
9	708.818	645.000

Factor of Safety
*** 1.502 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-18bs.pl2 Run By: SMC 5/16/2018 12:13PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-2.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:13PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-18bs.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18bs.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-18bs.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been

Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 40.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	250.00	425.00	320.00	425.00	30.00
2	520.00	445.00	660.00	445.00	60.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	235.473	442.717
2	235.732	442.545
3	269.564	421.204
4	613.199	452.731
5	638.664	483.578
6	666.740	512.069
7	692.470	542.695
8	719.372	572.297
9	742.755	604.751
10	758.599	630.657

Factor of Safety
*** 1.059 ***

Individual data on the 53 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.3	3.0	0.0	0.0	0.	0.	0.5	0.0	0.0
2	4.3	889.4	0.0	0.0	0.	0.	133.4	0.0	0.0
3	7.6	6695.8	0.0	0.0	0.	0.	1004.4	0.0	0.0
4	10.4	21033.1	0.0	0.0	0.	0.	3155.0	0.0	0.0
5	2.0	5673.7	0.0	0.0	0.	0.	851.0	0.0	0.0
6	9.6	35378.3	0.0	0.0	0.	0.	5306.7	0.0	0.0
7	18.4	91352.0	0.0	0.0	0.	0.	13702.8	0.0	0.0
8	2.0	11112.5	0.0	0.0	0.	0.	1666.9	0.0	0.0
9	8.0	47411.0	0.0	0.0	0.	0.	7111.7	0.0	0.0
10	3.0	19063.1	0.0	0.0	0.	0.	2859.5	0.0	0.0
11	3.0	19763.5	0.0	0.0	0.	0.	2964.5	0.0	0.0
12	13.0	95940.2	0.0	0.0	0.	0.	14391.0	0.0	0.0
13	3.0	24302.3	0.0	0.0	0.	0.	3645.3	0.0	0.0
14	13.0	108992.3	0.0	0.0	0.	0.	16348.9	0.0	0.0
15	9.0	80133.4	0.0	0.0	0.	0.	12020.0	0.0	0.0
16	6.0	56239.5	0.0	0.0	0.	0.	8435.9	0.0	0.0
17	12.0	119240.6	0.0	0.0	0.	0.	17886.1	0.0	0.0
18	13.0	137786.0	0.0	0.0	0.	0.	20667.9	0.0	0.0
19	4.0	43894.7	0.0	0.0	0.	0.	6584.2	0.0	0.0
20	1.0	11083.9	0.0	0.0	0.	0.	1662.6	0.0	0.0
21	12.0	136195.4	0.0	0.0	0.	0.	20429.3	0.0	0.0
22	10.0	115359.7	0.0	0.0	0.	0.	17304.0	0.0	1000.0
23	15.0	170889.3	0.0	0.0	0.	0.	25633.4	0.0	1500.0
24	37.0	410494.7	0.0	0.0	0.	0.	61574.2	0.0	3700.0
25	1.0	10876.6	0.0	0.0	0.	0.	1631.5	0.0	100.0
26	0.1	1087.1	0.0	0.0	0.	0.	163.1	0.0	0.0
27	10.9	117798.2	0.0	0.0	0.	0.	17669.7	0.0	2180.0
28	8.0	85590.5	0.0	0.0	0.	0.	12838.6	0.0	1600.0
29	1.0	10647.2	0.0	0.0	0.	0.	1597.1	0.0	200.0
30	0.1	1157.9	0.0	0.0	0.	0.	173.7	0.0	0.0
31	6.9	86082.6	0.0	0.0	0.	0.	12912.4	0.0	0.0
32	12.0	148408.6	0.0	0.0	0.	0.	22261.3	0.0	0.0

33	4.0	53352.6	0.0	0.0	0.	0.	8002.9	0.0	0.0
34	19.0	271106.4	0.0	0.0	0.	0.	40666.0	0.0	3800.0
35	8.0	112911.5	0.0	0.0	0.	0.	16936.7	0.0	1600.0
36	21.0	292900.8	0.0	0.0	0.	0.	43935.1	0.0	0.0
37	0.1	1444.8	0.0	0.0	0.	0.	216.7	0.0	0.0
38	1.9	28624.2	0.0	0.0	0.	0.	4293.6	0.0	0.0
39	0.1	1555.0	0.0	0.0	0.	0.	233.2	0.0	0.0
40	3.8	60920.0	0.0	0.0	0.	0.	9138.0	0.0	0.0
41	0.1	1644.2	0.0	0.0	0.	0.	246.6	0.0	0.0
42	50.0	911086.6	0.0	0.0	0.	0.	*******	0.0	0.0
43	13.2	262836.8	0.0	0.0	0.	0.	39425.5	0.0	0.0
44	25.5	488000.5	0.0	0.0	0.	0.	73200.1	0.0	0.0
45	13.3	235366.3	0.0	0.0	0.	0.	35304.9	0.0	0.0
46	11.0	185361.0	0.0	0.0	0.	0.	27804.2	0.0	0.0
47	3.7	60957.0	0.0	0.0	0.	0.	9143.6	0.0	0.0
48	13.3	204016.4	0.0	0.0	0.	0.	30602.5	0.0	0.0
49	12.5	171031.8	0.0	0.0	0.	0.	25654.8	0.0	0.0
50	26.9	294258.7	0.0	0.0	0.	0.	44138.8	0.0	0.0
51	8.6	71950.7	0.0	0.0	0.	0.	10792.6	0.0	0.0
52	14.8	86743.5	0.0	0.0	0.	0.	13011.5	0.0	0.0
53	15.8	33006.6	0.0	0.0	0.	0.	4951.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	235.473	442.717
2	235.732	442.545
3	269.564	421.204
4	613.199	452.731
5	638.664	483.578
6	666.740	512.069
7	692.470	542.695
8	719.372	572.297
9	742.755	604.751
10	758.599	630.657

Factor of Safety
*** 1.059 ***

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*** 1.059 ***

Failure Surface Specified By 10 Coordinate Points

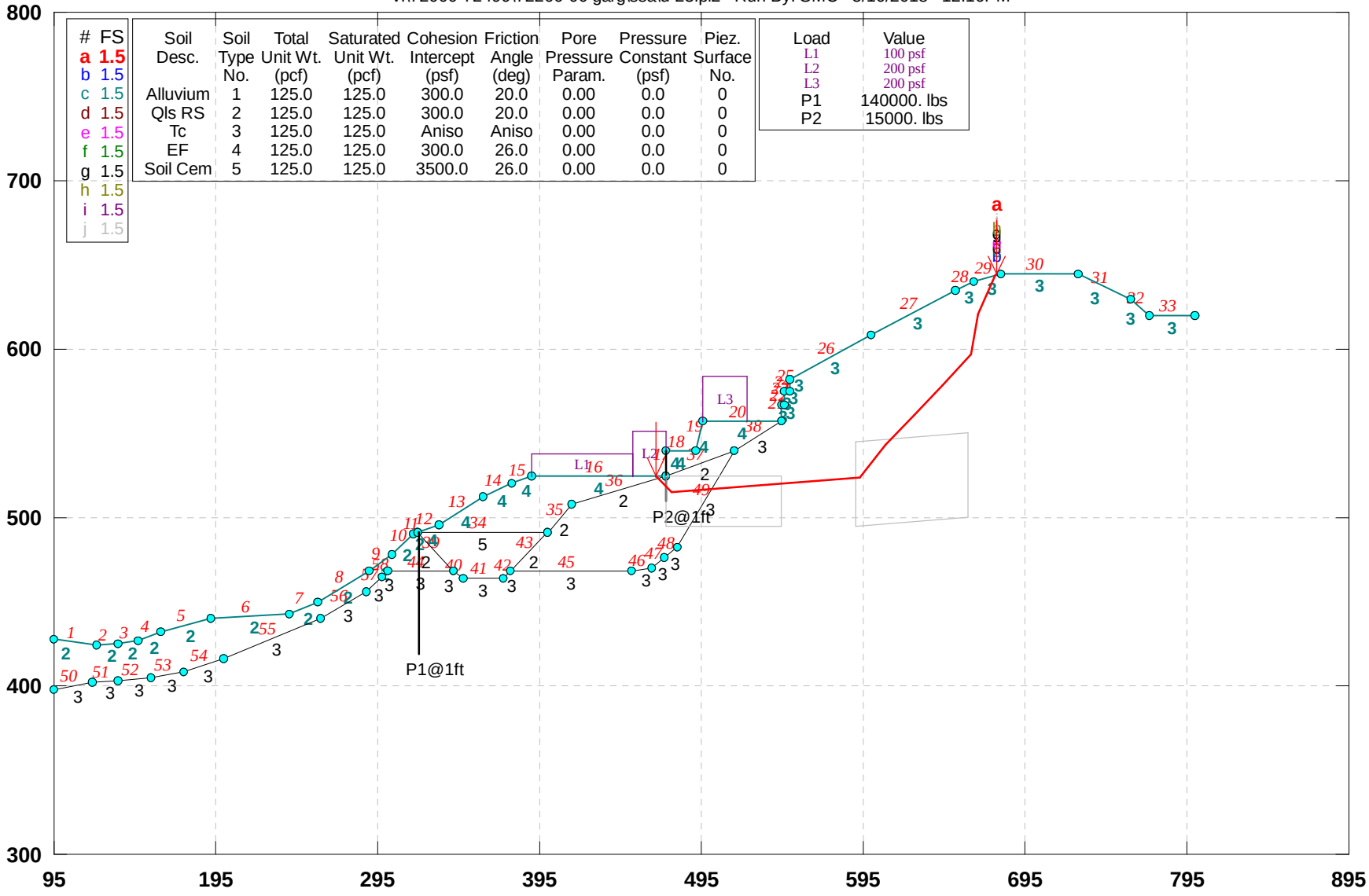
Point No.	X-Surf (ft)	Y-Surf (ft)
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Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        235.473      442.717
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    7        692.470      542.695
    8        719.372      572.297
    9        742.755      604.751
   10        758.599      630.657
       Factor of Safety
      ***    1.059   ***
          **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-23.pl2 Run By: SMC 5/16/2018 12:16PM



#	FS
a	1.5
b	1.5
c	1.5
d	1.5
e	1.5
f	1.5
g	1.5
h	1.5
i	1.5
j	1.5

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls RS	2	125.0	125.0	300.0	20.0	0.00	0.0	0
Tc	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
EF	4	125.0	125.0	300.0	26.0	0.00	0.0	0
Soil Cem	5	125.0	125.0	3500.0	26.0	0.00	0.0	0

Load	Value
L1	100 psf
L2	200 psf
L3	200 psf
P1	140000. lbs
P2	15000. lbs

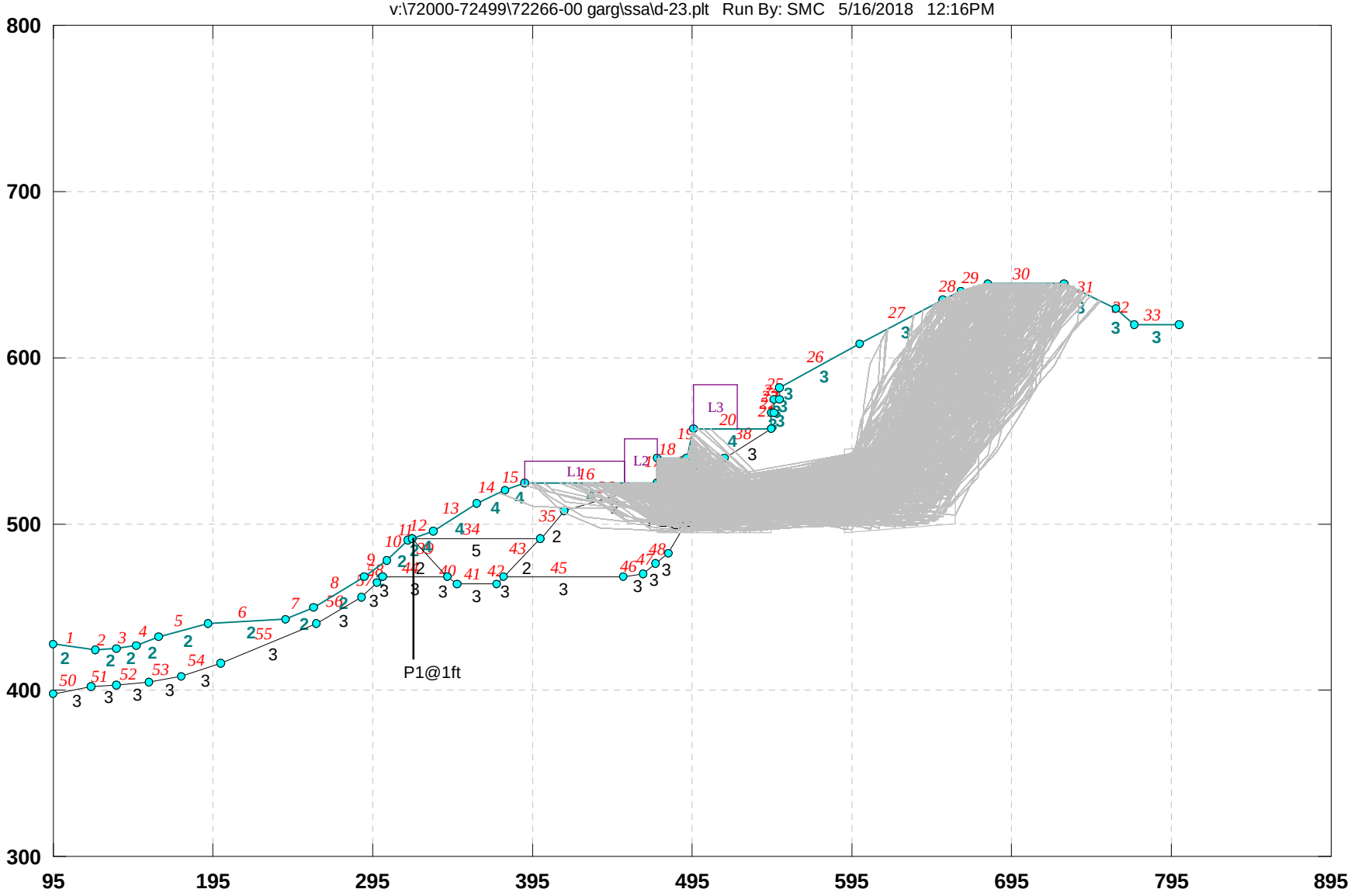
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-1.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-23.plt Run By: SMC 5/16/2018 12:16PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:16PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-23.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of

Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	473.00	510.00	544.00	510.00	30.00
2	590.00	520.00	660.00	525.00	50.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 9999

Number of Trial Failure Surfaces is Greater Than 5000.

Statistical Data on FS Values are Not Generated.

To Generate Stastical Data, Reduce Number of Trial Failure Surfaces to 5000 or less.

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.537	525.000
2	476.636	514.913
3	592.867	524.071
4	609.113	543.073
5	626.645	560.896
6	644.194	578.700
7	661.698	596.551
8	665.818	621.209
9	676.809	643.663
10	677.203	644.177

Factor of Safety

*** 1.466 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.5	134.2	0.0	0.0	0.	0.	0.0	0.0	293.2
2	5.0	2473.4	0.0	0.0	0.	0.	0.0	0.0	999.3
3	0.1	175.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.5	10307.5	0.0	0.0	0.	0.	0.0	0.0	0.0
5	15.4	47018.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	4.0	16109.5	0.0	0.0	0.	0.	0.0	0.0	0.0
7	5.0	25331.4	0.0	0.0	0.	0.	0.0	0.0	1004.1
8	14.0	69224.2	0.0	0.0	0.	0.	0.0	0.0	2795.9
9	8.0	38749.1	0.0	0.0	0.	0.	0.0	0.0	1600.0
10	21.0	98717.2	0.0	0.0	0.	0.	0.0	0.0	0.0
11	0.1	522.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	1.9	11090.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	0.1	632.6	0.0	0.0	0.	0.	0.0	0.0	0.0
14	3.8	25870.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.1	722.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	42.9	379172.8	0.0	0.0	0.	0.	0.0	0.0	0.0
17	7.1	69461.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	9.1	82730.0	0.0	0.0	0.	0.	0.0	0.0	0.0
19	17.5	143097.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	17.5	124147.6	0.0	0.0	0.	0.	0.0	0.0	0.0
21	7.8	49072.0	0.0	0.0	0.	0.	0.0	0.0	0.0
22	9.7	55274.4	0.0	0.0	0.	0.	0.0	0.0	0.0
23	1.3	6390.8	0.0	0.0	0.	0.	0.0	0.0	0.0
24	2.8	9734.9	0.0	0.0	0.	0.	0.0	0.0	0.0
25	11.0	13752.4	0.0	0.0	0.	0.	0.0	0.0	0.0
26	0.4	9.8	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
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2	476.636	514.913
3	592.867	524.071
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```
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    9         676.809      643.663
   10         677.203      644.177
       Factor of Safety
      ***    1.466   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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    3         592.867      524.071
    4         609.113      543.073
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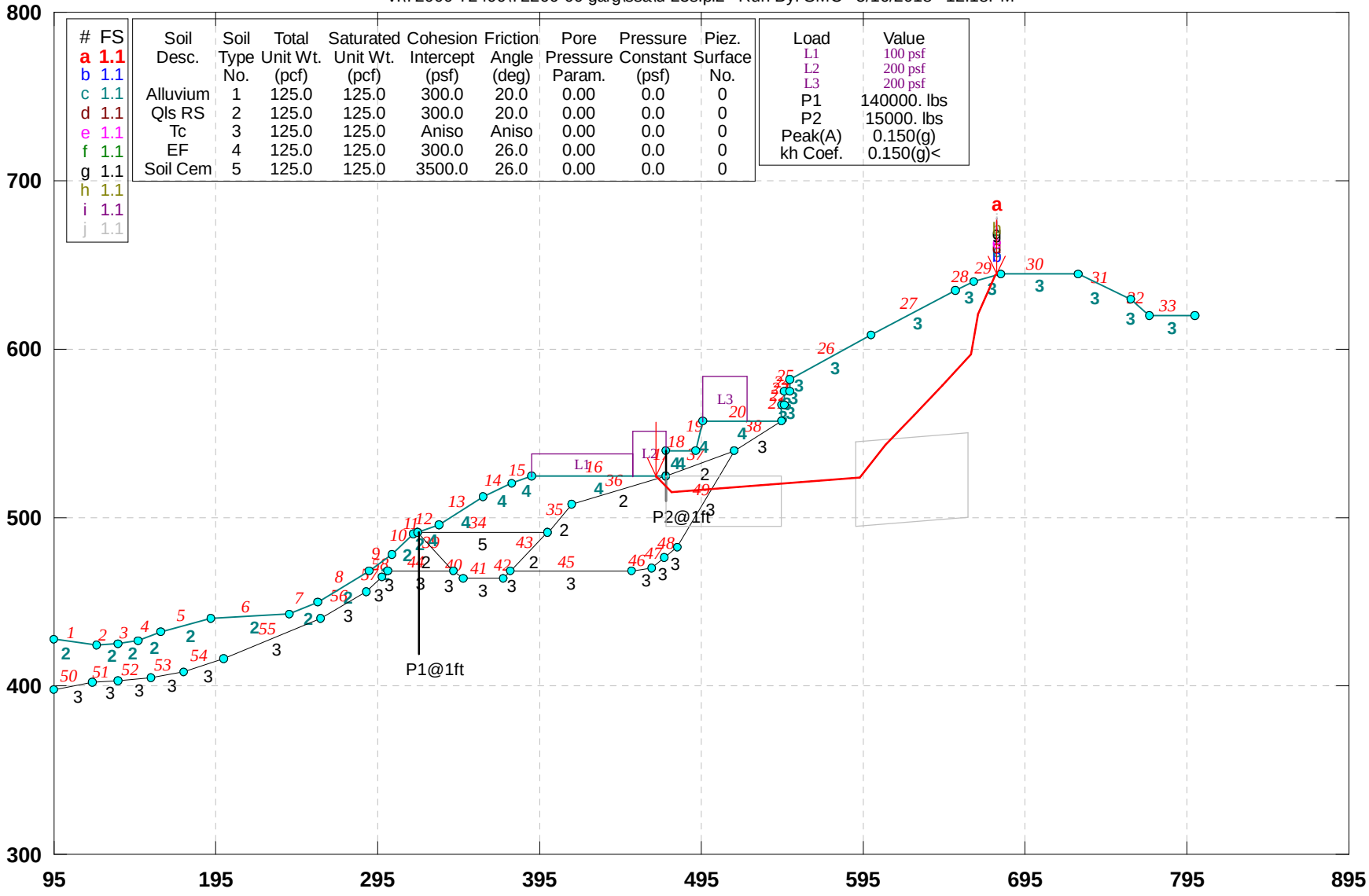
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Factor of Safety
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**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-23s.pl2 Run By: SMC 5/16/2018 12:18PM



#	FS
a	1.1
b	1.1
c	1.1
d	1.1
e	1.1
f	1.1
g	1.1
h	1.1
i	1.1
j	1.1

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls RS	2	125.0	125.0	300.0	20.0	0.00	0.0	0
Tc	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
EF	4	125.0	125.0	300.0	26.0	0.00	0.0	0
Soil Cem	5	125.0	125.0	3500.0	26.0	0.00	0.0	0

Load	Value
L1	100 psf
L2	200 psf
L3	200 psf
P1	140000. lbs
P2	15000. lbs
Peak(A)	0.150(g)
kh Coef.	0.150(g)<

GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-3.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:18PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-23s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-23s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been

Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	473.00	510.00	544.00	510.00	30.00
2	590.00	520.00	660.00	525.00	50.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.537	525.000
2	476.636	514.913
3	592.867	524.071
4	609.113	543.073
5	626.645	560.896
6	644.194	578.700
7	661.698	596.551
8	665.818	621.209
9	676.809	643.663
10	677.203	644.177

Factor of Safety
*** 1.071 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.5	134.2	0.0	0.0	0.	0.	20.1	0.0	293.2
2	5.0	2473.4	0.0	0.0	0.	0.	371.0	0.0	999.3
3	0.1	175.1	0.0	0.0	0.	0.	26.3	0.0	0.0
4	3.5	10307.5	0.0	0.0	0.	0.	1546.1	0.0	0.0
5	15.4	47018.2	0.0	0.0	0.	0.	7052.7	0.0	0.0
6	4.0	16109.5	0.0	0.0	0.	0.	2416.4	0.0	0.0
7	5.0	25331.4	0.0	0.0	0.	0.	3799.7	0.0	1004.1
8	14.0	69224.2	0.0	0.0	0.	0.	10383.6	0.0	2795.9
9	8.0	38749.1	0.0	0.0	0.	0.	5812.4	0.0	1600.0
10	21.0	98717.2	0.0	0.0	0.	0.	14807.6	0.0	0.0
11	0.1	522.1	0.0	0.0	0.	0.	78.3	0.0	0.0
12	1.9	11090.6	0.0	0.0	0.	0.	1663.6	0.0	0.0
13	0.1	632.6	0.0	0.0	0.	0.	94.9	0.0	0.0
14	3.8	25870.7	0.0	0.0	0.	0.	3880.6	0.0	0.0
15	0.1	722.5	0.0	0.0	0.	0.	108.4	0.0	0.0
16	42.9	379172.8	0.0	0.0	0.	0.	56875.9	0.0	0.0
17	7.1	69461.7	0.0	0.0	0.	0.	10419.3	0.0	0.0
18	9.1	82730.0	0.0	0.0	0.	0.	12409.5	0.0	0.0
19	17.5	143097.2	0.0	0.0	0.	0.	21464.6	0.0	0.0
20	17.5	124147.6	0.0	0.0	0.	0.	18622.1	0.0	0.0
21	7.8	49072.0	0.0	0.0	0.	0.	7360.8	0.0	0.0
22	9.7	55274.4	0.0	0.0	0.	0.	8291.2	0.0	0.0
23	1.3	6390.8	0.0	0.0	0.	0.	958.6	0.0	0.0
24	2.8	9734.9	0.0	0.0	0.	0.	1460.2	0.0	0.0
25	11.0	13752.4	0.0	0.0	0.	0.	2062.9	0.0	0.0
26	0.4	9.8	0.0	0.0	0.	0.	1.5	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

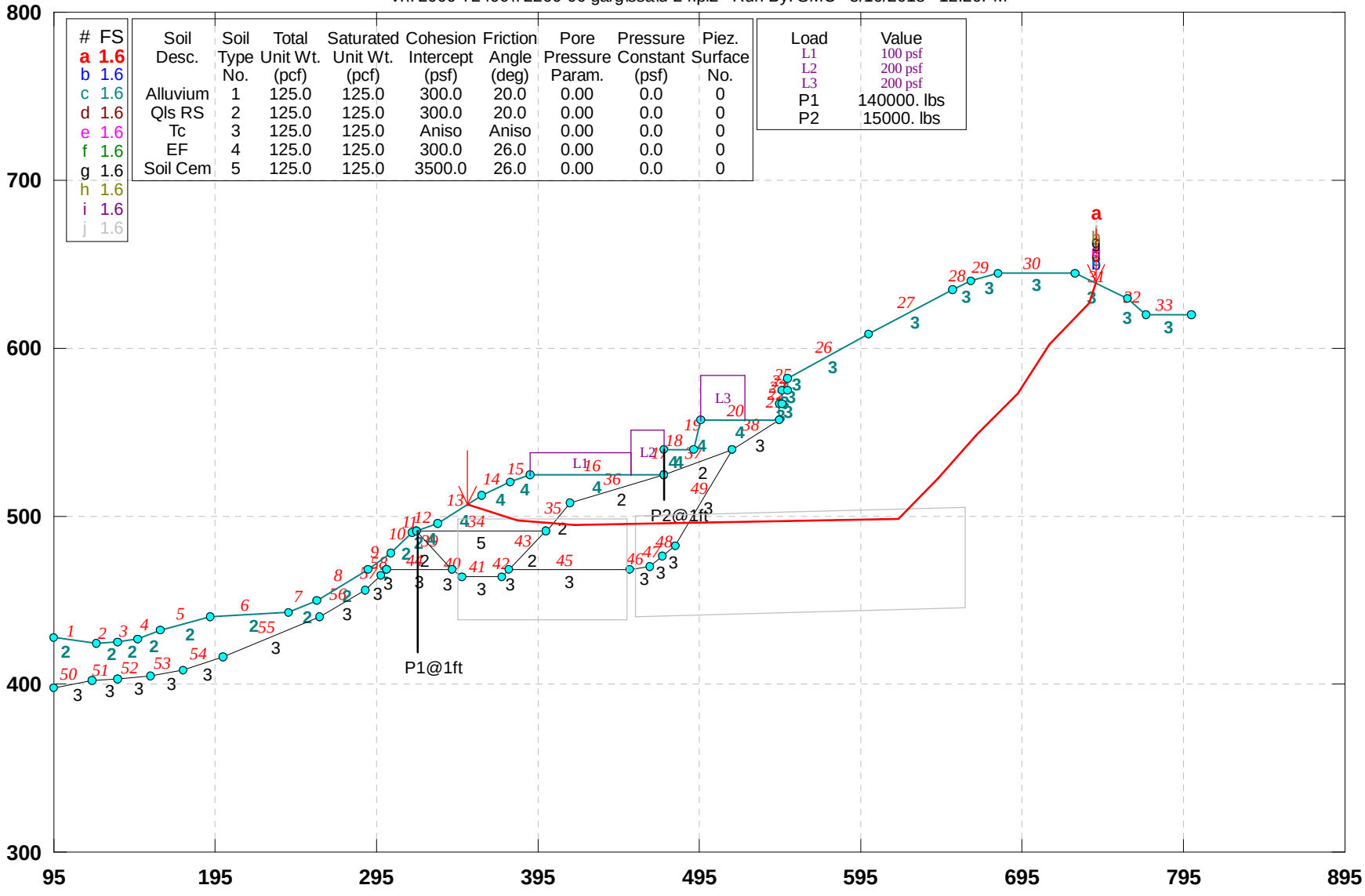
Point No.	X-Surf (ft)	Y-Surf (ft)
1	466.537	525.000
2	476.636	514.913
3	592.867	524.071

```
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
       Factor of Safety
      ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
       Factor of Safety
      ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
       Factor of Safety
      ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
       Factor of Safety
      ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
       Factor of Safety
      ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
```

```
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
        Factor of Safety
       ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
        Factor of Safety
       ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
        Factor of Safety
       ***    1.071   ***
Failure Surface Specified By 10 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        466.537      525.000
    2        476.636      514.913
    3        592.867      524.071
    4        609.113      543.073
    5        626.645      560.896
    6        644.194      578.700
    7        661.698      596.551
    8        665.818      621.209
    9        676.809      643.663
   10        677.203      644.177
        Factor of Safety
       ***    1.071   ***
           **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-24.pl2 Run By: SMC 5/16/2018 12:20PM



#	FS
a	1.6
b	1.6
c	1.6
d	1.6
e	1.6
f	1.6
g	1.6
h	1.6
i	1.6
j	1.6

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls RS	2	125.0	125.0	300.0	20.0	0.00	0.0	0
Tc	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
EF	4	125.0	125.0	300.0	26.0	0.00	0.0	0
Soil Cem	5	125.0	125.0	3500.0	26.0	0.00	0.0	0

Load	Value
L1	100 psf
L2	200 psf
L3	200 psf
P1	140000. lbs
P2	15000. lbs

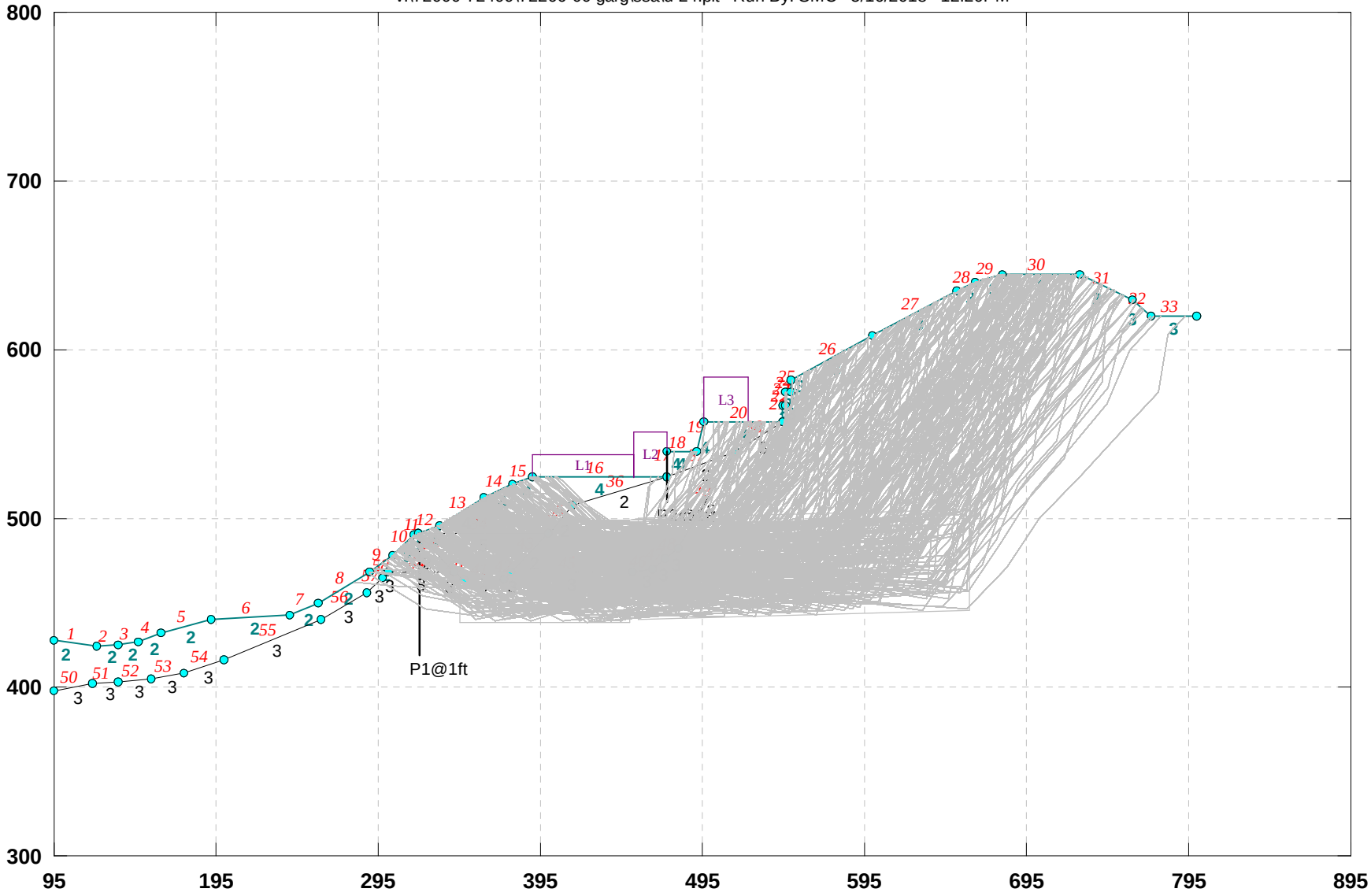
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-4.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-24.plt Run By: SMC 5/16/2018 12:20PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:20PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-24.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of

Sliding Block Is 35.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	345.00	468.00	450.00	468.00	60.00
2	455.00	470.00	660.00	475.00	60.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
4	618.897	497.959
5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety
*** 1.577 ***

Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.5	4134.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	18.0	32744.4	0.0	0.0	0.	0.	0.0	0.0	0.0
3	4.2	11981.8	0.0	0.0	0.	0.	0.0	0.0	0.0
4	7.8	25703.8	0.0	0.0	0.	0.	0.0	0.0	0.0
5	14.8	53159.0	0.0	0.0	0.	0.	0.0	0.0	1480.5
6	10.2	37700.0	0.0	0.0	0.	0.	0.0	0.0	1019.5
7	2.1	7892.7	0.0	0.0	0.	0.	0.0	0.0	210.4
8	35.9	133754.8	0.0	0.0	0.	0.	0.0	0.0	3589.6
9	0.1	369.3	0.0	0.0	0.	0.	0.0	0.0	0.0
10	19.9	73102.6	0.0	0.0	0.	0.	0.0	0.0	3980.0
11	0.1	459.2	0.0	0.0	0.	0.	0.0	0.0	0.0
12	15.3	84629.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	3.6	19543.7	0.0	0.0	0.	0.	0.0	0.0	0.0
14	4.0	26211.0	0.0	0.0	0.	0.	0.0	0.0	0.0
15	19.0	144278.4	0.0	0.0	0.	0.	0.0	0.0	3800.0
16	8.0	60545.5	0.0	0.0	0.	0.	0.0	0.0	1600.0
17	21.0	158358.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.1	814.4	0.0	0.0	0.	0.	0.0	0.0	0.0
19	1.9	16661.6	0.0	0.0	0.	0.	0.0	0.0	0.0
20	0.1	926.5	0.0	0.0	0.	0.	0.0	0.0	0.0
21	3.8	37102.2	0.0	0.0	0.	0.	0.0	0.0	0.0
22	0.1	1019.5	0.0	0.0	0.	0.	0.0	0.0	0.0
23	50.0	610639.4	0.0	0.0	0.	0.	0.0	0.0	0.0
24	18.9	271861.9	0.0	0.0	0.	0.	0.0	0.0	0.0
25	24.5	347500.3	0.0	0.0	0.	0.	0.0	0.0	0.0
26	8.6	113689.1	0.0	0.0	0.	0.	0.0	0.0	0.0
27	11.0	136784.0	0.0	0.0	0.	0.	0.0	0.0	0.0
28	4.3	51348.0	0.0	0.0	0.	0.	0.0	0.0	0.0
29	12.7	139694.5	0.0	0.0	0.	0.	0.0	0.0	0.0
30	12.1	117584.0	0.0	0.0	0.	0.	0.0	0.0	0.0
31	19.9	142985.3	0.0	0.0	0.	0.	0.0	0.0	0.0
32	16.0	69564.6	0.0	0.0	0.	0.	0.0	0.0	0.0
33	8.5	21604.4	0.0	0.0	0.	0.	0.0	0.0	0.0
34	4.6	4037.8	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
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5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
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9	736.501	627.020
10	741.117	638.852

Factor of Safety
*** 1.577 ***

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Factor of Safety
*** 1.577 ***

Failure Surface Specified By 10 Coordinate Points

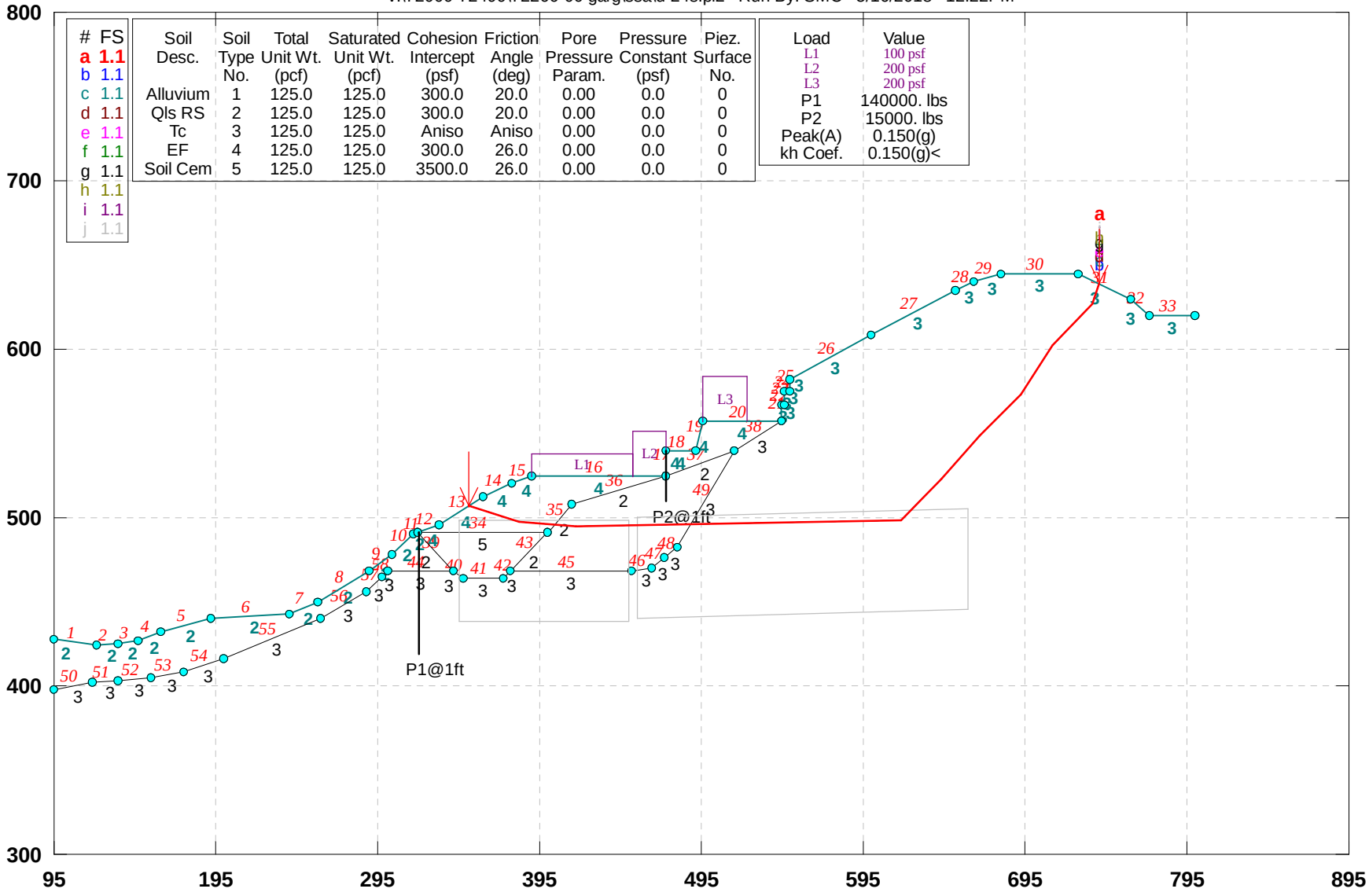
Point No.	X-Surf (ft)	Y-Surf (ft)
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9	736.501	627.020
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Factor of Safety
*** 1.577 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-24s.pl2 Run By: SMC 5/16/2018 12:22PM



#	FS
a	1.1
b	1.1
c	1.1
d	1.1
e	1.1
f	1.1
g	1.1
h	1.1
i	1.1
j	1.1

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Alluvium	1	125.0	125.0	300.0	20.0	0.00	0.0	0
Qls RS	2	125.0	125.0	300.0	20.0	0.00	0.0	0
Tc	3	125.0	125.0	Aniso	Aniso	0.00	0.0	0
EF	4	125.0	125.0	300.0	26.0	0.00	0.0	0
Soil Cem	5	125.0	125.0	3500.0	26.0	0.00	0.0	0

Load	Value
L1	100 psf
L2	200 psf
L3	200 psf
P1	140000. lbs
P2	15000. lbs
Peak(A)	0.150(g)
kh Coef.	0.150(g)<

GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-4.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:22PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-24s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-24s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
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44	301.00	468.00	342.00	468.00	3
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48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
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52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been

Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 35.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	345.00	468.00	450.00	468.00	60.00
2	455.00	470.00	660.00	475.00	60.00

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Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
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Factor of Safety
*** 1.094 ***

Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.5	4134.0	0.0	0.0	0.	0.	620.1	0.0	0.0
2	18.0	32744.4	0.0	0.0	0.	0.	4911.7	0.0	0.0
3	4.2	11981.8	0.0	0.0	0.	0.	1797.3	0.0	0.0
4	7.8	25703.8	0.0	0.0	0.	0.	3855.6	0.0	0.0
5	14.8	53159.0	0.0	0.0	0.	0.	7973.8	0.0	1480.5
6	10.2	37700.0	0.0	0.0	0.	0.	5655.0	0.0	1019.5
7	2.1	7892.7	0.0	0.0	0.	0.	1183.9	0.0	210.4
8	35.9	133754.8	0.0	0.0	0.	0.	20063.2	0.0	3589.6
9	0.1	369.3	0.0	0.0	0.	0.	55.4	0.0	0.0
10	19.9	73102.6	0.0	0.0	0.	0.	10965.4	0.0	3980.0
11	0.1	459.2	0.0	0.0	0.	0.	68.9	0.0	0.0
12	15.3	84629.2	0.0	0.0	0.	0.	12694.4	0.0	0.0
13	3.6	19543.7	0.0	0.0	0.	0.	2931.6	0.0	0.0
14	4.0	26211.0	0.0	0.0	0.	0.	3931.6	0.0	0.0
15	19.0	144278.4	0.0	0.0	0.	0.	21641.8	0.0	3800.0
16	8.0	60545.5	0.0	0.0	0.	0.	9081.8	0.0	1600.0
17	21.0	158358.9	0.0	0.0	0.	0.	23753.8	0.0	0.0
18	0.1	814.4	0.0	0.0	0.	0.	122.2	0.0	0.0
19	1.9	16661.6	0.0	0.0	0.	0.	2499.2	0.0	0.0
20	0.1	926.5	0.0	0.0	0.	0.	139.0	0.0	0.0
21	3.8	37102.2	0.0	0.0	0.	0.	5565.3	0.0	0.0
22	0.1	1019.5	0.0	0.0	0.	0.	152.9	0.0	0.0
23	50.0	610639.4	0.0	0.0	0.	0.	91595.9	0.0	0.0
24	18.9	271861.9	0.0	0.0	0.	0.	40779.3	0.0	0.0
25	24.5	347500.3	0.0	0.0	0.	0.	52125.1	0.0	0.0
26	8.6	113689.1	0.0	0.0	0.	0.	17053.4	0.0	0.0
27	11.0	136784.0	0.0	0.0	0.	0.	20517.6	0.0	0.0
28	4.3	51348.0	0.0	0.0	0.	0.	7702.2	0.0	0.0
29	12.7	139694.5	0.0	0.0	0.	0.	20954.2	0.0	0.0
30	12.1	117584.0	0.0	0.0	0.	0.	17637.6	0.0	0.0
31	19.9	142985.3	0.0	0.0	0.	0.	21447.8	0.0	0.0
32	16.0	69564.6	0.0	0.0	0.	0.	10434.7	0.0	0.0

```
33      8.5   21604.4     0.0     0.0       0.       0.  3240.7     0.0      0.0
34      4.6    4037.8     0.0     0.0       0.       0.   605.7     0.0      0.0
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452     506.935
            2        382.187     497.323
            3        417.104     494.920
            4        618.897     497.959
            5        643.352     522.999
            6        667.348     548.477
            7        692.089     573.234
            8        712.023     602.002
            9        736.501     627.020
           10        741.117     638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452     506.935
            2        382.187     497.323
            3        417.104     494.920
            4        618.897     497.959
            5        643.352     522.999
            6        667.348     548.477
            7        692.089     573.234
            8        712.023     602.002
            9        736.501     627.020
           10        741.117     638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452     506.935
            2        382.187     497.323
            3        417.104     494.920
            4        618.897     497.959
            5        643.352     522.999
            6        667.348     548.477
            7        692.089     573.234
            8        712.023     602.002
            9        736.501     627.020
           10        741.117     638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452     506.935
            2        382.187     497.323
            3        417.104     494.920
            4        618.897     497.959
            5        643.352     522.999
            6        667.348     548.477
            7        692.089     573.234
            8        712.023     602.002
            9        736.501     627.020
           10        741.117     638.852
               Factor of Safety
              ***    1.094   ***
        Failure Surface Specified By 10 Coordinate Points
          Point      X-Surf      Y-Surf
           No.        (ft)        (ft)
            1        351.452     506.935
            2        382.187     497.323
            3        417.104     494.920
            4        618.897     497.959
            5        643.352     522.999
```

6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety

*** 1.094 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
4	618.897	497.959
5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety

*** 1.094 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
4	618.897	497.959
5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety

*** 1.094 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
4	618.897	497.959
5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

Factor of Safety

*** 1.094 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	351.452	506.935
2	382.187	497.323
3	417.104	494.920
4	618.897	497.959
5	643.352	522.999
6	667.348	548.477
7	692.089	573.234
8	712.023	602.002
9	736.501	627.020
10	741.117	638.852

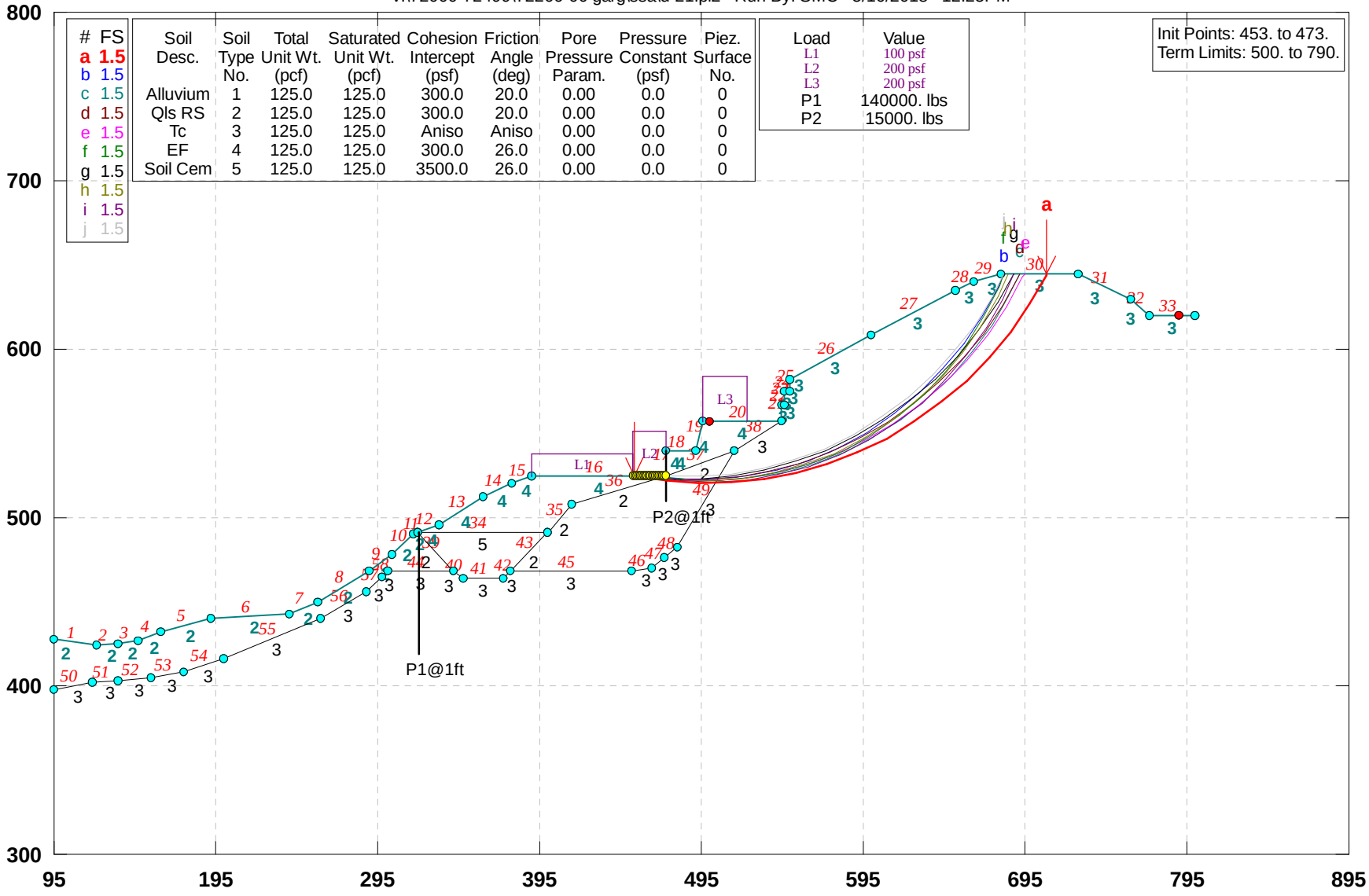
Factor of Safety

*** 1.094 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-21.pl2 Run By: SMC 5/16/2018 12:25PM



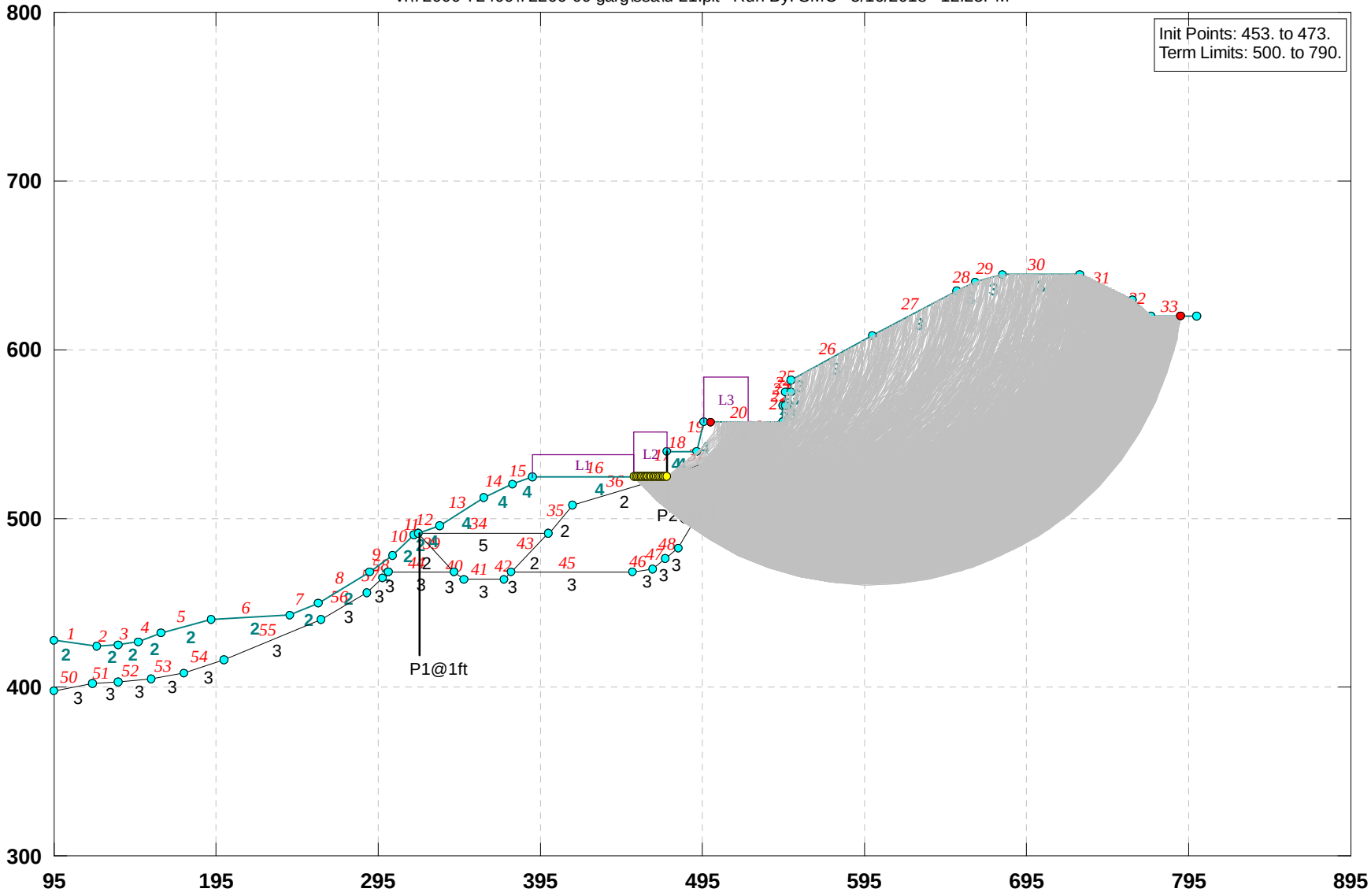
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-5.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-21.plt Run By: SMC 5/16/2018 12:25PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:25PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-21.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
4000 Trial Surfaces Have Been Generated.
200 Surface(s) Initiate(s) From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 453.00(ft)
and X = 473.00(ft)
Each Surface Terminates Between X = 500.00(ft)

and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 4000
Number of Trial Surfaces With Valid FS = 4000
Statistical Data On All Valid FS Values:
FS Max = 4.895 FS Min = 1.467 FS Ave = 2.350
Standard Deviation = 0.455 Coefficient of Variation = 19.37 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	454.053	525.000
2	473.812	521.909
3	493.763	520.501
4	513.761	520.785
5	533.663	522.760
6	553.327	526.412
7	572.611	531.713
8	591.378	538.627
9	609.493	547.103
10	626.827	557.081
11	643.254	568.490
12	658.657	581.247
13	672.926	595.261
14	685.958	610.432
15	697.660	626.651
16	707.949	643.802
17	708.536	645.000

Circle Center At X = 500.406 ; Y = 756.643 ; and Radius = 236.235
Factor of Safety
*** 1.467 ***
Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.4	1492.1	0.0	0.0	0.	0.	0.0	0.0	2470.9
2	6.6	2017.4	0.0	0.0	0.	0.	0.0	0.0	1318.6
3	0.1	130.9	0.0	0.0	0.	0.	0.0	0.0	0.0
4	0.7	1606.0	0.0	0.0	0.	0.	0.0	0.0	0.0
5	18.2	42587.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.8	5108.0	0.0	0.0	0.	0.	0.0	0.0	0.0
7	2.2	8873.2	0.0	0.0	0.	0.	0.0	0.0	0.0
8	7.3	33298.9	0.0	0.0	0.	0.	0.0	0.0	1463.1
9	10.4	47380.9	0.0	0.0	0.	0.	0.0	0.0	2089.1
10	1.2	5600.6	0.0	0.0	0.	0.	0.0	0.0	247.9
11	8.0	35694.6	0.0	0.0	0.	0.	0.0	0.0	1600.0
12	10.7	46342.2	0.0	0.0	0.	0.	0.0	0.0	0.0
13	10.3	43002.0	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.1	466.3	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.9	10004.9	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.1	574.1	0.0	0.0	0.	0.	0.0	0.0	0.0
17	3.8	23549.6	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.1	658.8	0.0	0.0	0.	0.	0.0	0.0	0.0
19	3.3	23604.9	0.0	0.0	0.	0.	0.0	0.0	0.0
20	19.3	143867.3	0.0	0.0	0.	0.	0.0	0.0	0.0
21	18.8	148887.3	0.0	0.0	0.	0.	0.0	0.0	0.0
22	8.6	70173.5	0.0	0.0	0.	0.	0.0	0.0	0.0
23	9.5	77826.1	0.0	0.0	0.	0.	0.0	0.0	0.0
24	17.3	141562.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	16.4	130201.7	0.0	0.0	0.	0.	0.0	0.0	0.0
26	8.7	66273.4	0.0	0.0	0.	0.	0.0	0.0	0.0
27	6.7	48280.3	0.0	0.0	0.	0.	0.0	0.0	0.0
28	4.3	30203.8	0.0	0.0	0.	0.	0.0	0.0	0.0
29	9.9	63366.3	0.0	0.0	0.	0.	0.0	0.0	0.0

30	7.1	39423.0	0.0	0.0	0.	0.	0.0	0.0	0.0
31	6.0	28326.7	0.0	0.0	0.	0.	0.0	0.0	0.0
32	11.7	38703.3	0.0	0.0	0.	0.	0.0	0.0	0.0
33	10.3	12569.7	0.0	0.0	0.	0.	0.0	0.0	0.0
34	0.6	44.0	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.362	522.891
3	502.362	522.727
4	522.282	524.508
5	541.935	528.218
6	561.134	533.822
7	579.697	541.266
8	597.448	550.481
9	614.218	561.378
10	629.849	573.854
11	644.193	587.792
12	657.114	603.058
13	668.488	619.509
14	678.208	636.988
15	681.692	645.000

Circle Center At X = 494.050 ; Y = 727.962 ; and Radius = 205.403

Factor of Safety

*** 1.471 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	465.632	525.000
2	485.489	522.619
3	505.484	522.139
4	525.433	523.566
5	545.155	526.887
6	564.472	532.071
7	583.206	539.071
8	601.190	547.824
9	618.257	558.249
10	634.254	570.253
11	649.035	583.726
12	662.466	598.546
13	674.424	614.577
14	684.801	631.674
15	691.241	645.000

Circle Center At X = 500.508 ; Y = 731.831 ; and Radius = 209.751

Factor of Safety

*** 1.472 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	456.158	525.000
2	476.046	522.891
3	496.043	522.535
4	515.994	523.934
5	535.746	527.078
6	555.145	531.943
7	574.043	538.490
8	592.294	546.669
9	609.757	556.418
10	626.297	567.662
11	641.788	580.312
12	656.109	594.273
13	669.151	609.436
14	680.812	625.685
15	691.003	642.894
16	692.012	645.000

Circle Center At X = 490.137 ; Y = 749.995 ; and Radius = 227.547

Factor of Safety

*** 1.477 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	459.316	525.000
2	479.174	522.619
3	499.165	522.028
4	519.128	523.234
5	538.903	526.227
6	558.330	530.981
7	577.252	537.460
8	595.516	545.610
9	612.975	555.366
10	629.488	566.649
11	644.923	579.368
12	659.154	593.421
13	672.066	608.694
14	683.556	625.064
15	693.531	642.399
16	694.732	645.000

Circle Center At X = 495.777 ; Y = 744.389 ; and Radius = 222.399

Factor of Safety

*** 1.477 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	465.632	525.000
2	485.467	522.441
3	505.461	521.922
4	525.402	523.449
5	545.083	527.005
6	564.298	532.555
7	582.845	540.039
8	600.530	549.379
9	617.168	560.477
10	632.585	573.218
11	646.619	587.467
12	659.124	603.076
13	669.968	619.881
14	679.038	637.706
15	681.853	645.000

Circle Center At X = 500.529 ; Y = 717.316 ; and Radius = 195.457

Factor of Safety

*** 1.478 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	454.053	525.000
2	473.968	523.167
3	493.968	523.071
4	513.901	524.712
5	533.615	528.079
6	552.963	533.145
7	571.797	539.873
8	589.976	548.211
9	607.362	558.097
10	623.824	569.456
11	639.237	582.201
12	653.484	596.237
13	666.458	611.458
14	678.061	627.748
15	688.206	644.984
16	688.213	645.000

Circle Center At X = 485.073 ; Y = 752.932 ; and Radius = 230.033

Factor of Safety

*** 1.479 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	459.316	525.000
2	479.151	522.441
3	499.141	521.805

4	519.099	523.100
5	538.840	526.312
6	558.179	531.412
7	576.936	538.352
8	594.937	547.068
9	612.014	557.479
10	628.007	569.487
11	642.769	582.980
12	656.162	597.834
13	668.060	613.910
14	678.354	631.058
15	684.987	645.000

Circle Center At X = 495.723 ; Y = 729.024 ; and Radius = 207.247

Factor of Safety

*** 1.479 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.273	522.173
3	502.254	521.300
4	522.224	522.388
5	541.992	525.428
6	561.367	530.389
7	580.162	537.225
8	598.198	545.869
9	615.300	556.239
10	631.304	568.234
11	646.055	581.739
12	659.413	596.624
13	671.248	612.746
14	681.447	629.951
15	688.477	645.000

Circle Center At X = 501.157 ; Y = 725.202 ; and Radius = 203.905

Factor of Safety

*** 1.480 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	473.000	525.032
2	492.995	524.581
3	512.947	525.972
4	532.686	529.193
5	552.044	534.217
6	570.858	541.001
7	588.968	549.488
8	606.220	559.606
9	622.468	571.268
10	637.573	584.377
11	651.408	598.820
12	663.855	614.474
13	674.809	631.208
14	682.120	645.000

Circle Center At X = 487.985 ; Y = 741.157 ; and Radius = 216.643

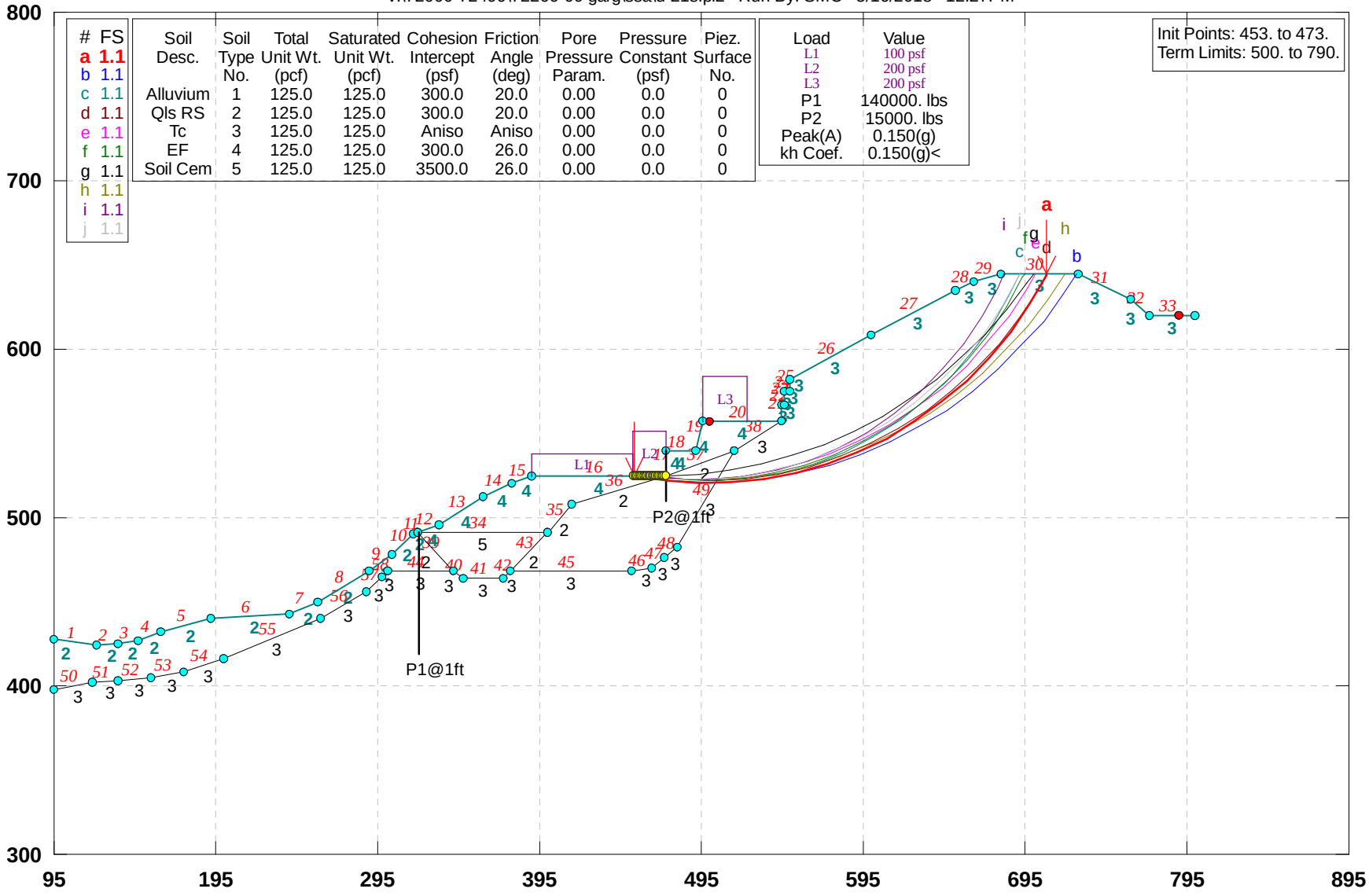
Factor of Safety

*** 1.480 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-21s.pl2 Run By: SMC 5/16/2018 12:27PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-5.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:27PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-21s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-21s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
4000 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 453.00(ft)
and X = 473.00(ft)
Each Surface Terminates Between X = 500.00(ft)
and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 4000
Number of Trial Surfaces With Valid FS = 4000
Statistical Data On All Valid FS Values:
FS Max = 3.540 FS Min = 1.092 FS Ave = 1.695
Standard Deviation = 0.299 Coefficient of Variation = 17.62 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	454.053	525.000
2	473.812	521.909
3	493.763	520.501
4	513.761	520.785
5	533.663	522.760
6	553.327	526.412
7	572.611	531.713
8	591.378	538.627
9	609.493	547.103
10	626.827	557.081
11	643.254	568.490
12	658.657	581.247
13	672.926	595.261
14	685.958	610.432
15	697.660	626.651
16	707.949	643.802
17	708.536	645.000

Circle Center At X = 500.406 ; Y = 756.643 ; and Radius = 236.235

Factor of Safety
*** 1.092 ***

Individual data on the 34 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.4	1492.1	0.0	0.0	0.	0.	223.8	0.0	2470.9
2	6.6	2017.4	0.0	0.0	0.	0.	302.6	0.0	1318.6
3	0.1	130.9	0.0	0.0	0.	0.	19.6	0.0	0.0
4	0.7	1606.0	0.0	0.0	0.	0.	240.9	0.0	0.0
5	18.2	42587.7	0.0	0.0	0.	0.	6388.2	0.0	0.0
6	1.8	5108.0	0.0	0.0	0.	0.	766.2	0.0	0.0
7	2.2	8873.2	0.0	0.0	0.	0.	1331.0	0.0	0.0
8	7.3	33298.9	0.0	0.0	0.	0.	4994.8	0.0	1463.1
9	10.4	47380.9	0.0	0.0	0.	0.	7107.1	0.0	2089.1
10	1.2	5600.6	0.0	0.0	0.	0.	840.1	0.0	247.9
11	8.0	35694.6	0.0	0.0	0.	0.	5354.2	0.0	1600.0
12	10.7	46342.2	0.0	0.0	0.	0.	6951.3	0.0	0.0
13	10.3	43002.0	0.0	0.0	0.	0.	6450.3	0.0	0.0
14	0.1	466.3	0.0	0.0	0.	0.	69.9	0.0	0.0
15	1.9	10004.9	0.0	0.0	0.	0.	1500.7	0.0	0.0
16	0.1	574.1	0.0	0.0	0.	0.	86.1	0.0	0.0
17	3.8	23549.6	0.0	0.0	0.	0.	3532.4	0.0	0.0
18	0.1	658.8	0.0	0.0	0.	0.	98.8	0.0	0.0
19	3.3	23604.9	0.0	0.0	0.	0.	3540.7	0.0	0.0
20	19.3	143867.3	0.0	0.0	0.	0.	21580.1	0.0	0.0
21	18.8	148887.3	0.0	0.0	0.	0.	22333.1	0.0	0.0
22	8.6	70173.5	0.0	0.0	0.	0.	10526.0	0.0	0.0
23	9.5	77826.1	0.0	0.0	0.	0.	11673.9	0.0	0.0
24	17.3	141562.6	0.0	0.0	0.	0.	21234.4	0.0	0.0
25	16.4	130201.7	0.0	0.0	0.	0.	19530.3	0.0	0.0

26	8.7	66273.4	0.0	0.0	0.	0.	9941.0	0.0	0.0
27	6.7	48280.3	0.0	0.0	0.	0.	7242.1	0.0	0.0
28	4.3	30203.8	0.0	0.0	0.	0.	4530.6	0.0	0.0
29	9.9	63366.3	0.0	0.0	0.	0.	9504.9	0.0	0.0
30	7.1	39423.0	0.0	0.0	0.	0.	5913.5	0.0	0.0
31	6.0	28326.7	0.0	0.0	0.	0.	4249.0	0.0	0.0
32	11.7	38703.3	0.0	0.0	0.	0.	5805.5	0.0	0.0
33	10.3	12569.7	0.0	0.0	0.	0.	1885.4	0.0	0.0
34	0.6	44.0	0.0	0.0	0.	0.	6.6	0.0	0.0

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	455.105	525.000
2	474.916	522.258
3	494.877	521.009
4	514.876	521.260
5	534.799	523.011
6	554.535	526.251
7	573.972	530.962
8	593.001	537.117
9	611.516	544.682
10	629.410	553.613
11	646.585	563.862
12	662.942	575.370
13	678.391	588.072
14	692.843	601.897
15	706.218	616.767
16	718.440	632.598
17	726.608	645.000

Circle Center At X = 501.526 ; Y = 787.431 ; and Radius = 266.505

Factor of Safety

*** 1.105 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	465.632	525.000
2	485.489	522.619
3	505.484	522.139
4	525.433	523.566
5	545.155	526.887
6	564.472	532.071
7	583.206	539.071
8	601.190	547.824
9	618.257	558.249
10	634.254	570.253
11	649.035	583.726
12	662.466	598.546
13	674.424	614.577
14	684.801	631.674
15	691.241	645.000

Circle Center At X = 500.508 ; Y = 731.831 ; and Radius = 209.751

Factor of Safety

*** 1.107 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.348	522.764
3	502.340	522.191
4	522.310	523.283
5	542.120	526.034
6	561.633	530.424
7	580.712	536.423
8	599.225	543.989
9	617.045	553.069
10	634.047	563.602
11	650.114	575.513
12	665.133	588.719
13	679.001	603.130
14	691.621	618.646

15	702.907	635.158
16	708.492	645.000

Circle Center At X = 499.303 ; Y = 761.682 ; and Radius = 239.530

Factor of Safety

*** 1.107 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	456.158	525.000
2	476.065	523.073
3	496.063	522.775
4	516.018	524.110
5	535.798	527.068
6	555.271	531.630
7	574.307	537.764
8	592.779	545.431
9	610.564	554.579
10	627.544	565.148
11	643.605	577.066
12	658.640	590.254
13	672.550	604.625
14	685.241	620.083
15	696.629	636.524
16	701.529	645.000

Circle Center At X = 489.793 ; Y = 767.087 ; and Radius = 244.413

Factor of Safety

*** 1.108 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	459.316	525.000
2	479.174	522.619
3	499.165	522.028
4	519.128	523.234
5	538.903	526.227
6	558.330	530.981
7	577.252	537.460
8	595.516	545.610
9	612.975	555.366
10	629.488	566.649
11	644.923	579.368
12	659.154	593.421
13	672.066	608.694
14	683.556	625.064
15	693.531	642.399
16	694.732	645.000

Circle Center At X = 495.777 ; Y = 744.389 ; and Radius = 222.399

Factor of Safety

*** 1.109 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	473.000	525.032
2	492.983	525.861
3	512.855	528.124
4	532.512	531.808
5	551.855	536.894
6	570.782	543.357
7	589.196	551.163
8	607.001	560.271
9	624.107	570.635
10	640.423	582.200
11	655.867	594.908
12	670.358	608.693
13	683.821	623.483
14	696.188	639.201
15	700.110	645.000

Circle Center At X = 471.464 ; Y = 803.271 ; and Radius = 278.244

Factor of Safety

*** 1.109 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	463.526	525.000
2	483.442	523.160
3	503.439	522.839
4	523.403	524.037
5	543.218	526.749
6	562.771	530.958
7	581.946	536.641
8	600.635	543.763
9	618.729	552.285
10	636.122	562.157
11	652.716	573.322
12	668.414	585.715
13	683.125	599.264
14	696.764	613.892
15	709.252	629.514
16	719.809	645.000

Circle Center At X = 497.685 ; Y = 785.717 ; and Radius = 262.945

Factor of Safety

*** 1.110 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	462.474	525.000
2	482.362	522.891
3	502.362	522.727
4	522.282	524.508
5	541.935	528.218
6	561.134	533.822
7	579.697	541.266
8	597.448	550.481
9	614.218	561.378
10	629.849	573.854
11	644.193	587.792
12	657.114	603.058
13	668.488	619.509
14	678.208	636.988
15	681.692	645.000

Circle Center At X = 494.050 ; Y = 727.962 ; and Radius = 205.403

Factor of Safety

*** 1.110 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	456.158	525.000
2	476.046	522.891
3	496.043	522.535
4	515.994	523.934
5	535.746	527.078
6	555.145	531.943
7	574.043	538.490
8	592.294	546.669
9	609.757	556.418
10	626.297	567.662
11	641.788	580.312
12	656.109	594.273
13	669.151	609.436
14	680.812	625.685
15	691.003	642.894
16	692.012	645.000

Circle Center At X = 490.137 ; Y = 749.995 ; and Radius = 227.547

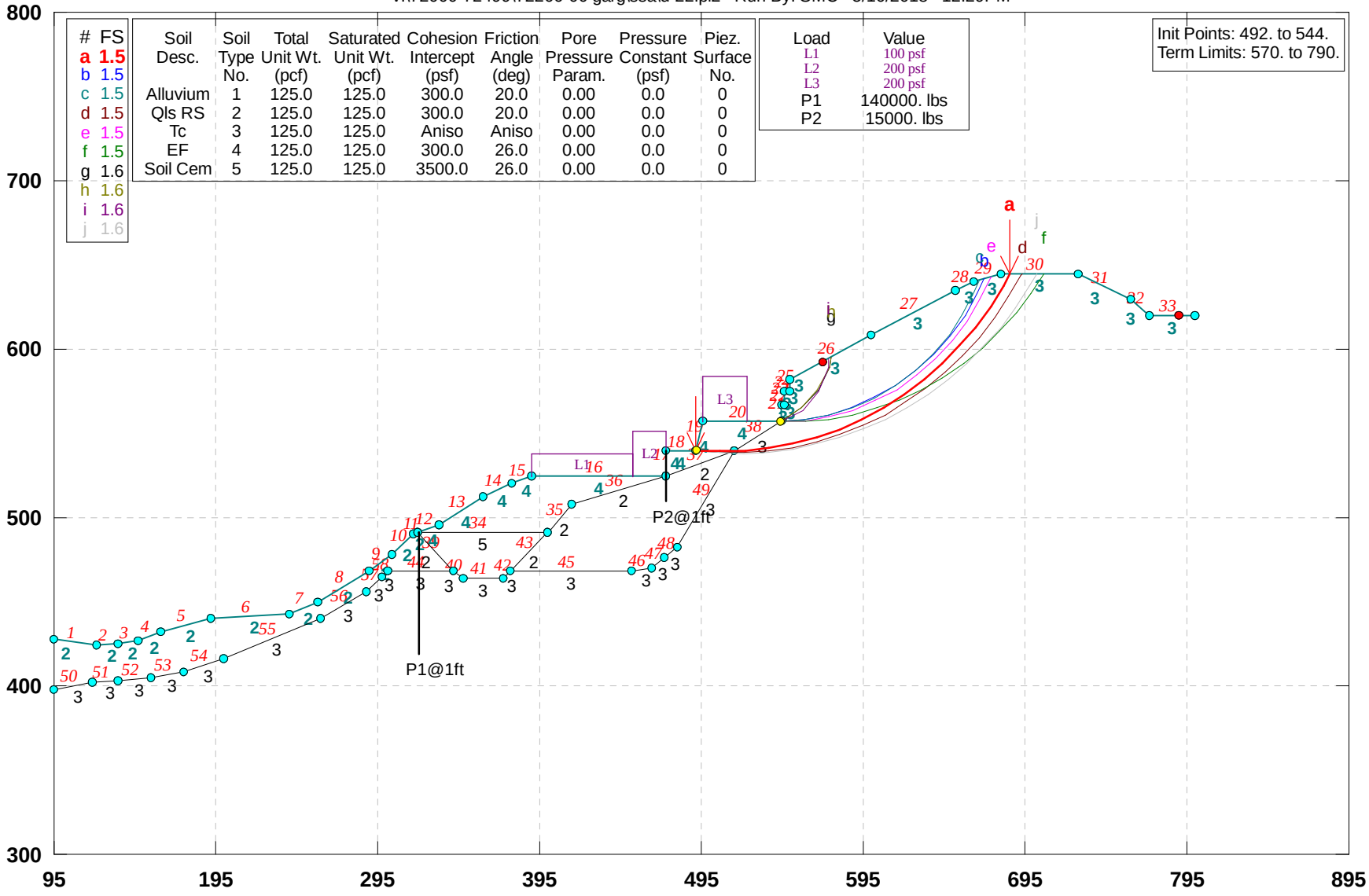
Factor of Safety

*** 1.111 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-22.pl2 Run By: SMC 5/16/2018 12:29PM



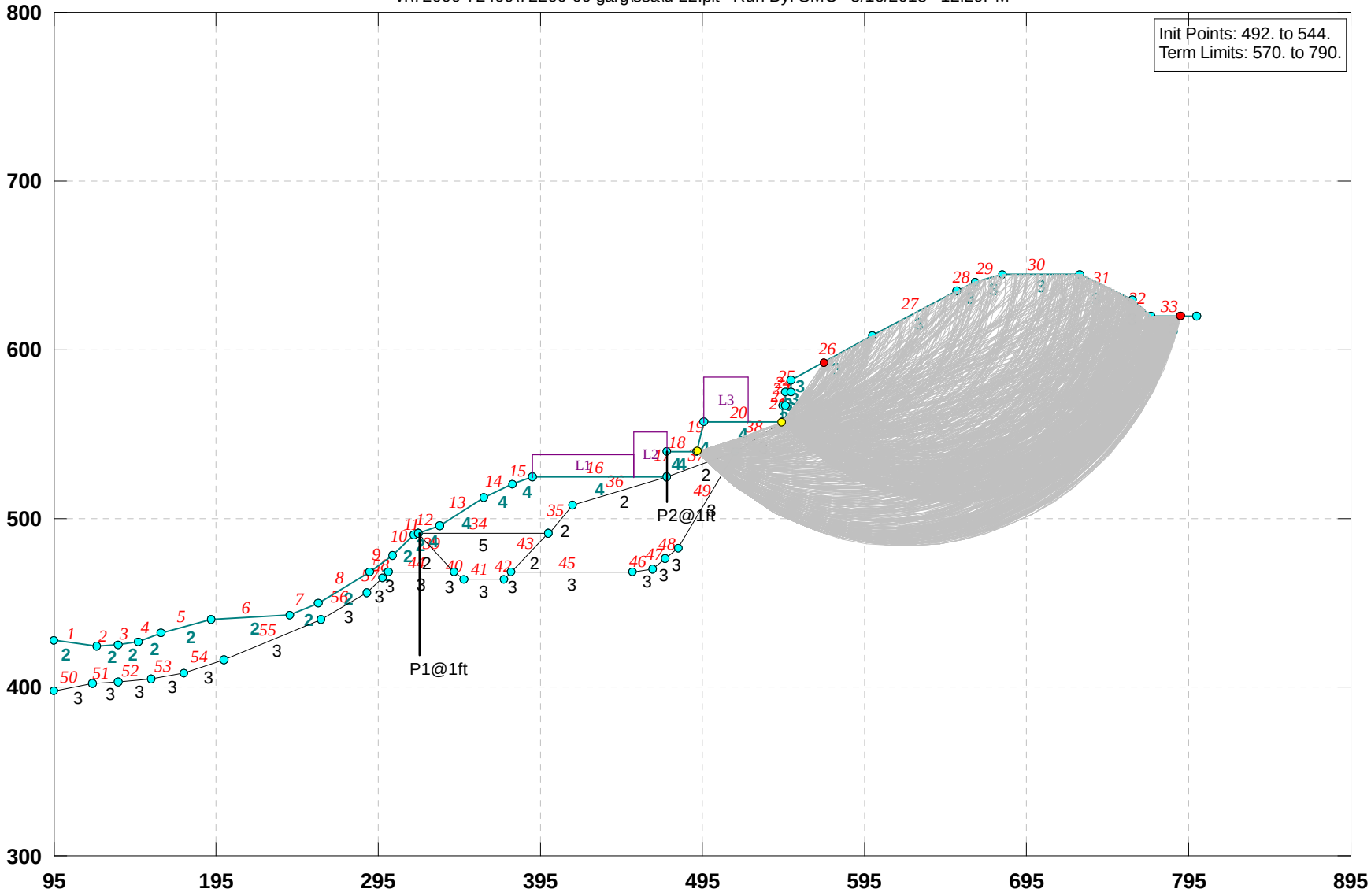
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-6.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-22.plt Run By: SMC 5/16/2018 12:29PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:29PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-22.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.
500 Surface(s) Initiate(s) From Each Of 2 Points Equally Spaced Along The Ground Surface Between X = 492.00(ft)
and X = 544.00(ft)
Each Surface Terminates Between X = 570.00(ft)

and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
15.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 4.693 FS Min = 1.517 FS Ave = 2.532
Standard Deviation = 0.792 Coefficient of Variation = 31.30 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.983	539.287
3	521.977	539.696
4	536.899	541.225
5	551.665	543.865
6	566.192	547.602
7	580.400	552.413
8	594.208	558.273
9	607.539	565.149
10	620.319	573.002
11	632.476	581.789
12	643.943	591.459
13	654.654	601.960
14	664.551	613.232
15	673.577	625.212
16	681.683	637.833
17	685.562	645.000

Circle Center At X = 509.014 ; Y = 739.812 ; and Radius = 200.535
Factor of Safety
*** 1.517 ***
Individual data on the 31 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.0	4297.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2	11.0	23958.9	0.0	0.0	0.	0.	0.0	0.0	2196.6
3	6.5	14361.9	0.0	0.0	0.	0.	0.0	0.0	1303.9
4	1.2	2615.8	0.0	0.0	0.	0.	0.0	0.0	238.9
5	0.3	663.0	0.0	0.0	0.	0.	0.0	0.0	60.6
6	7.0	15175.0	0.0	0.0	0.	0.	0.0	0.0	1395.5
7	1.0	2205.0	0.0	0.0	0.	0.	0.0	0.0	204.5
8	13.9	28644.4	0.0	0.0	0.	0.	0.0	0.0	0.0
9	7.1	13437.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	0.1	243.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.9	5775.5	0.0	0.0	0.	0.	0.0	0.0	0.0
12	0.1	351.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	3.8	15100.5	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.1	436.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.7	8059.0	0.0	0.0	0.	0.	0.0	0.0	0.0
16	14.5	74287.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	14.2	78329.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	13.8	79489.9	0.0	0.0	0.	0.	0.0	0.0	0.0
19	5.8	33832.0	0.0	0.0	0.	0.	0.0	0.0	0.0
20	7.5	44057.7	0.0	0.0	0.	0.	0.0	0.0	0.0
21	12.8	73734.8	0.0	0.0	0.	0.	0.0	0.0	0.0
22	12.2	67337.0	0.0	0.0	0.	0.	0.0	0.0	0.0
23	11.5	59074.4	0.0	0.0	0.	0.	0.0	0.0	0.0
24	8.1	37768.3	0.0	0.0	0.	0.	0.0	0.0	0.0
25	2.7	11593.5	0.0	0.0	0.	0.	0.0	0.0	0.0
26	8.3	32747.3	0.0	0.0	0.	0.	0.0	0.0	0.0
27	1.6	5404.5	0.0	0.0	0.	0.	0.0	0.0	0.0
28	9.0	25456.2	0.0	0.0	0.	0.	0.0	0.0	0.0
29	6.4	11113.7	0.0	0.0	0.	0.	0.0	0.0	0.0

30	1.7	1783.3	0.0	0.0	0.	0.	0.0	0.0	0.0
31	3.9	1737.3	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.952	558.201
3	573.693	560.978
4	588.056	565.301
5	601.882	571.120
6	615.013	578.369
7	627.304	586.969
8	638.615	596.821
9	648.819	607.815
10	657.802	619.828
11	665.463	632.724
12	669.703	641.972

Circle Center At X = 540.319 ; Y = 697.911 ; and Radius = 140.959

Factor of Safety
*** 1.529 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.969	557.963
3	573.735	560.602
4	588.111	564.884
5	601.915	570.754
6	614.971	578.138
7	627.116	586.942
8	638.194	597.055
9	648.066	608.349
10	656.606	620.680
11	663.706	633.893
12	666.569	641.050

Circle Center At X = 543.115 ; Y = 689.686 ; and Radius = 132.689

Factor of Safety
*** 1.541 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.946	538.732
3	521.946	538.588
4	536.913	539.571
5	551.765	541.675
6	566.417	544.887
7	580.787	549.189
8	594.793	554.558
9	608.357	560.963
10	621.402	568.367
11	633.855	576.730
12	645.644	586.004
13	656.705	596.136
14	666.974	607.070
15	676.394	618.743
16	684.911	631.091
17	692.477	644.043
18	692.944	645.000

Circle Center At X = 516.371 ; Y = 738.138 ; and Radius = 199.631

Factor of Safety
*** 1.543 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.983	557.708
3	573.804	560.018
4	588.292	563.906
5	602.279	569.324

6	615.604	576.212
7	628.114	584.489
8	639.663	594.060
9	650.120	604.815
10	659.362	616.629
11	667.284	629.367
12	673.794	642.880
13	673.911	643.209

Circle Center At X = 544.912 ; Y = 696.643 ; and Radius = 139.646

Factor of Safety

*** 1.545 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.999	557.127
3	573.938	558.480
4	588.717	561.049
5	603.236	564.816
6	617.399	569.758
7	631.110	575.840
8	644.279	583.022
9	656.817	591.256
10	668.640	600.488
11	679.669	610.654
12	689.831	621.688
13	699.057	633.515
14	706.593	645.000

Circle Center At X = 549.979 ; Y = 740.160 ; and Radius = 183.257

Factor of Safety

*** 1.548 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	556.680	565.013
3	566.913	575.981
4	574.028	589.186
5	575.499	595.260

Circle Center At X = 519.274 ; Y = 610.168 ; and Radius = 58.636

Factor of Safety

*** 1.554 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	556.667	565.034
3	566.893	576.008
4	574.013	589.211
5	575.487	595.253

Circle Center At X = 519.057 ; Y = 610.329 ; and Radius = 58.874

Factor of Safety

*** 1.554 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	557.337	563.864
3	567.469	574.925
4	573.140	588.812
5	573.319	594.126

Circle Center At X = 531.476 ; Y = 597.724 ; and Radius = 42.606

Factor of Safety

*** 1.554 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.938	538.642
3	521.935	538.346

4	536.916	539.114
5	551.804	540.942
6	566.525	543.820
7	581.006	547.735
8	595.172	552.666
9	608.953	558.588
10	622.280	565.473
11	635.085	573.284
12	647.305	581.984
13	658.877	591.528
14	669.744	601.867
15	679.851	612.952
16	689.146	624.724
17	697.584	637.126
18	702.161	645.000

Circle Center At X = 518.664 ; Y = 749.452 ; and Radius = 211.142

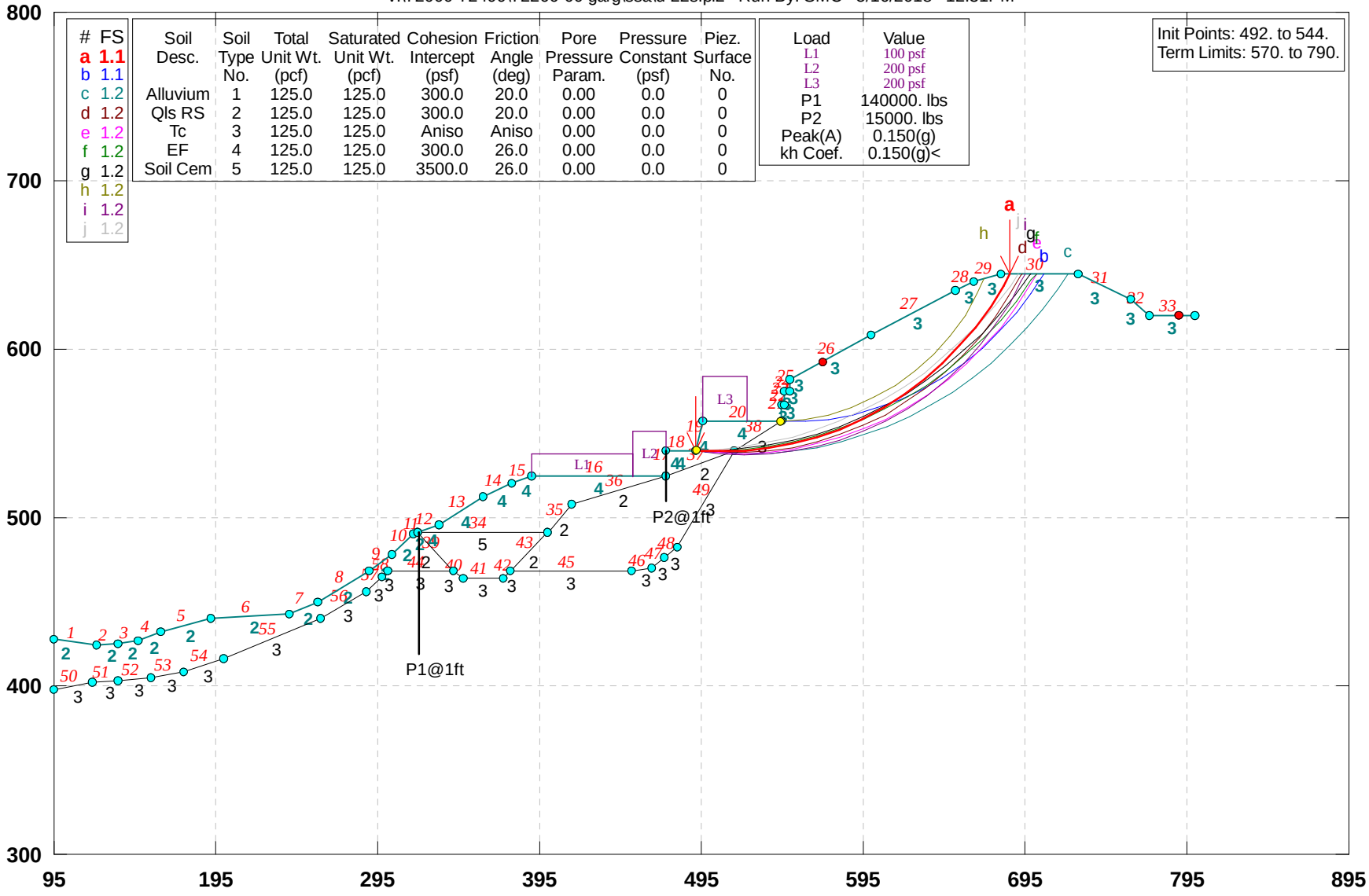
Factor of Safety

*** 1.555 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-22s.pl2 Run By: SMC 5/16/2018 12:31PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-6.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:31PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-22s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-22s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
1000 Trial Surfaces Have Been Generated.

500 Surface(s) Initiate(s) From Each Of 2 Points Equally Spaced
Along The Ground Surface Between X = 492.00(ft)
and X = 544.00(ft)
Each Surface Terminates Between X = 570.00(ft)
and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
15.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 1000
Number of Trial Surfaces With Valid FS = 1000
Statistical Data On All Valid FS Values:
FS Max = 2.858 FS Min = 1.142 FS Ave = 1.763
Standard Deviation = 0.435 Coefficient of Variation = 24.69 %
Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.983	539.287
3	521.977	539.696
4	536.899	541.225
5	551.665	543.865
6	566.192	547.602
7	580.400	552.413
8	594.208	558.273
9	607.539	565.149
10	620.319	573.002
11	632.476	581.789
12	643.943	591.459
13	654.654	601.960
14	664.551	613.232
15	673.577	625.212
16	681.683	637.833
17	685.562	645.000

Circle Center At X = 509.014 ; Y = 739.812 ; and Radius = 200.535
Factor of Safety
*** 1.142 ***
Individual data on the 31 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.0	4297.6	0.0	0.0	0.	0.	644.6	0.0	0.0
2	11.0	23958.9	0.0	0.0	0.	0.	3593.8	0.0	2196.6
3	6.5	14361.9	0.0	0.0	0.	0.	2154.3	0.0	1303.9
4	1.2	2615.8	0.0	0.0	0.	0.	392.4	0.0	238.9
5	0.3	663.0	0.0	0.0	0.	0.	99.4	0.0	60.6
6	7.0	15175.0	0.0	0.0	0.	0.	2276.2	0.0	1395.5
7	1.0	2205.0	0.0	0.0	0.	0.	330.7	0.0	204.5
8	13.9	28644.4	0.0	0.0	0.	0.	4296.7	0.0	0.0
9	7.1	13437.9	0.0	0.0	0.	0.	2015.7	0.0	0.0
10	0.1	243.6	0.0	0.0	0.	0.	36.5	0.0	0.0
11	1.9	5775.5	0.0	0.0	0.	0.	866.3	0.0	0.0
12	0.1	351.6	0.0	0.0	0.	0.	52.7	0.0	0.0
13	3.8	15100.5	0.0	0.0	0.	0.	2265.1	0.0	0.0
14	0.1	436.7	0.0	0.0	0.	0.	65.5	0.0	0.0
15	1.7	8059.0	0.0	0.0	0.	0.	1208.8	0.0	0.0
16	14.5	74287.9	0.0	0.0	0.	0.	11143.2	0.0	0.0
17	14.2	78329.7	0.0	0.0	0.	0.	11749.5	0.0	0.0
18	13.8	79489.9	0.0	0.0	0.	0.	11923.5	0.0	0.0
19	5.8	33832.0	0.0	0.0	0.	0.	5074.8	0.0	0.0
20	7.5	44057.7	0.0	0.0	0.	0.	6608.7	0.0	0.0
21	12.8	73734.8	0.0	0.0	0.	0.	11060.2	0.0	0.0
22	12.2	67337.0	0.0	0.0	0.	0.	10100.6	0.0	0.0
23	11.5	59074.4	0.0	0.0	0.	0.	8861.2	0.0	0.0
24	8.1	37768.3	0.0	0.0	0.	0.	5665.2	0.0	0.0
25	2.7	11593.5	0.0	0.0	0.	0.	1739.0	0.0	0.0

26	8.3	32747.3	0.0	0.0	0.	0.	4912.1	0.0	0.0
27	1.6	5404.5	0.0	0.0	0.	0.	810.7	0.0	0.0
28	9.0	25456.2	0.0	0.0	0.	0.	3818.4	0.0	0.0
29	6.4	11113.7	0.0	0.0	0.	0.	1667.1	0.0	0.0
30	1.7	1783.3	0.0	0.0	0.	0.	267.5	0.0	0.0
31	3.9	1737.3	0.0	0.0	0.	0.	260.6	0.0	0.0

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.999	557.127
3	573.938	558.480
4	588.717	561.049
5	603.236	564.816
6	617.399	569.758
7	631.110	575.840
8	644.279	583.022
9	656.817	591.256
10	668.640	600.488
11	679.669	610.654
12	689.831	621.688
13	699.057	633.515
14	706.593	645.000

Circle Center At X = 549.979 ; Y = 740.160 ; and Radius = 183.257

Factor of Safety

*** 1.146 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.921	538.464
3	521.910	537.877
4	536.905	538.240
5	551.848	539.552
6	566.677	541.808
7	581.334	544.998
8	595.759	549.111
9	609.895	554.129
10	623.685	560.032
11	637.073	566.797
12	650.005	574.396
13	662.431	582.799
14	674.299	591.972
15	685.562	601.878
16	696.176	612.478
17	706.096	623.729
18	715.284	635.585
19	721.669	645.000

Circle Center At X = 523.682 ; Y = 774.578 ; and Radius = 236.708

Factor of Safety

*** 1.153 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.946	538.732
3	521.946	538.588
4	536.913	539.571
5	551.765	541.675
6	566.417	544.887
7	580.787	549.189
8	594.793	554.558
9	608.357	560.963
10	621.402	568.367
11	633.855	576.730
12	645.644	586.004
13	656.705	596.136
14	666.974	607.070
15	676.394	618.743
16	684.911	631.091

17	692.477	644.043
18	692.944	645.000

Circle Center At X = 516.371 ; Y = 738.138 ; and Radius = 199.631

Factor of Safety

*** 1.159 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.938	538.642
3	521.935	538.346
4	536.916	539.114
5	551.804	540.942
6	566.525	543.820
7	581.006	547.735
8	595.172	552.666
9	608.953	558.588
10	622.280	565.473
11	635.085	573.284
12	647.305	581.984
13	658.877	591.528
14	669.744	601.867
15	679.851	612.952
16	689.146	624.724
17	697.584	637.126
18	702.161	645.000

Circle Center At X = 518.664 ; Y = 749.452 ; and Radius = 211.142

Factor of Safety

*** 1.160 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.999	539.805
3	521.981	540.541
4	536.888	542.206
5	551.663	544.794
6	566.249	548.294
7	580.589	552.693
8	594.629	557.974
9	608.314	564.117
10	621.590	571.097
11	634.408	578.889
12	646.717	587.461
13	658.470	596.781
14	669.622	606.813
15	680.129	617.519
16	689.951	628.856
17	699.050	640.781
18	701.873	645.000

Circle Center At X = 502.729 ; Y = 780.800 ; and Radius = 241.039

Factor of Safety

*** 1.163 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	507.000	540.083
3	521.966	541.091
4	536.841	543.019
5	551.570	545.862
6	566.095	549.607
7	580.361	554.240
8	594.315	559.745
9	607.902	566.099
10	621.072	573.279
11	633.774	581.257
12	645.960	590.004
13	657.584	599.485
14	668.600	609.665

15	678.968	620.505
16	688.648	631.964
17	697.603	643.998
18	698.257	645.000

Circle Center At X = 498.187 ; Y = 782.926 ; and Radius = 243.005

Factor of Safety

*** 1.163 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	544.000	557.000
2	558.952	558.201
3	573.693	560.978
4	588.056	565.301
5	601.882	571.120
6	615.013	578.369
7	627.304	586.969
8	638.615	596.821
9	648.819	607.815
10	657.802	619.828
11	665.463	632.724
12	669.703	641.972

Circle Center At X = 540.319 ; Y = 697.911 ; and Radius = 140.959

Factor of Safety

*** 1.169 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.872	538.046
3	521.852	537.274
4	536.847	537.688
5	551.761	539.286
6	566.503	542.058
7	580.980	545.986
8	595.100	551.046
9	608.777	557.206
10	621.924	564.428
11	634.459	572.666
12	646.304	581.869
13	657.385	591.980
14	667.632	602.934
15	676.981	614.664
16	685.373	627.097
17	692.757	640.154
18	695.012	645.000

Circle Center At X = 524.168 ; Y = 726.562 ; and Radius = 189.315

Factor of Safety

*** 1.171 ***

Failure Surface Specified By 17 Coordinate Points

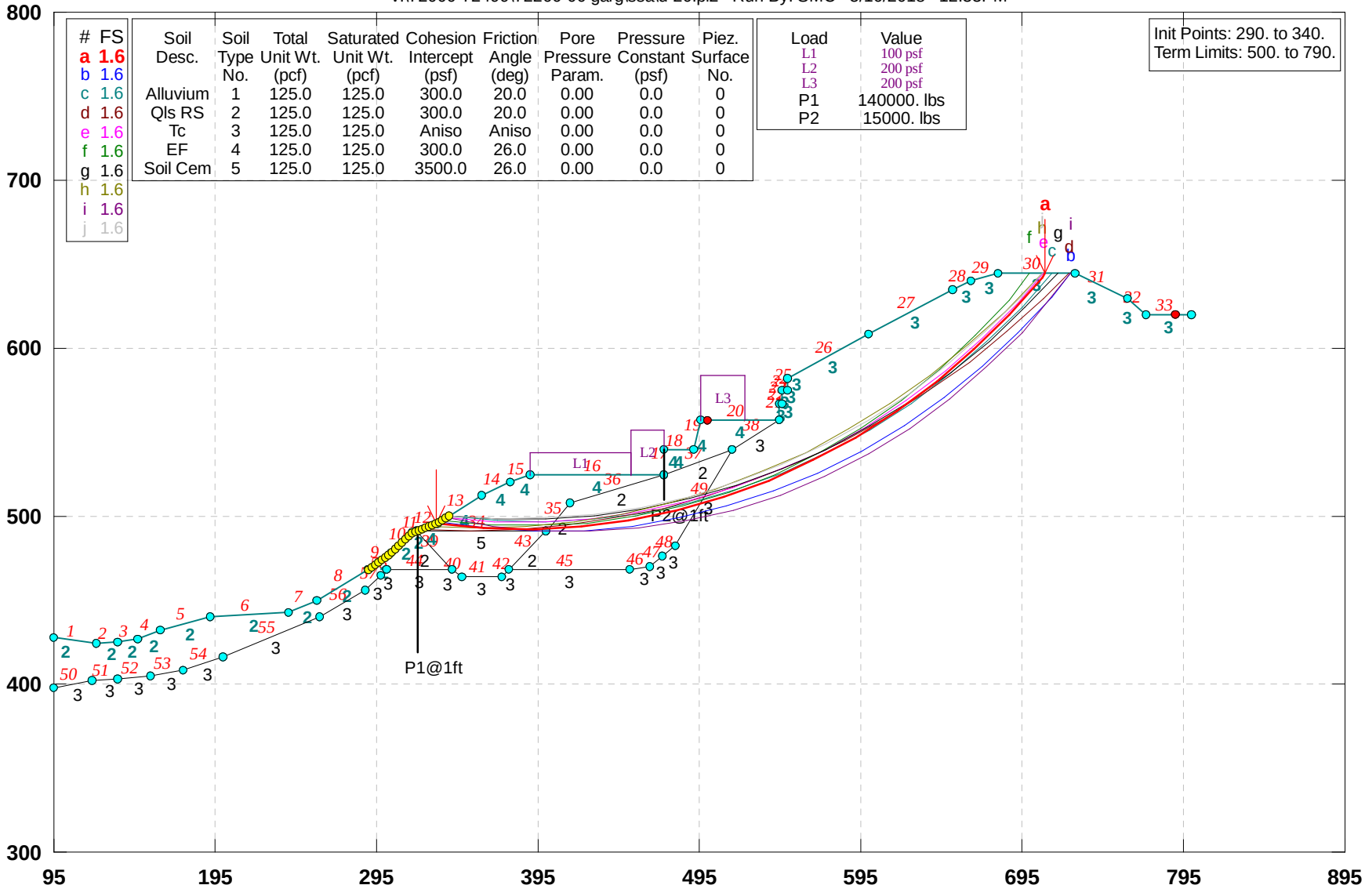
Point No.	X-Surf (ft)	Y-Surf (ft)
1	492.000	540.000
2	506.986	540.650
3	521.905	542.205
4	536.703	544.662
5	551.324	548.009
6	565.716	552.236
7	579.826	557.326
8	593.602	563.262
9	606.993	570.020
10	619.951	577.577
11	632.427	585.904
12	644.376	594.972
13	655.754	604.746
14	666.520	615.191
15	676.633	626.269
16	686.057	637.939
17	691.084	645.000

Circle Center At X = 488.773 ; Y = 787.616 ; and Radius = 247.637

```
 Factor of Safety
***    1.172   ***
    **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-20.pl2 Run By: SMC 5/16/2018 12:33PM



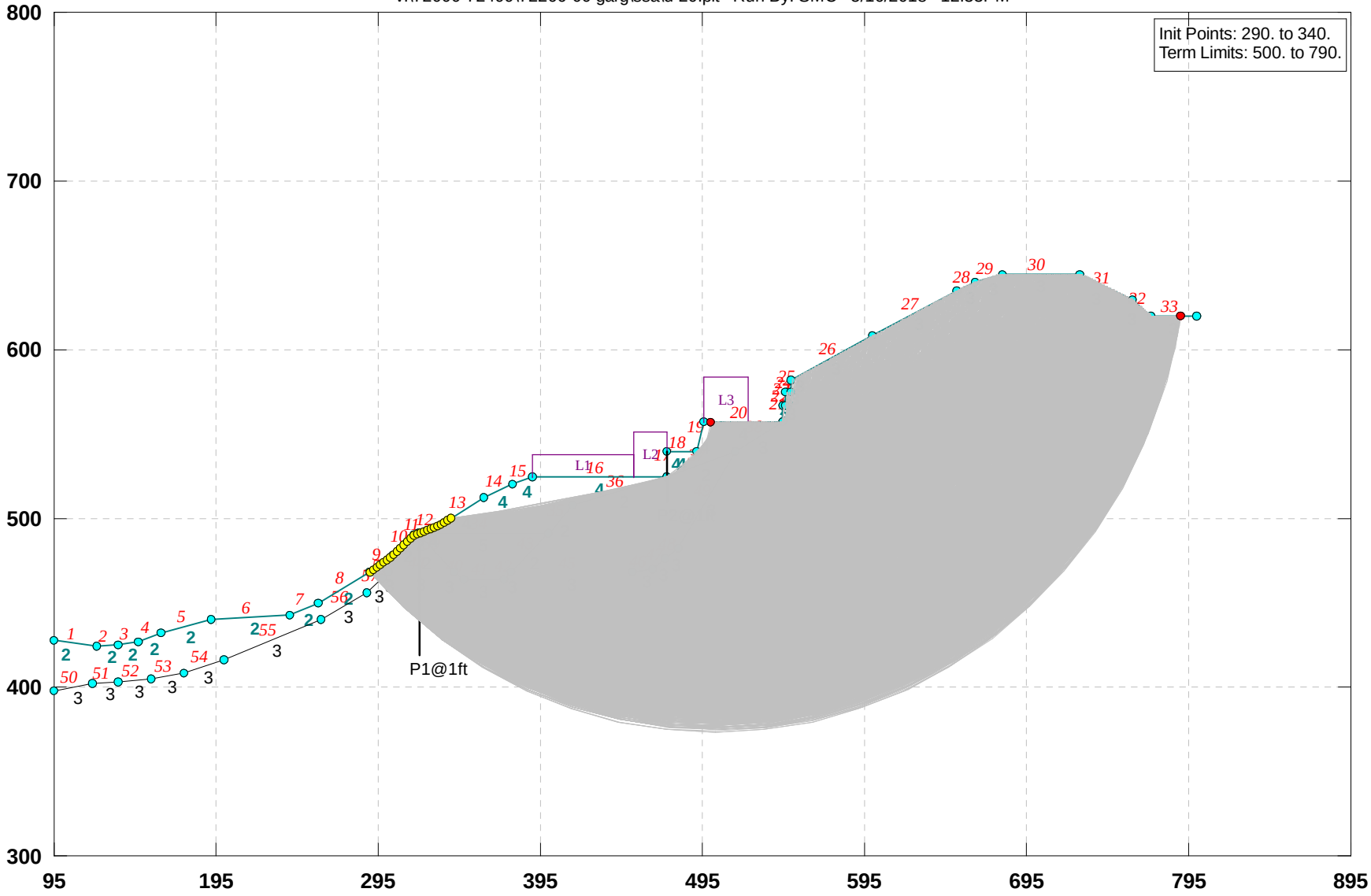
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-7.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-20.plt Run By: SMC 5/16/2018 12:33PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:33PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-20.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
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41	348.00	464.00	373.00	464.00	3
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43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
200 Surface(s) Initiate(s) From Each Of 25 Points Equally Spaced Along The Ground Surface Between X = 290.00(ft)
and X = 340.00(ft)
Each Surface Terminates Between X = 500.00(ft)

and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
30.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 5.852 FS Min = 1.572 FS Ave = 2.599
Standard Deviation = 0.676 Coefficient of Variation = 26.01 %
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	331.667	495.487
2	361.552	492.866
3	391.548	492.365
4	421.504	493.985
5	451.271	497.719
6	480.699	503.547
7	509.642	511.442
8	537.954	521.363
9	565.494	533.261
10	592.124	547.076
11	617.710	562.738
12	642.126	580.171
13	665.247	599.286
14	686.960	619.987
15	707.155	642.172
16	709.385	645.000

Circle Center At X = 383.696 ; Y = 915.920 ; and Radius = 423.640
Factor of Safety
*** 1.572 ***
Individual data on the 40 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.3	52.5	0.0	0.0	0.	0.	0.0	0.0	0.0
2	27.0	33121.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	1.6	3766.0	0.0	0.0	0.	0.	0.0	0.0	0.0
4	16.4	48554.4	0.0	0.0	0.	0.	0.0	0.0	0.0
5	12.0	45013.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.5	6312.3	0.0	0.0	0.	0.	0.0	0.0	154.8
7	10.9	44121.9	0.0	0.0	0.	0.	0.0	0.0	1091.4
8	12.5	49689.8	0.0	0.0	0.	0.	0.0	0.0	1253.8
9	6.5	25359.1	0.0	0.0	0.	0.	0.0	0.0	650.4
10	29.8	108456.5	0.0	0.0	0.	0.	0.0	0.0	2976.7
11	1.7	5859.5	0.0	0.0	0.	0.	0.0	0.0	172.9
12	0.1	336.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	19.9	62059.1	0.0	0.0	0.	0.	0.0	0.0	3980.0
14	0.1	380.8	0.0	0.0	0.	0.	0.0	0.0	0.0
15	7.6	35341.3	0.0	0.0	0.	0.	0.0	0.0	0.0
16	11.3	49315.7	0.0	0.0	0.	0.	0.0	0.0	0.0
17	3.4	17213.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	0.6	3448.3	0.0	0.0	0.	0.	0.0	0.0	0.0
19	13.6	80859.3	0.0	0.0	0.	0.	0.0	0.0	2728.4
20	5.4	29884.7	0.0	0.0	0.	0.	0.0	0.0	1071.6
21	8.0	42278.7	0.0	0.0	0.	0.	0.0	0.0	1600.0
22	15.0	71511.7	0.0	0.0	0.	0.	0.0	0.0	0.0
23	6.0	25946.0	0.0	0.0	0.	0.	0.0	0.0	0.0
24	0.1	474.9	0.0	0.0	0.	0.	0.0	0.0	0.0
25	1.9	10110.8	0.0	0.0	0.	0.	0.0	0.0	0.0
26	0.1	576.6	0.0	0.0	0.	0.	0.0	0.0	0.0
27	3.8	23416.3	0.0	0.0	0.	0.	0.0	0.0	0.0
28	0.1	649.3	0.0	0.0	0.	0.	0.0	0.0	0.0
29	15.5	108678.2	0.0	0.0	0.	0.	0.0	0.0	0.0
30	26.6	189113.6	0.0	0.0	0.	0.	0.0	0.0	0.0

31	7.9	55593.1	0.0	0.0	0.	0.	0.0	0.0	0.0
32	17.7	122378.4	0.0	0.0	0.	0.	0.0	0.0	0.0
33	24.4	158943.0	0.0	0.0	0.	0.	0.0	0.0	0.0
34	9.9	59473.5	0.0	0.0	0.	0.	0.0	0.0	0.0
35	11.0	61351.2	0.0	0.0	0.	0.	0.0	0.0	0.0
36	2.2	11791.7	0.0	0.0	0.	0.	0.0	0.0	0.0
37	14.8	67330.5	0.0	0.0	0.	0.	0.0	0.0	0.0
38	7.0	24648.1	0.0	0.0	0.	0.	0.0	0.0	0.0
39	20.2	35139.4	0.0	0.0	0.	0.	0.0	0.0	0.0
40	2.2	394.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	333.750	496.445
2	363.510	492.659
3	393.466	491.019
4	423.461	491.532
5	453.343	494.196
6	482.956	498.998
7	512.148	505.912
8	540.769	514.903
9	568.671	525.924
10	595.711	538.920
11	621.748	553.822
12	646.648	570.554
13	670.284	589.029
14	692.534	609.153
15	713.282	630.821
16	725.029	645.000

Circle Center At X = 401.403 ; Y = 907.825 ; and Radius = 416.906

Factor of Safety

*** 1.577 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.000	500.148
2	369.876	497.426
3	399.871	496.841
4	429.830	498.397
5	459.603	502.086
6	489.036	507.889
7	517.981	515.777
8	546.289	525.709
9	573.817	537.634
10	600.424	551.492
11	625.975	567.213
12	650.340	584.716
13	673.394	603.913
14	695.021	624.704
15	713.319	645.000

Circle Center At X = 393.060 ; Y = 917.147 ; and Radius = 420.361

Factor of Safety

*** 1.577 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	323.333	492.282
2	353.320	491.374
3	383.309	492.184
4	413.202	494.710
5	442.902	498.943
6	472.311	504.869
7	501.333	512.468
8	529.871	521.717
9	557.834	532.584
10	585.129	545.034
11	611.666	559.026
12	637.358	574.514
13	662.122	591.448
14	685.876	609.772

15	708.542	629.425
16	724.553	645.000

Circle Center At X = 354.301 ; Y = 1014.324 ; and Radius = 522.959

Factor of Safety

*** 1.579 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.831	496.647
3	397.831	496.491
4	427.767	498.446
5	457.492	502.503
6	486.857	508.640
7	515.718	516.828
8	543.931	527.027
9	571.357	539.185
10	597.860	553.243
11	623.307	569.130
12	647.575	586.768
13	670.540	606.070
14	692.091	626.940
15	708.287	645.000

Circle Center At X = 385.047 ; Y = 922.444 ; and Radius = 426.144

Factor of Safety

*** 1.579 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	335.834	497.679
2	365.703	494.881
3	395.698	494.337
4	425.649	496.049
5	455.386	500.008
6	484.742	506.193
7	513.550	514.566
8	541.646	525.082
9	568.873	537.681
10	595.075	552.291
11	620.104	568.830
12	643.819	587.204
13	666.085	607.309
14	686.777	629.031
15	699.845	645.000

Circle Center At X = 387.931 ; Y = 892.984 ; and Radius = 398.723

Factor of Safety

*** 1.582 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.000	500.148
2	369.940	498.241
3	399.939	498.323
4	429.868	500.394
5	459.593	504.444
6	488.985	510.456
7	517.913	518.404
8	546.250	528.252
9	573.872	539.957
10	600.658	553.468
11	626.488	568.725
12	651.251	585.661
13	674.836	604.202
14	697.140	624.265
15	717.321	645.000

Circle Center At X = 383.705 ; Y = 950.271 ; and Radius = 452.240

Factor of Safety

*** 1.583 ***

Failure Surface Specified By 16 Coordinate Points

Point	X-Surf	Y-Surf

No.	X-Surf (ft)	Y-Surf (ft)
1	327.500	493.885
2	357.484	492.897
3	387.470	493.796
4	417.341	496.577
5	446.978	501.230
6	476.264	507.736
7	505.083	516.070
8	533.322	526.198
9	560.868	538.081
10	587.613	551.672
11	613.452	566.916
12	638.281	583.754
13	662.003	602.118
14	684.524	621.938
15	705.755	643.133
16	707.403	645.000

Circle Center At X = 358.249 ; Y = 969.677 ; and Radius = 476.785

Factor of Safety

*** 1.584 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.501	493.938
3	397.383	491.278
4	427.381	490.948
5	457.314	492.952
6	487.001	497.277
7	516.262	503.896
8	544.919	512.770
9	572.800	523.845
10	599.736	537.054
11	625.563	552.317
12	650.125	569.542
13	673.274	588.624
14	694.869	609.448
15	714.780	631.888
16	724.705	645.000

Circle Center At X = 416.676 ; Y = 875.474 ; and Radius = 384.709

Factor of Safety

*** 1.585 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.000	500.148
2	369.950	498.411
3	399.948	498.726
4	429.855	501.093
5	459.529	505.500
6	488.833	511.927
7	517.628	520.343
8	545.780	530.709
9	573.157	542.976
10	599.631	557.088
11	625.078	572.977
12	649.378	590.570
13	672.418	609.784
14	694.089	630.529
15	707.270	645.000

Circle Center At X = 380.343 ; Y = 936.595 ; and Radius = 438.307

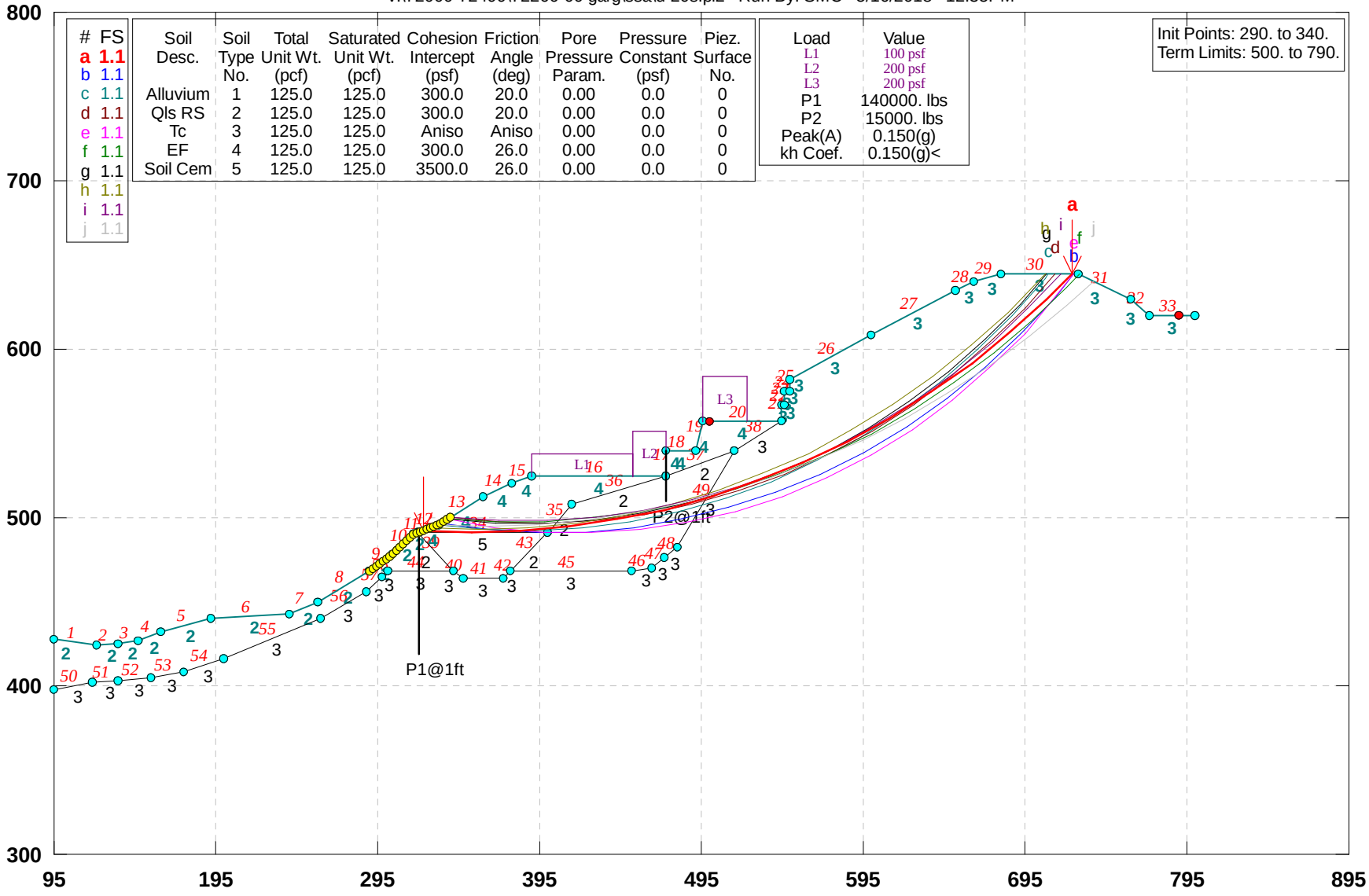
Factor of Safety

*** 1.586 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-20s.pl2 Run By: SMC 5/16/2018 12:35PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-7.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:35PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-20s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-20s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 25 Points Equally Spaced
Along The Ground Surface Between X = 290.00(ft)
and X = 340.00(ft)
Each Surface Terminates Between X = 500.00(ft)
and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
30.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 3.809 FS Min = 1.118 FS Ave = 1.794
Standard Deviation = 0.410 Coefficient of Variation = 22.87 %
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	323.333	492.282
2	353.320	491.374
3	383.309	492.184
4	413.202	494.710
5	442.902	498.943
6	472.311	504.869
7	501.333	512.468
8	529.871	521.717
9	557.834	532.584
10	585.129	545.034
11	611.666	559.026
12	637.358	574.514
13	662.122	591.448
14	685.876	609.772
15	708.542	629.425
16	724.553	645.000

Circle Center At X = 354.301 ; Y = 1014.324 ; and Radius = 522.959
Factor of Safety
*** 1.118 ***
Individual data on the 40 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	9.7	2423.0	0.0	0.0	0.	0.	363.5	0.0	0.0
2	20.3	26260.3	0.0	0.0	0.	0.	3939.1	0.0	0.0
3	6.7	15495.0	0.0	0.0	0.	0.	2324.2	0.0	0.0
4	18.0	54454.9	0.0	0.0	0.	0.	8168.2	0.0	0.0
5	5.3	19240.0	0.0	0.0	0.	0.	2886.0	0.0	0.0
6	6.7	26044.6	0.0	0.0	0.	0.	3906.7	0.0	0.0
7	13.2	52379.7	0.0	0.0	0.	0.	7857.0	0.0	1322.2
8	10.0	38312.9	0.0	0.0	0.	0.	5746.9	0.0	998.0
9	1.8	6777.8	0.0	0.0	0.	0.	1016.7	0.0	179.8
10	27.9	97816.8	0.0	0.0	0.	0.	14672.5	0.0	2790.2
11	10.1	31606.2	0.0	0.0	0.	0.	4740.9	0.0	1009.8
12	0.1	300.2	0.0	0.0	0.	0.	45.0	0.0	0.0
13	19.2	52991.3	0.0	0.0	0.	0.	7948.7	0.0	3842.2
14	0.7	1725.8	0.0	0.0	0.	0.	258.9	0.0	137.8
15	0.1	343.0	0.0	0.0	0.	0.	51.4	0.0	0.0
16	18.9	76663.6	0.0	0.0	0.	0.	11499.5	0.0	0.0
17	4.0	18975.9	0.0	0.0	0.	0.	2846.4	0.0	0.0
18	1.8	10468.3	0.0	0.0	0.	0.	1570.3	0.0	366.6
19	3.5	19680.5	0.0	0.0	0.	0.	2952.1	0.0	699.9
20	13.7	72295.9	0.0	0.0	0.	0.	10844.4	0.0	2733.5
21	8.0	38806.2	0.0	0.0	0.	0.	5820.9	0.0	1600.0
22	6.9	31261.6	0.0	0.0	0.	0.	4689.2	0.0	0.0
23	14.1	57464.3	0.0	0.0	0.	0.	8619.6	0.0	0.0
24	0.1	434.6	0.0	0.0	0.	0.	65.2	0.0	0.0
25	1.9	9353.9	0.0	0.0	0.	0.	1403.1	0.0	0.0
26	0.1	537.3	0.0	0.0	0.	0.	80.6	0.0	0.0

27	3.8	21963.2	0.0	0.0	0.	0.	3294.5	0.0	0.0
28	0.1	612.1	0.0	0.0	0.	0.	91.8	0.0	0.0
29	7.8	51875.4	0.0	0.0	0.	0.	7781.3	0.0	0.0
30	27.3	185471.0	0.0	0.0	0.	0.	27820.7	0.0	0.0
31	14.9	102573.6	0.0	0.0	0.	0.	15386.0	0.0	0.0
32	11.7	80315.3	0.0	0.0	0.	0.	12047.3	0.0	0.0
33	25.7	173287.4	0.0	0.0	0.	0.	25993.1	0.0	0.0
34	14.6	94582.0	0.0	0.0	0.	0.	14187.3	0.0	0.0
35	10.1	62395.1	0.0	0.0	0.	0.	9359.3	0.0	0.0
36	0.9	5268.0	0.0	0.0	0.	0.	790.2	0.0	0.0
37	17.0	93113.1	0.0	0.0	0.	0.	13967.0	0.0	0.0
38	5.9	27540.6	0.0	0.0	0.	0.	4131.1	0.0	0.0
39	22.7	71969.2	0.0	0.0	0.	0.	10795.4	0.0	0.0
40	16.0	15585.4	0.0	0.0	0.	0.	2337.8	0.0	0.0

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	333.750	496.445
2	363.510	492.659
3	393.466	491.019
4	423.461	491.532
5	453.343	494.196
6	482.956	498.998
7	512.148	505.912
8	540.769	514.903
9	568.671	525.924
10	595.711	538.920
11	621.748	553.822
12	646.648	570.554
13	670.284	589.029
14	692.534	609.153
15	713.282	630.821
16	725.029	645.000

Circle Center At X = 401.403 ; Y = 907.825 ; and Radius = 416.906

Factor of Safety

*** 1.119 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	331.667	495.487
2	361.552	492.866
3	391.548	492.365
4	421.504	493.985
5	451.271	497.719
6	480.699	503.547
7	509.642	511.442
8	537.954	521.363
9	565.494	533.261
10	592.124	547.076
11	617.710	562.738
12	642.126	580.171
13	665.247	599.286
14	686.960	619.987
15	707.155	642.172
16	709.385	645.000

Circle Center At X = 383.696 ; Y = 915.920 ; and Radius = 423.640

Factor of Safety

*** 1.120 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.000	500.148
2	369.876	497.426
3	399.871	496.841
4	429.830	498.397
5	459.603	502.086
6	489.036	507.889
7	517.981	515.777
8	546.289	525.709
9	573.817	537.634

10	600.424	551.492
11	625.975	567.213
12	650.340	584.716
13	673.394	603.913
14	695.021	624.704
15	713.319	645.000

Circle Center At X = 393.060 ; Y = 917.147 ; and Radius = 420.361

Factor of Safety

*** 1.126 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.501	493.938
3	397.383	491.278
4	427.381	490.948
5	457.314	492.952
6	487.001	497.277
7	516.262	503.896
8	544.919	512.770
9	572.800	523.845
10	599.736	537.054
11	625.563	552.317
12	650.125	569.542
13	673.274	588.624
14	694.869	609.448
15	714.780	631.888
16	724.705	645.000

Circle Center At X = 416.676 ; Y = 875.474 ; and Radius = 384.709

Factor of Safety

*** 1.127 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.874	497.307
3	397.873	497.543
4	427.801	499.619
5	457.545	503.529
6	486.993	509.256
7	516.034	516.780
8	544.559	526.073
9	572.459	537.099
10	599.630	549.816
11	625.970	564.177
12	651.378	580.128
13	675.759	597.608
14	699.021	616.552
15	721.077	636.888
16	728.591	644.723

Circle Center At X = 379.185 ; Y = 984.624 ; and Radius = 487.460

Factor of Safety

*** 1.127 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	337.917	498.914
2	367.831	496.647
3	397.831	496.491
4	427.767	498.446
5	457.492	502.503
6	486.857	508.640
7	515.718	516.828
8	543.931	527.027
9	571.357	539.185
10	597.860	553.243
11	623.307	569.130
12	647.575	586.768
13	670.540	606.070
14	692.091	626.940

15	708.287	645.000

Circle Center At X = 385.047 ; Y = 922.444 ; and Radius = 426.144

Factor of Safety

*** 1.128 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	327.500	493.885
2	357.484	492.897
3	387.470	493.796
4	417.341	496.577
5	446.978	501.230
6	476.264	507.736
7	505.083	516.070
8	533.322	526.198
9	560.868	538.081
10	587.613	551.672
11	613.452	566.916
12	638.281	583.754
13	662.003	602.118
14	684.524	621.938
15	705.755	643.133
16	707.403	645.000

Circle Center At X = 358.249 ; Y = 969.677 ; and Radius = 476.785

Factor of Safety

*** 1.129 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	340.000	500.148
2	369.940	498.241
3	399.939	498.323
4	429.868	500.394
5	459.593	504.444
6	488.985	510.456
7	517.913	518.404
8	546.250	528.252
9	573.872	539.957
10	600.658	553.468
11	626.488	568.725
12	651.251	585.661
13	674.836	604.202
14	697.140	624.265
15	717.321	645.000

Circle Center At X = 383.705 ; Y = 950.271 ; and Radius = 452.240

Factor of Safety

*** 1.129 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	331.667	495.487
2	361.661	494.885
3	391.645	495.867
4	421.535	498.428
5	451.249	502.563
6	480.703	508.259
7	509.816	515.502
8	538.506	524.270
9	566.694	534.539
10	594.300	546.281
11	621.249	559.463
12	647.465	574.048
13	672.875	589.995
14	697.408	607.261
15	720.997	625.797
16	737.731	640.439

Circle Center At X = 358.201 ; Y = 1062.399 ; and Radius = 567.532

Factor of Safety

*** 1.129 ***

**** END OF GSTABL7 OUTPUT ****

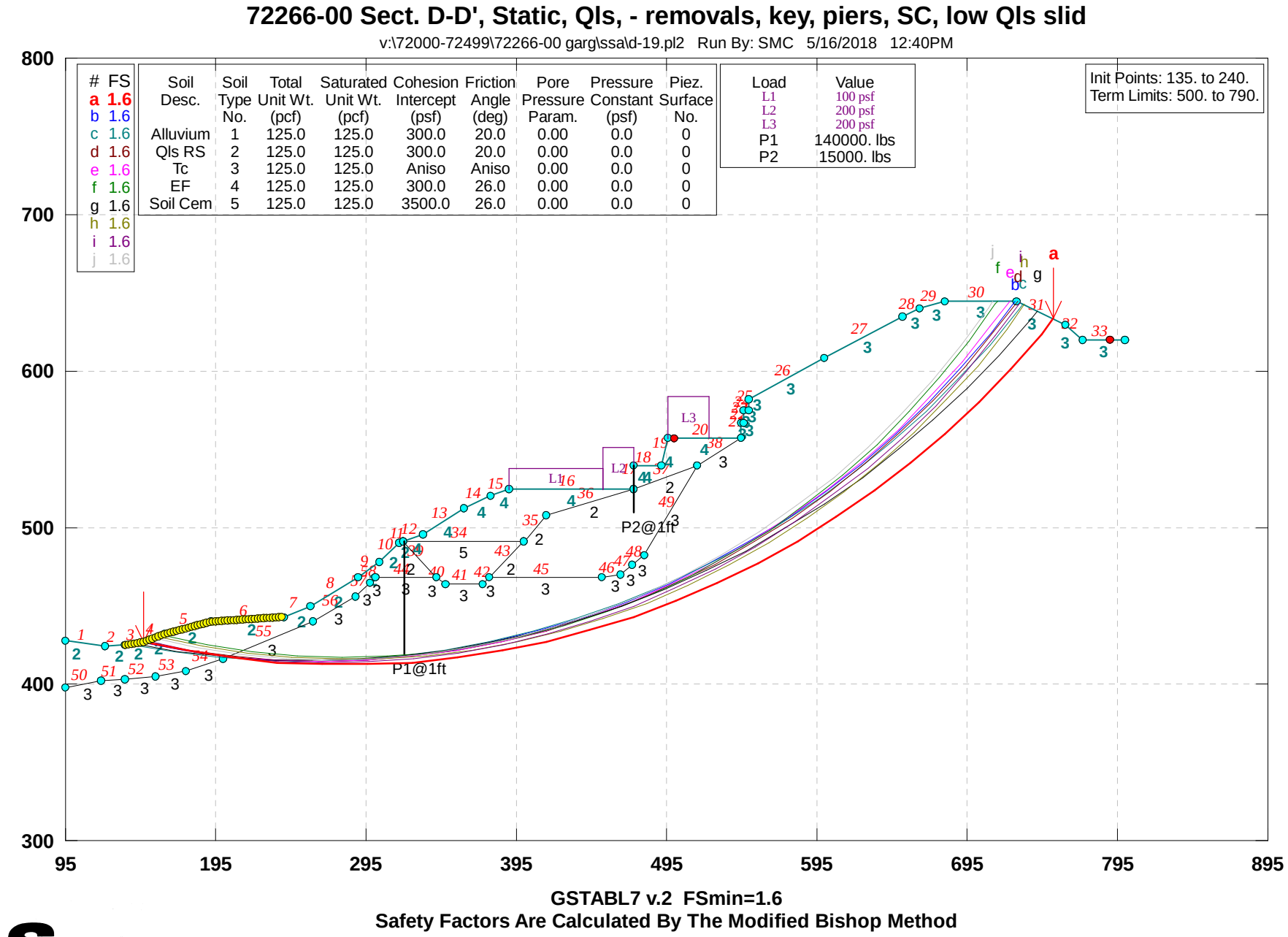
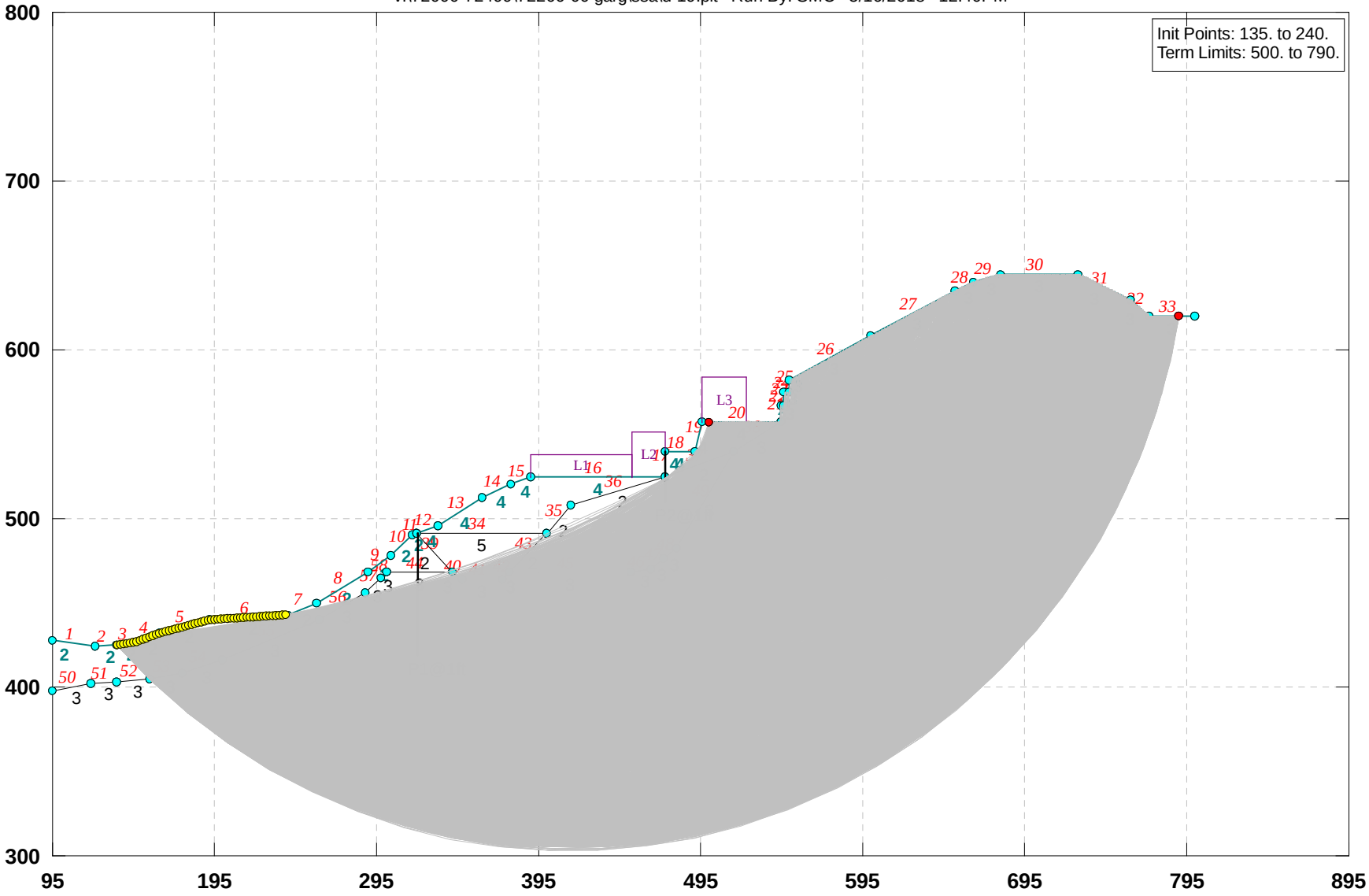

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid
v:\72000-72499\72266-00 garg\ssa\d-19.pl2 Run By: SMC 5/16/2018 12:40PM
FS
a 1.6
b 1.6
c 1.6
d 1.6
e 1.6
f 1.6
g 1.6
h 1.6
i 1.6
j 1.6
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Alluvium | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Qls RS | 2 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Tc | 3 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
EF | 4 | 125.0 | 125.0 | 300.0 | 26.0 | 0.00 | 0.0 | 0
Soil Cem | 5 | 125.0 | 125.0 | 3500.0 | 26.0 | 0.00 | 0.0 | 0
Load | Value
L1 | 100 psf
L2 | 200 psf
L3 | 200 psf
P1 | 140000. lbs
P2 | 15000. lbs
Init Points: 135. to 240.
Term Limits: 500. to 790.
P1@1ft
P2@1ft
L1
L2
L3
800
700
600
500
400
300
95
195
295
395
495
595
695
795
895
GSTABL7 v.2 FSmin=1.6
Safety Factors Are Calculated By The Modified Bishop Method

Figure D-8.1

72266-00 Sect. D-D', Static, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-19.plt Run By: SMC 5/16/2018 12:40PM



***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:40PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-19.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Static, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
21200 Trial Surfaces Have Been Generated.
200 Surface(s) Initiate(s) From Each Of 106 Points Equally Spaced Along The Ground Surface Between X = 135.00(ft)
and X = 240.00(ft)
Each Surface Terminates Between X = 500.00(ft)

and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
30.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0
Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000
2	176.433	421.197
3	206.115	416.838
4	235.974	413.933
5	265.939	412.490
6	295.939	412.512
7	325.903	413.998
8	355.757	416.945
9	385.433	421.347
10	414.858	427.192
11	443.962	434.466
12	472.677	443.154
13	500.933	453.232
14	528.664	464.679
15	555.803	477.465
16	582.284	491.561
17	608.047	506.934
18	633.027	523.546
19	657.167	541.358
20	680.409	560.327
21	702.697	580.408
22	723.977	601.554
23	744.200	623.713
24	752.359	633.582

Circle Center At X = 280.531 ; Y = 1025.959 ; and Radius = 613.663
Factor of Safety
*** 1.557 ***
Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	144.000	426.500
2	173.545	421.293
3	203.316	417.600
4	233.238	415.430
5	263.231	414.790
6	293.218	415.680
7	323.120	418.100
8	352.860	422.041
9	382.360	427.495
10	411.544	434.447
11	440.335	442.878
12	468.658	452.767
13	496.440	464.088
14	523.608	476.812
15	550.091	490.905
16	575.822	506.331
17	600.731	523.049
18	624.756	541.016
19	647.832	560.186

20	669.901	580.508
21	690.904	601.929
22	710.787	624.394
23	727.229	645.000

Circle Center At X = 260.777 ; Y = 1002.652 ; and Radius = 587.867

Factor of Safety

*** 1.559 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	425.500
2	167.593	420.577
3	197.391	417.102
4	227.323	415.084
5	257.318	414.526
6	287.305	415.432
7	317.211	417.797
8	346.967	421.618
9	376.501	426.883
10	405.744	433.583
11	434.625	441.699
12	463.076	451.213
13	491.030	462.103
14	518.420	474.342
15	545.181	487.901
16	571.249	502.749
17	596.563	518.849
18	621.062	536.164
19	644.688	554.652
20	667.384	574.270
21	689.098	594.970
22	709.777	616.705
23	729.372	639.421
24	732.194	643.034

Circle Center At X = 253.776 ; Y = 1029.546 ; and Radius = 615.041

Factor of Safety

*** 1.559 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000
2	176.516	421.632
3	206.269	417.794
4	236.181	415.499
5	266.172	414.751
6	296.161	415.552
7	326.069	417.901
8	355.816	421.792
9	385.322	427.213
10	414.509	434.150
11	443.299	442.585
12	471.614	452.496
13	499.380	463.856
14	526.523	476.634
15	552.969	490.797
16	578.649	506.306
17	603.494	523.121
18	627.437	541.196
19	650.415	560.484
20	672.367	580.932
21	693.233	602.487
22	712.959	625.090
23	728.438	644.795

Circle Center At X = 265.654 ; Y = 995.536 ; and Radius = 580.785

Factor of Safety

*** 1.559 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000

2	176.494	421.513
3	206.236	417.587
4	236.143	415.233
5	266.133	414.458
6	296.123	415.265
7	326.028	417.650
8	355.765	421.607
9	385.254	427.125
10	414.410	434.190
11	443.154	442.780
12	471.405	452.873
13	499.085	464.440
14	526.118	477.449
15	552.428	491.865
16	577.941	507.646
17	602.588	524.750
18	626.300	543.128
19	649.010	562.730
20	670.656	583.501
21	691.178	605.384
22	710.519	628.317
23	723.146	645.000

Circle Center At X = 265.834 ; Y = 983.714 ; and Radius = 569.255

Factor of Safety

*** 1.560 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	160.000	431.643
2	189.361	425.484
3	219.026	421.013
4	248.898	418.243
5	278.879	417.184
6	308.872	417.840
7	338.778	420.208
8	368.501	424.280
9	397.942	430.044
10	427.006	437.479
11	455.597	446.563
12	483.623	457.266
13	510.992	469.552
14	537.615	483.381
15	563.404	498.708
16	588.275	515.484
17	612.147	533.652
18	634.943	553.155
19	656.587	573.928
20	677.010	595.904
21	696.143	619.010
22	713.926	643.172
23	715.117	645.000

Circle Center At X = 282.408 ; Y = 942.138 ; and Radius = 524.966

Factor of Safety

*** 1.562 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.000	425.833
2	169.616	421.048
3	199.424	417.659
4	229.358	415.672
5	259.352	415.093
6	289.341	415.923
7	319.257	418.160
8	349.036	421.798
9	378.611	426.831
10	407.917	433.246
11	436.889	441.030
12	465.464	450.166
13	493.579	460.633

14	521.172	472.409
15	548.181	485.467
16	574.547	499.778
17	600.212	515.312
18	625.120	532.033
19	649.216	549.905
20	672.446	568.888
21	694.759	588.941
22	716.106	610.020
23	736.440	632.077
24	741.837	638.514

Circle Center At X = 256.722 ; Y = 1053.406 ; and Radius = 638.335

Factor of Safety

*** 1.562 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	157.000	430.571
2	186.385	424.526
3	216.051	420.067
4	245.915	417.208
5	275.889	415.956
6	305.886	416.315
7	335.822	418.285
8	365.608	421.859
9	395.160	427.027
10	424.391	433.775
11	453.218	442.082
12	481.557	451.925
13	509.327	463.276
14	536.447	476.101
15	562.840	490.364
16	588.428	506.024
17	613.139	523.034
18	636.901	541.348
19	659.645	560.910
20	681.306	581.666
21	701.822	603.555
22	721.132	626.514
23	733.216	642.555

Circle Center At X = 284.200 ; Y = 974.414 ; and Radius = 558.520

Factor of Safety

*** 1.562 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	148.000	427.357
2	177.440	421.587
3	207.142	417.370
4	237.025	414.718
5	267.005	413.639
6	297.001	414.135
7	326.930	416.205
8	356.708	419.844
9	386.255	425.041
10	415.487	431.782
11	444.326	440.048
12	472.691	449.817
13	500.504	461.061
14	527.688	473.750
15	554.169	487.849
16	579.873	503.318
17	604.730	520.116
18	628.670	538.195
19	651.628	557.506
20	673.541	577.996
21	694.348	599.608
22	713.991	622.282
23	730.691	643.738

Circle Center At X = 272.559 ; Y = 984.863 ; and Radius = 571.251

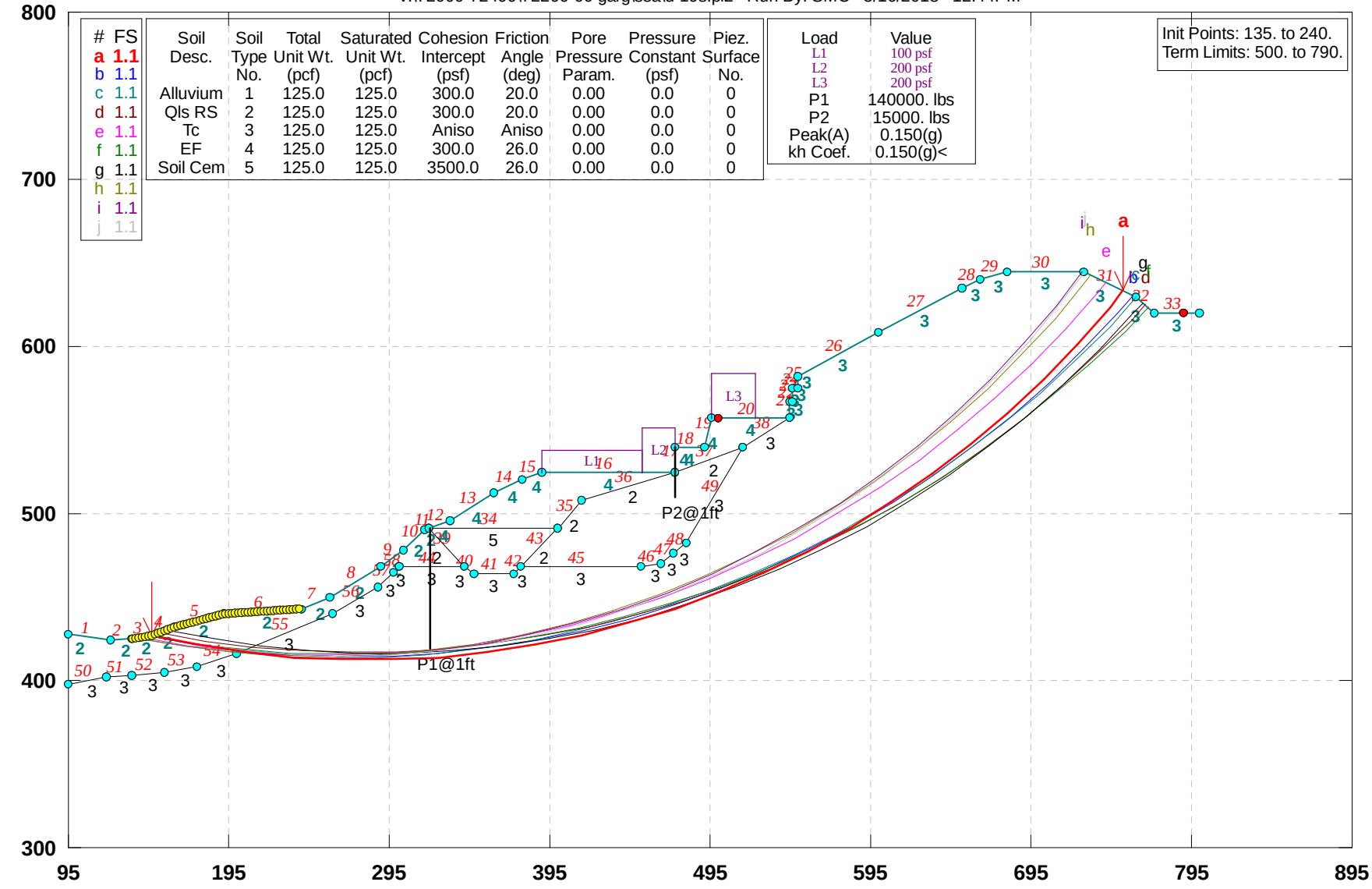
Factor of Safety
*** 1.563 ***
Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	153.000	429.143
2	182.424	423.293
3	212.129	419.096
4	242.022	416.565
5	272.010	415.707
6	301.999	416.525
7	331.895	419.017
8	361.605	423.175
9	391.037	428.985
10	420.099	436.431
11	448.699	445.488
12	476.749	456.128
13	504.160	468.318
14	530.848	482.021
15	556.729	497.192
16	581.723	513.785
17	605.750	531.748
18	628.737	551.026
19	650.611	571.557
20	671.305	593.277
21	690.752	616.120
22	708.894	640.013
23	712.259	645.000

Circle Center At X = 272.365 ; Y = 952.632 ; and Radius = 536.925
Factor of Safety
*** 1.563 ***
**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. D-D', Seismic, Qls, - removals, key, piers, SC, low Qls slid

v:\72000-72499\72266-00 garg\ssa\d-19s.pl2 Run By: SMC 5/16/2018 12:44PM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-8.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 12:44PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\d-19s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\d-19s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. D-D', Seismic, Qls,
- removals, key, piers, SC, low Qls slid

BOUNDARY COORDINATES
33 Top Boundaries
58 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	95.00	428.00	121.00	424.00	2
2	121.00	424.00	135.00	425.00	2
3	135.00	425.00	147.00	427.00	2
4	147.00	427.00	161.00	432.00	2
5	161.00	432.00	192.00	440.00	2
6	192.00	440.00	240.00	443.00	2
7	240.00	443.00	258.00	450.00	2
8	258.00	450.00	290.00	468.00	2
9	290.00	468.00	304.00	478.00	2
10	304.00	478.00	317.00	490.00	2
11	317.00	490.00	320.00	491.00	2
12	320.00	491.00	333.00	496.00	4
13	333.00	496.00	360.00	512.00	4
14	360.00	512.00	378.00	520.00	4
15	378.00	520.00	390.00	525.00	4
16	390.00	525.00	473.00	525.00	4
17	473.00	525.00	473.10	540.00	4
18	473.10	540.00	492.00	540.00	4
19	492.00	540.00	496.00	557.00	4
20	496.00	557.00	544.00	557.00	4
21	544.00	557.00	544.10	567.00	3
22	544.10	567.00	546.00	567.00	3
23	546.00	567.00	546.10	575.00	3
24	546.10	575.00	549.90	575.00	3
25	549.90	575.00	550.00	582.00	3
26	550.00	582.00	600.00	608.00	3
27	600.00	608.00	652.00	635.00	3
28	652.00	635.00	663.00	640.00	3
29	663.00	640.00	680.00	645.00	3
30	680.00	645.00	728.00	645.00	3
31	728.00	645.00	760.00	630.00	3
32	760.00	630.00	772.00	620.00	3
33	772.00	620.00	800.00	620.00	3
34	320.00	491.00	400.00	491.00	5
35	400.00	490.00	415.00	508.00	2
36	415.00	508.00	473.00	525.00	2
37	473.00	525.00	515.00	540.00	2
38	515.00	540.00	544.00	557.00	3
39	320.00	491.00	342.00	468.00	2
40	342.00	468.00	348.00	464.00	3
41	348.00	464.00	373.00	464.00	3
42	373.00	464.00	377.00	468.00	3
43	377.00	468.00	400.00	491.00	2

44	301.00	468.00	342.00	468.00	3
45	377.00	468.00	452.00	468.00	3
46	452.00	468.00	464.00	470.00	3
47	464.00	470.00	472.00	476.00	3
48	472.00	476.00	480.00	482.00	3
49	480.00	482.00	515.00	540.00	3
50	95.00	398.00	119.00	402.00	3
51	119.00	402.00	135.00	403.00	3
52	135.00	403.00	155.00	405.00	3
53	155.00	405.00	175.00	408.00	3
54	175.00	408.00	200.00	416.00	3
55	200.00	416.00	260.00	440.00	3
56	260.00	440.00	288.00	456.00	3
57	288.00	456.00	298.00	465.00	3
58	298.00	465.00	301.00	468.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

5 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

3 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	390.00	453.00	100.0	0.0
2	453.10	473.00	200.0	0.0
3	496.00	523.00	200.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	321.00	491.00	140000.0	1.0	90.00	72.0
2	473.20	540.00	15000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.
21200 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 106 Points Equally Spaced
Along The Ground Surface Between X = 135.00(ft)
and X = 240.00(ft)
Each Surface Terminates Between X = 500.00(ft)
and X = 790.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
30.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0
Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000
2	176.433	421.197
3	206.115	416.838
4	235.974	413.933
5	265.939	412.490
6	295.939	412.512
7	325.903	413.998
8	355.757	416.945
9	385.433	421.347
10	414.858	427.192
11	443.962	434.466
12	472.677	443.154
13	500.933	453.232
14	528.664	464.679
15	555.803	477.465
16	582.284	491.561
17	608.047	506.934
18	633.027	523.546
19	657.167	541.358
20	680.409	560.327
21	702.697	580.408
22	723.977	601.554
23	744.200	623.713
24	752.359	633.582

Circle Center At X = 280.531 ; Y = 1025.959 ; and Radius = 613.663
Factor of Safety
*** 1.087 ***
Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000
2	176.544	421.788
3	206.296	417.943
4	236.195	415.476
5	266.175	414.389
6	296.174	414.687
7	326.126	416.369
8	355.970	419.430
9	385.640	423.864
10	415.075	429.662
11	444.210	436.811
12	472.985	445.297
13	501.338	455.101
14	529.208	466.202
15	556.537	478.577

16	583.266	492.200
17	609.338	507.040
18	634.698	523.068
19	659.292	540.248
20	683.066	558.544
21	705.972	577.918
22	727.960	598.327
23	748.983	619.729
24	758.719	630.600

Circle Center At X = 274.757 ; Y = 1063.910 ; and Radius = 649.597

Factor of Safety

*** 1.088 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	425.500
2	167.590	420.556
3	197.369	416.924
4	227.280	414.612
5	257.264	413.624
6	287.262	413.963
7	317.216	415.626
8	347.067	418.612
9	376.757	422.914
10	406.227	428.524
11	435.421	435.431
12	464.282	443.621
13	492.752	453.079
14	520.776	463.786
15	548.300	475.720
16	575.270	488.860
17	601.632	503.178
18	627.336	518.648
19	652.331	535.238
20	676.569	552.917
21	700.001	571.650
22	722.583	591.400
23	744.270	612.129
24	760.770	629.358

Circle Center At X = 264.638 ; Y = 1091.815 ; and Radius = 678.243

Factor of Safety

*** 1.089 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	151.000	428.429
2	180.610	423.605
3	210.403	420.086
4	240.321	417.878
5	270.308	416.987
6	300.305	417.412
7	330.254	419.155
8	360.098	422.210
9	389.779	426.573
10	419.240	432.235
11	448.424	439.185
12	477.275	447.410
13	505.736	456.893
14	533.754	467.617
15	561.274	479.561
16	588.243	492.701
17	614.609	507.013
18	640.321	522.469
19	665.330	539.039
20	689.587	556.691
21	713.046	575.391
22	735.661	595.102
23	757.389	615.788
24	766.139	624.884

Circle Center At X = 275.656 ; Y = 1099.395 ; and Radius = 682.448

Factor of Safety
*** 1.094 ***
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	140.000	425.833
2	169.616	421.048
3	199.424	417.659
4	229.358	415.672
5	259.352	415.093
6	289.341	415.923
7	319.257	418.160
8	349.036	421.798
9	378.611	426.831
10	407.917	433.246
11	436.889	441.030
12	465.464	450.166
13	493.579	460.633
14	521.172	472.409
15	548.181	485.467
16	574.547	499.778
17	600.212	515.312
18	625.120	532.033
19	649.216	549.905
20	672.446	568.888
21	694.759	588.941
22	716.106	610.020
23	736.440	632.077
24	741.837	638.514

Circle Center At X = 256.722 ; Y = 1053.406 ; and Radius = 638.335

Factor of Safety
*** 1.095 ***
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	144.000	426.500
2	173.658	421.982
3	203.480	418.717
4	233.412	416.711
5	263.403	415.968
6	293.399	416.489
7	323.346	418.273
8	353.191	421.317
9	382.881	425.615
10	412.364	431.161
11	441.587	437.944
12	470.499	445.951
13	499.047	455.170
14	527.182	465.583
15	554.853	477.172
16	582.012	489.917
17	608.609	503.794
18	634.598	518.779
19	659.933	534.846
20	684.569	551.966
21	708.461	570.109
22	731.568	589.241
23	753.849	609.331
24	768.065	623.279

Circle Center At X = 266.077 ; Y = 1127.314 ; and Radius = 711.367

Factor of Safety
*** 1.096 ***
Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	156.000	430.214
2	185.493	424.720
3	215.209	420.604
4	245.085	417.875
5	275.055	416.538

6	305.055	416.597
7	335.019	418.051
8	364.884	420.898
9	394.584	425.131
10	424.055	430.741
11	453.233	437.715
12	482.055	446.039
13	510.458	455.696
14	538.382	466.662
15	565.765	478.916
16	592.549	492.431
17	618.674	507.177
18	644.086	523.122
19	668.729	540.232
20	692.549	558.469
21	715.494	577.795
22	737.516	598.168
23	758.567	619.542
24	764.548	626.210

Circle Center At X = 288.817 ; Y = 1060.571 ; and Radius = 644.197

Factor of Safety

*** 1.096 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	138.000	425.500
2	167.593	420.577
3	197.391	417.102
4	227.323	415.084
5	257.318	414.526
6	287.305	415.432
7	317.211	417.797
8	346.967	421.618
9	376.501	426.883
10	405.744	433.583
11	434.625	441.699
12	463.076	451.213
13	491.030	462.103
14	518.420	474.342
15	545.181	487.901
16	571.249	502.749
17	596.563	518.849
18	621.062	536.164
19	644.688	554.652
20	667.384	574.270
21	689.098	594.970
22	709.777	616.705
23	729.372	639.421
24	732.194	643.034

Circle Center At X = 253.776 ; Y = 1029.546 ; and Radius = 615.041

Factor of Safety

*** 1.096 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	144.000	426.500
2	173.545	421.293
3	203.316	417.600
4	233.238	415.430
5	263.231	414.790
6	293.218	415.680
7	323.120	418.100
8	352.860	422.041
9	382.360	427.495
10	411.544	434.447
11	440.335	442.878
12	468.658	452.767
13	496.440	464.088
14	523.608	476.812
15	550.091	490.905

16	575.822	506.331
17	600.731	523.049
18	624.756	541.016
19	647.832	560.186
20	669.901	580.508
21	690.904	601.929
22	710.787	624.394
23	727.229	645.000

Circle Center At X = 260.777 ; Y = 1002.652 ; and Radius = 587.867

Factor of Safety

*** 1.098 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	147.000	427.000
2	176.516	421.632
3	206.269	417.794
4	236.181	415.499
5	266.172	414.751
6	296.161	415.552
7	326.069	417.901
8	355.816	421.792
9	385.322	427.213
10	414.509	434.150
11	443.299	442.585
12	471.614	452.496
13	499.380	463.856
14	526.523	476.634
15	552.969	490.797
16	578.649	506.306
17	603.494	523.121
18	627.437	541.196
19	650.415	560.484
20	672.367	580.932
21	693.233	602.487
22	712.959	625.090
23	728.438	644.795

Circle Center At X = 265.654 ; Y = 995.536 ; and Radius = 580.785

Factor of Safety

*** 1.099 ***

**** END OF GSTABL7 OUTPUT ****

GeoFirm
801 Glenneyre St. • Suite F • Laguna Beach • CA 92651
(949) 494-2122 • FAX (949) 497-0270

PRELIMINARY GEOTECHNICAL INVESTIGATION
FOR NEW SINGLE-FAMILY RESIDENCE
1 O'Hill Ridge, Bear Brand Ranch
Laguna Niguel, California

VOLUME 2 of 2
(Appendices D-9.1 through J, Plates)

Prepared for:

Mr. and Ms. Garg

Project No: 72266-01
Report No: 18-8346

August 17, 2018

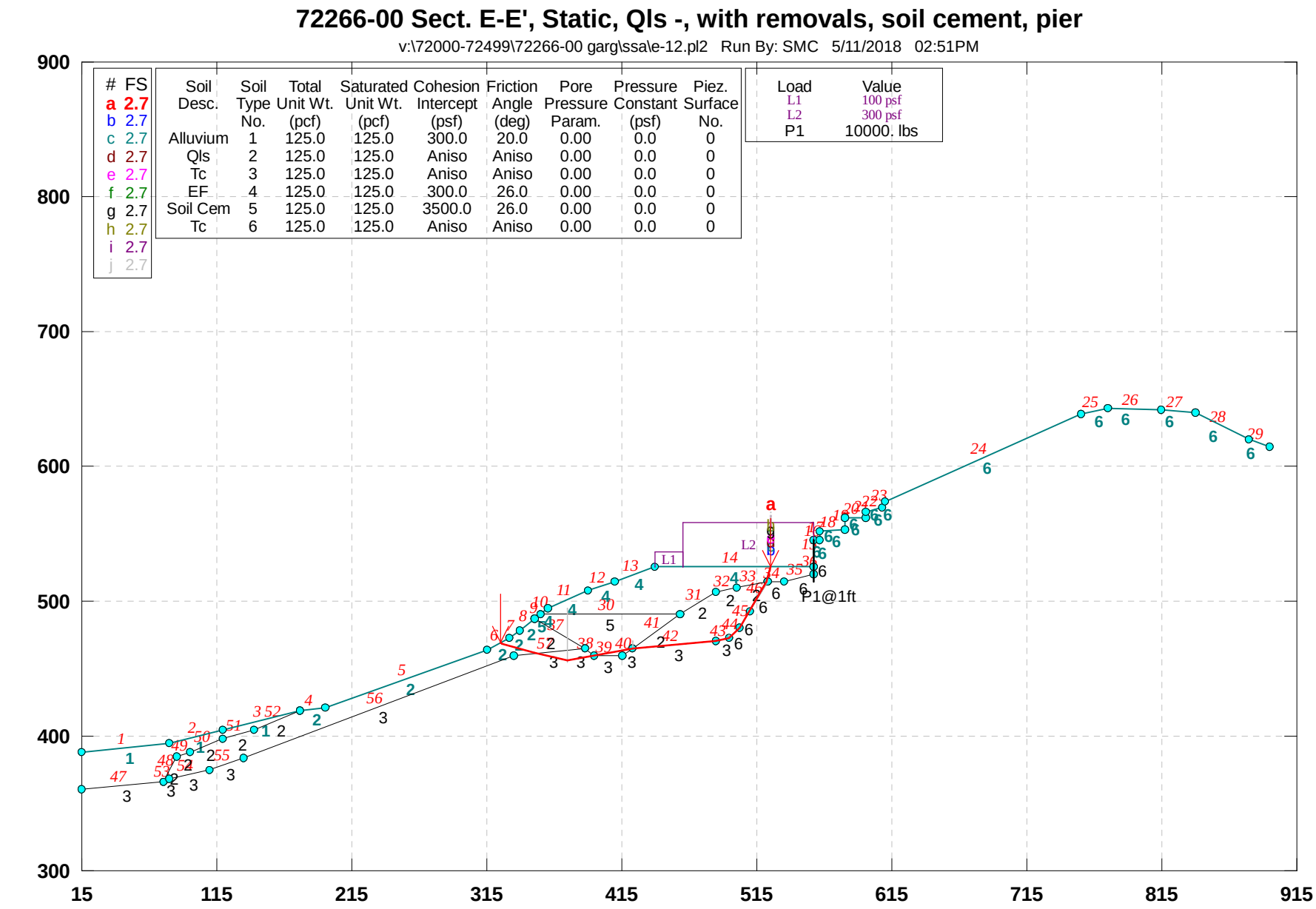
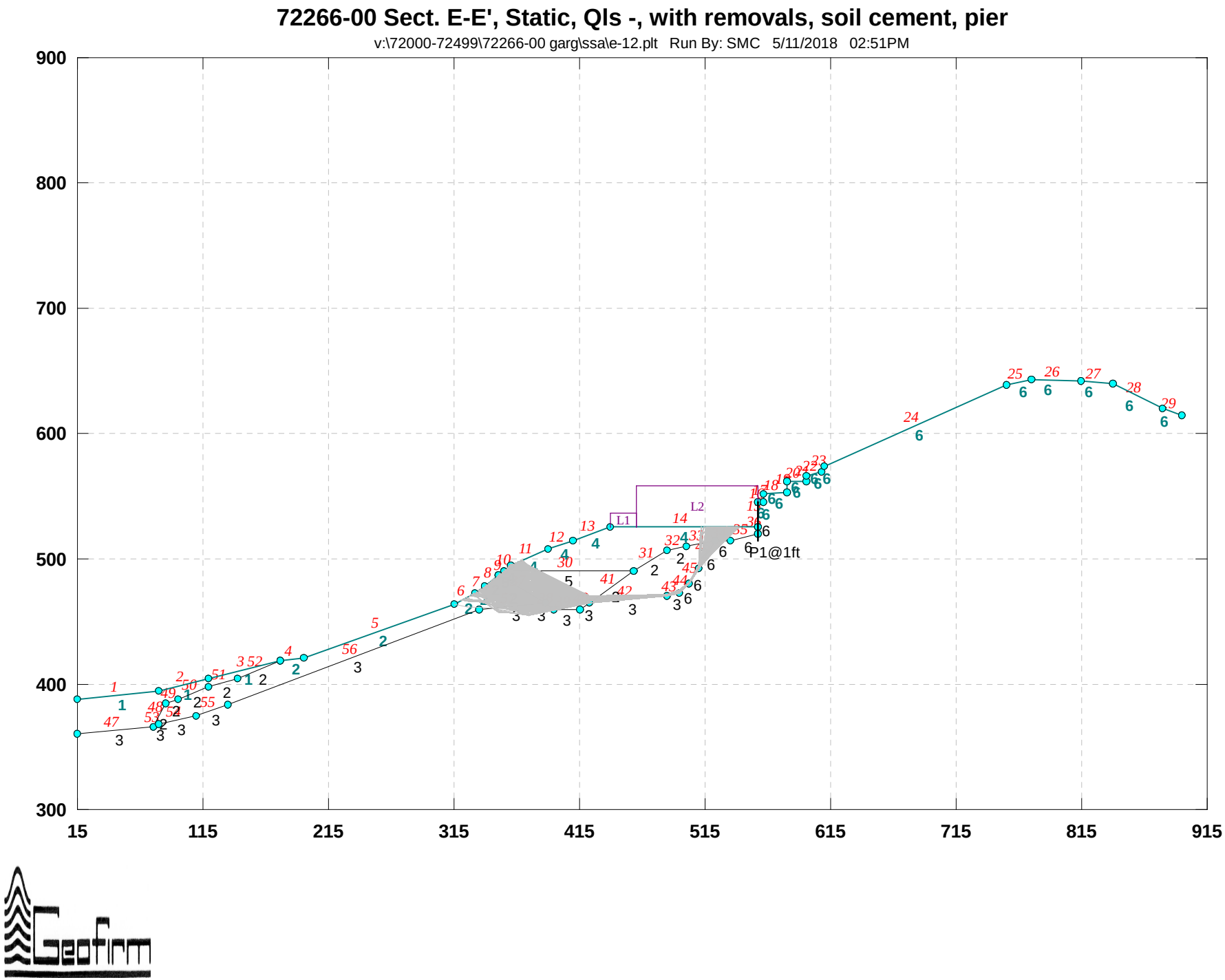

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier
v:\72000-72499\72266-00 garg\ssa\e-12.pl2 Run By: SMC 5/11/2018 02:51PM
FS
a 2.7
b 2.7
c 2.7
d 2.7
e 2.7
f 2.7
g 2.7
h 2.7
i 2.7
j 2.7
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Alluvium | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Qls | 2 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
Tc | 3 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
EF | 4 | 125.0 | 125.0 | 300.0 | 26.0 | 0.00 | 0.0 | 0
Soil Cem | 5 | 125.0 | 125.0 | 3500.0 | 26.0 | 0.00 | 0.0 | 0
Tc | 6 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
Load | Value
L1 | 100 psf
L2 | 300 psf
P1 | 10000. lbs
P1@1ft
900
800
700
600
500
400
300
15
115
215
315
415
515
615
715
815
915
GSTABL7 v.2 FSmin=2.7
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-9.1


72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier
v:\72000-72499\72266-00 garg\ssa\e-12.plt Run By: SMC 5/11/2018 02:51PM
900
800
700
600
500
400
300
15
115
215
315
415
515
615
715
815
915
L1
L2
P1@1ft

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 02:51PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-12.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

3 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
6 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	375.00	475.00	375.00	475.00	40.00
2	423.00	468.00	423.00	468.00	6.00
3	485.00	471.00	485.00	471.00	2.00
4	495.00	474.00	495.00	474.00	2.00
5	502.00	481.00	502.00	481.00	2.00
6	510.00	493.00	523.00	516.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 8.842 FS Min = 2.747 FS Ave = 4.698
Standard Deviation = 1.119 Coefficient of Variation = 23.81 %
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.202	469.401
2	326.533	468.387
3	350.551	461.449
4	375.000	456.228
5	423.000	465.076
6	485.000	470.356
7	495.000	473.242
8	502.000	480.370
9	522.145	514.416
10	525.653	526.000

Factor of Safety
*** 2.747 ***
Individual data on the 27 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	1.3	143.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	5.5	2703.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	8.0	9847.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	10.5	25361.7	0.0	0.0	0.	0.	0.0	0.0	0.0
5	0.0	150.7	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.4	1425.9	0.0	0.0	0.	0.	0.0	0.0	0.0
7	4.0	13787.1	0.0	0.0	0.	0.	0.0	0.0	0.0
8	5.0	20334.4	0.0	0.0	0.	0.	0.0	0.0	0.0
9	15.0	75788.3	0.0	0.0	0.	0.	0.0	0.0	0.0
10	13.0	76197.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	2.0	12189.5	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	30888.3	0.0	0.0	0.	0.	0.0	0.0	0.0
13	0.5	2888.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	14.5	92882.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	13.0	86946.8	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.1	823.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	16.9	120478.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	18.0	132097.0	0.0	0.0	0.	0.	0.0	0.0	1800.0

19	2.0	14464.5	0.0	0.0	0.	0.	0.0	0.0	200.0
20	0.1	722.2	0.0	0.0	0.	0.	0.0	0.0	0.0
21	24.9	176491.3	0.0	0.0	0.	0.	0.0	0.0	7470.0
22	10.0	67751.0	0.0	0.0	0.	0.	0.0	0.0	3000.0
23	5.0	31382.7	0.0	0.0	0.	0.	0.0	0.0	1500.0
24	2.0	11662.1	0.0	0.0	0.	0.	0.0	0.0	600.0
25	20.1	72037.8	0.0	0.0	0.	0.	0.0	0.0	6043.6
26	0.1	183.7	0.0	0.0	0.	0.	0.0	0.0	38.8
27	3.4	2356.2	0.0	0.0	0.	0.	0.0	0.0	1013.6

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.202	469.401
2	326.533	468.387
3	350.551	461.449
4	375.000	456.228
5	423.000	465.076
6	485.000	470.356
7	495.000	473.242
8	502.000	480.370
9	522.145	514.416
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Factor of Safety
*** 2.747 ***

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5	423.000	465.076
6	485.000	470.356
7	495.000	473.242
8	502.000	480.370
9	522.145	514.416
10	525.653	526.000

Factor of Safety
*** 2.747 ***

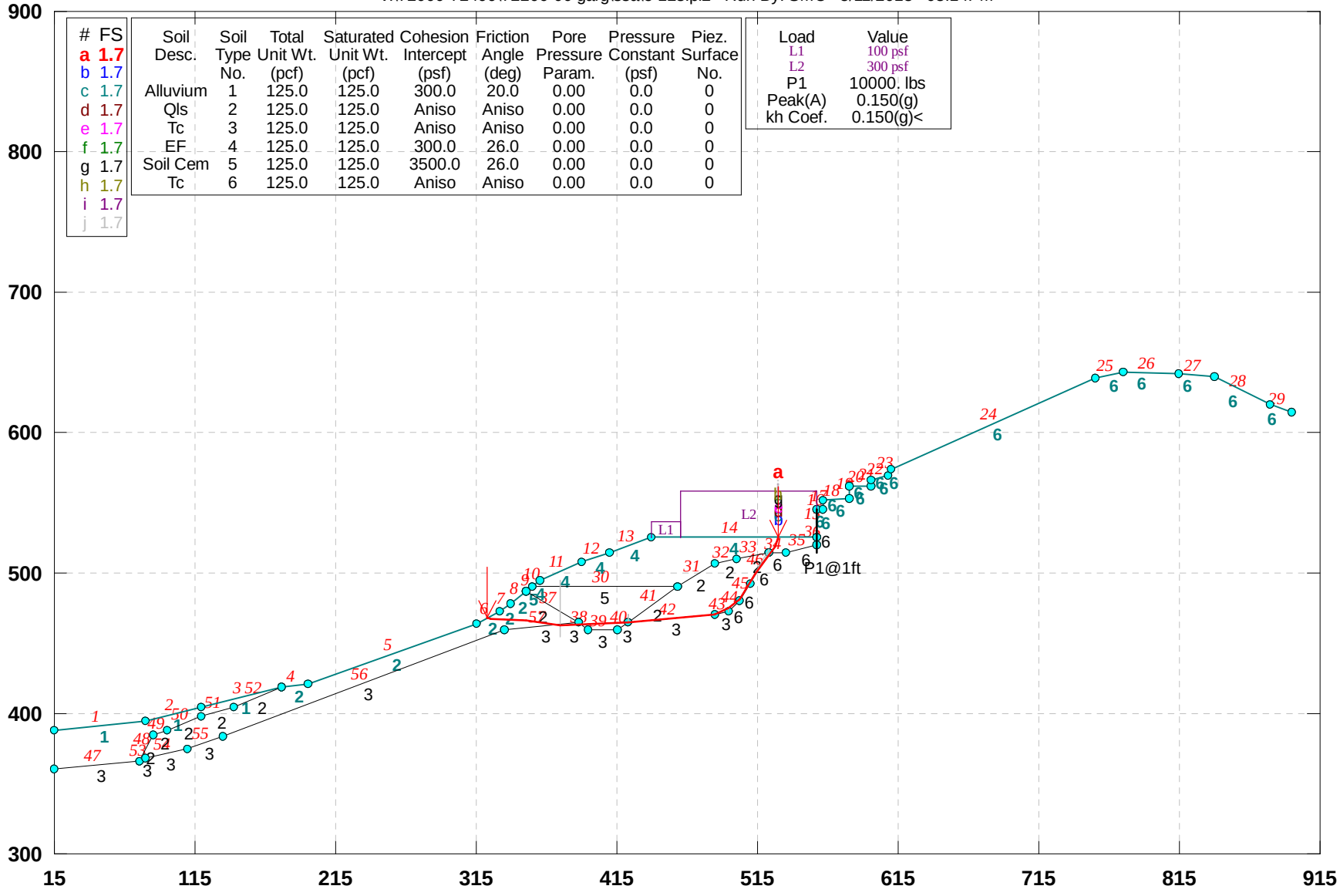
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	325.202	469.401
2	326.533	468.387
3	350.551	461.449
4	375.000	456.228
5	423.000	465.076
6	485.000	470.356
7	495.000	473.242
8	502.000	480.370

```
 9        522.145      514.416
10        525.653      526.000
    Factor of Safety
   ***    2.747   ***
       **** END OF GSTABL7 OUTPUT ****
```

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-12s.pl2 Run By: SMC 5/11/2018 03:14PM



GSTABL7 v.2 FSmin=1.7

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-9.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/11/2018
Time of Run: 03:14PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-12s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-12s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

3 soil type(s)

Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000
PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
6 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	375.00	475.00	375.00	475.00	40.00
2	423.00	468.00	423.00	468.00	6.00
3	485.00	471.00	485.00	471.00	2.00
4	495.00	474.00	495.00	474.00	2.00
5	502.00	481.00	502.00	481.00	2.00
6	510.00	493.00	523.00	516.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 3.799 FS Min = 1.661 FS Ave = 2.560
Standard Deviation = 0.492 Coefficient of Variation = 19.22 %
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
2	325.261	466.899
3	350.231	465.670
4	375.000	462.283
5	423.000	465.187
6	485.000	470.503
7	495.000	474.873
8	502.000	481.860
9	512.789	498.587
10	527.442	518.842
11	530.094	526.000

Factor of Safety
*** 1.661 ***
Individual data on the 29 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.6	409.1	0.0	0.0	0.	0.	61.4	0.0	0.0
2	6.7	3776.6	0.0	0.0	0.	0.	566.5	0.0	0.0
3	8.0	9129.6	0.0	0.0	0.	0.	1369.4	0.0	0.0
4	10.2	20797.8	0.0	0.0	0.	0.	3119.7	0.0	0.0
5	0.8	2026.3	0.0	0.0	0.	0.	303.9	0.0	0.0
6	4.0	11604.2	0.0	0.0	0.	0.	1740.6	0.0	0.0
7	5.0	17389.9	0.0	0.0	0.	0.	2608.5	0.0	0.0
8	8.5	35374.0	0.0	0.0	0.	0.	5306.1	0.0	0.0
9	6.5	30141.4	0.0	0.0	0.	0.	4521.2	0.0	0.0
10	13.0	67666.1	0.0	0.0	0.	0.	10149.9	0.0	0.0
11	2.0	11109.2	0.0	0.0	0.	0.	1666.4	0.0	0.0
12	0.5	2759.3	0.0	0.0	0.	0.	413.9	0.0	0.0
13	19.5	116502.1	0.0	0.0	0.	0.	17475.3	0.0	0.0

14	13.0	85458.0	0.0	0.0	0.	0.	12818.7	0.0	0.0
15	0.3	2032.8	0.0	0.0	0.	0.	304.9	0.0	0.0
16	16.7	119023.0	0.0	0.0	0.	0.	17853.5	0.0	0.0
17	18.0	131813.3	0.0	0.0	0.	0.	19772.0	0.0	1800.0
18	2.0	14431.6	0.0	0.0	0.	0.	2164.7	0.0	200.0
19	0.1	720.5	0.0	0.0	0.	0.	108.1	0.0	0.0
20	24.9	176057.3	0.0	0.0	0.	0.	26408.6	0.0	7470.0
21	10.0	66640.2	0.0	0.0	0.	0.	9996.0	0.0	3000.0
22	5.0	30394.8	0.0	0.0	0.	0.	4559.2	0.0	1500.0
23	2.0	11284.5	0.0	0.0	0.	0.	1692.7	0.0	600.0
24	10.8	48249.2	0.0	0.0	0.	0.	7237.4	0.0	3236.7
25	4.3	13058.5	0.0	0.0	0.	0.	1958.8	0.0	1281.2
26	5.9	12923.1	0.0	0.0	0.	0.	1938.5	0.0	1782.1
27	1.7	2524.7	0.0	0.0	0.	0.	378.7	0.0	498.7
28	2.8	3154.3	0.0	0.0	0.	0.	473.1	0.0	833.8
29	2.7	1186.4	0.0	0.0	0.	0.	178.0	0.0	795.6

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
2	325.261	466.899
3	350.231	465.670
4	375.000	462.283
5	423.000	465.187
6	485.000	470.503
7	495.000	474.873
8	502.000	481.860
9	512.789	498.587
10	527.442	518.842
11	530.094	526.000

Factor of Safety
*** 1.661 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
2	325.261	466.899
3	350.231	465.670
4	375.000	462.283
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Factor of Safety
*** 1.661 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
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Factor of Safety
*** 1.661 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
2	325.261	466.899
3	350.231	465.670

```
    4        375.000      462.283
    5        423.000      465.187
    6        485.000      470.503
    7        495.000      474.873
    8        502.000      481.860
    9        512.789      498.587
   10        527.442      518.842
   11        530.094      526.000
       Factor of Safety
      ***    1.661   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        322.677      468.065
    2        325.261      466.899
    3        350.231      465.670
    4        375.000      462.283
    5        423.000      465.187
    6        485.000      470.503
    7        495.000      474.873
    8        502.000      481.860
    9        512.789      498.587
   10        527.442      518.842
   11        530.094      526.000
       Factor of Safety
      ***    1.661   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        322.677      468.065
    2        325.261      466.899
    3        350.231      465.670
    4        375.000      462.283
    5        423.000      465.187
    6        485.000      470.503
    7        495.000      474.873
    8        502.000      481.860
    9        512.789      498.587
   10        527.442      518.842
   11        530.094      526.000
       Factor of Safety
      ***    1.661   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        322.677      468.065
    2        325.261      466.899
    3        350.231      465.670
    4        375.000      462.283
    5        423.000      465.187
    6        485.000      470.503
    7        495.000      474.873
    8        502.000      481.860
    9        512.789      498.587
   10        527.442      518.842
   11        530.094      526.000
       Factor of Safety
      ***    1.661   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        322.677      468.065
    2        325.261      466.899
    3        350.231      465.670
    4        375.000      462.283
    5        423.000      465.187
    6        485.000      470.503
    7        495.000      474.873
    8        502.000      481.860
    9        512.789      498.587
```

10	527.442	518.842
11	530.094	526.000

Factor of Safety

*** 1.661 ***

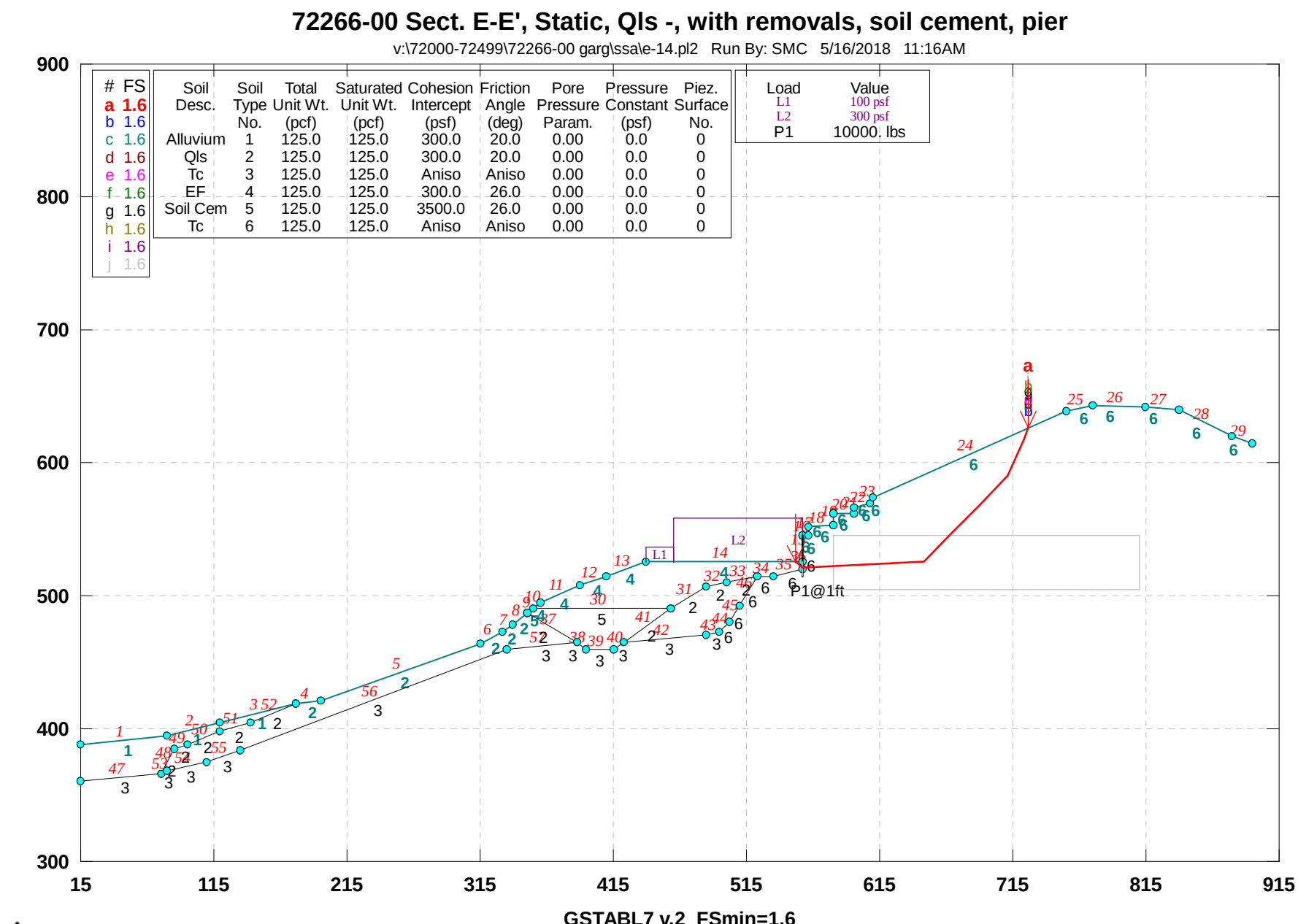
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	322.677	468.065
2	325.261	466.899
3	350.231	465.670
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5	423.000	465.187
6	485.000	470.503
7	495.000	474.873
8	502.000	481.860
9	512.789	498.587
10	527.442	518.842
11	530.094	526.000

Factor of Safety

*** 1.661 ***

**** END OF GSTABL7 OUTPUT ****



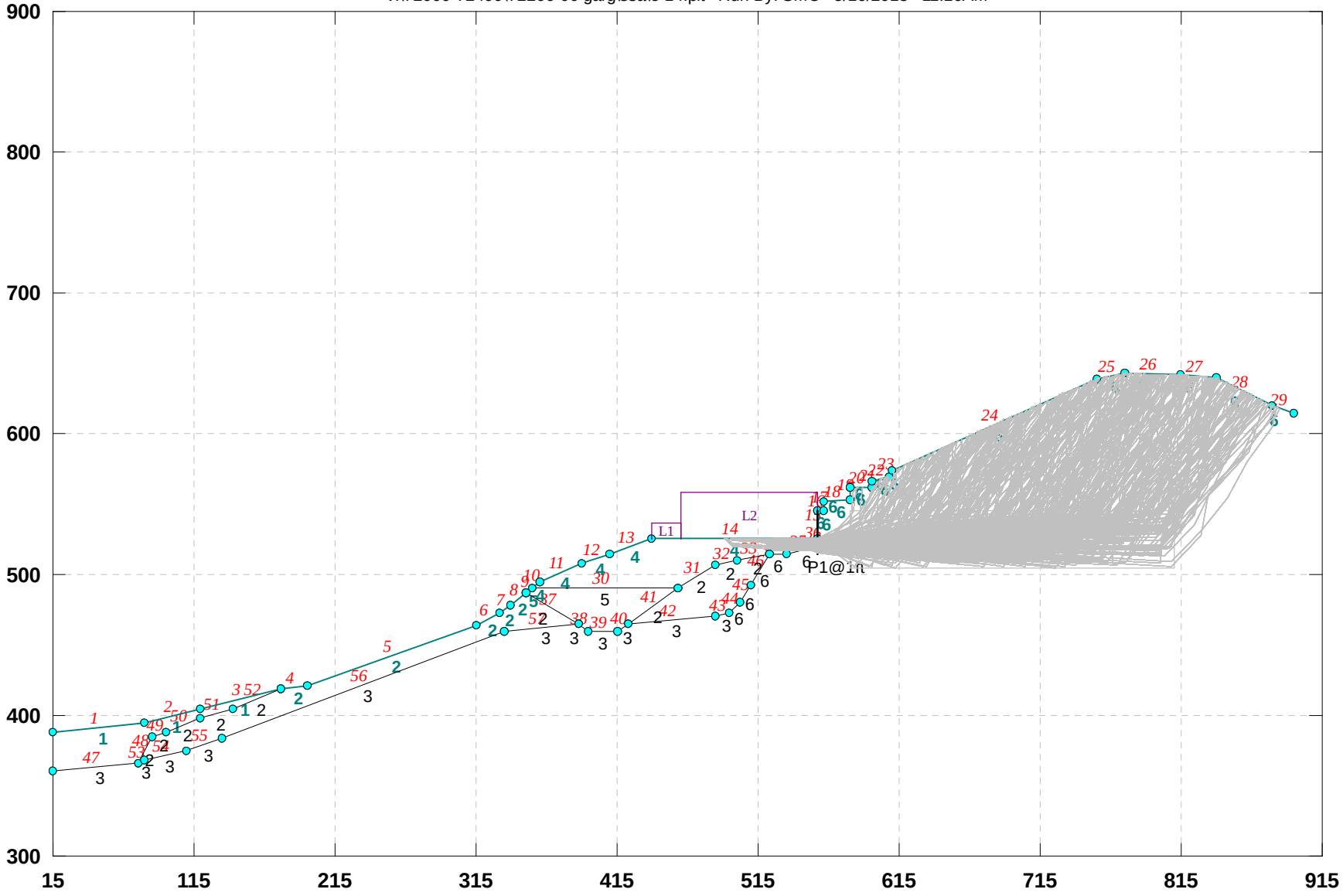
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-10.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-14.plt Run By: SMC 5/16/2018 11:16AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:16AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-14.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	557.00	521.00	557.00	521.00	10.00
2	580.00	525.00	810.00	525.00	40.00

WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	541.90	526.00
2	557.00	517.52
3	600.03	523.65
4	600.26	553.65
5	605.58	569.19

Factor of Safety for the Preceding Surface is Between15.993 and15.968
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	552.43	526.00
2	557.00	523.78
3	645.68	513.43
4	645.72	543.43
5	666.93	564.64
6	681.08	591.09
7	696.49	612.77

Factor of Safety for the Preceding Surface is Between 6.928 and 6.923
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	541.90	526.00
2	557.00	517.52
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The Trial Failure Surface In Question Is Defined
By The Following 5 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	541.90	526.00
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4	600.26	553.65
5	605.58	569.19

Factor of Safety for the Preceding Surface is Between15.993 and15.968
WARNING! The factor of safety calculation did not converge in 20 iterations.
The Trial Failure Surface In Question Is Defined
By The Following 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

###################### SOME LINES SKIPPED ####################

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.
Number of Trial Surfaces with Non-Converged FS = 47
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	551.648	526.000
2	557.000	520.653
3	648.211	525.701
4	669.352	546.986
5	690.476	568.288
6	710.985	590.183
7	723.677	617.366
8	726.547	626.245

Factor of Safety
*** 1.550 ***

Individual data on the 18 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	5.3	1722.3	0.0	0.0	0.	0.	0.0	0.0	1575.5
2	0.0	8.1	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	58.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	0.1	185.5	0.0	0.0	0.	0.	0.0	0.0	0.0
5	4.9	14826.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.1	344.5	0.0	0.0	0.	0.	0.0	0.0	0.0
7	17.9	69518.6	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.1	444.5	0.0	0.0	0.	0.	0.0	0.0	0.0
9	15.9	78762.5	0.0	0.0	0.	0.	0.0	0.0	0.0
10	0.1	514.7	0.0	0.0	0.	0.	0.0	0.0	0.0
11	11.9	66720.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	2.0	12117.4	0.0	0.0	0.	0.	0.0	0.0	0.0
13	38.2	276654.1	0.0	0.0	0.	0.	0.0	0.0	0.0
14	21.1	157298.6	0.0	0.0	0.	0.	0.0	0.0	0.0
15	21.1	125964.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	20.5	90844.1	0.0	0.0	0.	0.	0.0	0.0	0.0
17	12.7	29094.9	0.0	0.0	0.	0.	0.0	0.0	0.0
18	2.9	1362.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	551.648	526.000
2	557.000	520.653
3	648.211	525.701
4	669.352	546.986
5	690.476	568.288
6	710.985	590.183

```
    7        723.677      617.366
    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
    2        557.000      520.653
    3        648.211      525.701
    4        669.352      546.986
    5        690.476      568.288
    6        710.985      590.183
    7        723.677      617.366
    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
    2        557.000      520.653
    3        648.211      525.701
    4        669.352      546.986
    5        690.476      568.288
    6        710.985      590.183
    7        723.677      617.366
    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        551.648      526.000
    2        557.000      520.653
    3        648.211      525.701
    4        669.352      546.986
    5        690.476      568.288
    6        710.985      590.183
    7        723.677      617.366
    8        726.547      626.245
       Factor of Safety
      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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    2        557.000      520.653
    3        648.211      525.701
    4        669.352      546.986
    5        690.476      568.288
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    7        723.677      617.366
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       Factor of Safety
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Failure Surface Specified By  8 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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      ***    1.550   ***
Failure Surface Specified By  8 Coordinate Points
```

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Factor of Safety
*** 1.550 ***

Failure Surface Specified By 8 Coordinate Points

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6	710.985	590.183
7	723.677	617.366
8	726.547	626.245

Factor of Safety
*** 1.550 ***

Failure Surface Specified By 8 Coordinate Points

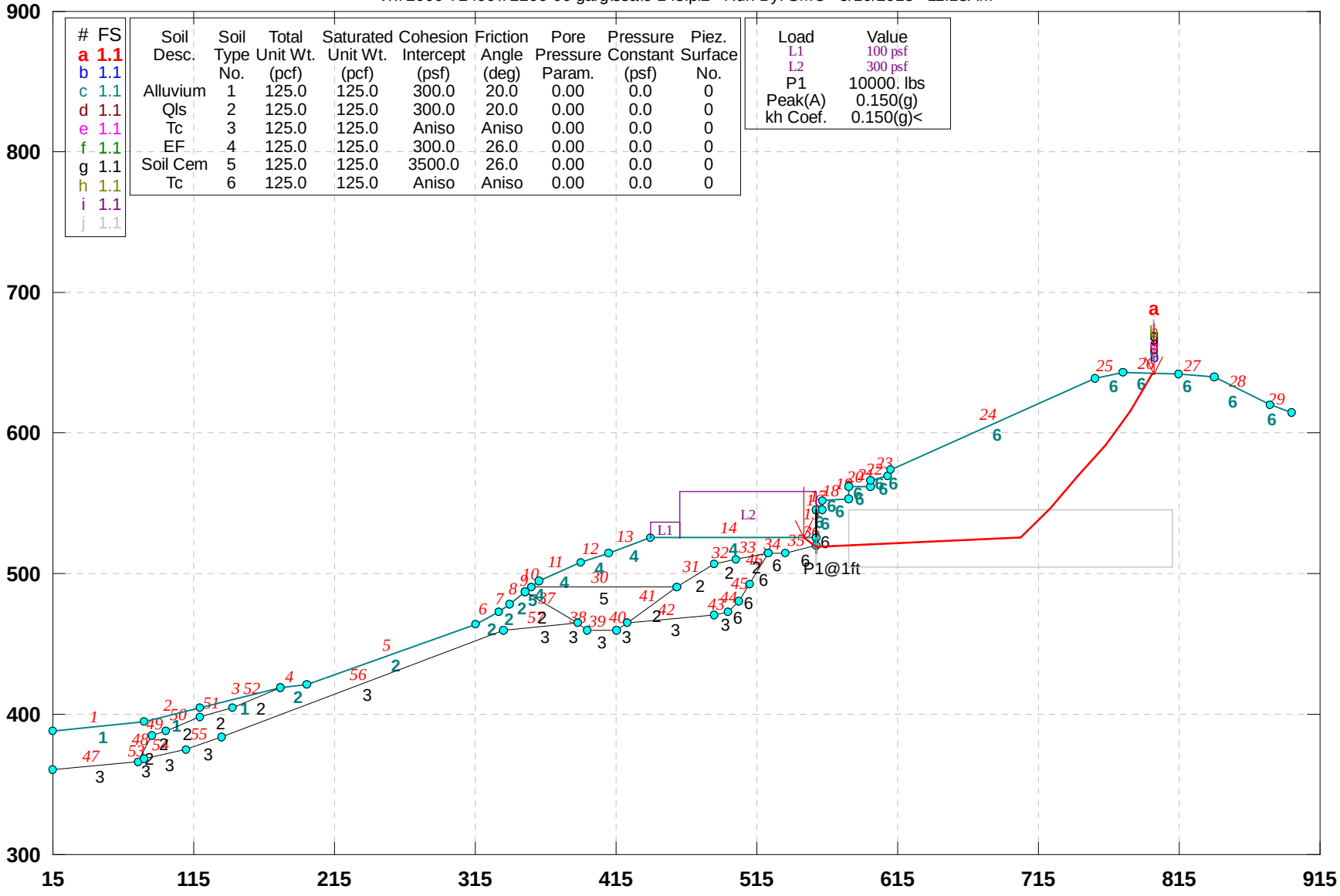
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6	710.985	590.183
7	723.677	617.366
8	726.547	626.245

Factor of Safety
*** 1.550 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-14s.pl2 Run By: SMC 5/16/2018 11:18AM



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure -10.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:18AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-14s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-14s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

1 557.20 545.00 10000.0 1.0 90.00 30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	557.00	516.00	557.00	516.00	20.00
2	580.00	525.00	810.00	525.00	40.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	548.008	526.000
2	557.000	518.577
3	702.454	525.212
4	723.511	546.581
5	742.808	569.551
6	762.985	591.752
7	780.523	616.092
8	796.174	641.685
9	796.750	642.456

Factor of Safety
*** 1.080 ***

Individual data on the 21 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	7.6	2995.8	0.0	0.0	0.	0.	449.4	0.0	2286.0
2	1.3	1083.7	0.0	0.0	0.	0.	162.6	0.0	381.6
3	0.1	92.3	0.0	0.0	0.	0.	13.8	0.0	0.0
4	0.1	211.5	0.0	0.0	0.	0.	31.7	0.0	0.0
5	4.9	16113.0	0.0	0.0	0.	0.	2416.9	0.0	0.0
6	0.1	371.1	0.0	0.0	0.	0.	55.7	0.0	0.0
7	17.9	74468.9	0.0	0.0	0.	0.	11170.3	0.0	0.0
8	0.1	473.3	0.0	0.0	0.	0.	71.0	0.0	0.0
9	15.9	83488.2	0.0	0.0	0.	0.	12523.2	0.0	0.0
10	0.1	545.4	0.0	0.0	0.	0.	81.8	0.0	0.0
11	11.9	70460.0	0.0	0.0	0.	0.	10569.0	0.0	0.0
12	2.0	12762.7	0.0	0.0	0.	0.	1914.4	0.0	0.0
13	92.5	827683.7	0.0	0.0	0.	0.	*******	0.0	0.0
14	21.1	221805.8	0.0	0.0	0.	0.	33270.9	0.0	0.0
15	19.3	171608.7	0.0	0.0	0.	0.	25741.3	0.0	0.0
16	12.2	91451.3	0.0	0.0	0.	0.	13717.7	0.0	0.0
17	8.0	52343.5	0.0	0.0	0.	0.	7851.5	0.0	0.0
18	12.0	62640.2	0.0	0.0	0.	0.	9396.0	0.0	0.0
19	5.5	21173.0	0.0	0.0	0.	0.	3175.9	0.0	0.0
20	15.7	26955.7	0.0	0.0	0.	0.	4043.4	0.0	0.0
21	0.6	28.2	0.0	0.0	0.	0.	4.2	0.0	0.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	548.008	526.000
2	557.000	518.577

```
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
    3        702.454      525.212
    4        723.511      546.581
    5        742.808      569.551
    6        762.985      591.752
    7        780.523      616.092
    8        796.174      641.685
    9        796.750      642.456
       Factor of Safety
      ***    1.080   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        548.008      526.000
    2        557.000      518.577
```

3	702.454	525.212
4	723.511	546.581
5	742.808	569.551
6	762.985	591.752
7	780.523	616.092
8	796.174	641.685
9	796.750	642.456

Factor of Safety
*** 1.080 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	548.008	526.000
2	557.000	518.577
3	702.454	525.212
4	723.511	546.581
5	742.808	569.551
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8	796.174	641.685
9	796.750	642.456

Factor of Safety
*** 1.080 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	548.008	526.000
2	557.000	518.577
3	702.454	525.212
4	723.511	546.581
5	742.808	569.551
6	762.985	591.752
7	780.523	616.092
8	796.174	641.685
9	796.750	642.456

Factor of Safety
*** 1.080 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	548.008	526.000
2	557.000	518.577
3	702.454	525.212
4	723.511	546.581
5	742.808	569.551
6	762.985	591.752
7	780.523	616.092
8	796.174	641.685
9	796.750	642.456

Factor of Safety
*** 1.080 ***

**** END OF GSTABL7 OUTPUT ****

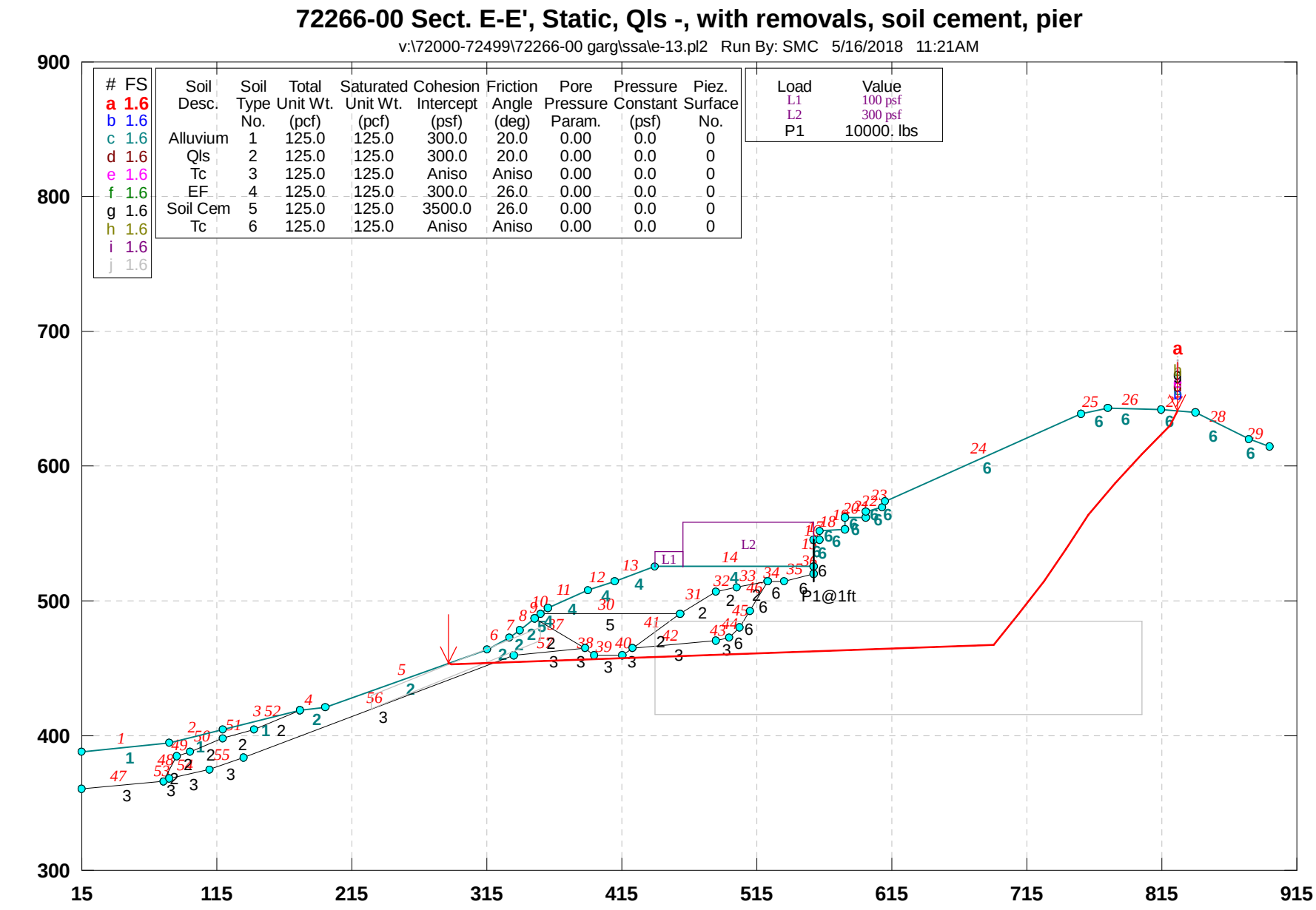
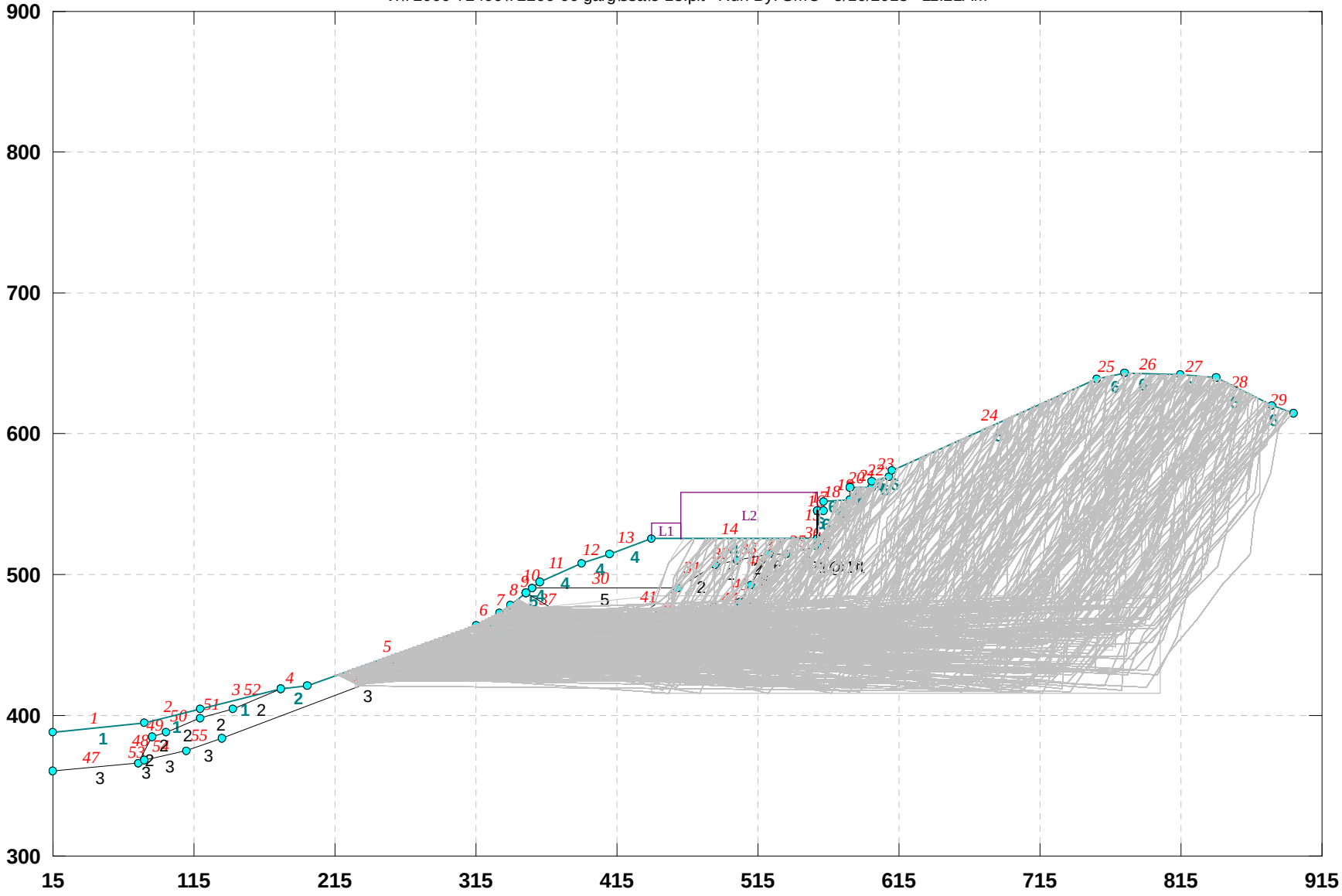

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier
v:\72000-72499\72266-00 garg\ssa\e-13.pl2 Run By: SMC 5/16/2018 11:21AM
FS
a 1.6
b 1.6
c 1.6
d 1.6
e 1.6
f 1.6
g 1.6
h 1.6
i 1.6
j 1.6
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Alluvium | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Qls | 2 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Tc | 3 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
EF | 4 | 125.0 | 125.0 | 300.0 | 26.0 | 0.00 | 0.0 | 0
Soil Cem | 5 | 125.0 | 125.0 | 3500.0 | 26.0 | 0.00 | 0.0 | 0
Tc | 6 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
Load | Value
L1 | 100 psf
L2 | 300 psf
P1 | 10000. lbs
L1
L2
P1@1ft
900
800
700
600
500
400
300
15
115
215
315
415
515
615
715
815
915
GSTABL7 v.2 FSmin=1.6
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-11.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-13.plt Run By: SMC 5/16/2018 11:21AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:21AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-13.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-13.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-13.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
9999 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	230.00	425.00	355.00	475.00	10.00
2	440.00	450.00	800.00	450.00	70.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 9999
Number of Trial Failure Surfaces is Greater Than 5000.
Statistical Data on FS Values are Not Generated.
To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.647 ***
Individual data on the 49 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.0	298.3	0.0	0.0	0.	0.	0.0	0.0	0.0
2	25.8	21069.2	0.0	0.0	0.	0.	0.0	0.0	0.0
3	2.6	3744.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	14.4	27885.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.0	7485.3	0.0	0.0	0.	0.	0.0	0.0	0.0
6	5.0	13947.6	0.0	0.0	0.	0.	0.0	0.0	0.0
7	11.0	38623.2	0.0	0.0	0.	0.	0.0	0.0	0.0
8	4.0	16909.3	0.0	0.0	0.	0.	0.0	0.0	0.0
9	5.0	23535.0	0.0	0.0	0.	0.	0.0	0.0	0.0
10	28.0	159692.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	2.0	12896.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	32978.8	0.0	0.0	0.	0.	0.0	0.0	0.0
13	15.0	104821.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	36928.1	0.0	0.0	0.	0.	0.0	0.0	0.0
15	8.0	61233.3	0.0	0.0	0.	0.	0.0	0.0	0.0
16	17.0	138900.5	0.0	0.0	0.	0.	0.0	0.0	0.0
17	18.0	152660.6	0.0	0.0	0.	0.	0.0	0.0	1800.0
18	2.0	16871.9	0.0	0.0	0.	0.	0.0	0.0	200.0
19	0.1	843.2	0.0	0.0	0.	0.	0.0	0.0	0.0
20	24.9	208531.5	0.0	0.0	0.	0.	0.0	0.0	7470.0
21	10.0	82959.3	0.0	0.0	0.	0.	0.0	0.0	3000.0
22	5.0	41310.3	0.0	0.0	0.	0.	0.0	0.0	1500.0
23	2.0	16492.5	0.0	0.0	0.	0.	0.0	0.0	600.0
24	8.0	65789.2	0.0	0.0	0.	0.	0.0	0.0	2400.0
25	13.0	106290.9	0.0	0.0	0.	0.	0.0	0.0	3900.0
26	12.0	97437.0	0.0	0.0	0.	0.	0.0	0.0	3600.0
27	21.9	176145.8	0.0	0.0	0.	0.	0.0	0.0	6570.0
28	0.1	799.2	0.0	0.0	0.	0.	0.0	0.0	0.0

29	0.1	917.8	0.0	0.0	0.	0.	0.0	0.0	0.0
30	4.9	50748.3	0.0	0.0	0.	0.	0.0	0.0	0.0
31	0.1	1078.0	0.0	0.0	0.	0.	0.0	0.0	0.0
32	17.9	201237.3	0.0	0.0	0.	0.	0.0	0.0	0.0
33	0.1	1182.4	0.0	0.0	0.	0.	0.0	0.0	0.0
34	15.9	196413.0	0.0	0.0	0.	0.	0.0	0.0	0.0
35	0.1	1256.4	0.0	0.0	0.	0.	0.0	0.0	0.0
36	11.9	155173.4	0.0	0.0	0.	0.	0.0	0.0	0.0
37	2.0	27016.7	0.0	0.0	0.	0.	0.0	0.0	0.0
38	80.6	1275075.8	0.0	0.0	0.	0.	0.0	0.0	0.0
39	18.0	305146.4	0.0	0.0	0.	0.	0.0	0.0	0.0
40	18.9	283496.8	0.0	0.0	0.	0.	0.0	0.0	0.0
41	16.6	214640.6	0.0	0.0	0.	0.	0.0	0.0	0.0
42	10.9	122080.2	0.0	0.0	0.	0.	0.0	0.0	0.0
43	5.8	58077.3	0.0	0.0	0.	0.	0.0	0.0	0.0
44	14.2	122446.6	0.0	0.0	0.	0.	0.0	0.0	0.0
45	5.1	37393.2	0.0	0.0	0.	0.	0.0	0.0	0.0
46	20.5	114503.2	0.0	0.0	0.	0.	0.0	0.0	0.0
47	14.4	46898.8	0.0	0.0	0.	0.	0.0	0.0	0.0
48	6.8	12771.6	0.0	0.0	0.	0.	0.0	0.0	0.0
49	4.6	3265.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
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Factor of Safety
*** 1.647 ***

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Factor of Safety

*** 1.647 ***

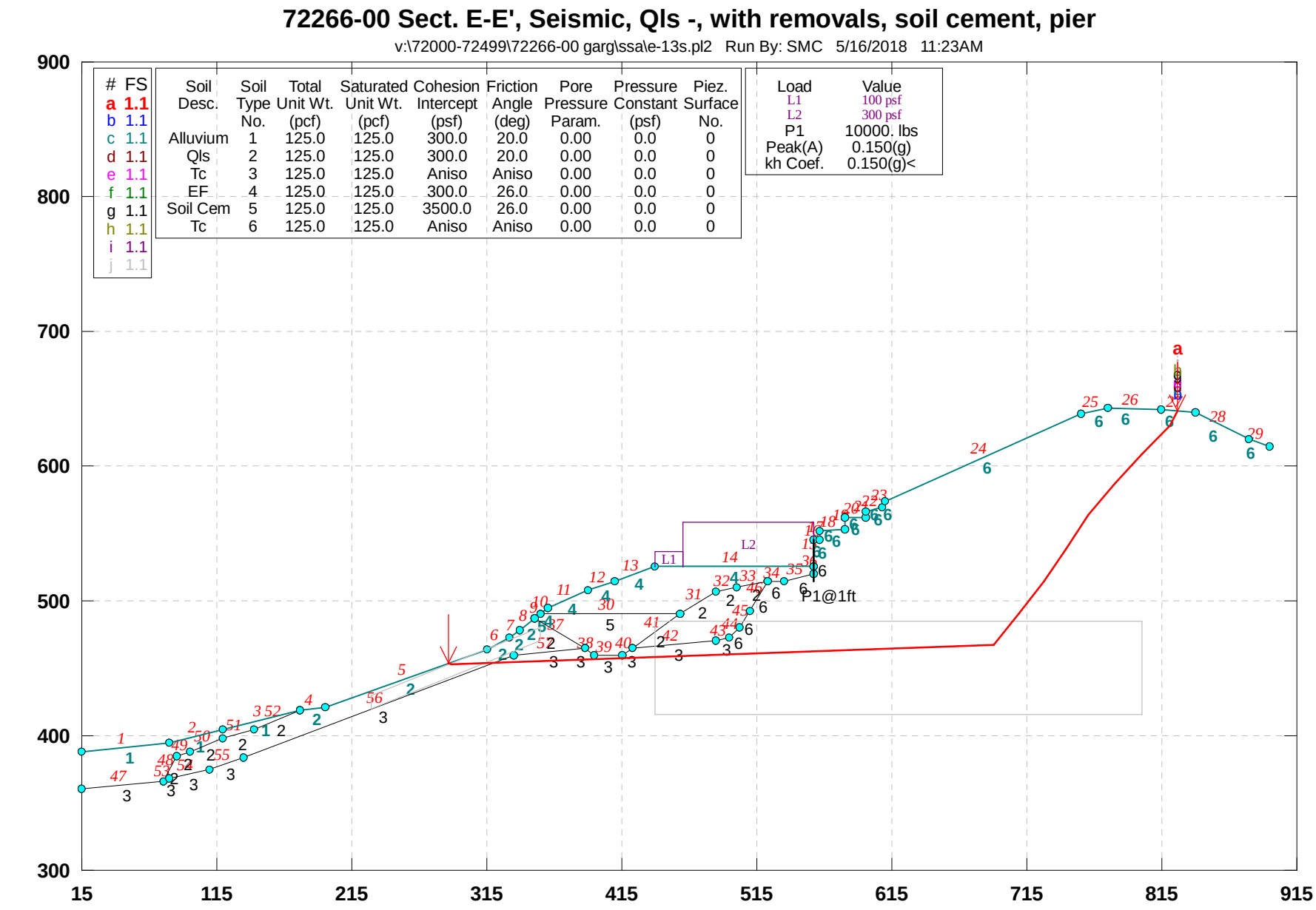
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Factor of Safety

*** 1.647 ***

**** END OF GSTABL7 OUTPUT ****



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-11.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:23AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-13s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-13s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-13s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

1 557.20 545.00 10000.0 1.0 90.00 30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.

9999 Trial Surfaces Have Been Generated.

2 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	230.00	425.00	355.00	475.00	10.00
2	440.00	450.00	800.00	450.00	70.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 9999

Number of Trial Failure Surfaces is Greater Than 5000.

Statistical Data on FS Values are Not Generated.

To Generate Stastical Data, Reduce Number of Trial
Failure Surfaces to 5000 or less.

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
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9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.106 ***

Individual data on the 49 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.0	298.3	0.0	0.0	0.	0.	44.7	0.0	0.0
2	25.8	21069.2	0.0	0.0	0.	0.	3160.4	0.0	0.0
3	2.6	3744.7	0.0	0.0	0.	0.	561.7	0.0	0.0
4	14.4	27885.3	0.0	0.0	0.	0.	4182.8	0.0	0.0
5	3.0	7485.3	0.0	0.0	0.	0.	1122.8	0.0	0.0
6	5.0	13947.6	0.0	0.0	0.	0.	2092.1	0.0	0.0
7	11.0	38623.2	0.0	0.0	0.	0.	5793.5	0.0	0.0
8	4.0	16909.3	0.0	0.0	0.	0.	2536.4	0.0	0.0
9	5.0	23535.0	0.0	0.0	0.	0.	3530.2	0.0	0.0
10	28.0	159692.1	0.0	0.0	0.	0.	23953.8	0.0	0.0
11	2.0	12896.1	0.0	0.0	0.	0.	1934.4	0.0	0.0
12	5.0	32978.8	0.0	0.0	0.	0.	4946.8	0.0	0.0
13	15.0	104821.2	0.0	0.0	0.	0.	15723.2	0.0	0.0
14	5.0	36928.1	0.0	0.0	0.	0.	5539.2	0.0	0.0
15	8.0	61233.3	0.0	0.0	0.	0.	9185.0	0.0	0.0
16	17.0	138900.5	0.0	0.0	0.	0.	20835.1	0.0	0.0
17	18.0	152660.6	0.0	0.0	0.	0.	22899.1	0.0	1800.0
18	2.0	16871.9	0.0	0.0	0.	0.	2530.8	0.0	200.0
19	0.1	843.2	0.0	0.0	0.	0.	126.5	0.0	0.0
20	24.9	208531.5	0.0	0.0	0.	0.	31279.7	0.0	7470.0
21	10.0	82959.3	0.0	0.0	0.	0.	12443.9	0.0	3000.0
22	5.0	41310.3	0.0	0.0	0.	0.	6196.5	0.0	1500.0
23	2.0	16492.5	0.0	0.0	0.	0.	2473.9	0.0	600.0
24	8.0	65789.2	0.0	0.0	0.	0.	9868.4	0.0	2400.0

25	13.0	106290.9	0.0	0.0	0.	0.	15943.6	0.0	3900.0
26	12.0	97437.0	0.0	0.0	0.	0.	14615.6	0.0	3600.0
27	21.9	176145.8	0.0	0.0	0.	0.	26421.9	0.0	6570.0
28	0.1	799.2	0.0	0.0	0.	0.	119.9	0.0	0.0
29	0.1	917.8	0.0	0.0	0.	0.	137.7	0.0	0.0
30	4.9	50748.3	0.0	0.0	0.	0.	7612.2	0.0	0.0
31	0.1	1078.0	0.0	0.0	0.	0.	161.7	0.0	0.0
32	17.9	201237.3	0.0	0.0	0.	0.	30185.6	0.0	0.0
33	0.1	1182.4	0.0	0.0	0.	0.	177.4	0.0	0.0
34	15.9	196413.0	0.0	0.0	0.	0.	29461.9	0.0	0.0
35	0.1	1256.4	0.0	0.0	0.	0.	188.5	0.0	0.0
36	11.9	155173.4	0.0	0.0	0.	0.	23276.0	0.0	0.0
37	2.0	27016.7	0.0	0.0	0.	0.	4052.5	0.0	0.0
38	80.6	1275075.8	0.0	0.0	0.	0.	*******	0.0	0.0
39	18.0	305146.4	0.0	0.0	0.	0.	45772.0	0.0	0.0
40	18.9	283496.8	0.0	0.0	0.	0.	42524.5	0.0	0.0
41	16.6	214640.6	0.0	0.0	0.	0.	32196.1	0.0	0.0
42	10.9	122080.2	0.0	0.0	0.	0.	18312.0	0.0	0.0
43	5.8	58077.3	0.0	0.0	0.	0.	8711.6	0.0	0.0
44	14.2	122446.6	0.0	0.0	0.	0.	18367.0	0.0	0.0
45	5.1	37393.2	0.0	0.0	0.	0.	5609.0	0.0	0.0
46	20.5	114503.2	0.0	0.0	0.	0.	17175.5	0.0	0.0
47	14.4	46898.8	0.0	0.0	0.	0.	7034.8	0.0	0.0
48	6.8	12771.6	0.0	0.0	0.	0.	1915.7	0.0	0.0
49	4.6	3265.4	0.0	0.0	0.	0.	489.8	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety

*** 1.106 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety

*** 1.106 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138

```
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1        287.229      454.049
    2        289.227      452.377
    3        690.554      466.880
    4        708.598      490.848
    5        727.507      514.138
    6        744.059      539.159
    7        760.818      564.041
    8        780.077      587.043
    9        800.600      608.924
   10        821.813      630.138
   11        826.430      641.086
       Factor of Safety
      ***    1.106   ***
Failure Surface Specified By 11 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
```

1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.106 ***

Failure Surface Specified By 11 Coordinate Points

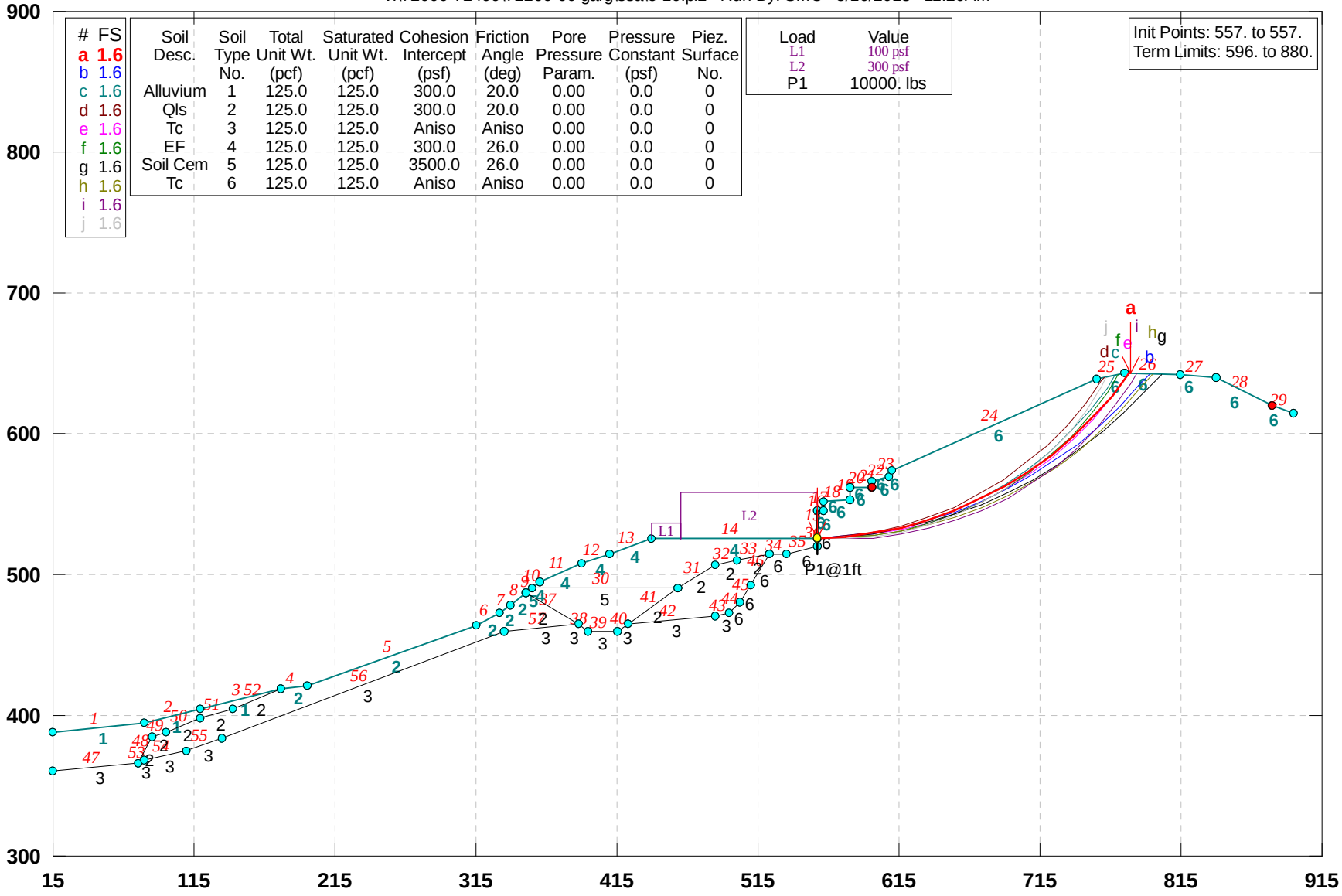
Point No.	X-Surf (ft)	Y-Surf (ft)
1	287.229	454.049
2	289.227	452.377
3	690.554	466.880
4	708.598	490.848
5	727.507	514.138
6	744.059	539.159
7	760.818	564.041
8	780.077	587.043
9	800.600	608.924
10	821.813	630.138
11	826.430	641.086

Factor of Safety
*** 1.106 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-16.pl2 Run By: SMC 5/16/2018 11:26AM



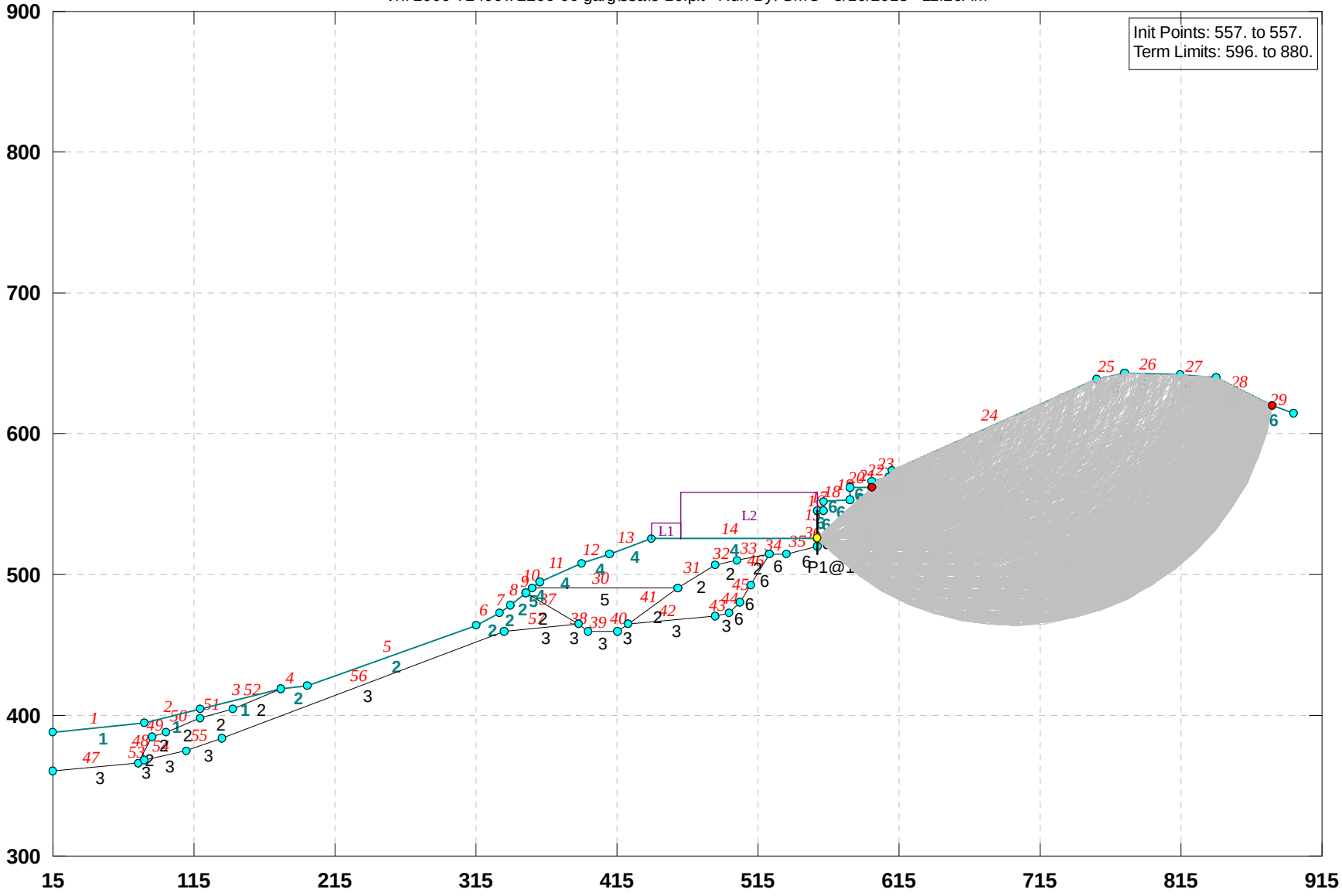
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-12.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-16.plt Run By: SMC 5/16/2018 11:26AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:26AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-16.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
2000 Trial Surfaces Have Been Generated.
2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 557.00(ft)
and X = 557.00(ft)
Each Surface Terminates Between X = 596.00(ft)
and X = 880.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000
Statistical Data On All Valid FS Values:
FS Max = 3.599 FS Min = 1.606 FS Ave = 2.457
Standard Deviation = 0.584 Coefficient of Variation = 23.78 %
Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.970	527.094
3	596.811	529.615
4	616.420	533.548
5	635.698	538.875
6	654.544	545.568
7	672.864	553.592
8	690.563	562.906
9	707.550	573.463
10	723.738	585.208
11	739.044	598.082
12	753.389	612.018
13	766.701	626.944
14	778.910	642.785
15	778.986	642.900

Circle Center At X = 551.713 ; Y = 805.271 ; and Radius = 279.321
Factor of Safety
*** 1.606 ***
Individual data on the 25 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	118.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	4.9	11552.0	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	277.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	14.9	47823.1	0.0	0.0	0.	0.	0.0	0.0	0.0
5	3.0	9706.8	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.1	375.1	0.0	0.0	0.	0.	0.0	0.0	0.0
7	15.9	66577.8	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.1	430.9	0.0	0.0	0.	0.	0.0	0.0	0.0
9	0.7	3246.7	0.0	0.0	0.	0.	0.0	0.0	0.0
10	11.2	52285.9	0.0	0.0	0.	0.	0.0	0.0	0.0
11	2.0	9985.0	0.0	0.0	0.	0.	0.0	0.0	0.0
12	6.4	34133.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	19.3	108405.2	0.0	0.0	0.	0.	0.0	0.0	0.0
14	18.8	111957.2	0.0	0.0	0.	0.	0.0	0.0	0.0
15	18.3	111052.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	17.7	105968.0	0.0	0.0	0.	0.	0.0	0.0	0.0
17	17.0	97116.8	0.0	0.0	0.	0.	0.0	0.0	0.0
18	16.2	85031.0	0.0	0.0	0.	0.	0.0	0.0	0.0
19	15.3	70352.9	0.0	0.0	0.	0.	0.0	0.0	0.0
20	14.3	53818.5	0.0	0.0	0.	0.	0.0	0.0	0.0
21	1.6	5178.9	0.0	0.0	0.	0.	0.0	0.0	0.0
22	11.7	28938.3	0.0	0.0	0.	0.	0.0	0.0	0.0
23	8.3	10210.2	0.0	0.0	0.	0.	0.0	0.0	0.0
24	3.9	1320.7	0.0	0.0	0.	0.	0.0	0.0	0.0

25 0.1 0.6 0.0 0.0 0. 0. 0.0 0.0 0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.962	527.240
3	596.805	529.741
4	616.449	533.494
5	635.817	538.483
6	654.830	544.688
7	673.412	552.085
8	691.488	560.643
9	708.987	570.328
10	725.836	581.103
11	741.970	592.922
12	757.324	605.739
13	771.834	619.503
14	785.445	634.158
15	792.316	642.567

Circle Center At X = 547.418 ; Y = 841.571 ; and Radius = 315.717

Factor of Safety
*** 1.612 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.984	526.797
3	596.842	529.174
4	616.450	533.115
5	635.684	538.596
6	654.424	545.583
7	672.552	554.031
8	689.954	563.889
9	706.522	575.093
10	722.150	587.573
11	736.741	601.252
12	750.203	616.042
13	762.452	631.853
14	768.963	641.793

Circle Center At X = 557.124 ; Y = 777.673 ; and Radius = 251.673

Factor of Safety
*** 1.613 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.961	527.249
3	596.757	530.097
4	616.261	534.524
5	635.347	540.503
6	653.891	547.994
7	671.774	556.949
8	688.880	567.311
9	705.100	579.012
10	720.328	591.978
11	734.466	606.124
12	747.423	621.359
13	759.116	637.585
14	760.656	640.131

Circle Center At X = 551.556 ; Y = 774.482 ; and Radius = 248.542

Factor of Safety
*** 1.615 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.997	526.350
3	596.906	528.260
4	616.604	531.718
5	635.973	536.702

6	654.894	543.183
7	673.251	551.121
8	690.933	560.468
9	707.831	571.166
10	723.843	583.150
11	738.871	596.347
12	752.823	610.677
13	765.614	626.052
14	777.166	642.378
15	777.500	642.938

Circle Center At X = 562.518 ; Y = 782.007 ; and Radius = 256.066

Factor of Safety

*** 1.617 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	577.000	526.075
3	596.923	527.821
4	616.631	531.227
5	635.986	536.268
6	654.851	542.910
7	673.094	551.105
8	690.589	560.797
9	707.212	571.917
10	722.848	584.388
11	737.386	598.123
12	750.726	613.025
13	762.772	628.990
14	771.120	642.224

Circle Center At X = 566.214 ; Y = 764.375 ; and Radius = 238.553

Factor of Safety

*** 1.624 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.974	527.029
3	596.847	529.272
4	616.548	532.719
5	636.003	537.358
6	655.139	543.172
7	673.886	550.138
8	692.175	558.233
9	709.938	567.425
10	727.108	577.680
11	743.624	588.960
12	759.422	601.225
13	774.445	614.427
14	788.637	628.519
15	800.968	642.351

Circle Center At X = 550.079 ; Y = 854.585 ; and Radius = 328.658

Factor of Safety

*** 1.629 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.999	526.199
3	596.935	527.795
4	616.711	530.781
5	636.230	535.142
6	655.396	540.857
7	674.116	547.897
8	692.298	556.229
9	709.853	565.811
10	726.695	576.597
11	742.743	588.533
12	757.917	601.563
13	772.143	615.620

14	785.351	630.638
15	794.407	642.515

Circle Center At X = 564.155 ; Y = 811.868 ; and Radius = 285.958

Factor of Safety

*** 1.630 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.984	525.192
3	596.966	526.043
4	616.808	528.547
5	636.375	532.687
6	655.532	538.434
7	674.146	545.749
8	692.090	554.581
9	709.240	564.871
10	725.479	576.546
11	740.694	589.526
12	754.781	603.723
13	767.644	619.038
14	779.193	635.367
15	783.565	642.786

Circle Center At X = 576.723 ; Y = 766.319 ; and Radius = 241.127

Factor of Safety

*** 1.636 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.995	525.535
3	596.946	526.927
4	616.682	530.165
5	636.033	535.220
6	654.831	542.049
7	672.914	550.592
8	690.127	560.777
9	706.320	572.515
10	721.355	585.705
11	735.100	600.232
12	747.438	615.973
13	758.263	632.791
14	762.239	640.448

Circle Center At X = 572.144 ; Y = 740.095 ; and Radius = 214.630

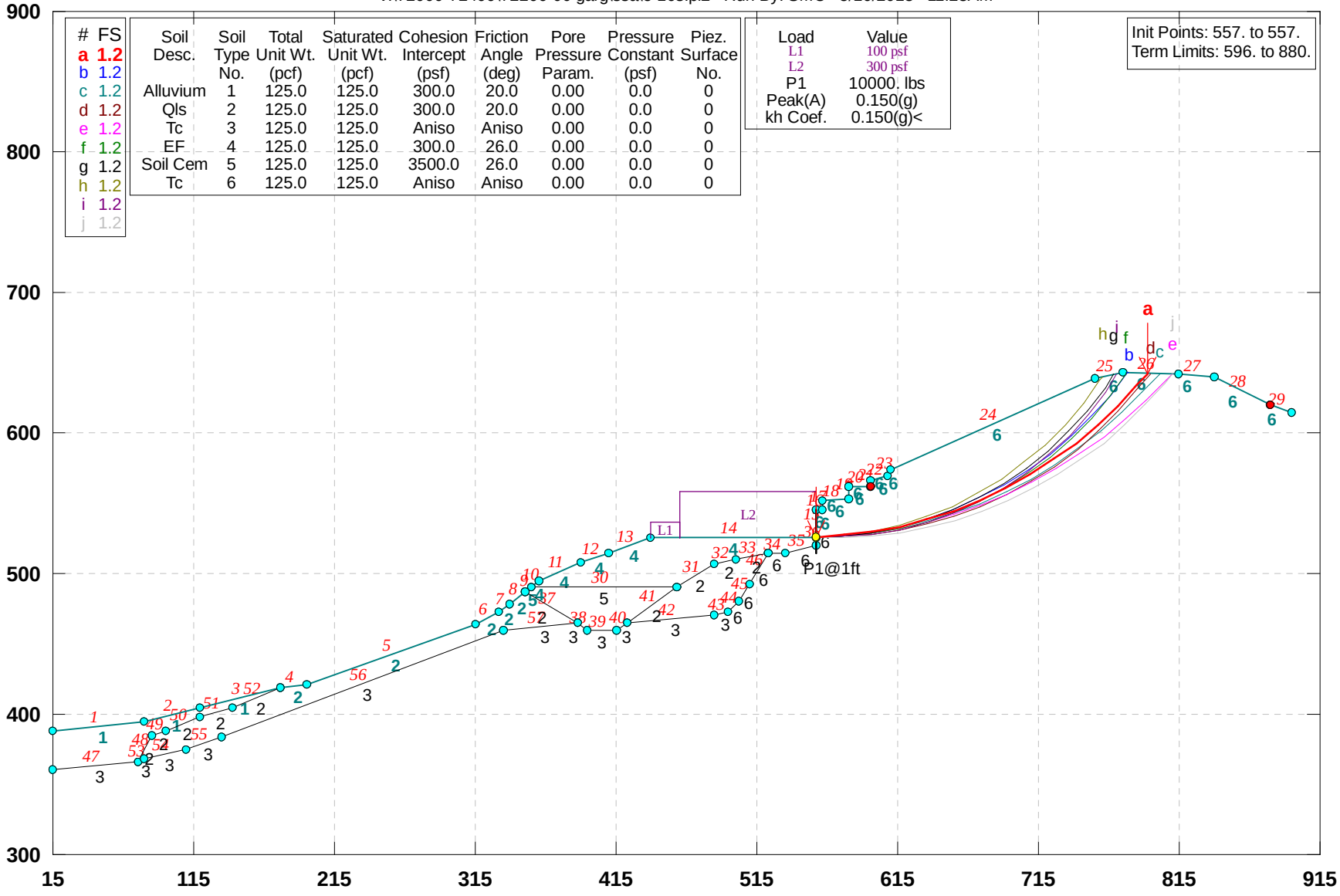
Factor of Safety

*** 1.637 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-16s.pl2 Run By: SMC 5/16/2018 11:28AM



GSTABL7 v.2 FSmin=1.2

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-12.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:28AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-16s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-16s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

```
   1     557.20   545.00    10000.0     1.0      90.00       30.0
NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
       Assuming A Uniform Distribution Of Load Horizontally Between
       Individual Piers/Piles.
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
2000 Trial Surfaces Have Been Generated.
2000 Surface(s) Initiate(s) From Each Of     1 Points Equally Spaced
Along The Ground Surface Between  X = 557.00(ft)
                                  and  X = 557.00(ft)
Each Surface Terminates Between   X = 596.00(ft)
                                  and   X = 880.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =    300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Modified Bishop Method * *
      Total Number of Trial Surfaces Attempted =  2000
      Number of Trial Surfaces With Valid FS = 2000
      Statistical Data On All Valid FS Values:
         FS Max =   2.400   FS Min =   1.173   FS Ave =   1.755
         Standard Deviation =    0.344   Coefficient of Variation =   19.62 %
      Failure Surface Specified By 15 Coordinate Points
        Point      X-Surf      Y-Surf
         No.        (ft)        (ft)
          1        557.000      526.000
          2        576.962      527.240
          3        596.805      529.741
          4        616.449      533.494
          5        635.817      538.483
          6        654.830      544.688
          7        673.412      552.085
          8        691.488      560.643
          9        708.987      570.328
         10        725.836      581.103
         11        741.970      592.922
         12        757.324      605.739
         13        771.834      619.503
         14        785.445      634.158
         15        792.316      642.567
      Circle Center At X =   547.418 ; Y =   841.571 ; and Radius =   315.717
            Factor of Safety
           ***    1.173   ***
         Individual data on the    25  slices
                    Water  Water     Tie     Tie     Earthquake
                    Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
  1      0.1     118.7     0.0     0.0       0.      0.    17.8     0.0      0.0
  2      4.9   11540.5     0.0     0.0       0.      0.  1731.1     0.0      0.0
  3      0.1     277.3     0.0     0.0       0.      0.    41.6     0.0      0.0
  4     14.9   47625.4     0.0     0.0       0.      0.  7143.8     0.0      0.0
  5      3.0    9678.9     0.0     0.0       0.      0.  1451.8     0.0      0.0
  6      0.1     373.3     0.0     0.0       0.      0.    56.0     0.0      0.0
  7     15.9   66307.8     0.0     0.0       0.      0.  9946.2     0.0      0.0
  8      0.1     429.3     0.0     0.0       0.      0.    64.4     0.0      0.0
  9      0.7    3207.5     0.0     0.0       0.      0.   481.1     0.0      0.0
 10     11.2   52210.2     0.0     0.0       0.      0.  7831.5     0.0      0.0
 11      2.0    9982.3     0.0     0.0       0.      0.  1497.3     0.0      0.0
 12      6.4   34316.4     0.0     0.0       0.      0.  5147.5     0.0      0.0
 13     19.4  109534.2     0.0     0.0       0.      0. 16430.1     0.0      0.0
 14     19.0  114670.7     0.0     0.0       0.      0. 17200.6     0.0      0.0
 15     18.6  115846.8     0.0     0.0       0.      0. 17377.0     0.0      0.0
 16     18.1  113234.8     0.0     0.0       0.      0. 16985.2     0.0      0.0
 17     17.5  107101.5     0.0     0.0       0.      0. 16065.2     0.0      0.0
 18     16.8   97801.7     0.0     0.0       0.      0. 14670.3     0.0      0.0
 19     16.1   85773.1     0.0     0.0       0.      0. 12866.0     0.0      0.0
 20     13.0   61432.7     0.0     0.0       0.      0.  9214.9     0.0      0.0
```

21	2.3	10009.6	0.0	0.0	0.	0.	1501.4	0.0	0.0
22	14.5	51322.4	0.0	0.0	0.	0.	7698.4	0.0	0.0
23	3.2	8498.3	0.0	0.0	0.	0.	1274.7	0.0	0.0
24	10.4	18715.3	0.0	0.0	0.	0.	2807.3	0.0	0.0
25	6.9	3685.5	0.0	0.0	0.	0.	552.8	0.0	0.0

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.970	527.094
3	596.811	529.615
4	616.420	533.548
5	635.698	538.875
6	654.544	545.568
7	672.864	553.592
8	690.563	562.906
9	707.550	573.463
10	723.738	585.208
11	739.044	598.082
12	753.389	612.018
13	766.701	626.944
14	778.910	642.785
15	778.986	642.900

Circle Center At X = 551.713 ; Y = 805.271 ; and Radius = 279.321

Factor of Safety

*** 1.178 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.974	527.029
3	596.847	529.272
4	616.548	532.719
5	636.003	537.358
6	655.139	543.172
7	673.886	550.138
8	692.175	558.233
9	709.938	567.425
10	727.108	577.680
11	743.624	588.960
12	759.422	601.225
13	774.445	614.427
14	788.637	628.519
15	800.968	642.351

Circle Center At X = 550.079 ; Y = 854.585 ; and Radius = 328.658

Factor of Safety

*** 1.178 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.999	526.199
3	596.935	527.795
4	616.711	530.781
5	636.230	535.142
6	655.396	540.857
7	674.116	547.897
8	692.298	556.229
9	709.853	565.811
10	726.695	576.597
11	742.743	588.533
12	757.917	601.563
13	772.143	615.620
14	785.351	630.638
15	794.407	642.515

Circle Center At X = 564.155 ; Y = 811.868 ; and Radius = 285.958

Factor of Safety

*** 1.184 ***

Failure Surface Specified By 16 Coordinate Points

Point	X-Surf	Y-Surf

No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.971	527.076
3	596.849	529.277
4	616.572	532.597
5	636.076	537.023
6	655.299	542.544
7	674.180	549.140
8	692.659	556.791
9	710.676	565.473
10	728.175	575.157
11	745.100	585.813
12	761.396	597.408
13	777.012	609.903
14	791.899	623.260
15	806.008	637.435
16	810.172	642.121

Circle Center At X = 548.096 ; Y = 879.462 ; and Radius = 353.574

Factor of Safety

*** 1.185 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.997	526.350
3	596.906	528.260
4	616.604	531.718
5	635.973	536.702
6	654.894	543.183
7	673.251	551.121
8	690.933	560.468
9	707.831	571.166
10	723.843	583.150
11	738.871	596.347
12	752.823	610.677
13	765.614	626.052
14	777.166	642.378
15	777.500	642.938

Circle Center At X = 562.518 ; Y = 782.007 ; and Radius = 256.066

Factor of Safety

*** 1.186 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.984	526.797
3	596.842	529.174
4	616.450	533.115
5	635.684	538.596
6	654.424	545.583
7	672.552	554.031
8	689.954	563.889
9	706.522	575.093
10	722.150	587.573
11	736.741	601.252
12	750.203	616.042
13	762.452	631.853
14	768.963	641.793

Circle Center At X = 557.124 ; Y = 777.673 ; and Radius = 251.673

Factor of Safety

*** 1.188 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.961	527.249
3	596.757	530.097
4	616.261	534.524
5	635.347	540.503
6	653.891	547.994

7	671.774	556.949
8	688.880	567.311
9	705.100	579.012
10	720.328	591.978
11	734.466	606.124
12	747.423	621.359
13	759.116	637.585
14	760.656	640.131

Circle Center At X = 551.556 ; Y = 774.482 ; and Radius = 248.542

Factor of Safety

*** 1.193 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	577.000	526.075
3	596.923	527.821
4	616.631	531.227
5	635.986	536.268
6	654.851	542.910
7	673.094	551.105
8	690.589	560.797
9	707.212	571.917
10	722.848	584.388
11	737.386	598.123
12	750.726	613.025
13	762.772	628.990
14	771.120	642.224

Circle Center At X = 566.214 ; Y = 764.375 ; and Radius = 238.553

Factor of Safety

*** 1.194 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	557.000	526.000
2	576.999	525.781
3	596.969	526.873
4	616.825	529.271
5	636.481	532.965
6	655.852	537.938
7	674.857	544.170
8	693.412	551.634
9	711.438	560.297
10	728.858	570.123
11	745.597	581.069
12	761.582	593.088
13	776.746	606.129
14	791.023	620.135
15	804.352	635.046
16	809.892	642.128

Circle Center At X = 570.471 ; Y = 830.091 ; and Radius = 304.389

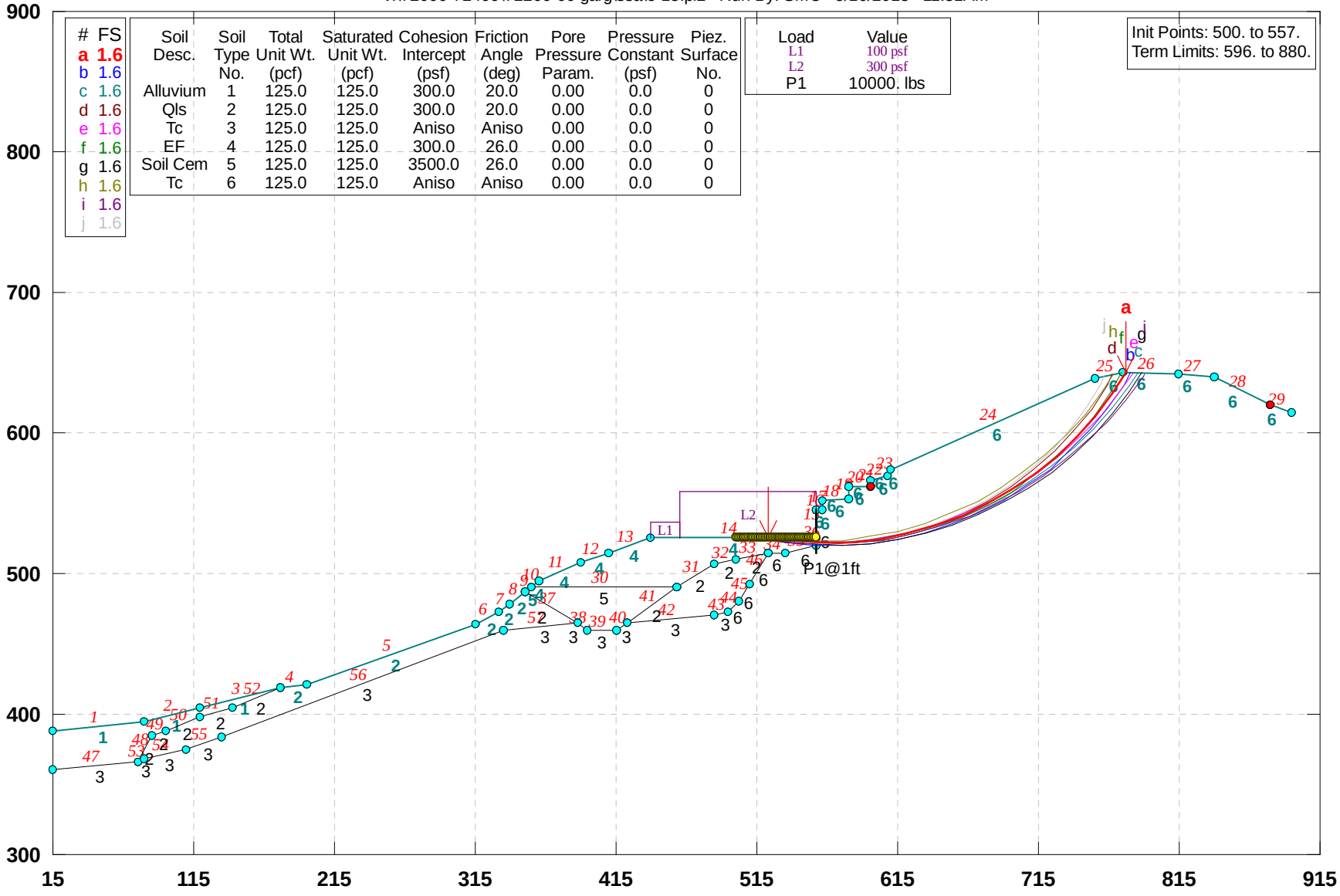
Factor of Safety

*** 1.197 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-15.pl2 Run By: SMC 5/16/2018 11:31AM



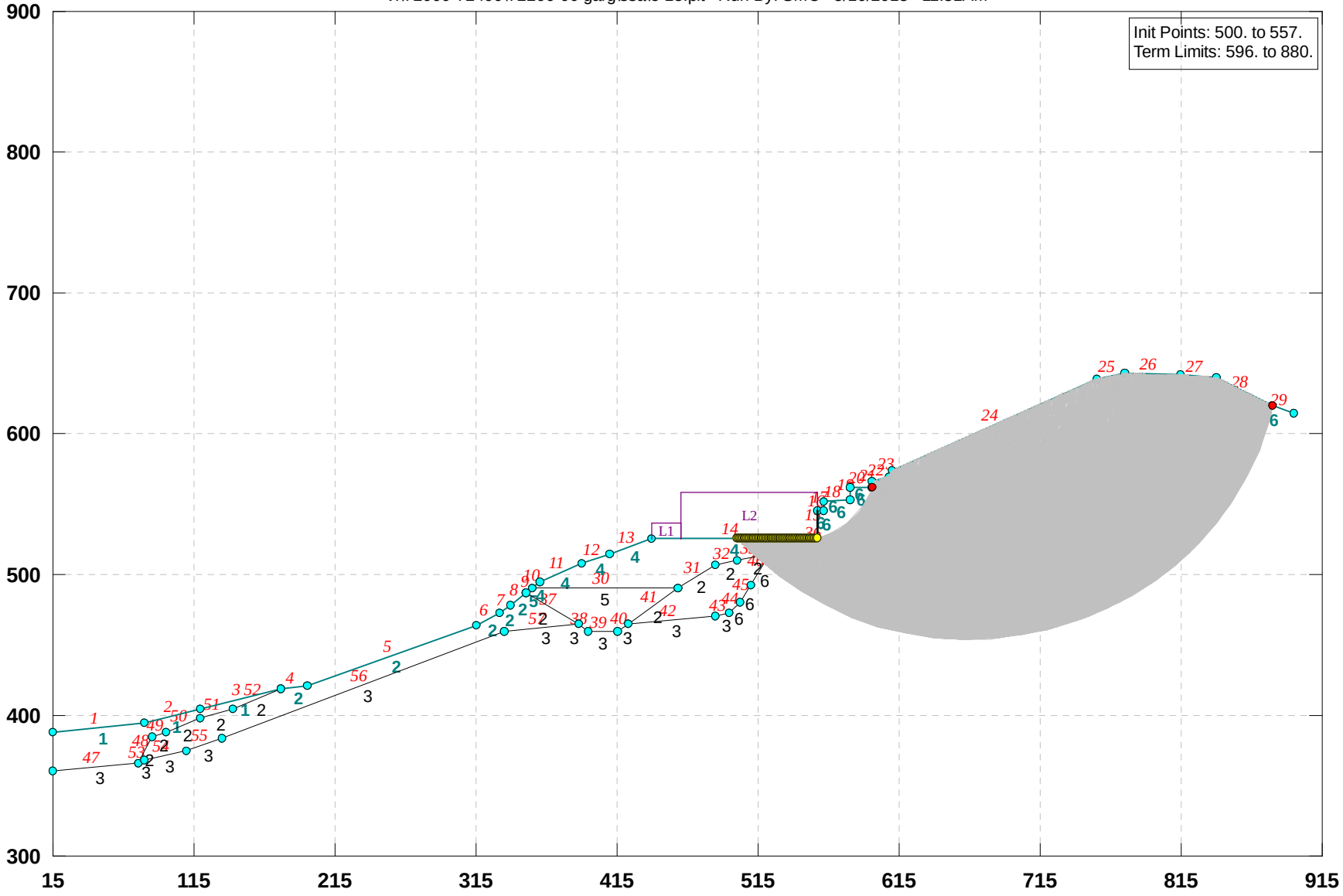
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-13.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-15.plt Run By: SMC 5/16/2018 11:31AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:31AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-15.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
11600 Trial Surfaces Have Been Generated.
200 Surface(s) Initiate(s) From Each Of 58 Points Equally Spaced
Along The Ground Surface Between X = 500.00(ft)
and X = 557.00(ft)
Each Surface Terminates Between X = 596.00(ft)
and X = 880.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
20.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0
Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	523.000	526.000
2	542.813	523.271
3	562.782	522.165
4	582.775	522.691
5	602.659	524.845
6	622.301	528.611
7	641.571	533.966
8	660.340	540.874
9	678.484	549.288
10	695.882	559.154
11	712.418	570.404
12	727.982	582.964
13	742.470	596.751
14	755.787	611.673
15	767.843	627.631
16	777.555	642.936

Circle Center At X = 566.359 ; Y = 767.147 ; and Radius = 245.014
Factor of Safety
*** 1.638 ***
Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.674	522.404
3	555.577	520.433
4	575.574	520.102
5	595.531	521.411
6	615.313	524.354
7	634.788	528.909
8	653.823	535.045
9	672.291	542.723
10	690.067	551.889
11	707.031	562.483
12	723.069	574.432
13	738.073	587.656
14	751.941	602.066
15	764.581	617.566
16	775.908	634.049
17	780.946	642.851

Circle Center At X = 569.610 ; Y = 763.665 ; and Radius = 243.637
Factor of Safety
*** 1.641 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.813	523.271
3	555.774	522.030
4	575.773	522.284
5	595.696	524.032
6	615.433	527.264
7	634.874	531.961
8	653.909	538.099
9	672.432	545.641
10	690.340	554.547
11	707.532	564.766
12	723.913	576.241
13	739.390	588.908
14	753.877	602.697
15	767.294	617.529
16	779.564	633.322
17	785.805	642.730

Circle Center At X = 562.378 ; Y = 789.399 ; and Radius = 267.451

Factor of Safety
*** 1.642 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	524.000	526.000
2	543.788	523.096
3	563.754	521.932
4	583.746	522.518
5	603.609	524.849
6	623.193	528.907
7	642.347	534.661
8	660.926	542.068
9	678.785	551.070
10	695.790	561.598
11	711.809	573.573
12	726.720	586.901
13	740.410	601.482
14	752.772	617.204
15	763.713	633.946
16	767.786	641.557

Circle Center At X = 567.125 ; Y = 749.952 ; and Radius = 228.066

Factor of Safety
*** 1.643 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	506.000	526.000
2	525.762	522.922
3	545.697	521.320
4	565.697	521.201
5	585.650	522.567
6	605.447	525.411
7	624.978	529.716
8	644.136	535.458
9	662.815	542.607
10	680.911	551.123
11	698.326	560.958
12	714.963	572.059
13	730.729	584.364
14	745.539	597.805
15	759.311	612.308
16	771.968	627.794
17	782.486	642.813

Circle Center At X = 557.292 ; Y = 790.343 ; and Radius = 269.273

Factor of Safety
*** 1.644 ***

Failure Surface Specified By 16 Coordinate Points

Point	X-Surf	Y-Surf

No.	X-Surf (ft)	Y-Surf (ft)
1	524.000	526.000
2	543.748	522.833
3	563.695	521.384
4	583.693	521.665
5	603.592	523.673
6	623.243	527.393
7	642.499	532.798
8	661.215	539.847
9	679.253	548.488
10	696.476	558.655
11	712.755	570.272
12	727.970	583.254
13	742.006	597.501
14	754.758	612.909
15	766.131	629.360
16	773.769	642.754

Circle Center At X = 570.491 ; Y = 752.084 ; and Radius = 230.814

Factor of Safety

*** 1.644 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.704	522.573
3	555.615	520.690
4	575.613	520.363
5	595.575	521.593
6	615.381	524.373
7	634.910	528.687
8	654.044	534.507
9	672.667	541.800
10	690.666	550.520
11	707.932	560.614
12	724.359	572.022
13	739.849	584.674
14	754.307	598.493
15	767.645	613.395
16	779.783	629.291
17	788.435	642.664

Circle Center At X = 569.813 ; Y = 777.041 ; and Radius = 256.744

Factor of Safety

*** 1.644 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.859	523.632
3	555.844	522.858
4	575.827	523.685
5	595.680	526.106
6	615.276	530.106
7	634.490	535.660
8	653.198	542.731
9	671.281	551.275
10	688.623	561.238
11	705.113	572.554
12	720.647	585.153
13	735.123	598.952
14	748.450	613.865
15	760.543	629.795
16	768.112	641.622

Circle Center At X = 555.572 ; Y = 772.387 ; and Radius = 249.545

Factor of Safety

*** 1.646 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	509.000	526.000
2	528.748	522.833

3	548.673	521.106
4	568.671	520.830
5	588.637	522.005
6	608.464	524.625
7	628.049	528.676
8	647.289	534.138
9	666.082	540.981
10	684.329	549.169
11	701.934	558.659
12	718.804	569.402
13	734.851	581.340
14	749.989	594.410
15	764.139	608.544
16	777.227	623.668
17	789.182	639.701
18	791.033	642.599

Circle Center At X = 562.509 ; Y = 795.964 ; and Radius = 275.216

Factor of Safety

*** 1.647 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	522.000	526.000
2	541.762	522.922
3	561.720	521.635
4	581.714	522.150
5	601.580	524.462
6	621.157	528.552
7	640.286	534.388
8	658.813	541.922
9	676.587	551.092
10	693.463	561.825
11	709.305	574.034
12	723.983	587.618
13	737.380	602.468
14	749.385	618.464
15	759.903	635.476
16	762.405	640.481

Circle Center At X = 566.065 ; Y = 743.127 ; and Radius = 221.553

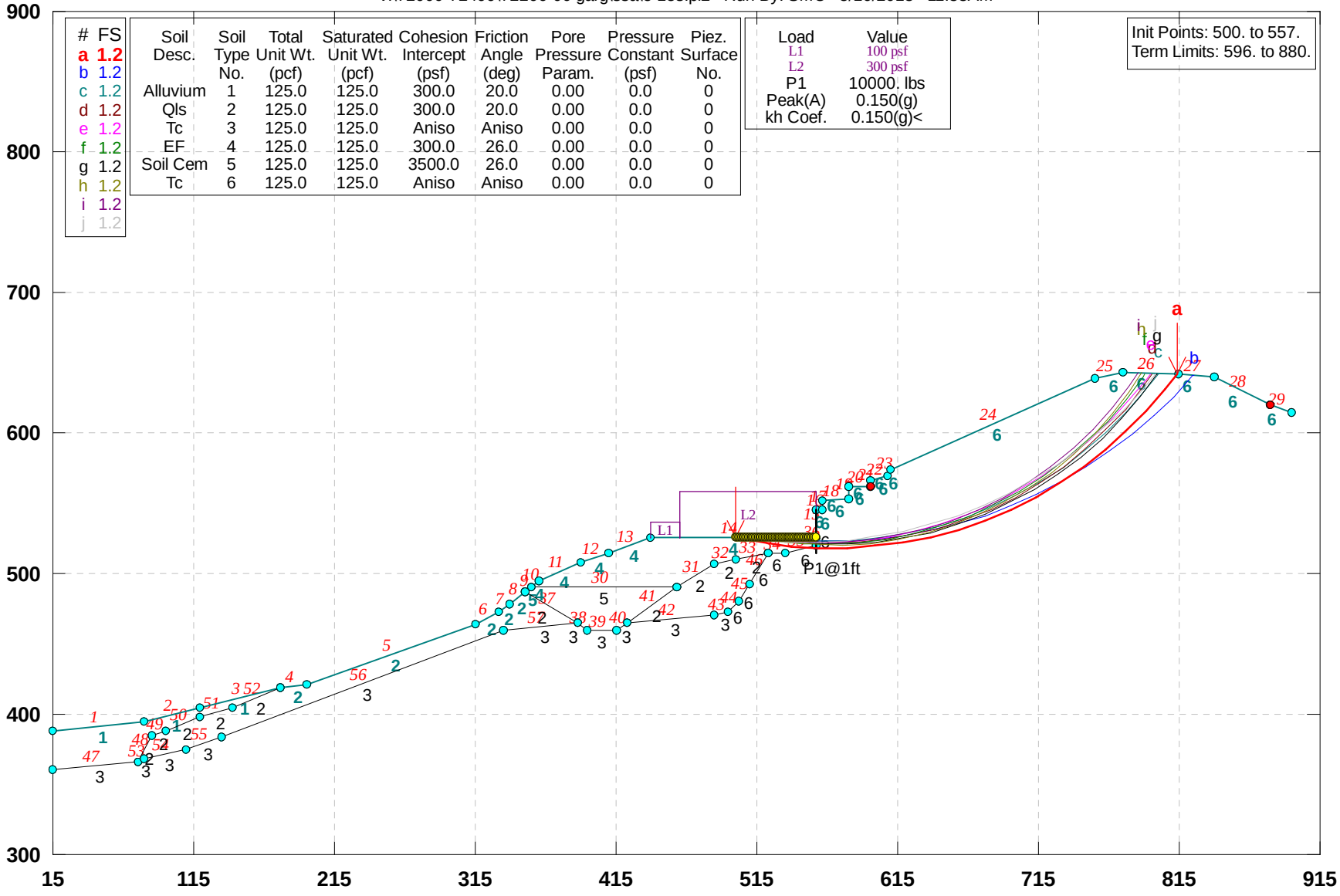
Factor of Safety

*** 1.648 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-15s.pl2 Run By: SMC 5/16/2018 11:33AM



GSTABL7 v.2 FSmin=1.2

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-13.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:33AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-15s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-15s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
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22	596.10	566.00	608.00	570.00	6
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24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
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56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

```
   1     557.20   545.00    10000.0     1.0      90.00       30.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
11600 Trial Surfaces Have Been Generated.
  200 Surface(s) Initiate(s) From Each Of    58 Points Equally Spaced
 Along The Ground Surface Between  X = 500.00(ft)
                             and  X = 557.00(ft)
 Each Surface Terminates Between   X = 596.00(ft)
                            and   X = 880.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =    300.00(ft)
 20.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =     0
       Number of Trial Surfaces With Valid FS =    0
       Statistical Data On All Valid FS Values:
          FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
          Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
       Failure Surface Specified By 19 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1        500.000      526.000
           2        519.609      522.063
           3        539.435      519.432
           4        559.392      518.116
           5        579.392      518.123
           6        599.347      519.452
           7        619.172      522.097
           8        638.778      526.047
           9        658.080      531.285
          10        676.993      537.787
          11        695.436      545.525
          12        713.326      554.465
          13        730.587      564.569
          14        747.141      575.791
          15        762.918      588.084
          16        777.847      601.392
          17        791.864      615.658
          18        804.908      630.820
          19        813.338      642.042
       Circle Center At X =   569.288 ; Y =   820.329 ; and Radius =   302.375
             Factor of Safety
            ***    1.194   ***
           Individual data on the     0  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
       Failure Surface Specified By 19 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1        519.000      526.000
           2        538.888      523.891
           3        558.866      522.939
           4        578.865      523.146
           5        598.818      524.512
           6        618.659      527.033
           7        638.320      530.699
           8        657.735      535.499
           9        676.840      541.417
          10        695.569      548.432
          11        713.860      556.520
          12        731.652      565.656
          13        748.884      575.807
```

14	765.499	586.941
15	781.440	599.018
16	796.655	612.000
17	811.091	625.842
18	824.701	640.497
19	825.264	641.179

Circle Center At X = 565.293 ; Y = 867.752 ; and Radius = 344.873

Factor of Safety

*** 1.195 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	523.000	526.000
2	542.879	523.804
3	562.862	522.974
4	582.855	523.512
5	602.764	525.417
6	622.496	528.679
7	641.959	533.283
8	661.061	539.208
9	679.713	546.426
10	697.828	554.903
11	715.320	564.599
12	732.108	575.469
13	748.113	587.462
14	763.261	600.522
15	777.479	614.588
16	790.702	629.593
17	800.488	642.363

Circle Center At X = 564.998 ; Y = 815.161 ; and Radius = 292.195

Factor of Safety

*** 1.201 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	525.000	526.000
2	544.824	523.356
3	564.790	522.181
4	584.788	522.483
5	604.709	524.260
6	624.444	527.502
7	643.887	532.191
8	662.930	538.302
9	681.471	545.802
10	699.407	554.649
11	716.642	564.796
12	733.082	576.187
13	748.636	588.759
14	763.219	602.445
15	776.754	617.170
16	789.164	632.854
17	795.689	642.483

Circle Center At X = 570.701 ; Y = 792.978 ; and Radius = 270.861

Factor of Safety

*** 1.202 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	508.000	526.000
2	527.813	523.271
3	547.766	521.900
4	567.766	521.895
5	587.720	523.255
6	607.534	525.974
7	627.116	530.040
8	646.376	535.432
9	665.222	542.127
10	683.567	550.093
11	701.326	559.292
12	718.415	569.682

13	734.755	581.215
14	750.270	593.836
15	764.887	607.486
16	778.539	622.103
17	791.160	637.617
18	794.613	642.510

Circle Center At X = 557.890 ; Y = 814.059 ; and Radius = 292.347

Factor of Safety

*** 1.203 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	509.000	526.000
2	528.748	522.833
3	548.673	521.106
4	568.671	520.830
5	588.637	522.005
6	608.464	524.625
7	628.049	528.676
8	647.289	534.138
9	666.082	540.981
10	684.329	549.169
11	701.934	558.659
12	718.804	569.402
13	734.851	581.340
14	749.989	594.410
15	764.139	608.544
16	777.227	623.668
17	789.182	639.701
18	791.033	642.599

Circle Center At X = 562.509 ; Y = 795.964 ; and Radius = 275.216

Factor of Safety

*** 1.203 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	520.000	526.000
2	539.761	522.916
3	559.694	521.284
4	579.693	521.114
5	599.652	522.406
6	619.462	525.153
7	639.019	529.341
8	658.217	534.947
9	676.954	541.942
10	695.130	550.287
11	712.647	559.939
12	729.411	570.845
13	745.334	582.948
14	760.329	596.182
15	774.318	610.476
16	787.223	625.755
17	798.978	641.936
18	799.262	642.393

Circle Center At X = 572.026 ; Y = 794.385 ; and Radius = 273.381

Factor of Safety

*** 1.203 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.704	522.573
3	555.615	520.690
4	575.613	520.363
5	595.575	521.593
6	615.381	524.373
7	634.910	528.687
8	654.044	534.507
9	672.667	541.800
10	690.666	550.520

11	707.932	560.614
12	724.359	572.022
13	739.849	584.674
14	754.307	598.493
15	767.645	613.395
16	779.783	629.291
17	788.435	642.664

Circle Center At X = 569.813 ; Y = 777.041 ; and Radius = 256.744

Factor of Safety

*** 1.203 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	516.000	526.000
2	535.813	523.271
3	555.774	522.030
4	575.773	522.284
5	595.696	524.032
6	615.433	527.264
7	634.874	531.961
8	653.909	538.099
9	672.432	545.641
10	690.340	554.547
11	707.532	564.766
12	723.913	576.241
13	739.390	588.908
14	753.877	602.697
15	767.294	617.529
16	779.564	633.322
17	785.805	642.730

Circle Center At X = 562.378 ; Y = 789.399 ; and Radius = 267.451

Factor of Safety

*** 1.204 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	500.000	526.000
2	519.848	523.539
3	539.811	522.328
4	559.811	522.372
5	579.769	523.669
6	599.606	526.216
7	619.245	530.003
8	638.607	535.013
9	657.617	541.228
10	676.199	548.623
11	694.282	557.168
12	711.792	566.832
13	728.662	577.574
14	744.826	589.353
15	760.218	602.123
16	774.780	615.833
17	788.452	630.430
18	798.345	642.416

Circle Center At X = 549.157 ; Y = 840.521 ; and Radius = 318.339

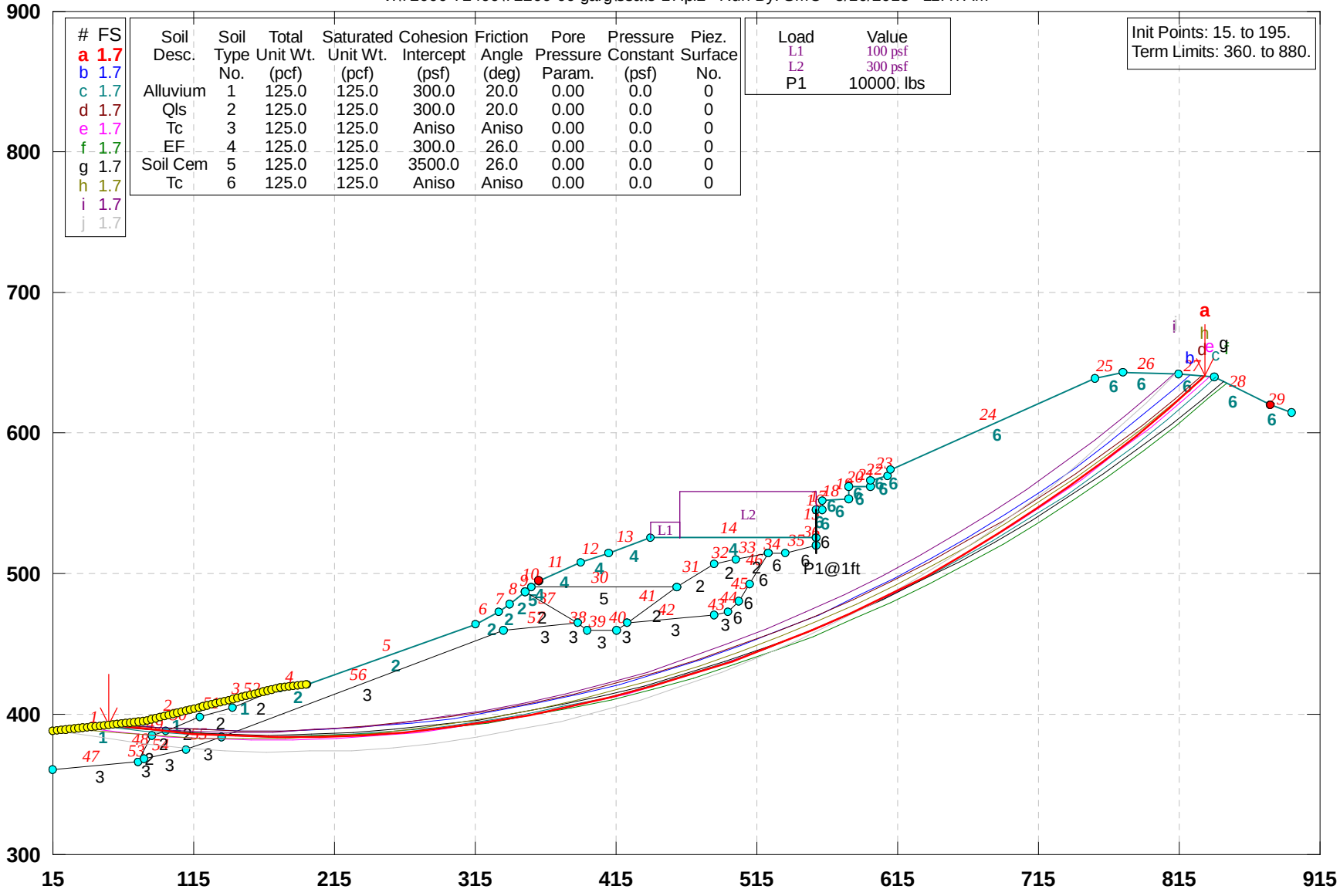
Factor of Safety

*** 1.204 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-17.pl2 Run By: SMC 5/16/2018 11:47AM



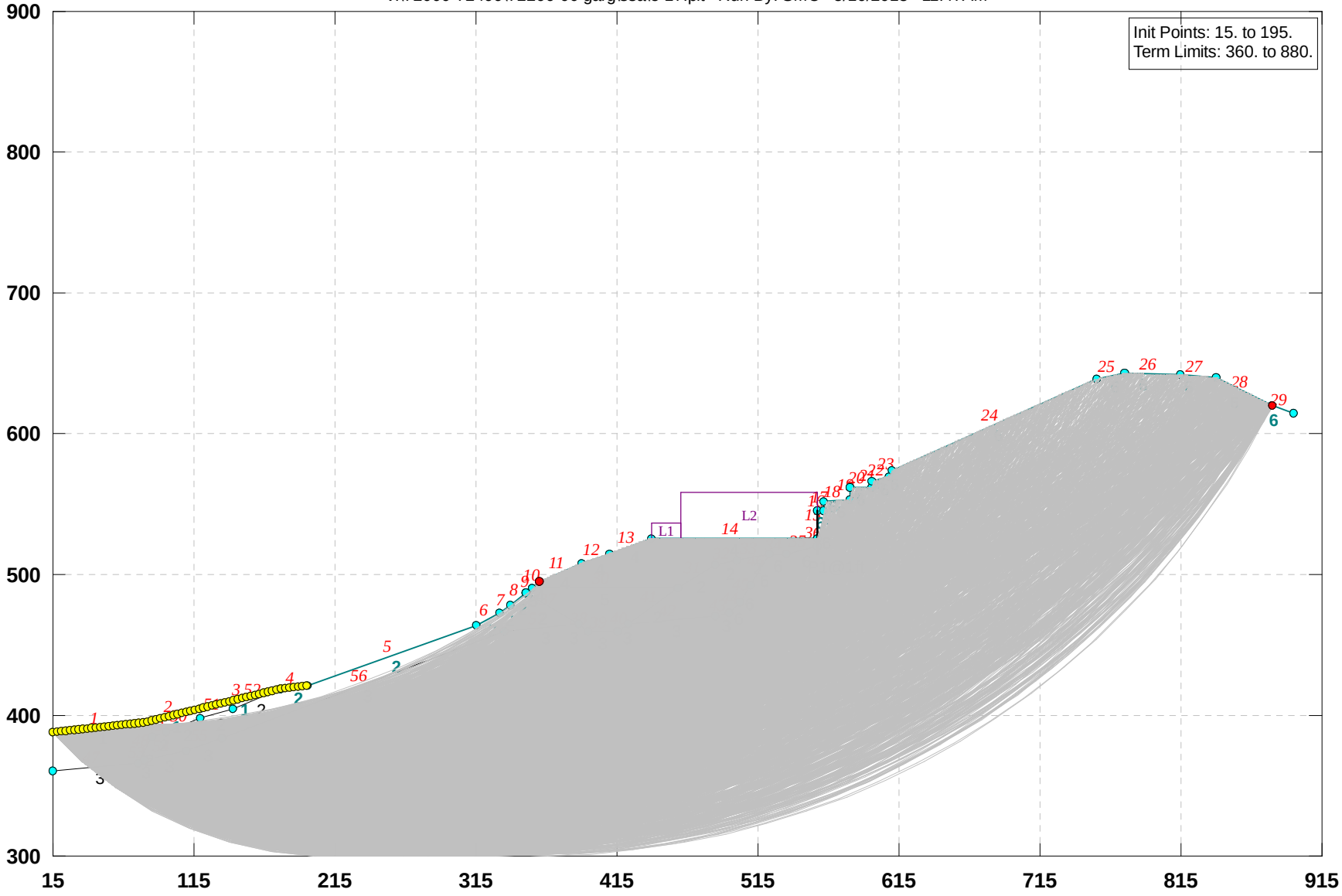
GSTABL7 v.2 FSmin=1.7

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-14.1

72266-00 Sect. E-E', Static, Qls -, with removals, soil cement, pier

v:\72000-72499\72266-00 garg\ssa\e-17.plt Run By: SMC 5/16/2018 11:47AM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:47AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-17.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Static, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	557.20	545.00	10000.0	1.0	90.00	30.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
18000 Trial Surfaces Have Been Generated.
300 Surface(s) Initiate(s) From Each Of 60 Points Equally Spaced
Along The Ground Surface Between X = 15.00(ft)
and X = 195.00(ft)
Each Surface Terminates Between X = 360.00(ft)
and X = 880.00(ft)
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 300.00(ft)
30.00(ft) Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *
Total Number of Trial Surfaces Attempted = 0
Number of Trial Surfaces With Valid FS = 0
Statistical Data On All Valid FS Values:
FS Max = 0.000 FS Min = 500.000 FS Ave = NaN
Standard Deviation = 0.000 Coefficient of Variation = NaN %
Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.661	392.271
2	84.453	388.741
3	114.340	386.150
4	144.295	384.499
5	174.287	383.791
6	204.286	384.026
7	234.263	385.204
8	264.188	387.325
9	294.031	390.385
10	323.764	394.382
11	353.356	399.311
12	382.778	405.169
13	412.002	411.949
14	440.999	419.644
15	469.739	428.247
16	498.194	437.749
17	526.336	448.142
18	554.138	459.414
19	581.572	471.554
20	608.610	484.552
21	635.227	498.392
22	661.395	513.063
23	687.089	528.549
24	712.283	544.836
25	736.953	561.906
26	761.074	579.744
27	784.622	598.331
28	807.574	617.650
29	829.907	637.680
30	832.928	640.566

Circle Center At X = 181.831 ; Y = 1337.530 ; and Radius = 953.775
Factor of Safety
*** 1.681 ***
Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.763	392.928
2	90.646	390.284
3	120.596	388.551
4	150.585	387.732
5	180.585	387.826
6	210.568	388.835

7	240.506	390.756
8	270.372	393.589
9	300.138	397.330
10	329.776	401.977
11	359.258	407.524
12	388.558	413.967
13	417.648	421.300
14	446.502	429.515
15	475.091	438.606
16	503.390	448.563
17	531.373	459.378
18	559.013	471.041
19	586.285	483.540
20	613.164	496.865
21	639.624	511.002
22	665.642	525.938
23	691.192	541.661
24	716.251	558.154
25	740.796	575.403
26	764.804	593.392
27	788.253	612.105
28	811.121	631.523
29	822.096	641.432

Circle Center At X = 162.481 ; Y = 1372.237 ; and Radius = 984.577

Factor of Safety

*** 1.684 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	48.559	391.614
2	78.384	388.373
3	108.292	386.024
4	138.256	384.568
5	168.251	384.008
6	198.249	384.342
7	228.224	385.572
8	258.149	387.696
9	287.997	390.712
10	317.741	394.618
11	347.356	399.409
12	376.815	405.082
13	406.091	411.632
14	435.159	419.053
15	463.992	427.338
16	492.566	436.479
17	520.853	446.470
18	548.830	457.300
19	576.471	468.960
20	603.752	481.440
21	630.648	494.729
22	657.136	508.815
23	683.192	523.684
24	708.792	539.325
25	733.914	555.723
26	758.535	572.863
27	782.634	590.731
28	806.189	609.309
29	829.179	628.583
30	841.281	639.360

Circle Center At X = 172.091 ; Y = 1388.470 ; and Radius = 1004.481

Factor of Safety

*** 1.687 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	57.712	392.600
2	87.620	390.252
3	117.583	388.771
4	147.577	388.159
5	177.576	388.417

6	207.555	389.543
7	237.488	391.538
8	267.352	394.398
9	297.120	398.123
10	326.767	402.709
11	356.269	408.151
12	385.601	414.447
13	414.739	421.589
14	443.657	429.572
15	472.332	438.390
16	500.739	448.035
17	528.855	458.499
18	556.656	469.773
19	584.119	481.848
20	611.220	494.713
21	637.937	508.358
22	664.248	522.771
23	690.130	537.941
24	715.562	553.854
25	740.522	570.497
26	764.990	587.856
27	788.944	605.917
28	812.365	624.664
29	831.249	640.700

Circle Center At X = 153.695 ; Y = 1423.535 ; and Radius = 1035.394

Factor of Safety

*** 1.688 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	36.356	390.300
2	66.148	386.770
3	96.032	384.141
4	125.983	382.417
5	155.971	381.598
6	185.971	381.685
7	215.955	382.679
8	245.895	384.578
9	275.763	387.380
10	305.534	391.083
11	335.179	395.684
12	364.672	401.179
13	393.985	407.561
14	423.092	414.827
15	451.966	422.968
16	480.581	431.978
17	508.911	441.848
18	536.930	452.569
19	564.612	464.132
20	591.932	476.526
21	618.865	489.740
22	645.387	503.761
23	671.474	518.576
24	697.100	534.173
25	722.244	550.538
26	746.882	567.654
27	770.992	585.506
28	794.552	604.079
29	817.539	623.355
30	836.525	640.278

Circle Center At X = 168.106 ; Y = 1374.216 ; and Radius = 992.698

Factor of Safety

*** 1.689 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.661	392.271
2	84.469	388.880
3	114.364	386.380
4	144.321	384.772

5	174.313	384.058
6	204.312	384.240
7	234.293	385.316
8	264.228	387.286
9	294.091	390.147
10	323.856	393.898
11	353.495	398.536
12	382.983	404.055
13	412.293	410.451
14	441.400	417.719
15	470.276	425.852
16	498.898	434.842
17	527.238	444.682
18	555.272	455.363
19	582.976	466.875
20	610.323	479.208
21	637.291	492.352
22	663.854	506.294
23	689.990	521.022
24	715.675	536.523
25	740.886	552.784
26	765.601	569.789
27	789.797	587.523
28	813.454	605.972
29	836.551	625.118
30	848.580	635.710

Circle Center At X = 183.284 ; Y = 1389.106 ; and Radius = 1005.099

Factor of Safety

*** 1.691 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	48.559	391.614
2	78.414	388.665
3	108.341	386.574
4	138.316	385.343
5	168.313	384.973
6	198.309	385.465
7	228.279	386.817
8	258.197	389.029
9	288.040	392.100
10	317.782	396.026
11	347.399	400.804
12	376.867	406.430
13	406.161	412.900
14	435.257	420.208
15	464.131	428.349
16	492.760	437.315
17	521.119	447.100
18	549.186	457.694
19	576.938	469.091
20	604.350	481.279
21	631.402	494.249
22	658.069	507.990
23	684.332	522.491
24	710.167	537.740
25	735.554	553.725
26	760.471	570.432
27	784.899	587.847
28	808.816	605.957
29	832.204	624.746
30	846.373	636.814

Circle Center At X = 166.248 ; Y = 1429.222 ; and Radius = 1044.261

Factor of Safety

*** 1.692 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.254	389.643
2	60.095	386.553

3	90.012	384.333
4	119.982	382.984
5	149.978	382.508
6	179.976	382.906
7	209.949	384.176
8	239.872	386.318
9	269.721	389.330
10	299.469	393.209
11	329.091	397.953
12	358.563	403.557
13	387.860	410.015
14	416.956	417.324
15	445.827	425.477
16	474.448	434.466
17	502.796	444.285
18	530.846	454.924
19	558.575	466.375
20	585.958	478.628
21	612.974	491.673
22	639.598	505.499
23	665.808	520.094
24	691.583	535.445
25	716.900	551.540
26	741.738	568.365
27	766.076	585.906
28	789.893	604.147
29	813.169	623.074
30	833.400	640.528

Circle Center At X = 151.345 ; Y = 1412.979 ; and Radius = 1030.475

Factor of Safety

*** 1.692 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.610	391.943
2	81.507	389.452
3	111.465	387.869
4	141.457	387.197
5	171.456	387.436
6	201.434	388.585
7	231.364	390.644
8	261.217	393.610
9	290.966	397.481
10	320.584	402.253
11	350.043	407.923
12	379.317	414.484
13	408.378	421.930
14	437.200	430.256
15	465.755	439.452
16	494.019	449.511
17	521.964	460.423
18	549.565	472.179
19	576.796	484.767
20	603.632	498.176
21	630.049	512.394
22	656.023	527.406
23	681.528	543.201
24	706.543	559.762
25	731.043	577.075
26	755.006	595.124
27	778.411	613.892
28	801.235	633.362
29	810.874	642.103

Circle Center At X = 148.598 ; Y = 1375.318 ; and Radius = 988.147

Factor of Safety

*** 1.692 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	18.051	388.329

2	47.617	383.247
3	77.341	379.181
4	107.186	376.137
5	137.118	374.118
6	167.101	373.126
7	197.101	373.163
8	227.082	374.228
9	257.009	376.320
10	286.847	379.437
11	316.560	383.574
12	346.114	388.728
13	375.474	394.892
14	404.605	402.059
15	433.474	410.220
16	462.046	419.367
17	490.287	429.487
18	518.165	440.569
19	545.647	452.601
20	572.700	465.567
21	599.293	479.454
22	625.394	494.243
23	650.972	509.919
24	675.999	526.463
25	700.443	543.854
26	724.277	562.074
27	747.472	581.100
28	770.002	600.909
29	791.839	621.480
30	812.247	642.069

Circle Center At X = 181.039 ; Y = 1247.952 ; and Radius = 874.938

Factor of Safety

*** 1.694 ***

**** END OF GSTABL7 OUTPUT ****

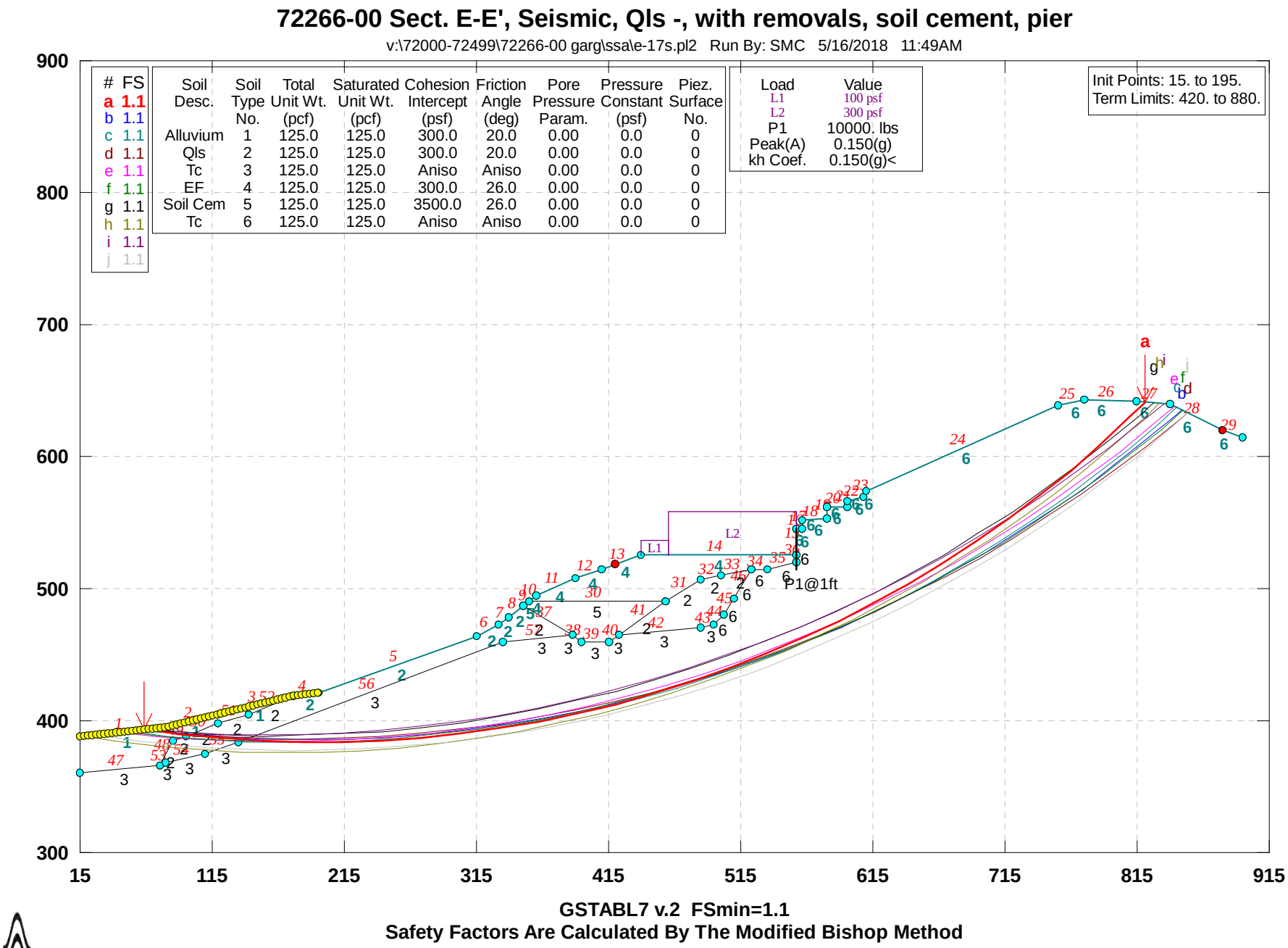

72266-00 Sect. E-E', Seismic, Qls -, with removals, soil cement, pier
v:\72000-72499\72266-00 garg\ssa\e-17s.pl2 Run By: SMC 5/16/2018 11:49AM
FS
a 1.1
b 1.1
c 1.1
d 1.1
e 1.1
f 1.1
g 1.1
h 1.1
i 1.1
j 1.1
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Alluvium 1 125.0 125.0 300.0 20.0 0.00 0.0 0
Qls 2 125.0 125.0 300.0 20.0 0.00 0.0 0
Tc 3 125.0 125.0 Aniso Aniso 0.00 0.0 0
EF 4 125.0 125.0 300.0 26.0 0.00 0.0 0
Soil Cem 5 125.0 125.0 3500.0 26.0 0.00 0.0 0
Tc 6 125.0 125.0 Aniso Aniso 0.00 0.0 0
Load Value
L1 100 psf
L2 300 psf
P1 10000. lbs
Peak(A) 0.150(g)
kh Coef. 0.150(g)<
Init Points: 15. to 195.
Term Limits: 420. to 880.
P1@1ft
900
800
700
600
500
400
300
15
115
215
315
415
515
615
715
815
915
GSTABL7 v.2 FSmin=1.1
Safety Factors Are Calculated By The Modified Bishop Method

Figure D-14.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 5/16/2018
Time of Run: 11:49AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\e-17s.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17s.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\e-17s.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. E-E', Seismic, Qls
-, with removals, soil cement, pier

BOUNDARY COORDINATES
29 Top Boundaries
57 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	15.00	388.00	80.00	395.00	1
2	80.00	395.00	120.00	405.00	1
3	120.00	405.00	177.00	419.00	1
4	177.00	419.00	195.00	421.00	2
5	195.00	421.00	315.00	464.00	2
6	315.00	464.00	332.00	473.00	2
7	332.00	473.00	340.00	478.00	2
8	340.00	478.00	351.00	487.00	2
9	351.00	487.00	355.00	490.00	5
10	355.00	490.00	360.00	495.00	4
11	360.00	495.00	390.00	508.00	4
12	390.00	508.00	410.00	515.00	4
13	410.00	515.00	440.00	526.00	4
14	440.00	526.00	557.00	526.00	4
15	557.00	526.00	557.10	545.00	6
16	557.10	545.00	562.00	545.00	6
17	562.00	545.00	562.10	552.00	6
18	562.10	552.00	580.00	553.00	6
19	580.00	553.00	580.10	562.00	6
20	580.10	562.00	596.00	562.00	6
21	596.00	562.00	596.10	566.00	6
22	596.10	566.00	608.00	570.00	6
23	608.00	570.00	610.00	574.00	6
24	610.00	574.00	755.00	639.00	6
25	755.00	639.00	775.00	643.00	6
26	775.00	643.00	815.00	642.00	6
27	815.00	642.00	840.00	640.00	6
28	840.00	640.00	880.00	620.00	6
29	880.00	620.00	895.00	615.00	6
30	355.00	490.00	458.00	490.00	5
31	458.00	490.00	485.00	507.00	2
32	485.00	507.00	500.00	510.00	2
33	500.00	510.00	523.00	515.00	2
34	523.00	515.00	535.00	515.00	6
35	535.00	515.00	556.90	520.00	6
36	556.90	520.00	557.00	526.00	6
37	351.00	487.00	388.00	465.00	2
38	388.00	465.00	395.00	460.00	3
39	395.00	460.00	415.00	460.00	3
40	415.00	460.00	423.00	465.00	3
41	423.00	465.00	458.00	490.00	2
42	423.00	465.00	485.00	470.00	3

43	485.00	470.00	495.00	473.00	3
44	495.00	473.00	502.00	480.00	6
45	502.00	480.00	510.00	492.00	6
46	510.00	492.00	523.00	515.00	6
47	15.00	360.00	75.00	366.00	3
48	75.00	366.00	85.00	385.00	2
49	85.00	385.00	95.00	388.00	2
50	95.00	388.00	120.00	398.00	2
51	120.00	398.00	143.00	405.00	2
52	143.00	405.00	177.00	419.00	2
53	75.00	366.00	80.00	368.00	3
54	80.00	368.00	110.00	375.00	3
55	110.00	375.00	135.00	384.00	3
56	135.00	384.00	335.00	460.00	3
57	335.00	460.00	388.00	465.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

6 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	850.0	25.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0
5	125.0	125.0	3500.0	26.0	0.00	0.0	0
6	125.0	125.0	850.0	25.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

Soil Type 6 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	4.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

BOUNDARY LOAD(S)

2 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	440.00	460.00	100.0	0.0
2	460.10	556.90	300.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.
Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)

```
   1     557.20   545.00    10000.0     1.0      90.00       30.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
18000 Trial Surfaces Have Been Generated.
 300 Surface(s) Initiate(s) From Each Of    60 Points Equally Spaced
 Along The Ground Surface Between  X =  15.00(ft)
                                and  X = 195.00(ft)
 Each Surface Terminates Between   X = 420.00(ft)
                               and   X = 880.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =    300.00(ft)
 30.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =     0
       Number of Trial Surfaces With Valid FS =    0
       Statistical Data On All Valid FS Values:
          FS Max =   0.000   FS Min = 500.000   FS Ave =  NaN
          Standard Deviation =    0.000   Coefficient of Variation =  NaN    %
       Failure Surface Specified By 29 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         63.814      393.257
           2         93.552      389.303
           3        123.407      386.356
           4        153.344      384.420
           5        183.330      383.497
           6        213.330      383.588
           7        243.310      384.693
           8        273.235      386.810
           9        303.071      389.937
          10        332.785      394.071
          11        362.342      399.207
          12        391.709      405.339
          13        420.852      412.460
          14        449.737      420.561
          15        478.332      429.635
          16        506.604      439.669
          17        534.521      450.653
          18        562.050      462.575
          19        589.161      475.420
          20        615.823      489.174
          21        642.004      503.821
          22        667.675      519.345
          23        692.807      535.727
          24        717.371      552.950
          25        741.339      570.992
          26        764.684      589.835
          27        787.378      609.455
          28        809.396      629.832
          29        821.185      641.505
       Circle Center At X =   195.643 ; Y =  1270.952 ; and Radius =   887.541
             Factor of Safety
            ***    1.137   ***
           Individual data on the     0  slices
                     Water  Water     Tie     Tie     Earthquake
                     Force  Force    Force   Force       Force   Surcharge
Slice  Width   Weight    Top    Bot     Norm     Tan     Hor     Ver    Load
 No.    (ft)    (lbs)   (lbs)  (lbs)    (lbs)   (lbs)   (lbs)   (lbs)   (lbs)
       Failure Surface Specified By 30 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         63.814      393.257
           2         93.638      390.016
           3        123.546      387.670
```

4	153.511	386.220
5	183.506	385.668
6	213.504	386.015
7	243.478	387.260
8	273.402	389.402
9	303.247	392.439
10	332.989	396.369
11	362.600	401.187
12	392.053	406.890
13	421.322	413.472
14	450.380	420.928
15	479.203	429.250
16	507.763	438.432
17	536.036	448.465
18	563.995	459.341
19	591.616	471.048
20	618.875	483.578
21	645.745	496.918
22	672.205	511.056
23	698.229	525.981
24	723.794	541.679
25	748.878	558.134
26	773.458	575.334
27	797.512	593.262
28	821.018	611.902
29	843.956	631.238
30	848.817	635.592

Circle Center At X = 186.965 ; Y = 1386.940 ; and Radius = 1001.285

Factor of Safety

*** 1.138 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.610	391.943
2	81.402	388.413
3	111.287	385.786
4	141.237	384.065
5	171.226	383.252
6	201.226	383.346
7	231.209	384.349
8	261.148	386.259
9	291.016	389.074
10	320.785	392.792
11	350.427	397.410
12	379.916	402.922
13	409.225	409.325
14	438.327	416.612
15	467.194	424.776
16	495.802	433.811
17	524.122	443.707
18	552.131	454.456
19	579.801	466.048
20	607.107	478.472
21	634.025	491.717
22	660.529	505.771
23	686.597	520.620
24	712.202	536.252
25	737.323	552.651
26	761.936	569.804
27	786.018	587.694
28	809.548	606.304
29	832.503	625.618
30	845.505	637.247

Circle Center At X = 183.146 ; Y = 1373.564 ; and Radius = 990.395

Factor of Safety

*** 1.139 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.763	392.928

2	90.617	389.979
3	120.544	387.888
4	150.519	386.657
5	180.517	386.287
6	210.513	386.779
7	240.482	388.131
8	270.401	390.343
9	300.243	393.413
10	329.985	397.339
11	359.602	402.117
12	389.070	407.743
13	418.364	414.213
14	447.460	421.521
15	476.335	429.661
16	504.964	438.627
17	533.323	448.412
18	561.390	459.006
19	589.142	470.402
20	616.554	482.589
21	643.606	495.559
22	670.274	509.300
23	696.537	523.801
24	722.372	539.050
25	747.759	555.034
26	772.677	571.740
27	797.105	589.155
28	821.023	607.264
29	844.411	626.053
30	853.098	633.451

Circle Center At X = 178.455 ; Y = 1430.547 ; and Radius = 1044.272

Factor of Safety

*** 1.140 ***

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	42.458	390.957
2	72.298	387.867
3	102.215	385.642
4	132.185	384.285
5	162.181	383.796
6	192.178	384.176
7	222.152	385.424
8	252.078	387.540
9	281.929	390.522
10	311.682	394.366
11	341.311	399.071
12	370.791	404.631
13	400.098	411.043
14	429.206	418.301
15	458.093	426.399
16	486.733	435.329
17	515.102	445.086
18	543.177	455.659
19	570.934	467.042
20	598.349	479.223
21	625.401	492.193
22	652.065	505.941
23	678.321	520.455
24	704.145	535.723
25	729.516	551.733
26	754.412	568.471
27	778.814	585.922
28	802.700	604.073
29	826.050	622.908
30	843.804	638.098

Circle Center At X = 164.101 ; Y = 1419.274 ; and Radius = 1035.487

Factor of Safety

*** 1.141 ***

Failure Surface Specified By 30 Coordinate Points

Point	X-Surf	Y-Surf

Point No.	X-Surf (ft)	Y-Surf (ft)
1	48.559	391.614
2	78.384	388.373
3	108.290	386.000
4	138.252	384.496
5	168.245	383.863
6	198.244	384.101
7	228.224	385.210
8	258.159	387.190
9	288.023	390.037
10	317.792	393.751
11	347.441	398.328
12	376.945	403.764
13	406.278	410.054
14	435.416	417.194
15	464.334	425.177
16	493.009	433.996
17	521.415	443.644
18	549.529	454.113
19	577.327	465.394
20	604.786	477.477
21	631.882	490.353
22	658.593	504.010
23	684.896	518.438
24	710.770	533.623
25	736.191	549.552
26	761.139	566.214
27	785.592	583.593
28	809.531	601.674
29	832.934	620.444
30	850.026	634.987

Circle Center At X = 175.085 ; Y = 1416.312 ; and Radius = 1032.479

Factor of Safety

*** 1.141 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	63.814	393.257
2	93.710	390.766
3	123.667	389.169
4	153.659	388.469
5	183.659	388.665
6	213.639	389.757
7	243.573	391.745
8	273.434	394.627
9	303.196	398.399
10	332.832	403.060
11	362.315	408.604
12	391.620	415.026
13	420.719	422.321
14	449.587	430.483
15	478.199	439.504
16	506.528	449.375
17	534.550	460.089
18	562.239	471.636
19	589.571	484.005
20	616.520	497.185
21	643.064	511.164
22	669.178	525.931
23	694.840	541.471
24	720.025	557.771
25	744.712	574.817
26	768.879	592.592
27	792.503	611.082
28	815.565	630.270
29	827.687	640.985

Circle Center At X = 162.100 ; Y = 1392.214 ; and Radius = 1003.780

Factor of Safety

*** 1.141 ***

Failure Surface Specified By 31 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	18.051	388.329
2	47.729	383.946
3	77.530	380.497
4	107.425	377.985
5	137.384	376.414
6	167.377	375.784
7	197.375	376.097
8	227.349	377.351
9	257.269	379.546
10	287.105	382.679
11	316.827	386.748
12	346.408	391.748
13	375.817	397.674
14	405.025	404.521
15	434.004	412.282
16	462.724	420.949
17	491.159	430.513
18	519.279	440.966
19	547.057	452.297
20	574.466	464.494
21	601.477	477.546
22	628.066	491.440
23	654.206	506.162
24	679.870	521.697
25	705.033	538.031
26	729.672	555.147
27	753.761	573.028
28	777.276	591.657
29	800.195	611.015
30	822.494	631.083
31	832.430	640.606

Circle Center At X = 172.431 ; Y = 1331.006 ; and Radius = 955.235

Factor of Safety

*** 1.141 ***

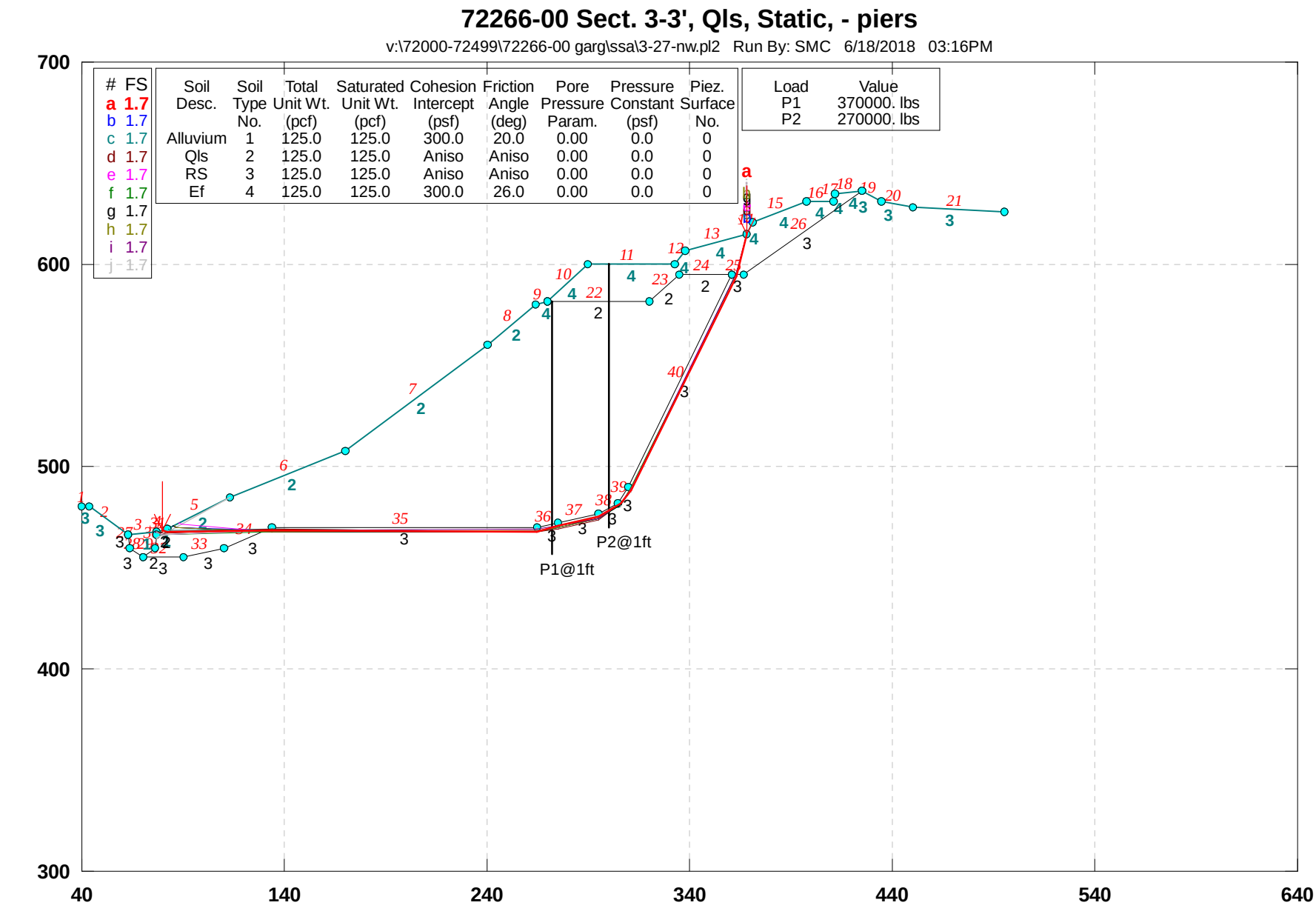
Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.763	392.928
2	90.682	390.735
3	120.652	389.395
4	150.649	388.909
5	180.646	389.278
6	210.621	390.502
7	240.549	392.579
8	270.406	395.507
9	300.167	399.286
10	329.809	403.910
11	359.306	409.377
12	388.636	415.683
13	417.774	422.821
14	446.698	430.787
15	475.382	439.573
16	503.805	449.173
17	531.942	459.579
18	559.772	470.782
19	587.271	482.774
20	614.417	495.544
21	641.188	509.083
22	667.563	523.378
23	693.520	538.420
24	719.038	554.194
25	744.096	570.689
26	768.674	587.892
27	792.752	605.788
28	816.310	624.362
29	835.457	640.363

Circle Center At X = 152.697 ; Y = 1441.809 ; and Radius = 1052.902

Factor of Safety

```
     ***    1.143   ***
Failure Surface Specified By 31 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         27.203      389.314
    2         56.916      385.171
    3         86.738      381.911
    4        116.644      379.538
    5        146.607      378.053
    6        176.602      377.457
    7        206.600      377.751
    8        236.577      378.935
    9        266.505      381.008
   10        296.359      383.968
   11        326.111      387.812
   12        355.737      392.537
   13        385.209      398.139
   14        414.502      404.613
   15        443.591      411.953
   16        472.448      420.152
   17        501.050      429.204
   18        529.371      439.101
   19        557.385      449.833
   20        585.069      461.392
   21        612.398      473.767
   22        639.347      486.948
   23        665.894      500.922
   24        692.015      515.677
   25        717.686      531.201
   26        742.885      547.479
   27        767.591      564.498
   28        791.780      582.242
   29        815.433      600.697
   30        838.528      619.844
   31        853.662      633.169
Circle Center At X =   181.683 ; Y =  1388.586 ; and Radius =  1011.142
      Factor of Safety
     ***    1.143   ***
         **** END OF GSTABL7 OUTPUT ****
```



GSTABL7 v.2 FSmin=1.7

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-15.1

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 03:16PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-27-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Static,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	20.00

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	17.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.

(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.

(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

9 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	77.00	465.00	113.00	485.00	0.00
2	134.00	469.00	134.00	469.00	2.00
3	265.00	469.00	265.00	469.00	2.00
4	275.00	470.00	275.00	470.00	2.00
5	295.00	475.00	295.00	475.00	2.00
6	306.00	481.00	306.00	481.00	2.00
7	311.00	489.00	311.00	489.00	2.00
8	363.00	595.00	363.00	595.00	2.00
9	368.00	615.00	368.00	615.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 2000

Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:

FS Max = 1.778 FS Min = 1.684 FS Ave = 1.730

Standard Deviation = 0.016 Coefficient of Variation = 0.94 %

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.064	468.613
2	81.867	467.704
3	134.000	468.307
4	265.000	468.126
5	275.000	470.782
6	295.000	475.210
7	306.000	481.850
8	311.000	488.638
9	363.000	594.012
10	368.000	615.000

Factor of Safety

*** 1.684 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.7	21.6	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.1	121.4	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.1	21.3	0.0	0.0	0.	0.	0.0	0.0	0.0
4	31.0	35321.7	0.0	0.0	0.	0.	0.0	0.0	0.0
5	16.8	42540.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	4.2	12719.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	36.0	146045.9	0.0	0.0	0.	0.	0.0	0.0	0.0
8	70.0	575670.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	24.0	305567.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	1.0	14005.0	0.0	0.0	0.	0.	0.0	0.0	0.0
11	5.0	70235.3	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	71332.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	15.0	226514.3	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	78339.5	0.0	0.0	0.	0.	0.0	0.0	0.0
15	10.0	152214.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	1.0	14806.5	0.0	0.0	0.	0.	0.0	0.0	0.0
17	4.0	57717.4	0.0	0.0	0.	0.	0.0	0.0	0.0
18	1.0	14005.1	0.0	0.0	0.	0.	0.0	0.0	0.0
19	9.0	115023.4	0.0	0.0	0.	0.	0.0	0.0	0.0
20	13.0	129922.6	0.0	0.0	0.	0.	0.0	0.0	0.0
21	2.0	16538.6	0.0	0.0	0.	0.	0.0	0.0	0.0
22	3.0	24220.6	0.0	0.0	0.	0.	0.0	0.0	0.0
23	23.0	124807.4	0.0	0.0	0.	0.	0.0	0.0	0.0
24	2.0	5353.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	0.2	564.6	0.0	0.0	0.	0.	0.0	0.0	0.0
26	4.8	5577.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.351	470.730
2	86.323	470.179
3	134.000	468.209
4	265.000	468.134
5	275.000	470.363
6	295.000	474.585
7	306.000	481.986
8	311.000	489.255
9	363.000	595.578
10	368.000	615.000

Factor of Safety

*** 1.686 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.768	469.396
2	83.563	468.646
3	134.000	469.145
4	265.000	468.094
5	275.000	470.784
6	295.000	474.404

7	306.000	481.641
8	311.000	488.683
9	363.000	594.218
10	368.000	615.000

Factor of Safety
*** 1.689 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.510	467.930
2	80.874	467.152
3	134.000	469.039
4	265.000	468.042
5	275.000	469.474
6	295.000	474.024
7	306.000	481.879
8	311.000	488.725
9	363.000	594.752
10	368.000	615.000

Factor of Safety
*** 1.689 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.024	472.109
2	89.302	471.835
3	134.000	468.013
4	265.000	468.387
5	275.000	470.285
6	295.000	474.143
7	306.000	481.900
8	311.000	488.993
9	363.000	595.359
10	368.000	615.000

Factor of Safety
*** 1.689 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.854	467.979
2	79.318	466.288
3	134.000	468.115
4	265.000	468.051
5	275.000	470.011
6	295.000	474.432
7	306.000	481.251
8	311.000	489.907
9	363.000	594.335
10	368.000	615.000

Factor of Safety
*** 1.690 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.272	470.689
2	86.464	470.258
3	134.000	468.123
4	265.000	468.110
5	275.000	470.902
6	295.000	474.186
7	306.000	481.150
8	311.000	488.481
9	363.000	595.367
10	368.000	615.000

Factor of Safety
*** 1.692 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.603	470.859

2	86.332	470.184
3	134.000	468.078
4	265.000	468.382
5	275.000	469.897
6	295.000	474.560
7	306.000	481.809
8	311.000	488.581
9	363.000	594.315
10	368.000	615.000

Factor of Safety
*** 1.692 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.506	467.929
2	79.986	466.659
3	134.000	468.206
4	265.000	468.940
5	275.000	470.572
6	295.000	474.539
7	306.000	481.781
8	311.000	488.733
9	363.000	594.333
10	368.000	615.000

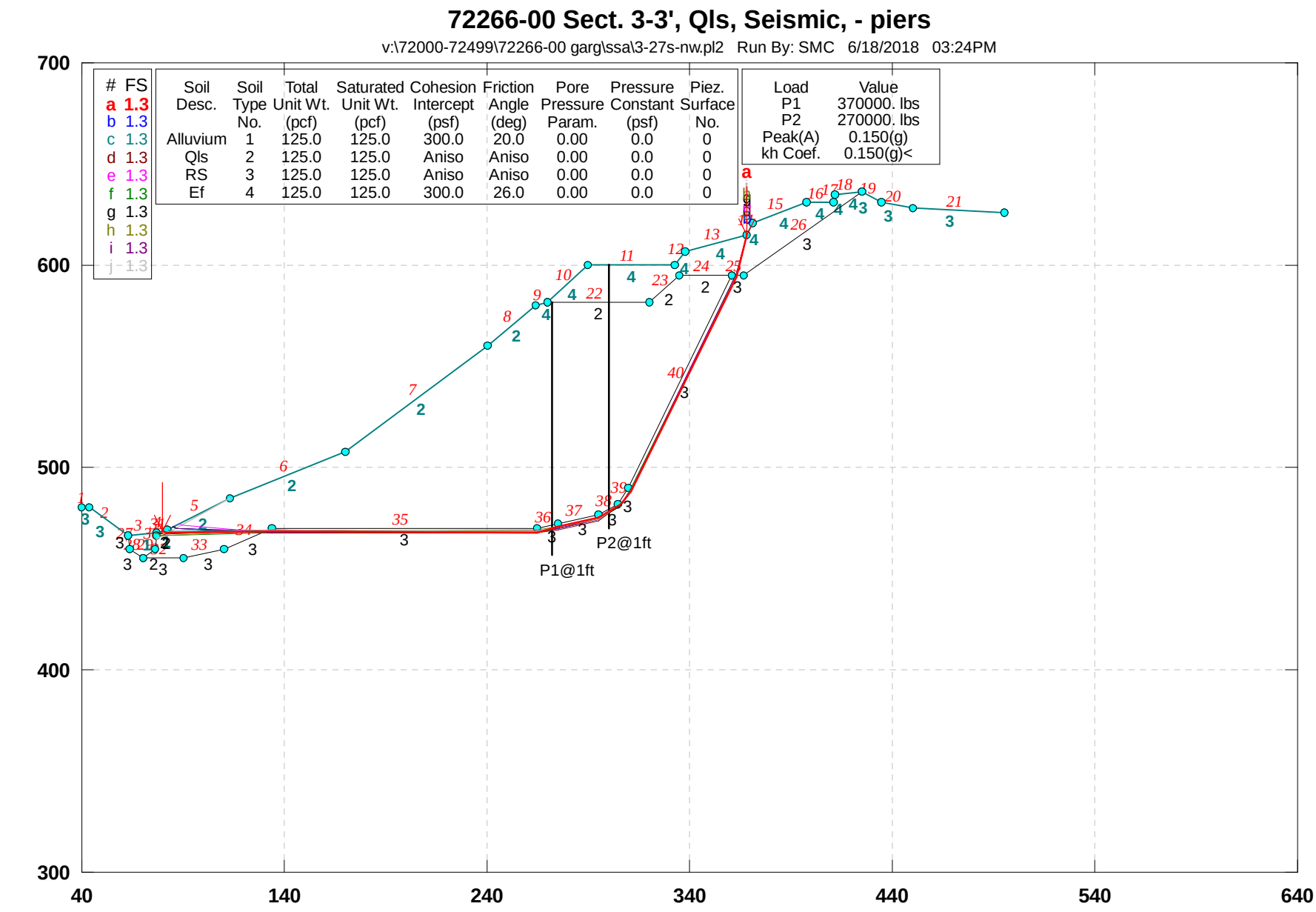
Factor of Safety
*** 1.692 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.956	467.994
2	78.896	466.053
3	134.000	468.372
4	265.000	468.121
5	275.000	470.394
6	295.000	475.627
7	306.000	481.759
8	311.000	488.227
9	363.000	594.968
10	368.000	615.000

Factor of Safety
*** 1.693 ***

**** END OF GSTABL7 OUTPUT ****



GSTABL7 v.2 FSmin=1.3

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-15.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 03:24PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-27s-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27s-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-27s-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Seismic,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

2 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	20.00

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	17.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.

(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.

(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)

Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)

Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

9 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	77.00	465.00	113.00	485.00	0.00
2	134.00	469.00	134.00	469.00	2.00
3	265.00	469.00	265.00	469.00	2.00
4	275.00	470.00	275.00	470.00	2.00
5	295.00	475.00	295.00	475.00	2.00
6	306.00	481.00	306.00	481.00	2.00
7	311.00	489.00	311.00	489.00	2.00
8	363.00	595.00	363.00	595.00	2.00
9	368.00	615.00	368.00	615.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Simplified Janbu Method * *

Total Number of Trial Surfaces Attempted = 2000

Number of Trial Surfaces With Valid FS = 2000
Statistical Data On All Valid FS Values:
FS Max = 1.341 FS Min = 1.267 FS Ave = 1.302
Standard Deviation = 0.013 Coefficient of Variation = 0.98 %
Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.064	468.613
2	81.867	467.704
3	134.000	468.307
4	265.000	468.126
5	275.000	470.782
6	295.000	475.210
7	306.000	481.850
8	311.000	488.638
9	363.000	594.012
10	368.000	615.000

Factor of Safety
*** 1.267 ***

Individual data on the 26 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.7	21.6	0.0	0.0	0.	0.	3.2	0.0	0.0
2	1.1	121.4	0.0	0.0	0.	0.	18.2	0.0	0.0
3	0.1	21.3	0.0	0.0	0.	0.	3.2	0.0	0.0
4	31.0	35321.7	0.0	0.0	0.	0.	5298.2	0.0	0.0
5	16.8	42540.4	0.0	0.0	0.	0.	6381.1	0.0	0.0
6	4.2	12719.3	0.0	0.0	0.	0.	1907.9	0.0	0.0
7	36.0	146045.9	0.0	0.0	0.	0.	21906.9	0.0	0.0
8	70.0	575670.6	0.0	0.0	0.	0.	86350.6	0.0	0.0
9	24.0	305567.2	0.0	0.0	0.	0.	45835.1	0.0	0.0
10	1.0	14005.0	0.0	0.0	0.	0.	2100.7	0.0	0.0
11	5.0	70235.3	0.0	0.0	0.	0.	10535.3	0.0	0.0
12	5.0	71332.6	0.0	0.0	0.	0.	10699.9	0.0	0.0
13	15.0	226514.3	0.0	0.0	0.	0.	33977.1	0.0	0.0
14	5.0	78339.5	0.0	0.0	0.	0.	11750.9	0.0	0.0
15	10.0	152214.5	0.0	0.0	0.	0.	22832.2	0.0	0.0
16	1.0	14806.5	0.0	0.0	0.	0.	2221.0	0.0	0.0
17	4.0	57717.4	0.0	0.0	0.	0.	8657.6	0.0	0.0
18	1.0	14005.1	0.0	0.0	0.	0.	2100.8	0.0	0.0
19	9.0	115023.4	0.0	0.0	0.	0.	17253.5	0.0	0.0
20	13.0	129922.6	0.0	0.0	0.	0.	19488.4	0.0	0.0
21	2.0	16538.6	0.0	0.0	0.	0.	2480.8	0.0	0.0
22	3.0	24220.6	0.0	0.0	0.	0.	3633.1	0.0	0.0
23	23.0	124807.4	0.0	0.0	0.	0.	18721.1	0.0	0.0
24	2.0	5353.6	0.0	0.0	0.	0.	803.0	0.0	0.0
25	0.2	564.6	0.0	0.0	0.	0.	84.7	0.0	0.0
26	4.8	5577.4	0.0	0.0	0.	0.	836.6	0.0	0.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.351	470.730
2	86.323	470.179
3	134.000	468.209
4	265.000	468.134
5	275.000	470.363
6	295.000	474.585
7	306.000	481.986
8	311.000	489.255
9	363.000	595.578
10	368.000	615.000

Factor of Safety
*** 1.269 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.768	469.396
2	83.563	468.646

3	134.000	469.145
4	265.000	468.094
5	275.000	470.784
6	295.000	474.404
7	306.000	481.641
8	311.000	488.683
9	363.000	594.218
10	368.000	615.000

Factor of Safety
*** 1.271 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.510	467.930
2	80.874	467.152
3	134.000	469.039
4	265.000	468.042
5	275.000	469.474
6	295.000	474.024
7	306.000	481.879
8	311.000	488.725
9	363.000	594.752
10	368.000	615.000

Factor of Safety
*** 1.271 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.024	472.109
2	89.302	471.835
3	134.000	468.013
4	265.000	468.387
5	275.000	470.285
6	295.000	474.143
7	306.000	481.900
8	311.000	488.993
9	363.000	595.359
10	368.000	615.000

Factor of Safety
*** 1.271 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.854	467.979
2	79.318	466.288
3	134.000	468.115
4	265.000	468.051
5	275.000	470.011
6	295.000	474.432
7	306.000	481.251
8	311.000	489.907
9	363.000	594.335
10	368.000	615.000

Factor of Safety
*** 1.272 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.272	470.689
2	86.464	470.258
3	134.000	468.123
4	265.000	468.110
5	275.000	470.902
6	295.000	474.186
7	306.000	481.150
8	311.000	488.481
9	363.000	595.367
10	368.000	615.000

Factor of Safety
*** 1.273 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.506	467.929
2	79.986	466.659
3	134.000	468.206
4	265.000	468.940
5	275.000	470.572
6	295.000	474.539
7	306.000	481.781
8	311.000	488.733
9	363.000	594.333
10	368.000	615.000

Factor of Safety
*** 1.273 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.603	470.859
2	86.332	470.184
3	134.000	468.078
4	265.000	468.382
5	275.000	469.897
6	295.000	474.560
7	306.000	481.809
8	311.000	488.581
9	363.000	594.315
10	368.000	615.000

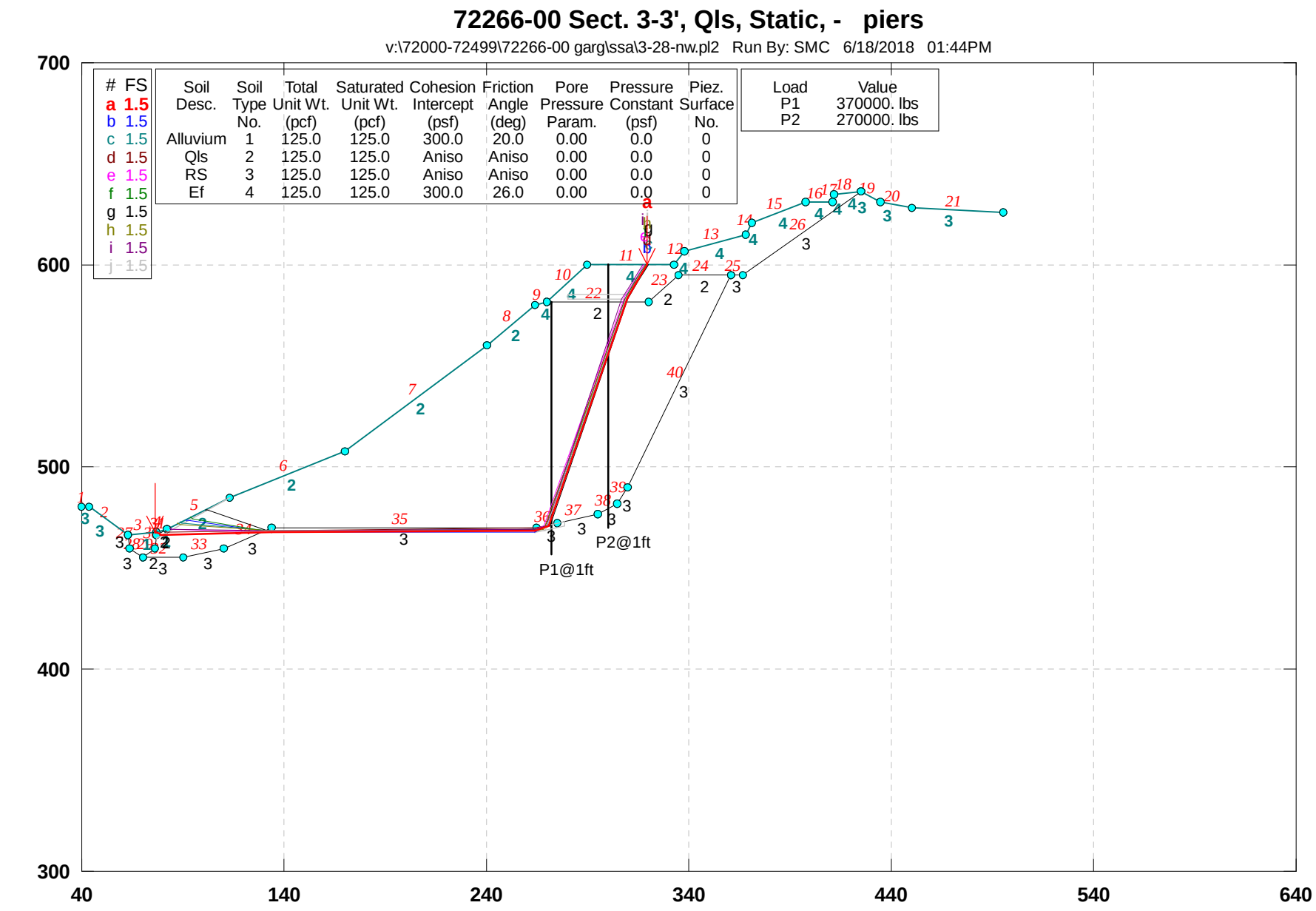
Factor of Safety
*** 1.273 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.162	468.632
2	81.375	467.430
3	134.000	469.608
4	265.000	468.208
5	275.000	470.895
6	295.000	474.605
7	306.000	481.776
8	311.000	488.345
9	363.000	594.750
10	368.000	615.000

Factor of Safety
*** 1.273 ***

**** END OF GSTABL7 OUTPUT ****



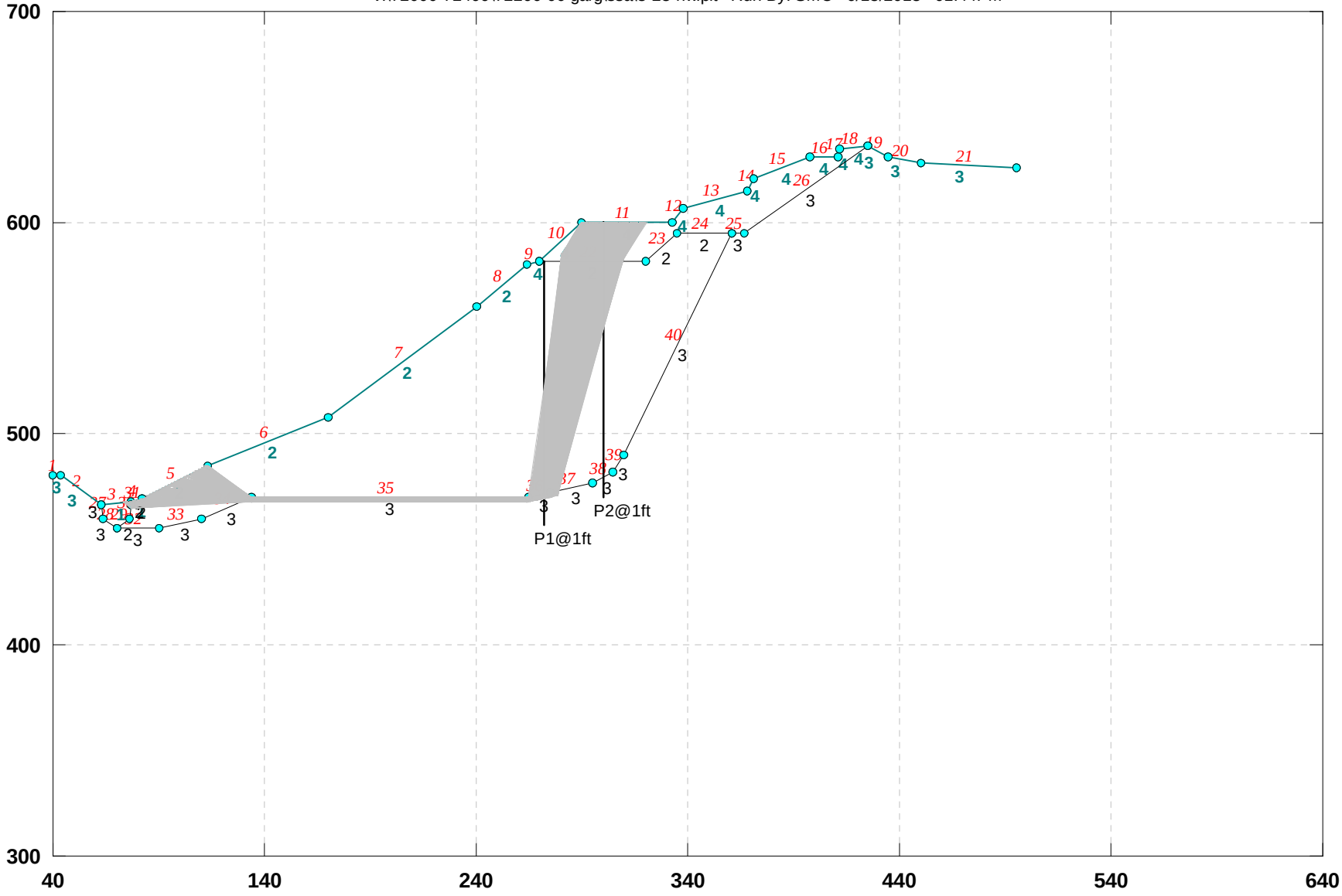
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-16.1

72266-00 Sect. 3-3', Qls, Static, - piers

v:\72000-72499\72266-00 garg\ssa\3-28-nw.plt Run By: SMC 6/18/2018 01:44PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 01:44PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-28-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Static,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

```
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0     300.0     17.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     2 soil type(s)
 Soil Type  2 Is Anisotropic
 Number Of Direction Ranges Specified =  2
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             300.00         20.00
     2             90.0             300.00         20.00
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  2
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             300.00         17.00
     2             90.0             300.00         17.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 Janbus Empirical Coef is being used for the case of  c & phi both > 0
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 The Active And Passive Portions Of The Sliding Surfaces
 Are Generated According To The Rankine Theory.
 2000 Trial Surfaces Have Been Generated.
 5 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  10.0
 Box        X-Left     Y-Left    X-Right    Y-Right      Height
 No.         (ft)       (ft)      (ft)       (ft)        (ft)
  1         77.00     465.00     113.00     485.00       0.00
  2        134.00     469.00     134.00     469.00       2.00
  3        264.00     469.00     264.00     469.00       2.00
  4        265.00     469.00     279.00     472.00       2.00
  5        280.00     584.00     310.00     584.00       2.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  2000
       Number of Trial Surfaces With Valid FS = 2000
       Statistical Data On All Valid FS Values:
          FS Max =   6.502   FS Min =   1.453   FS Ave =   2.067
          Standard Deviation =    0.581   Coefficient of Variation =   28.13 %
       Failure Surface Specified By  9 Coordinate Points
         Point      X-Surf      Y-Surf
```

No.	(ft)	(ft)
1	76.489	467.927
2	78.207	466.724
3	79.046	466.136
4	134.000	468.156
5	264.000	468.347
6	270.697	470.687
7	309.537	584.204
8	314.836	592.684
9	319.407	600.000

Factor of Safety
*** 1.453 ***

Individual data on the 19 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.5	13.8	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.2	146.9	0.0	0.0	0.	0.	0.0	0.0	0.0
3	0.8	198.7	0.0	0.0	0.	0.	0.0	0.0	0.0
4	3.0	928.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	31.0	39468.0	0.0	0.0	0.	0.	0.0	0.0	0.0
6	16.1	41530.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	4.9	14819.5	0.0	0.0	0.	0.	0.0	0.0	0.0
8	36.0	146494.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	70.0	575223.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	24.0	305013.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	1.0	13955.7	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	69747.9	0.0	0.0	0.	0.	0.0	0.0	0.0
13	0.7	9734.6	0.0	0.0	0.	0.	0.0	0.0	0.0
14	0.2	2319.1	0.0	0.0	0.	0.	0.0	0.0	0.0
15	19.1	220674.5	0.0	0.0	0.	0.	0.0	0.0	0.0
16	18.8	106704.0	0.0	0.0	0.	0.	0.0	0.0	0.0
17	0.8	1592.8	0.0	0.0	0.	0.	0.0	0.0	0.0
18	5.3	7654.5	0.0	0.0	0.	0.	0.0	0.0	0.0
19	4.6	2090.1	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.447	473.876
2	92.124	473.402
3	134.000	468.164
4	264.000	468.167
5	270.095	470.691
6	309.185	583.149
7	314.484	591.630
8	319.715	600.000

Factor of Safety
*** 1.458 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.070	472.649
2	89.821	472.123
3	134.000	468.321
4	264.000	469.051
5	270.239	470.895
6	309.610	583.674
7	314.909	592.154
8	319.812	600.000

Factor of Safety
*** 1.459 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	81.033	468.807
2	81.330	468.598
3	82.280	467.933
4	134.000	468.180
5	264.000	469.807

6	268.892	470.699
7	308.482	583.040
8	313.781	591.520
9	319.080	600.000

Factor of Safety
*** 1.464 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.662	469.858
2	84.583	469.213
3	134.000	468.022
4	264.000	468.924
5	268.749	470.496
6	308.057	584.516
7	313.356	592.996
8	317.733	600.000

Factor of Safety
*** 1.465 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	93.824	475.103
2	94.427	474.681
3	134.000	468.007
4	264.000	469.283
5	269.952	470.488
6	308.760	584.625
7	314.060	593.105
8	318.368	600.000

Factor of Safety
*** 1.470 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.610	479.121
2	101.968	478.871
3	134.000	468.148
4	264.000	468.526
5	271.298	470.684
6	309.888	583.259
7	315.188	591.739
8	320.349	600.000

Factor of Safety
*** 1.470 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	87.654	471.918
2	88.450	471.361
3	134.000	468.659
4	264.000	468.279
5	268.721	469.314
6	309.405	583.558
7	314.704	592.039
8	319.679	600.000

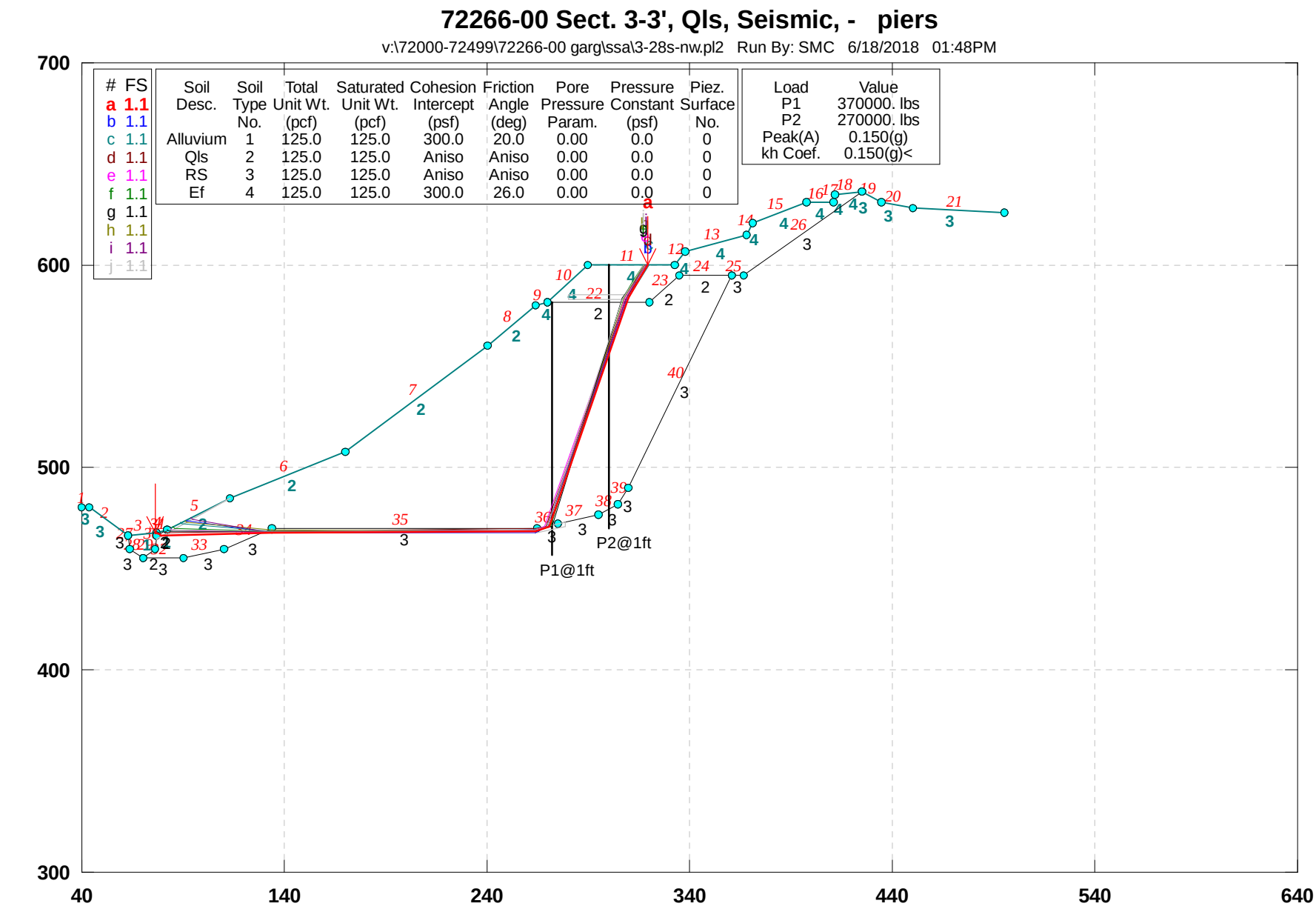
Factor of Safety
*** 1.472 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.462	469.755
2	84.389	469.105
3	134.000	468.891
4	264.000	469.456
5	270.150	471.055
6	306.490	583.063
7	311.789	591.544
8	317.073	600.000

Factor of Safety

```
      ***    1.472   ***
Failure Surface Specified By  9 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         77.821      468.164
    2         79.106      467.264
    3         79.977      466.654
    4        134.000      468.337
    5        264.000      468.691
    6        269.036      468.903
    7        308.907      583.564
    8        314.206      592.045
    9        319.177      600.000
       Factor of Safety
      ***    1.473   ***
          **** END OF GSTABL7 OUTPUT ****
```



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-16.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 01:48PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-28s-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28s-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-28s-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Seismic,
- piers

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

```
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0     300.0     17.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     2 soil type(s)
 Soil Type  2 Is Anisotropic
 Number Of Direction Ranges Specified =  2
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             300.00         20.00
     2             90.0             300.00         20.00
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  2
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             300.00         17.00
     2             90.0             300.00         17.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
 Specified Peak Ground Acceleration Coefficient (A) =   0.150(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)     (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 Janbus Empirical Coef is being used for the case of  c & phi both > 0
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 The Active And Passive Portions Of The Sliding Surfaces
 Are Generated According To The Rankine Theory.
 2000 Trial Surfaces Have Been Generated.
 5 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  10.0
 Box        X-Left     Y-Left    X-Right    Y-Right      Height
 No.         (ft)       (ft)       (ft)       (ft)        (ft)
  1          77.00     465.00     113.00     485.00       0.00
  2         134.00     469.00     134.00     469.00       2.00
  3         264.00     469.00     264.00     469.00       2.00
  4         265.00     469.00     279.00     472.00       2.00
  5         280.00     584.00     310.00     584.00       2.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  2000
       Number of Trial Surfaces With Valid FS = 2000
       Statistical Data On All Valid FS Values:
```

FS Max = 3.519 FS Min = 1.106 FS Ave = 1.526
Standard Deviation = 0.360 Coefficient of Variation = 23.62 %

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.489	467.927
2	78.207	466.724
3	79.046	466.136
4	134.000	468.156
5	264.000	468.347
6	270.697	470.687
7	309.537	584.204
8	314.836	592.684
9	319.407	600.000

Factor of Safety
*** 1.106 ***

Individual data on the 19 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.5	13.8	0.0	0.0	0.	0.	2.1	0.0	0.0
2	1.2	146.9	0.0	0.0	0.	0.	22.0	0.0	0.0
3	0.8	198.7	0.0	0.0	0.	0.	29.8	0.0	0.0
4	3.0	928.3	0.0	0.0	0.	0.	139.2	0.0	0.0
5	31.0	39468.0	0.0	0.0	0.	0.	5920.2	0.0	0.0
6	16.1	41530.3	0.0	0.0	0.	0.	6229.5	0.0	0.0
7	4.9	14819.5	0.0	0.0	0.	0.	2222.9	0.0	0.0
8	36.0	146494.6	0.0	0.0	0.	0.	21974.2	0.0	0.0
9	70.0	575223.9	0.0	0.0	0.	0.	86283.6	0.0	0.0
10	24.0	305013.1	0.0	0.0	0.	0.	45752.0	0.0	0.0
11	1.0	13955.7	0.0	0.0	0.	0.	2093.4	0.0	0.0
12	5.0	69747.9	0.0	0.0	0.	0.	10462.2	0.0	0.0
13	0.7	9734.6	0.0	0.0	0.	0.	1460.2	0.0	0.0
14	0.2	2319.1	0.0	0.0	0.	0.	347.9	0.0	0.0
15	19.1	220674.5	0.0	0.0	0.	0.	33101.2	0.0	0.0
16	18.8	106704.0	0.0	0.0	0.	0.	16005.6	0.0	0.0
17	0.8	1592.8	0.0	0.0	0.	0.	238.9	0.0	0.0
18	5.3	7654.5	0.0	0.0	0.	0.	1148.2	0.0	0.0
19	4.6	2090.1	0.0	0.0	0.	0.	313.5	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.447	473.876
2	92.124	473.402
3	134.000	468.164
4	264.000	468.167
5	270.095	470.691
6	309.185	583.149
7	314.484	591.630
8	319.715	600.000

Factor of Safety
*** 1.112 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.070	472.649
2	89.821	472.123
3	134.000	468.321
4	264.000	469.051
5	270.239	470.895
6	309.610	583.674
7	314.909	592.154
8	319.812	600.000

Factor of Safety
*** 1.112 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	81.033	468.807

2	81.330	468.598
3	82.280	467.933
4	134.000	468.180
5	264.000	469.807
6	268.892	470.699
7	308.482	583.040
8	313.781	591.520
9	319.080	600.000

Factor of Safety
*** 1.116 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.662	469.858
2	84.583	469.213
3	134.000	468.022
4	264.000	468.924
5	268.749	470.496
6	308.057	584.516
7	313.356	592.996
8	317.733	600.000

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.878	470.485
2	85.760	469.867
3	134.000	468.553
4	264.000	468.227
5	271.668	470.636
6	306.695	583.179
7	311.994	591.659
8	317.206	600.000

Factor of Safety
*** 1.118 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.500	469.258
2	83.458	468.588
3	134.000	468.710
4	264.000	469.111
5	271.811	470.839
6	307.120	583.703
7	312.419	592.183
8	317.303	600.000

Factor of Safety
*** 1.119 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.247	473.773
2	91.930	473.295
3	134.000	469.032
4	264.000	468.699
5	271.497	471.250
6	307.618	583.697
7	312.917	592.178
8	317.805	600.000

Factor of Safety
*** 1.120 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	93.824	475.103
2	94.427	474.681
3	134.000	468.007
4	264.000	469.283
5	269.952	470.488

6	308.760	584.625
7	314.060	593.105
8	318.368	600.000

Factor of Safety
*** 1.120 ***

Failure Surface Specified By 8 Coordinate Points

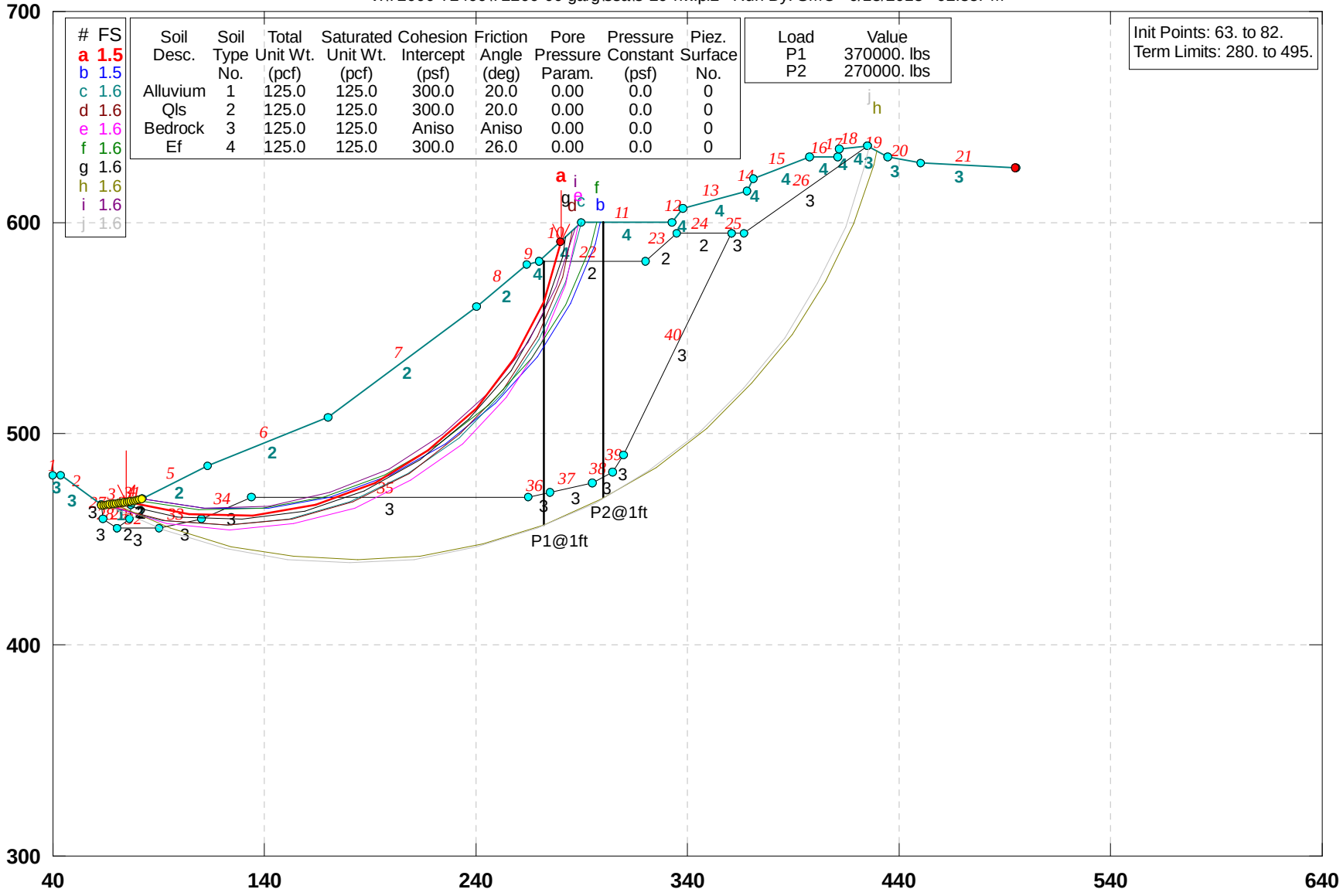
Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.462	469.755
2	84.389	469.105
3	134.000	468.891
4	264.000	469.456
5	270.150	471.055
6	306.490	583.063
7	311.789	591.544
8	317.073	600.000

Factor of Safety
*** 1.120 ***

**** END OF GSTABL7 OUTPUT ****

72266-00 Sect. 3-3', Static, - Circular mode, pier

v:\72000-72499\72266-00 garg\ssa\3-29-nw.pl2 Run By: SMC 6/18/2018 02:35PM



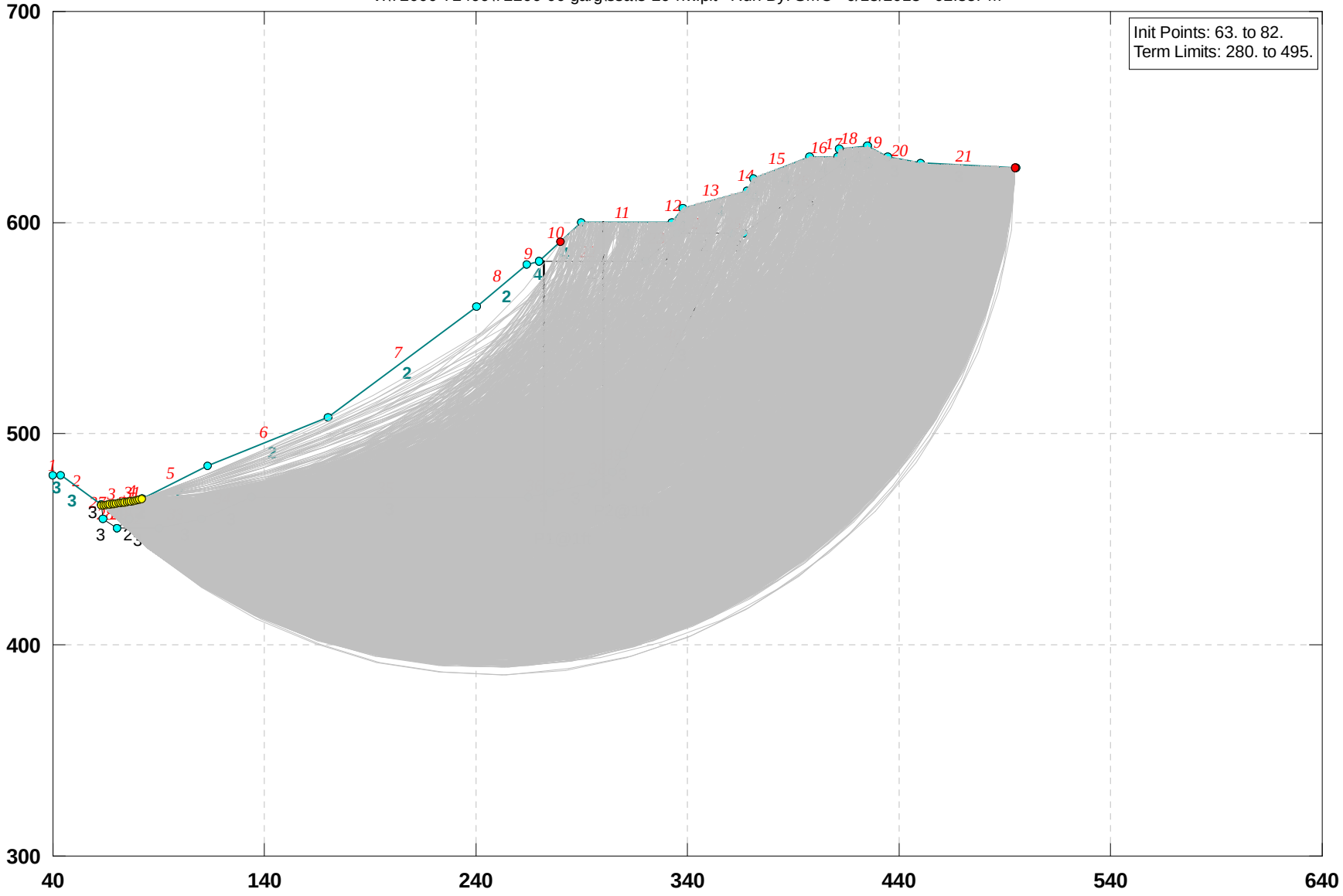
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Modified Bishop Method

Figure D-17.1

72266-00 Sect. 3-3', Static, - Circular mode, pier

v:\72000-72499\72266-00 garg\ssa\3-29-nw.plt Run By: SMC 6/18/2018 02:35PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 02:35PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-29-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Static,
- Circular mode, pier

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	0.0	0.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:

(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.

(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.

(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

4000 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 63.00(ft)
and X = 82.00(ft)

Each Surface Terminates Between X = 280.00(ft)
and X = 495.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)

30.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 4000

Number of Trial Surfaces With Valid FS = 4000

Statistical Data On All Valid FS Values:

FS Max = 5.723 FS Min = 1.527 FS Ave = 2.001

Standard Deviation = 0.220 Coefficient of Variation = 11.01 %

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	75.000	467.714
2	104.389	461.690
3	134.385	461.211
4	163.951	466.295
5	192.065	476.765
6	217.753	492.260
7	240.129	512.243
8	258.417	536.024
9	271.986	562.781
10	280.265	591.238

Circle Center At X = 121.954 ; Y = 622.000 ; and Radius = 161.272

Factor of Safety
*** 1.527 ***
Individual data on the 21 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	2.0	87.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.6	207.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	3.4	860.2	0.0	0.0	0.	0.	0.0	0.0	0.0
4	22.4	30206.0	0.0	0.0	0.	0.	0.0	0.0	0.0
5	8.6	22772.9	0.0	0.0	0.	0.	0.0	0.0	0.0
6	0.7	2061.1	0.0	0.0	0.	0.	0.0	0.0	0.0
7	20.3	71050.5	0.0	0.0	0.	0.	0.0	0.0	0.0
8	0.4	1556.4	0.0	0.0	0.	0.	0.0	0.0	0.0
9	29.6	132460.6	0.0	0.0	0.	0.	0.0	0.0	0.0
10	6.0	29759.1	0.0	0.0	0.	0.	0.0	0.0	0.0
11	3.9	19584.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	18.2	100500.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	25.7	158691.5	0.0	0.0	0.	0.	0.0	0.0	0.0
14	22.2	137769.8	0.0	0.0	0.	0.	0.0	0.0	0.0
15	0.1	771.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	18.3	99656.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.6	25223.7	0.0	0.0	0.	0.	0.0	0.0	0.0
18	6.0	21038.5	0.0	0.0	0.	0.	0.0	0.0	0.0
19	2.0	5479.3	0.0	0.0	0.	0.	0.0	0.0	0.0
20	5.6	9723.9	0.0	0.0	0.	0.	0.0	0.0	0.0
21	2.7	1145.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.000	469.000
2	111.659	464.490
3	141.656	464.938
4	171.167	470.330
5	199.384	480.518
6	225.532	495.225
7	248.894	514.045
8	268.830	536.463
9	284.792	561.864
10	296.343	589.551
11	298.783	600.000

Circle Center At X = 123.966 ; Y = 645.213 ; and Radius = 181.141

Factor of Safety
*** 1.546 ***
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	63.000	466.000
2	92.102	458.715
3	122.025	456.562
4	151.870	459.606
5	180.742	467.754
6	207.775	480.763
7	232.157	498.242
8	253.157	519.667
9	270.144	544.394
10	282.608	571.682
11	289.989	599.990

Circle Center At X = 119.445 ; Y = 629.722 ; and Radius = 173.179

Factor of Safety
*** 1.559 ***
Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	64.000	466.143
2	93.044	458.628
3	122.961	456.402
4	152.797	459.536
5	181.598	467.930

6	208.446	481.316
7	232.483	499.267
8	252.942	521.209
9	269.169	546.442
10	280.645	574.160
11	285.342	595.808

Circle Center At X = 120.409 ; Y = 624.272 ; and Radius = 167.890

Factor of Safety

*** 1.561 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.000	466.286
2	93.774	457.798
3	123.613	454.696
4	153.518	457.085
5	182.487	464.884
6	209.549	477.832
7	233.798	495.495
8	254.422	517.282
9	270.729	542.462
10	282.174	570.193
11	288.111	598.300

Circle Center At X = 125.569 ; Y = 618.601 ; and Radius = 163.916

Factor of Safety

*** 1.570 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	79.000	468.400
2	108.698	464.157
3	138.692	464.787
4	168.186	470.272
5	196.401	480.467
6	222.588	495.103
7	246.056	513.792
8	266.182	536.039
9	282.434	561.255
10	294.382	588.773
11	297.210	600.000

Circle Center At X = 119.839 ; Y = 648.204 ; and Radius = 184.384

Factor of Safety

*** 1.571 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.000	467.000
2	99.289	460.509
3	129.269	459.396
4	158.959	463.698
5	187.389	473.274
6	213.632	487.811
7	236.829	506.834
8	256.224	529.722
9	271.181	555.727
10	281.213	584.000
11	282.741	593.467

Circle Center At X = 120.411 ; Y = 625.142 ; and Radius = 165.982

Factor of Safety

*** 1.574 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.000	466.714
2	95.624	455.012
3	124.427	446.625
4	154.015	441.666
5	183.979	440.206
6	213.908	442.263
7	243.391	447.810

8	272.022	456.770
9	299.407	469.020
10	325.169	484.392
11	348.955	502.674
12	370.438	523.615
13	389.321	546.926
14	405.345	572.288
15	418.290	599.351
16	427.978	627.744
17	429.291	633.855

Circle Center At X = 181.430 ; Y = 696.021 ; and Radius = 255.828

Factor of Safety

*** 1.576 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.000	469.000
2	111.702	464.782
3	141.683	465.836
4	171.016	472.129
5	198.791	483.467
6	224.148	499.499
7	246.302	519.727
8	264.567	543.526
9	278.377	570.159
10	286.774	597.096

Circle Center At X = 120.757 ; Y = 634.766 ; and Radius = 170.236

Factor of Safety

*** 1.579 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.000	466.286
2	92.496	454.288
3	121.221	445.633
4	150.769	440.444
5	180.723	438.794
6	210.662	440.706
7	240.164	446.153
8	268.811	455.058
9	296.202	467.296
10	321.949	482.694
11	345.689	501.035
12	367.088	522.061
13	385.844	545.475
14	401.692	570.947
15	414.410	598.118
16	423.818	626.605
17	425.657	635.671

Circle Center At X = 179.619 ; Y = 691.454 ; and Radius = 252.663

Factor of Safety

*** 1.580 ***

**** END OF GSTABL7 OUTPUT ****

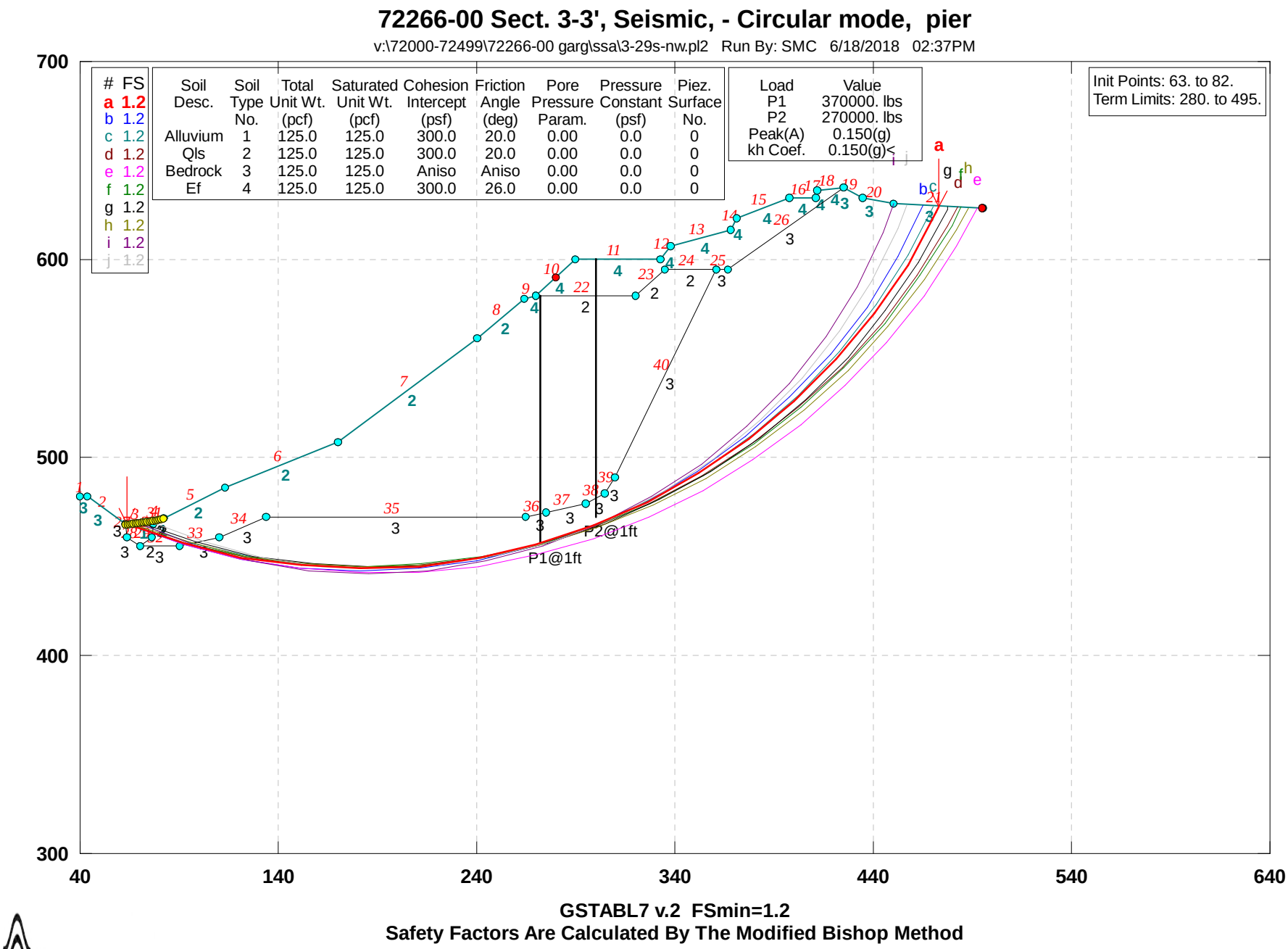

72266-00 Sect. 3-3', Seismic, - Circular mode, pier
v:\72000-72499\72266-00 garg\ssa\3-29s-nw.pl2 Run By: SMC 6/18/2018 02:37PM
FS
a 1.2
b 1.2
c 1.2
d 1.2
e 1.2
f 1.2
g 1.2
h 1.2
i 1.2
j 1.2
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Alluvium | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Qls | 2 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Bedrock | 3 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
Ef | 4 | 125.0 | 125.0 | 300.0 | 26.0 | 0.00 | 0.0 | 0
Load | Value
P1 | 370000. lbs
P2 | 270000. lbs
Peak(A) | 0.150(g)
kh Coef. | 0.150(g)<
Init Points: 63. to 82.
Term Limits: 280. to 495.
P1@1ft
P2@1ft
700
600
500
400
300
40
140
240
340
440
540
640
GSTABL7 v.2 FSmin=1.2
Safety Factors Are Calculated By The Modified Bishop Method

Figure D-17.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 02:37PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-29s-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29s-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-29s-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Seismic,
- Circular mode, pier

BOUNDARY COORDINATES
21 Top Boundaries
40 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	468.00	1
4	77.00	468.00	82.00	469.00	1
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	170.00	508.00	2
7	170.00	508.00	240.00	560.00	2
8	240.00	560.00	264.00	580.00	2
9	264.00	580.00	270.00	582.00	4
10	270.00	582.00	290.00	600.00	4
11	290.00	600.00	333.00	600.00	4
12	333.00	600.00	338.00	607.00	4
13	338.00	607.00	368.00	615.00	4
14	368.00	615.00	371.00	621.00	4
15	371.00	621.00	398.00	631.00	4
16	398.00	631.00	411.00	631.00	4
17	411.00	631.00	412.00	635.00	4
18	412.00	635.00	425.00	636.00	4
19	425.00	636.00	435.00	631.00	3
20	435.00	631.00	450.00	628.00	3
21	450.00	628.00	495.00	626.00	3
22	270.00	582.00	320.00	582.00	2
23	320.00	582.00	335.00	595.00	2
24	335.00	595.00	361.00	595.00	2
25	361.00	595.00	367.00	595.00	3
26	367.00	595.00	425.00	636.00	3
27	63.00	466.00	64.00	460.00	3
28	64.00	460.00	70.00	455.00	3
29	70.00	455.00	76.00	460.00	2
30	76.00	460.00	77.00	466.00	2
31	77.00	466.00	82.00	469.00	2
32	70.00	455.00	90.00	455.00	3
33	90.00	455.00	110.00	460.00	3
34	110.00	460.00	134.00	470.00	3
35	134.00	470.00	265.00	470.00	3
36	265.00	470.00	275.00	472.00	3
37	275.00	472.00	295.00	477.00	3
38	295.00	477.00	305.00	482.00	3
39	305.00	482.00	310.00	490.00	3
40	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)

```
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0       0.0      0.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)         (deg)
     1              0.0             850.00         25.00
     2              6.0             300.00         20.00
     3             90.0             850.00         25.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
 Specified Peak Ground Acceleration Coefficient (A) =   0.150(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Circular Surfaces, Has Been Specified.
 4000 Trial Surfaces Have Been Generated.
  200 Surface(s) Initiate(s) From Each Of    20 Points Equally Spaced
 Along The Ground Surface Between  X =  63.00(ft)
                              and  X =  82.00(ft)
 Each Surface Terminates Between   X = 280.00(ft)
                             and   X = 495.00(ft)
 Unless Further Limitations Were Imposed, The Minimum Elevation
 At Which A Surface Extends Is  Y =      0.00(ft)
 30.00(ft) Line Segments Define Each Trial Failure Surface.
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Modified Bishop Method * *
       Total Number of Trial Surfaces Attempted =  4000
       Number of Trial Surfaces With Valid FS = 4000
       Statistical Data On All Valid FS Values:
          FS Max =   4.614   FS Min =   1.161   FS Ave =   1.498
          Standard Deviation =    0.168   Coefficient of Variation =   11.20 %
       Failure Surface Specified By 18 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         64.000      466.143
           2         92.404      456.489
           3        121.581      449.509
           4        151.279      445.264
           5        181.243      443.789
           6        211.214      445.097
           7        240.935      449.178
```

8	270.151	455.995
9	298.608	465.491
10	326.063	477.584
11	352.279	492.168
12	377.030	509.120
13	400.104	528.293
14	421.302	549.522
15	440.440	572.624
16	457.356	597.401
17	471.902	623.638
18	473.360	626.962

Circle Center At X = 182.140 ; Y = 766.837 ; and Radius = 323.069

Factor of Safety

*** 1.161 ***

Individual data on the 48 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Surcharge Ver (lbs)	Load (lbs)
1	12.3	4583.6	0.0	0.0	0.	0.	687.5	0.0	0.0
2	0.7	515.3	0.0	0.0	0.	0.	77.3	0.0	0.0
3	5.0	4765.7	0.0	0.0	0.	0.	714.9	0.0	0.0
4	10.4	17463.5	0.0	0.0	0.	0.	2619.5	0.0	0.0
5	1.8	4212.1	0.0	0.0	0.	0.	631.8	0.0	0.0
6	15.8	49733.0	0.0	0.0	0.	0.	7459.9	0.0	0.0
7	3.0	12114.4	0.0	0.0	0.	0.	1817.2	0.0	0.0
8	8.6	38824.5	0.0	0.0	0.	0.	5823.7	0.0	0.0
9	12.4	65737.8	0.0	0.0	0.	0.	9860.7	0.0	0.0
10	17.3	108990.3	0.0	0.0	0.	0.	16348.5	0.0	0.0
11	18.7	139050.2	0.0	0.0	0.	0.	20857.5	0.0	0.0
12	11.2	95719.1	0.0	0.0	0.	0.	14357.9	0.0	0.0
13	30.0	311108.4	0.0	0.0	0.	0.	46666.3	0.0	0.0
14	28.8	367864.4	0.0	0.0	0.	0.	55179.7	0.0	0.0
15	0.9	13011.3	0.0	0.0	0.	0.	1951.7	0.0	0.0
16	23.1	341704.7	0.0	0.0	0.	0.	51255.7	0.0	0.0
17	1.0	15686.3	0.0	0.0	0.	0.	2352.9	0.0	0.0
18	5.0	78618.8	0.0	0.0	0.	0.	11792.8	0.0	0.0
19	0.2	2372.3	0.0	0.0	0.	0.	355.8	0.0	0.0
20	4.8	77296.9	0.0	0.0	0.	0.	11594.5	0.0	0.0
21	15.0	249626.2	0.0	0.0	0.	0.	37443.9	0.0	0.0
22	5.0	85342.0	0.0	0.0	0.	0.	12801.3	0.0	0.0
23	3.6	60935.0	0.0	0.0	0.	0.	9140.3	0.0	0.0
24	6.4	106347.9	0.0	0.0	0.	0.	15952.2	0.0	0.0
25	5.0	81620.3	0.0	0.0	0.	0.	12243.0	0.0	0.0
26	10.0	159111.4	0.0	0.0	0.	0.	23866.7	0.0	0.0
27	6.1	93786.7	0.0	0.0	0.	0.	14068.0	0.0	0.0
28	6.9	104478.7	0.0	0.0	0.	0.	15671.8	0.0	0.0
29	2.0	29850.2	0.0	0.0	0.	0.	4477.5	0.0	0.0
30	3.0	45566.2	0.0	0.0	0.	0.	6834.9	0.0	0.0
31	14.3	215446.0	0.0	0.0	0.	0.	32316.9	0.0	0.0
32	8.7	127345.0	0.0	0.0	0.	0.	19101.8	0.0	0.0
33	6.0	85302.9	0.0	0.0	0.	0.	12795.4	0.0	0.0
34	1.0	14034.2	0.0	0.0	0.	0.	2105.1	0.0	0.0
35	3.0	42763.9	0.0	0.0	0.	0.	6414.6	0.0	0.0
36	6.0	86732.3	0.0	0.0	0.	0.	13009.8	0.0	0.0
37	21.0	286456.3	0.0	0.0	0.	0.	42968.4	0.0	0.0
38	2.1	27243.4	0.0	0.0	0.	0.	4086.5	0.0	0.0
39	10.9	132454.0	0.0	0.0	0.	0.	19868.1	0.0	0.0
40	1.0	11661.8	0.0	0.0	0.	0.	1749.3	0.0	0.0
41	9.3	105217.3	0.0	0.0	0.	0.	15782.6	0.0	0.0
42	3.7	38880.4	0.0	0.0	0.	0.	5832.1	0.0	0.0
43	10.0	91847.8	0.0	0.0	0.	0.	13777.2	0.0	0.0
44	5.4	41561.9	0.0	0.0	0.	0.	6234.3	0.0	0.0
45	9.6	58947.3	0.0	0.0	0.	0.	8842.1	0.0	0.0
46	7.4	32938.2	0.0	0.0	0.	0.	4940.7	0.0	0.0
47	14.5	30602.3	0.0	0.0	0.	0.	4590.3	0.0	0.0
48	1.5	308.8	0.0	0.0	0.	0.	46.3	0.0	0.0

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	64.000	466.143
2	92.237	456.010
3	121.324	448.664
4	150.985	444.172
5	180.943	442.579
6	210.914	443.897
7	240.616	448.116
8	269.769	455.196
9	298.097	465.069
10	325.335	477.643
11	351.225	492.799
12	375.524	510.394
13	398.001	530.263
14	418.446	552.217
15	436.666	576.051
16	452.488	601.539
17	465.213	627.324

Circle Center At X = 182.360 ; Y = 751.572 ; and Radius = 308.996

Factor of Safety

*** 1.163 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.000	466.714
2	96.346	456.892
3	125.500	449.817
4	155.196	445.553
5	185.162	444.140
6	215.127	445.590
7	244.818	449.891
8	273.963	457.002
9	302.297	466.859
10	329.563	479.372
11	355.511	494.428
12	379.906	511.889
13	402.525	531.597
14	423.162	553.370
15	441.630	577.013
16	457.759	602.308
17	470.417	627.093

Circle Center At X = 184.968 ; Y = 758.465 ; and Radius = 314.325

Factor of Safety

*** 1.166 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	64.000	466.143
2	92.511	456.810
3	121.739	450.045
4	151.451	445.902
5	181.414	444.414
6	211.391	445.591
7	241.145	449.426
8	270.441	455.886
9	299.048	464.923
10	326.739	476.463
11	353.297	490.417
12	378.511	506.673
13	402.182	525.103
14	424.123	545.563
15	444.161	567.889
16	462.137	591.907
17	477.911	617.426
18	482.488	626.556

Circle Center At X = 183.163 ; Y = 781.353 ; and Radius = 336.983

Factor of Safety

*** 1.166 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	64.000	466.143
2	92.286	456.147
3	121.345	448.692
4	150.949	443.838
5	180.867	441.620
6	210.864	442.058
7	240.705	445.148
8	270.155	450.865
9	298.984	459.165
10	326.966	469.983
11	353.881	483.233
12	379.518	498.812
13	403.678	516.598
14	426.169	536.451
15	446.815	558.216
16	465.456	581.722
17	481.944	606.785
18	492.339	626.118

Circle Center At X = 190.909 ; Y = 779.775 ; and Radius = 338.336

Factor of Safety

*** 1.166 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	65.000	466.286
2	93.543	457.051
3	122.789	450.368
4	152.511	446.287
5	182.476	444.840
6	212.452	446.039
7	242.205	449.875
8	271.506	456.317
9	300.124	465.316
10	327.839	476.800
11	354.434	490.683
12	379.702	506.854
13	403.447	525.188
14	425.485	545.544
15	445.644	567.762
16	463.766	591.669
17	479.712	617.080
18	484.506	626.466

Circle Center At X = 183.877 ; Y = 784.377 ; and Radius = 339.579

Factor of Safety

*** 1.168 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	70.000	467.000
2	98.394	457.315
3	127.566	450.316
4	157.263	446.062
5	187.227	444.592
6	217.197	445.917
7	246.915	450.026
8	276.120	456.883
9	304.561	466.430
10	331.989	478.582
11	358.168	493.235
12	382.868	510.261
13	405.876	529.513
14	426.993	550.822
15	446.034	574.005
16	462.834	598.860
17	477.248	625.170
18	477.934	626.758

Circle Center At X = 188.009 ; Y = 766.369 ; and Radius = 321.788

Factor of Safety

*** 1.174 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.000	466.429
2	94.518	457.115
3	123.743	450.340
4	153.449	446.155
5	183.409	444.592
6	213.389	445.664
7	243.161	449.362
8	272.493	455.658
9	301.159	464.503
10	328.939	475.828
11	355.618	489.548
12	380.991	505.555
13	404.861	523.727
14	427.045	543.923
15	447.372	565.987
16	465.684	589.749
17	481.841	615.027
18	487.734	626.323

Circle Center At X = 186.201 ; Y = 785.516 ; and Radius = 340.976

Factor of Safety

*** 1.175 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	69.000	466.857
2	96.907	455.848
3	125.828	447.875
4	155.434	443.028
5	185.388	441.364
6	215.348	442.900
7	244.975	447.620
8	273.930	455.470
9	301.883	466.360
10	328.518	480.166
11	353.529	496.732
12	376.634	515.868
13	397.568	537.356
14	416.093	560.953
15	431.999	586.390
16	445.104	613.376
17	450.359	627.984

Circle Center At X = 185.988 ; Y = 722.532 ; and Radius = 281.169

Factor of Safety

*** 1.176 ***

Failure Surface Specified By 17 Coordinate Points

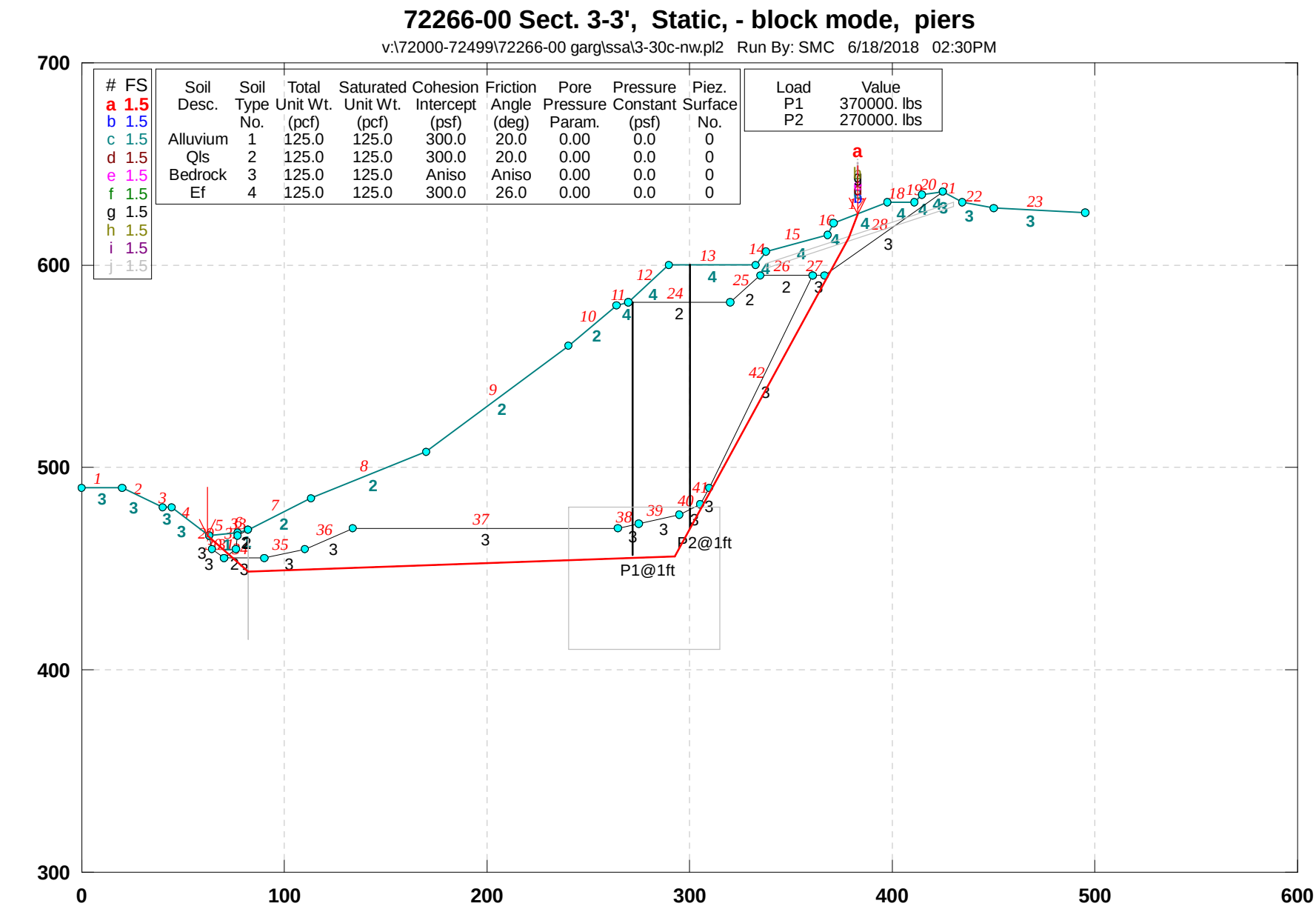
Point No.	X-Surf (ft)	Y-Surf (ft)
1	75.000	467.714
2	103.091	457.185
3	132.129	449.645
4	161.794	445.179
5	191.764	443.835
6	221.711	445.627
7	251.306	450.536
8	280.228	458.508
9	308.158	469.457
10	334.793	483.262
11	359.841	499.772
12	383.029	518.808
13	404.102	540.160
14	422.830	563.596
15	439.010	588.859
16	452.463	615.674
17	456.991	627.689

Circle Center At X = 189.620 ; Y = 730.762 ; and Radius = 286.935

Factor of Safety

*** 1.176 ***

**** END OF GSTABL7 OUTPUT ****



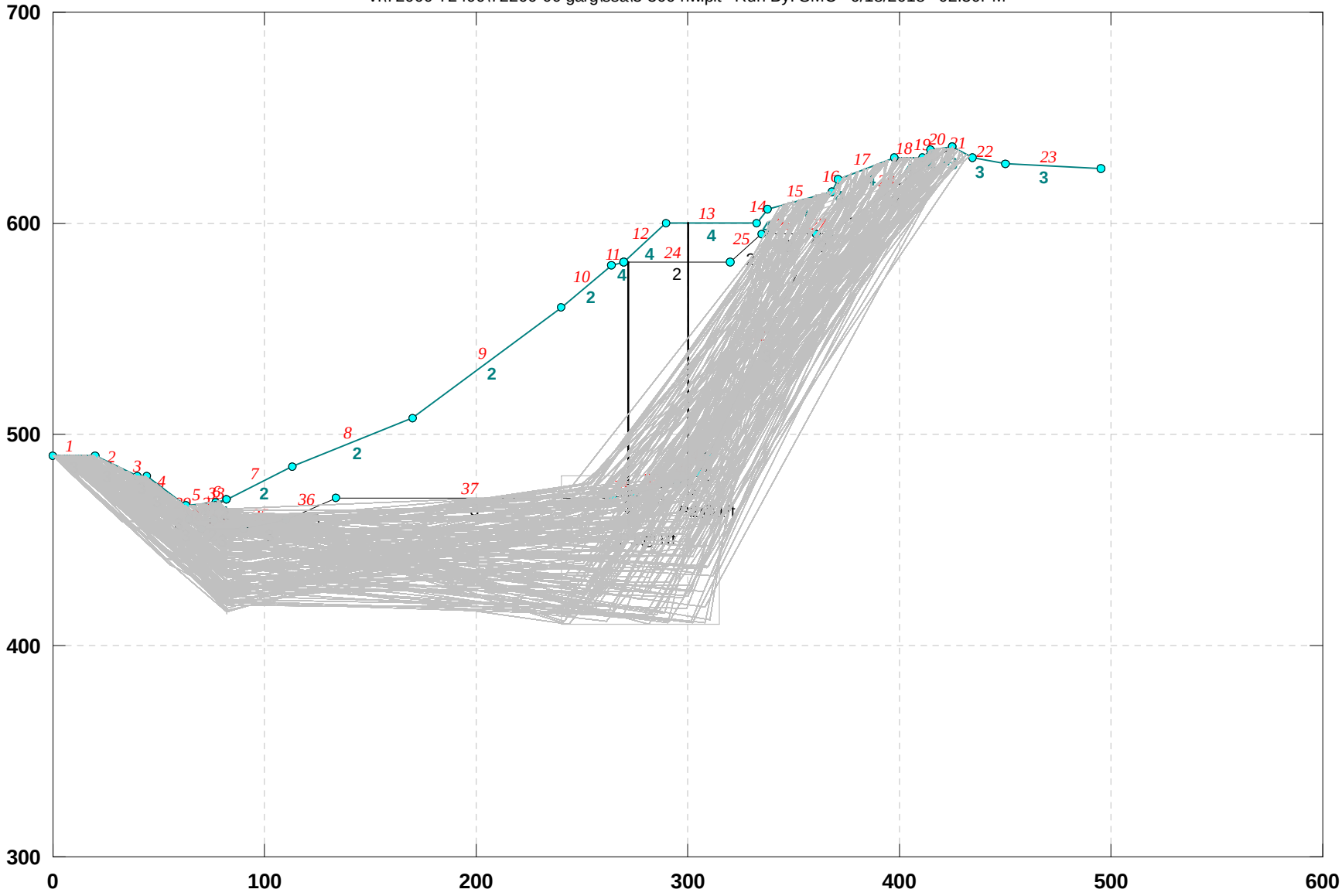
GSTABL7 v.2 FSmin=1.5

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-18.1

72266-00 Sect. 3-3', Static, - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30c-nw.plt Run By: SMC 6/18/2018 02:30PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 02:30PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30c-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30c-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30c-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Static,
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

```
 User Specified Y-Origin =       300.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  4 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
   1   125.0    125.0     300.0     20.0    0.00       0.0      0
   2   125.0    125.0     300.0     20.0    0.00       0.0      0
   3   125.0    125.0       0.0      0.0    0.00       0.0      0
   4   125.0    125.0     300.0     26.0    0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  3 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion     Friction
   Range       Direction Limit    Intercept       Angle
    No.            (deg)            (psf)        (deg)
     1              0.0             850.00         25.00
     2              6.0             300.00         20.00
     3             90.0             850.00         25.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
PIER/PILE LOAD(S)
     2 Pier/Pile Load(s) Specified
Pier/Pile  X-Pos    Y-Pos     Load    Spacing  Inclination  Length
   No.     (ft)     (ft)      (lbs)     (ft)      (deg)      (ft)
    1     272.00   582.00   370000.0     1.0      90.00      125.0
    2     300.00   600.00   270000.0     1.0      90.00      130.0
 NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
        Assuming A Uniform Distribution Of Load Horizontally Between
        Individual Piers/Piles.
 Janbus Empirical Coef is being used for the case of  c & phi both > 0
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 5000 Trial Surfaces Have Been Generated.
 3 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  30.0
 Box        X-Left     Y-Left    X-Right    Y-Right      Height
 No.         (ft)       (ft)       (ft)       (ft)        (ft)
  1          82.00     440.00      82.00     440.00      50.00
  2         240.00     445.00     315.00     445.00      70.00
  3         338.00     600.00     430.00     630.00       2.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  5000
       Number of Trial Surfaces With Valid FS = 5000
       Statistical Data On All Valid FS Values:
          FS Max =   3.497   FS Min =   1.469   FS Ave =   1.933
          Standard Deviation =    0.263   Coefficient of Variation =   13.58 %
       Failure Surface Specified By  5 Coordinate Points
         Point      X-Surf      Y-Surf
          No.        (ft)        (ft)
           1         62.444      466.410
           2         82.000      448.298
           3        292.675      455.626
           4        378.491      613.659
           5        382.902      625.408
              Factor of Safety
            ***    1.469   ***
```

Individual data on the 33 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.6	3.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.0	0.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	9.5	6164.1	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.3	3235.9	0.0	0.0	0.	0.	0.0	0.0	0.0
5	1.2	2062.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.0	1817.1	0.0	0.0	0.	0.	0.0	0.0	0.0
7	5.0	11179.3	0.0	0.0	0.	0.	0.0	0.0	0.0
8	8.0	22627.7	0.0	0.0	0.	0.	0.0	0.0	0.0
9	20.0	73416.2	0.0	0.0	0.	0.	0.0	0.0	0.0
10	3.0	13088.2	0.0	0.0	0.	0.	0.0	0.0	0.0
11	21.0	103676.0	0.0	0.0	0.	0.	0.0	0.0	0.0
12	36.0	225019.4	0.0	0.0	0.	0.	0.0	0.0	0.0
13	70.0	712459.8	0.0	0.0	0.	0.	0.0	0.0	0.0
14	24.0	347367.6	0.0	0.0	0.	0.	0.0	0.0	0.0
15	1.0	15690.1	0.0	0.0	0.	0.	0.0	0.0	0.0
16	5.0	79010.5	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.0	80828.8	0.0	0.0	0.	0.	0.0	0.0	0.0
18	15.0	258709.3	0.0	0.0	0.	0.	0.0	0.0	0.0
19	2.7	48288.3	0.0	0.0	0.	0.	0.0	0.0	0.0
20	2.3	41339.0	0.0	0.0	0.	0.	0.0	0.0	0.0
21	10.0	163606.3	0.0	0.0	0.	0.	0.0	0.0	0.0
22	5.0	73171.0	0.0	0.0	0.	0.	0.0	0.0	0.0
23	10.0	129077.7	0.0	0.0	0.	0.	0.0	0.0	0.0
24	13.0	133387.6	0.0	0.0	0.	0.	0.0	0.0	0.0
25	2.0	17418.3	0.0	0.0	0.	0.	0.0	0.0	0.0
26	3.0	25713.6	0.0	0.0	0.	0.	0.0	0.0	0.0
27	23.0	143164.4	0.0	0.0	0.	0.	0.0	0.0	0.0
28	6.0	20220.7	0.0	0.0	0.	0.	0.0	0.0	0.0
29	1.0	2681.1	0.0	0.0	0.	0.	0.0	0.0	0.0
30	1.2	3129.4	0.0	0.0	0.	0.	0.0	0.0	0.0
31	1.8	4707.9	0.0	0.0	0.	0.	0.0	0.0	0.0
32	7.5	14633.1	0.0	0.0	0.	0.	0.0	0.0	0.0
33	4.4	2788.3	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

Factor of Safety
*** 1.469 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

Factor of Safety
*** 1.469 ***

Failure Surface Specified By 5 Coordinate Points

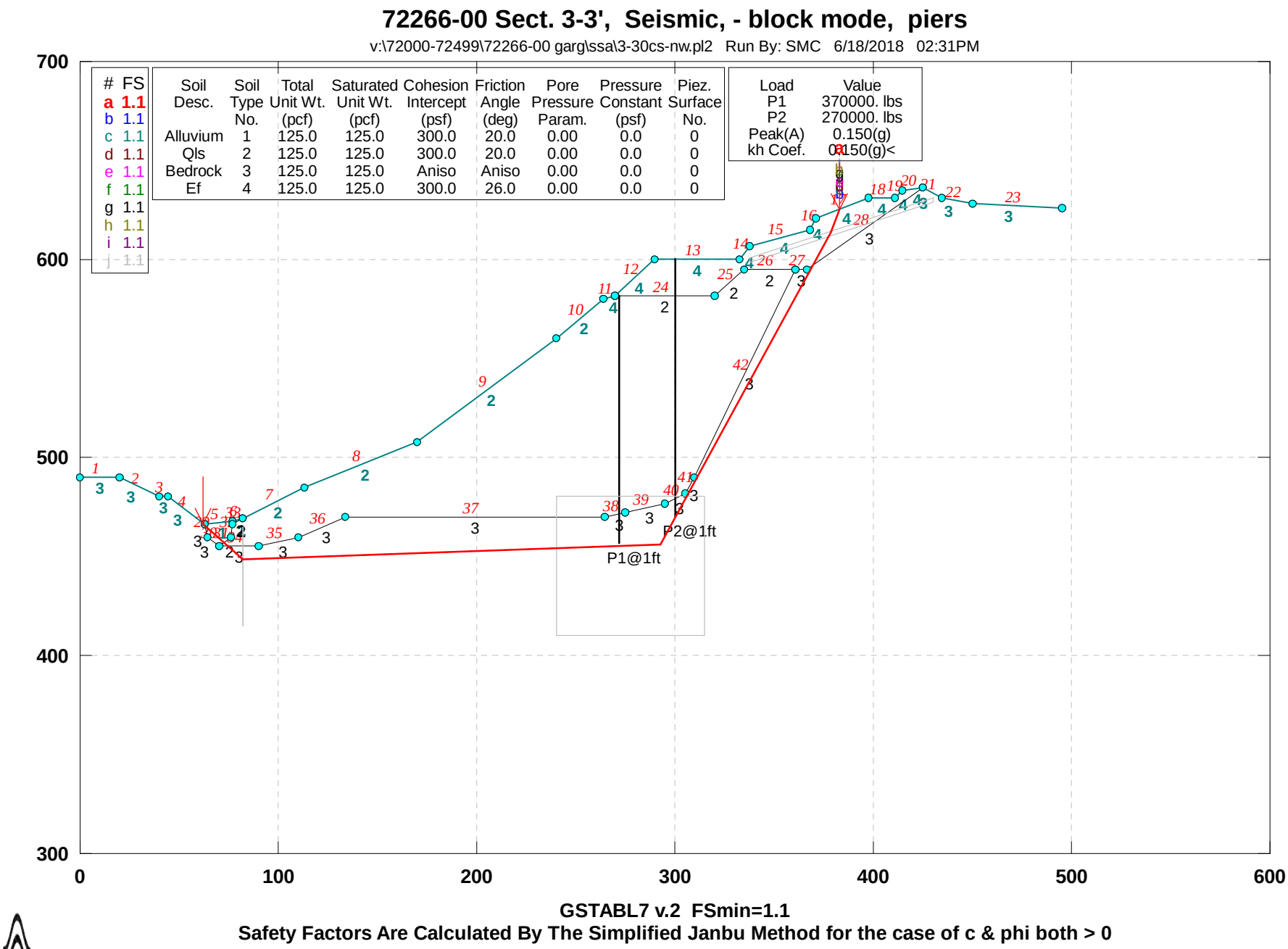
Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

Factor of Safety
*** 1.469 ***

Failure Surface Specified By 5 Coordinate Points

Point	X-Surf	Y-Surf

```
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.469   ***
          **** END OF GSTABL7 OUTPUT ****
```



GSTABL7 v.2 FSmin=1.1

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-18.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 02:31PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30cs-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30cs-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30cs-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Seismic,
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	0.0	0.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
3 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	82.00	440.00	82.00	440.00	50.00
2	240.00	445.00	315.00	445.00	70.00
3	338.00	600.00	430.00	630.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 2.396 FS Min = 1.065 FS Ave = 1.442
Standard Deviation = 0.174 Coefficient of Variation = 12.05 %
Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626

4	378.491	613.659
5	382.902	625.408

Factor of Safety

*** 1.065 ***

Individual data on the 33 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.6	3.7	0.0	0.0	0.	0.	0.5	0.0	0.0
2	0.0	0.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	9.5	6164.1	0.0	0.0	0.	0.	924.6	0.0	0.0
4	2.3	3235.9	0.0	0.0	0.	0.	485.4	0.0	0.0
5	1.2	2062.4	0.0	0.0	0.	0.	309.4	0.0	0.0
6	1.0	1817.1	0.0	0.0	0.	0.	272.6	0.0	0.0
7	5.0	11179.3	0.0	0.0	0.	0.	1676.9	0.0	0.0
8	8.0	22627.7	0.0	0.0	0.	0.	3394.1	0.0	0.0
9	20.0	73416.2	0.0	0.0	0.	0.	11012.4	0.0	0.0
10	3.0	13088.2	0.0	0.0	0.	0.	1963.2	0.0	0.0
11	21.0	103676.0	0.0	0.0	0.	0.	15551.4	0.0	0.0
12	36.0	225019.4	0.0	0.0	0.	0.	33752.9	0.0	0.0
13	70.0	712459.8	0.0	0.0	0.	0.	*******	0.0	0.0
14	24.0	347367.6	0.0	0.0	0.	0.	52105.1	0.0	0.0
15	1.0	15690.1	0.0	0.0	0.	0.	2353.5	0.0	0.0
16	5.0	79010.5	0.0	0.0	0.	0.	11851.6	0.0	0.0
17	5.0	80828.8	0.0	0.0	0.	0.	12124.3	0.0	0.0
18	15.0	258709.3	0.0	0.0	0.	0.	38806.4	0.0	0.0
19	2.7	48288.3	0.0	0.0	0.	0.	7243.2	0.0	0.0
20	2.3	41339.0	0.0	0.0	0.	0.	6200.8	0.0	0.0
21	10.0	163606.3	0.0	0.0	0.	0.	24540.9	0.0	0.0
22	5.0	73171.0	0.0	0.0	0.	0.	10975.6	0.0	0.0
23	10.0	129077.7	0.0	0.0	0.	0.	19361.7	0.0	0.0
24	13.0	133387.6	0.0	0.0	0.	0.	20008.1	0.0	0.0
25	2.0	17418.3	0.0	0.0	0.	0.	2612.7	0.0	0.0
26	3.0	25713.6	0.0	0.0	0.	0.	3857.0	0.0	0.0
27	23.0	143164.4	0.0	0.0	0.	0.	21474.7	0.0	0.0
28	6.0	20220.7	0.0	0.0	0.	0.	3033.1	0.0	0.0
29	1.0	2681.1	0.0	0.0	0.	0.	402.2	0.0	0.0
30	1.2	3129.4	0.0	0.0	0.	0.	469.4	0.0	0.0
31	1.8	4707.9	0.0	0.0	0.	0.	706.2	0.0	0.0
32	7.5	14633.1	0.0	0.0	0.	0.	2195.0	0.0	0.0
33	4.4	2788.3	0.0	0.0	0.	0.	418.2	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

Factor of Safety

*** 1.065 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

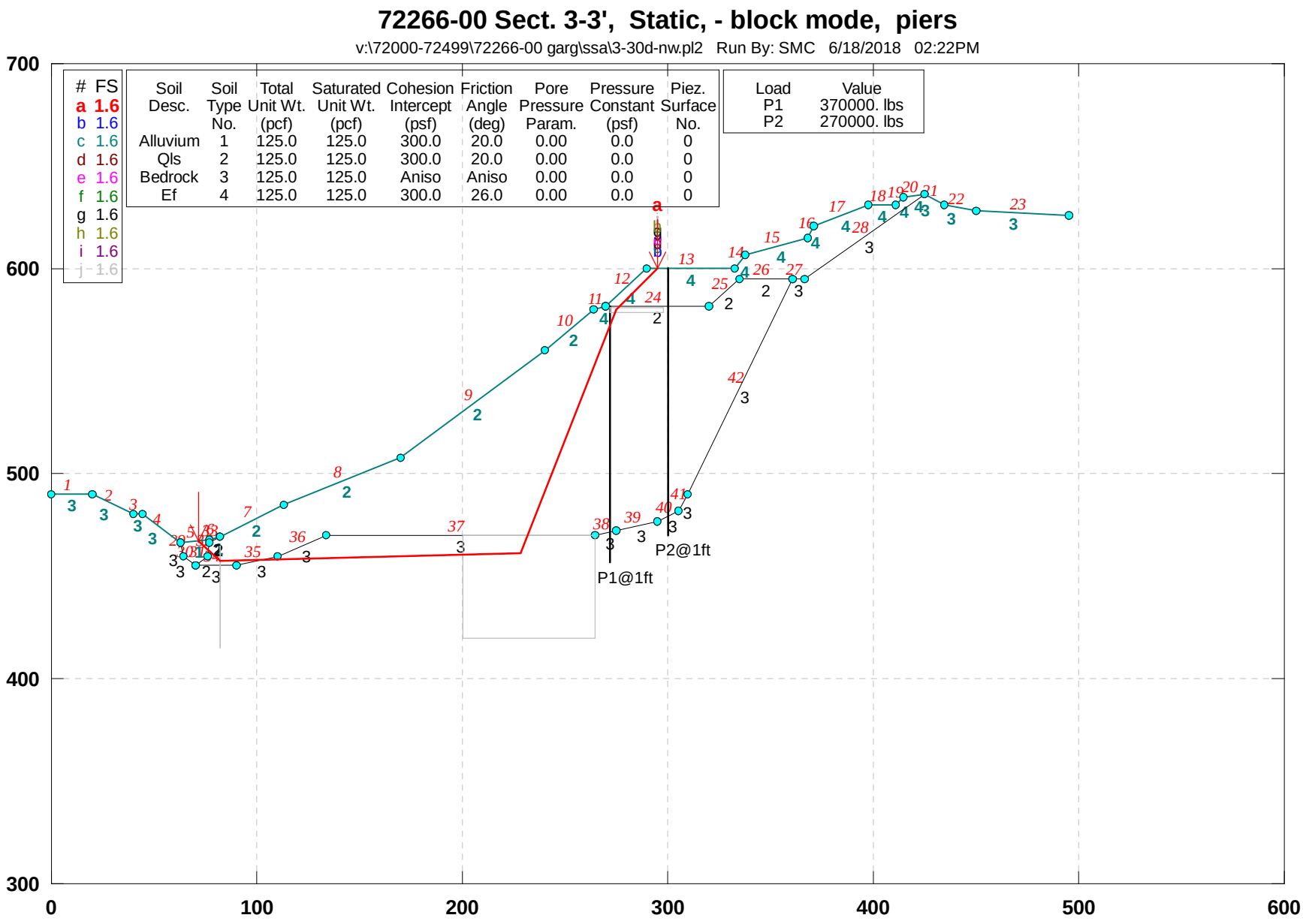
Factor of Safety

*** 1.065 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	62.444	466.410
2	82.000	448.298
3	292.675	455.626
4	378.491	613.659
5	382.902	625.408

```
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         62.444      466.410
    2         82.000      448.298
    3        292.675      455.626
    4        378.491      613.659
    5        382.902      625.408
       Factor of Safety
      ***    1.065   ***
          **** END OF GSTABL7 OUTPUT ****
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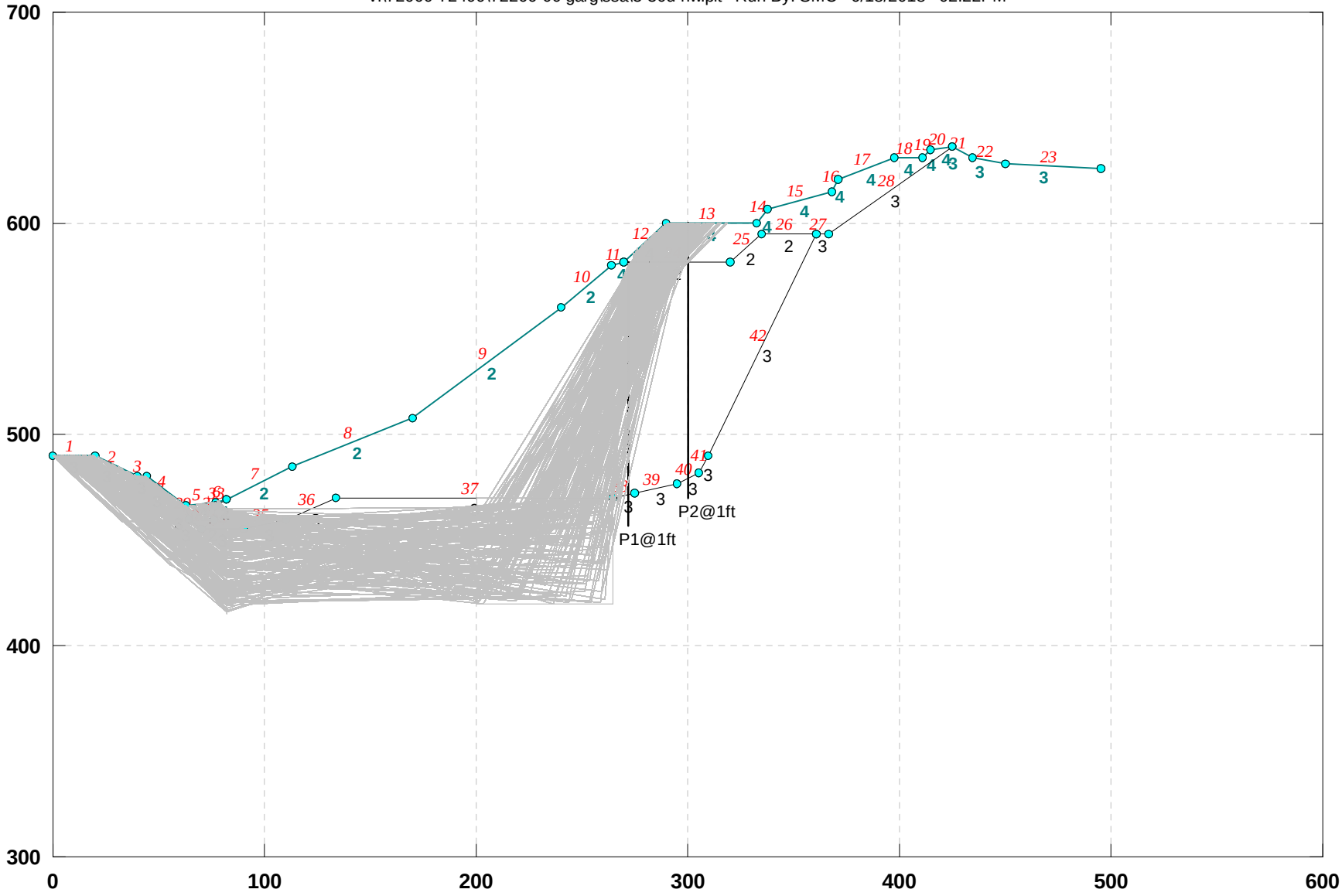
GSTABL7 v.2 FSmin=1.6

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-19.1

72266-00 Sect. 3-3', Static, - block mode, piers

v:\72000-72499\72266-00 garg\ssa\3-30d-nw.plt Run By: SMC 6/18/2018 02:22PM



Geofirm

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 02:22PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30d-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30d-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30d-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Static,
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	0.0	0.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
3 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	82.00	440.00	82.00	440.00	50.00
2	200.00	445.00	265.00	445.00	50.00
3	272.00	580.00	298.00	580.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 4.928 FS Min = 1.555 FS Ave = 2.175
Standard Deviation = 0.406 Coefficient of Variation = 18.65 %
Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Individual data on the 17 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.4	1365.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	0.5	322.8	0.0	0.0	0.	0.	0.0	0.0	0.0
3	5.0	5232.2	0.0	0.0	0.	0.	0.0	0.0	0.0
4	20.6	42296.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	7.4	21422.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	3.0	9703.0	0.0	0.0	0.	0.	0.0	0.0	0.0
7	21.0	80402.6	0.0	0.0	0.	0.	0.0	0.0	0.0
8	36.0	186846.0	0.0	0.0	0.	0.	0.0	0.0	0.0
9	58.2	504808.1	0.0	0.0	0.	0.	0.0	0.0	0.0
10	3.6	39265.6	0.0	0.0	0.	0.	0.0	0.0	0.0
11	8.2	78450.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	24.0	146025.0	0.0	0.0	0.	0.	0.0	0.0	0.0
13	6.0	16171.8	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	6806.3	0.0	0.0	0.	0.	0.0	0.0	0.0
15	2.1	1747.9	0.0	0.0	0.	0.	0.0	0.0	0.0
16	12.8	9290.9	0.0	0.0	0.	0.	0.0	0.0	0.0
17	5.1	1642.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Failure Surface Specified By 5 Coordinate Points

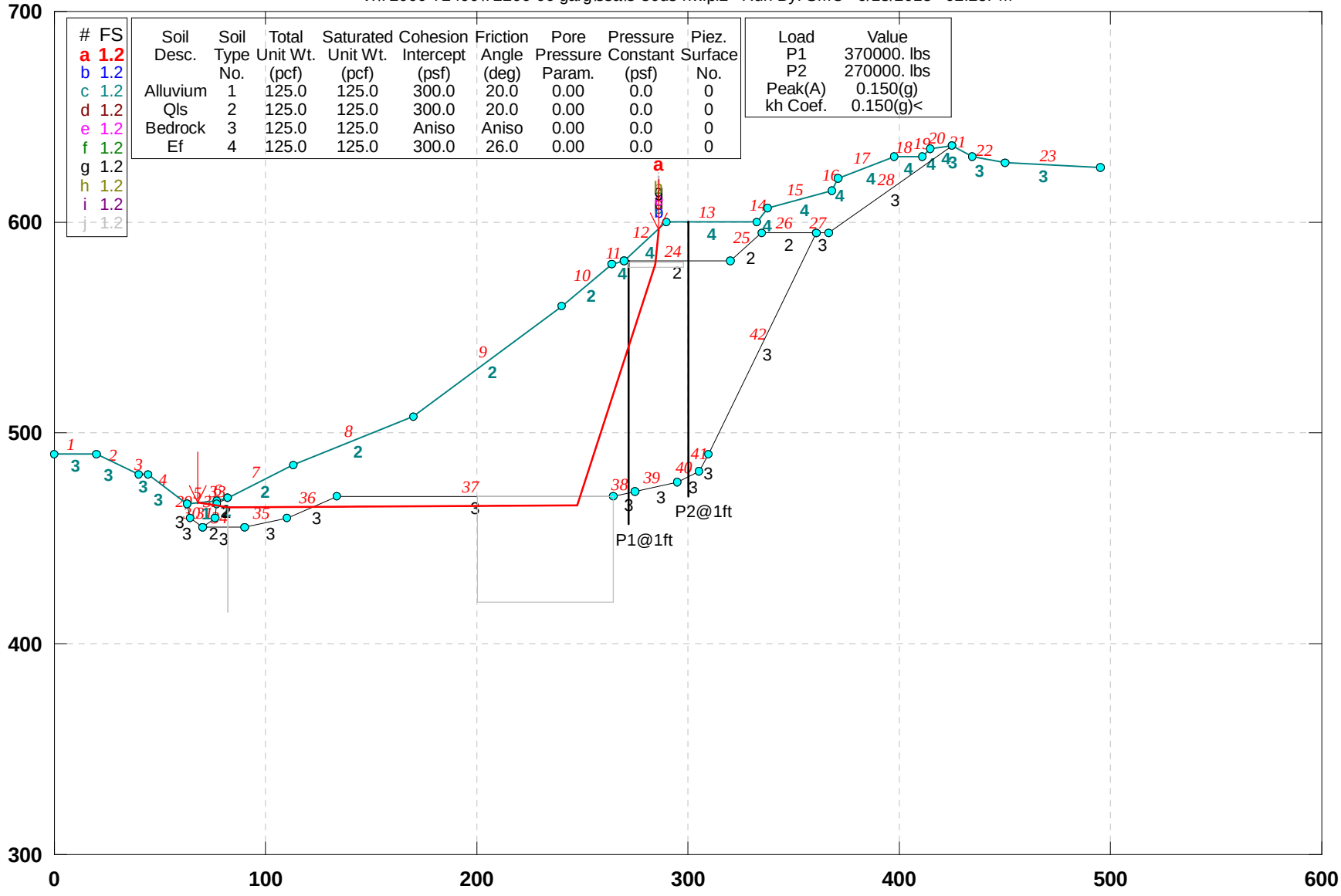
Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

Factor of Safety
*** 1.555 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.057	467.294
2	82.000	457.722
3	228.195	460.842
4	275.039	579.863
5	295.119	600.000

```
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         72.057      467.294
    2         82.000      457.722
    3        228.195      460.842
    4        275.039      579.863
    5        295.119      600.000
       Factor of Safety
      ***    1.555   ***
          **** END OF GSTABL7 OUTPUT ****
```



GSTABL7 v.2 FSmin=1.2

Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-19.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 6/18/2018
Time of Run: 02:25PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-30ds-nw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30ds-nw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-30ds-nw.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Seismic
- block mode, piers

BOUNDARY COORDINATES
23 Top Boundaries
42 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	490.00	20.00	490.00	3
2	20.00	490.00	40.00	480.00	3
3	40.00	480.00	44.00	480.00	3
4	44.00	480.00	63.00	466.00	3
5	63.00	466.00	77.00	468.00	1
6	77.00	468.00	82.00	469.00	1
7	82.00	469.00	113.00	485.00	2
8	113.00	485.00	170.00	508.00	2
9	170.00	508.00	240.00	560.00	2
10	240.00	560.00	264.00	580.00	2
11	264.00	580.00	270.00	582.00	4
12	270.00	582.00	290.00	600.00	4
13	290.00	600.00	333.00	600.00	4
14	333.00	600.00	338.00	607.00	4
15	338.00	607.00	368.00	615.00	4
16	368.00	615.00	371.00	621.00	4
17	371.00	621.00	398.00	631.00	4
18	398.00	631.00	411.00	631.00	4
19	411.00	631.00	415.00	635.00	4
20	415.00	635.00	425.00	636.00	4
21	425.00	636.00	435.00	631.00	3
22	435.00	631.00	450.00	628.00	3
23	450.00	628.00	495.00	626.00	3
24	270.00	582.00	320.00	582.00	2
25	320.00	582.00	335.00	595.00	2
26	335.00	595.00	361.00	595.00	2
27	361.00	595.00	367.00	595.00	3
28	367.00	595.00	425.00	636.00	3
29	63.00	466.00	64.00	460.00	3
30	64.00	460.00	70.00	455.00	3
31	70.00	455.00	76.00	460.00	2
32	76.00	460.00	77.00	466.00	2
33	77.00	466.00	82.00	469.00	2
34	70.00	455.00	90.00	455.00	3
35	90.00	455.00	110.00	460.00	3
36	110.00	460.00	134.00	470.00	3
37	134.00	470.00	265.00	470.00	3
38	265.00	470.00	275.00	472.00	3
39	275.00	472.00	295.00	477.00	3
40	295.00	477.00	305.00	482.00	3
41	305.00	482.00	310.00	490.00	3
42	310.00	490.00	361.00	595.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	0.0	0.0	0.00	0.0	0
4	125.0	125.0	300.0	26.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	850.00	25.00
2	6.0	300.00	20.00
3	90.0	850.00	25.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)

2 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	272.00	582.00	370000.0	1.0	90.00	125.0
2	300.00	600.00	270000.0	1.0	90.00	130.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
3 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	82.00	440.00	82.00	440.00	50.00
2	200.00	445.00	265.00	445.00	50.00
3	272.00	580.00	298.00	580.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 3.288 FS Min = 1.186 FS Ave = 1.650
Standard Deviation = 0.258 Coefficient of Variation = 15.65 %
Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554

4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Individual data on the 15 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	8.7	1419.3	0.0	0.0	0.	0.	212.9	0.0	0.0
2	0.1	33.9	0.0	0.0	0.	0.	5.1	0.0	0.0
3	5.0	2204.7	0.0	0.0	0.	0.	330.7	0.0	0.0
4	31.0	47767.8	0.0	0.0	0.	0.	7165.2	0.0	0.0
5	8.6	23454.3	0.0	0.0	0.	0.	3518.2	0.0	0.0
6	12.4	40625.8	0.0	0.0	0.	0.	6093.9	0.0	0.0
7	36.0	160849.5	0.0	0.0	0.	0.	24127.4	0.0	0.0
8	70.0	601095.2	0.0	0.0	0.	0.	90164.3	0.0	0.0
9	7.7	93397.2	0.0	0.0	0.	0.	14009.6	0.0	0.0
10	1.4	17770.2	0.0	0.0	0.	0.	2665.5	0.0	0.0
11	14.9	150363.1	0.0	0.0	0.	0.	22554.5	0.0	0.0
12	6.0	41561.2	0.0	0.0	0.	0.	6234.2	0.0	0.0
13	14.5	56528.8	0.0	0.0	0.	0.	8479.3	0.0	0.0
14	0.2	390.5	0.0	0.0	0.	0.	58.6	0.0	0.0
15	1.7	1371.7	0.0	0.0	0.	0.	205.8	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554
4	284.548	580.028
5	286.419	596.777

Factor of Safety
*** 1.186 ***

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	68.183	466.740
2	82.000	464.582
3	247.651	465.554

```
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
Failure Surface Specified By  5 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         68.183      466.740
    2         82.000      464.582
    3        247.651      465.554
    4        284.548      580.028
    5        286.419      596.777
       Factor of Safety
      ***    1.186   ***
          **** END OF GSTABL7 OUTPUT ****
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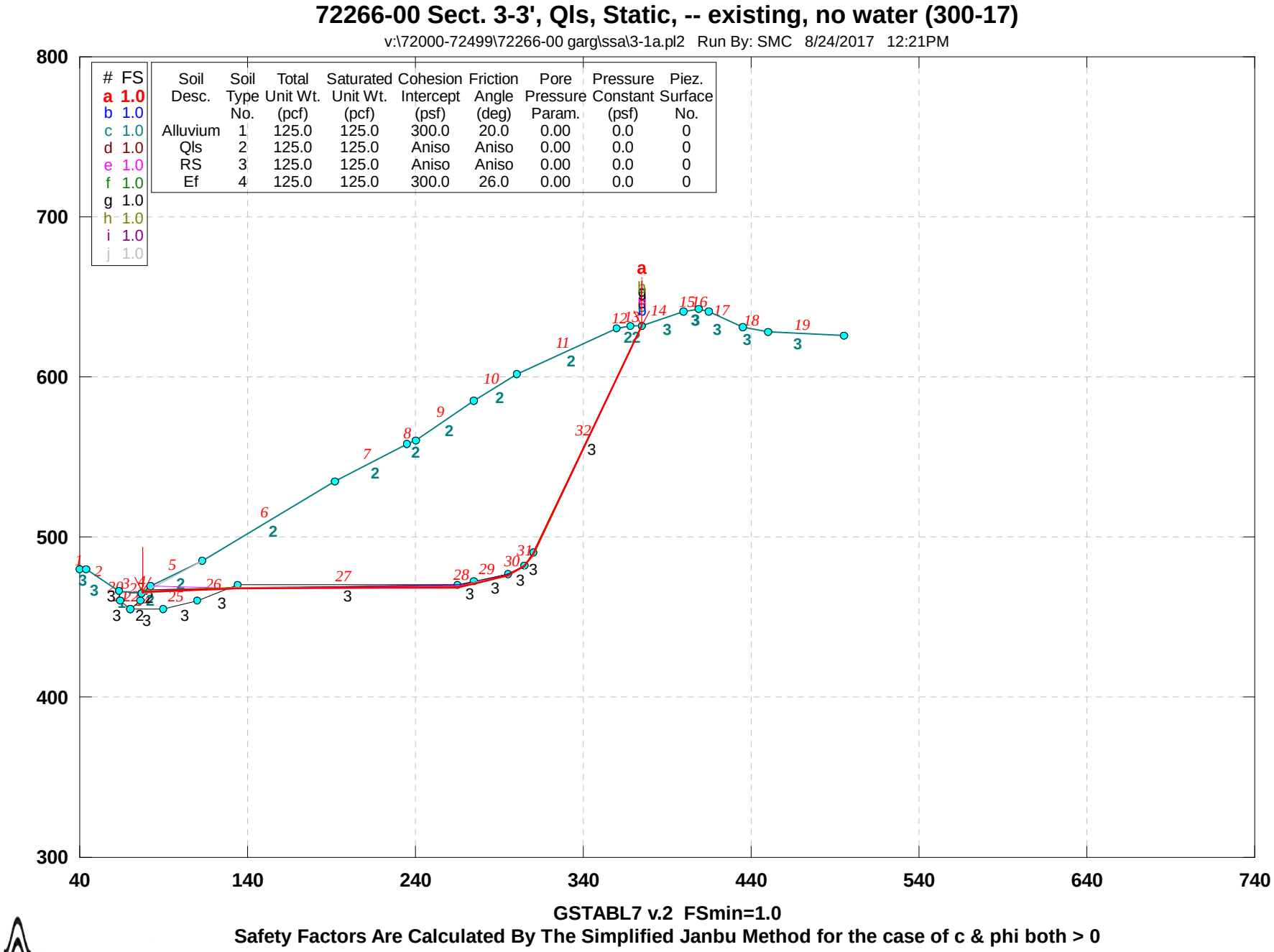

72266-00 Sect. 3-3', Qls, Static, -- existing, no water (300-17)
v:\72000-72499\72266-00 garg\ssa\3-1a.pl2 Run By: SMC 8/24/2017 12:21PM
FS
a 1.0
b 1.0
c 1.0
d 1.0
e 1.0
f 1.0
g 1.0
h 1.0
i 1.0
j 1.0
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Alluvium | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Qls | 2 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
RS | 3 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
Ef | 4 | 125.0 | 125.0 | 300.0 | 26.0 | 0.00 | 0.0 | 0
800
700
600
500
400
300
40
140
240
340
440
540
640
740
GSTABL7 v.2 FSmin=1.0
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-20

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 8/24/2017
Time of Run: 12:21PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\3-1a.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-1a.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\3-1a.PLT
PROBLEM DESCRIPTION: 72266-00 Sect. 3-3', Qls, Static,
-- existing, no water (300-17)

BOUNDARY COORDINATES
19 Top Boundaries
32 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	40.00	480.00	44.00	480.00	3
2	44.00	480.00	63.00	466.00	3
3	63.00	466.00	77.00	465.00	1
4	77.00	465.00	82.00	469.00	2
5	82.00	469.00	113.00	485.00	2
6	113.00	485.00	192.00	535.00	2
7	192.00	535.00	235.00	558.00	2
8	235.00	558.00	240.00	560.00	2
9	240.00	560.00	275.00	585.00	2
10	275.00	585.00	300.00	602.00	2
11	300.00	602.00	360.00	630.00	2
12	360.00	630.00	368.00	632.00	2
13	368.00	632.00	375.00	632.00	2
14	375.00	632.00	400.00	641.00	3
15	400.00	641.00	409.00	642.00	3
16	409.00	642.00	415.00	641.00	3
17	415.00	641.00	435.00	631.00	3
18	435.00	631.00	450.00	628.00	3
19	450.00	628.00	495.00	626.00	3
20	63.00	466.00	64.00	460.00	3
21	64.00	460.00	70.00	455.00	3
22	70.00	455.00	76.00	460.00	2
23	76.00	460.00	77.00	465.00	2
24	70.00	455.00	90.00	455.00	3
25	90.00	455.00	110.00	460.00	3
26	110.00	460.00	134.00	470.00	3
27	134.00	470.00	265.00	470.00	3
28	265.00	470.00	275.00	472.00	3
29	275.00	472.00	295.00	477.00	3
30	295.00	477.00	305.00	482.00	3
31	305.00	482.00	310.00	490.00	3
32	310.00	490.00	375.00	632.00	3

User Specified Y-Origin = 300.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0

4 125.0 125.0 300.0 26.0 0.00 0.0 0

ANISOTROPIC STRENGTH PARAMETERS
2 soil type(s)
Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	20.00

Soil Type 3 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	17.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
2000 Trial Surfaces Have Been Generated.
8 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 25.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	77.00	465.00	113.00	485.00	0.00
2	134.00	469.00	134.00	469.00	2.00
3	265.00	469.00	265.00	469.00	2.00
4	275.00	471.00	275.00	471.00	2.00
5	295.00	476.00	295.00	476.00	2.00
6	305.00	481.00	305.00	481.00	2.00
7	310.00	489.00	310.00	489.00	2.00
8	375.00	632.00	375.00	632.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000
Statistical Data On All Valid FS Values:
FS Max = 1.015 FS Min = 0.973 FS Ave = 0.989
Standard Deviation = 0.008 Coefficient of Variation = 0.80 %
Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.544	465.436
2	77.701	465.389
3	134.000	468.103
4	265.000	468.321
5	275.000	470.812
6	295.000	476.014
7	305.000	481.865
8	310.000	489.801
9	375.000	632.000

Factor of Safety
*** 0.973 ***
Individual data on the 17 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)

1	0.2	1.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	4.3	960.5	0.0	0.0	0.	0.	0.0	0.0	0.0
3	31.0	41293.2	0.0	0.0	0.	0.	0.0	0.0	0.0
4	15.9	44668.3	0.0	0.0	0.	0.	0.0	0.0	0.0
5	5.1	18459.6	0.0	0.0	0.	0.	0.0	0.0	0.0
6	58.0	351584.7	0.0	0.0	0.	0.	0.0	0.0	0.0
7	43.0	420674.0	0.0	0.0	0.	0.	0.0	0.0	0.0
8	5.0	56703.1	0.0	0.0	0.	0.	0.0	0.0	0.0
9	25.0	314464.7	0.0	0.0	0.	0.	0.0	0.0	0.0
10	10.0	139827.9	0.0	0.0	0.	0.	0.0	0.0	0.0
11	20.0	295967.6	0.0	0.0	0.	0.	0.0	0.0	0.0
12	5.0	76764.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	5.0	76727.9	0.0	0.0	0.	0.	0.0	0.0	0.0
14	5.0	74791.9	0.0	0.0	0.	0.	0.0	0.0	0.0
15	50.0	461501.7	0.0	0.0	0.	0.	0.0	0.0	0.0
16	8.0	23064.4	0.0	0.0	0.	0.	0.0	0.0	0.0
17	7.0	6699.8	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.820	465.656
2	78.096	465.609
3	134.000	468.236
4	265.000	469.505
5	275.000	471.828
6	295.000	476.893
7	305.000	481.889
8	310.000	489.501
9	375.000	632.000

Factor of Safety
*** 0.973 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	79.170	466.736
2	79.582	466.434
3	134.000	468.203
4	265.000	469.507
5	275.000	471.022
6	295.000	476.685
7	305.000	481.934
8	310.000	489.706
9	375.000	632.000

Factor of Safety
*** 0.973 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.864	465.692
2	78.105	465.614
3	134.000	468.106
4	265.000	469.753
5	275.000	471.362
6	295.000	476.869
7	305.000	481.711
8	310.000	488.828
9	375.000	632.000

Factor of Safety
*** 0.974 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.693	469.874
2	84.442	469.135
3	134.000	468.108
4	265.000	468.947
5	275.000	471.153
6	295.000	476.914
7	305.000	481.917
8	310.000	489.349

9	375.000	632.000

Factor of Safety
*** 0.974 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	78.452	466.161
2	78.905	466.058
3	134.000	468.242
4	265.000	468.370
5	275.000	470.928
6	295.000	476.602
7	305.000	481.582
8	310.000	489.554
9	375.000	632.000

Factor of Safety
*** 0.974 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.358	465.287
2	77.420	465.233
3	134.000	468.275
4	265.000	468.368
5	275.000	471.734
6	295.000	476.811
7	305.000	481.536
8	310.000	489.348
9	375.000	632.000

Factor of Safety
*** 0.974 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	79.813	467.251
2	80.382	466.879
3	134.000	468.340
4	265.000	468.124
5	275.000	470.588
6	295.000	476.419
7	305.000	481.805
8	310.000	488.432
9	375.000	632.000

Factor of Safety
*** 0.974 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.042	467.434
2	81.076	467.264
3	134.000	468.040
4	265.000	469.758
5	275.000	471.749
6	295.000	476.452
7	305.000	481.802
8	310.000	489.239
9	375.000	632.000

Factor of Safety
*** 0.974 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	77.006	465.004
2	77.007	465.004
3	134.000	468.402
4	265.000	468.686
5	275.000	471.650
6	295.000	475.981
7	305.000	481.867
8	310.000	488.995

```
9        375.000      632.000
   Factor of Safety
  ***     0.975   ***
      **** END OF GSTABL7 OUTPUT ****
```

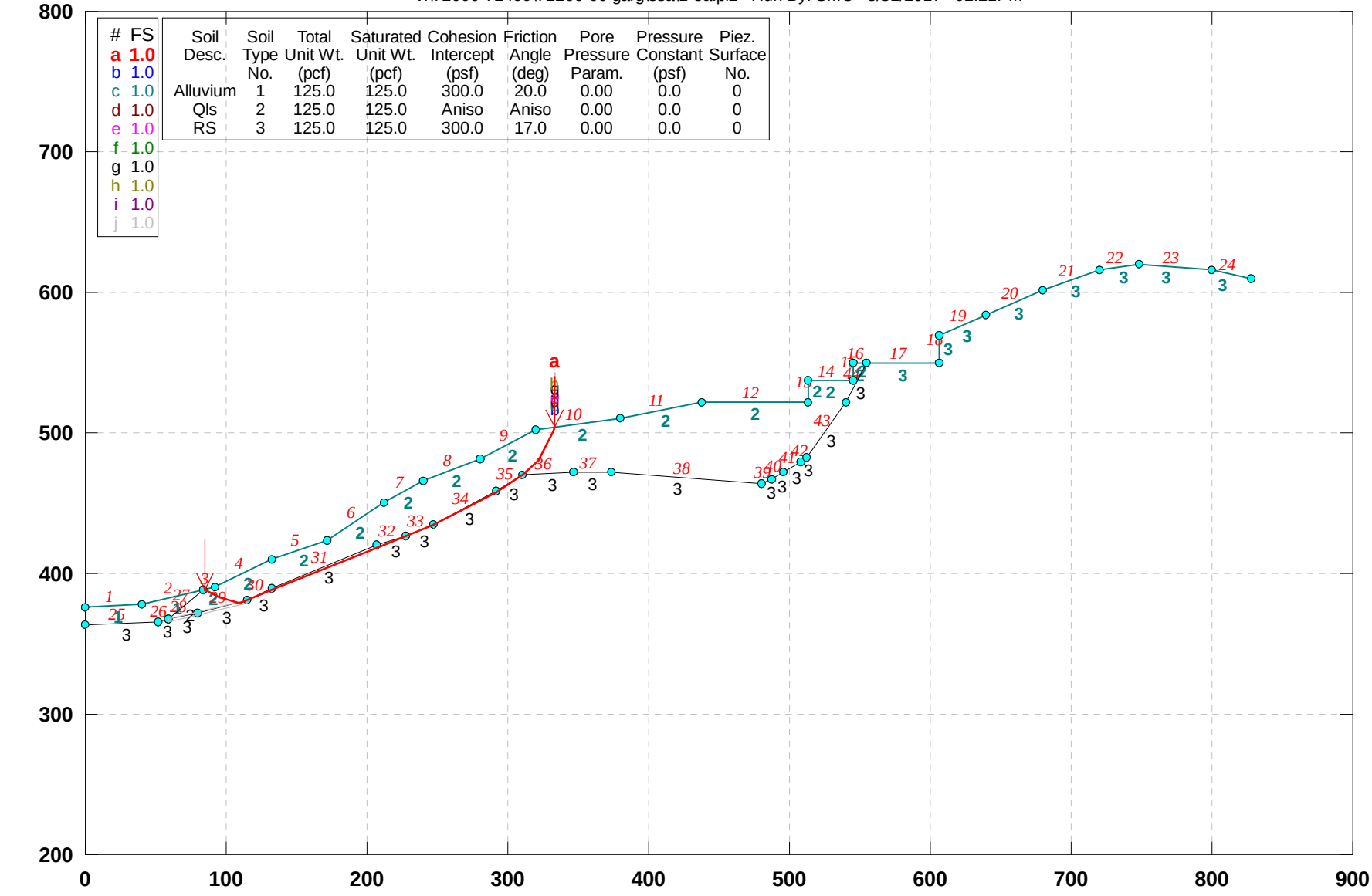

72145-00 Sect. 1-1' -Static, Qls, (300/17)
v:\72000-72499\72266-00 garg\ssa\1-5a.pl2 Run By: SMC 8/31/2017 02:21PM
FS
a 1.0
b 1.0
c 1.0
d 1.0
e 1.0
f 1.0
g 1.0
h 1.0
i 1.0
j 1.0
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Alluvium | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Qls | 2 | 125.0 | 125.0 | Aniso | Aniso | 0.00 | 0.0 | 0
RS | 3 | 125.0 | 125.0 | 300.0 | 17.0 | 0.00 | 0.0 | 0
800
700
600
500
400
300
200
0
100
200
300
400
500
600
700
800
900
GSTABL7 v.2 FSmin=1.0
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-21

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 8/31/2017
Time of Run: 02:21PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\1-5a.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\1-5a.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\1-5a.PLT
PROBLEM DESCRIPTION: 72145-00 Sect. 1-1'
-Static, Qls, (300/17)

BOUNDARY COORDINATES
24 Top Boundaries
44 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	376.00	40.00	378.00	1
2	40.00	378.00	84.00	388.00	1
3	84.00	388.00	92.00	390.00	2
4	92.00	390.00	132.00	410.00	2
5	132.00	410.00	172.00	424.00	2
6	172.00	424.00	212.00	450.00	2
7	212.00	450.00	240.00	466.00	2
8	240.00	466.00	280.00	482.00	2
9	280.00	482.00	320.00	502.00	2
10	320.00	502.00	380.00	510.00	2
11	380.00	510.00	438.00	522.00	2
12	438.00	522.00	513.00	522.00	2
13	513.00	522.00	513.10	537.00	2
14	513.10	537.00	545.00	537.00	2
15	545.00	537.00	545.10	550.00	2
16	545.10	550.00	555.00	550.00	2
17	555.00	550.00	606.00	550.00	3
18	606.00	550.00	606.10	570.00	3
19	606.10	570.00	640.00	584.00	3
20	640.00	584.00	680.00	602.00	3
21	680.00	602.00	720.00	616.00	3
22	720.00	616.00	748.00	620.00	3
23	748.00	620.00	800.00	616.00	3
24	800.00	616.00	828.00	610.00	3
25	0.00	364.00	52.00	366.00	3
26	52.00	366.00	59.00	368.00	3
27	59.00	368.00	84.00	388.00	2
28	59.00	368.00	80.00	372.00	3
29	80.00	372.00	115.00	381.00	3
30	115.00	381.00	132.00	389.00	3
31	132.00	389.00	207.00	420.00	3
32	207.00	420.00	228.00	427.00	3
33	228.00	427.00	247.00	435.00	3
34	247.00	435.00	292.00	459.00	3
35	292.00	459.00	311.00	470.00	3
36	311.00	470.00	347.00	472.00	3
37	347.00	472.00	374.00	472.00	3
38	374.00	472.00	480.00	464.00	3
39	480.00	464.00	488.00	467.00	3
40	488.00	467.00	496.00	472.00	3
41	496.00	472.00	508.00	479.00	3
42	508.00	479.00	512.00	483.00	3

43	512.00	483.00	540.00	522.00	3
44	540.00	522.00	555.00	550.00	3

User Specified Y-Origin = 200.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0
2	125.0	125.0	300.0	20.0	0.00	0.0	0
3	125.0	125.0	300.0	17.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 2

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	0.0	300.00	20.00
2	90.0	300.00	17.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
2000 Trial Surfaces Have Been Generated.
9 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 15.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	59.00	367.00	115.00	380.00	2.00
2	132.00	388.00	132.00	388.00	2.00
3	207.00	419.00	207.00	419.00	2.00
4	228.00	426.00	228.00	426.00	2.00
5	247.00	434.00	247.00	434.00	2.00
6	292.00	458.00	292.00	458.00	2.00
7	311.00	469.00	311.00	469.00	2.00
8	322.00	480.00	322.00	480.00	2.00
9	332.00	501.00	332.00	501.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000
Statistical Data On All Valid FS Values:
FS Max = 1.097 FS Min = 1.011 FS Ave = 1.051
Standard Deviation = 0.020 Coefficient of Variation = 1.88 %
Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158
5	207.000	418.302
6	228.000	426.500
7	247.000	434.440
8	292.000	457.310
9	311.000	469.798
10	322.000	480.090

11	332.000	501.000
12	333.601	503.813

Factor of Safety

*** 1.011 ***

Individual data on the 20 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	7.5	2529.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	3.0	2573.6	0.0	0.0	0.	0.	0.0	0.0	0.0
3	12.6	21226.0	0.0	0.0	0.	0.	0.0	0.0	0.0
4	1.7	4037.8	0.0	0.0	0.	0.	0.0	0.0	0.0
5	5.7	14548.2	0.0	0.0	0.	0.	0.0	0.0	0.0
6	17.0	45016.4	0.0	0.0	0.	0.	0.0	0.0	0.0
7	40.0	104018.2	0.0	0.0	0.	0.	0.0	0.0	0.0
8	35.0	105467.6	0.0	0.0	0.	0.	0.0	0.0	0.0
9	5.0	18185.9	0.0	0.0	0.	0.	0.0	0.0	0.0
10	16.0	62389.4	0.0	0.0	0.	0.	0.0	0.0	0.0
11	12.0	50346.1	0.0	0.0	0.	0.	0.0	0.0	0.0
12	7.0	30119.6	0.0	0.0	0.	0.	0.0	0.0	0.0
13	33.0	134367.6	0.0	0.0	0.	0.	0.0	0.0	0.0
14	12.0	46108.4	0.0	0.0	0.	0.	0.0	0.0	0.0
15	19.0	69340.3	0.0	0.0	0.	0.	0.0	0.0	0.0
16	0.2	794.4	0.0	0.0	0.	0.	0.0	0.0	0.0
17	8.8	28165.2	0.0	0.0	0.	0.	0.0	0.0	0.0
18	2.0	5744.8	0.0	0.0	0.	0.	0.0	0.0	0.0
19	10.0	15485.6	0.0	0.0	0.	0.	0.0	0.0	0.0
20	1.6	260.2	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158
5	207.000	418.302
6	228.000	426.500
7	247.000	434.440
8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

Factor of Safety

*** 1.011 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158
5	207.000	418.302
6	228.000	426.500
7	247.000	434.440
8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

Factor of Safety

*** 1.011 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158

5	207.000	418.302
6	228.000	426.500
7	247.000	434.440
8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

Factor of Safety
*** 1.011 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
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5	207.000	418.302
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8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
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5	207.000	418.302
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8	292.000	457.310
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10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

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*** 1.011 ***

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4	132.000	388.158
5	207.000	418.302
6	228.000	426.500

7	247.000	434.440
8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

Factor of Safety
*** 1.011 ***

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Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
2	95.016	383.229
3	109.268	378.551
4	132.000	388.158
5	207.000	418.302
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8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
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Factor of Safety
*** 1.011 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.469	388.117
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4	132.000	388.158
5	207.000	418.302
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8	292.000	457.310
9	311.000	469.798
10	322.000	480.090
11	332.000	501.000
12	333.601	503.813

Factor of Safety
*** 1.011 ***

**** END OF GSTABL7 OUTPUT ****

SURFICIAL SLOPE STABILITY ANALYSIS

ADAPTED FROM: U.S. Geological Survey
Prof. Paper 851
Campbell, 1975

SOIL TYPE: Engineered Fill

SLOPE RATIO: 2:1 (Horizontal:vertical)

DATA:

C = Cohesion = 300 PSF

ϕ = Angle of Interior Friction = 26 degrees

γ = Density = 125 PCF

i = Slope of Angle = 26.57 degrees

D_s = Depth of Saturation = 4 feet

γ_B = Buoyant Density (γ - 62.4) = 62.6 PCF

$$\text{STATIC SAFETY FACTOR} = \frac{C + (\gamma_B) * D_s * COS^2\, i * TAN\, \phi}{\gamma * D_s * SIN\, i * COS\, i}$$

STATIC FACTOR OF SAFETY: 2.0

Geofirm	SURFICIAL SLOPE STABILITY ANALYSIS		
JOB NO: 72266-01	DATE: JUNE 2018	FIGURE: D-22	

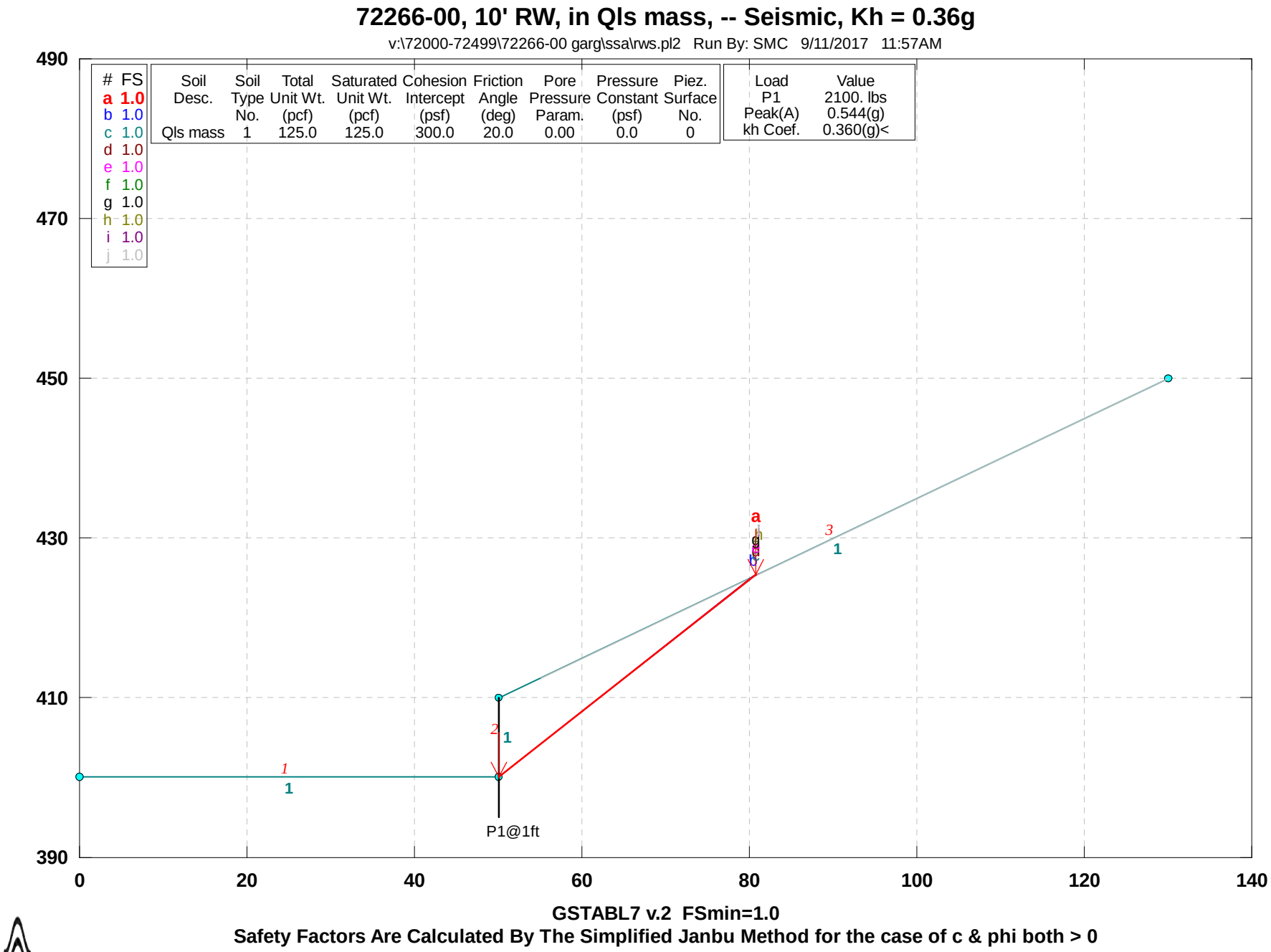
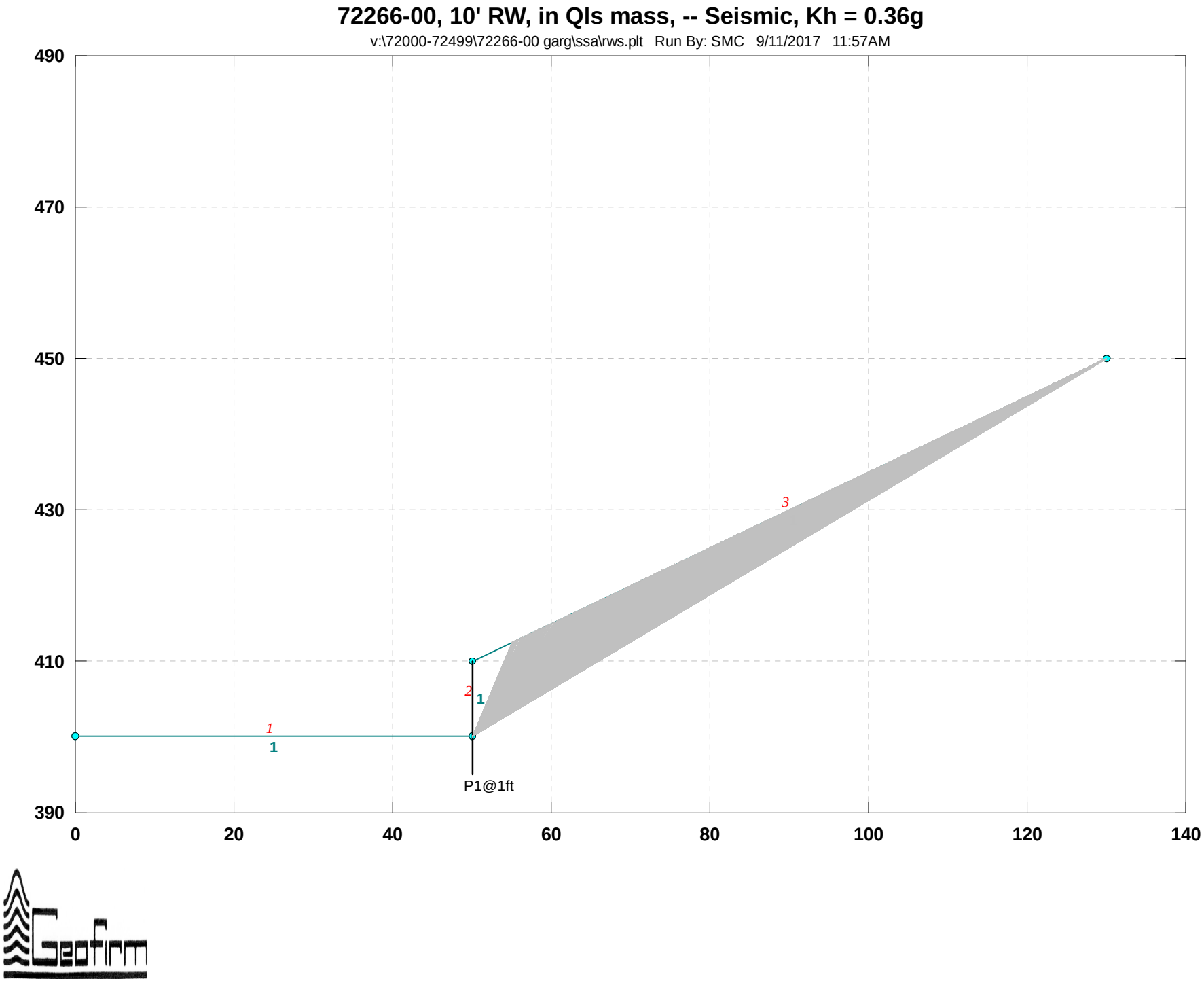

72266-00, 10' RW, in Qls mass, -- Seismic, Kh = 0.36g
v:\72000-72499\72266-00 garg\ssa\rws.pl2 Run By: SMC 9/11/2017 11:57AM
FS
a 1.0
b 1.0
c 1.0
d 1.0
e 1.0
f 1.0
g 1.0
h 1.0
i 1.0
j 1.0
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Qls mass | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
Load | Value
P1 | 2100. lbs
Peak(A) | 0.544(g)
kh Coef. | 0.360(g)<
490
470
450
430
410
390
0
20
40
60
80
100
120
140
a
1
2
3
P1@1ft
GSTABL7 v.2 FSmin=1.0
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-23.1


72266-00, 10' RW, in Qls mass, -- Seismic, Kh = 0.36g
v:\72000-72499\72266-00 garg\ssa\rws.plt Run By: SMC 9/11/2017 11:57AM
490
470
450
430
410
390
0
20
40
60
80
100
120
140
1
1
2
1
3
P1@1ft

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 9/11/2017
Time of Run: 11:57AM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\rws.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\rws.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\rws.PLT
PROBLEM DESCRIPTION: 72266-00, 10' RW, in Qls mass,
-- Seismic, Kh = 0.36g

BOUNDARY COORDINATES
3 Top Boundaries
3 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	400.00	50.00	400.00	1
2	50.00	400.00	50.10	410.00	1
3	50.10	410.00	130.00	450.00	1

User Specified Y-Origin = 390.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0

Specified Peak Ground Acceleration Coefficient (A) = 0.544(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.360(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	50.10	410.00	2100.0	1.0	90.00	15.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 27.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	50.00	400.00	50.00	400.00	0.00
2	55.10	412.50	130.00	450.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:

FS Max = 1.390 FS Min = 0.997 FS Ave = 1.022
Standard Deviation = 0.060 Coefficient of Variation = 5.86 %

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	80.824	425.379
3	80.824	425.381

Factor of Safety
*** 0.997 ***

Individual data on the 2 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	62.0	0.0	0.0	0.	0.	22.3	0.0	0.0
2	30.7	19048.4	0.0	0.0	0.	0.	6857.4	0.0	0.0

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	80.513	425.224
3	80.513	425.226

Factor of Safety
*** 0.997 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	80.806	425.370
3	80.806	425.372

Factor of Safety
*** 0.997 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	80.806	425.370
3	80.806	425.372

Factor of Safety
*** 0.997 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	80.806	425.370
3	80.806	425.372

Factor of Safety
*** 0.997 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	80.806	425.370
3	80.806	425.372

Factor of Safety
*** 0.997 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	80.806	425.370
3	80.806	425.372

Factor of Safety
*** 0.997 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	81.117	425.526

```
    3         81.117      425.528
       Factor of Safety
      ***    0.997   ***
Failure Surface Specified By  3 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         50.000      400.000
    2         81.117      425.526
    3         81.117      425.528
       Factor of Safety
      ***    0.997   ***
Failure Surface Specified By  3 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1         50.000      400.000
    2         81.117      425.526
    3         81.117      425.528
       Factor of Safety
      ***    0.997   ***
          **** END OF GSTABL7 OUTPUT ****
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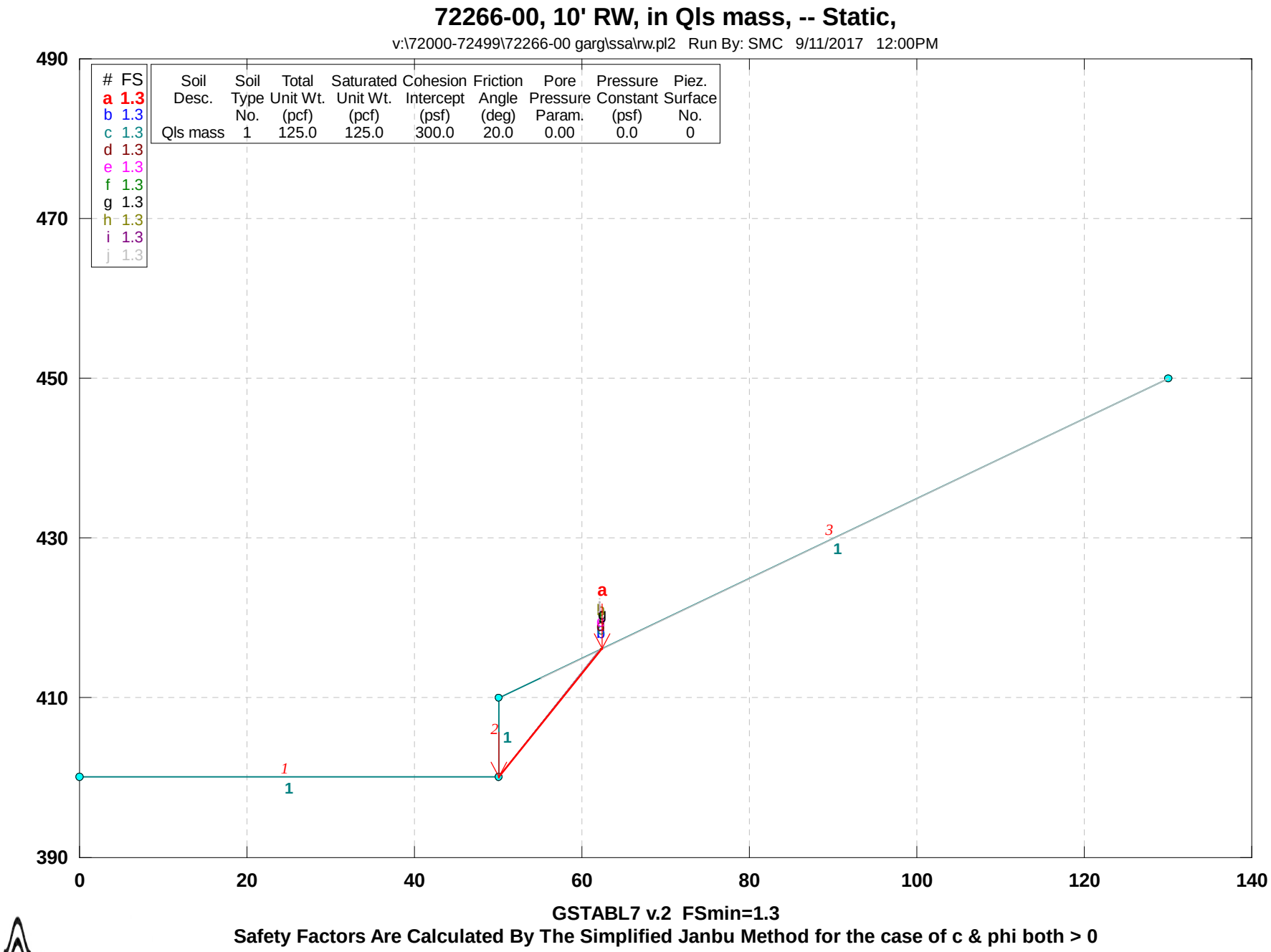

72266-00, 10' RW, in Qls mass, -- Static,
v:\72000-72499\72266-00 garg\ssa\rw.pl2 Run By: SMC 9/11/2017 12:00PM
FS
a 1.3
b 1.3
c 1.3
d 1.3
e 1.3
f 1.3
g 1.3
h 1.3
i 1.3
j 1.3
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Qls mass | 1 | 125.0 | 125.0 | 300.0 | 20.0 | 0.00 | 0.0 | 0
490
470
450
430
410
390
0
20
40
60
80
100
120
140
a
1
2
3
GSTABL7 v.2 FSmin=1.3
Safety Factors Are Calculated By The Simplified Janbu Method for the case of c & phi both > 0

Figure D-23.2

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.005, Sept. 2006 **

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****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 9/11/2017
Time of Run: 12:00PM
Run By: SMC
Input Data Filename: V:\72000-72499\72266-00 Garg\SSA\rw.in
Output Filename: V:\72000-72499\72266-00 Garg\SSA\rw.OUT
Unit System: English
Plotted Output Filename: V:\72000-72499\72266-00 Garg\SSA\rw.PLT
PROBLEM DESCRIPTION: 72266-00, 10' RW, in Qls mass,
-- Static,

BOUNDARY COORDINATES
3 Top Boundaries
3 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	400.00	50.00	400.00	1
2	50.00	400.00	50.10	410.00	1
3	50.10	410.00	130.00	450.00	1

User Specified Y-Origin = 390.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
1 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	20.0	0.00	0.0	0

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	50.10	410.00	2100.0	1.0	90.00	15.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.
PIER/PILE LOAD DATA HAS BEEN SUPPRESSED
Janbus Empirical Coef is being used for the case of c & phi both > 0
A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Sliding Block Surfaces, Has Been
Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of
Sliding Block Is 27.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	50.00	400.00	50.00	400.00	0.00
2	55.10	412.50	130.00	450.00	0.00

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 1.657 FS Min = 1.287 FS Ave = 1.494
Standard Deviation = 0.117 Coefficient of Variation = 7.84 %
Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.446	416.178
3	62.447	416.181

Factor of Safety
*** 1.287 ***

Individual data on the 2 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.1	61.7	0.0	0.0	0.	0.	0.0	0.0	0.0
2	12.3	7618.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.282	416.096
3	62.282	416.099

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.428	416.169
3	62.429	416.172

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.264	416.087
3	62.265	416.090

Factor of Safety
*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.136	416.022
3	62.136	416.025

Factor of Safety

*** 1.287 ***

Failure Surface Specified By 3 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	400.000
2	62.117	416.013
3	62.118	416.017

Factor of Safety

*** 1.287 ***

**** END OF GSTABL7 OUTPUT ****

APPENDIX E

SEISMIC REFRACTION STUDY
(SUBSURFACE SURVEY, INC.)

Subsurface Surveys & Associates, Inc.
2075 Corte Del Nogal, Suite W Carlsbad, CA 92011
Phone: (760) 476-0492 Fax: (760) 476-0493

Geofirm
801 Glenneyre St., Suite F
Laguna Beach, CA 92651

September 26, 2014

Attn: Kevin Trigg

Re: Seismic Survey Summary Report
Bear Brand Ranch, Laguna Niguel, CA

This report covers the results of a seismic refraction survey performed at 10 Hill Ridge in Laguna Niguel, California. The purpose of the survey was to detect and map potential landslide structures and other geologic features that may affect grading, cuts, and foundation design for future development of the property.

The field work was conducted on September 18, 2014 and was carried out according to Subsurface Surveys proposal dated September 5, 2014. Three lines were recorded at locations selected by Geofirm. Two of the lines used double overlapping spreads. A Survey Location map is provided on Figure 1 that shows the location and orientation of the lines.

GEOLOGIC SETTING

A review of the "Geologic Map of California, Santa Ana Sheet", (California Division of Mines and Geology, 1965) indicates the local area is underlain by Pleistocene marine terrace deposits and Upper Miocene marine sedimentary bedrock. This unit is locally referred to as the Capistrano Formation, which is mainly composed of clayey siltstone and thinly bedded siltstone. Thin layers of sandstone, diatomite and bentonitic tuff are interbedded with the clayey siltstone. Surface sediments are colluvium and terrace deposits.

DATA ACQUISITION AND FIELD METHODS

Seismic refraction data were recorded with a Bison 9024 signal enhancement seismograph and 30 Hz geophones. The standard spread layout used 24 geophones with a 10-foot spacing. Seven shotpoints were used, one off each end (5-10 foot offset) and five within the interior of the spread.

Compressional wave energy was created by sledge hammer impacts on a metal plate. The signal enhancement feature of the seismograph allowed returns from repeated hits to be stacked, thus improving the signal. Noise from vehicle traffic was not a factor at this site.

Each record was stored digitally on an internal hard disk and printed copies of each seismogram were made in the field on thermal paper.

Relative elevations of all shotpoints and geophones were determined by differential leveling with a hand level. Geophone 1 at the beginning of each spread was assigned a elevation value based on elevation data from Google Earth software. All other elevation measurements along the line are relative to these datum points.

SEISMIC REFRACTION METHOD

The refraction method involves measuring the total time for compressional waves to travel from a shotpoint through the subsurface to a set of geophones placed linearly along the ground. Based on Snell's Law, when two or more layers are present with increasingly higher acoustic velocity, waves become critically refracted across the layer boundaries and begin traveling at the speed of the underlying layer. The advancing waves then generate new wavefronts back to the ground surface. The first surge of energy hitting the geophone is termed the "first arrival" and is depicted on the seismogram as a high angle deflection along each trace.

Recognition of direct wave arrivals (non-refracted) verses refracted waves is a key element of refraction interpretation. To assist this process, the first arrival times measured from the seismic records are plotted on graphs of time verses distance called Time-Distance graphs. An example T-D graph from Line 3 is provided on Figure 2.

SEISMIC PROCESSING AND INVERSION MODELING

Seismic data from this survey was processed using tomographic inversion modeling which produces velocity gradient cross sections in color. Tomography does not perform refraction layer calculations or attempt to measure discrete depths. Instead, the main objective is to create a velocity distribution grid in the subsurface. Each node of the grid has a specific velocity associated with it. The goal is to adjust or “iterate” the velocity matrix so that the computer derived travel-time curves match what was recorded in the field. The final velocity grid is then loaded into a contouring program that produces color-filled cross sections. This method is typically used for imaging the shape and configuration of complex structures such as faults, landslides and intrusions, and areas where high velocity gradients are suspected within the weathered profile. Another advantage of this technique is the ability to associate variation in color with changes in geology.

The tomographic modeling program used for this survey is SeisOpt Version 3.5 from Optim LLC. It uses a proprietary inversion algorithm that applies a non-linear optimization technique called generalized simulated annealing to adjust the velocity grid points for the best statistical match. It is referred to as an optimization because it attempts to find the model that has the least minimum travel-time error between the calculated and observed (field) measurements.

Interpretation Notes For The Velocity Gradient Models

Gradient models are primarily used for interpreting geologic structures with high angle relief and complex geometry and for evaluating how velocity is changing, both laterally and vertically within a particular stratigraphic unit. The color contours should not be viewed as representing an absolute velocity measurement at any given point, but rather a mathematical and statistical formulation.

The color contours are constrained by a uniform grid containing hundreds of subsurface data points. Therefore, the gradients provide more detail on the shape and geometry of a structure, especially faults and other vertical features.

Contours are only valid within the limits of the posted grid points. Trends outside the control points are merely contour extrapolation.

Refraction horizons representing layer interfaces are not shown on velocity gradient models but can be inferred in areas where the gradient is the greatest (i.e. where the contour lines are closely spaced).

DISCUSSION AND INTERPRETATION OF RESULTS

Tomographic modeling results for Lines 1, 2 and 3 are displayed on Figures 3-5. The cross sections use the same color scheme and a similar contour interval. The benefit of this approach is the ability to correlate color and seismic velocity with changing geologic conditions from line to line.

Seven shotpoints per spread and a six geophone overlap produced continuous profiling and high density data coverage. The color cross sections for Lines 1 and 3 are also presented with the data points removed to show a clear image of the contours and associated geologic features.

High angle bedrock structures are observed west and east of the entrance dirt road. The eastern most feature is interpreted to be a possible landslide scarp and is located beneath station 335 feet on Line 1 and station 225 feet on Line 3. A steep break in slope and undulating bedrock contours are characteristic features of landslide deposits. The location of the interpreted scarp is shown as a dashed orange line, in plan view, on Figure 1.

Similar steep dipping features are observed west of the entry road and below stations 20-70 feet on Lines 1, 2, and 3. The location of a possible scarp is also shown on Figure 1.

Line 2 was limited to one spread due to thick brush and lack of a clear walking path. If additional seismic data is needed up slope and/or downslope, brush clearing will be required prior to the fieldwork.

Surface sediments colored dark blue on the cross sections have velocities that are slower than the speed of sound (approximately 1145 ft/sec). This indicates poorly consolidated materials that are prone to failure on slopes. These surficial deposits should be considered Class E (Soft Soil Profile) based on the 1997 Uniform Building Code.

All data acquired during this survey is considered confidential and is available for review by your staff at any time. We appreciate the opportunity to participate in this project. Please call if there are any questions.



Phillip A. Walen
Senior Geophysicist
CA Registration No. GP917

Seismic Survey Location Map

10 Hill Ridge -- Laguna Niguel, California

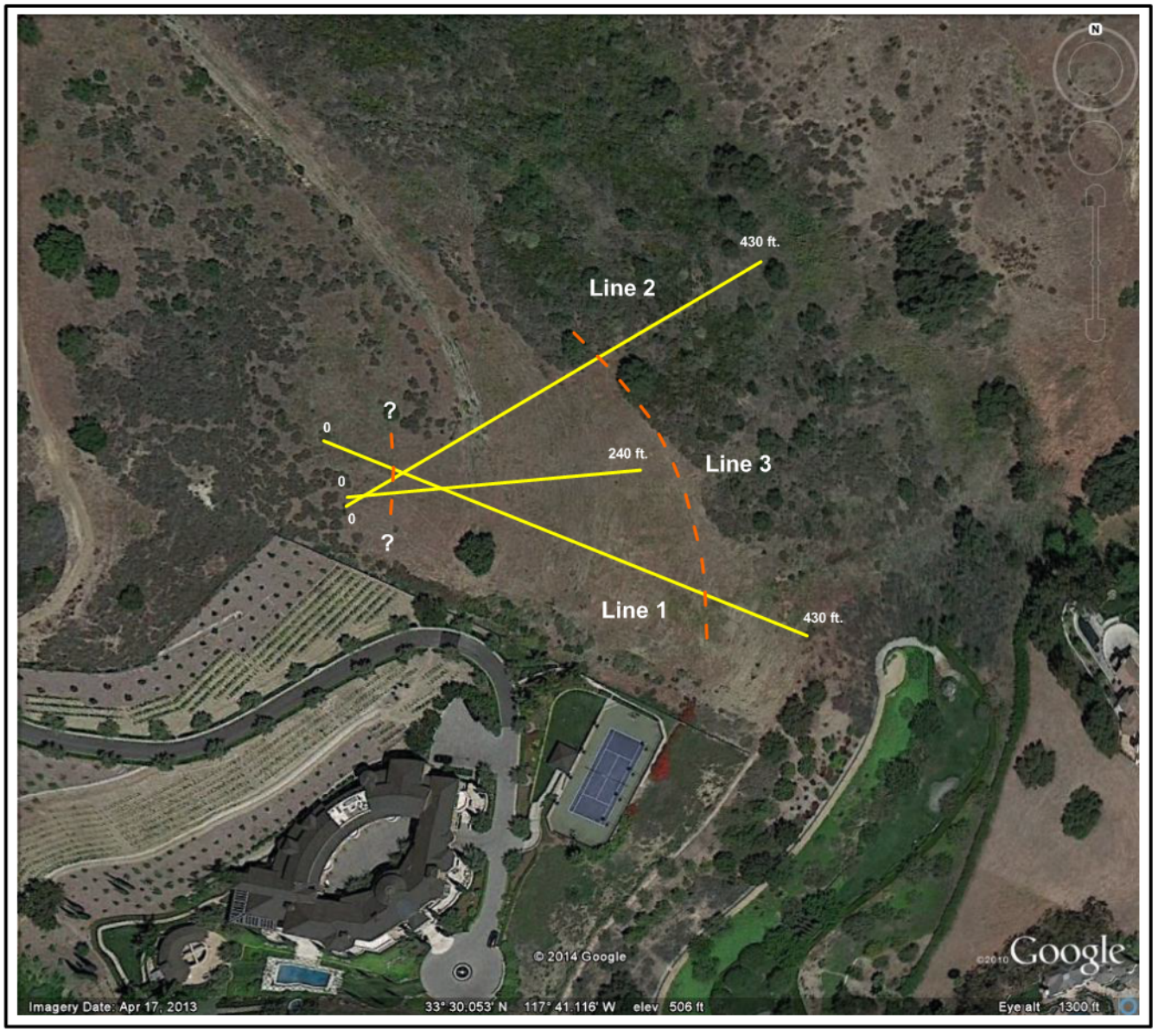
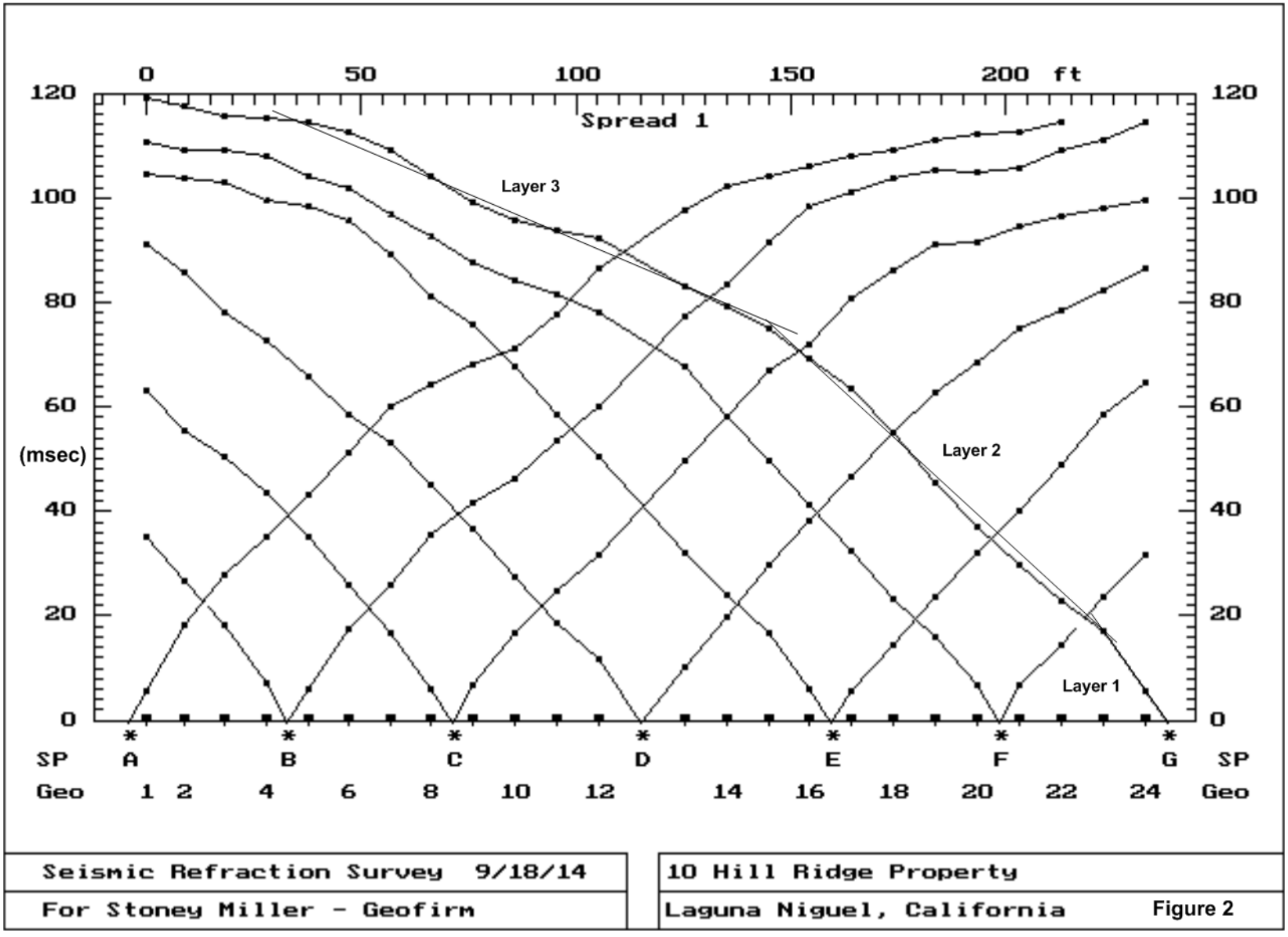


Figure 1

Possible landslide scarp

Example Time-Distance Graph -- Line 3



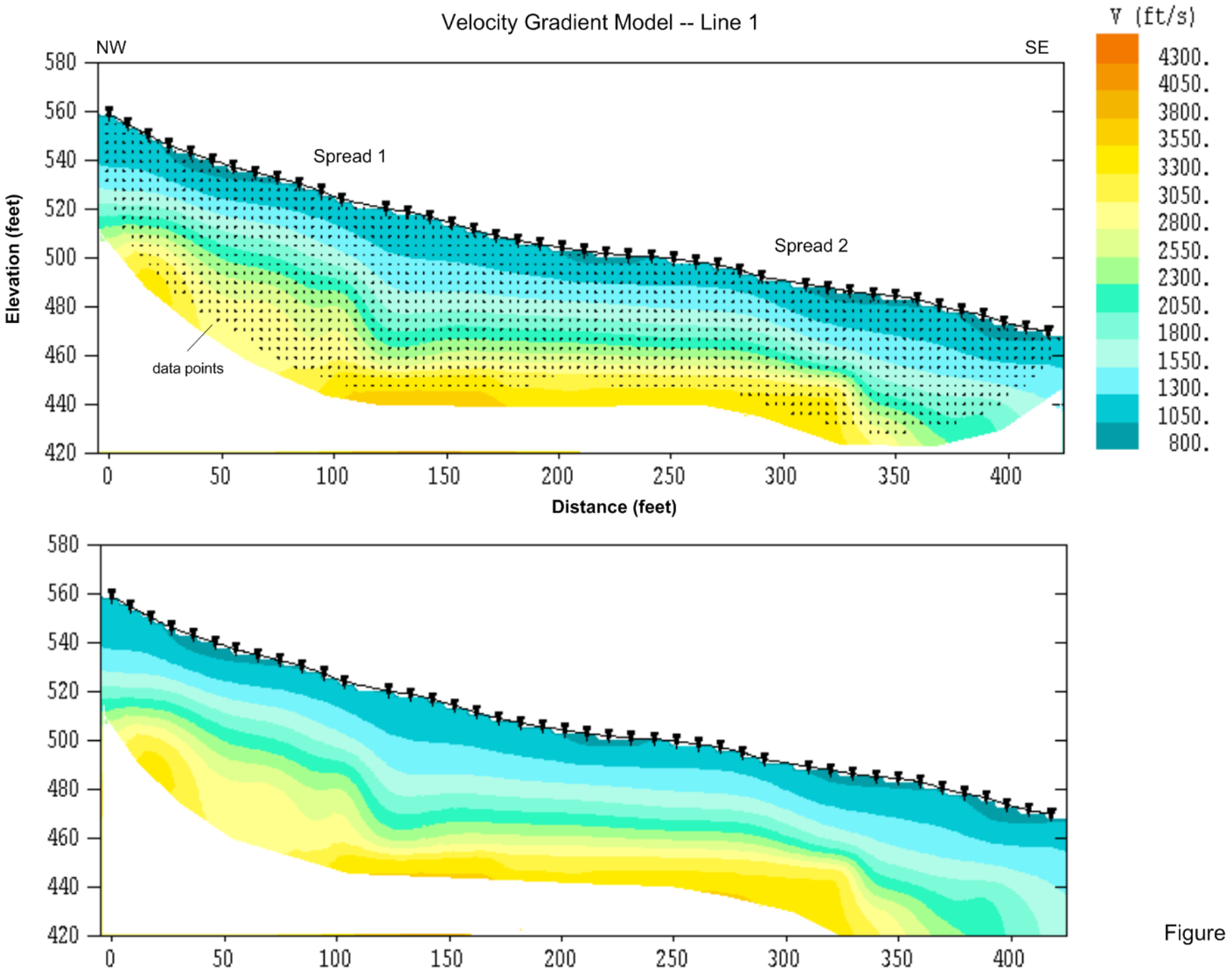

Velocity Gradient Model -- Line 1
NW
SE
Spread 1
Spread 2
data points
Elevation (feet)
Distance (feet)
V (ft/s)
4300.
4050.
3800.
3550.
3300.
3050.
2800.
2550.
2300.
2050.
1800.
1550.
1300.
1050.
800.
580
560
540
520
500
480
460
440
420
0
50
100
150
200
250
300
350
400

Figure 3

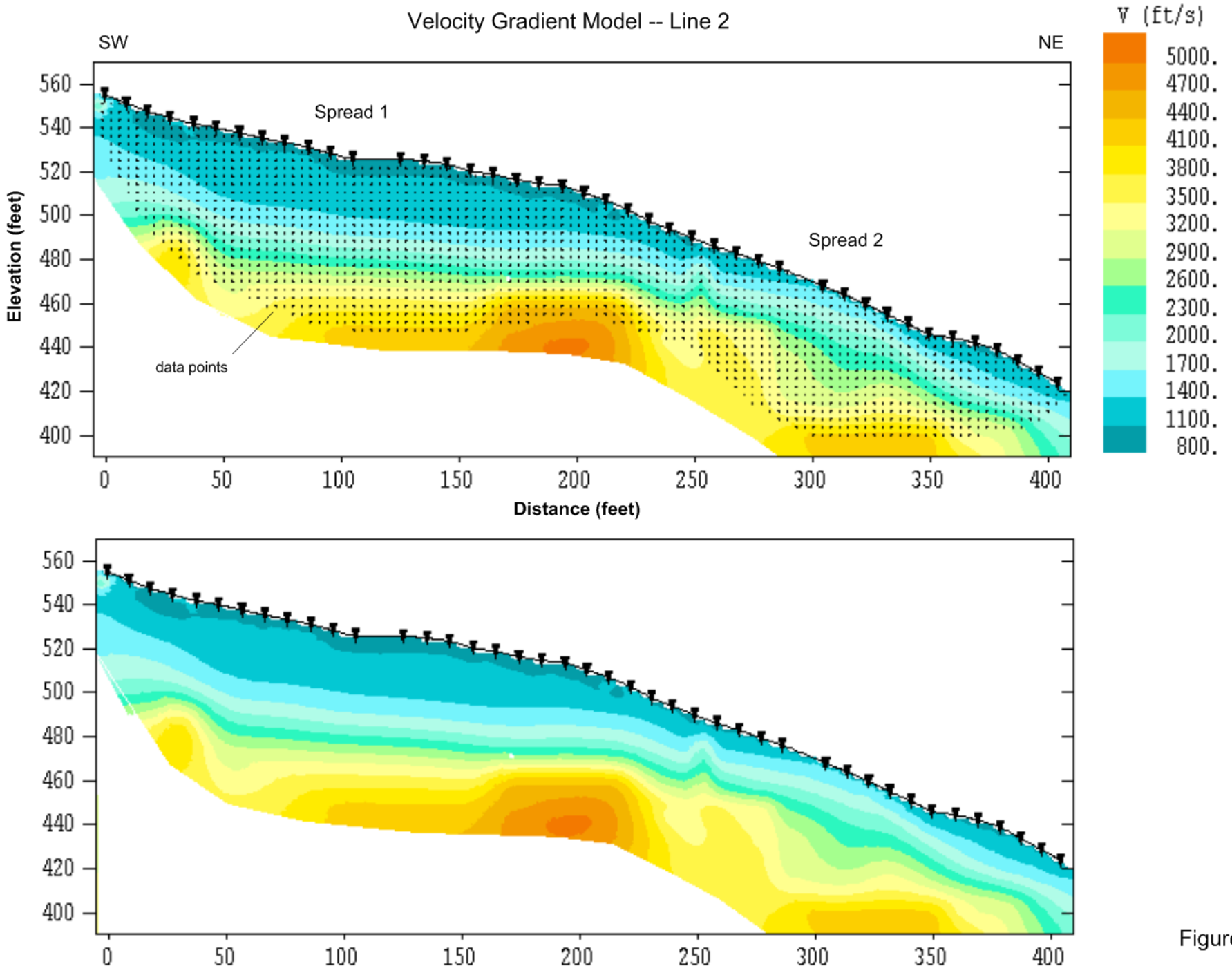

Velocity Gradient Model -- Line 2
SW
NE
Spread 1
Spread 2
data points
Elevation (feet)
Distance (feet)
V (ft/s)
5000.
4700.
4400.
4100.
3800.
3500.
3200.
2900.
2600.
2300.
2000.
1700.
1400.
1100.
800.
560
540
520
500
480
460
440
420
400
0
50
100
150
200
250
300
350
400

Figure 4

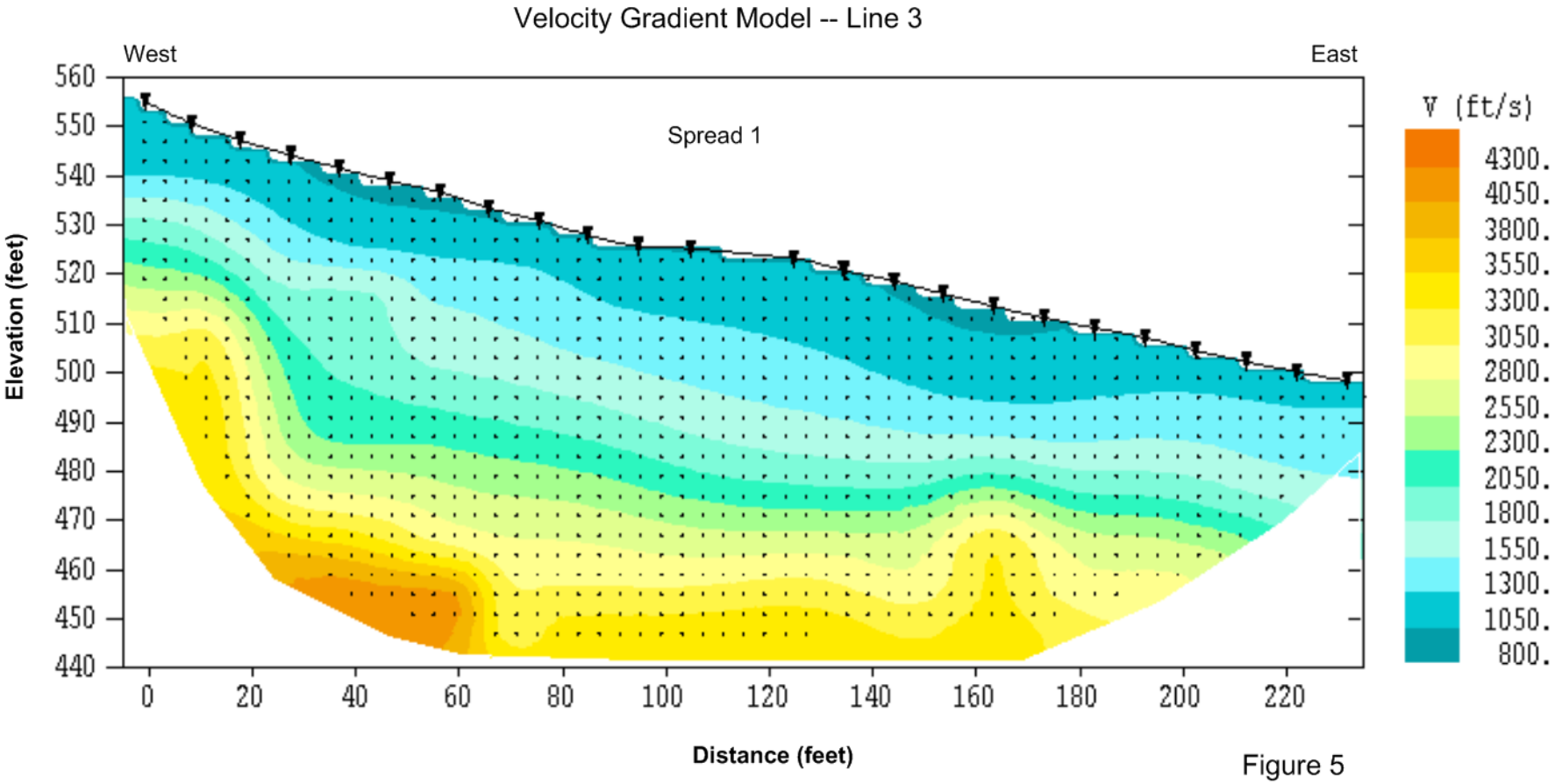

Velocity Gradient Model -- Line 3
West
East
Spread 1
Elevation (feet)
560
550
540
530
520
510
500
490
480
470
460
450
440
0
20
40
60
80
100
120
140
160
180
200
220
Distance (feet)
V (ft/s)
4300.
4050.
3800.
3550.
3300.
3050.
2800.
2550.
2300.
2050.
1800.
1550.
1300.
1050.
800.

Figure 5

APPENDIX F

STANDARD GRADING SPECIFICATIONS

APPENDIX F

STANDARD GRADING SPECIFICATIONS

GENERAL

These specifications present the usual and minimum requirements for grading operations observed by **Geofirm** or its designated representative. No deviation from these specifications will be allowed, except where specifically superseded in the geotechnical report signed by a registered geotechnical engineer.

The placement, spreading, mixing, watering and compaction of the fills in strict accordance with these guidelines shall be the sole responsibility of the contractor. The construction, excavation, and placement of fill shall be under the direct observation of the soils engineer signing the soils report. If unsatisfactory soil-related conditions exist, the soils engineer shall have the authority to reject the compacted fill ground and, if necessary, excavation equipment will be shut down to permit completion of compaction. Conformance with these specifications will be discussed in the final report issued by the soils engineer.

SITE PREPARATION

All brush, vegetation and other deleterious material such as rubbish shall be collected, piled and removed from the site prior to placing fill, leaving the site clear and free from objectionable material.

Soil, alluvium, or rock materials determined by the soils engineer as being unsuitable for placement in compacted fills shall be removed from the site. Any material incorporated as part of a compacted fill must be approved by the soils engineer.

The surface shall then be plowed or scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used. After the area to receive fill has been cleared and scarified, it shall be diced or bladed by the contractor until it is uniform and free from large clods, brought to the proper moisture content and compacted to minimum requirements. If the scarified zone is greater than 12 inches in depth, the excess shall be removed and placed in lifts restricted to 6 inches.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines or others not located prior to grading are to be removed or treated in a manner prescribed by the soils engineer.

MATERIALS

Materials for compacted fill shall consist of materials approved by the soils engineer. These materials may be excavated from the cut area or imported from other approved sources, and soils from one or more sources may be blended. Fill soils shall be free from organic vegetable matter

and other unsuitable substances. Normally, the material shall contain no rocks or hard lumps greater than 6 inches in size and shall contain at least 50 percent of material smaller than 1/4-inch in size. Materials greater than 4 inches in size shall be placed so that they are completely surrounded by compacted fines; no nesting of rocks shall be permitted. No material of a perishable, spongy, or otherwise of an unsuitable nature shall be used in the fill soils.

Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the soils engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the geotechnical engineer as soon as possible.

PLACING, SPREADING, AND COMPACTING FILL MATERIAL

The material used in the compacting process shall be evenly spread, watered, processed and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer.

When the moisture content of the fill material is below that specified by the soils engineer, water shall be added by the contractor until the moisture content is near optimum as specified.

When the moisture content of the fill material is above that specified by the geotechnical engineer, the fill material shall be aerated by the contractor by blading, mixing, or other satisfactory methods until the moisture content is near optimum as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to 90 percent of the maximum laboratory density in compliance with ASTM D: 1557-70 (five layers). Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes to obtain the desired density uniformly.

A minimum relative compaction of 90 percent out to the finished slope face of all fill slopes will be required. Compacting of the slopes shall be accomplished by backrolling the slopes in increments of 2 to 5 feet in elevation gain or by overbuilding and cutting back to the compacted inner core, or by any other procedure which produces the required compaction.

GRADING OBSERVATIONS_AND TESTING

The geotechnical engineer shall observe the placement of fill during the grading process and will file a written report upon completion of grading stating his observations as to compliance with these specifications.

One density test shall be required for each 2 vertical feet of fill placed, or one for each 1,000 cubic yards of fill, whichever requires the greater number of tests.

Any cleanouts and processed ground to receive fill must be observed by the soils engineer and/or engineering geologist prior to any fill placement. The contractor shall notify the geotechnical engineer when these areas are ready for observation.

PROTECTION OF WORK

During the grading process and prior to the complete construction of permanent drainage controls, it shall be the responsibility of the contractor to provide good drainage and prevent ponding of water and damage to adjoining properties or to finished work on the site.

After the geotechnical engineer has terminated his observations of the completed grading, no further excavations and/or filling shall be performed without the approval of the soils engineer, if it is to be subject to the recommendations of this report.

APPENDIX G

UTILITY TRENCH BACKFILL GUIDELINES

APPENDIX G

UTILITY TRENCH BACKFILL GUIDELINES

The following guidelines pertinent to utility trench backfills have been adopted by the County of Orange, Environmental Management Agency Grading Section, effective March 31, 1986. The application of the guidelines is strictly enforced by the County reviewers and inspectors.

1. Each utility subcontractor (gas, electric, water, sewer, telephone, cable TV, irrigation, drainage, etc.) shall submit to the developer for dissemination to his consultants (civil engineer, geotechnical engineer, and utility contractor) a plot plan of all utility lines installed under his purview which identifies line type, material, size, depth, and approximate location.

2. The developer or his agent shall provide a composite plot plan of all utilities or a copy of all individual utility plot plans to his geotechnical engineer for use in evaluating whether all utility trench backfills are suitable for the intended use.

3. The geotechnical engineer shall provide the County with a report which includes a plot plan showing the location of all utility trenches which:

   A. Are located within the load influence zone of a structure (1:1 projection)

   B. Are located beneath any hardscape

   C. Are parallel and in close proximity to the top or toe of a slope and may adversely impact slope stability if improperly backfilled

   D. Are located on the face of a slope in a trench 18 or more inches in depth.

   Typically, trenches that are less than 18 inches in depth will not be within the load influence zone if located next to a structure, and will not have a significant effect on slope stability if constructed near the top or toe of a slope and need not be shown on the plot plan unless determined to be significant by the geotechnical engineer. This plot plan may be prepared by someone other than the soil engineer, but must meet his approval.

4. Backfill compaction test locations must be shown on the plot plan described in No. 3 above, and a table of test data provided in the geotechnical report.

5. The geotechnical report (utility trench backfill) must state that all utility trenches within the subject lots have been backfilled in a manner suitable for the intended use. This includes the backfill of all trenches shown on the plot plan described in No. 3 and the backfill of those trenches which did not need to be plotted on this plan.

APPENDIX H

RESPONSE TO CITY OF LAGUNA NIGUEL GEOTECHNICAL REVIEW SHEET, DATED MAY 8, 2017

RESPONSE TO CITY OF LAGUNA NIGUEL
GEOTECHNICAL REVIEW SHEET, DATED MAY 8, 2017
REGARDING GEOFIRM REPORT NO: 14-7613
DATED DECEMBER 18, 2014

This document is in response to the City of Laguna Niguel, Geotechnical Review Sheet dated May 8, 2017. The review requests additional geotechnical response to twelve items regarding the above report. A copy of the review sheet is attached in Appendix J. Our response is presented immediately following each comment.

Comment 1: *The geotechnical report is greater than one year old. Please provide an updated report including/addressing the following:*

a. A description of current site conditions;
b. Description of proposed grading and construction based on the latest grading plans;
c. Updates to the geotechnical maps and cross sections to reflect the latest plans;
d. Discussion of any changes to the remedial recommendations based on the latest grading plans;
e. Discussion and recommendations for the feasibility and design of the new alignment of the access driveway as shown on the latest plans;
f. Confirmation that all recommendations meet the requirements of the 2016 Code;
g. A discussion of the results of the seismic refraction study mentioned on Page 1 and included as appendix E in the report should be provided. Were the results utilized for development of landslide structure beyond the broad spectrum review mentioned on Page 1?

Response: Items "a" through "f" are all addressed in the body of this text. With regard to item "g", we utilized the seismic refraction data that was presented in Appendix E of the subject report to confirm the findings of our boring data. At an elevation of about 470, there was a near horizontal layer that transitioned to much harder rock below. This was indicated the base of the landslide at this elevation, consistent with boring data. As there were no breaks below this surface, the landslide configuration indicated on our cross sections was analyzed. Subsequent to publishing our report we were able to confirm that there was a landslide shear key for Qls 6 completed as part of the adjacent grading in 1988 as is now depicted on Plate 1 and Cross Section F-F'.

Comment 2: *It appears that only peak and ultimate shear strength values have been plotted. Was re-shearing performed to develop along bedding strengths? If not, consideration should be given to running re-shears. Otherwise, justification should be provided for the along-bedding strengths used.*

Response: Re-shearing tests were not performed by Geofirm to develop along bedding strengths; however, the rate of shearing was slow, at 0.0004 in/min, and the samples were inundated prior to and during the testing. Also, reshears were performed by Petra Geotechnical, Inc., as presented in References 14 and15, for a site located north/northeast of our site, and are included in Appendix C. These tests results are generally consistent with the shear values used in slope stability analyses.

Shear strengths used for bedding planes (which have not been sheared) are only slightly higher than that of the rupture surface. Generally, the shear strengths used in the slope stability analyses are based on the following:

- Shear testing, Peak and Ultimate at shearing rates of 0.001 to 0.0004 in/min.
- Back-calculations, (it is noted that the tested shear strengths used for the rupture surface are within the range of the back-calculation data), see Figures D-32 and D-33.
- Prior geotechnical investigations performed within and around the subject site.
- Local experience in similar soils and engineering judgment.

It is our opinion that the shear values used in our slopes stability analyses are appropriate for the subject site.

Comment 3: *Table D-1 only contains pseudo-static strengths. Please also provide the static strengths in the table.*

Response: The values presented in Table D-1 were used both static and pseudo-static conditions.

Comment 4: *Relatively deep-seated stability analysis was performed for the slope to remain in-place above the building pad; however, shallow failure planes that run along bedding and that daylight at the bottom of the toe-of-slope retaining wall were not performed. Please provide.*

Response: Shallow trial surfaces were evaluated along bedding day-lighting at the base or below retaining walls. See Figures D-10, D-11, and D-10, specifically the plots presenting all the surfaces analyzed.

Comment 5: *Re-activation of the shallow landslide materials to be left in-place on the slope below the proposed building pad and access driveway could adversely affect the properties below the site. Please discuss the impacts this potential situation could have on the planned development, and provide stability calculations to show that the building pad and driveway will maintain suitable factors of safety with the unremediated landslide materials removed. In addition, please provide*

stability analysis for potential failure planes along the contact between the landslide materials and the underlying bedrock. If found to be unstable, what will be the impact of these failures on the properties below?

Response: The remedial measures consist in part of constructing a shear key partially backfilled with soil cement and installing shear pins along the top of the descending slope at the site, isolating the graded site from the shallow landslides. In addition the slope stability analyses were performed assuming that some slumping of the shallow landslides on the slope face has occurred. The project is constrained from activity downslope of the grading limits, and remedial stabilization of the lower slope is therefore precluded. It is noted that site stability overall will be enhanced, but some risk to downslope properties remains.

*The following items will be **Conditions of Approval** to be addressed during the grading permit process:*

Comment 6: *Additional laboratory testing should be performed as needed based on the latest grading plans.*

Response: The grading plans will be reviewed when available and additional laboratory testing can be conducted as needed.

Comment 7: *The consultant should review the grading plan and provide updated recommendations for:*

a. Temporary stability and potential shoring for wall excavations;
b. Stability of slopes to be left in-place both above and below the areas of proposed grading and construction, with additional stability analyses as needed;
c. Structural slope setbacks – updated lines based on the latest grading plans should be provided and included on the grading plans.

Response: So noted.

Comment 8: *The grading plans should include the limits of Remedial Areas A and B, as well as the setback lines discussed above.*

Response: Current remedial measures based on the changed architectural plans reviewed herein do not incorporate the prior Remedial Areas A and B. We will address the limits of setbacks associated with remedial measures specific to the new plans when the grading plans are prepared.

Comment 9: *On Page 12, the report recommends concrete with Type V cement and a maximum water cement ratio of 0.45 but a compressive strength of only 3000 psi. Should a compressive strength of 4500 psi be recommended?*

Response: In this updated report we defer concrete mix design to the structural engineer, but it is likely 4500 psi concrete will be required.

Comment 10: *To what horizontal distance behind the retaining walls should the non-cohesive granular material be placed in order to design the walls with the reduced earth pressures provided for non-expansive backfill conditions? The 45 pcf equivalent fluid density for 2:1 ascending non-expansive backfill provided on Page 16 appears low. Please provide supporting calculations.*

Response: The non-cohesive granular material be placed within a distance equal to half the height of the wall or within a line projected 45 degrees upward from the base of the retaining wall, s shown on Figure 2.

The Equivalent Fluid Pressures of 45 pcf for a sloping condition with non-expansive/granular soils was based on Terzaghi and Peck Chart for estimating earth pressures (Table 46.1 and Figure 46.1, page 364 and 365, of Reference 20), and is considered adequate.

Comment 11: *Does the 15 pcf seismic earth pressure provided on Page 17 apply to both cantilever and restrained walls and to both level and 2:1 backfill conditions? If not, please provide the supplemental seismic earth pressures.*

Response: Updated recommendations are based upon Atik and Sitar (2010), and result in no additional dynamic loads for level flexible/cantilever and stiff/restrained walls; however, we are conservatively recommending 15 pounds per cubic foot equivalent fluid pressure for level flexible/cantilever and stiff/restrained walls.

Potential wedge failures were made using GLE methods to assess lateral retaining wall loads for static and pseudostatic conditions as recommended by the NCHRP Report 611. Factors of safety (FS) of 1.0 were used for stability under both static and seismic condition. The accelerations for seismic analyses were developed using a pseudostatic horizontal acceleration of 0.36g derived using two-thirds of the site PGAm of 0.544g as recommended in NEHRP Recommended Seismic Provisions, 2009 Edition, Commentary to Section 11.8.3. Based on our evaluation, the dynamic load recommended above is also sufficient for a sloping condition at slope ratio of 2:1 (horizontal:vertical). Our analyses indicates that a total load of 42 pcf EFP is required for a FS of 1.0, which is less than what we recommended for static condition (EFP of 100 pcf for site soils, respectively); see Figure D-35. No additional seismic loading is required.

Comment 12: *For the hardscape recommendations provided on Page 18, should the underlying subgrade be pre-saturated? Should deepened perimeter edges be used to prevent moisture intrusion?*

Response: As the grading plans are developed and the civil engineer has identified the drainage requirements of the site, we will provide additional input for the hardscape and various landscape features that could be impacted by the site soil characteristics. If hardscape areas are underlain by expansive soils at finish grade, pre-saturation is recommended.

APPENDIX I

SPECIFICATIONS FOR CEMENT-TREATED SOILS

APPENDIX I

SPECIFICATIONS FOR CEMENT-TREATED SOILS

1. General

   1.1 Description: Cement-Treated Soil shall consist of soil, Portland cement, and water uniformly mixed, compacted, finished, and cured in accordance with these specifications. It shall conform to the lines, grades, thickness, and typical cross-section shown on the plans. The Portland Cement content shall be 8 percent of the dry weight of soil.

2. Materials

   2.1 Portland Cement: Portland cement shall comply with the latest specifications for Portland cement – AASHO M85, M134, M151, ASTM: C150, C595 (Types IS and ISA); Federal SS-C-192, SS-C-197; or CSA A5- for the type specified.

   2.2 Water: Water shall be free from substances deleterious to the hardening of the mixture.

   2.3 Soil: Soil shall consist of material existing in the area of construction, of approved borrow material, or of a combination of these materials proportioned as directed. The soil shall not contain gravel or stone retained on a 2-inch sieve or more than 45 percent retained on a No. 4 sieve.

3. Equipment

   3.1 Description: Treated soil may be constructed with any combination of machined or equipment that will produce the results meeting these specifications.

4. Construction Methods

   4.1 Preparation: Before other construction operations are begun, the area to receive treated soil shall be graded and shaped as required to construct the embankment in conformance with the grades, lines, and typical cross-section shown on the plans. The subgrade shall be firm and able to support without displacement the construction equipment and the compaction hereinafter specified. Unsuitable soil or material shall be removed and replaced with acceptable soil.

   4.2 Pulverization: The soil shall be so pulverized that, at the completion of moist-mixing, 100 percent of dry weight passes a 1-inch sieve, and a minimum of 90 percent passes a No. 4 sieve, exclusive of gravel or stone retained on these sieves. The following operations specified in 4.3 to 4.5, inclusive, shall be continuous and completed in daylight within 6 hours

4.3 Cement Application, Mixing and Spreading: No mixture shall be spread when the air temperature is less than 40°F in the shade.

The percentage of moisture in the soil, at the time of cement application, shall be the amount that assures a uniform and intimate mixture of soil and cement during mixing operations. It shall not exceed the specified optimum moisture content for the mixture.

Any treated soil mixture that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

4.3a Central-Plant Mixing, Handling, Placing

4.3a.1 Mixing: Soil-cement which is central-plant mixed should utilize an approved continuous-flow or batch-type pugmill mixer. The plant shall be equipped with metering and feeding devices that will supply the soil, cement, and water into the mixer in the specified quantities. If the actual quantities in the mix deviate more than 3% by weight from the specified quantities, the engineer may require such changes in the plant operation as will provide the required accuracy.

The mixing time shall be that which is required to secure an intimate uniform mixture of the soil, cement, and water.

4.3a.2 Handling: The soil-cement mixture shall be transported in trucks or other equipment having beds that are smooth, clean, and tight. The contractor shall protect the soil-cement mixture whenever it is transported during unfavorable weather. Any soil-cement wet excessively by rain, whether during transport or after it has been spread, will be subject to rejection.

The total elapsed time between the addition of water to the soil and cement and the start of compaction shall not exceed 60 minutes.

The contractor shall take all necessary precautions to avoid damage to completed soil-cement by the equipment.

4.3b Mixed-In-Place Method: Loose soils shall be spread in the mixing area to a uniform thickness not exceeding 8-inches and the specified quantity of cement spread uniformly on the soil.

The cement shall be mixed with the soil until they are sufficiently blended to prevent the formation of balls when water is applied. Water shall then be incorporated into the mixture.

Excessive concentrations of water on or near the surface shall be avoided. A water supply and pressure distributing equipment shall be provided that will

assure a maximum of 3 hours for the application of all mixing water required on the section being processed.

After all mixing water has been applied, mixing shall continue until a uniform and intimate mixture of soil, cement, and water has been obtained. The total elapsed time between the addition of water to the mixture and the start of compaction shall not exceed 60 minutes, and the mixture is not to be left undisturbed for longer than 30 minutes during this period.

4.4 Placing: The mixture shall be placed and spread on the moistened subgrade, or previously completed treated soil, with equipment that will produce layers of such widths and thicknesses as are necessary for compaction to the required dimensions of the completed treated soil layers. Successive layers shall be placed as soon as practicable after the preceding layer is completed.

The contractor shall take all necessary precautions to avoid damage to completed cement-treated soil by the equipment, and to avoid the deposition of raw earth or foreign materials between layers of treated soil.

All treated soil surfaces which will be in contact with succeeding layers of treated soil shall be kept continuously moist until placement of the subsequent layer, provided that the contractor will not be required to keep such surfaces moist for a period longer than 7 days. Any loose material on the surface of the completed layer shall be removed, and the surface moistened immediately before placement of the next layer.

Treated soil shall not be mixed or placed when the air temperature is below 45°F unless the temperature is at least 40°F and rising.

4.5 Compaction: Treated soil shall be uniformly compacted to at least 90 percent of maximum density as determined by field density tests. Optimum moisture and maximum density shall be determined by moisture-density test ASTM: D1557. At the start of compaction, the mixture shall be in a uniform, loose condition throughout its full depth and its moisture content shall not be more than 1 percentage point below nor 3 percentage points above the specified optimum moisture. No section shall be left undisturbed for longer than 30 minutes during compaction operations.

4.6 Finishing: After compaction, the treated soil layer shall be further shaped if necessary to the required lines, grades, and cross-sections and rolled to a reasonably smooth surface. Surface compaction and finished of each layer shall be done in such a manner as to produce, in not longer than 2 hours, a dense surface free of compaction planes or loose materials.

4.7 Curing: Temporarily exposed surfaces shall be kept moist as set forth in the section "Placing". Care must be exercised to ensure that no curing material other than water is applied to the surfaces that will be in contact with succeeding layers.

Permanently exposed surfaces shall be kept in a moist condition for 7 days, or they may be covered with some suitable curing material, subject to the engineer's approval. Any damage to the protective covering within 6 days shall be repaired to the satisfaction of the engineer.

Regardless of the curing material used, the permanently exposed surfaces shall be kept moist until the protective cover is applied. Such protective cover is to be applied as soon as practicable, with a maximum time limit of 24 hours between the finishing of the surface and the application of the protective cover or membrane.

4.8 Maintenance: The contractor shall be required, within the limits of his contract, to maintain the treated soil in good condition until all work is completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. This work shall be done by the contractor at his own expense and repeated as often as necessary. Faulty work shall be replaced for the full depth of the layer. Specifications for Cement-Treated Soils continued

5. Inspection and Testing

The engineering representative, with the assistance and cooperation of the contractor, shall make such inspections and tests as he deems necessary to verify the conformance of the work to the contract documents. These inspections and tests may include, but shall not be limited to, (1) the taking of test samples of the treated soil and its individual components at all stages of processing and after completion, and (2) the close observation of the operation of all equipment used on the work. Only those materials, machines, and methods meeting the requirements of the contract documents shall be approved by the engineer.

All testing of treated soil or its individual components, unless otherwise provided specifically in the contract documents, shall be in accordance with the latest applicable ASTM specifications in effect as of the date of the advertisement for bids on the project.

APPENDIX J

CITY OF LAGUNA NIGUEL
GEOTECHNICAL REVIEW SHEET
DATED MAY 8, 2017

CITY OF LAGUNA NIGUEL
30111 Crown Valley Parkway
Laguna Niguel, California 92677
Phone (949) 362-4300 | Fax (949) 362-4340

RECEIVED
MAY 11 2017
Brion Jeannette Architecture

GEOTECHNICAL REVIEW SHEET

Reviewed by:

GMU GEOTECHNICAL, INC.
23241 Arroyo Vista
Rancho Santa Margarita, CA 92688
(949) 888-6513 · Fax: (949) 888-1380 · email: info@gmugeo.com

REFERENCE NO.: SP17-03P DATE: May 8, 2017

PROJECT DESCRIPTION: Proposed Single-Family Residence

LOCATION: 1 O'Hill Ridge – Garg Residence

DEVELOPER/OWNER: Brion Jeannette Architecture

GEOTECHNICAL FIRM: Geofirm

THEIR JOB NO.: 72145-00

GEOTECHNICAL ENGINEER: Hannes H. Richter, GE 717

ENGINEERING GEOLOGIST: Kevin A. Trigg, CEG 1619

DOCUMENT REVIEWED: "Preliminary Geotechnical Investigation, For New Single-Family Residence, 1 O'Hill Ridge, Bear Brand Ranch, Laguna Niguel, California," prepared by Geofirm, dated December 18, 2014.

ACTION:

____ RECOMMENDED APPROVAL OF DOCUMENT SUBMITTED
____ CONDITIONAL APPROVAL OF DOCUMENT SUBMITTED
_X_ REQUEST ADDITIONAL DATA FOR REVIEW – ***See COMMENTS.***
Please send responses directly to the City of Laguna Niguel, Attn: Planning Department. GMU Geotechnical can only accept responses forwarded from the City.

DISTRIBUTION: Erich List, Abdullah Sharif, City of Laguna Niguel (email)
Hannes Richter, Geofirm (email)
Mr. and Ms. Ferrell, Owner (postal mail)

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REFERENCE NO.: SP17-03P DATE: May 8, 2017

COMMENTS

1. The geotechnical report is greater than one year old. Please provide an updated report including/addressing the following:
    a. A description of current site conditions;
    b. Description of proposed grading and construction based on the latest grading plans;
    c. Updates to the geotechnical maps and cross sections to reflect the latest plans;
    d. Discussion of any changes to the remedial recommendations based on the latest grading plans;
    e. Discussion and recommendations for the feasibility and design of the new alignment of the access driveway as shown on the latest plans;
    f. Confirmation that all recommendations meet the requirements of the 2016 Code;
    g. A discussion of the results of the seismic refraction study mentioned on Page 1 and included as Appendix E in the report should be provided. Were the results utilized for development of landslide structure beyond the broad spectrum review mentioned on Page 1?

The following comments are regarding slope stability analysis:

2. It appears that only peak and ultimate shear strength values have been plotted. Was re-shearing performed to develop along bedding strengths? If not, consideration should be given to running re-shears. Otherwise, justification should be provided for the along-bedding strengths used.

3. Table D-1 only contains psuedo-static strengths. Please also provide the static strengths in the table.

4. Relatively deep-seated stability analysis was performed for the slope to remain in-place above the building pad; however, shallow failure planes that run along bedding and that daylight at the bottom of the toe-of-slope retaining wall were not performed. Please provide.

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REFERENCE NO.: SP17-03P DATE: May 8, 2017

COMMENTS (continued)

5. Re-activation of the shallow landslide materials to be left in-place on the slope below the proposed building pad and access driveway could adversely affect the properties below the site. Please discuss the impacts this potential situation could have on the planned development, and provide stability calculations to show that the building pad and driveway will maintain suitable factors of safety with the unremediated landslide materials removed. In addition, please provide stability analysis for potential failure planes along the contact between the landslide materials and the underlying bedrock. If found to be unstable, what will be the impact of these failures on the properties below?

The following items will be **Conditions of Approval** to be addressed during the grading permit process:

6. Additional laboratory testing should be performed as needed based on the latest grading plans.

7. The consultant should review the grading plan and provide updated recommendations for:
   a. Temporary stability and potential shoring for wall excavations;
   b. Stability of slopes to be left in-place both above and below the areas of proposed grading and construction, with additional stability analyses as needed;
   c. Structural slope setbacks – updated lines based on the latest grading plans should be provided and included on the grading plans.

8. The grading plans should include the limits of Remedial Areas A and B, as well as the setback lines discussed above.

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COMMENTS (continued)

9. On Page 12, the report recommends concrete with Type V cement and a maximum water cement ratio of 0.45 but a compressive strength of only 3000 psi. Should a compressive strength of 4500 psi be recommended?

10. To what horizontal distance behind the retaining walls should the non-cohesive granular material be placed in order to design the walls with the reduced earth pressures provided for non-expansive backfill conditions? The 45 pcf equivalent fluid density for 2:1 ascending non-expansive backfill provided on Page 16 appears low. Please provide supporting calculations.

11. Does the 15 pcf seismic earth pressure provided on Page 17 apply to both cantilever and restrained walls and to both level and 2:1 backfill conditions? If not, please provide the supplemental seismic earth pressures.

12. For the hardscape recommendations provided on Page 18, should the underlying subgrade be pre-saturated? Should deepened perimeter edges be used to prevent moisture intrusion?

REVIEWED BY:

Lisa Bates, PG, CEG 2293
Associate Geologist

David Hansen, M.Sc., PE, GE 3056
Senior Geotechnical Engineer

EXPLANATION

Af	ARTIFICIAL FILL
Afu	UNDOCUMENTED ARTIFICIAL FILL
Qal	ALLUVIUM
Qls	LANDSLIDE
Qcol	COLLUVIUM
Q_{sw}	QUARTERNARY SLOPEWASH
Tc	CAPISTRANO FORMATION
TP-24	APPROXIMATE TEST PIT LOCATION
BA-4	APPROXIMATE GEOFIRM BORING LOCATION
P.A B4	APPROXIMATE P.A BORING LOCATION
	GEOLOGIC CONTACT
	LANDSLIDE
45	RUPTURE SURFACE
45	BEDDING ATTITUDE
45	JOINT
45	SHEAR
	HORIZONTAL BEDDING OR RUPTURE SURFACE (RS)
F F	APPROXIMATE LOCATION OF GEOTECHNICAL CROSS SECTION
LINE 3	APPROXIMATE LOCATION OF SEISMIC LINE
	APPROXIMATE LOCATION OF KEY
	APPROXIMATE LOCATION OF CAISSONS AND TIEBACKS
	APPROXIMATE LOCATION OF SHEAR PINS

GRAPHIC SCALE
(1" = 40')
0 40 80
FEET

LIMIT OF GRADING

PROPERTY LINE

TP-23
0 - 8' Qls
8' - 10' Tc
T.D. = 10'

TP-22
0 - 5' Qal
5' - 6' Qls
T.D. = 6'

TP-21
0 - 8' Qls
@ 4' ↖ N35W 37NE
T.D. = 8'

TP-20
0 - 3' Qcol
3' - 9' Qls
9' - 10' Tc
@ 6' ↖ N10W 38NE
T.D. = 10'

TP-19
0 - 4' Qcol
4' - 6' Tc
@ 2.5' ↖ N80W 35SW
3.5' ↖ N75W 34-45SW
T.D. = 6'

TP-18
0 - 15.5' Qcol
T.D. = 15.5'

PA B-2
0 - 90' Tc
T.D = 90'
@ 4' ↖ 32NE N38W
10' ↖ 27NE N34W
29' ↖ 35NE N55W
83' ↖ 26NE N58W

TP-17
0 - 7' Qcol
7' - 9' Tc
T.D. = 9'

TP-16
0 - 14' Qal
14' - 15' Qls
T.D. = 15'

TP-24
0 - 18' Qal
T.D. = 18'

370 KIPS/FT
TIP ELEV. 457'

270 KIPS/FT
TIP ELEV. 470'

140 KIPS/FT
TIP ELEV. 419'

PROPOSED SHEAR PINS
140 KIPS/FT

25' W
ELEV. 464'

20' W
ELEV. 460'

20' W
ELEV. 464'

15 KIPS/FT
TIP ELEV. 510'

10 KIPS/FT
TIP ELEV. 515'

10 KIPS/FT
TIP 10' BELOW
PAD GRADE

ENTIRE KEY CEMENT TREATED ENGINEERED FILL TO EL. 490'

EXISTING SHEAR KEY EL. 445 (GSI, 1988)

EXISTING BUTTRESS EL. 405 (GSI, 1988)

Af (from P.A & Assoc. 2010)

Qls 6 (from P.A & Assoc. 2010)

BA-3

Qcol	
Q_{sw}	
Qls	
Tc	
32E 61	48.3'
39E 43	53.6'
14W 15	72'
42W 22	72.25'
51W 20	72.5'
5W 74	75'
14W 43	80'
30-40E 6-8	80.75'
36 57W	81'
29E 14	85.5'
15W 20	86.5'
35-40W 35 43	88'
T.D 91'	

PA B-4
0 - 80' Tc
T.D = 80'
11' ↖ 23SE N21E
32' ↖ 25NE N33W
37' ↖ 33NE N12W
52' ↖ 30NE N33W
61' ↖ 43SE N10E

PA B-3
0 - 80' Tc
T.D = 80'
@ 4' ↙ 19NE N66W
66' ↙ 39NE N75W

PA B-1
0 - 70' Qls
70' - 100' Tc
T.D = 100'
@ 29' ↙ 26SE N85E
30' ↙ 30SE N40E
43' ↙ 28SE N52E
47' ↙ 60SE N85E
54' ↙ 24SE N45E
71.5' ↙ 32SE N12E
74' ↘ 42NE N8W

BA-2

Afu	
Q_{sw}	
Qls	
Tc	
60-70 51W	21.25'
65-75E 52	25.6'
N-S 42	28'
8W 54W	39'
50E 3-4	68'
	69'7"
T.D 76'	

BA-1

Af	
Qls	
Tc	
10-15W 35-38	16.5'
10E 10	29'
31'	
8E 95	42.3'
HORIZONTAL BEDDING	52.6'
HORIZONTAL BEDDING	75.75'
T.D 81'	

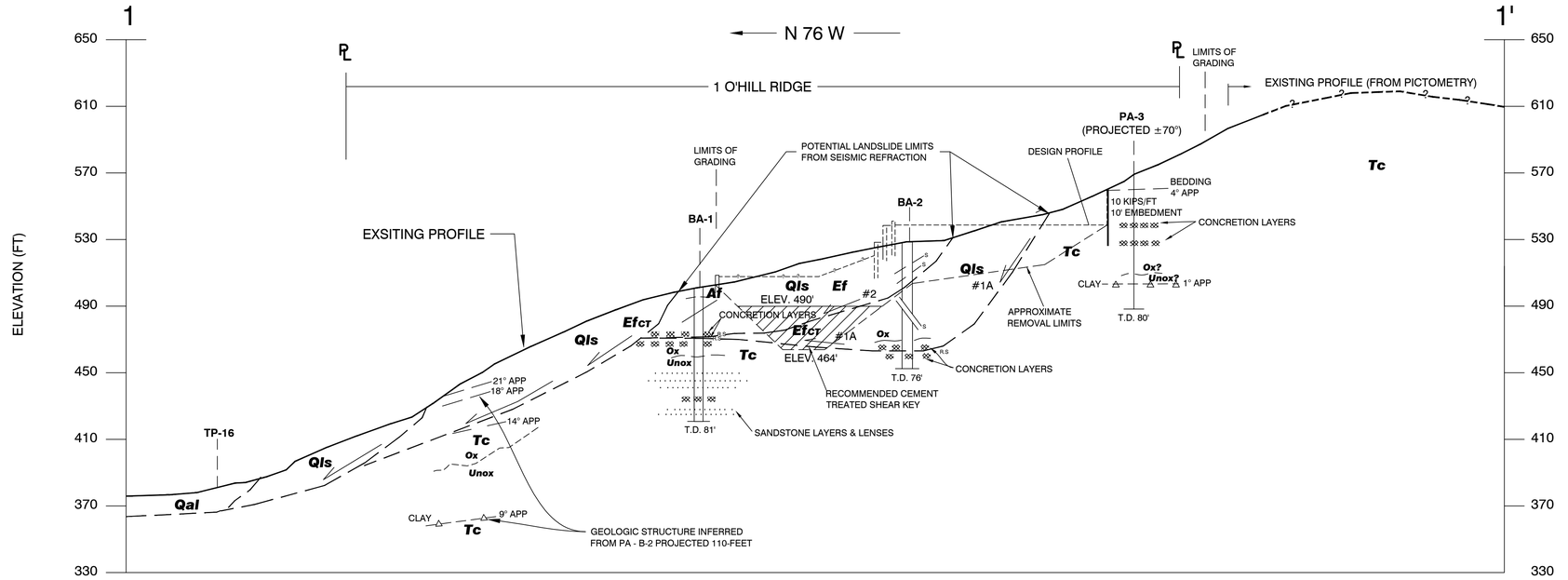
PA B-5
0 - 6' Af
6' - 50' Qls
50' - 80' Tc
T.D = 80'
@ 23' ↙ 25
30' ↙ 30

BASE REFERENCE: BRION JEANNETTE ARCHITECTURE, SITE PLAN, 1 O'HILL RIDGE, LAGUNA NIGUEL, SHEET A-1, DATED 8-8-17

GEOTECHNICAL MAP
1 O'HILL RIDGE, BEAR BRAND RANCH
LAGUNA NIGUEL, CA

Geofirm

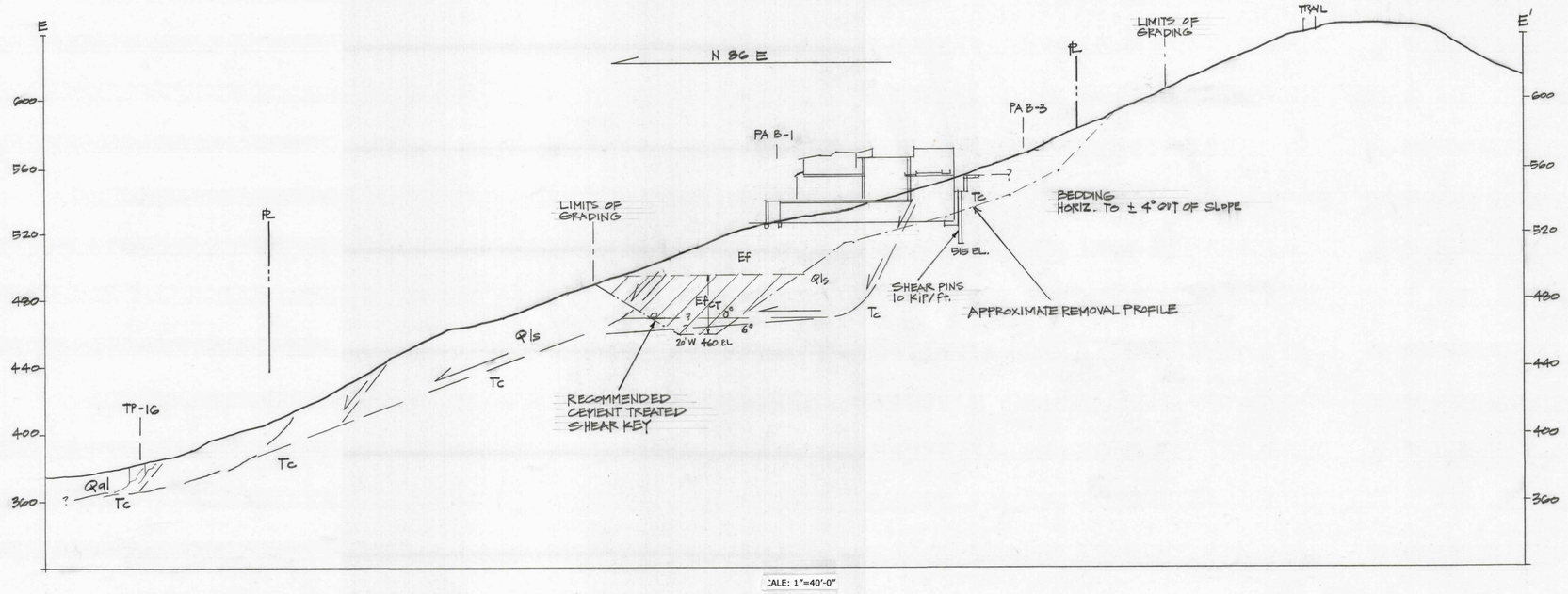
Project no.:	Date:	Plate:
72266-01	AUGUST 2018	1



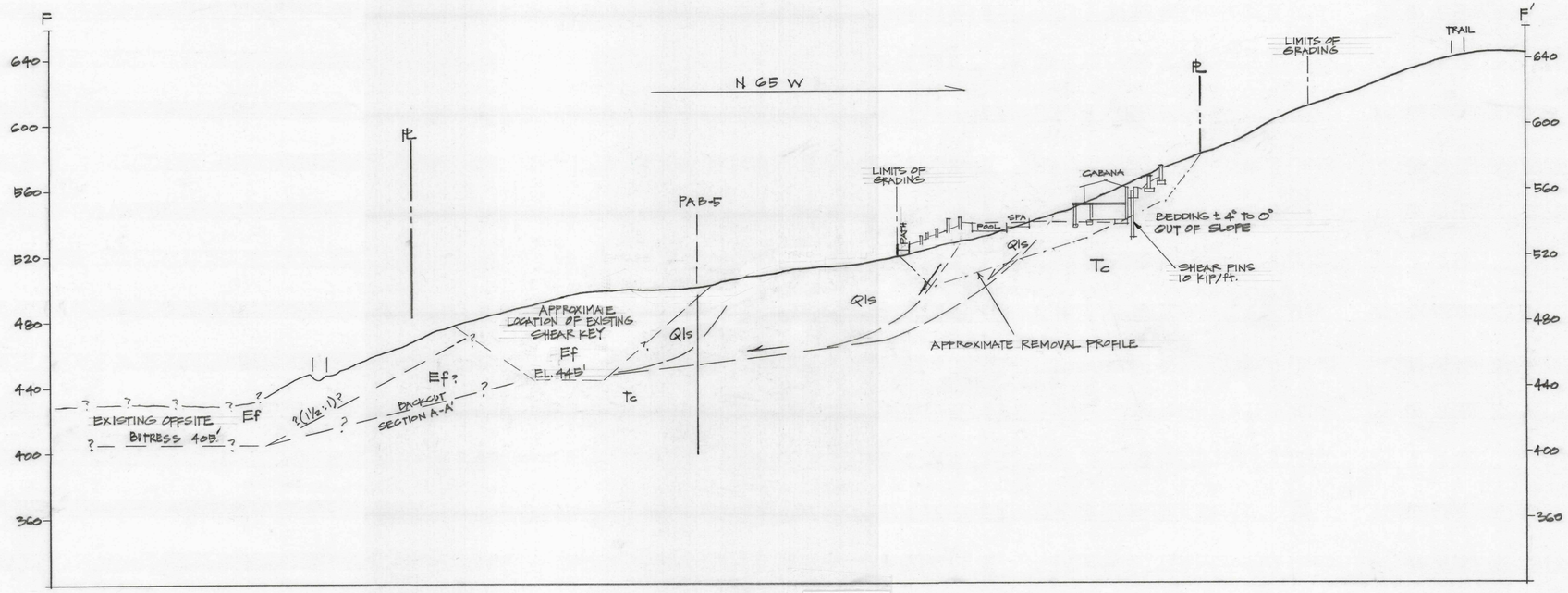
GEOTECHNICAL CROSS SECTIONS 1-1' AND 2-2'
1 O' HILL RIDGE BRAND RANCH
LAGUNA NIGUEL, CA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	PLATE:
72266-01	18-8346	AUGUST 2018	2



SCALE: 1"=40'-0"

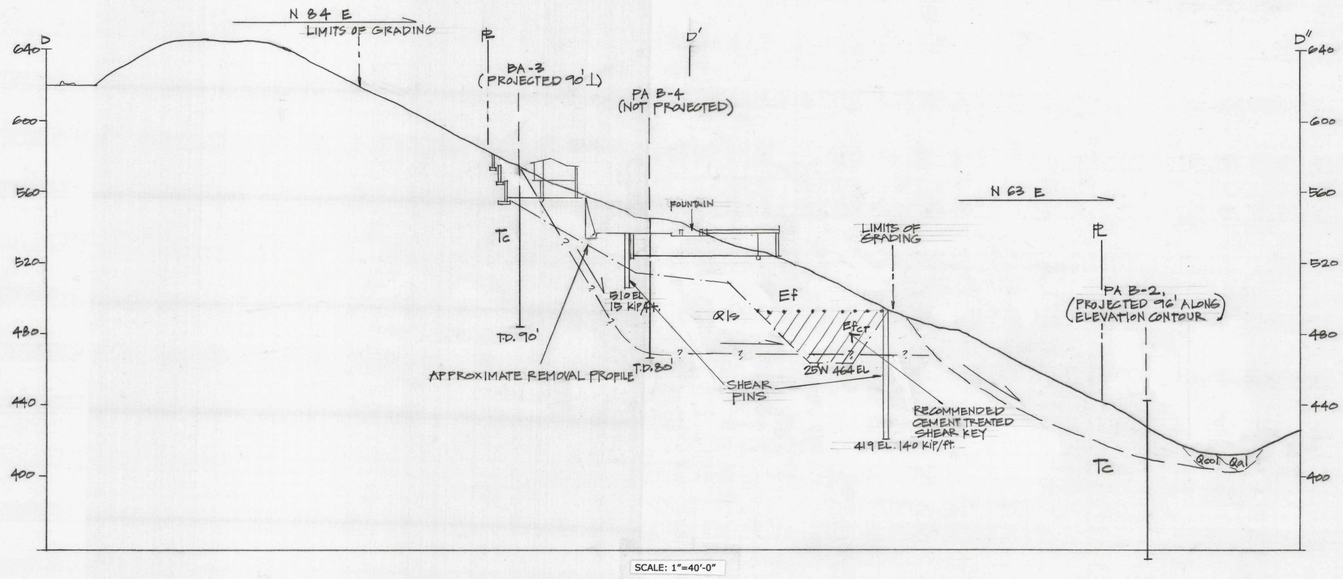


SCALE: 1"=40'-0"

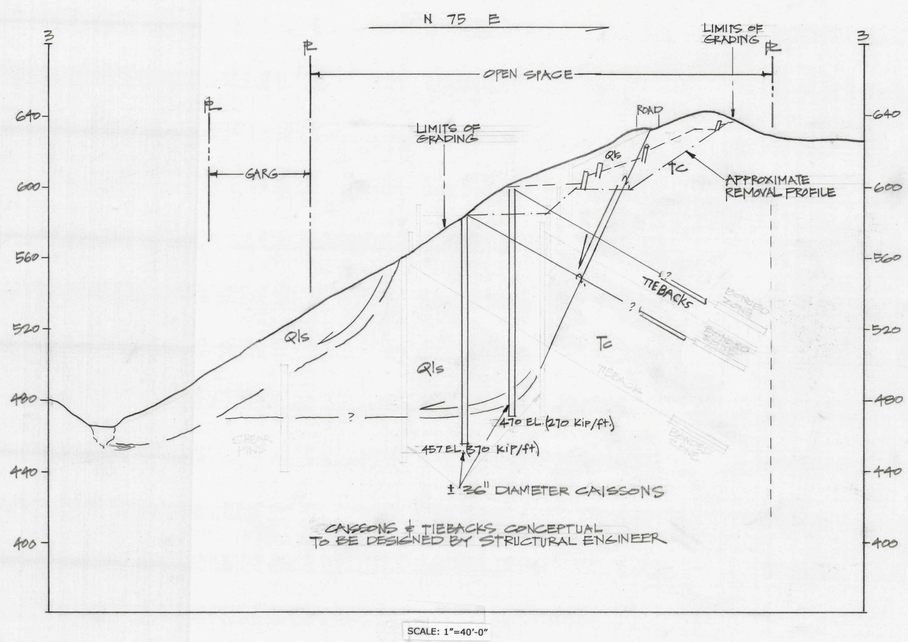
GEOTECHNICAL CROSS SECTIONS E-E' AND F-F'
1 O' HILL RIDGE BRAND RANCH
LAGUNA NIGUEL, CA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	PLATE:
72266-01	18-8346	AUGUST 2018	3



SCALE: 1"=40'-0"



SCALE: 1"=40'-0"

GEOTECHNICAL CROSS SECTIONS D-D'
AND 3-3'
1 O' HILL RIDGE BRAND RANCH
LAGUNA NIGUEL, CA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	PLATE:
72266-01	18-8346	AUGUST 2018	4

Attachment E: Hydrology Study

Hydrology Report

For:

Garg Residence
1 O'Hill Ridge
Laguna Niguel, CA

Prepared by:

GILBERT ENGINEERING & ASSOCIATES, INC.
2 Merriweather Place
Ladera Ranch, California 92694
(949) 218-8075

Project Number:
423.000

Supervising Engineer:
R. William Gilbert, P.E.
RCE No. 53251



Date Prepared:
March 2019

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I. Introduction

Geographic Setting

The Study area consists of the existing natural hillside at 1 O'Hill Ridge in the City of Laguna Niguel. A proposed residence with landscaping will be constructed on the natural hillside. The project site's entire tributary drainage area is 6.44 acres.

Purpose of This Report

The purpose of this report is to accomplish the following objectives:

1. To determine the storm water discharges generated within local drainage areas within the project.
2. To support the design of "local" storm drains, consisting of laterals and catch basins, as submitted with this report.
3. To demonstrate that the "storm water" and "flood" protection goals as required by the City of Laguna Niguel have been met.

Project Site Location Map



Google Earth, 2017

II. Existing Topographic & Hydrologic Conditions

Existing Topography

The Study area consists of the existing natural hillside at 1 O'Hill Ridge in the City of Laguna Niguel. The project site's entire drainage area is 6.44 acres. It is a steep hillside lot that has 144' of fall from north to south.

Existing Drainage Pattern

The existing project site flows in two directions. The existing dirt road falls downhill back to O'Hill Street which consists of 0.43 acres. The remaining site, 6.01 acres flows from north to south down into an existing canyon below the property.

The existing canyon flows between two homes below in a natural drainage channel and outlets into a 30" storm drain entrance which travels under Peppertree Bend. The storm drain flows down the hillside where it ties into the San Juan Creek Channel and finally outlets into the Pacific Ocean at Doheny Beach.

Existing Storm Drain Facilities

There are no existing storm drain facilities onsite. All runoff sheet flows out to O'Hill Ridge or down into the natural ravine below.

Existing Conditions

Currently there are no signs of erosion on the site. All the surface areas are natural.

III. Proposed Storm Drain Facilities

The proposed storm drain system collects all the roof drain runoff and area drains and carries them through the project site to the proposed Lake.

The Lake captures all the site runoff and then overflow into at outlet which connects to a storm drain and drains the overflow down the hill toward the ravine. Near the bottom of the property, the pipe will

outlet into a rip rap energy dissipation structure which will distribute the flow and allow it to sheet flow into the ravine below.

IV. Hydrology Study

Storm Frequency

The storm frequency for this study is based on the 2, 10, 25 year and 100 year storm.

Methodology

This study was prepared in conformance with the Orange County Hydrology Manual and the calculations were performed with the CivilD software for the Peak Flow Hydrologic Analysis.

Soil Type D Per Plate C of Hydrologic Classification of Soil, County of Orange.


PROJECT SITE
Laguna Niguel
San Juan Capistrano
Dana Point

Using the CivilD software, the following flows were calculated based on the areas in the hydrology exhibit.

The hydraulic analysis was performed using the Civil Design computer program which uses Manning's formula $Q = A*1.486/n*R^{2/3} *S^{1/2}$. The roughness coefficient n=0.010 for the PVC pipe and n=0.013 for RCP pipe.

V. Local Area Drain Pipe Sizing

The onsite drain sizes will be designed during the construction document phase. All pipes will have a minimum 1% slope.

VI. Design Criteria

The proposed storm drain systems will be designed so as to be consistent with the following goals and guidelines:

A. All buildings shall be protected from flooding during a 100-year frequency storm because the site is not in a flood zone and overflow protection will be designed into the project.

B. 1. Onsite design storm is based on a 25-year frequency. In sump conditions for catch basins and the connecting storm drains also use a 25-year frequency.

2. Offsite design storm frequency, subject to individual review by the County, should be in accordance with the O.C. P.F.&R.D. Hydrology Manual.

C. 1. Velocity should not exceed 20 FPS in P.V.C pipe and standard wall R.C.P.

2. Where velocity exceeds 20 FPS, a special wall R.C.P. with a minimum of 1½-inch steel clearance on the inside surface shall be used.

3. Maximum velocity in special cover R.C.P. shall be 45 FPS.

D. On arterial highways, one (1) 12' lane each direction should be clear of water, with a 10-year storm. In sump conditions, a 25-year storm event shall be used.

E. On local streets, flow should not exceed top of curb, for a 10-year storm event, and in sump conditions, a 25-year storm event shall be used.

F. Cross gutter is not allowed at any through street.

G. Catch basins are to be constructed at all four corners of arterial highway intersections.

H. Open cut is not allowed at any existing arterial highway. Pipe must be jacked across street.

I. Maximum W.S. in CB's for design conditions shall be 0.5' below inlet (FL.) elevation.

J. Once water is picked up in a storm drain, it should remain in the system.

K. Pipe size may not be decreased downstream without the County's approval.

L. Branching of flow is not allowed.

M. Provide hydraulic and energy grade line calculations and plot of hydraulic grade line on plans with table of appropriate hydraulic data.

N. The ratio of normal velocity to critical velocity should be less than 0.9 or greater than 1.2.

O. All pipes and conduits laid parallel to the roadway shall be placed at least 30" below the roadway surface. However, when pipe depth is in excess of 10' (measured from top of pipe to ground surface), the County's approval is required prior to the initial design of the system.

P. Junction structures should be designed according to the O.C. P.F.&R.D. "Design Manual".

Q. Storm Drain Easement width shall be determined in the following manner:

1. D = 36" or smaller – Distance from top of pipe to ground level times 1.5 + diameter of pipe +2.0' (When cover exceeds 10', use 2 below.)

2. D = 39" or greater – a. Distance from bottom of pipe to ground level times 2.0 + diameter of pipe + 2.0'.

In any case, the width of easement shall not be less than 10.0' in width.

R. Storm drain shall be located at the center line of the easement.

S. Easement shall be exclusively for storm drain purposes.

T. Storm drain with high fills:

1. Fill Greater than 40 Feet

Storm drains which are installed with cover greater than 40 feet shall have a diameter a minimum of 12 inches larger than that

required for hydraulic adequacy and shall be constructed using pre-stressed concrete pipe.*

2. Fill between 30 and 40 Feet

   Storm drains which are installed with cover between 30 and 40 feet shall have a diameter a minimum of 12 inches larger than that required for hydraulic adequacy and shall be constructed using pre-stressed concrete pipe if the subgrade of the pipe is in a fill area.* If subgrade is in native soil, reinforced concrete pipe may be used.

3. Fill Between 20 and 30 Feet

   Storm drains which are installed with cover between 20 and 30 feet shall be constructed using reinforced concrete pipe. A pipe diameter greater than that required for hydraulic adequacy may be required if, in the opinion of the County Engineer's staff, the particular conditions involved warrant the larger size.

4. Fill Less Than 20 Feet

   Normal criteria for storm drain design shall be followed.

* Exceptions may be made for a roadway crossing of a natural watercourse which will remain undisturbed with future development.

VII. Results and Conclusions

This report's purpose determine if the existing drainage is sufficiently designed to handle the 2, 10, 25 and 100 year storm events.

The existing project site areas storm runoff in area A-1 that travels down the hillside in a sheet flow condition is 12.88, 9.94, 8.17 and 4.18 c.f.s. in a 100 year, 25 year 10 year, and 2 year storm event, respectively.

The existing project site areas storm runoff in area B-1 that travels down the existing dirt road to O'Hill Ridge is 1.84, 1.42, 1.17 and 0.60 c.f.s. in a 100 year, 25 year 10 year, and 2 year storm event, respectively.

The proposed project site has runoff the travels down the driveway in area D-1 to O'Hill Ridge. The runoff is 1.68, 1.30, 1.08 and 0.57 c.f.s. in a 100 year, 25 year 10 year, and 2 year storm event, respectively.

The remaining proposed site run off travels down the hillside and the driveway are collected by storm drains. The storm drains pick up all the landscape areas and roof drains and carry them to the proposed lake at the bottom of the building area. The site runoff enters the lake

at various points. The lake has been designed to capture the 100 year storm runoff increase so no additional water will exit the lake downstream into the ravine. When the lake begins to overflow in the in a 100 year or larger storm event, the runoff enters a overflow spillway and into a storm drain which runs down the hill into the energy disappation rip rap structure. The flow rate is are controlled by the lake (detention basin) size at the outlet based on the flood routing program for the 100 year storm event. The lake's normal water surface elevation is 510.50' with a surface edge of 510.83'. There is 1.67' of storage depth above the normal sufrace elevation prior to entrance to the overlow outlet at elevation 512.50'. The lake will contain 1' of freeboard above the outlet to 513.50'. The runoff entering the lake is 16.64 cfs, but only 11.1 cfs is leaving the lake's outlet at the peak of the 24 hour storm event for a 33% reduction in the 100 year storm event.

The driveway will decrease the flows travelling to O'hill Ridge by about 0.1 c.f.s in each storm event.

There will be a decrease in peak storm events up to the 100 year storm event as the peak runoff will be detained or stored in the lake and will be reused for irrigation.

The reduced flows that enter the overflow will have a redecued impact on the ravine below and we see no impacts on the existing canyon below, nor the 30" storm drain that travels under Peppertree Bend at the bottom of the canyon.

VIII. Appendices

Appendix 1 – 2, 10, 25 & 100 Year Hydrology Calculations

Appendix 2 – 4", 6", 8", 10",12", 18" & 24" Hydraulic Calculations

Appendix 3 – 100 Year Unit Hydrograph Analysis

Appendix 4 – 100 Year Flood Hydrograph Detention Basin Routing

Appendix 5 – Hydrology Exhibit

Appendix 1

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exa1.roc

---

2 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 1.218(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.752
Subarea runoff = 4.186(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exb1.roc

---

2 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 1.244(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.755
Subarea runoff = 0.601(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2exa1.roc

---

10 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 2.186(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.818
Subarea runoff = 8.168(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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10 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 2.233(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.819
Subarea runoff = 1.171(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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25 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 2.617(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.831
Subarea runoff = 9.942(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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25 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 2.673(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.833
Subarea runoff = 1.424(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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100 Year Existing Area A-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 828.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 488.000(Ft.)
Difference in elevation = 143.700(Ft.)
Slope = 0.17355 s(%)= 17.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.728 min.
Rainfall intensity = 3.332(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.846
Subarea runoff = 12.881(CFS)
Total initial stream area = 4.570(Ac.)
End of computations, total study area = 4.57 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2exb1.roc

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100 Year Existing Area B-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.200(In/Hr)
Initial subarea data:
Initial area flow distance = 480.000(Ft.)
Top (of initial area) elevation = 631.700(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 33.700(Ft.)
Slope = 0.07021 s(%)= 7.02
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.191 min.
Rainfall intensity = 3.403(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.847
Subarea runoff = 1.845(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000

Area averaged SCS curve number (AMC 2) = 84.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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2 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 1.777(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.809
Subarea runoff = 0.819(CFS)
Total initial stream area = 0.570(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.819(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.819(CFS)
Normal flow depth in pipe =    2.08(In.)
Flow top width inside pipe =    5.71(In.)
Critical Depth =    5.37(In.)
Pipe flow velocity =     13.56(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =     7.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.92 min.
Rainfall intensity =      1.738(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.807
Subarea runoff =      1.691(CFS) for    1.220(Ac.)
Total runoff =      2.510(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     2.510(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     2.510(CFS)
Normal flow depth in pipe =    3.40(In.)
Flow top width inside pipe =    5.95(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.87(Ft/s)
Travel time through pipe =    0.07 min.
```

```
Time of concentration (TC) =     7.99 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.99 min.
Rainfall intensity =      1.730(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.806
Subarea runoff =      1.326(CFS) for    0.960(Ac.)
Total runoff =      3.835(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     3.835(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.835(CFS)
Normal flow depth in pipe =    4.90(In.)
Flow top width inside pipe =    8.96(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.60(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     8.19 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
```

Time of concentration = 8.19 min.
Rainfall intensity = 1.705(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.805
Subarea runoff = 0.681(CFS) for 0.540(Ac.)
Total runoff = 4.516(CFS) Total area = 3.29(Ac.)
Area averaged Fm value = 0.180(In/Hr)

++
Process from Point/Station 104.000 to Point/Station 105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 507.000(Ft.)
Downstream point/station elevation = 506.500(Ft.)
Pipe length = 10.00(Ft.) Manning's N = 0.010
No. of pipes = 1 Required pipe flow = 4.516(CFS)
Nearest computed pipe diameter = 9.00(In.)
Calculated individual pipe flow = 4.516(CFS)
Normal flow depth in pipe = 6.93(In.)
Flow top width inside pipe = 7.58(In.)
Critical depth could not be calculated.
Pipe flow velocity = 12.38(Ft/s)
Travel time through pipe = 0.01 min.
Time of concentration (TC) = 8.20 min.
End of computations, total study area = 3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

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2 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 2.314(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.834
Subarea runoff = 0.347(CFS)
Total initial stream area = 0.180(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   571.500(Ft.)
Downstream point/station elevation =   530.000(Ft.)
Pipe length  =   289.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.347(CFS)
Nearest computed pipe diameter  =      3.00(In.)
Calculated individual pipe flow  =     0.347(CFS)
Normal flow depth in pipe =    2.03(In.)
Flow top width inside pipe =    2.81(In.)
Critical depth could not be calculated.
Pipe flow velocity =      9.85(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =     5.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     5.30 min.
Rainfall intensity =      2.189(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.827
Subarea runoff =      1.137(CFS) for    0.640(Ac.)
Total runoff =      1.484(CFS)    Total area =        0.82(Ac.)
Area averaged Fm value =    0.178(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   510.000(Ft.)
Downstream point/station elevation =   509.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     1.484(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.484(CFS)
Normal flow depth in pipe =    4.49(In.)
Flow top width inside pipe =    5.21(In.)
Critical depth could not be calculated.
Pipe flow velocity =      9.41(Ft/s)
Travel time through pipe =    0.02 min.
```

Time of concentration (TC) = 5.32 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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2 year proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 1.930(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.821
Subarea runoff = 0.982(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

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2 Year Proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 1.726(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.806
Subarea runoff = 0.571(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propa.roc

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10 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 3.187(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.849
Subarea runoff = 1.543(CFS)
Total initial stream area = 0.570(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     1.543(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.543(CFS)
Normal flow depth in pipe =    2.95(In.)
Flow top width inside pipe =    6.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.05(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     7.88 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.88 min.
Rainfall intensity =      3.128(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =      3.207(CFS) for    1.220(Ac.)
Total runoff =      4.750(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     4.750(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     4.750(CFS)
Normal flow depth in pipe =    3.93(In.)
Flow top width inside pipe =    8.93(In.)
Critical depth could not be calculated.
Pipe flow velocity =     25.66(Ft/s)
Travel time through pipe =    0.06 min.
```

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Time of concentration (TC) =     7.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.93 min.
Rainfall intensity =      3.116(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =      2.516(CFS) for    0.960(Ac.)
Total runoff =      7.266(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     7.266(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     7.266(CFS)
Normal flow depth in pipe =    6.05(In.)
Flow top width inside pipe =   12.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.31(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     8.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
```

```
Time of concentration =     8.11 min.
Rainfall intensity =      3.078(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.847
Subarea runoff =      1.315(CFS) for    0.540(Ac.)
Total runoff =      8.581(CFS)    Total area =        3.29(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   507.000(Ft.)
Downstream point/station elevation =   506.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     8.581(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     8.581(CFS)
Normal flow depth in pipe =    8.33(In.)
Flow top width inside pipe =   11.06(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.74(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.12 min.
End of computations, total study area =            3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) =  75.0
```

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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10 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 4.150(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff = 0.645(CFS)
Total initial stream area = 0.180(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   571.500(Ft.)
Downstream point/station elevation =   530.000(Ft.)
Pipe length  =   289.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.645(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.645(CFS)
Normal flow depth in pipe =    1.97(In.)
Flow top width inside pipe =    5.64(In.)
Critical Depth =    4.89(In.)
Pipe flow velocity =     11.48(Ft/s)
Travel time through pipe =    0.42 min.
Time of concentration (TC) =     5.23 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     5.23 min.
Rainfall intensity =      3.956(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.860
Subarea runoff =      2.143(CFS) for    0.640(Ac.)
Total runoff =      2.788(CFS)    Total area =        0.82(Ac.)
Area averaged Fm value =    0.178(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   510.000(Ft.)
Downstream point/station elevation =   509.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     2.788(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.788(CFS)
Normal flow depth in pipe =    4.92(In.)
Flow top width inside pipe =    8.96(In.)
Critical Depth =    8.53(In.)
Pipe flow velocity =     11.29(Ft/s)
Travel time through pipe =    0.01 min.
```

Time of concentration (TC) = 5.25 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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10 year proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 3.463(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.856
Subarea runoff = 1.837(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

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10 Year Proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 3.097(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.848
Subarea runoff = 1.076(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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25 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 3.799(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.857
Subarea runoff = 1.856(CFS)
Total initial stream area = 0.570(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     1.856(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.856(CFS)
Normal flow depth in pipe =    3.30(In.)
Flow top width inside pipe =    5.97(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.79(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     7.87 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.87 min.
Rainfall intensity =      3.732(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.857
Subarea runoff =      3.866(CFS) for    1.220(Ac.)
Total runoff =      5.723(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     5.723(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     5.723(CFS)
Normal flow depth in pipe =    4.37(In.)
Flow top width inside pipe =    9.00(In.)
Critical depth could not be calculated.
```

```
Pipe flow velocity =     26.92(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     7.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.92 min.
Rainfall intensity =      3.718(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.856
Subarea runoff =      3.034(CFS) for    0.960(Ac.)
Total runoff =      8.757(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     8.757(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     8.757(CFS)
Normal flow depth in pipe =    6.78(In.)
Flow top width inside pipe =   11.90(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.15(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =     8.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
```

```
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     8.08 min.
Rainfall intensity =      3.675(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.856
Subarea runoff =      1.593(CFS) for    0.540(Ac.)
Total runoff =     10.350(CFS)    Total area =        3.29(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   507.000(Ft.)
Downstream point/station elevation =   506.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =    10.350(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    10.350(CFS)
Normal flow depth in pipe =    9.83(In.)
Flow top width inside pipe =    9.24(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.03(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.09 min.
End of computations, total study area =            3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) =  75.0
```

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propb.roc

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25 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 4.930(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.869
Subarea runoff = 0.771(CFS)
Total initial stream area = 0.180(Ac.)

++
Process from Point/Station 201.000 to Point/Station 202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____
Upstream point/station elevation = 571.500(Ft.)
Downstream point/station elevation = 530.000(Ft.)
Pipe length = 289.00(Ft.) Manning's N = 0.010
No. of pipes = 1 Required pipe flow = 0.771(CFS)
Nearest computed pipe diameter = 6.00(In.)
Calculated individual pipe flow = 0.771(CFS)
Normal flow depth in pipe = 2.17(In.)
Flow top width inside pipe = 5.76(In.)
Critical Depth = 5.26(In.)
Pipe flow velocity = 12.06(Ft/s)
Travel time through pipe = 0.40 min.
Time of concentration (TC) = 5.21 min.

++
Process from Point/Station 202.000 to Point/Station 202.000
**** SUBAREA FLOW ADDITION ****
_____
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Time of concentration = 5.21 min.
Rainfall intensity = 4.712(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff = 2.575(CFS) for 0.640(Ac.)
Total runoff = 3.346(CFS) Total area = 0.82(Ac.)
Area averaged Fm value = 0.178(In/Hr)

++
Process from Point/Station 202.000 to Point/Station 203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____
Upstream point/station elevation = 510.000(Ft.)
Downstream point/station elevation = 509.500(Ft.)
Pipe length = 10.00(Ft.) Manning's N = 0.010
No. of pipes = 1 Required pipe flow = 3.346(CFS)
Nearest computed pipe diameter = 9.00(In.)
Calculated individual pipe flow = 3.346(CFS)
Normal flow depth in pipe = 5.53(In.)
Flow top width inside pipe = 8.76(In.)
Critical depth could not be calculated.
Pipe flow velocity = 11.76(Ft/s)
Travel time through pipe = 0.01 min.

Time of concentration (TC) = 5.23 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propc.roc

---

25 Year Proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 4.123(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff = 2.206(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

---

25 Year Proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 3.692(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.856
Subarea runoff = 1.296(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propa.roc

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100 Year Proposed Area A-1, 2, 3, 4

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 252.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06746 s(%)= 6.75
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.626 min.
Rainfall intensity = 4.858(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.867
Subarea runoff = 2.400(CFS)
Total initial stream area = 0.570(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   598.000(Ft.)
Downstream point/station elevation =   552.000(Ft.)
Pipe length  =   243.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     2.400(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     2.400(CFS)
Normal flow depth in pipe =    3.90(In.)
Flow top width inside pipe =    5.72(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.77(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =     7.85 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.85 min.
Rainfall intensity =      4.777(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      5.006(CFS) for    1.220(Ac.)
Total runoff =      7.405(CFS)    Total area =        1.79(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   552.000(Ft.)
Downstream point/station elevation =   525.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     7.405(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     7.405(CFS)
Normal flow depth in pipe =    5.10(In.)
Flow top width inside pipe =    8.92(In.)
Critical depth could not be calculated.
Pipe flow velocity =     28.67(Ft/s)
Travel time through pipe =    0.05 min.
```

```
Time of concentration (TC) =     7.90 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     7.90 min.
Rainfall intensity =      4.759(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      3.929(CFS) for    0.960(Ac.)
Total runoff =     11.334(CFS)    Total area =        2.75(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   525.000(Ft.)
Downstream point/station elevation =   507.000(Ft.)
Pipe length  =   188.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =    11.334(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    11.334(CFS)
Normal flow depth in pipe =    8.05(In.)
Flow top width inside pipe =   11.28(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.23(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =     8.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
```

```
Time of concentration =     8.06 min.
Rainfall intensity =      4.707(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      2.070(CFS) for    0.540(Ac.)
Total runoff =     13.404(CFS)    Total area =        3.29(Ac.)
Area averaged Fm value =    0.180(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   507.000(Ft.)
Downstream point/station elevation =   506.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =    13.404(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    13.404(CFS)
Normal flow depth in pipe =    9.37(In.)
Flow top width inside pipe =   14.53(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.62(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.07 min.
End of computations, total study area =            3.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) =  75.0
```

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propb.roc

---

100 Year Proposed Area B-1 and B-2

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++

Process from Point/Station 200.000 to Point/Station 201.000
**** INITIAL AREA EVALUATION ****

PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 191.000(Ft.)
Top (of initial area) elevation = 642.500(Ft.)
Bottom (of initial area) elevation = 571.500(Ft.)
Difference in elevation = 71.000(Ft.)
Slope = 0.37173 s(%)= 37.17
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 4.812 min.
Rainfall intensity = 6.325(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff = 0.997(CFS)
Total initial stream area = 0.180(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   571.500(Ft.)
Downstream point/station elevation =   530.000(Ft.)
Pipe length  =   289.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     0.997(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.997(CFS)
Normal flow depth in pipe =    2.49(In.)
Flow top width inside pipe =    5.91(In.)
Critical Depth =    5.66(In.)
Pipe flow velocity =     12.93(Ft/s)
Travel time through pipe =    0.37 min.
Time of concentration (TC) =     5.18 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.9000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.180(In/Hr)
Time of concentration =     5.18 min.
Rainfall intensity =      6.060(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =      3.344(CFS) for    0.640(Ac.)
Total runoff =      4.341(CFS)    Total area =        0.82(Ac.)
Area averaged Fm value =    0.178(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   510.000(Ft.)
Downstream point/station elevation =   509.500(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.010
No. of pipes = 1  Required pipe flow  =     4.341(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     4.341(CFS)
Normal flow depth in pipe =    6.69(In.)
Flow top width inside pipe =    7.86(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.32(Ft/s)
Travel time through pipe =    0.01 min.
```

Time of concentration (TC) = 5.20 min.
End of computations, total study area = 0.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.889
Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

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Rational Hydrology Study, Date: 02/11/19 File Name: garg2propc.roc

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100 Year Proposed Area C-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 300.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.8500 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.170(In/Hr)
Initial subarea data:
Initial area flow distance = 309.000(Ft.)
Top (of initial area) elevation = 557.000(Ft.)
Bottom (of initial area) elevation = 495.000(Ft.)
Difference in elevation = 62.000(Ft.)
Slope = 0.20065 s(%)= 20.06
TC = k(0.483)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.598 min.
Rainfall intensity = 5.278(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.871
Subarea runoff = 2.850(CFS)
Total initial stream area = 0.620(Ac.)
End of computations, total study area = 0.62 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.850

Area averaged SCS curve number (AMC 2) = 75.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 02/11/19 File Name: garg2propd.roc

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100 year proposed Area D-1

Program License Serial Number 6004

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 100.000 to Point/Station 401.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(2.5 acre lot)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.9000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.180(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 615.000(Ft.)
Bottom (of initial area) elevation = 598.000(Ft.)
Difference in elevation = 17.000(Ft.)
Slope = 0.06204 s(%)= 6.20
TC = k(0.487)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.018 min.
Rainfall intensity = 4.720(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.866
Subarea runoff = 1.675(CFS)
Total initial stream area = 0.410(Ac.)
End of computations, total study area = 0.41 (Ac.)
The following figures may

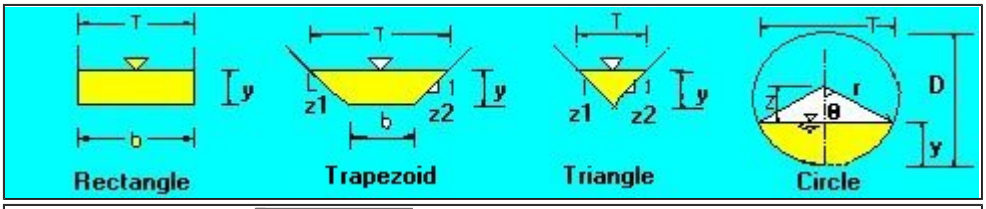
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.900
Area averaged SCS curve number (AMC 2) = 75.0

Appendix 2

The open channel flow calculator

Select Channel Type: Circle



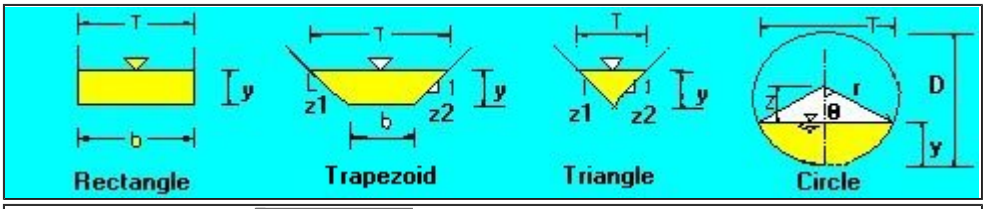
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.01 ft/ft	Water depth(y): .49999 ft	Radius (r) .25 ft
Flow velocity 3.7221 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 0.7308 ft^3/s	Input n value .01 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 1.57 ft	Flow area 0.2 ft^2	Top width(T) 0 ft
Specific energy 0.72 ft	Froude number 0.1	Flow status Subcritical flow
Critical depth 0.43 ft	Critical slope 0.0093 ft/ft	Velocity head 0.22 ft

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The open channel flow calculator

Select Channel Type: Circle



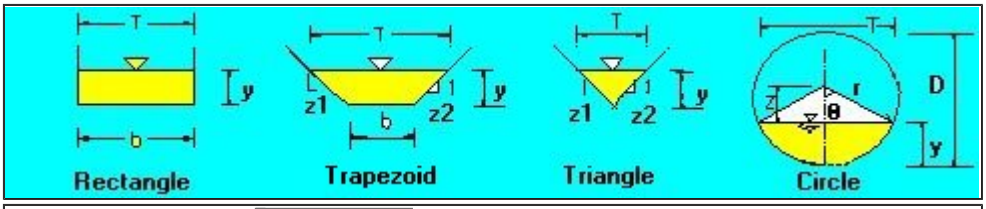
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): .66 ft	Radius (r) .333 ft
Flow velocity 4.684 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 1.6294 ft^3/s	Input n value .010 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 1.97 ft	Flow area 0.35 ft^2	Top width(T) 0.13 ft
Specific energy 1 ft	Froude number 0.5	Flow status Subcritical flow
Critical depth 0.59 ft	Critical slope 0.0096 ft/ft	Velocity head 0.34 ft

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The open channel flow calculator

Select Channel Type: Circle



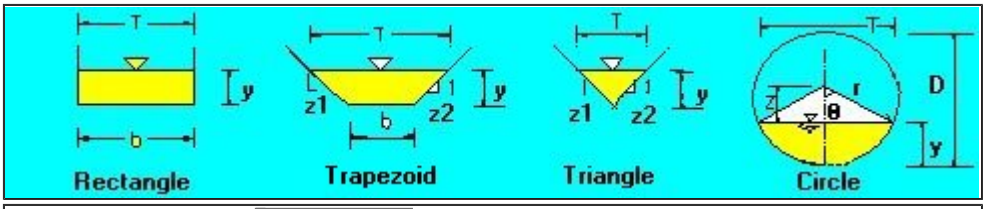
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): .8299 ft	Radius (r) .415 ft
Flow velocity 5.2327 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 2.8312 ft^3/s	Input n value .010 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.59 ft	Flow area 0.54 ft^2	Top width(T) 0.02 ft
Specific energy 1.26 ft	Froude number 0.17	Flow status Subcritical flow
Critical depth 0.74 ft	Critical slope 0.009 ft/ft	Velocity head 0.43 ft

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The open channel flow calculator

Select Channel Type: Circle



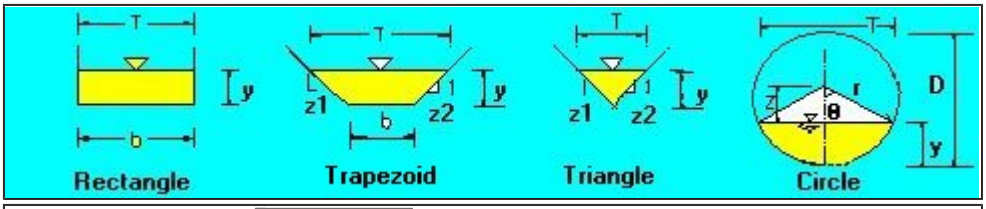
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): .9999 ft	Radius (r) .5 ft
Flow velocity 5.9224 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 4.6514 ft^3/s	Input n value .010 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.12 ft	Flow area 0.79 ft^2	Top width(T) 0.02 ft
Specific energy 1.54 ft	Froude number 0.17	Flow status Subcritical flow
Critical depth 0.9 ft	Critical slope 0.0089 ft/ft	Velocity head 0.54 ft

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The open channel flow calculator

Select Channel Type: Circle



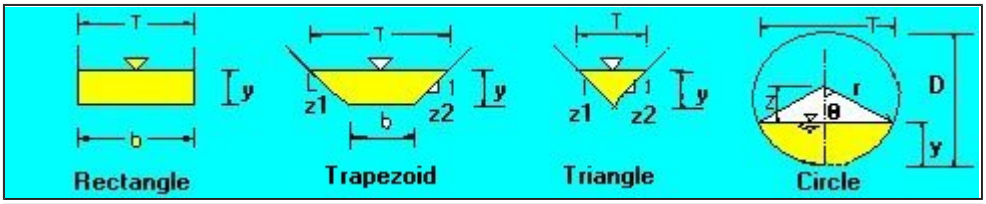
Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.49 ft	Radius (r) .75 ft
Flow velocity 8.0029 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 14.1292 ft^3/s	Input n value .01 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 4.47 ft	Flow area 1.77 ft^2	Top width(T) 0.24 ft
Specific energy 2.48 ft	Froude number 0.52	Flow status Subcritical flow
Critical depth 1.39 ft	Critical slope 0.0093 ft/ft	Velocity head 0.99 ft

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The open channel flow calculator

Select Channel Type: Circle



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: .01 ft/ft	Water depth(y): 1.99 ft	Radius (r) 1 ft
Flow velocity 9.6495 ft/s	LeftSlope (Z1): to 1 (H:V	RightSlope (Z2): to 1 (H:V
Flow discharge 30.2967 ft^3/s	Input n value .01 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 6 ft	Flow area 3.14 ft^2	Top width(T) 0.28 ft
Specific energy 3.44 ft	Froude number 0.51	Flow status Subcritical flow
Critical depth 1.87 ft	Critical slope 0.0092 ft/ft	Velocity head 1.45 ft

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Appendix 3

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989-2004, Version 7.0

Study date 02/11/19 File Name garg100.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6004

Detention Basin Unit Hydrograph

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
75.0	4.7	1.00	D	0.200	0.810	0.162

Area-averaged adjusted loss rate Fm (In/Hr) = 0.162

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
3.83	0.810	75.0	91.0	0.99	0.816
0.90	0.190	98.0	98.0	0.20	0.958

Area-averaged catchment yield fraction, Y = 0.843
Area-averaged low loss fraction, Yb = 0.157
++
User entry of time of concentration = 0.135 (hours)
Watershed area = 4.73(Ac.)
Catchment Lag time = 0.108 hours
Unit interval = 5.000 minutes

Unit interval percentage of lag time = 77.4473
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.162(In/Hr)
Average low loss rate fraction (Yb) = 0.157 (decimal)
VALLEY DEVELOPED S-Graph proportion = 0.190
VALLEY UNDEVELOPED S-Graph proportion = 0.810
FOOTHILL S-Graph proportion = 0.000
MOUNTAIN S-Graph proportion = 0.000

Computed peak 5-minute rainfall = 0.520(In)
Computed peak 30-minute rainfall = 1.090(In)
Specified peak 1-hour rainfall = 1.450(In)
Computed peak 3-hour rainfall = 2.430(In)
Specified peak 6-hour rainfall = 3.360(In)
Specified peak 24-hour rainfall = 5.630(In)

Rainfall depth area reduction factors:
Using a total area of 4.73(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.520(In)
30-minute factor = 1.000 Adjusted rainfall = 1.090(In)
1-hour factor = 1.000 Adjusted rainfall = 1.450(In)
3-hour factor = 1.000 Adjusted rainfall = 2.430(In)
6-hour factor = 1.000 Adjusted rainfall = 3.360(In)
24-hour factor = 1.000 Adjusted rainfall = 5.630(In)

U n i t H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 57.20 (CFS))		
1	12.223	6.992
2	57.066	25.652
3	79.869	13.044
4	87.756	4.512
5	92.117	2.494
6	94.747	1.505
7	96.607	1.063
8	97.930	0.757
9	98.833	0.517
10	99.480	0.370
11	100.000	0.298

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.5199	0.5199
2	0.6922	0.1723
3	0.8184	0.1262
4	0.9217	0.1033
5	1.0107	0.0890

6	1.0898	0.0791
7	1.1612	0.0714
8	1.2268	0.0656
9	1.2877	0.0610
10	1.3448	0.0571
11	1.3987	0.0538
12	1.4497	0.0510
13	1.5053	0.0556
14	1.5586	0.0534
15	1.6100	0.0514
16	1.6596	0.0496
17	1.7076	0.0480
18	1.7541	0.0465
19	1.7993	0.0452
20	1.8432	0.0439
21	1.8860	0.0428
22	1.9277	0.0417
23	1.9684	0.0407
24	2.0082	0.0398
25	2.0471	0.0389
26	2.0852	0.0381
27	2.1225	0.0373
28	2.1591	0.0366
29	2.1950	0.0359
30	2.2303	0.0353
31	2.2650	0.0346
32	2.2990	0.0341
33	2.3325	0.0335
34	2.3655	0.0330
35	2.3980	0.0325
36	2.4299	0.0320
37	2.4613	0.0313
38	2.4921	0.0309
39	2.5226	0.0304
40	2.5526	0.0300
41	2.5823	0.0296
42	2.6115	0.0293
43	2.6404	0.0289
44	2.6689	0.0285
45	2.6971	0.0282
46	2.7250	0.0279
47	2.7525	0.0275
48	2.7798	0.0272
49	2.8067	0.0269
50	2.8333	0.0266
51	2.8597	0.0264
52	2.8857	0.0261
53	2.9116	0.0258
54	2.9371	0.0256
55	2.9624	0.0253
56	2.9875	0.0251
57	3.0123	0.0248
58	3.0369	0.0246
59	3.0613	0.0244

60	3.0854	0.0241
61	3.1094	0.0239
62	3.1331	0.0237
63	3.1566	0.0235
64	3.1799	0.0233
65	3.2031	0.0231
66	3.2260	0.0229
67	3.2488	0.0228
68	3.2714	0.0226
69	3.2938	0.0224
70	3.3160	0.0222
71	3.3381	0.0221
72	3.3600	0.0219
73	3.3773	0.0173
74	3.3944	0.0172
75	3.4114	0.0170
76	3.4283	0.0169
77	3.4450	0.0167
78	3.4616	0.0166
79	3.4781	0.0165
80	3.4944	0.0163
81	3.5106	0.0162
82	3.5267	0.0161
83	3.5426	0.0160
84	3.5584	0.0158
85	3.5742	0.0157
86	3.5898	0.0156
87	3.6052	0.0155
88	3.6206	0.0154
89	3.6359	0.0153
90	3.6510	0.0152
91	3.6661	0.0151
92	3.6810	0.0149
93	3.6959	0.0148
94	3.7106	0.0147
95	3.7253	0.0146
96	3.7398	0.0146
97	3.7543	0.0145
98	3.7687	0.0144
99	3.7829	0.0143
100	3.7971	0.0142
101	3.8112	0.0141
102	3.8252	0.0140
103	3.8391	0.0139
104	3.8530	0.0138
105	3.8667	0.0138
106	3.8804	0.0137
107	3.8940	0.0136
108	3.9075	0.0135
109	3.9209	0.0134
110	3.9343	0.0134
111	3.9476	0.0133
112	3.9608	0.0132
113	3.9739	0.0131

114	3.9870	0.0131
115	4.0000	0.0130
116	4.0129	0.0129
117	4.0257	0.0128
118	4.0385	0.0128
119	4.0512	0.0127
120	4.0638	0.0126
121	4.0764	0.0126
122	4.0889	0.0125
123	4.1014	0.0124
124	4.1138	0.0124
125	4.1261	0.0123
126	4.1383	0.0123
127	4.1505	0.0122
128	4.1627	0.0121
129	4.1748	0.0121
130	4.1868	0.0120
131	4.1987	0.0120
132	4.2106	0.0119
133	4.2225	0.0118
134	4.2343	0.0118
135	4.2460	0.0117
136	4.2577	0.0117
137	4.2693	0.0116
138	4.2809	0.0116
139	4.2924	0.0115
140	4.3039	0.0115
141	4.3153	0.0114
142	4.3267	0.0114
143	4.3380	0.0113
144	4.3493	0.0113
145	4.3605	0.0112
146	4.3717	0.0112
147	4.3828	0.0111
148	4.3939	0.0111
149	4.4049	0.0110
150	4.4159	0.0110
151	4.4269	0.0109
152	4.4377	0.0109
153	4.4486	0.0108
154	4.4594	0.0108
155	4.4702	0.0108
156	4.4809	0.0107
157	4.4915	0.0107
158	4.5022	0.0106
159	4.5128	0.0106
160	4.5233	0.0105
161	4.5338	0.0105
162	4.5443	0.0105
163	4.5547	0.0104
164	4.5651	0.0104
165	4.5754	0.0103
166	4.5857	0.0103
167	4.5960	0.0103

168	4.6062	0.0102
169	4.6164	0.0102
170	4.6266	0.0102
171	4.6367	0.0101
172	4.6468	0.0101
173	4.6568	0.0100
174	4.6668	0.0100
175	4.6768	0.0100
176	4.6867	0.0099
177	4.6966	0.0099
178	4.7065	0.0099
179	4.7163	0.0098
180	4.7261	0.0098
181	4.7359	0.0098
182	4.7456	0.0097
183	4.7553	0.0097
184	4.7649	0.0097
185	4.7746	0.0096
186	4.7842	0.0096
187	4.7937	0.0096
188	4.8032	0.0095
189	4.8127	0.0095
190	4.8222	0.0095
191	4.8316	0.0094
192	4.8410	0.0094
193	4.8504	0.0094
194	4.8598	0.0093
195	4.8691	0.0093
196	4.8784	0.0093
197	4.8876	0.0093
198	4.8968	0.0092
199	4.9060	0.0092
200	4.9152	0.0092
201	4.9243	0.0091
202	4.9334	0.0091
203	4.9425	0.0091
204	4.9516	0.0091
205	4.9606	0.0090
206	4.9696	0.0090
207	4.9786	0.0090
208	4.9875	0.0089
209	4.9964	0.0089
210	5.0053	0.0089
211	5.0142	0.0089
212	5.0230	0.0088
213	5.0318	0.0088
214	5.0406	0.0088
215	5.0493	0.0088
216	5.0581	0.0087
217	5.0668	0.0087
218	5.0755	0.0087
219	5.0841	0.0087
220	5.0928	0.0086
221	5.1014	0.0086

222	5.1099	0.0086
223	5.1185	0.0086
224	5.1270	0.0085
225	5.1355	0.0085
226	5.1440	0.0085
227	5.1525	0.0085
228	5.1609	0.0084
229	5.1694	0.0084
230	5.1777	0.0084
231	5.1861	0.0084
232	5.1945	0.0083
233	5.2028	0.0083
234	5.2111	0.0083
235	5.2194	0.0083
236	5.2276	0.0083
237	5.2359	0.0082
238	5.2441	0.0082
239	5.2523	0.0082
240	5.2605	0.0082
241	5.2686	0.0082
242	5.2767	0.0081
243	5.2848	0.0081
244	5.2929	0.0081
245	5.3010	0.0081
246	5.3090	0.0080
247	5.3171	0.0080
248	5.3251	0.0080
249	5.3331	0.0080
250	5.3410	0.0080
251	5.3490	0.0079
252	5.3569	0.0079
253	5.3648	0.0079
254	5.3727	0.0079
255	5.3805	0.0079
256	5.3884	0.0078
257	5.3962	0.0078
258	5.4040	0.0078
259	5.4118	0.0078
260	5.4196	0.0078
261	5.4273	0.0078
262	5.4351	0.0077
263	5.4428	0.0077
264	5.4505	0.0077
265	5.4582	0.0077
266	5.4658	0.0077
267	5.4735	0.0076
268	5.4811	0.0076
269	5.4887	0.0076
270	5.4963	0.0076
271	5.5039	0.0076
272	5.5114	0.0076
273	5.5189	0.0075
274	5.5265	0.0075
275	5.5340	0.0075

276	5.5415	0.0075
277	5.5489	0.0075
278	5.5564	0.0075
279	5.5638	0.0074
280	5.5712	0.0074
281	5.5786	0.0074
282	5.5860	0.0074
283	5.5934	0.0074
284	5.6007	0.0074
285	5.6081	0.0073
286	5.6154	0.0073
287	5.6227	0.0073
288	5.6300	0.0073

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0073	0.0011	0.0061
2	0.0073	0.0011	0.0062
3	0.0073	0.0012	0.0062
4	0.0074	0.0012	0.0062
5	0.0074	0.0012	0.0062
6	0.0074	0.0012	0.0062
7	0.0074	0.0012	0.0063
8	0.0075	0.0012	0.0063
9	0.0075	0.0012	0.0063
10	0.0075	0.0012	0.0063
11	0.0075	0.0012	0.0064
12	0.0076	0.0012	0.0064
13	0.0076	0.0012	0.0064
14	0.0076	0.0012	0.0064
15	0.0076	0.0012	0.0064
16	0.0077	0.0012	0.0065
17	0.0077	0.0012	0.0065
18	0.0077	0.0012	0.0065
19	0.0078	0.0012	0.0065
20	0.0078	0.0012	0.0066
21	0.0078	0.0012	0.0066
22	0.0078	0.0012	0.0066
23	0.0079	0.0012	0.0066
24	0.0079	0.0012	0.0066
25	0.0079	0.0012	0.0067
26	0.0079	0.0012	0.0067
27	0.0080	0.0013	0.0067
28	0.0080	0.0013	0.0067
29	0.0080	0.0013	0.0068
30	0.0081	0.0013	0.0068
31	0.0081	0.0013	0.0068
32	0.0081	0.0013	0.0069
33	0.0082	0.0013	0.0069
34	0.0082	0.0013	0.0069
35	0.0082	0.0013	0.0069
36	0.0083	0.0013	0.0070

37	0.0083	0.0013	0.0070
38	0.0083	0.0013	0.0070
39	0.0084	0.0013	0.0071
40	0.0084	0.0013	0.0071
41	0.0084	0.0013	0.0071
42	0.0085	0.0013	0.0071
43	0.0085	0.0013	0.0072
44	0.0085	0.0013	0.0072
45	0.0086	0.0013	0.0072
46	0.0086	0.0014	0.0073
47	0.0087	0.0014	0.0073
48	0.0087	0.0014	0.0073
49	0.0087	0.0014	0.0074
50	0.0088	0.0014	0.0074
51	0.0088	0.0014	0.0074
52	0.0088	0.0014	0.0074
53	0.0089	0.0014	0.0075
54	0.0089	0.0014	0.0075
55	0.0090	0.0014	0.0076
56	0.0090	0.0014	0.0076
57	0.0091	0.0014	0.0076
58	0.0091	0.0014	0.0077
59	0.0091	0.0014	0.0077
60	0.0092	0.0014	0.0077
61	0.0092	0.0014	0.0078
62	0.0093	0.0015	0.0078
63	0.0093	0.0015	0.0079
64	0.0093	0.0015	0.0079
65	0.0094	0.0015	0.0079
66	0.0094	0.0015	0.0080
67	0.0095	0.0015	0.0080
68	0.0095	0.0015	0.0080
69	0.0096	0.0015	0.0081
70	0.0096	0.0015	0.0081
71	0.0097	0.0015	0.0082
72	0.0097	0.0015	0.0082
73	0.0098	0.0015	0.0083
74	0.0098	0.0015	0.0083
75	0.0099	0.0016	0.0083
76	0.0099	0.0016	0.0084
77	0.0100	0.0016	0.0084
78	0.0100	0.0016	0.0085
79	0.0101	0.0016	0.0085
80	0.0102	0.0016	0.0086
81	0.0102	0.0016	0.0086
82	0.0103	0.0016	0.0087
83	0.0103	0.0016	0.0087
84	0.0104	0.0016	0.0088
85	0.0105	0.0016	0.0088
86	0.0105	0.0016	0.0089
87	0.0106	0.0017	0.0089
88	0.0106	0.0017	0.0090
89	0.0107	0.0017	0.0090
90	0.0108	0.0017	0.0091

91	0.0108	0.0017	0.0091
92	0.0109	0.0017	0.0092
93	0.0110	0.0017	0.0093
94	0.0110	0.0017	0.0093
95	0.0111	0.0017	0.0094
96	0.0112	0.0018	0.0094
97	0.0113	0.0018	0.0095
98	0.0113	0.0018	0.0095
99	0.0114	0.0018	0.0096
100	0.0115	0.0018	0.0097
101	0.0116	0.0018	0.0098
102	0.0116	0.0018	0.0098
103	0.0117	0.0018	0.0099
104	0.0118	0.0018	0.0099
105	0.0119	0.0019	0.0100
106	0.0120	0.0019	0.0101
107	0.0121	0.0019	0.0102
108	0.0121	0.0019	0.0102
109	0.0123	0.0019	0.0103
110	0.0123	0.0019	0.0104
111	0.0124	0.0020	0.0105
112	0.0125	0.0020	0.0105
113	0.0126	0.0020	0.0107
114	0.0127	0.0020	0.0107
115	0.0128	0.0020	0.0108
116	0.0129	0.0020	0.0109
117	0.0131	0.0020	0.0110
118	0.0131	0.0021	0.0111
119	0.0133	0.0021	0.0112
120	0.0134	0.0021	0.0113
121	0.0135	0.0021	0.0114
122	0.0136	0.0021	0.0115
123	0.0138	0.0022	0.0116
124	0.0138	0.0022	0.0117
125	0.0140	0.0022	0.0118
126	0.0141	0.0022	0.0119
127	0.0143	0.0022	0.0120
128	0.0144	0.0023	0.0121
129	0.0146	0.0023	0.0123
130	0.0146	0.0023	0.0124
131	0.0148	0.0023	0.0125
132	0.0149	0.0023	0.0126
133	0.0152	0.0024	0.0128
134	0.0153	0.0024	0.0129
135	0.0155	0.0024	0.0131
136	0.0156	0.0024	0.0132
137	0.0158	0.0025	0.0133
138	0.0160	0.0025	0.0135
139	0.0162	0.0025	0.0137
140	0.0163	0.0026	0.0138
141	0.0166	0.0026	0.0140
142	0.0167	0.0026	0.0141
143	0.0170	0.0027	0.0143
144	0.0172	0.0027	0.0145

145	0.0219	0.0034	0.0185
146	0.0221	0.0035	0.0186
147	0.0224	0.0035	0.0189
148	0.0226	0.0035	0.0190
149	0.0229	0.0036	0.0193
150	0.0231	0.0036	0.0195
151	0.0235	0.0037	0.0198
152	0.0237	0.0037	0.0200
153	0.0241	0.0038	0.0204
154	0.0244	0.0038	0.0205
155	0.0248	0.0039	0.0209
156	0.0251	0.0039	0.0211
157	0.0256	0.0040	0.0215
158	0.0258	0.0040	0.0218
159	0.0264	0.0041	0.0222
160	0.0266	0.0042	0.0225
161	0.0272	0.0043	0.0230
162	0.0275	0.0043	0.0232
163	0.0282	0.0044	0.0238
164	0.0285	0.0045	0.0241
165	0.0293	0.0046	0.0247
166	0.0296	0.0046	0.0250
167	0.0304	0.0048	0.0257
168	0.0309	0.0048	0.0260
169	0.0320	0.0050	0.0270
170	0.0325	0.0051	0.0274
171	0.0335	0.0053	0.0282
172	0.0341	0.0053	0.0287
173	0.0353	0.0055	0.0297
174	0.0359	0.0056	0.0303
175	0.0373	0.0059	0.0315
176	0.0381	0.0060	0.0321
177	0.0398	0.0062	0.0335
178	0.0407	0.0064	0.0343
179	0.0428	0.0067	0.0361
180	0.0439	0.0069	0.0370
181	0.0465	0.0073	0.0392
182	0.0480	0.0075	0.0405
183	0.0514	0.0081	0.0433
184	0.0534	0.0084	0.0450
185	0.0510	0.0080	0.0430
186	0.0538	0.0084	0.0454
187	0.0610	0.0096	0.0514
188	0.0656	0.0103	0.0553
189	0.0791	0.0124	0.0667
190	0.0890	0.0135	0.0755
191	0.1262	0.0135	0.1127
192	0.1723	0.0135	0.1588
193	0.5199	0.0135	0.5064
194	0.1033	0.0135	0.0898
195	0.0714	0.0112	0.0602
196	0.0571	0.0090	0.0481
197	0.0556	0.0087	0.0469
198	0.0496	0.0078	0.0418

199	0.0452	0.0071	0.0381
200	0.0417	0.0065	0.0352
201	0.0389	0.0061	0.0328
202	0.0366	0.0057	0.0309
203	0.0346	0.0054	0.0292
204	0.0330	0.0052	0.0278
205	0.0313	0.0049	0.0264
206	0.0300	0.0047	0.0253
207	0.0289	0.0045	0.0244
208	0.0279	0.0044	0.0235
209	0.0269	0.0042	0.0227
210	0.0261	0.0041	0.0220
211	0.0253	0.0040	0.0213
212	0.0246	0.0039	0.0207
213	0.0239	0.0038	0.0202
214	0.0233	0.0037	0.0197
215	0.0228	0.0036	0.0192
216	0.0222	0.0035	0.0187
217	0.0173	0.0027	0.0146
218	0.0169	0.0026	0.0142
219	0.0165	0.0026	0.0139
220	0.0161	0.0025	0.0136
221	0.0157	0.0025	0.0132
222	0.0154	0.0024	0.0130
223	0.0151	0.0024	0.0127
224	0.0147	0.0023	0.0124
225	0.0145	0.0023	0.0122
226	0.0142	0.0022	0.0120
227	0.0139	0.0022	0.0117
228	0.0137	0.0021	0.0115
229	0.0134	0.0021	0.0113
230	0.0132	0.0021	0.0111
231	0.0130	0.0020	0.0109
232	0.0128	0.0020	0.0108
233	0.0126	0.0020	0.0106
234	0.0124	0.0019	0.0104
235	0.0122	0.0019	0.0103
236	0.0120	0.0019	0.0101
237	0.0118	0.0019	0.0100
238	0.0117	0.0018	0.0099
239	0.0115	0.0018	0.0097
240	0.0114	0.0018	0.0096
241	0.0112	0.0018	0.0095
242	0.0111	0.0017	0.0093
243	0.0109	0.0017	0.0092
244	0.0108	0.0017	0.0091
245	0.0107	0.0017	0.0090
246	0.0105	0.0017	0.0089
247	0.0104	0.0016	0.0088
248	0.0103	0.0016	0.0087
249	0.0102	0.0016	0.0086
250	0.0101	0.0016	0.0085
251	0.0100	0.0016	0.0084
252	0.0099	0.0015	0.0083

253	0.0098	0.0015	0.0082
254	0.0097	0.0015	0.0081
255	0.0096	0.0015	0.0081
256	0.0095	0.0015	0.0080
257	0.0094	0.0015	0.0079
258	0.0093	0.0015	0.0078
259	0.0092	0.0014	0.0078
260	0.0091	0.0014	0.0077
261	0.0090	0.0014	0.0076
262	0.0089	0.0014	0.0075
263	0.0089	0.0014	0.0075
264	0.0088	0.0014	0.0074
265	0.0087	0.0014	0.0073
266	0.0086	0.0014	0.0073
267	0.0086	0.0013	0.0072
268	0.0085	0.0013	0.0072
269	0.0084	0.0013	0.0071
270	0.0083	0.0013	0.0070
271	0.0083	0.0013	0.0070
272	0.0082	0.0013	0.0069
273	0.0082	0.0013	0.0069
274	0.0081	0.0013	0.0068
275	0.0080	0.0013	0.0068
276	0.0080	0.0012	0.0067
277	0.0079	0.0012	0.0067
278	0.0078	0.0012	0.0066
279	0.0078	0.0012	0.0066
280	0.0077	0.0012	0.0065
281	0.0077	0.0012	0.0065
282	0.0076	0.0012	0.0064
283	0.0076	0.0012	0.0064
284	0.0075	0.0012	0.0063
285	0.0075	0.0012	0.0063
286	0.0074	0.0012	0.0063
287	0.0074	0.0012	0.0062
288	0.0073	0.0011	0.0062

Total soil rain loss = 0.79(In)
Total effective rainfall = 4.84(In)
Peak flow rate in flood hydrograph = 16.64(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

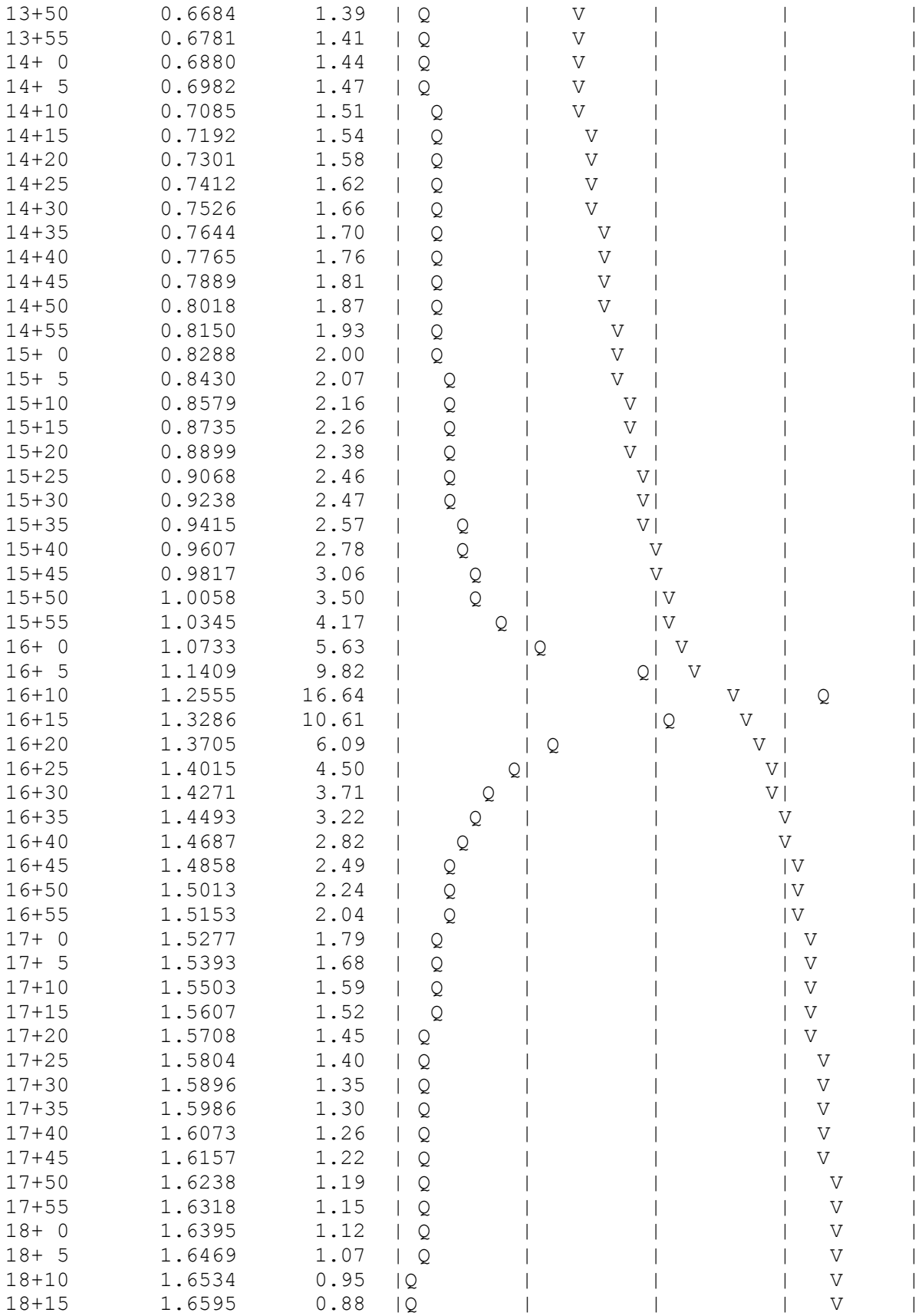
Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0003	0.04	Q	|	|	|	|
0+10	0.0017	0.20	Q	|	|	|	|
0+15	0.0036	0.28	Q	|	|	|	|

0+20	0.0058	0.31	Q				
0+25	0.0080	0.33	Q				
0+30	0.0103	0.34	Q				
0+35	0.0127	0.34	Q				
0+40	0.0151	0.35	Q				
0+45	0.0175	0.35	Q				
0+50	0.0200	0.36	Q				
0+55	0.0225	0.36	Q				
1+ 0	0.0250	0.36	Q				
1+ 5	0.0275	0.36	Q				
1+10	0.0300	0.36	Q				
1+15	0.0325	0.37	Q				
1+20	0.0351	0.37	Q				
1+25	0.0376	0.37	Q				
1+30	0.0401	0.37	Q				
1+35	0.0427	0.37	Q				
1+40	0.0453	0.37	Q				
1+45	0.0478	0.37	QV				
1+50	0.0504	0.38	QV				
1+55	0.0530	0.38	QV				
2+ 0	0.0556	0.38	QV				
2+ 5	0.0582	0.38	QV				
2+10	0.0609	0.38	QV				
2+15	0.0635	0.38	QV				
2+20	0.0661	0.38	QV				
2+25	0.0688	0.39	QV				
2+30	0.0714	0.39	QV				
2+35	0.0741	0.39	QV				
2+40	0.0768	0.39	QV				
2+45	0.0795	0.39	QV				
2+50	0.0822	0.39	QV				
2+55	0.0849	0.39	QV				
3+ 0	0.0876	0.40	QV				
3+ 5	0.0904	0.40	QV				
3+10	0.0931	0.40	QV				
3+15	0.0959	0.40	Q V				
3+20	0.0986	0.40	Q V				
3+25	0.1014	0.40	Q V				
3+30	0.1042	0.41	Q V				
3+35	0.1070	0.41	Q V				
3+40	0.1098	0.41	Q V				
3+45	0.1127	0.41	Q V				
3+50	0.1155	0.41	Q V				
3+55	0.1184	0.41	Q V				
4+ 0	0.1212	0.42	Q V				
4+ 5	0.1241	0.42	Q V				
4+10	0.1270	0.42	Q V				
4+15	0.1299	0.42	Q V				
4+20	0.1328	0.42	Q V				
4+25	0.1357	0.42	Q V				
4+30	0.1387	0.43	Q V				
4+35	0.1416	0.43	Q V				
4+40	0.1446	0.43	Q V				
4+45	0.1476	0.43	Q V				

4+50	0.1506	0.43	Q V	|	|	|	|
4+55	0.1536	0.44	Q V	|	|	|	|
5+ 0	0.1566	0.44	Q V	|	|	|	|
5+ 5	0.1596	0.44	Q V	|	|	|	|
5+10	0.1627	0.44	Q V	|	|	|	|
5+15	0.1657	0.44	Q V	|	|	|	|
5+20	0.1688	0.45	Q V	|	|	|	|
5+25	0.1719	0.45	Q V	|	|	|	|
5+30	0.1750	0.45	Q V	|	|	|	|
5+35	0.1781	0.45	Q V	|	|	|	|
5+40	0.1813	0.46	Q V	|	|	|	|
5+45	0.1844	0.46	Q V	|	|	|	|
5+50	0.1876	0.46	Q V	|	|	|	|
5+55	0.1908	0.46	Q V	|	|	|	|
6+ 0	0.1940	0.47	Q V	|	|	|	|
6+ 5	0.1972	0.47	Q V	|	|	|	|
6+10	0.2004	0.47	Q V	|	|	|	|
6+15	0.2037	0.47	Q V	|	|	|	|
6+20	0.2070	0.47	Q V	|	|	|	|
6+25	0.2103	0.48	Q V	|	|	|	|
6+30	0.2136	0.48	Q V	|	|	|	|
6+35	0.2169	0.48	Q V	|	|	|	|
6+40	0.2202	0.49	Q V	|	|	|	|
6+45	0.2236	0.49	Q V	|	|	|	|
6+50	0.2270	0.49	Q V	|	|	|	|
6+55	0.2304	0.49	Q V	|	|	|	|
7+ 0	0.2338	0.50	Q V	|	|	|	|
7+ 5	0.2372	0.50	Q V	|	|	|	|
7+10	0.2407	0.50	|Q V	|	|	|	|
7+15	0.2442	0.50	|Q V	|	|	|	|
7+20	0.2476	0.51	|Q V	|	|	|	|
7+25	0.2512	0.51	|Q V	|	|	|	|
7+30	0.2547	0.51	|Q V	|	|	|	|
7+35	0.2583	0.52	|Q V	|	|	|	|
7+40	0.2618	0.52	|Q V	|	|	|	|
7+45	0.2655	0.52	|Q V	|	|	|	|
7+50	0.2691	0.53	|Q V	|	|	|	|
7+55	0.2727	0.53	|Q V	|	|	|	|
8+ 0	0.2764	0.53	|Q V	|	|	|	|
8+ 5	0.2801	0.54	|Q V	|	|	|	|
8+10	0.2838	0.54	|Q V	|	|	|	|
8+15	0.2876	0.54	|Q V	|	|	|	|
8+20	0.2913	0.55	|Q V	|	|	|	|
8+25	0.2951	0.55	|Q V	|	|	|	|
8+30	0.2989	0.55	|Q V	|	|	|	|
8+35	0.3028	0.56	|Q V	|	|	|	|
8+40	0.3067	0.56	|Q V	|	|	|	|
8+45	0.3106	0.57	|Q V	|	|	|	|
8+50	0.3145	0.57	|Q V	|	|	|	|
8+55	0.3184	0.57	|Q V	|	|	|	|
9+ 0	0.3224	0.58	|Q V	|	|	|	|
9+ 5	0.3264	0.58	|Q V	|	|	|	|
9+10	0.3305	0.59	|Q V	|	|	|	|
9+15	0.3346	0.59	|Q V	|	|	|	|

9+20	0.3387	0.60	Q	V			
9+25	0.3428	0.60	Q	V			
9+30	0.3470	0.61	Q	V			
9+35	0.3512	0.61	Q	V			
9+40	0.3554	0.61	Q	V			
9+45	0.3597	0.62	Q	V			
9+50	0.3640	0.62	Q	V			
9+55	0.3683	0.63	Q	V			
10+ 0	0.3727	0.64	Q	V			
10+ 5	0.3771	0.64	Q	V			
10+10	0.3815	0.65	Q	V			
10+15	0.3860	0.65	Q	V			
10+20	0.3906	0.66	Q	V			
10+25	0.3951	0.66	Q	V			
10+30	0.3997	0.67	Q	V			
10+35	0.4044	0.68	Q	V			
10+40	0.4091	0.68	Q	V			
10+45	0.4138	0.69	Q	V			
10+50	0.4186	0.70	Q	V			
10+55	0.4235	0.70	Q	V			
11+ 0	0.4284	0.71	Q	V			
11+ 5	0.4333	0.72	Q	V			
11+10	0.4383	0.72	Q	V			
11+15	0.4433	0.73	Q	V			
11+20	0.4484	0.74	Q	V			
11+25	0.4535	0.75	Q	V			
11+30	0.4587	0.76	Q	V			
11+35	0.4640	0.76	Q	V			
11+40	0.4693	0.77	Q	V			
11+45	0.4747	0.78	Q	V			
11+50	0.4802	0.79	Q	V			
11+55	0.4857	0.80	Q	V			
12+ 0	0.4913	0.81	Q	V			
12+ 5	0.4971	0.85	Q	V			
12+10	0.5037	0.95	Q	V			
12+15	0.5106	1.01	Q	V			
12+20	0.5178	1.04	Q	V			
12+25	0.5252	1.06	Q	V			
12+30	0.5326	1.08	Q	V			
12+35	0.5402	1.10	Q	V			
12+40	0.5479	1.12	Q	V			
12+45	0.5557	1.13	Q	V			
12+50	0.5636	1.15	Q	V			
12+55	0.5716	1.17	Q	V			
13+ 0	0.5798	1.18	Q	V			
13+ 5	0.5880	1.20	Q	V			
13+10	0.5964	1.22	Q	V			
13+15	0.6049	1.23	Q	V			
13+20	0.6135	1.25	Q	V			
13+25	0.6223	1.27	Q	V			
13+30	0.6312	1.29	Q	V			
13+35	0.6402	1.31	Q	V			
13+40	0.6494	1.34	Q	V			
13+45	0.6588	1.36	Q	V			



18+20	1.6652	0.84	|Q	|	|	|	V |
18+25	1.6708	0.81	|Q	|	|	|	V |
18+30	1.6762	0.79	|Q	|	|	|	V |
18+35	1.6815	0.76	|Q	|	|	|	V |
18+40	1.6866	0.74	|Q	|	|	|	V |
18+45	1.6916	0.73	|Q	|	|	|	V |
18+50	1.6965	0.71	|Q	|	|	|	V |
18+55	1.7013	0.70	|Q	|	|	|	V |
19+ 0	1.7060	0.68	|Q	|	|	|	V |
19+ 5	1.7106	0.67	|Q	|	|	|	V |
19+10	1.7152	0.66	|Q	|	|	|	V |
19+15	1.7196	0.65	|Q	|	|	|	V |
19+20	1.7240	0.64	|Q	|	|	|	V |
19+25	1.7283	0.63	|Q	|	|	|	V |
19+30	1.7326	0.62	|Q	|	|	|	V |
19+35	1.7367	0.61	|Q	|	|	|	V |
19+40	1.7408	0.60	|Q	|	|	|	V |
19+45	1.7449	0.59	|Q	|	|	|	V |
19+50	1.7489	0.58	|Q	|	|	|	V |
19+55	1.7528	0.57	|Q	|	|	|	V |
20+ 0	1.7567	0.56	|Q	|	|	|	V |
20+ 5	1.7605	0.56	|Q	|	|	|	V |
20+10	1.7643	0.55	|Q	|	|	|	V |
20+15	1.7680	0.54	|Q	|	|	|	V |
20+20	1.7717	0.53	|Q	|	|	|	V |
20+25	1.7753	0.53	|Q	|	|	|	V |
20+30	1.7789	0.52	|Q	|	|	|	V |
20+35	1.7824	0.51	|Q	|	|	|	V |
20+40	1.7859	0.51	|Q	|	|	|	V |
20+45	1.7894	0.50	|Q	|	|	|	V |
20+50	1.7928	0.50	Q	|	|	|	V |
20+55	1.7962	0.49	Q	|	|	|	V |
21+ 0	1.7995	0.49	Q	|	|	|	V |
21+ 5	1.8028	0.48	Q	|	|	|	V |
21+10	1.8061	0.48	Q	|	|	|	V |
21+15	1.8093	0.47	Q	|	|	|	V |
21+20	1.8125	0.47	Q	|	|	|	V |
21+25	1.8157	0.46	Q	|	|	|	V |
21+30	1.8188	0.46	Q	|	|	|	V |
21+35	1.8220	0.45	Q	|	|	|	V |
21+40	1.8250	0.45	Q	|	|	|	V |
21+45	1.8281	0.44	Q	|	|	|	V |
21+50	1.8311	0.44	Q	|	|	|	V |
21+55	1.8341	0.43	Q	|	|	|	V |
22+ 0	1.8371	0.43	Q	|	|	|	V |
22+ 5	1.8400	0.43	Q	|	|	|	V |
22+10	1.8429	0.42	Q	|	|	|	V |
22+15	1.8458	0.42	Q	|	|	|	V |
22+20	1.8487	0.42	Q	|	|	|	V |
22+25	1.8515	0.41	Q	|	|	|	V |
22+30	1.8543	0.41	Q	|	|	|	V |
22+35	1.8571	0.41	Q	|	|	|	V |
22+40	1.8599	0.40	Q	|	|	|	V|
22+45	1.8626	0.40	Q	|	|	|	V|

22+50	1.8654	0.40	Q	|	|	|	V|
22+55	1.8681	0.39	Q	|	|	|	V|
23+ 0	1.8708	0.39	Q	|	|	|	V|
23+ 5	1.8734	0.39	Q	|	|	|	V|
23+10	1.8761	0.38	Q	|	|	|	V|
23+15	1.8787	0.38	Q	|	|	|	V|
23+20	1.8813	0.38	Q	|	|	|	V|
23+25	1.8839	0.38	Q	|	|	|	V|
23+30	1.8864	0.37	Q	|	|	|	V|
23+35	1.8890	0.37	Q	|	|	|	V|
23+40	1.8915	0.37	Q	|	|	|	V|
23+45	1.8940	0.36	Q	|	|	|	V|
23+50	1.8965	0.36	Q	|	|	|	V|
23+55	1.8990	0.36	Q	|	|	|	V|
24+ 0	1.9015	0.36	Q	|	|	|	V|
24+ 5	1.9036	0.31	Q	|	|	|	V|
24+10	1.9047	0.15	Q	|	|	|	V|
24+15	1.9052	0.07	Q	|	|	|	V|
24+20	1.9055	0.04	Q	|	|	|	V|
24+25	1.9057	0.03	Q	|	|	|	V|
24+30	1.9058	0.02	Q	|	|	|	V|
24+35	1.9059	0.01	Q	|	|	|	V|
24+40	1.9059	0.01	Q	|	|	|	V|
24+45	1.9059	0.00	Q	|	|	|	V|
24+50	1.9060	0.00	Q	|	|	|	V|

Appendix 4

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2005
Study date: 03/17/19

Detention Basin 100 year

Program License Serial Number 6004

********** HYDROGRAPH INFORMATION **********

From study/file name: garg100.rte
**********HYDROGRAPH DATA**********
Number of intervals = 298
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 16.637 (CFS)
Total volume = 1.906 (Ac.Ft)
Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

++
Process from Point/Station 105.000 to Point/Station 106.000
**** RETARDING BASIN ROUTING ****
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User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 298
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth	Storage	Outflow	(S-O*dt/2)	(S+O*dt/2)

(Ft.)	(Ac.Ft)	(CFS)	(Ac.Ft)	(Ac.Ft)
0.000	0.000	0.000	0.000	0.000
0.500	0.030	0.001	0.030	0.030
1.080	0.115	0.002	0.115	0.115
1.670	0.257	0.003	0.257	0.257
2.670	0.411	12.880	0.367	0.455

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0 4.2 8.32 12.48 16.64	Depth (Ft.)
0.083	0.04	0.00	0.000	O | | | |	0.00
0.167	0.20	0.00	0.001	O | | | |	0.02
0.250	0.28	0.00	0.003	O | | | |	0.04
0.333	0.31	0.00	0.005	O | | | |	0.08
0.417	0.33	0.00	0.007	O | | | |	0.11
0.500	0.34	0.00	0.009	O | | | |	0.15
0.583	0.34	0.00	0.011	O | | | |	0.19
0.667	0.35	0.00	0.014	O | | | |	0.23
0.750	0.35	0.00	0.016	O | | | |	0.27
0.833	0.36	0.00	0.019	O | | | |	0.31
0.917	0.36	0.00	0.021	O | | | |	0.35
1.000	0.36	0.00	0.024	O | | | |	0.40
1.083	0.36	0.00	0.026	O | | | |	0.44
1.167	0.36	0.00	0.029	O | | | |	0.48
1.250	0.37	0.00	0.031	O | | | |	0.51
1.333	0.37	0.00	0.034	O | | | |	0.53
1.417	0.37	0.00	0.036	O | | | |	0.54
1.500	0.37	0.00	0.039	O | | | |	0.56
1.583	0.37	0.00	0.041	O | | | |	0.58
1.667	0.37	0.00	0.044	O | | | |	0.59
1.750	0.37	0.00	0.046	O | | | |	0.61
1.833	0.38	0.00	0.049	O | | | |	0.63
1.917	0.38	0.00	0.052	O | | | |	0.65
2.000	0.38	0.00	0.054	O | | | |	0.67
2.083	0.38	0.00	0.057	O | | | |	0.68
2.167	0.38	0.00	0.059	O | | | |	0.70
2.250	0.38	0.00	0.062	O | | | |	0.72
2.333	0.38	0.00	0.065	O | | | |	0.74
2.417	0.39	0.00	0.067	O | | | |	0.75
2.500	0.39	0.00	0.070	O | | | |	0.77
2.583	0.39	0.00	0.073	O | | | |	0.79
2.667	0.39	0.00	0.075	O | | | |	0.81
2.750	0.39	0.00	0.078	O | | | |	0.83
2.833	0.39	0.00	0.081	O | | | |	0.85
2.917	0.39	0.00	0.083	O | | | |	0.86
3.000	0.40	0.00	0.086	O | | | |	0.88
3.083	0.40	0.00	0.089	O | | | |	0.90
3.167	0.40	0.00	0.091	O | | | |	0.92
3.250	0.40	0.00	0.094	O | | | |	0.94

3.333	0.40	0.00	0.097	O				0.96
3.417	0.40	0.00	0.100	O				0.98
3.500	0.41	0.00	0.103	O				0.99
3.583	0.41	0.00	0.105	O				1.01
3.667	0.41	0.00	0.108	O				1.03
3.750	0.41	0.00	0.111	O				1.05
3.833	0.41	0.00	0.114	O				1.07
3.917	0.41	0.00	0.117	O				1.09
4.000	0.42	0.00	0.119	O				1.10
4.083	0.42	0.00	0.122	O				1.11
4.167	0.42	0.00	0.125	O				1.12
4.250	0.42	0.00	0.128	O				1.13
4.333	0.42	0.00	0.131	O				1.15
4.417	0.42	0.00	0.134	O				1.16
4.500	0.43	0.00	0.137	O				1.17
4.583	0.43	0.00	0.140	O				1.18
4.667	0.43	0.00	0.143	O				1.19
4.750	0.43	0.00	0.146	O				1.21
4.833	0.43	0.00	0.149	O				1.22
4.917	0.44	0.00	0.152	O				1.23
5.000	0.44	0.00	0.155	O				1.24
5.083	0.44	0.00	0.158	O				1.26
5.167	0.44	0.00	0.161	O				1.27
5.250	0.44	0.00	0.164	O				1.28
5.333	0.45	0.00	0.167	O				1.29
5.417	0.45	0.00	0.170	O				1.31
5.500	0.45	0.00	0.173	O				1.32
5.583	0.45	0.00	0.176	O				1.33
5.667	0.46	0.00	0.179	O				1.35
5.750	0.46	0.00	0.182	O				1.36
5.833	0.46	0.00	0.185	O				1.37
5.917	0.46	0.00	0.188	O				1.39
6.000	0.47	0.00	0.192	O				1.40
6.083	0.47	0.00	0.195	O				1.41
6.167	0.47	0.00	0.198	O				1.42
6.250	0.47	0.00	0.201	O				1.44
6.333	0.47	0.00	0.204	O				1.45
6.417	0.48	0.00	0.208	O				1.47
6.500	0.48	0.00	0.211	O				1.48
6.583	0.48	0.00	0.214	O				1.49
6.667	0.49	0.00	0.218	O				1.51
6.750	0.49	0.00	0.221	O				1.52
6.833	0.49	0.00	0.224	O				1.53
6.917	0.49	0.00	0.228	O				1.55
7.000	0.50	0.00	0.231	O				1.56
7.083	0.50	0.00	0.234	O				1.58
7.167	0.50	0.00	0.238	O				1.59
7.250	0.50	0.00	0.241	O				1.61
7.333	0.51	0.00	0.245	O				1.62
7.417	0.51	0.00	0.248	O				1.63
7.500	0.51	0.00	0.252	O				1.65
7.583	0.52	0.00	0.255	O				1.66
7.667	0.52	0.13	0.258	OI				1.68
7.750	0.52	0.30	0.261	OI				1.69

7.833	0.53	0.40	0.262	OI	|	|	|	1.70
7.917	0.53	0.46	0.262	OI	|	|	|	1.71
8.000	0.53	0.49	0.263	OI	|	|	|	1.71
8.083	0.54	0.51	0.263	OI	|	|	|	1.71
8.167	0.54	0.52	0.263	|O	|	|	|	1.71
8.250	0.54	0.53	0.263	|O	|	|	|	1.71
8.333	0.55	0.54	0.263	|O	|	|	|	1.71
8.417	0.55	0.54	0.263	|O	|	|	|	1.71
8.500	0.55	0.55	0.264	|O	|	|	|	1.71
8.583	0.56	0.55	0.264	|O	|	|	|	1.71
8.667	0.56	0.56	0.264	|O	|	|	|	1.71
8.750	0.57	0.56	0.264	|O	|	|	|	1.71
8.833	0.57	0.56	0.264	|O	|	|	|	1.71
8.917	0.57	0.57	0.264	|O	|	|	|	1.71
9.000	0.58	0.57	0.264	|O	|	|	|	1.71
9.083	0.58	0.58	0.264	|O	|	|	|	1.71
9.167	0.59	0.58	0.264	|O	|	|	|	1.71
9.250	0.59	0.58	0.264	|O	|	|	|	1.72
9.333	0.60	0.59	0.264	|O	|	|	|	1.72
9.417	0.60	0.59	0.264	|O	|	|	|	1.72
9.500	0.61	0.60	0.264	|O	|	|	|	1.72
9.583	0.61	0.60	0.264	|O	|	|	|	1.72
9.667	0.61	0.61	0.264	|O	|	|	|	1.72
9.750	0.62	0.61	0.264	|O	|	|	|	1.72
9.833	0.62	0.62	0.264	|O	|	|	|	1.72
9.917	0.63	0.62	0.264	|O	|	|	|	1.72
10.000	0.64	0.63	0.264	|O	|	|	|	1.72
10.083	0.64	0.63	0.265	|O	|	|	|	1.72
10.167	0.65	0.64	0.265	|O	|	|	|	1.72
10.250	0.65	0.64	0.265	|O	|	|	|	1.72
10.333	0.66	0.65	0.265	|O	|	|	|	1.72
10.417	0.66	0.65	0.265	|O	|	|	|	1.72
10.500	0.67	0.66	0.265	|O	|	|	|	1.72
10.583	0.68	0.67	0.265	|O	|	|	|	1.72
10.667	0.68	0.67	0.265	|O	|	|	|	1.72
10.750	0.69	0.68	0.265	|O	|	|	|	1.72
10.833	0.70	0.68	0.265	|O	|	|	|	1.72
10.917	0.70	0.69	0.265	|O	|	|	|	1.72
11.000	0.71	0.70	0.265	|O	|	|	|	1.72
11.083	0.72	0.70	0.265	|O	|	|	|	1.72
11.167	0.72	0.71	0.265	|O	|	|	|	1.73
11.250	0.73	0.72	0.266	|O	|	|	|	1.73
11.333	0.74	0.73	0.266	|O	|	|	|	1.73
11.417	0.75	0.73	0.266	|O	|	|	|	1.73
11.500	0.76	0.74	0.266	|O	|	|	|	1.73
11.583	0.76	0.75	0.266	|O	|	|	|	1.73
11.667	0.77	0.76	0.266	|O	|	|	|	1.73
11.750	0.78	0.77	0.266	|O	|	|	|	1.73
11.833	0.79	0.78	0.266	|O	|	|	|	1.73
11.917	0.80	0.78	0.266	|O	|	|	|	1.73
12.000	0.81	0.79	0.266	|O	|	|	|	1.73
12.083	0.85	0.81	0.267	|O	|	|	|	1.73
12.167	0.95	0.85	0.267	|O	|	|	|	1.74
12.250	1.01	0.91	0.268	|O	|	|	|	1.74

12.333	1.04	0.96	0.268	OI				1.74
12.417	1.06	1.00	0.269	OI				1.75
12.500	1.08	1.03	0.269	OI				1.75
12.583	1.10	1.06	0.270	O				1.75
12.667	1.12	1.08	0.270	O				1.75
12.750	1.13	1.10	0.270	O				1.76
12.833	1.15	1.12	0.270	O				1.76
12.917	1.17	1.14	0.271	O				1.76
13.000	1.18	1.15	0.271	O				1.76
13.083	1.20	1.17	0.271	O				1.76
13.167	1.22	1.19	0.271	O				1.76
13.250	1.23	1.20	0.271	O				1.76
13.333	1.25	1.22	0.272	O				1.76
13.417	1.27	1.24	0.272	O				1.77
13.500	1.29	1.26	0.272	O				1.77
13.583	1.31	1.28	0.272	O				1.77
13.667	1.34	1.30	0.273	O				1.77
13.750	1.36	1.32	0.273	O				1.77
13.833	1.39	1.35	0.273	O				1.77
13.917	1.41	1.37	0.273	O				1.78
14.000	1.44	1.40	0.274	O				1.78
14.083	1.47	1.42	0.274	O				1.78
14.167	1.51	1.45	0.274	O				1.78
14.250	1.54	1.49	0.275	O				1.79
14.333	1.58	1.52	0.275	OI				1.79
14.417	1.62	1.56	0.276	OI				1.79
14.500	1.66	1.59	0.276	O				1.79
14.583	1.70	1.63	0.276	O				1.80
14.667	1.76	1.68	0.277	O				1.80
14.750	1.81	1.72	0.278	O				1.80
14.833	1.87	1.77	0.278	O				1.81
14.917	1.93	1.83	0.279	O				1.81
15.000	2.00	1.89	0.280	O				1.82
15.083	2.07	1.95	0.280	O				1.82
15.167	2.16	2.03	0.281	OI				1.83
15.250	2.26	2.11	0.282	O				1.83
15.333	2.38	2.20	0.283	O				1.84
15.417	2.46	2.30	0.284	O				1.85
15.500	2.47	2.37	0.285	O				1.85
15.583	2.57	2.44	0.286	O				1.86
15.667	2.78	2.54	0.287	OI				1.87
15.750	3.06	2.71	0.289	O				1.88
15.833	3.50	2.96	0.292	OI				1.90
15.917	4.17	3.35	0.297	O I				1.93
16.000	5.63	4.05	0.305	O I				1.98
16.083	9.82	5.69	0.325	O	I			2.11
16.167	16.64	9.06	0.365		O		I	2.37
16.250	10.61	11.10	0.390		IO			2.53
16.333	6.09	9.87	0.375	I	O			2.44
16.417	4.50	7.83	0.351	I O				2.28
16.500	3.71	6.16	0.331	I O				2.15
16.583	3.22	4.96	0.316	I O				2.05
16.667	2.82	4.09	0.306	I O				1.99
16.750	2.49	3.45	0.298	I O				1.94

16.833	2.24	2.96	0.292	IO				1.90
16.917	2.04	2.60	0.288	IO				1.87
17.000	1.79	2.29	0.284	IO				1.85
17.083	1.68	2.05	0.281	O				1.83
17.167	1.59	1.86	0.279	O				1.81
17.250	1.52	1.73	0.278	IO				1.80
17.333	1.45	1.62	0.276	IO				1.80
17.417	1.40	1.53	0.275	O				1.79
17.500	1.35	1.46	0.274	O				1.78
17.583	1.30	1.40	0.274	O				1.78
17.667	1.26	1.35	0.273	O				1.77
17.750	1.22	1.30	0.272	O				1.77
17.833	1.19	1.26	0.272	O				1.77
17.917	1.15	1.22	0.272	O				1.76
18.000	1.12	1.18	0.271	O				1.76
18.083	1.07	1.14	0.271	O				1.76
18.167	0.95	1.08	0.270	IO				1.75
18.250	0.88	1.01	0.269	O				1.75
18.333	0.84	0.94	0.268	O				1.74
18.417	0.81	0.89	0.268	O				1.74
18.500	0.79	0.85	0.267	O				1.74
18.583	0.76	0.82	0.267	O				1.73
18.667	0.74	0.79	0.266	O				1.73
18.750	0.73	0.76	0.266	O				1.73
18.833	0.71	0.74	0.266	O				1.73
18.917	0.70	0.73	0.266	O				1.73
19.000	0.68	0.71	0.265	O				1.72
19.083	0.67	0.70	0.265	O				1.72
19.167	0.66	0.68	0.265	O				1.72
19.250	0.65	0.67	0.265	O				1.72
19.333	0.64	0.66	0.265	O				1.72
19.417	0.63	0.64	0.265	O				1.72
19.500	0.62	0.63	0.265	O				1.72
19.583	0.61	0.62	0.264	O				1.72
19.667	0.60	0.61	0.264	O				1.72
19.750	0.59	0.60	0.264	O				1.72
19.833	0.58	0.59	0.264	O				1.72
19.917	0.57	0.59	0.264	O				1.72
20.000	0.56	0.58	0.264	O				1.71
20.083	0.56	0.57	0.264	O				1.71
20.167	0.55	0.56	0.264	O				1.71
20.250	0.54	0.55	0.264	O				1.71
20.333	0.53	0.55	0.263	O				1.71
20.417	0.53	0.54	0.263	O				1.71
20.500	0.52	0.53	0.263	O				1.71
20.583	0.51	0.53	0.263	IO				1.71
20.667	0.51	0.52	0.263	O				1.71
20.750	0.50	0.51	0.263	O				1.71
20.833	0.50	0.51	0.263	O				1.71
20.917	0.49	0.50	0.263	O				1.71
21.000	0.49	0.50	0.263	O				1.71
21.083	0.48	0.49	0.263	O				1.71
21.167	0.48	0.48	0.263	O				1.71
21.250	0.47	0.48	0.263	O				1.71

21.333	0.47	0.47	0.263	O	|	|	|	1.71
21.417	0.46	0.47	0.263	O	|	|	|	1.71
21.500	0.46	0.46	0.263	O	|	|	|	1.71
21.583	0.45	0.46	0.262	O	|	|	|	1.71
21.667	0.45	0.45	0.262	O	|	|	|	1.71
21.750	0.44	0.45	0.262	O	|	|	|	1.70
21.833	0.44	0.45	0.262	O	|	|	|	1.70
21.917	0.43	0.44	0.262	O	|	|	|	1.70
22.000	0.43	0.44	0.262	O	|	|	|	1.70
22.083	0.43	0.43	0.262	O	|	|	|	1.70
22.167	0.42	0.43	0.262	O	|	|	|	1.70
22.250	0.42	0.43	0.262	O	|	|	|	1.70
22.333	0.42	0.42	0.262	O	|	|	|	1.70
22.417	0.41	0.42	0.262	O	|	|	|	1.70
22.500	0.41	0.42	0.262	O	|	|	|	1.70
22.583	0.41	0.41	0.262	O	|	|	|	1.70
22.667	0.40	0.41	0.262	O	|	|	|	1.70
22.750	0.40	0.40	0.262	O	|	|	|	1.70
22.833	0.40	0.40	0.262	O	|	|	|	1.70
22.917	0.39	0.40	0.262	O	|	|	|	1.70
23.000	0.39	0.40	0.262	O	|	|	|	1.70
23.083	0.39	0.39	0.262	O	|	|	|	1.70
23.167	0.38	0.39	0.262	O	|	|	|	1.70
23.250	0.38	0.39	0.262	O	|	|	|	1.70
23.333	0.38	0.38	0.262	O	|	|	|	1.70
23.417	0.38	0.38	0.262	O	|	|	|	1.70
23.500	0.37	0.38	0.261	O	|	|	|	1.70
23.583	0.37	0.37	0.261	O	|	|	|	1.70
23.667	0.37	0.37	0.261	O	|	|	|	1.70
23.750	0.36	0.37	0.261	O	|	|	|	1.70
23.833	0.36	0.37	0.261	O	|	|	|	1.70
23.917	0.36	0.36	0.261	O	|	|	|	1.70
24.000	0.36	0.36	0.261	O	|	|	|	1.70
24.083	0.31	0.35	0.261	O	|	|	|	1.70
24.167	0.15	0.30	0.261	O	|	|	|	1.69
24.250	0.07	0.21	0.260	O	|	|	|	1.69
24.333	0.04	0.14	0.259	O	|	|	|	1.68
24.417	0.03	0.10	0.258	O	|	|	|	1.68
24.500	0.02	0.06	0.258	O	|	|	|	1.67
24.583	0.01	0.04	0.257	O	|	|	|	1.67
24.667	0.01	0.03	0.257	O	|	|	|	1.67
24.750	0.00	0.02	0.257	O	|	|	|	1.67
24.833	0.00	0.01	0.257	O	|	|	|	1.67
24.917	0.00	0.01	0.257	O	|	|	|	1.67
25.000	0.00	0.00	0.257	O	|	|	|	1.67
25.083	0.00	0.00	0.257	O	|	|	|	1.67
25.167	0.00	0.00	0.257	O	|	|	|	1.67
25.250	0.00	0.00	0.257	O	|	|	|	1.67
25.333	0.00	0.00	0.257	O	|	|	|	1.67
25.417	0.00	0.00	0.257	O	|	|	|	1.67
25.500	0.00	0.00	0.257	O	|	|	|	1.67
25.583	0.00	0.00	0.257	O	|	|	|	1.67
25.667	0.00	0.00	0.257	O	|	|	|	1.67
25.750	0.00	0.00	0.257	O	|	|	|	1.67

25.833	0.00	0.00	0.257	O				1.67
25.917	0.00	0.00	0.257	O				1.67
26.000	0.00	0.00	0.257	O				1.67
26.083	0.00	0.00	0.257	O				1.67
26.167	0.00	0.00	0.257	O				1.67
26.250	0.00	0.00	0.257	O				1.67
26.333	0.00	0.00	0.257	O				1.67
26.417	0.00	0.00	0.257	O				1.67
26.500	0.00	0.00	0.257	O				1.67
26.583	0.00	0.00	0.257	O				1.67
26.667	0.00	0.00	0.257	O				1.67
26.750	0.00	0.00	0.257	O				1.67
26.833	0.00	0.00	0.257	O				1.67
26.917	0.00	0.00	0.257	O				1.67
27.000	0.00	0.00	0.257	O				1.67
27.083	0.00	0.00	0.256	O				1.67
27.167	0.00	0.00	0.256	O				1.67
27.250	0.00	0.00	0.256	O				1.67
27.333	0.00	0.00	0.256	O				1.67
27.417	0.00	0.00	0.256	O				1.67
27.500	0.00	0.00	0.256	O				1.67
27.583	0.00	0.00	0.256	O				1.67
27.667	0.00	0.00	0.256	O				1.67
27.750	0.00	0.00	0.256	O				1.67
27.833	0.00	0.00	0.256	O				1.67
27.917	0.00	0.00	0.256	O				1.67
28.000	0.00	0.00	0.256	O				1.67
28.083	0.00	0.00	0.256	O				1.67
28.167	0.00	0.00	0.256	O				1.67
28.250	0.00	0.00	0.256	O				1.67
28.333	0.00	0.00	0.256	O				1.67
28.417	0.00	0.00	0.256	O				1.67
28.500	0.00	0.00	0.256	O				1.67
28.583	0.00	0.00	0.256	O				1.67
28.667	0.00	0.00	0.256	O				1.67
28.750	0.00	0.00	0.256	O				1.67
28.833	0.00	0.00	0.256	O				1.67
28.917	0.00	0.00	0.256	O				1.67
29.000	0.00	0.00	0.256	O				1.67
29.083	0.00	0.00	0.256	O				1.67
29.167	0.00	0.00	0.256	O				1.67
29.250	0.00	0.00	0.256	O				1.67
29.333	0.00	0.00	0.256	O				1.67
29.417	0.00	0.00	0.256	O				1.67
29.500	0.00	0.00	0.256	O				1.67
29.583	0.00	0.00	0.256	O				1.67
29.667	0.00	0.00	0.256	O				1.67
29.750	0.00	0.00	0.256	O				1.67
29.833	0.00	0.00	0.256	O				1.67
29.917	0.00	0.00	0.256	O				1.66
30.000	0.00	0.00	0.256	O				1.66
30.083	0.00	0.00	0.256	O				1.66
30.167	0.00	0.00	0.256	O				1.66
30.250	0.00	0.00	0.256	O				1.66

30.333	0.00	0.00	0.256	O	|	|	|	1.66
30.417	0.00	0.00	0.256	O	|	|	|	1.66
30.500	0.00	0.00	0.256	O	|	|	|	1.66
30.583	0.00	0.00	0.256	O	|	|	|	1.66
30.667	0.00	0.00	0.256	O	|	|	|	1.66
30.750	0.00	0.00	0.256	O	|	|	|	1.66
30.833	0.00	0.00	0.256	O	|	|	|	1.66
30.917	0.00	0.00	0.256	O	|	|	|	1.66
31.000	0.00	0.00	0.256	O	|	|	|	1.66
31.083	0.00	0.00	0.255	O	|	|	|	1.66
31.167	0.00	0.00	0.255	O	|	|	|	1.66
31.250	0.00	0.00	0.255	O	|	|	|	1.66
31.333	0.00	0.00	0.255	O	|	|	|	1.66
31.417	0.00	0.00	0.255	O	|	|	|	1.66
31.500	0.00	0.00	0.255	O	|	|	|	1.66
31.583	0.00	0.00	0.255	O	|	|	|	1.66
31.667	0.00	0.00	0.255	O	|	|	|	1.66
31.750	0.00	0.00	0.255	O	|	|	|	1.66
31.833	0.00	0.00	0.255	O	|	|	|	1.66
31.917	0.00	0.00	0.255	O	|	|	|	1.66
32.000	0.00	0.00	0.255	O	|	|	|	1.66
32.083	0.00	0.00	0.255	O	|	|	|	1.66
32.167	0.00	0.00	0.255	O	|	|	|	1.66
32.250	0.00	0.00	0.255	O	|	|	|	1.66
32.333	0.00	0.00	0.255	O	|	|	|	1.66
32.417	0.00	0.00	0.255	O	|	|	|	1.66
32.500	0.00	0.00	0.255	O	|	|	|	1.66
32.583	0.00	0.00	0.255	O	|	|	|	1.66
32.667	0.00	0.00	0.255	O	|	|	|	1.66
32.750	0.00	0.00	0.255	O	|	|	|	1.66
32.833	0.00	0.00	0.255	O	|	|	|	1.66
32.917	0.00	0.00	0.255	O	|	|	|	1.66
33.000	0.00	0.00	0.255	O	|	|	|	1.66
33.083	0.00	0.00	0.255	O	|	|	|	1.66
33.167	0.00	0.00	0.255	O	|	|	|	1.66
33.250	0.00	0.00	0.255	O	|	|	|	1.66
33.333	0.00	0.00	0.255	O	|	|	|	1.66
33.417	0.00	0.00	0.255	O	|	|	|	1.66
33.500	0.00	0.00	0.255	O	|	|	|	1.66
33.583	0.00	0.00	0.255	O	|	|	|	1.66
33.667	0.00	0.00	0.255	O	|	|	|	1.66
33.750	0.00	0.00	0.255	O	|	|	|	1.66
33.833	0.00	0.00	0.255	O	|	|	|	1.66
33.917	0.00	0.00	0.255	O	|	|	|	1.66
34.000	0.00	0.00	0.255	O	|	|	|	1.66
34.083	0.00	0.00	0.255	O	|	|	|	1.66
34.167	0.00	0.00	0.255	O	|	|	|	1.66
34.250	0.00	0.00	0.255	O	|	|	|	1.66
34.333	0.00	0.00	0.255	O	|	|	|	1.66
34.417	0.00	0.00	0.255	O	|	|	|	1.66
34.500	0.00	0.00	0.255	O	|	|	|	1.66
34.583	0.00	0.00	0.255	O	|	|	|	1.66
34.667	0.00	0.00	0.255	O	|	|	|	1.66
34.750	0.00	0.00	0.255	O	|	|	|	1.66

34.833	0.00	0.00	0.255	O	|	|	|	1.66
34.917	0.00	0.00	0.255	O	|	|	|	1.66
35.000	0.00	0.00	0.255	O	|	|	|	1.66
35.083	0.00	0.00	0.255	O	|	|	|	1.66
35.167	0.00	0.00	0.254	O	|	|	|	1.66
35.250	0.00	0.00	0.254	O	|	|	|	1.66
35.333	0.00	0.00	0.254	O	|	|	|	1.66
35.417	0.00	0.00	0.254	O	|	|	|	1.66
35.500	0.00	0.00	0.254	O	|	|	|	1.66
35.583	0.00	0.00	0.254	O	|	|	|	1.66
35.667	0.00	0.00	0.254	O	|	|	|	1.66
35.750	0.00	0.00	0.254	O	|	|	|	1.66
35.833	0.00	0.00	0.254	O	|	|	|	1.66
35.917	0.00	0.00	0.254	O	|	|	|	1.66
36.000	0.00	0.00	0.254	O	|	|	|	1.66
36.083	0.00	0.00	0.254	O	|	|	|	1.66
36.167	0.00	0.00	0.254	O	|	|	|	1.66
36.250	0.00	0.00	0.254	O	|	|	|	1.66
36.333	0.00	0.00	0.254	O	|	|	|	1.66
36.417	0.00	0.00	0.254	O	|	|	|	1.66
36.500	0.00	0.00	0.254	O	|	|	|	1.66
36.583	0.00	0.00	0.254	O	|	|	|	1.66
36.667	0.00	0.00	0.254	O	|	|	|	1.66
36.750	0.00	0.00	0.254	O	|	|	|	1.66
36.833	0.00	0.00	0.254	O	|	|	|	1.66
36.917	0.00	0.00	0.254	O	|	|	|	1.66
37.000	0.00	0.00	0.254	O	|	|	|	1.66
37.083	0.00	0.00	0.254	O	|	|	|	1.66
37.167	0.00	0.00	0.254	O	|	|	|	1.66
37.250	0.00	0.00	0.254	O	|	|	|	1.66
37.333	0.00	0.00	0.254	O	|	|	|	1.66
37.417	0.00	0.00	0.254	O	|	|	|	1.66
37.500	0.00	0.00	0.254	O	|	|	|	1.66
37.583	0.00	0.00	0.254	O	|	|	|	1.66
37.667	0.00	0.00	0.254	O	|	|	|	1.66
37.750	0.00	0.00	0.254	O	|	|	|	1.66
37.833	0.00	0.00	0.254	O	|	|	|	1.66
37.917	0.00	0.00	0.254	O	|	|	|	1.66
38.000	0.00	0.00	0.254	O	|	|	|	1.66
38.083	0.00	0.00	0.254	O	|	|	|	1.66
38.167	0.00	0.00	0.254	O	|	|	|	1.66
38.250	0.00	0.00	0.254	O	|	|	|	1.66
38.333	0.00	0.00	0.254	O	|	|	|	1.66
38.417	0.00	0.00	0.254	O	|	|	|	1.66
38.500	0.00	0.00	0.254	O	|	|	|	1.66
38.583	0.00	0.00	0.254	O	|	|	|	1.66
38.667	0.00	0.00	0.254	O	|	|	|	1.66
38.750	0.00	0.00	0.254	O	|	|	|	1.66
38.833	0.00	0.00	0.254	O	|	|	|	1.66
38.917	0.00	0.00	0.254	O	|	|	|	1.66
39.000	0.00	0.00	0.254	O	|	|	|	1.66
39.083	0.00	0.00	0.254	O	|	|	|	1.66
39.167	0.00	0.00	0.254	O	|	|	|	1.66
39.250	0.00	0.00	0.253	O	|	|	|	1.66

39.333	0.00	0.00	0.253	O	|	|	|	1.66
39.417	0.00	0.00	0.253	O	|	|	|	1.66
39.500	0.00	0.00	0.253	O	|	|	|	1.66
39.583	0.00	0.00	0.253	O	|	|	|	1.66
39.667	0.00	0.00	0.253	O	|	|	|	1.65
39.750	0.00	0.00	0.253	O	|	|	|	1.65
39.833	0.00	0.00	0.253	O	|	|	|	1.65
39.917	0.00	0.00	0.253	O	|	|	|	1.65
40.000	0.00	0.00	0.253	O	|	|	|	1.65
40.083	0.00	0.00	0.253	O	|	|	|	1.65
40.167	0.00	0.00	0.253	O	|	|	|	1.65
40.250	0.00	0.00	0.253	O	|	|	|	1.65
40.333	0.00	0.00	0.253	O	|	|	|	1.65
40.417	0.00	0.00	0.253	O	|	|	|	1.65
40.500	0.00	0.00	0.253	O	|	|	|	1.65
40.583	0.00	0.00	0.253	O	|	|	|	1.65
40.667	0.00	0.00	0.253	O	|	|	|	1.65
40.750	0.00	0.00	0.253	O	|	|	|	1.65
40.833	0.00	0.00	0.253	O	|	|	|	1.65
40.917	0.00	0.00	0.253	O	|	|	|	1.65
41.000	0.00	0.00	0.253	O	|	|	|	1.65
41.083	0.00	0.00	0.253	O	|	|	|	1.65
41.167	0.00	0.00	0.253	O	|	|	|	1.65
41.250	0.00	0.00	0.253	O	|	|	|	1.65
41.333	0.00	0.00	0.253	O	|	|	|	1.65
41.417	0.00	0.00	0.253	O	|	|	|	1.65
41.500	0.00	0.00	0.253	O	|	|	|	1.65
41.583	0.00	0.00	0.253	O	|	|	|	1.65
41.667	0.00	0.00	0.253	O	|	|	|	1.65
41.750	0.00	0.00	0.253	O	|	|	|	1.65
41.833	0.00	0.00	0.253	O	|	|	|	1.65
41.917	0.00	0.00	0.253	O	|	|	|	1.65
42.000	0.00	0.00	0.253	O	|	|	|	1.65
42.083	0.00	0.00	0.253	O	|	|	|	1.65
42.167	0.00	0.00	0.253	O	|	|	|	1.65
42.250	0.00	0.00	0.253	O	|	|	|	1.65
42.333	0.00	0.00	0.253	O	|	|	|	1.65
42.417	0.00	0.00	0.253	O	|	|	|	1.65
42.500	0.00	0.00	0.253	O	|	|	|	1.65
42.583	0.00	0.00	0.253	O	|	|	|	1.65
42.667	0.00	0.00	0.253	O	|	|	|	1.65
42.750	0.00	0.00	0.253	O	|	|	|	1.65
42.833	0.00	0.00	0.253	O	|	|	|	1.65
42.917	0.00	0.00	0.253	O	|	|	|	1.65
43.000	0.00	0.00	0.253	O	|	|	|	1.65
43.083	0.00	0.00	0.253	O	|	|	|	1.65
43.167	0.00	0.00	0.253	O	|	|	|	1.65
43.250	0.00	0.00	0.253	O	|	|	|	1.65
43.333	0.00	0.00	0.252	O	|	|	|	1.65
43.417	0.00	0.00	0.252	O	|	|	|	1.65
43.500	0.00	0.00	0.252	O	|	|	|	1.65
43.583	0.00	0.00	0.252	O	|	|	|	1.65
43.667	0.00	0.00	0.252	O	|	|	|	1.65
43.750	0.00	0.00	0.252	O	|	|	|	1.65

43.833	0.00	0.00	0.252	O	|	|	|	1.65
43.917	0.00	0.00	0.252	O	|	|	|	1.65
44.000	0.00	0.00	0.252	O	|	|	|	1.65
44.083	0.00	0.00	0.252	O	|	|	|	1.65
44.167	0.00	0.00	0.252	O	|	|	|	1.65
44.250	0.00	0.00	0.252	O	|	|	|	1.65
44.333	0.00	0.00	0.252	O	|	|	|	1.65
44.417	0.00	0.00	0.252	O	|	|	|	1.65
44.500	0.00	0.00	0.252	O	|	|	|	1.65
44.583	0.00	0.00	0.252	O	|	|	|	1.65
44.667	0.00	0.00	0.252	O	|	|	|	1.65
44.750	0.00	0.00	0.252	O	|	|	|	1.65
44.833	0.00	0.00	0.252	O	|	|	|	1.65
44.917	0.00	0.00	0.252	O	|	|	|	1.65
45.000	0.00	0.00	0.252	O	|	|	|	1.65
45.083	0.00	0.00	0.252	O	|	|	|	1.65
45.167	0.00	0.00	0.252	O	|	|	|	1.65
45.250	0.00	0.00	0.252	O	|	|	|	1.65
45.333	0.00	0.00	0.252	O	|	|	|	1.65
45.417	0.00	0.00	0.252	O	|	|	|	1.65
45.500	0.00	0.00	0.252	O	|	|	|	1.65
45.583	0.00	0.00	0.252	O	|	|	|	1.65
45.667	0.00	0.00	0.252	O	|	|	|	1.65
45.750	0.00	0.00	0.252	O	|	|	|	1.65
45.833	0.00	0.00	0.252	O	|	|	|	1.65
45.917	0.00	0.00	0.252	O	|	|	|	1.65
46.000	0.00	0.00	0.252	O	|	|	|	1.65
46.083	0.00	0.00	0.252	O	|	|	|	1.65
46.167	0.00	0.00	0.252	O	|	|	|	1.65
46.250	0.00	0.00	0.252	O	|	|	|	1.65
46.333	0.00	0.00	0.252	O	|	|	|	1.65
46.417	0.00	0.00	0.252	O	|	|	|	1.65
46.500	0.00	0.00	0.252	O	|	|	|	1.65
46.583	0.00	0.00	0.252	O	|	|	|	1.65
46.667	0.00	0.00	0.252	O	|	|	|	1.65
46.750	0.00	0.00	0.252	O	|	|	|	1.65
46.833	0.00	0.00	0.252	O	|	|	|	1.65
46.917	0.00	0.00	0.252	O	|	|	|	1.65
47.000	0.00	0.00	0.252	O	|	|	|	1.65
47.083	0.00	0.00	0.252	O	|	|	|	1.65
47.167	0.00	0.00	0.252	O	|	|	|	1.65
47.250	0.00	0.00	0.252	O	|	|	|	1.65
47.333	0.00	0.00	0.252	O	|	|	|	1.65
47.417	0.00	0.00	0.251	O	|	|	|	1.65
47.500	0.00	0.00	0.251	O	|	|	|	1.65
47.583	0.00	0.00	0.251	O	|	|	|	1.65
47.667	0.00	0.00	0.251	O	|	|	|	1.65
47.750	0.00	0.00	0.251	O	|	|	|	1.65
47.833	0.00	0.00	0.251	O	|	|	|	1.65
47.917	0.00	0.00	0.251	O	|	|	|	1.65
48.000	0.00	0.00	0.251	O	|	|	|	1.65
48.083	0.00	0.00	0.251	O	|	|	|	1.65
48.167	0.00	0.00	0.251	O	|	|	|	1.65
48.250	0.00	0.00	0.251	O	|	|	|	1.65

48.333	0.00	0.00	0.251	O	|	|	|	1.65
48.417	0.00	0.00	0.251	O	|	|	|	1.65
48.500	0.00	0.00	0.251	O	|	|	|	1.65
48.583	0.00	0.00	0.251	O	|	|	|	1.65
48.667	0.00	0.00	0.251	O	|	|	|	1.65
48.750	0.00	0.00	0.251	O	|	|	|	1.65
48.833	0.00	0.00	0.251	O	|	|	|	1.65
48.917	0.00	0.00	0.251	O	|	|	|	1.65
49.000	0.00	0.00	0.251	O	|	|	|	1.65
49.083	0.00	0.00	0.251	O	|	|	|	1.65
49.167	0.00	0.00	0.251	O	|	|	|	1.65
49.250	0.00	0.00	0.251	O	|	|	|	1.65
49.333	0.00	0.00	0.251	O	|	|	|	1.65
49.417	0.00	0.00	0.251	O	|	|	|	1.65
49.500	0.00	0.00	0.251	O	|	|	|	1.64
49.583	0.00	0.00	0.251	O	|	|	|	1.64
49.667	0.00	0.00	0.251	O	|	|	|	1.64
49.750	0.00	0.00	0.251	O	|	|	|	1.64
49.833	0.00	0.00	0.251	O	|	|	|	1.64
49.917	0.00	0.00	0.251	O	|	|	|	1.64
50.000	0.00	0.00	0.251	O	|	|	|	1.64
50.083	0.00	0.00	0.251	O	|	|	|	1.64
50.167	0.00	0.00	0.251	O	|	|	|	1.64
50.250	0.00	0.00	0.251	O	|	|	|	1.64
50.333	0.00	0.00	0.251	O	|	|	|	1.64
50.417	0.00	0.00	0.251	O	|	|	|	1.64
50.500	0.00	0.00	0.251	O	|	|	|	1.64
50.583	0.00	0.00	0.251	O	|	|	|	1.64
50.667	0.00	0.00	0.251	O	|	|	|	1.64
50.750	0.00	0.00	0.251	O	|	|	|	1.64
50.833	0.00	0.00	0.251	O	|	|	|	1.64
50.917	0.00	0.00	0.251	O	|	|	|	1.64
51.000	0.00	0.00	0.251	O	|	|	|	1.64
51.083	0.00	0.00	0.251	O	|	|	|	1.64
51.167	0.00	0.00	0.251	O	|	|	|	1.64
51.250	0.00	0.00	0.251	O	|	|	|	1.64
51.333	0.00	0.00	0.251	O	|	|	|	1.64
51.417	0.00	0.00	0.251	O	|	|	|	1.64
51.500	0.00	0.00	0.250	O	|	|	|	1.64
51.583	0.00	0.00	0.250	O	|	|	|	1.64
51.667	0.00	0.00	0.250	O	|	|	|	1.64
51.750	0.00	0.00	0.250	O	|	|	|	1.64
51.833	0.00	0.00	0.250	O	|	|	|	1.64
51.917	0.00	0.00	0.250	O	|	|	|	1.64
52.000	0.00	0.00	0.250	O	|	|	|	1.64
52.083	0.00	0.00	0.250	O	|	|	|	1.64
52.167	0.00	0.00	0.250	O	|	|	|	1.64
52.250	0.00	0.00	0.250	O	|	|	|	1.64
52.333	0.00	0.00	0.250	O	|	|	|	1.64
52.417	0.00	0.00	0.250	O	|	|	|	1.64
52.500	0.00	0.00	0.250	O	|	|	|	1.64
52.583	0.00	0.00	0.250	O	|	|	|	1.64
52.667	0.00	0.00	0.250	O	|	|	|	1.64
52.750	0.00	0.00	0.250	O	|	|	|	1.64

52.833	0.00	0.00	0.250	O	|	|	|	1.64
52.917	0.00	0.00	0.250	O	|	|	|	1.64
53.000	0.00	0.00	0.250	O	|	|	|	1.64
53.083	0.00	0.00	0.250	O	|	|	|	1.64
53.167	0.00	0.00	0.250	O	|	|	|	1.64
53.250	0.00	0.00	0.250	O	|	|	|	1.64
53.333	0.00	0.00	0.250	O	|	|	|	1.64
53.417	0.00	0.00	0.250	O	|	|	|	1.64
53.500	0.00	0.00	0.250	O	|	|	|	1.64
53.583	0.00	0.00	0.250	O	|	|	|	1.64
53.667	0.00	0.00	0.250	O	|	|	|	1.64
53.750	0.00	0.00	0.250	O	|	|	|	1.64
53.833	0.00	0.00	0.250	O	|	|	|	1.64
53.917	0.00	0.00	0.250	O	|	|	|	1.64
54.000	0.00	0.00	0.250	O	|	|	|	1.64
54.083	0.00	0.00	0.250	O	|	|	|	1.64
54.167	0.00	0.00	0.250	O	|	|	|	1.64
54.250	0.00	0.00	0.250	O	|	|	|	1.64
54.333	0.00	0.00	0.250	O	|	|	|	1.64
54.417	0.00	0.00	0.250	O	|	|	|	1.64
54.500	0.00	0.00	0.250	O	|	|	|	1.64
54.583	0.00	0.00	0.250	O	|	|	|	1.64
54.667	0.00	0.00	0.250	O	|	|	|	1.64
54.750	0.00	0.00	0.250	O	|	|	|	1.64
54.833	0.00	0.00	0.250	O	|	|	|	1.64
54.917	0.00	0.00	0.250	O	|	|	|	1.64
55.000	0.00	0.00	0.250	O	|	|	|	1.64
55.083	0.00	0.00	0.250	O	|	|	|	1.64
55.167	0.00	0.00	0.250	O	|	|	|	1.64
55.250	0.00	0.00	0.250	O	|	|	|	1.64
55.333	0.00	0.00	0.250	O	|	|	|	1.64
55.417	0.00	0.00	0.250	O	|	|	|	1.64
55.500	0.00	0.00	0.250	O	|	|	|	1.64
55.583	0.00	0.00	0.249	O	|	|	|	1.64
55.667	0.00	0.00	0.249	O	|	|	|	1.64
55.750	0.00	0.00	0.249	O	|	|	|	1.64
55.833	0.00	0.00	0.249	O	|	|	|	1.64
55.917	0.00	0.00	0.249	O	|	|	|	1.64
56.000	0.00	0.00	0.249	O	|	|	|	1.64
56.083	0.00	0.00	0.249	O	|	|	|	1.64
56.167	0.00	0.00	0.249	O	|	|	|	1.64
56.250	0.00	0.00	0.249	O	|	|	|	1.64
56.333	0.00	0.00	0.249	O	|	|	|	1.64
56.417	0.00	0.00	0.249	O	|	|	|	1.64
56.500	0.00	0.00	0.249	O	|	|	|	1.64
56.583	0.00	0.00	0.249	O	|	|	|	1.64
56.667	0.00	0.00	0.249	O	|	|	|	1.64
56.750	0.00	0.00	0.249	O	|	|	|	1.64
56.833	0.00	0.00	0.249	O	|	|	|	1.64
56.917	0.00	0.00	0.249	O	|	|	|	1.64
57.000	0.00	0.00	0.249	O	|	|	|	1.64
57.083	0.00	0.00	0.249	O	|	|	|	1.64
57.167	0.00	0.00	0.249	O	|	|	|	1.64
57.250	0.00	0.00	0.249	O	|	|	|	1.64

57.333	0.00	0.00	0.249	O	|	|	|	1.64
57.417	0.00	0.00	0.249	O	|	|	|	1.64
57.500	0.00	0.00	0.249	O	|	|	|	1.64
57.583	0.00	0.00	0.249	O	|	|	|	1.64
57.667	0.00	0.00	0.249	O	|	|	|	1.64
57.750	0.00	0.00	0.249	O	|	|	|	1.64
57.833	0.00	0.00	0.249	O	|	|	|	1.64
57.917	0.00	0.00	0.249	O	|	|	|	1.64
58.000	0.00	0.00	0.249	O	|	|	|	1.64
58.083	0.00	0.00	0.249	O	|	|	|	1.64
58.167	0.00	0.00	0.249	O	|	|	|	1.64
58.250	0.00	0.00	0.249	O	|	|	|	1.64
58.333	0.00	0.00	0.249	O	|	|	|	1.64
58.417	0.00	0.00	0.249	O	|	|	|	1.64
58.500	0.00	0.00	0.249	O	|	|	|	1.64
58.583	0.00	0.00	0.249	O	|	|	|	1.64
58.667	0.00	0.00	0.249	O	|	|	|	1.64
58.750	0.00	0.00	0.249	O	|	|	|	1.64
58.833	0.00	0.00	0.249	O	|	|	|	1.64
58.917	0.00	0.00	0.249	O	|	|	|	1.64
59.000	0.00	0.00	0.249	O	|	|	|	1.64
59.083	0.00	0.00	0.249	O	|	|	|	1.64
59.167	0.00	0.00	0.249	O	|	|	|	1.64
59.250	0.00	0.00	0.249	O	|	|	|	1.64
59.333	0.00	0.00	0.249	O	|	|	|	1.64
59.417	0.00	0.00	0.249	O	|	|	|	1.63
59.500	0.00	0.00	0.249	O	|	|	|	1.63
59.583	0.00	0.00	0.249	O	|	|	|	1.63
59.667	0.00	0.00	0.248	O	|	|	|	1.63
59.750	0.00	0.00	0.248	O	|	|	|	1.63
59.833	0.00	0.00	0.248	O	|	|	|	1.63
59.917	0.00	0.00	0.248	O	|	|	|	1.63
60.000	0.00	0.00	0.248	O	|	|	|	1.63
60.083	0.00	0.00	0.248	O	|	|	|	1.63
60.167	0.00	0.00	0.248	O	|	|	|	1.63
60.250	0.00	0.00	0.248	O	|	|	|	1.63
60.333	0.00	0.00	0.248	O	|	|	|	1.63
60.417	0.00	0.00	0.248	O	|	|	|	1.63
60.500	0.00	0.00	0.248	O	|	|	|	1.63
60.583	0.00	0.00	0.248	O	|	|	|	1.63
60.667	0.00	0.00	0.248	O	|	|	|	1.63
60.750	0.00	0.00	0.248	O	|	|	|	1.63
60.833	0.00	0.00	0.248	O	|	|	|	1.63
60.917	0.00	0.00	0.248	O	|	|	|	1.63
61.000	0.00	0.00	0.248	O	|	|	|	1.63
61.083	0.00	0.00	0.248	O	|	|	|	1.63
61.167	0.00	0.00	0.248	O	|	|	|	1.63
61.250	0.00	0.00	0.248	O	|	|	|	1.63
61.333	0.00	0.00	0.248	O	|	|	|	1.63
61.417	0.00	0.00	0.248	O	|	|	|	1.63
61.500	0.00	0.00	0.248	O	|	|	|	1.63
61.583	0.00	0.00	0.248	O	|	|	|	1.63
61.667	0.00	0.00	0.248	O	|	|	|	1.63
61.750	0.00	0.00	0.248	O	|	|	|	1.63

61.833	0.00	0.00	0.248	O	|	|	|	1.63
61.917	0.00	0.00	0.248	O	|	|	|	1.63
62.000	0.00	0.00	0.248	O	|	|	|	1.63
62.083	0.00	0.00	0.248	O	|	|	|	1.63
62.167	0.00	0.00	0.248	O	|	|	|	1.63
62.250	0.00	0.00	0.248	O	|	|	|	1.63
62.333	0.00	0.00	0.248	O	|	|	|	1.63
62.417	0.00	0.00	0.248	O	|	|	|	1.63
62.500	0.00	0.00	0.248	O	|	|	|	1.63
62.583	0.00	0.00	0.248	O	|	|	|	1.63
62.667	0.00	0.00	0.248	O	|	|	|	1.63
62.750	0.00	0.00	0.248	O	|	|	|	1.63
62.833	0.00	0.00	0.248	O	|	|	|	1.63
62.917	0.00	0.00	0.248	O	|	|	|	1.63
63.000	0.00	0.00	0.248	O	|	|	|	1.63
63.083	0.00	0.00	0.248	O	|	|	|	1.63
63.167	0.00	0.00	0.248	O	|	|	|	1.63
63.250	0.00	0.00	0.248	O	|	|	|	1.63
63.333	0.00	0.00	0.248	O	|	|	|	1.63
63.417	0.00	0.00	0.248	O	|	|	|	1.63
63.500	0.00	0.00	0.248	O	|	|	|	1.63
63.583	0.00	0.00	0.248	O	|	|	|	1.63
63.667	0.00	0.00	0.248	O	|	|	|	1.63
63.750	0.00	0.00	0.248	O	|	|	|	1.63
63.833	0.00	0.00	0.247	O	|	|	|	1.63
63.917	0.00	0.00	0.247	O	|	|	|	1.63
64.000	0.00	0.00	0.247	O	|	|	|	1.63
64.083	0.00	0.00	0.247	O	|	|	|	1.63
64.167	0.00	0.00	0.247	O	|	|	|	1.63
64.250	0.00	0.00	0.247	O	|	|	|	1.63
64.333	0.00	0.00	0.247	O	|	|	|	1.63
64.417	0.00	0.00	0.247	O	|	|	|	1.63
64.500	0.00	0.00	0.247	O	|	|	|	1.63
64.583	0.00	0.00	0.247	O	|	|	|	1.63
64.667	0.00	0.00	0.247	O	|	|	|	1.63
64.750	0.00	0.00	0.247	O	|	|	|	1.63
64.833	0.00	0.00	0.247	O	|	|	|	1.63
64.917	0.00	0.00	0.247	O	|	|	|	1.63
65.000	0.00	0.00	0.247	O	|	|	|	1.63
65.083	0.00	0.00	0.247	O	|	|	|	1.63
65.167	0.00	0.00	0.247	O	|	|	|	1.63
65.250	0.00	0.00	0.247	O	|	|	|	1.63
65.333	0.00	0.00	0.247	O	|	|	|	1.63
65.417	0.00	0.00	0.247	O	|	|	|	1.63
65.500	0.00	0.00	0.247	O	|	|	|	1.63
65.583	0.00	0.00	0.247	O	|	|	|	1.63
65.667	0.00	0.00	0.247	O	|	|	|	1.63
65.750	0.00	0.00	0.247	O	|	|	|	1.63
65.833	0.00	0.00	0.247	O	|	|	|	1.63
65.917	0.00	0.00	0.247	O	|	|	|	1.63
66.000	0.00	0.00	0.247	O	|	|	|	1.63
66.083	0.00	0.00	0.247	O	|	|	|	1.63
66.167	0.00	0.00	0.247	O	|	|	|	1.63
66.250	0.00	0.00	0.247	O	|	|	|	1.63

66.333	0.00	0.00	0.247	O	|	|	|	| 1.63
66.417	0.00	0.00	0.247	O	|	|	|	| 1.63
66.500	0.00	0.00	0.247	O	|	|	|	| 1.63
66.583	0.00	0.00	0.247	O	|	|	|	| 1.63
66.667	0.00	0.00	0.247	O	|	|	|	| 1.63
66.750	0.00	0.00	0.247	O	|	|	|	| 1.63
66.833	0.00	0.00	0.247	O	|	|	|	| 1.63
66.917	0.00	0.00	0.247	O	|	|	|	| 1.63
67.000	0.00	0.00	0.247	O	|	|	|	| 1.63
67.083	0.00	0.00	0.247	O	|	|	|	| 1.63
67.167	0.00	0.00	0.247	O	|	|	|	| 1.63
67.250	0.00	0.00	0.247	O	|	|	|	| 1.63
67.333	0.00	0.00	0.247	O	|	|	|	| 1.63
67.417	0.00	0.00	0.247	O	|	|	|	| 1.63
67.500	0.00	0.00	0.247	O	|	|	|	| 1.63
67.583	0.00	0.00	0.247	O	|	|	|	| 1.63
67.667	0.00	0.00	0.247	O	|	|	|	| 1.63
67.750	0.00	0.00	0.247	O	|	|	|	| 1.63
67.833	0.00	0.00	0.247	O	|	|	|	| 1.63
67.917	0.00	0.00	0.246	O	|	|	|	| 1.63
68.000	0.00	0.00	0.246	O	|	|	|	| 1.63
68.083	0.00	0.00	0.246	O	|	|	|	| 1.63
68.167	0.00	0.00	0.246	O	|	|	|	| 1.63
68.250	0.00	0.00	0.246	O	|	|	|	| 1.63
68.333	0.00	0.00	0.246	O	|	|	|	| 1.63
68.417	0.00	0.00	0.246	O	|	|	|	| 1.63
68.500	0.00	0.00	0.246	O	|	|	|	| 1.63
68.583	0.00	0.00	0.246	O	|	|	|	| 1.63
68.667	0.00	0.00	0.246	O	|	|	|	| 1.63
68.750	0.00	0.00	0.246	O	|	|	|	| 1.63
68.833	0.00	0.00	0.246	O	|	|	|	| 1.63
68.917	0.00	0.00	0.246	O	|	|	|	| 1.63
69.000	0.00	0.00	0.246	O	|	|	|	| 1.63
69.083	0.00	0.00	0.246	O	|	|	|	| 1.63
69.167	0.00	0.00	0.246	O	|	|	|	| 1.63
69.250	0.00	0.00	0.246	O	|	|	|	| 1.63
69.333	0.00	0.00	0.246	O	|	|	|	| 1.62
69.417	0.00	0.00	0.246	O	|	|	|	| 1.62
69.500	0.00	0.00	0.246	O	|	|	|	| 1.62
69.583	0.00	0.00	0.246	O	|	|	|	| 1.62
69.667	0.00	0.00	0.246	O	|	|	|	| 1.62
69.750	0.00	0.00	0.246	O	|	|	|	| 1.62
69.833	0.00	0.00	0.246	O	|	|	|	| 1.62
69.917	0.00	0.00	0.246	O	|	|	|	| 1.62
70.000	0.00	0.00	0.246	O	|	|	|	| 1.62
70.083	0.00	0.00	0.246	O	|	|	|	| 1.62
70.167	0.00	0.00	0.246	O	|	|	|	| 1.62
70.250	0.00	0.00	0.246	O	|	|	|	| 1.62
70.333	0.00	0.00	0.246	O	|	|	|	| 1.62
70.417	0.00	0.00	0.246	O	|	|	|	| 1.62
70.500	0.00	0.00	0.246	O	|	|	|	| 1.62
70.583	0.00	0.00	0.246	O	|	|	|	| 1.62
70.667	0.00	0.00	0.246	O	|	|	|	| 1.62
70.750	0.00	0.00	0.246	O	|	|	|	| 1.62

70.833	0.00	0.00	0.246	O	|	|	|	| 1.62
70.917	0.00	0.00	0.246	O	|	|	|	| 1.62
71.000	0.00	0.00	0.246	O	|	|	|	| 1.62
71.083	0.00	0.00	0.246	O	|	|	|	| 1.62
71.167	0.00	0.00	0.246	O	|	|	|	| 1.62
71.250	0.00	0.00	0.246	O	|	|	|	| 1.62
71.333	0.00	0.00	0.246	O	|	|	|	| 1.62
71.417	0.00	0.00	0.246	O	|	|	|	| 1.62
71.500	0.00	0.00	0.246	O	|	|	|	| 1.62
71.583	0.00	0.00	0.246	O	|	|	|	| 1.62
71.667	0.00	0.00	0.246	O	|	|	|	| 1.62
71.750	0.00	0.00	0.246	O	|	|	|	| 1.62
71.833	0.00	0.00	0.246	O	|	|	|	| 1.62
71.917	0.00	0.00	0.246	O	|	|	|	| 1.62
72.000	0.00	0.00	0.246	O	|	|	|	| 1.62
72.083	0.00	0.00	0.245	O	|	|	|	| 1.62
72.167	0.00	0.00	0.245	O	|	|	|	| 1.62
72.250	0.00	0.00	0.245	O	|	|	|	| 1.62
72.333	0.00	0.00	0.245	O	|	|	|	| 1.62
72.417	0.00	0.00	0.245	O	|	|	|	| 1.62
72.500	0.00	0.00	0.245	O	|	|	|	| 1.62
72.583	0.00	0.00	0.245	O	|	|	|	| 1.62
72.667	0.00	0.00	0.245	O	|	|	|	| 1.62
72.750	0.00	0.00	0.245	O	|	|	|	| 1.62
72.833	0.00	0.00	0.245	O	|	|	|	| 1.62
72.917	0.00	0.00	0.245	O	|	|	|	| 1.62
73.000	0.00	0.00	0.245	O	|	|	|	| 1.62
73.083	0.00	0.00	0.245	O	|	|	|	| 1.62
73.167	0.00	0.00	0.245	O	|	|	|	| 1.62
73.250	0.00	0.00	0.245	O	|	|	|	| 1.62
73.333	0.00	0.00	0.245	O	|	|	|	| 1.62
73.417	0.00	0.00	0.245	O	|	|	|	| 1.62
73.500	0.00	0.00	0.245	O	|	|	|	| 1.62
73.583	0.00	0.00	0.245	O	|	|	|	| 1.62
73.667	0.00	0.00	0.245	O	|	|	|	| 1.62
73.750	0.00	0.00	0.245	O	|	|	|	| 1.62
73.833	0.00	0.00	0.245	O	|	|	|	| 1.62
73.917	0.00	0.00	0.245	O	|	|	|	| 1.62
74.000	0.00	0.00	0.245	O	|	|	|	| 1.62
74.083	0.00	0.00	0.245	O	|	|	|	| 1.62
74.167	0.00	0.00	0.245	O	|	|	|	| 1.62
74.250	0.00	0.00	0.245	O	|	|	|	| 1.62
74.333	0.00	0.00	0.245	O	|	|	|	| 1.62
74.417	0.00	0.00	0.245	O	|	|	|	| 1.62
74.500	0.00	0.00	0.245	O	|	|	|	| 1.62
74.583	0.00	0.00	0.245	O	|	|	|	| 1.62
74.667	0.00	0.00	0.245	O	|	|	|	| 1.62
74.750	0.00	0.00	0.245	O	|	|	|	| 1.62
74.833	0.00	0.00	0.245	O	|	|	|	| 1.62
74.917	0.00	0.00	0.245	O	|	|	|	| 1.62
75.000	0.00	0.00	0.245	O	|	|	|	| 1.62
75.083	0.00	0.00	0.245	O	|	|	|	| 1.62
75.167	0.00	0.00	0.245	O	|	|	|	| 1.62
75.250	0.00	0.00	0.245	O	|	|	|	| 1.62

75.333	0.00	0.00	0.245	O	|	|	|	| 1.62
75.417	0.00	0.00	0.245	O	|	|	|	| 1.62
75.500	0.00	0.00	0.245	O	|	|	|	| 1.62
75.583	0.00	0.00	0.245	O	|	|	|	| 1.62
75.667	0.00	0.00	0.245	O	|	|	|	| 1.62
75.750	0.00	0.00	0.245	O	|	|	|	| 1.62
75.833	0.00	0.00	0.245	O	|	|	|	| 1.62
75.917	0.00	0.00	0.245	O	|	|	|	| 1.62
76.000	0.00	0.00	0.245	O	|	|	|	| 1.62
76.083	0.00	0.00	0.245	O	|	|	|	| 1.62
76.167	0.00	0.00	0.245	O	|	|	|	| 1.62
76.250	0.00	0.00	0.244	O	|	|	|	| 1.62
76.333	0.00	0.00	0.244	O	|	|	|	| 1.62
76.417	0.00	0.00	0.244	O	|	|	|	| 1.62
76.500	0.00	0.00	0.244	O	|	|	|	| 1.62
76.583	0.00	0.00	0.244	O	|	|	|	| 1.62
76.667	0.00	0.00	0.244	O	|	|	|	| 1.62
76.750	0.00	0.00	0.244	O	|	|	|	| 1.62
76.833	0.00	0.00	0.244	O	|	|	|	| 1.62
76.917	0.00	0.00	0.244	O	|	|	|	| 1.62
77.000	0.00	0.00	0.244	O	|	|	|	| 1.62
77.083	0.00	0.00	0.244	O	|	|	|	| 1.62
77.167	0.00	0.00	0.244	O	|	|	|	| 1.62
77.250	0.00	0.00	0.244	O	|	|	|	| 1.62
77.333	0.00	0.00	0.244	O	|	|	|	| 1.62
77.417	0.00	0.00	0.244	O	|	|	|	| 1.62
77.500	0.00	0.00	0.244	O	|	|	|	| 1.62
77.583	0.00	0.00	0.244	O	|	|	|	| 1.62
77.667	0.00	0.00	0.244	O	|	|	|	| 1.62
77.750	0.00	0.00	0.244	O	|	|	|	| 1.62
77.833	0.00	0.00	0.244	O	|	|	|	| 1.62
77.917	0.00	0.00	0.244	O	|	|	|	| 1.62
78.000	0.00	0.00	0.244	O	|	|	|	| 1.62
78.083	0.00	0.00	0.244	O	|	|	|	| 1.62
78.167	0.00	0.00	0.244	O	|	|	|	| 1.62
78.250	0.00	0.00	0.244	O	|	|	|	| 1.62
78.333	0.00	0.00	0.244	O	|	|	|	| 1.62
78.417	0.00	0.00	0.244	O	|	|	|	| 1.62
78.500	0.00	0.00	0.244	O	|	|	|	| 1.62
78.583	0.00	0.00	0.244	O	|	|	|	| 1.62
78.667	0.00	0.00	0.244	O	|	|	|	| 1.62
78.750	0.00	0.00	0.244	O	|	|	|	| 1.62
78.833	0.00	0.00	0.244	O	|	|	|	| 1.62
78.917	0.00	0.00	0.244	O	|	|	|	| 1.62
79.000	0.00	0.00	0.244	O	|	|	|	| 1.62
79.083	0.00	0.00	0.244	O	|	|	|	| 1.62
79.167	0.00	0.00	0.244	O	|	|	|	| 1.62
79.250	0.00	0.00	0.244	O	|	|	|	| 1.62
79.333	0.00	0.00	0.244	O	|	|	|	| 1.61
79.417	0.00	0.00	0.244	O	|	|	|	| 1.61
79.500	0.00	0.00	0.244	O	|	|	|	| 1.61
79.583	0.00	0.00	0.244	O	|	|	|	| 1.61
79.667	0.00	0.00	0.244	O	|	|	|	| 1.61
79.750	0.00	0.00	0.244	O	|	|	|	| 1.61

79.833	0.00	0.00	0.244	O	|	|	|	1.61
79.917	0.00	0.00	0.244	O	|	|	|	1.61
80.000	0.00	0.00	0.244	O	|	|	|	1.61
80.083	0.00	0.00	0.244	O	|	|	|	1.61
80.167	0.00	0.00	0.244	O	|	|	|	1.61
80.250	0.00	0.00	0.244	O	|	|	|	1.61
80.333	0.00	0.00	0.244	O	|	|	|	1.61
80.417	0.00	0.00	0.243	O	|	|	|	1.61
80.500	0.00	0.00	0.243	O	|	|	|	1.61
80.583	0.00	0.00	0.243	O	|	|	|	1.61
80.667	0.00	0.00	0.243	O	|	|	|	1.61
80.750	0.00	0.00	0.243	O	|	|	|	1.61
80.833	0.00	0.00	0.243	O	|	|	|	1.61
80.917	0.00	0.00	0.243	O	|	|	|	1.61
81.000	0.00	0.00	0.243	O	|	|	|	1.61
81.083	0.00	0.00	0.243	O	|	|	|	1.61
81.167	0.00	0.00	0.243	O	|	|	|	1.61
81.250	0.00	0.00	0.243	O	|	|	|	1.61
81.333	0.00	0.00	0.243	O	|	|	|	1.61
81.417	0.00	0.00	0.243	O	|	|	|	1.61
81.500	0.00	0.00	0.243	O	|	|	|	1.61
81.583	0.00	0.00	0.243	O	|	|	|	1.61
81.667	0.00	0.00	0.243	O	|	|	|	1.61
81.750	0.00	0.00	0.243	O	|	|	|	1.61
81.833	0.00	0.00	0.243	O	|	|	|	1.61
81.917	0.00	0.00	0.243	O	|	|	|	1.61
82.000	0.00	0.00	0.243	O	|	|	|	1.61
82.083	0.00	0.00	0.243	O	|	|	|	1.61
82.167	0.00	0.00	0.243	O	|	|	|	1.61
82.250	0.00	0.00	0.243	O	|	|	|	1.61
82.333	0.00	0.00	0.243	O	|	|	|	1.61
82.417	0.00	0.00	0.243	O	|	|	|	1.61
82.500	0.00	0.00	0.243	O	|	|	|	1.61
82.583	0.00	0.00	0.243	O	|	|	|	1.61
82.667	0.00	0.00	0.243	O	|	|	|	1.61
82.750	0.00	0.00	0.243	O	|	|	|	1.61
82.833	0.00	0.00	0.243	O	|	|	|	1.61
82.917	0.00	0.00	0.243	O	|	|	|	1.61
83.000	0.00	0.00	0.243	O	|	|	|	1.61
83.083	0.00	0.00	0.243	O	|	|	|	1.61
83.167	0.00	0.00	0.243	O	|	|	|	1.61
83.250	0.00	0.00	0.243	O	|	|	|	1.61
83.333	0.00	0.00	0.243	O	|	|	|	1.61
83.417	0.00	0.00	0.243	O	|	|	|	1.61
83.500	0.00	0.00	0.243	O	|	|	|	1.61
83.583	0.00	0.00	0.243	O	|	|	|	1.61
83.667	0.00	0.00	0.243	O	|	|	|	1.61
83.750	0.00	0.00	0.243	O	|	|	|	1.61
83.833	0.00	0.00	0.243	O	|	|	|	1.61
83.917	0.00	0.00	0.243	O	|	|	|	1.61
84.000	0.00	0.00	0.243	O	|	|	|	1.61
84.083	0.00	0.00	0.243	O	|	|	|	1.61
84.167	0.00	0.00	0.243	O	|	|	|	1.61
84.250	0.00	0.00	0.243	O	|	|	|	1.61

84.333	0.00	0.00	0.243	O	|	|	|	1.61
84.417	0.00	0.00	0.243	O	|	|	|	1.61
84.500	0.00	0.00	0.243	O	|	|	|	1.61
84.583	0.00	0.00	0.242	O	|	|	|	1.61
84.667	0.00	0.00	0.242	O	|	|	|	1.61
84.750	0.00	0.00	0.242	O	|	|	|	1.61
84.833	0.00	0.00	0.242	O	|	|	|	1.61
84.917	0.00	0.00	0.242	O	|	|	|	1.61
85.000	0.00	0.00	0.242	O	|	|	|	1.61
85.083	0.00	0.00	0.242	O	|	|	|	1.61
85.167	0.00	0.00	0.242	O	|	|	|	1.61
85.250	0.00	0.00	0.242	O	|	|	|	1.61
85.333	0.00	0.00	0.242	O	|	|	|	1.61
85.417	0.00	0.00	0.242	O	|	|	|	1.61
85.500	0.00	0.00	0.242	O	|	|	|	1.61
85.583	0.00	0.00	0.242	O	|	|	|	1.61
85.667	0.00	0.00	0.242	O	|	|	|	1.61
85.750	0.00	0.00	0.242	O	|	|	|	1.61
85.833	0.00	0.00	0.242	O	|	|	|	1.61
85.917	0.00	0.00	0.242	O	|	|	|	1.61
86.000	0.00	0.00	0.242	O	|	|	|	1.61
86.083	0.00	0.00	0.242	O	|	|	|	1.61
86.167	0.00	0.00	0.242	O	|	|	|	1.61
86.250	0.00	0.00	0.242	O	|	|	|	1.61
86.333	0.00	0.00	0.242	O	|	|	|	1.61
86.417	0.00	0.00	0.242	O	|	|	|	1.61
86.500	0.00	0.00	0.242	O	|	|	|	1.61
86.583	0.00	0.00	0.242	O	|	|	|	1.61
86.667	0.00	0.00	0.242	O	|	|	|	1.61
86.750	0.00	0.00	0.242	O	|	|	|	1.61
86.833	0.00	0.00	0.242	O	|	|	|	1.61
86.917	0.00	0.00	0.242	O	|	|	|	1.61
87.000	0.00	0.00	0.242	O	|	|	|	1.61
87.083	0.00	0.00	0.242	O	|	|	|	1.61
87.167	0.00	0.00	0.242	O	|	|	|	1.61
87.250	0.00	0.00	0.242	O	|	|	|	1.61
87.333	0.00	0.00	0.242	O	|	|	|	1.61
87.417	0.00	0.00	0.242	O	|	|	|	1.61
87.500	0.00	0.00	0.242	O	|	|	|	1.61
87.583	0.00	0.00	0.242	O	|	|	|	1.61
87.667	0.00	0.00	0.242	O	|	|	|	1.61
87.750	0.00	0.00	0.242	O	|	|	|	1.61
87.833	0.00	0.00	0.242	O	|	|	|	1.61
87.917	0.00	0.00	0.242	O	|	|	|	1.61
88.000	0.00	0.00	0.242	O	|	|	|	1.61
88.083	0.00	0.00	0.242	O	|	|	|	1.61
88.167	0.00	0.00	0.242	O	|	|	|	1.61
88.250	0.00	0.00	0.242	O	|	|	|	1.61
88.333	0.00	0.00	0.242	O	|	|	|	1.61
88.417	0.00	0.00	0.242	O	|	|	|	1.61
88.500	0.00	0.00	0.242	O	|	|	|	1.61
88.583	0.00	0.00	0.242	O	|	|	|	1.61
88.667	0.00	0.00	0.242	O	|	|	|	1.61
88.750	0.00	0.00	0.241	O	|	|	|	1.61

88.833	0.00	0.00	0.241	O	|	|	|	1.61
88.917	0.00	0.00	0.241	O	|	|	|	1.61
89.000	0.00	0.00	0.241	O	|	|	|	1.61
89.083	0.00	0.00	0.241	O	|	|	|	1.61
89.167	0.00	0.00	0.241	O	|	|	|	1.61
89.250	0.00	0.00	0.241	O	|	|	|	1.61
89.333	0.00	0.00	0.241	O	|	|	|	1.60
89.417	0.00	0.00	0.241	O	|	|	|	1.60
89.500	0.00	0.00	0.241	O	|	|	|	1.60
89.583	0.00	0.00	0.241	O	|	|	|	1.60
89.667	0.00	0.00	0.241	O	|	|	|	1.60
89.750	0.00	0.00	0.241	O	|	|	|	1.60
89.833	0.00	0.00	0.241	O	|	|	|	1.60
89.917	0.00	0.00	0.241	O	|	|	|	1.60
90.000	0.00	0.00	0.241	O	|	|	|	1.60
90.083	0.00	0.00	0.241	O	|	|	|	1.60
90.167	0.00	0.00	0.241	O	|	|	|	1.60
90.250	0.00	0.00	0.241	O	|	|	|	1.60
90.333	0.00	0.00	0.241	O	|	|	|	1.60
90.417	0.00	0.00	0.241	O	|	|	|	1.60
90.500	0.00	0.00	0.241	O	|	|	|	1.60
90.583	0.00	0.00	0.241	O	|	|	|	1.60
90.667	0.00	0.00	0.241	O	|	|	|	1.60
90.750	0.00	0.00	0.241	O	|	|	|	1.60
90.833	0.00	0.00	0.241	O	|	|	|	1.60
90.917	0.00	0.00	0.241	O	|	|	|	1.60
91.000	0.00	0.00	0.241	O	|	|	|	1.60
91.083	0.00	0.00	0.241	O	|	|	|	1.60
91.167	0.00	0.00	0.241	O	|	|	|	1.60
91.250	0.00	0.00	0.241	O	|	|	|	1.60
91.333	0.00	0.00	0.241	O	|	|	|	1.60
91.417	0.00	0.00	0.241	O	|	|	|	1.60
91.500	0.00	0.00	0.241	O	|	|	|	1.60
91.583	0.00	0.00	0.241	O	|	|	|	1.60
91.667	0.00	0.00	0.241	O	|	|	|	1.60
91.750	0.00	0.00	0.241	O	|	|	|	1.60
91.833	0.00	0.00	0.241	O	|	|	|	1.60
91.917	0.00	0.00	0.241	O	|	|	|	1.60
92.000	0.00	0.00	0.241	O	|	|	|	1.60
92.083	0.00	0.00	0.241	O	|	|	|	1.60
92.167	0.00	0.00	0.241	O	|	|	|	1.60
92.250	0.00	0.00	0.241	O	|	|	|	1.60
92.333	0.00	0.00	0.241	O	|	|	|	1.60
92.417	0.00	0.00	0.241	O	|	|	|	1.60
92.500	0.00	0.00	0.241	O	|	|	|	1.60
92.583	0.00	0.00	0.241	O	|	|	|	1.60
92.667	0.00	0.00	0.241	O	|	|	|	1.60
92.750	0.00	0.00	0.241	O	|	|	|	1.60
92.833	0.00	0.00	0.241	O	|	|	|	1.60
92.917	0.00	0.00	0.240	O	|	|	|	1.60
93.000	0.00	0.00	0.240	O	|	|	|	1.60
93.083	0.00	0.00	0.240	O	|	|	|	1.60
93.167	0.00	0.00	0.240	O	|	|	|	1.60
93.250	0.00	0.00	0.240	O	|	|	|	1.60

93.333	0.00	0.00	0.240	O	|	|	|	1.60
93.417	0.00	0.00	0.240	O	|	|	|	1.60
93.500	0.00	0.00	0.240	O	|	|	|	1.60
93.583	0.00	0.00	0.240	O	|	|	|	1.60
93.667	0.00	0.00	0.240	O	|	|	|	1.60
93.750	0.00	0.00	0.240	O	|	|	|	1.60
93.833	0.00	0.00	0.240	O	|	|	|	1.60
93.917	0.00	0.00	0.240	O	|	|	|	1.60
94.000	0.00	0.00	0.240	O	|	|	|	1.60
94.083	0.00	0.00	0.240	O	|	|	|	1.60
94.167	0.00	0.00	0.240	O	|	|	|	1.60
94.250	0.00	0.00	0.240	O	|	|	|	1.60
94.333	0.00	0.00	0.240	O	|	|	|	1.60
94.417	0.00	0.00	0.240	O	|	|	|	1.60
94.500	0.00	0.00	0.240	O	|	|	|	1.60
94.583	0.00	0.00	0.240	O	|	|	|	1.60
94.667	0.00	0.00	0.240	O	|	|	|	1.60
94.750	0.00	0.00	0.240	O	|	|	|	1.60
94.833	0.00	0.00	0.240	O	|	|	|	1.60
94.917	0.00	0.00	0.240	O	|	|	|	1.60
95.000	0.00	0.00	0.240	O	|	|	|	1.60
95.083	0.00	0.00	0.240	O	|	|	|	1.60
95.167	0.00	0.00	0.240	O	|	|	|	1.60
95.250	0.00	0.00	0.240	O	|	|	|	1.60
95.333	0.00	0.00	0.240	O	|	|	|	1.60
95.417	0.00	0.00	0.240	O	|	|	|	1.60
95.500	0.00	0.00	0.240	O	|	|	|	1.60
95.583	0.00	0.00	0.240	O	|	|	|	1.60
95.667	0.00	0.00	0.240	O	|	|	|	1.60
95.750	0.00	0.00	0.240	O	|	|	|	1.60
95.833	0.00	0.00	0.240	O	|	|	|	1.60
95.917	0.00	0.00	0.240	O	|	|	|	1.60
96.000	0.00	0.00	0.240	O	|	|	|	1.60
96.083	0.00	0.00	0.240	O	|	|	|	1.60
96.167	0.00	0.00	0.240	O	|	|	|	1.60
96.250	0.00	0.00	0.240	O	|	|	|	1.60
96.333	0.00	0.00	0.240	O	|	|	|	1.60
96.417	0.00	0.00	0.240	O	|	|	|	1.60
96.500	0.00	0.00	0.240	O	|	|	|	1.60
96.583	0.00	0.00	0.240	O	|	|	|	1.60
96.667	0.00	0.00	0.240	O	|	|	|	1.60
96.750	0.00	0.00	0.240	O	|	|	|	1.60
96.833	0.00	0.00	0.240	O	|	|	|	1.60
96.917	0.00	0.00	0.240	O	|	|	|	1.60
97.000	0.00	0.00	0.240	O	|	|	|	1.60
97.083	0.00	0.00	0.240	O	|	|	|	1.60
97.167	0.00	0.00	0.239	O	|	|	|	1.60
97.250	0.00	0.00	0.239	O	|	|	|	1.60
97.333	0.00	0.00	0.239	O	|	|	|	1.60
97.417	0.00	0.00	0.239	O	|	|	|	1.60
97.500	0.00	0.00	0.239	O	|	|	|	1.60
97.583	0.00	0.00	0.239	O	|	|	|	1.60
97.667	0.00	0.00	0.239	O	|	|	|	1.60
97.750	0.00	0.00	0.239	O	|	|	|	1.60

97.833	0.00	0.00	0.239	O	|	|	|	1.60
97.917	0.00	0.00	0.239	O	|	|	|	1.60
98.000	0.00	0.00	0.239	O	|	|	|	1.60
98.083	0.00	0.00	0.239	O	|	|	|	1.60
98.167	0.00	0.00	0.239	O	|	|	|	1.60
98.250	0.00	0.00	0.239	O	|	|	|	1.60
98.333	0.00	0.00	0.239	O	|	|	|	1.60
98.417	0.00	0.00	0.239	O	|	|	|	1.60
98.500	0.00	0.00	0.239	O	|	|	|	1.60
98.583	0.00	0.00	0.239	O	|	|	|	1.60
98.667	0.00	0.00	0.239	O	|	|	|	1.60
98.750	0.00	0.00	0.239	O	|	|	|	1.60
98.833	0.00	0.00	0.239	O	|	|	|	1.60
98.917	0.00	0.00	0.239	O	|	|	|	1.60
99.000	0.00	0.00	0.239	O	|	|	|	1.60
99.083	0.00	0.00	0.239	O	|	|	|	1.60
99.167	0.00	0.00	0.239	O	|	|	|	1.60
99.250	0.00	0.00	0.239	O	|	|	|	1.60
99.333	0.00	0.00	0.239	O	|	|	|	1.60
99.417	0.00	0.00	0.239	O	|	|	|	1.59
99.500	0.00	0.00	0.239	O	|	|	|	1.59
99.583	0.00	0.00	0.239	O	|	|	|	1.59
99.667	0.00	0.00	0.239	O	|	|	|	1.59
99.750	0.00	0.00	0.239	O	|	|	|	1.59
99.833	0.00	0.00	0.239	O	|	|	|	1.59
99.917	0.00	0.00	0.239	O	|	|	|	1.59
100.000	0.00	0.00	0.239	O	|	|	|	1.59
100.083	0.00	0.00	0.239	O	|	|	|	1.59
100.167	0.00	0.00	0.239	O	|	|	|	1.59
100.250	0.00	0.00	0.239	O	|	|	|	1.59
100.333	0.00	0.00	0.239	O	|	|	|	1.59
100.417	0.00	0.00	0.239	O	|	|	|	1.59
100.500	0.00	0.00	0.239	O	|	|	|	1.59
100.583	0.00	0.00	0.239	O	|	|	|	1.59
100.667	0.00	0.00	0.239	O	|	|	|	1.59
100.750	0.00	0.00	0.239	O	|	|	|	1.59
100.833	0.00	0.00	0.239	O	|	|	|	1.59
100.917	0.00	0.00	0.239	O	|	|	|	1.59
101.000	0.00	0.00	0.239	O	|	|	|	1.59
101.083	0.00	0.00	0.239	O	|	|	|	1.59
101.167	0.00	0.00	0.239	O	|	|	|	1.59
101.250	0.00	0.00	0.239	O	|	|	|	1.59
101.333	0.00	0.00	0.238	O	|	|	|	1.59
101.417	0.00	0.00	0.238	O	|	|	|	1.59
101.500	0.00	0.00	0.238	O	|	|	|	1.59
101.583	0.00	0.00	0.238	O	|	|	|	1.59
101.667	0.00	0.00	0.238	O	|	|	|	1.59
101.750	0.00	0.00	0.238	O	|	|	|	1.59
101.833	0.00	0.00	0.238	O	|	|	|	1.59
101.917	0.00	0.00	0.238	O	|	|	|	1.59
102.000	0.00	0.00	0.238	O	|	|	|	1.59
102.083	0.00	0.00	0.238	O	|	|	|	1.59
102.167	0.00	0.00	0.238	O	|	|	|	1.59
102.250	0.00	0.00	0.238	O	|	|	|	1.59

102.333	0.00	0.00	0.238	O	|	|	|	1.59
102.417	0.00	0.00	0.238	O	|	|	|	1.59
102.500	0.00	0.00	0.238	O	|	|	|	1.59
102.583	0.00	0.00	0.238	O	|	|	|	1.59
102.667	0.00	0.00	0.238	O	|	|	|	1.59
102.750	0.00	0.00	0.238	O	|	|	|	1.59
102.833	0.00	0.00	0.238	O	|	|	|	1.59
102.917	0.00	0.00	0.238	O	|	|	|	1.59
103.000	0.00	0.00	0.238	O	|	|	|	1.59
103.083	0.00	0.00	0.238	O	|	|	|	1.59
103.167	0.00	0.00	0.238	O	|	|	|	1.59
103.250	0.00	0.00	0.238	O	|	|	|	1.59
103.333	0.00	0.00	0.238	O	|	|	|	1.59
103.417	0.00	0.00	0.238	O	|	|	|	1.59
103.500	0.00	0.00	0.238	O	|	|	|	1.59
103.583	0.00	0.00	0.238	O	|	|	|	1.59
103.667	0.00	0.00	0.238	O	|	|	|	1.59
103.750	0.00	0.00	0.238	O	|	|	|	1.59
103.833	0.00	0.00	0.238	O	|	|	|	1.59
103.917	0.00	0.00	0.238	O	|	|	|	1.59
104.000	0.00	0.00	0.238	O	|	|	|	1.59
104.083	0.00	0.00	0.238	O	|	|	|	1.59
104.167	0.00	0.00	0.238	O	|	|	|	1.59
104.250	0.00	0.00	0.238	O	|	|	|	1.59
104.333	0.00	0.00	0.238	O	|	|	|	1.59
104.417	0.00	0.00	0.238	O	|	|	|	1.59
104.500	0.00	0.00	0.238	O	|	|	|	1.59
104.583	0.00	0.00	0.238	O	|	|	|	1.59
104.667	0.00	0.00	0.238	O	|	|	|	1.59
104.750	0.00	0.00	0.238	O	|	|	|	1.59
104.833	0.00	0.00	0.238	O	|	|	|	1.59
104.917	0.00	0.00	0.238	O	|	|	|	1.59
105.000	0.00	0.00	0.238	O	|	|	|	1.59
105.083	0.00	0.00	0.238	O	|	|	|	1.59
105.167	0.00	0.00	0.238	O	|	|	|	1.59
105.250	0.00	0.00	0.238	O	|	|	|	1.59
105.333	0.00	0.00	0.238	O	|	|	|	1.59
105.417	0.00	0.00	0.238	O	|	|	|	1.59
105.500	0.00	0.00	0.238	O	|	|	|	1.59
105.583	0.00	0.00	0.237	O	|	|	|	1.59
105.667	0.00	0.00	0.237	O	|	|	|	1.59
105.750	0.00	0.00	0.237	O	|	|	|	1.59
105.833	0.00	0.00	0.237	O	|	|	|	1.59
105.917	0.00	0.00	0.237	O	|	|	|	1.59
106.000	0.00	0.00	0.237	O	|	|	|	1.59
106.083	0.00	0.00	0.237	O	|	|	|	1.59
106.167	0.00	0.00	0.237	O	|	|	|	1.59
106.250	0.00	0.00	0.237	O	|	|	|	1.59
106.333	0.00	0.00	0.237	O	|	|	|	1.59
106.417	0.00	0.00	0.237	O	|	|	|	1.59
106.500	0.00	0.00	0.237	O	|	|	|	1.59
106.583	0.00	0.00	0.237	O	|	|	|	1.59
106.667	0.00	0.00	0.237	O	|	|	|	1.59
106.750	0.00	0.00	0.237	O	|	|	|	1.59

106.833	0.00	0.00	0.237	O	|	|	|	1.59
106.917	0.00	0.00	0.237	O	|	|	|	1.59
107.000	0.00	0.00	0.237	O	|	|	|	1.59
107.083	0.00	0.00	0.237	O	|	|	|	1.59
107.167	0.00	0.00	0.237	O	|	|	|	1.59
107.250	0.00	0.00	0.237	O	|	|	|	1.59
107.333	0.00	0.00	0.237	O	|	|	|	1.59
107.417	0.00	0.00	0.237	O	|	|	|	1.59
107.500	0.00	0.00	0.237	O	|	|	|	1.59
107.583	0.00	0.00	0.237	O	|	|	|	1.59
107.667	0.00	0.00	0.237	O	|	|	|	1.59
107.750	0.00	0.00	0.237	O	|	|	|	1.59
107.833	0.00	0.00	0.237	O	|	|	|	1.59
107.917	0.00	0.00	0.237	O	|	|	|	1.59
108.000	0.00	0.00	0.237	O	|	|	|	1.59
108.083	0.00	0.00	0.237	O	|	|	|	1.59
108.167	0.00	0.00	0.237	O	|	|	|	1.59
108.250	0.00	0.00	0.237	O	|	|	|	1.59
108.333	0.00	0.00	0.237	O	|	|	|	1.59
108.417	0.00	0.00	0.237	O	|	|	|	1.59
108.500	0.00	0.00	0.237	O	|	|	|	1.59
108.583	0.00	0.00	0.237	O	|	|	|	1.59
108.667	0.00	0.00	0.237	O	|	|	|	1.59
108.750	0.00	0.00	0.237	O	|	|	|	1.59
108.833	0.00	0.00	0.237	O	|	|	|	1.59
108.917	0.00	0.00	0.237	O	|	|	|	1.59
109.000	0.00	0.00	0.237	O	|	|	|	1.59
109.083	0.00	0.00	0.237	O	|	|	|	1.59
109.167	0.00	0.00	0.237	O	|	|	|	1.59
109.250	0.00	0.00	0.237	O	|	|	|	1.59
109.333	0.00	0.00	0.237	O	|	|	|	1.59
109.417	0.00	0.00	0.237	O	|	|	|	1.59
109.500	0.00	0.00	0.237	O	|	|	|	1.59
109.583	0.00	0.00	0.237	O	|	|	|	1.58
109.667	0.00	0.00	0.237	O	|	|	|	1.58
109.750	0.00	0.00	0.237	O	|	|	|	1.58
109.833	0.00	0.00	0.236	O	|	|	|	1.58
109.917	0.00	0.00	0.236	O	|	|	|	1.58
110.000	0.00	0.00	0.236	O	|	|	|	1.58
110.083	0.00	0.00	0.236	O	|	|	|	1.58
110.167	0.00	0.00	0.236	O	|	|	|	1.58
110.250	0.00	0.00	0.236	O	|	|	|	1.58
110.333	0.00	0.00	0.236	O	|	|	|	1.58
110.417	0.00	0.00	0.236	O	|	|	|	1.58
110.500	0.00	0.00	0.236	O	|	|	|	1.58
110.583	0.00	0.00	0.236	O	|	|	|	1.58
110.667	0.00	0.00	0.236	O	|	|	|	1.58
110.750	0.00	0.00	0.236	O	|	|	|	1.58
110.833	0.00	0.00	0.236	O	|	|	|	1.58
110.917	0.00	0.00	0.236	O	|	|	|	1.58
111.000	0.00	0.00	0.236	O	|	|	|	1.58
111.083	0.00	0.00	0.236	O	|	|	|	1.58
111.167	0.00	0.00	0.236	O	|	|	|	1.58
111.250	0.00	0.00	0.236	O	|	|	|	1.58

111.333	0.00	0.00	0.236	O	|	|	|	|	1.58
111.417	0.00	0.00	0.236	O	|	|	|	|	1.58
111.500	0.00	0.00	0.236	O	|	|	|	|	1.58
111.583	0.00	0.00	0.236	O	|	|	|	|	1.58
111.667	0.00	0.00	0.236	O	|	|	|	|	1.58
111.750	0.00	0.00	0.236	O	|	|	|	|	1.58
111.833	0.00	0.00	0.236	O	|	|	|	|	1.58
111.917	0.00	0.00	0.236	O	|	|	|	|	1.58
112.000	0.00	0.00	0.236	O	|	|	|	|	1.58
112.083	0.00	0.00	0.236	O	|	|	|	|	1.58
112.167	0.00	0.00	0.236	O	|	|	|	|	1.58
112.250	0.00	0.00	0.236	O	|	|	|	|	1.58
112.333	0.00	0.00	0.236	O	|	|	|	|	1.58
112.417	0.00	0.00	0.236	O	|	|	|	|	1.58
112.500	0.00	0.00	0.236	O	|	|	|	|	1.58
112.583	0.00	0.00	0.236	O	|	|	|	|	1.58
112.667	0.00	0.00	0.236	O	|	|	|	|	1.58
112.750	0.00	0.00	0.236	O	|	|	|	|	1.58
112.833	0.00	0.00	0.236	O	|	|	|	|	1.58
112.917	0.00	0.00	0.236	O	|	|	|	|	1.58
113.000	0.00	0.00	0.236	O	|	|	|	|	1.58
113.083	0.00	0.00	0.236	O	|	|	|	|	1.58
113.167	0.00	0.00	0.236	O	|	|	|	|	1.58
113.250	0.00	0.00	0.236	O	|	|	|	|	1.58
113.333	0.00	0.00	0.236	O	|	|	|	|	1.58
113.417	0.00	0.00	0.236	O	|	|	|	|	1.58
113.500	0.00	0.00	0.236	O	|	|	|	|	1.58
113.583	0.00	0.00	0.236	O	|	|	|	|	1.58
113.667	0.00	0.00	0.236	O	|	|	|	|	1.58
113.750	0.00	0.00	0.236	O	|	|	|	|	1.58
113.833	0.00	0.00	0.236	O	|	|	|	|	1.58
113.917	0.00	0.00	0.236	O	|	|	|	|	1.58
114.000	0.00	0.00	0.236	O	|	|	|	|	1.58
114.083	0.00	0.00	0.235	O	|	|	|	|	1.58
114.167	0.00	0.00	0.235	O	|	|	|	|	1.58
114.250	0.00	0.00	0.235	O	|	|	|	|	1.58
114.333	0.00	0.00	0.235	O	|	|	|	|	1.58
114.417	0.00	0.00	0.235	O	|	|	|	|	1.58
114.500	0.00	0.00	0.235	O	|	|	|	|	1.58
114.583	0.00	0.00	0.235	O	|	|	|	|	1.58
114.667	0.00	0.00	0.235	O	|	|	|	|	1.58
114.750	0.00	0.00	0.235	O	|	|	|	|	1.58
114.833	0.00	0.00	0.235	O	|	|	|	|	1.58
114.917	0.00	0.00	0.235	O	|	|	|	|	1.58
115.000	0.00	0.00	0.235	O	|	|	|	|	1.58
115.083	0.00	0.00	0.235	O	|	|	|	|	1.58
115.167	0.00	0.00	0.235	O	|	|	|	|	1.58
115.250	0.00	0.00	0.235	O	|	|	|	|	1.58
115.333	0.00	0.00	0.235	O	|	|	|	|	1.58
115.417	0.00	0.00	0.235	O	|	|	|	|	1.58
115.500	0.00	0.00	0.235	O	|	|	|	|	1.58
115.583	0.00	0.00	0.235	O	|	|	|	|	1.58
115.667	0.00	0.00	0.235	O	|	|	|	|	1.58
115.750	0.00	0.00	0.235	O	|	|	|	|	1.58

115.833	0.00	0.00	0.235	O	|	|	|	1.58
115.917	0.00	0.00	0.235	O	|	|	|	1.58
116.000	0.00	0.00	0.235	O	|	|	|	1.58
116.083	0.00	0.00	0.235	O	|	|	|	1.58
116.167	0.00	0.00	0.235	O	|	|	|	1.58
116.250	0.00	0.00	0.235	O	|	|	|	1.58
116.333	0.00	0.00	0.235	O	|	|	|	1.58
116.417	0.00	0.00	0.235	O	|	|	|	1.58
116.500	0.00	0.00	0.235	O	|	|	|	1.58
116.583	0.00	0.00	0.235	O	|	|	|	1.58
116.667	0.00	0.00	0.235	O	|	|	|	1.58
116.750	0.00	0.00	0.235	O	|	|	|	1.58
116.833	0.00	0.00	0.235	O	|	|	|	1.58
116.917	0.00	0.00	0.235	O	|	|	|	1.58
117.000	0.00	0.00	0.235	O	|	|	|	1.58
117.083	0.00	0.00	0.235	O	|	|	|	1.58
117.167	0.00	0.00	0.235	O	|	|	|	1.58
117.250	0.00	0.00	0.235	O	|	|	|	1.58
117.333	0.00	0.00	0.235	O	|	|	|	1.58
117.417	0.00	0.00	0.235	O	|	|	|	1.58
117.500	0.00	0.00	0.235	O	|	|	|	1.58
117.583	0.00	0.00	0.235	O	|	|	|	1.58
117.667	0.00	0.00	0.235	O	|	|	|	1.58
117.750	0.00	0.00	0.235	O	|	|	|	1.58
117.833	0.00	0.00	0.235	O	|	|	|	1.58
117.917	0.00	0.00	0.235	O	|	|	|	1.58
118.000	0.00	0.00	0.235	O	|	|	|	1.58
118.083	0.00	0.00	0.235	O	|	|	|	1.58
118.167	0.00	0.00	0.235	O	|	|	|	1.58
118.250	0.00	0.00	0.235	O	|	|	|	1.58
118.333	0.00	0.00	0.234	O	|	|	|	1.58
118.417	0.00	0.00	0.234	O	|	|	|	1.58
118.500	0.00	0.00	0.234	O	|	|	|	1.58
118.583	0.00	0.00	0.234	O	|	|	|	1.58
118.667	0.00	0.00	0.234	O	|	|	|	1.58
118.750	0.00	0.00	0.234	O	|	|	|	1.58
118.833	0.00	0.00	0.234	O	|	|	|	1.58
118.917	0.00	0.00	0.234	O	|	|	|	1.58
119.000	0.00	0.00	0.234	O	|	|	|	1.58
119.083	0.00	0.00	0.234	O	|	|	|	1.58
119.167	0.00	0.00	0.234	O	|	|	|	1.58
119.250	0.00	0.00	0.234	O	|	|	|	1.58
119.333	0.00	0.00	0.234	O	|	|	|	1.58
119.417	0.00	0.00	0.234	O	|	|	|	1.58
119.500	0.00	0.00	0.234	O	|	|	|	1.58
119.583	0.00	0.00	0.234	O	|	|	|	1.58
119.667	0.00	0.00	0.234	O	|	|	|	1.58
119.750	0.00	0.00	0.234	O	|	|	|	1.58
119.833	0.00	0.00	0.234	O	|	|	|	1.57
119.917	0.00	0.00	0.234	O	|	|	|	1.57
120.000	0.00	0.00	0.234	O	|	|	|	1.57
120.083	0.00	0.00	0.234	O	|	|	|	1.57
120.167	0.00	0.00	0.234	O	|	|	|	1.57
120.250	0.00	0.00	0.234	O	|	|	|	1.57

120.333	0.00	0.00	0.234	O	|	|	|	|	1.57
120.417	0.00	0.00	0.234	O	|	|	|	|	1.57
120.500	0.00	0.00	0.234	O	|	|	|	|	1.57
120.583	0.00	0.00	0.234	O	|	|	|	|	1.57
120.667	0.00	0.00	0.234	O	|	|	|	|	1.57
120.750	0.00	0.00	0.234	O	|	|	|	|	1.57
120.833	0.00	0.00	0.234	O	|	|	|	|	1.57
120.917	0.00	0.00	0.234	O	|	|	|	|	1.57
121.000	0.00	0.00	0.234	O	|	|	|	|	1.57
121.083	0.00	0.00	0.234	O	|	|	|	|	1.57
121.167	0.00	0.00	0.234	O	|	|	|	|	1.57
121.250	0.00	0.00	0.234	O	|	|	|	|	1.57
121.333	0.00	0.00	0.234	O	|	|	|	|	1.57
121.417	0.00	0.00	0.234	O	|	|	|	|	1.57
121.500	0.00	0.00	0.234	O	|	|	|	|	1.57
121.583	0.00	0.00	0.234	O	|	|	|	|	1.57
121.667	0.00	0.00	0.234	O	|	|	|	|	1.57
121.750	0.00	0.00	0.234	O	|	|	|	|	1.57
121.833	0.00	0.00	0.234	O	|	|	|	|	1.57
121.917	0.00	0.00	0.234	O	|	|	|	|	1.57
122.000	0.00	0.00	0.234	O	|	|	|	|	1.57
122.083	0.00	0.00	0.234	O	|	|	|	|	1.57
122.167	0.00	0.00	0.234	O	|	|	|	|	1.57
122.250	0.00	0.00	0.234	O	|	|	|	|	1.57
122.333	0.00	0.00	0.234	O	|	|	|	|	1.57
122.417	0.00	0.00	0.234	O	|	|	|	|	1.57
122.500	0.00	0.00	0.234	O	|	|	|	|	1.57
122.583	0.00	0.00	0.233	O	|	|	|	|	1.57
122.667	0.00	0.00	0.233	O	|	|	|	|	1.57
122.750	0.00	0.00	0.233	O	|	|	|	|	1.57
122.833	0.00	0.00	0.233	O	|	|	|	|	1.57
122.917	0.00	0.00	0.233	O	|	|	|	|	1.57
123.000	0.00	0.00	0.233	O	|	|	|	|	1.57
123.083	0.00	0.00	0.233	O	|	|	|	|	1.57
123.167	0.00	0.00	0.233	O	|	|	|	|	1.57
123.250	0.00	0.00	0.233	O	|	|	|	|	1.57
123.333	0.00	0.00	0.233	O	|	|	|	|	1.57
123.417	0.00	0.00	0.233	O	|	|	|	|	1.57
123.500	0.00	0.00	0.233	O	|	|	|	|	1.57
123.583	0.00	0.00	0.233	O	|	|	|	|	1.57
123.667	0.00	0.00	0.233	O	|	|	|	|	1.57
123.750	0.00	0.00	0.233	O	|	|	|	|	1.57
123.833	0.00	0.00	0.233	O	|	|	|	|	1.57
123.917	0.00	0.00	0.233	O	|	|	|	|	1.57
124.000	0.00	0.00	0.233	O	|	|	|	|	1.57
124.083	0.00	0.00	0.233	O	|	|	|	|	1.57
124.167	0.00	0.00	0.233	O	|	|	|	|	1.57
124.250	0.00	0.00	0.233	O	|	|	|	|	1.57
124.333	0.00	0.00	0.233	O	|	|	|	|	1.57
124.417	0.00	0.00	0.233	O	|	|	|	|	1.57
124.500	0.00	0.00	0.233	O	|	|	|	|	1.57
124.583	0.00	0.00	0.233	O	|	|	|	|	1.57
124.667	0.00	0.00	0.233	O	|	|	|	|	1.57
124.750	0.00	0.00	0.233	O	|	|	|	|	1.57

124.833	0.00	0.00	0.233	O	|	|	|	1.57
124.917	0.00	0.00	0.233	O	|	|	|	1.57
125.000	0.00	0.00	0.233	O	|	|	|	1.57
125.083	0.00	0.00	0.233	O	|	|	|	1.57
125.167	0.00	0.00	0.233	O	|	|	|	1.57
125.250	0.00	0.00	0.233	O	|	|	|	1.57
125.333	0.00	0.00	0.233	O	|	|	|	1.57
125.417	0.00	0.00	0.233	O	|	|	|	1.57
125.500	0.00	0.00	0.233	O	|	|	|	1.57
125.583	0.00	0.00	0.233	O	|	|	|	1.57
125.667	0.00	0.00	0.233	O	|	|	|	1.57
125.750	0.00	0.00	0.233	O	|	|	|	1.57
125.833	0.00	0.00	0.233	O	|	|	|	1.57
125.917	0.00	0.00	0.233	O	|	|	|	1.57
126.000	0.00	0.00	0.233	O	|	|	|	1.57
126.083	0.00	0.00	0.233	O	|	|	|	1.57
126.167	0.00	0.00	0.233	O	|	|	|	1.57
126.250	0.00	0.00	0.233	O	|	|	|	1.57
126.333	0.00	0.00	0.233	O	|	|	|	1.57
126.417	0.00	0.00	0.233	O	|	|	|	1.57
126.500	0.00	0.00	0.233	O	|	|	|	1.57
126.583	0.00	0.00	0.233	O	|	|	|	1.57
126.667	0.00	0.00	0.233	O	|	|	|	1.57
126.750	0.00	0.00	0.233	O	|	|	|	1.57
126.833	0.00	0.00	0.232	O	|	|	|	1.57
126.917	0.00	0.00	0.232	O	|	|	|	1.57
127.000	0.00	0.00	0.232	O	|	|	|	1.57
127.083	0.00	0.00	0.232	O	|	|	|	1.57
127.167	0.00	0.00	0.232	O	|	|	|	1.57
127.250	0.00	0.00	0.232	O	|	|	|	1.57
127.333	0.00	0.00	0.232	O	|	|	|	1.57
127.417	0.00	0.00	0.232	O	|	|	|	1.57
127.500	0.00	0.00	0.232	O	|	|	|	1.57
127.583	0.00	0.00	0.232	O	|	|	|	1.57
127.667	0.00	0.00	0.232	O	|	|	|	1.57
127.750	0.00	0.00	0.232	O	|	|	|	1.57
127.833	0.00	0.00	0.232	O	|	|	|	1.57
127.917	0.00	0.00	0.232	O	|	|	|	1.57
128.000	0.00	0.00	0.232	O	|	|	|	1.57
128.083	0.00	0.00	0.232	O	|	|	|	1.57
128.167	0.00	0.00	0.232	O	|	|	|	1.57
128.250	0.00	0.00	0.232	O	|	|	|	1.57
128.333	0.00	0.00	0.232	O	|	|	|	1.57
128.417	0.00	0.00	0.232	O	|	|	|	1.57
128.500	0.00	0.00	0.232	O	|	|	|	1.57
128.583	0.00	0.00	0.232	O	|	|	|	1.57
128.667	0.00	0.00	0.232	O	|	|	|	1.57
128.750	0.00	0.00	0.232	O	|	|	|	1.57
128.833	0.00	0.00	0.232	O	|	|	|	1.57
128.917	0.00	0.00	0.232	O	|	|	|	1.57
129.000	0.00	0.00	0.232	O	|	|	|	1.57
129.083	0.00	0.00	0.232	O	|	|	|	1.57
129.167	0.00	0.00	0.232	O	|	|	|	1.57
129.250	0.00	0.00	0.232	O	|	|	|	1.57

129.333	0.00	0.00	0.232	O	|	|	|	|	1.57
129.417	0.00	0.00	0.232	O	|	|	|	|	1.57
129.500	0.00	0.00	0.232	O	|	|	|	|	1.57
129.583	0.00	0.00	0.232	O	|	|	|	|	1.57
129.667	0.00	0.00	0.232	O	|	|	|	|	1.57
129.750	0.00	0.00	0.232	O	|	|	|	|	1.57
129.833	0.00	0.00	0.232	O	|	|	|	|	1.57
129.917	0.00	0.00	0.232	O	|	|	|	|	1.57
130.000	0.00	0.00	0.232	O	|	|	|	|	1.57
130.083	0.00	0.00	0.232	O	|	|	|	|	1.57
130.167	0.00	0.00	0.232	O	|	|	|	|	1.56
130.250	0.00	0.00	0.232	O	|	|	|	|	1.56
130.333	0.00	0.00	0.232	O	|	|	|	|	1.56
130.417	0.00	0.00	0.232	O	|	|	|	|	1.56
130.500	0.00	0.00	0.232	O	|	|	|	|	1.56
130.583	0.00	0.00	0.232	O	|	|	|	|	1.56
130.667	0.00	0.00	0.232	O	|	|	|	|	1.56
130.750	0.00	0.00	0.232	O	|	|	|	|	1.56
130.833	0.00	0.00	0.232	O	|	|	|	|	1.56
130.917	0.00	0.00	0.232	O	|	|	|	|	1.56
131.000	0.00	0.00	0.232	O	|	|	|	|	1.56
131.083	0.00	0.00	0.231	O	|	|	|	|	1.56
131.167	0.00	0.00	0.231	O	|	|	|	|	1.56
131.250	0.00	0.00	0.231	O	|	|	|	|	1.56
131.333	0.00	0.00	0.231	O	|	|	|	|	1.56
131.417	0.00	0.00	0.231	O	|	|	|	|	1.56
131.500	0.00	0.00	0.231	O	|	|	|	|	1.56
131.583	0.00	0.00	0.231	O	|	|	|	|	1.56
131.667	0.00	0.00	0.231	O	|	|	|	|	1.56
131.750	0.00	0.00	0.231	O	|	|	|	|	1.56
131.833	0.00	0.00	0.231	O	|	|	|	|	1.56
131.917	0.00	0.00	0.231	O	|	|	|	|	1.56
132.000	0.00	0.00	0.231	O	|	|	|	|	1.56
132.083	0.00	0.00	0.231	O	|	|	|	|	1.56
132.167	0.00	0.00	0.231	O	|	|	|	|	1.56
132.250	0.00	0.00	0.231	O	|	|	|	|	1.56
132.333	0.00	0.00	0.231	O	|	|	|	|	1.56
132.417	0.00	0.00	0.231	O	|	|	|	|	1.56
132.500	0.00	0.00	0.231	O	|	|	|	|	1.56
132.583	0.00	0.00	0.231	O	|	|	|	|	1.56
132.667	0.00	0.00	0.231	O	|	|	|	|	1.56
132.750	0.00	0.00	0.231	O	|	|	|	|	1.56
132.833	0.00	0.00	0.231	O	|	|	|	|	1.56
132.917	0.00	0.00	0.231	O	|	|	|	|	1.56
133.000	0.00	0.00	0.231	O	|	|	|	|	1.56
133.083	0.00	0.00	0.231	O	|	|	|	|	1.56
133.167	0.00	0.00	0.231	O	|	|	|	|	1.56
133.250	0.00	0.00	0.231	O	|	|	|	|	1.56
133.333	0.00	0.00	0.231	O	|	|	|	|	1.56
133.417	0.00	0.00	0.231	O	|	|	|	|	1.56
133.500	0.00	0.00	0.231	O	|	|	|	|	1.56
133.583	0.00	0.00	0.231	O	|	|	|	|	1.56
133.667	0.00	0.00	0.231	O	|	|	|	|	1.56
133.750	0.00	0.00	0.231	O	|	|	|	|	1.56

133.833	0.00	0.00	0.231	O	|	|	|	1.56
133.917	0.00	0.00	0.231	O	|	|	|	1.56
134.000	0.00	0.00	0.231	O	|	|	|	1.56
134.083	0.00	0.00	0.231	O	|	|	|	1.56
134.167	0.00	0.00	0.231	O	|	|	|	1.56
134.250	0.00	0.00	0.231	O	|	|	|	1.56
134.333	0.00	0.00	0.231	O	|	|	|	1.56
134.417	0.00	0.00	0.231	O	|	|	|	1.56
134.500	0.00	0.00	0.231	O	|	|	|	1.56
134.583	0.00	0.00	0.231	O	|	|	|	1.56
134.667	0.00	0.00	0.231	O	|	|	|	1.56
134.750	0.00	0.00	0.231	O	|	|	|	1.56
134.833	0.00	0.00	0.231	O	|	|	|	1.56
134.917	0.00	0.00	0.231	O	|	|	|	1.56
135.000	0.00	0.00	0.231	O	|	|	|	1.56
135.083	0.00	0.00	0.231	O	|	|	|	1.56
135.167	0.00	0.00	0.231	O	|	|	|	1.56
135.250	0.00	0.00	0.231	O	|	|	|	1.56
135.333	0.00	0.00	0.231	O	|	|	|	1.56
135.417	0.00	0.00	0.230	O	|	|	|	1.56
135.500	0.00	0.00	0.230	O	|	|	|	1.56
135.583	0.00	0.00	0.230	O	|	|	|	1.56
135.667	0.00	0.00	0.230	O	|	|	|	1.56
135.750	0.00	0.00	0.230	O	|	|	|	1.56
135.833	0.00	0.00	0.230	O	|	|	|	1.56
135.917	0.00	0.00	0.230	O	|	|	|	1.56
136.000	0.00	0.00	0.230	O	|	|	|	1.56
136.083	0.00	0.00	0.230	O	|	|	|	1.56
136.167	0.00	0.00	0.230	O	|	|	|	1.56
136.250	0.00	0.00	0.230	O	|	|	|	1.56
136.333	0.00	0.00	0.230	O	|	|	|	1.56
136.417	0.00	0.00	0.230	O	|	|	|	1.56
136.500	0.00	0.00	0.230	O	|	|	|	1.56
136.583	0.00	0.00	0.230	O	|	|	|	1.56
136.667	0.00	0.00	0.230	O	|	|	|	1.56
136.750	0.00	0.00	0.230	O	|	|	|	1.56
136.833	0.00	0.00	0.230	O	|	|	|	1.56
136.917	0.00	0.00	0.230	O	|	|	|	1.56
137.000	0.00	0.00	0.230	O	|	|	|	1.56
137.083	0.00	0.00	0.230	O	|	|	|	1.56
137.167	0.00	0.00	0.230	O	|	|	|	1.56
137.250	0.00	0.00	0.230	O	|	|	|	1.56
137.333	0.00	0.00	0.230	O	|	|	|	1.56
137.417	0.00	0.00	0.230	O	|	|	|	1.56
137.500	0.00	0.00	0.230	O	|	|	|	1.56
137.583	0.00	0.00	0.230	O	|	|	|	1.56
137.667	0.00	0.00	0.230	O	|	|	|	1.56
137.750	0.00	0.00	0.230	O	|	|	|	1.56
137.833	0.00	0.00	0.230	O	|	|	|	1.56
137.917	0.00	0.00	0.230	O	|	|	|	1.56
138.000	0.00	0.00	0.230	O	|	|	|	1.56
138.083	0.00	0.00	0.230	O	|	|	|	1.56
138.167	0.00	0.00	0.230	O	|	|	|	1.56
138.250	0.00	0.00	0.230	O	|	|	|	1.56

138.333	0.00	0.00	0.230	O	|	|	|	1.56
138.417	0.00	0.00	0.230	O	|	|	|	1.56
138.500	0.00	0.00	0.230	O	|	|	|	1.56
138.583	0.00	0.00	0.230	O	|	|	|	1.56
138.667	0.00	0.00	0.230	O	|	|	|	1.56
138.750	0.00	0.00	0.230	O	|	|	|	1.56
138.833	0.00	0.00	0.230	O	|	|	|	1.56
138.917	0.00	0.00	0.230	O	|	|	|	1.56
139.000	0.00	0.00	0.230	O	|	|	|	1.56
139.083	0.00	0.00	0.230	O	|	|	|	1.56
139.167	0.00	0.00	0.230	O	|	|	|	1.56
139.250	0.00	0.00	0.230	O	|	|	|	1.56
139.333	0.00	0.00	0.230	O	|	|	|	1.56
139.417	0.00	0.00	0.230	O	|	|	|	1.56
139.500	0.00	0.00	0.230	O	|	|	|	1.56
139.583	0.00	0.00	0.230	O	|	|	|	1.56
139.667	0.00	0.00	0.230	O	|	|	|	1.56
139.750	0.00	0.00	0.229	O	|	|	|	1.56
139.833	0.00	0.00	0.229	O	|	|	|	1.56
139.917	0.00	0.00	0.229	O	|	|	|	1.56
140.000	0.00	0.00	0.229	O	|	|	|	1.56
140.083	0.00	0.00	0.229	O	|	|	|	1.56
140.167	0.00	0.00	0.229	O	|	|	|	1.56
140.250	0.00	0.00	0.229	O	|	|	|	1.56
140.333	0.00	0.00	0.229	O	|	|	|	1.56
140.417	0.00	0.00	0.229	O	|	|	|	1.56
140.500	0.00	0.00	0.229	O	|	|	|	1.55
140.583	0.00	0.00	0.229	O	|	|	|	1.55
140.667	0.00	0.00	0.229	O	|	|	|	1.55
140.750	0.00	0.00	0.229	O	|	|	|	1.55
140.833	0.00	0.00	0.229	O	|	|	|	1.55
140.917	0.00	0.00	0.229	O	|	|	|	1.55
141.000	0.00	0.00	0.229	O	|	|	|	1.55
141.083	0.00	0.00	0.229	O	|	|	|	1.55
141.167	0.00	0.00	0.229	O	|	|	|	1.55
141.250	0.00	0.00	0.229	O	|	|	|	1.55
141.333	0.00	0.00	0.229	O	|	|	|	1.55
141.417	0.00	0.00	0.229	O	|	|	|	1.55
141.500	0.00	0.00	0.229	O	|	|	|	1.55
141.583	0.00	0.00	0.229	O	|	|	|	1.55
141.667	0.00	0.00	0.229	O	|	|	|	1.55
141.750	0.00	0.00	0.229	O	|	|	|	1.55
141.833	0.00	0.00	0.229	O	|	|	|	1.55
141.917	0.00	0.00	0.229	O	|	|	|	1.55
142.000	0.00	0.00	0.229	O	|	|	|	1.55
142.083	0.00	0.00	0.229	O	|	|	|	1.55
142.167	0.00	0.00	0.229	O	|	|	|	1.55
142.250	0.00	0.00	0.229	O	|	|	|	1.55
142.333	0.00	0.00	0.229	O	|	|	|	1.55
142.417	0.00	0.00	0.229	O	|	|	|	1.55
142.500	0.00	0.00	0.229	O	|	|	|	1.55
142.583	0.00	0.00	0.229	O	|	|	|	1.55
142.667	0.00	0.00	0.229	O	|	|	|	1.55
142.750	0.00	0.00	0.229	O	|	|	|	1.55

142.833	0.00	0.00	0.229	O	|	|	|	1.55
142.917	0.00	0.00	0.229	O	|	|	|	1.55
143.000	0.00	0.00	0.229	O	|	|	|	1.55
143.083	0.00	0.00	0.229	O	|	|	|	1.55
143.167	0.00	0.00	0.229	O	|	|	|	1.55
143.250	0.00	0.00	0.229	O	|	|	|	1.55
143.333	0.00	0.00	0.229	O	|	|	|	1.55
143.417	0.00	0.00	0.229	O	|	|	|	1.55
143.500	0.00	0.00	0.229	O	|	|	|	1.55
143.583	0.00	0.00	0.229	O	|	|	|	1.55
143.667	0.00	0.00	0.229	O	|	|	|	1.55
143.750	0.00	0.00	0.229	O	|	|	|	1.55
143.833	0.00	0.00	0.229	O	|	|	|	1.55
143.917	0.00	0.00	0.229	O	|	|	|	1.55
144.000	0.00	0.00	0.228	O	|	|	|	1.55
144.083	0.00	0.00	0.228	O	|	|	|	1.55
144.167	0.00	0.00	0.228	O	|	|	|	1.55
144.250	0.00	0.00	0.228	O	|	|	|	1.55
144.333	0.00	0.00	0.228	O	|	|	|	1.55
144.417	0.00	0.00	0.228	O	|	|	|	1.55
144.500	0.00	0.00	0.228	O	|	|	|	1.55
144.583	0.00	0.00	0.228	O	|	|	|	1.55
144.667	0.00	0.00	0.228	O	|	|	|	1.55
144.750	0.00	0.00	0.228	O	|	|	|	1.55
144.833	0.00	0.00	0.228	O	|	|	|	1.55
144.917	0.00	0.00	0.228	O	|	|	|	1.55
145.000	0.00	0.00	0.228	O	|	|	|	1.55
145.083	0.00	0.00	0.228	O	|	|	|	1.55
145.167	0.00	0.00	0.228	O	|	|	|	1.55
145.250	0.00	0.00	0.228	O	|	|	|	1.55
145.333	0.00	0.00	0.228	O	|	|	|	1.55
145.417	0.00	0.00	0.228	O	|	|	|	1.55
145.500	0.00	0.00	0.228	O	|	|	|	1.55
145.583	0.00	0.00	0.228	O	|	|	|	1.55
145.667	0.00	0.00	0.228	O	|	|	|	1.55
145.750	0.00	0.00	0.228	O	|	|	|	1.55
145.833	0.00	0.00	0.228	O	|	|	|	1.55
145.917	0.00	0.00	0.228	O	|	|	|	1.55
146.000	0.00	0.00	0.228	O	|	|	|	1.55
146.083	0.00	0.00	0.228	O	|	|	|	1.55
146.167	0.00	0.00	0.228	O	|	|	|	1.55
146.250	0.00	0.00	0.228	O	|	|	|	1.55
146.333	0.00	0.00	0.228	O	|	|	|	1.55
146.417	0.00	0.00	0.228	O	|	|	|	1.55
146.500	0.00	0.00	0.228	O	|	|	|	1.55
146.583	0.00	0.00	0.228	O	|	|	|	1.55
146.667	0.00	0.00	0.228	O	|	|	|	1.55
146.750	0.00	0.00	0.228	O	|	|	|	1.55
146.833	0.00	0.00	0.228	O	|	|	|	1.55
146.917	0.00	0.00	0.228	O	|	|	|	1.55
147.000	0.00	0.00	0.228	O	|	|	|	1.55
147.083	0.00	0.00	0.228	O	|	|	|	1.55
147.167	0.00	0.00	0.228	O	|	|	|	1.55
147.250	0.00	0.00	0.228	O	|	|	|	1.55

147.333	0.00	0.00	0.228	O	|	|	|	1.55
147.417	0.00	0.00	0.228	O	|	|	|	1.55
147.500	0.00	0.00	0.228	O	|	|	|	1.55
147.583	0.00	0.00	0.228	O	|	|	|	1.55
147.667	0.00	0.00	0.228	O	|	|	|	1.55
147.750	0.00	0.00	0.228	O	|	|	|	1.55
147.833	0.00	0.00	0.228	O	|	|	|	1.55
147.917	0.00	0.00	0.228	O	|	|	|	1.55
148.000	0.00	0.00	0.228	O	|	|	|	1.55
148.083	0.00	0.00	0.228	O	|	|	|	1.55
148.167	0.00	0.00	0.228	O	|	|	|	1.55
148.250	0.00	0.00	0.228	O	|	|	|	1.55
148.333	0.00	0.00	0.227	O	|	|	|	1.55
148.417	0.00	0.00	0.227	O	|	|	|	1.55
148.500	0.00	0.00	0.227	O	|	|	|	1.55
148.583	0.00	0.00	0.227	O	|	|	|	1.55
148.667	0.00	0.00	0.227	O	|	|	|	1.55
148.750	0.00	0.00	0.227	O	|	|	|	1.55
148.833	0.00	0.00	0.227	O	|	|	|	1.55
148.917	0.00	0.00	0.227	O	|	|	|	1.55
149.000	0.00	0.00	0.227	O	|	|	|	1.55
149.083	0.00	0.00	0.227	O	|	|	|	1.55
149.167	0.00	0.00	0.227	O	|	|	|	1.55
149.250	0.00	0.00	0.227	O	|	|	|	1.55
149.333	0.00	0.00	0.227	O	|	|	|	1.55
149.417	0.00	0.00	0.227	O	|	|	|	1.55
149.500	0.00	0.00	0.227	O	|	|	|	1.55
149.583	0.00	0.00	0.227	O	|	|	|	1.55
149.667	0.00	0.00	0.227	O	|	|	|	1.55
149.750	0.00	0.00	0.227	O	|	|	|	1.55
149.833	0.00	0.00	0.227	O	|	|	|	1.55
149.917	0.00	0.00	0.227	O	|	|	|	1.55
150.000	0.00	0.00	0.227	O	|	|	|	1.55
150.083	0.00	0.00	0.227	O	|	|	|	1.55
150.167	0.00	0.00	0.227	O	|	|	|	1.55
150.250	0.00	0.00	0.227	O	|	|	|	1.55
150.333	0.00	0.00	0.227	O	|	|	|	1.55
150.417	0.00	0.00	0.227	O	|	|	|	1.55
150.500	0.00	0.00	0.227	O	|	|	|	1.55
150.583	0.00	0.00	0.227	O	|	|	|	1.55
150.667	0.00	0.00	0.227	O	|	|	|	1.55
150.750	0.00	0.00	0.227	O	|	|	|	1.55
150.833	0.00	0.00	0.227	O	|	|	|	1.55
150.917	0.00	0.00	0.227	O	|	|	|	1.54
151.000	0.00	0.00	0.227	O	|	|	|	1.54
151.083	0.00	0.00	0.227	O	|	|	|	1.54
151.167	0.00	0.00	0.227	O	|	|	|	1.54
151.250	0.00	0.00	0.227	O	|	|	|	1.54
151.333	0.00	0.00	0.227	O	|	|	|	1.54
151.417	0.00	0.00	0.227	O	|	|	|	1.54
151.500	0.00	0.00	0.227	O	|	|	|	1.54
151.583	0.00	0.00	0.227	O	|	|	|	1.54
151.667	0.00	0.00	0.227	O	|	|	|	1.54
151.750	0.00	0.00	0.227	O	|	|	|	1.54

151.833	0.00	0.00	0.227	O	|	|	|	|	1.54
151.917	0.00	0.00	0.227	O	|	|	|	|	1.54
152.000	0.00	0.00	0.227	O	|	|	|	|	1.54
152.083	0.00	0.00	0.227	O	|	|	|	|	1.54
152.167	0.00	0.00	0.227	O	|	|	|	|	1.54
152.250	0.00	0.00	0.227	O	|	|	|	|	1.54
152.333	0.00	0.00	0.227	O	|	|	|	|	1.54
152.417	0.00	0.00	0.227	O	|	|	|	|	1.54
152.500	0.00	0.00	0.227	O	|	|	|	|	1.54
152.583	0.00	0.00	0.227	O	|	|	|	|	1.54
152.667	0.00	0.00	0.226	O	|	|	|	|	1.54
152.750	0.00	0.00	0.226	O	|	|	|	|	1.54
152.833	0.00	0.00	0.226	O	|	|	|	|	1.54
152.917	0.00	0.00	0.226	O	|	|	|	|	1.54
153.000	0.00	0.00	0.226	O	|	|	|	|	1.54
153.083	0.00	0.00	0.226	O	|	|	|	|	1.54
153.167	0.00	0.00	0.226	O	|	|	|	|	1.54
153.250	0.00	0.00	0.226	O	|	|	|	|	1.54
153.333	0.00	0.00	0.226	O	|	|	|	|	1.54
153.417	0.00	0.00	0.226	O	|	|	|	|	1.54
153.500	0.00	0.00	0.226	O	|	|	|	|	1.54
153.583	0.00	0.00	0.226	O	|	|	|	|	1.54
153.667	0.00	0.00	0.226	O	|	|	|	|	1.54
153.750	0.00	0.00	0.226	O	|	|	|	|	1.54
153.833	0.00	0.00	0.226	O	|	|	|	|	1.54
153.917	0.00	0.00	0.226	O	|	|	|	|	1.54
154.000	0.00	0.00	0.226	O	|	|	|	|	1.54
154.083	0.00	0.00	0.226	O	|	|	|	|	1.54
154.167	0.00	0.00	0.226	O	|	|	|	|	1.54
154.250	0.00	0.00	0.226	O	|	|	|	|	1.54
154.333	0.00	0.00	0.226	O	|	|	|	|	1.54
154.417	0.00	0.00	0.226	O	|	|	|	|	1.54
154.500	0.00	0.00	0.226	O	|	|	|	|	1.54
154.583	0.00	0.00	0.226	O	|	|	|	|	1.54
154.667	0.00	0.00	0.226	O	|	|	|	|	1.54
154.750	0.00	0.00	0.226	O	|	|	|	|	1.54
154.833	0.00	0.00	0.226	O	|	|	|	|	1.54
154.917	0.00	0.00	0.226	O	|	|	|	|	1.54
155.000	0.00	0.00	0.226	O	|	|	|	|	1.54
155.083	0.00	0.00	0.226	O	|	|	|	|	1.54
155.167	0.00	0.00	0.226	O	|	|	|	|	1.54
155.250	0.00	0.00	0.226	O	|	|	|	|	1.54
155.333	0.00	0.00	0.226	O	|	|	|	|	1.54
155.417	0.00	0.00	0.226	O	|	|	|	|	1.54
155.500	0.00	0.00	0.226	O	|	|	|	|	1.54
155.583	0.00	0.00	0.226	O	|	|	|	|	1.54
155.667	0.00	0.00	0.226	O	|	|	|	|	1.54
155.750	0.00	0.00	0.226	O	|	|	|	|	1.54
155.833	0.00	0.00	0.226	O	|	|	|	|	1.54
155.917	0.00	0.00	0.226	O	|	|	|	|	1.54
156.000	0.00	0.00	0.226	O	|	|	|	|	1.54
156.083	0.00	0.00	0.226	O	|	|	|	|	1.54
156.167	0.00	0.00	0.226	O	|	|	|	|	1.54
156.250	0.00	0.00	0.226	O	|	|	|	|	1.54

156.333	0.00	0.00	0.226	O	|	|	|	1.54
156.417	0.00	0.00	0.226	O	|	|	|	1.54
156.500	0.00	0.00	0.226	O	|	|	|	1.54
156.583	0.00	0.00	0.226	O	|	|	|	1.54
156.667	0.00	0.00	0.226	O	|	|	|	1.54
156.750	0.00	0.00	0.226	O	|	|	|	1.54
156.833	0.00	0.00	0.226	O	|	|	|	1.54
156.917	0.00	0.00	0.226	O	|	|	|	1.54
157.000	0.00	0.00	0.226	O	|	|	|	1.54
157.083	0.00	0.00	0.225	O	|	|	|	1.54
157.167	0.00	0.00	0.225	O	|	|	|	1.54
157.250	0.00	0.00	0.225	O	|	|	|	1.54
157.333	0.00	0.00	0.225	O	|	|	|	1.54
157.417	0.00	0.00	0.225	O	|	|	|	1.54
157.500	0.00	0.00	0.225	O	|	|	|	1.54
157.583	0.00	0.00	0.225	O	|	|	|	1.54
157.667	0.00	0.00	0.225	O	|	|	|	1.54
157.750	0.00	0.00	0.225	O	|	|	|	1.54
157.833	0.00	0.00	0.225	O	|	|	|	1.54
157.917	0.00	0.00	0.225	O	|	|	|	1.54
158.000	0.00	0.00	0.225	O	|	|	|	1.54
158.083	0.00	0.00	0.225	O	|	|	|	1.54
158.167	0.00	0.00	0.225	O	|	|	|	1.54
158.250	0.00	0.00	0.225	O	|	|	|	1.54
158.333	0.00	0.00	0.225	O	|	|	|	1.54
158.417	0.00	0.00	0.225	O	|	|	|	1.54
158.500	0.00	0.00	0.225	O	|	|	|	1.54
158.583	0.00	0.00	0.225	O	|	|	|	1.54
158.667	0.00	0.00	0.225	O	|	|	|	1.54
158.750	0.00	0.00	0.225	O	|	|	|	1.54
158.833	0.00	0.00	0.225	O	|	|	|	1.54
158.917	0.00	0.00	0.225	O	|	|	|	1.54
159.000	0.00	0.00	0.225	O	|	|	|	1.54
159.083	0.00	0.00	0.225	O	|	|	|	1.54
159.167	0.00	0.00	0.225	O	|	|	|	1.54
159.250	0.00	0.00	0.225	O	|	|	|	1.54
159.333	0.00	0.00	0.225	O	|	|	|	1.54
159.417	0.00	0.00	0.225	O	|	|	|	1.54
159.500	0.00	0.00	0.225	O	|	|	|	1.54
159.583	0.00	0.00	0.225	O	|	|	|	1.54
159.667	0.00	0.00	0.225	O	|	|	|	1.54
159.750	0.00	0.00	0.225	O	|	|	|	1.54
159.833	0.00	0.00	0.225	O	|	|	|	1.54
159.917	0.00	0.00	0.225	O	|	|	|	1.54
160.000	0.00	0.00	0.225	O	|	|	|	1.54
160.083	0.00	0.00	0.225	O	|	|	|	1.54
160.167	0.00	0.00	0.225	O	|	|	|	1.54
160.250	0.00	0.00	0.225	O	|	|	|	1.54
160.333	0.00	0.00	0.225	O	|	|	|	1.54
160.417	0.00	0.00	0.225	O	|	|	|	1.54
160.500	0.00	0.00	0.225	O	|	|	|	1.54
160.583	0.00	0.00	0.225	O	|	|	|	1.54
160.667	0.00	0.00	0.225	O	|	|	|	1.54
160.750	0.00	0.00	0.225	O	|	|	|	1.54

160.833	0.00	0.00	0.225	O	|	|	|	1.54
160.917	0.00	0.00	0.225	O	|	|	|	1.54
161.000	0.00	0.00	0.225	O	|	|	|	1.54
161.083	0.00	0.00	0.225	O	|	|	|	1.54
161.167	0.00	0.00	0.225	O	|	|	|	1.54
161.250	0.00	0.00	0.225	O	|	|	|	1.54
161.333	0.00	0.00	0.225	O	|	|	|	1.54
161.417	0.00	0.00	0.224	O	|	|	|	1.53
161.500	0.00	0.00	0.224	O	|	|	|	1.53
161.583	0.00	0.00	0.224	O	|	|	|	1.53
161.667	0.00	0.00	0.224	O	|	|	|	1.53
161.750	0.00	0.00	0.224	O	|	|	|	1.53
161.833	0.00	0.00	0.224	O	|	|	|	1.53
161.917	0.00	0.00	0.224	O	|	|	|	1.53
162.000	0.00	0.00	0.224	O	|	|	|	1.53
162.083	0.00	0.00	0.224	O	|	|	|	1.53
162.167	0.00	0.00	0.224	O	|	|	|	1.53
162.250	0.00	0.00	0.224	O	|	|	|	1.53
162.333	0.00	0.00	0.224	O	|	|	|	1.53
162.417	0.00	0.00	0.224	O	|	|	|	1.53
162.500	0.00	0.00	0.224	O	|	|	|	1.53
162.583	0.00	0.00	0.224	O	|	|	|	1.53
162.667	0.00	0.00	0.224	O	|	|	|	1.53
162.750	0.00	0.00	0.224	O	|	|	|	1.53
162.833	0.00	0.00	0.224	O	|	|	|	1.53
162.917	0.00	0.00	0.224	O	|	|	|	1.53
163.000	0.00	0.00	0.224	O	|	|	|	1.53
163.083	0.00	0.00	0.224	O	|	|	|	1.53
163.167	0.00	0.00	0.224	O	|	|	|	1.53
163.250	0.00	0.00	0.224	O	|	|	|	1.53
163.333	0.00	0.00	0.224	O	|	|	|	1.53
163.417	0.00	0.00	0.224	O	|	|	|	1.53
163.500	0.00	0.00	0.224	O	|	|	|	1.53
163.583	0.00	0.00	0.224	O	|	|	|	1.53
163.667	0.00	0.00	0.224	O	|	|	|	1.53
163.750	0.00	0.00	0.224	O	|	|	|	1.53
163.833	0.00	0.00	0.224	O	|	|	|	1.53
163.917	0.00	0.00	0.224	O	|	|	|	1.53
164.000	0.00	0.00	0.224	O	|	|	|	1.53
164.083	0.00	0.00	0.224	O	|	|	|	1.53
164.167	0.00	0.00	0.224	O	|	|	|	1.53
164.250	0.00	0.00	0.224	O	|	|	|	1.53
164.333	0.00	0.00	0.224	O	|	|	|	1.53
164.417	0.00	0.00	0.224	O	|	|	|	1.53
164.500	0.00	0.00	0.224	O	|	|	|	1.53
164.583	0.00	0.00	0.224	O	|	|	|	1.53
164.667	0.00	0.00	0.224	O	|	|	|	1.53
164.750	0.00	0.00	0.224	O	|	|	|	1.53
164.833	0.00	0.00	0.224	O	|	|	|	1.53
164.917	0.00	0.00	0.224	O	|	|	|	1.53
165.000	0.00	0.00	0.224	O	|	|	|	1.53
165.083	0.00	0.00	0.224	O	|	|	|	1.53
165.167	0.00	0.00	0.224	O	|	|	|	1.53
165.250	0.00	0.00	0.224	O	|	|	|	1.53

165.333	0.00	0.00	0.224	O	|	|	|	1.53
165.417	0.00	0.00	0.224	O	|	|	|	1.53
165.500	0.00	0.00	0.224	O	|	|	|	1.53
165.583	0.00	0.00	0.224	O	|	|	|	1.53
165.667	0.00	0.00	0.224	O	|	|	|	1.53
165.750	0.00	0.00	0.223	O	|	|	|	1.53
165.833	0.00	0.00	0.223	O	|	|	|	1.53
165.917	0.00	0.00	0.223	O	|	|	|	1.53
166.000	0.00	0.00	0.223	O	|	|	|	1.53
166.083	0.00	0.00	0.223	O	|	|	|	1.53
166.167	0.00	0.00	0.223	O	|	|	|	1.53
166.250	0.00	0.00	0.223	O	|	|	|	1.53
166.333	0.00	0.00	0.223	O	|	|	|	1.53
166.417	0.00	0.00	0.223	O	|	|	|	1.53
166.500	0.00	0.00	0.223	O	|	|	|	1.53
166.583	0.00	0.00	0.223	O	|	|	|	1.53
166.667	0.00	0.00	0.223	O	|	|	|	1.53

Remaining water in basin = 0.22 (Ac.Ft)

**********HYDROGRAPH DATA**********

Number of intervals = 2001
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 11.101 (CFS)
Total volume = 1.683 (Ac.Ft)

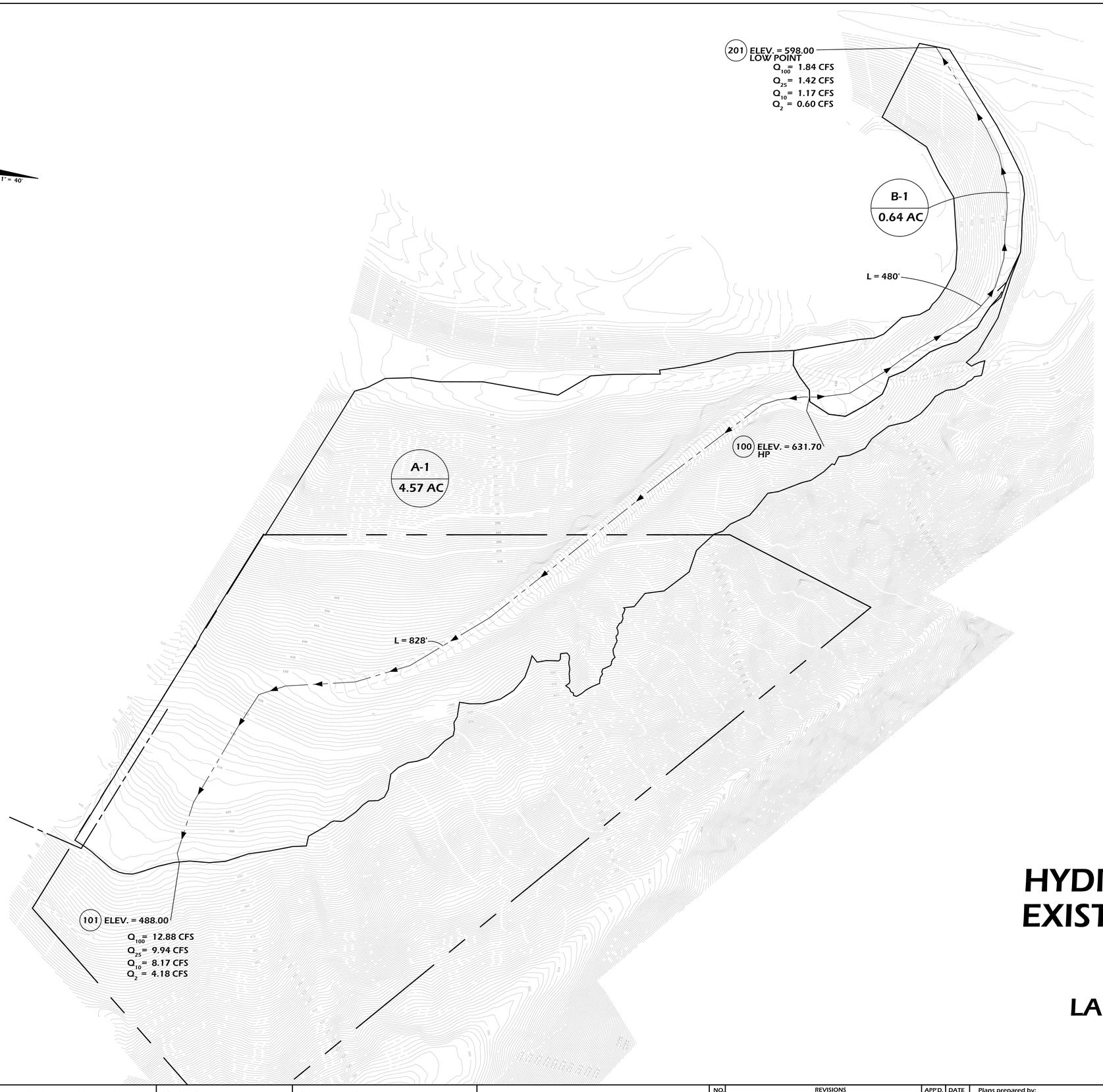
Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

Appendix 5

SCALE: 1" = 40'



GARG RESIDENCE
HYDROLOGY STUDY

03-17-19

HYDROLOGY EXHIBIT
EXISTING CONDITION
FOR
1 O'HILL DRIVE
IN
LAGUNA NIGUEL, CA

Underground Service Alert
Call: TOLL FREE
811
TWO WORKING DAYS BEFORE YOU DIG

SOILS ENGINEER:

OWNER/DEVELOPER:

MR. AND MRS. GARG

27261 HIDDEN TRAILS ROAD
LAGUNA HILLS, CA 92653

NO.	REVISIONS	APP'D.	DATE

Plans prepared by:
GILBERT
ENGINEERING & ASSOCIATES, INC.
CIVIL ENGINEERING, SURVEYING AND LAND DEVELOPMENT SERVICES
2 MERRIWEATHER PLACE LADERA RANCH, CA 92694
PH. (949) 218-8075
www.gilbert-engineering.com

REGISTERED PROFESSIONAL ENGINEER
WILLIAM G. GILBERT
No. C-60384
Exp. 06/30/19
CIVIL
STATE OF CALIFORNIA

EXISTING CONDITION
FOR
1 O'HILL RIDGE
LAGUNA NIGUEL, CA

DRAWN:	R.W.G.
DESIGN:	R.W.G.
CHECKED:	R.W.G.
SCALE:	1" = 40'
JOB NO.:	423.000

SCALE: 1" = 40'

401 ELEV. = 598.0
Q_{100}= 1.68 CFS
Q_{25}= 1.30 CFS
Q_{10}= 1.08 CFS
Q_2 = 0.57 CFS

O HILL RIDGE

UPPER VINTAGE RD.

D-1
0.41 AC

L = 274'

100 ELEV. = 615.0

L = 252'

ELEV. = 642.5 200

L= 191'

B-1
0.18 AC

A-3
0.96 AC

A-2
1.22 AC

A-1
0.57 AC

ELEV. = 571.5 201

ELEV. = 557.0 300

101 ELEV. = 598.0

102 ELEV. = 552.0

103 ELEV. = 525.0

C-1
0.62 AC

202
ELEV. = 510.0

106 ELEV. = 506.0

A-4
0.54 AC

104 ELEV. = 507.0

309 LF

B-2
0.64 AC

105 ELEV. = 506.5
Q_{100}= 13.40 CFS
Q_{25}= 10.35 CFS
Q_{10}= 8.58 CFS
Q_2 = 4.52 CFS

301
ELEV. = 495.0
Q_{100}= 2.85 CFS
Q_{25}= 2.21 CFS
Q_{10}= 1.84 CFS
Q_2 = 0.98 CFS

MODULAR WETLAND
MODEL NO. MWS-L-6-8
W/ HIGH FLOW BYPASS

203
ELEV. = 506.0
Q_{100}= 4.34 CFS
Q_{25}= 3.35 CFS
Q_{10}= 2.79 CFS
Q_2 = 1.48 CFS

PROPOSED LAKE

MATCHLINE - SEE RIGHT

C-1
0.62 AC

202
ELEV. = 510.0

106 ELEV. = 506.0

309 LF

B-2
0.64 AC

301
ELEV. = 495.0
Q_{100}= 2.85 CFS
Q_{25}= 2.21 CFS
Q_{10}= 1.84 CFS
Q_2 = 0.98 CFS

MODULAR WETLAND
MODEL NO. MWS-L-6-8
W/ HIGH FLOW BYPASS

203
ELEV. = 506.0
Q_{100}= 4.34 CFS
Q_{25}= 3.35 CFS
Q_{10}= 2.79 CFS
Q_2 = 1.48 CFS

PROPOSED LAKE

MATCH LINE - SEE LEFT

10' x 10' DISSAPATION STRUCTURE

107
ELEV. = 356.00
Q_{100}= 12.88 CFS
Q_{25}= 9.94 CFS
Q_{10}= 8.17 CFS
Q_2 = 4.18 CFS

GARG RESIDENCE
HYDROLOGY STUDY
03-17-19

HYDROLOGY EXHIBIT
PROPOSED CONDITION
FOR
1 O'HILL DRIVE
IN
LAGUNA NIGUEL, CA

Underground Service Alert
Call: TOLL FREE
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TWO WORKING DAYS BEFORE YOU DIG

SOILS ENGINEER:

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NO.	REVISIONS	APP'D.	DATE

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REGISTERED PROFESSIONAL ENGINEER
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NO. C-053591
Exp. 06/30/19
CIVIL
STATE OF CALIFORNIA

PROPOSED CONDITION
FOR
1 O'HILL RIDGE
LAGUNA NIGUEL, CA

DRAWN:	R.W.G.
DESIGN:	R.W.G.
CHECKED:	R.W.G.
SCALE:	1" = 40'
JOB NO.:	423.000

SHEET 2 OF 2

Attachment F: South Orange County Hydrologic Model (SOHM) Results

SOHM

PROJECT REPORT

General Model Information

Project Name:	Garg Residence 2
Site Name:	Garg Residence
Site Address:	1 O'Hill Ridge
City:	Laguna Hills, CA
Report Date:	3/18/2019
Gage:	Laguna Beach
Data Start:	10/01/1949
Data End:	09/30/2006
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/02/19

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
D,Scrub,VSteep(>15%)	6.01
Pervious Total	6.01
Impervious Land Use	acre
Impervious Total	0
Basin Total	6.01

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
D,Urban,VSteep(>15%)	4.83
Pervious Total	4.83

Impervious Land Use	acre
Impervious,Flat(0-5)	1.18
Impervious Total	1.18
Basin Total	6.01

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length: 145.40 ft.
Bottom Width: 36.35 ft.
Depth: 3 ft.
Volume at riser head: 0.2596 acre-feet.
Side slope 1: 1 To 1
Side slope 2: 1 To 1
Side slope 3: 1 To 1
Side slope 4: 1 To 1
Discharge Structure
Riser Height: 2 ft.
Riser Diameter: 54 in.
Notch Type: Rectangular
Notch Width: 0.002 ft.
Notch Height: 0.117 ft.
Orifice 1 Diameter: 3.078 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2
MWS 6

Pond Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.121	0.000	0.000	0.000
0.0333	0.121	0.004	0.046	0.000
0.0667	0.121	0.008	0.066	0.000
0.1000	0.122	0.012	0.081	0.000
0.1333	0.122	0.016	0.093	0.000
0.1667	0.122	0.020	0.105	0.000
0.2000	0.123	0.024	0.115	0.000
0.2333	0.123	0.028	0.124	0.000
0.2667	0.123	0.032	0.132	0.000
0.3000	0.123	0.036	0.140	0.000
0.3333	0.124	0.040	0.148	0.000
0.3667	0.124	0.045	0.155	0.000
0.4000	0.124	0.049	0.162	0.000
0.4333	0.125	0.053	0.169	0.000
0.4667	0.125	0.057	0.175	0.000
0.5000	0.125	0.061	0.181	0.000
0.5333	0.125	0.065	0.187	0.000
0.5667	0.126	0.070	0.193	0.000
0.6000	0.126	0.074	0.199	0.000
0.6333	0.126	0.078	0.204	0.000
0.6667	0.126	0.082	0.209	0.000
0.7000	0.127	0.087	0.215	0.000
0.7333	0.127	0.091	0.220	0.000
0.7667	0.127	0.095	0.225	0.000
0.8000	0.128	0.099	0.230	0.000
0.8333	0.128	0.104	0.234	0.000
0.8667	0.128	0.108	0.239	0.000
0.9000	0.128	0.112	0.243	0.000
0.9333	0.129	0.116	0.248	0.000
0.9667	0.129	0.121	0.252	0.000
1.0000	0.129	0.125	0.257	0.000
1.0333	0.130	0.129	0.261	0.000

1.0667	0.130	0.134	0.265	0.000
1.1000	0.130	0.138	0.269	0.000
1.1333	0.130	0.142	0.273	0.000
1.1667	0.131	0.147	0.277	0.000
1.2000	0.131	0.151	0.281	0.000
1.2333	0.131	0.156	0.285	0.000
1.2667	0.132	0.160	0.289	0.000
1.3000	0.132	0.164	0.293	0.000
1.3333	0.132	0.169	0.296	0.000
1.3667	0.132	0.173	0.300	0.000
1.4000	0.133	0.178	0.304	0.000
1.4333	0.133	0.182	0.307	0.000
1.4667	0.133	0.187	0.311	0.000
1.5000	0.134	0.191	0.314	0.000
1.5333	0.134	0.196	0.318	0.000
1.5667	0.134	0.200	0.321	0.000
1.6000	0.134	0.205	0.325	0.000
1.6333	0.135	0.209	0.328	0.000
1.6667	0.135	0.214	0.331	0.000
1.7000	0.135	0.218	0.335	0.000
1.7333	0.136	0.223	0.338	0.000
1.7667	0.136	0.227	0.341	0.000
1.8000	0.136	0.232	0.344	0.000
1.8333	0.136	0.236	0.348	0.000
1.8667	0.137	0.241	0.351	0.000
1.9000	0.137	0.245	0.354	0.000
1.9333	0.137	0.250	0.357	0.000
1.9667	0.138	0.255	0.360	0.000
2.0000	0.138	0.259	0.363	0.000
2.0333	0.138	0.264	0.657	0.000
2.0667	0.139	0.268	1.192	0.000
2.1000	0.139	0.273	1.882	0.000
2.1333	0.139	0.278	2.699	0.000
2.1667	0.139	0.282	3.625	0.000
2.2000	0.140	0.287	4.648	0.000
2.2333	0.140	0.292	5.759	0.000
2.2667	0.140	0.296	6.951	0.000
2.3000	0.141	0.301	8.218	0.000
2.3333	0.141	0.306	9.556	0.000
2.3667	0.141	0.310	10.95	0.000
2.4000	0.141	0.315	12.42	0.000
2.4333	0.142	0.320	13.94	0.000
2.4667	0.142	0.325	15.52	0.000
2.5000	0.142	0.329	17.15	0.000
2.5333	0.143	0.334	18.82	0.000
2.5667	0.143	0.339	20.54	0.000
2.6000	0.143	0.344	22.30	0.000
2.6333	0.144	0.349	24.10	0.000
2.6667	0.144	0.353	25.93	0.000
2.7000	0.144	0.358	27.80	0.000
2.7333	0.144	0.363	29.69	0.000
2.7667	0.145	0.368	31.60	0.000
2.8000	0.145	0.373	33.53	0.000
2.8333	0.145	0.378	35.48	0.000
2.8667	0.146	0.382	37.45	0.000
2.9000	0.146	0.387	39.42	0.000
2.9333	0.146	0.392	41.41	0.000
2.9667	0.146	0.397	43.39	0.000

3.0000	0.147	0.402	45.38	0.000
3.0333	0.147	0.407	47.36	0.000

MWS 6

MWS Model Number: MWS-L-6-8
Media Filter Rate (in/hr): 25

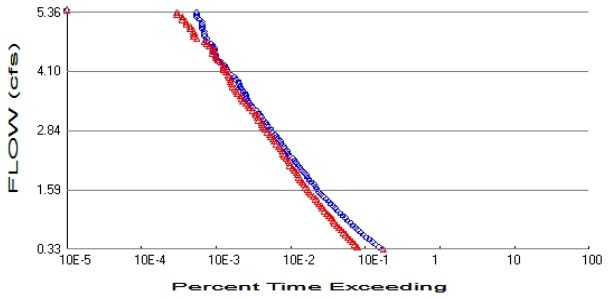
Element Flows To:
Outlet 1 Outlet 2

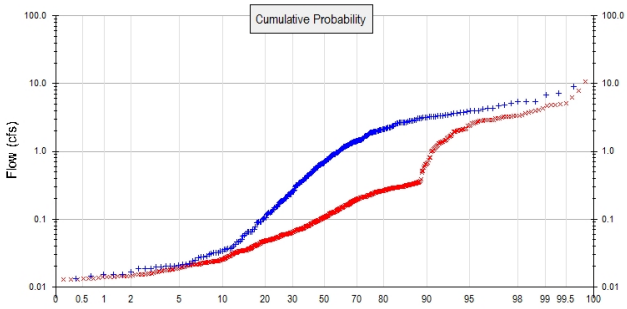
MWS Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
9.0000	0.000	0.000	0.000	0.000
9.0000	0.000	0.000	0.000	0.004
9.0000	0.000	0.000	0.000	0.008
9.0000	0.000	0.000	0.000	0.012
9.0000	0.000	0.000	0.000	0.016
9.0000	0.000	0.001	0.000	0.020
9.0000	0.000	0.001	0.000	0.025
9.0000	0.000	0.001	0.000	0.029
9.0000	0.000	0.002	0.000	0.033
9.0000	0.000	0.003	0.000	0.037
9.0000	0.000	0.003	0.000	0.041
9.0000	0.000	0.004	0.000	0.045
9.0000	0.000	0.005	0.000	0.049
9.0000	0.000	0.006	0.000	0.054
9.0000	0.000	0.007	0.000	0.058
9.0000	0.000	0.008	0.000	0.062
9.0000	0.000	0.009	0.000	0.066
9.0000	0.000	0.010	0.000	0.070
9.0000	0.000	0.011	0.000	0.074
9.0000	0.000	0.012	0.000	0.079
9.0000	0.000	0.014	0.000	0.083
9.0000	0.000	0.015	0.000	0.087
9.0000	0.000	0.017	0.000	0.091
9.0000	0.000	0.018	0.000	0.095
9.0000	0.000	0.020	0.000	0.099
9.0000	0.000	0.021	0.000	0.104
9.0000	0.000	0.023	0.000	0.108
9.0000	0.000	0.025	0.000	0.112
9.0000	0.000	0.027	0.000	0.116
9.0000	0.000	0.029	0.000	0.120
9.0000	0.000	0.031	0.000	0.124
9.0000	0.000	0.033	0.000	0.129
9.0000	0.000	0.035	0.000	0.133
9.0000	0.000	0.037	0.000	0.137
9.0000	0.000	0.040	0.000	0.141
9.0000	0.000	0.042	6.000	0.141

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 6.01
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 4.83
Total Impervious Area: 1.18

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	3.269045
5 year	4.234864
10 year	5.359338
25 year	6.890759

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	2.876352
5 year	3.883888
10 year	4.836778
25 year	6.637721

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.3269	3400	3478	102	Pass
0.3777	3062	1559	50	Pass
0.4286	2770	1453	52	Pass
0.4794	2492	1330	53	Pass
0.5302	2262	1247	55	Pass
0.5811	2049	1168	57	Pass
0.6319	1876	1089	58	Pass
0.6827	1734	1024	59	Pass
0.7336	1575	944	59	Pass
0.7844	1472	878	59	Pass
0.8352	1355	828	61	Pass
0.8861	1256	774	61	Pass
0.9369	1161	740	63	Pass
0.9877	1072	698	65	Pass
1.0386	988	653	66	Pass
1.0894	919	611	66	Pass
1.1402	851	568	66	Pass
1.1911	788	526	66	Pass
1.2419	732	511	69	Pass
1.2927	677	475	70	Pass
1.3436	636	458	72	Pass
1.3944	594	428	72	Pass
1.4452	546	401	73	Pass
1.4961	505	368	72	Pass
1.5469	475	346	72	Pass
1.5977	448	334	74	Pass
1.6486	430	314	73	Pass
1.6994	406	299	73	Pass
1.7502	377	285	75	Pass
1.8011	353	268	75	Pass
1.8519	337	258	76	Pass
1.9027	319	248	77	Pass
1.9535	304	237	77	Pass
2.0044	283	224	79	Pass
2.0552	268	211	78	Pass
2.1060	252	196	77	Pass
2.1569	238	190	79	Pass
2.2077	225	184	81	Pass
2.2585	212	173	81	Pass
2.3094	193	165	85	Pass
2.3602	185	158	85	Pass
2.4110	180	151	83	Pass
2.4619	169	144	85	Pass
2.5127	160	136	85	Pass
2.5635	151	126	83	Pass
2.6144	144	121	84	Pass
2.6652	137	117	85	Pass
2.7160	129	108	83	Pass
2.7669	123	104	84	Pass
2.8177	113	97	85	Pass
2.8685	108	89	82	Pass
2.9194	100	84	84	Pass
2.9702	96	81	84	Pass

3.0210	92	81	88	Pass
3.0719	86	74	86	Pass
3.1227	81	72	88	Pass
3.1735	79	68	86	Pass
3.2244	74	67	90	Pass
3.2752	69	62	89	Pass
3.3260	62	56	90	Pass
3.3769	59	54	91	Pass
3.4277	56	50	89	Pass
3.4785	54	46	85	Pass
3.5294	52	43	82	Pass
3.5802	51	42	82	Pass
3.6310	49	38	77	Pass
3.6819	46	37	80	Pass
3.7327	43	36	83	Pass
3.7835	42	33	78	Pass
3.8344	41	32	78	Pass
3.8852	40	31	77	Pass
3.9360	37	31	83	Pass
3.9869	35	30	85	Pass
4.0377	32	29	90	Pass
4.0885	29	27	93	Pass
4.1394	28	25	89	Pass
4.1902	27	25	92	Pass
4.2410	26	25	96	Pass
4.2919	22	24	109	Pass
4.3427	21	21	100	Pass
4.3935	20	20	100	Pass
4.4444	20	20	100	Pass
4.4952	19	18	94	Pass
4.5460	19	18	94	Pass
4.5968	19	18	94	Pass
4.6477	18	16	88	Pass
4.6985	17	15	88	Pass
4.7493	15	14	93	Pass
4.8002	15	11	73	Pass
4.8510	14	10	71	Pass
4.9018	14	10	71	Pass
4.9527	14	10	71	Pass
5.0035	13	9	69	Pass
5.0543	13	9	69	Pass
5.1052	13	8	61	Pass
5.1560	13	8	61	Pass
5.2068	12	7	58	Pass
5.2577	11	7	63	Pass
5.3085	11	6	54	Pass
5.3593	11	6	54	Pass

Water Quality

POC 2

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

Model Default Modifications

Total of 0 changes have been made.

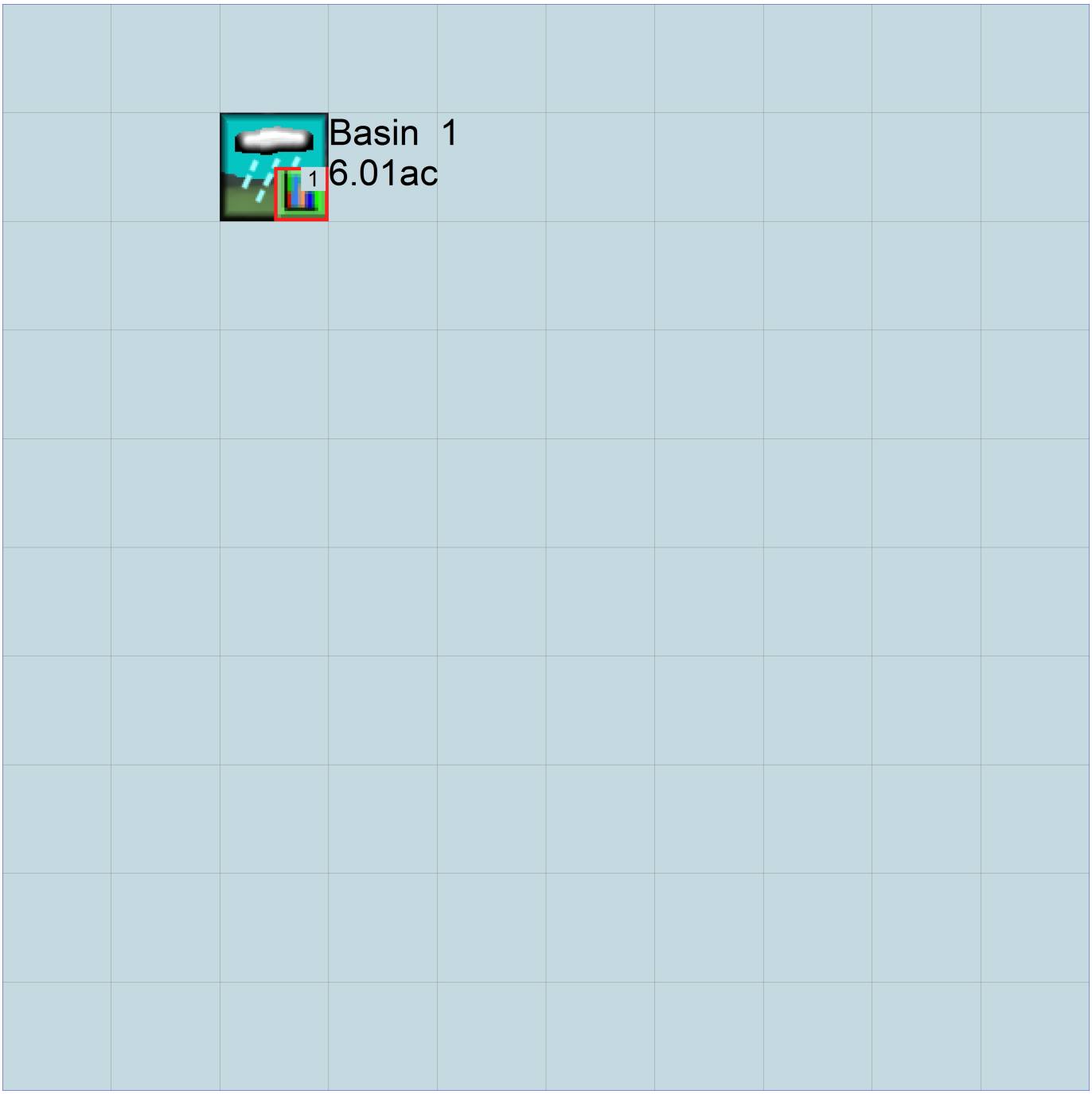
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1949 10 01        END    2006 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   Garg Residence 2.wdm
MESSU       25   MitGarg Residence 2.MES
            27   MitGarg Residence 2.L61
            28   MitGarg Residence 2.L62
            30   POCGarg Residence 21.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      64
      IMPLND       1
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Trapezoidal Pond  1         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   64     D,Urban,VSteep(>15%)    1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   64         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
```

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   64         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   64         0    0    0    1    0    0    0    0    1    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   64              0       3.6     0.012       250       0.2       0.8     0.955
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   64             40        35         4         2         0      0.03         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   64              0       0.2      0.25         1       0.3         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   64       0.5  0.5  0.5  0.6 0.65 0.65 0.65 0.65 0.65 0.65 0.55  0.5
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   64      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   64              0         0      0.02         0      0.72       0.3      0.01
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                    in  out           ***
    1     Impervious,Flat(0-5)    1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

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

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

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

```
    1         0    0    0    0    0
  END IWAT-PARM1

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

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

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  64                        4.83     RCHRES   1      2
PERLND  64                        4.83     RCHRES   1      3
IMPLND   1                        1.18     RCHRES   1      5

******Routing******
PERLND  64                        4.83     COPY     1     12
IMPLND   1                        1.18     COPY     1     15
PERLND  64                        4.83     COPY     1     13
RCHRES   1                           1     RCHRES   2      6
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                        in  out                             ***
    1     Trapezoidal Pond-035    1    1    1    1   28    0    1
    2     MWS  6                  2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

```
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------->      ***
    1              1      0.03       0.0       0.0       0.5       0.0
    2              2       1.0       0.0       9.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.121341  0.000000  0.000000
  0.033333  0.121619  0.004049  0.046939
  0.066667  0.121898  0.008108  0.066382
  0.100000  0.122176  0.012176  0.081301
  0.133333  0.122455  0.016253  0.093878
  0.166667  0.122734  0.020340  0.104959
  0.200000  0.123014  0.024435  0.114977
  0.233333  0.123293  0.028540  0.124189
  0.266667  0.123573  0.032655  0.132764
  0.300000  0.123853  0.036779  0.140817
  0.333333  0.124133  0.040912  0.148435
  0.366667  0.124413  0.045054  0.155680
  0.400000  0.124694  0.049206  0.162602
  0.433333  0.124974  0.053367  0.169242
  0.466667  0.125255  0.057538  0.175630
  0.500000  0.125536  0.061717  0.181795
  0.533333  0.125818  0.065907  0.187757
  0.566667  0.126099  0.070105  0.193535
  0.600000  0.126381  0.074313  0.199146
  0.633333  0.126663  0.078531  0.204603
  0.666667  0.126945  0.082757  0.209918
  0.700000  0.127227  0.086994  0.215102
  0.733333  0.127510  0.091239  0.220164
  0.766667  0.127793  0.095494  0.225112
  0.800000  0.128076  0.099759  0.229954
  0.833333  0.128359  0.104033  0.234696
  0.866667  0.128642  0.108316  0.239344
  0.900000  0.128926  0.112609  0.243903
  0.933333  0.129210  0.116911  0.248379
  0.966667  0.129494  0.121223  0.252775
  1.000000  0.129778  0.125544  0.257096
  1.033333  0.130062  0.129875  0.261346
  1.066667  0.130347  0.134215  0.265528
  1.100000  0.130632  0.138564  0.269645
```

```
1.133333  0.130917  0.142924  0.273700
1.166667  0.131202  0.147292  0.277696
1.200000  0.131487  0.151670  0.281635
1.233333  0.131773  0.156058  0.285520
1.266667  0.132059  0.160455  0.289352
1.300000  0.132345  0.164862  0.293135
1.333333  0.132631  0.169278  0.296869
1.366667  0.132917  0.173704  0.300557
1.400000  0.133204  0.178139  0.304201
1.433333  0.133491  0.182584  0.307801
1.466667  0.133778  0.187039  0.311359
1.500000  0.134065  0.191503  0.314877
1.533333  0.134352  0.195976  0.318357
1.566667  0.134640  0.200460  0.321799
1.600000  0.134928  0.204952  0.325204
1.633333  0.135216  0.209455  0.328574
1.666667  0.135504  0.213967  0.331910
1.700000  0.135793  0.218488  0.335213
1.733333  0.136081  0.223020  0.338483
1.766667  0.136370  0.227561  0.341722
1.800000  0.136659  0.232111  0.344931
1.833333  0.136949  0.236671  0.348110
1.866667  0.137238  0.241241  0.351261
1.900000  0.137528  0.245820  0.354398
1.933333  0.137818  0.250409  0.357557
1.966667  0.138108  0.255008  0.360715
2.000000  0.138398  0.259617  0.363867
2.033333  0.138689  0.264235  0.657646
2.066667  0.138979  0.268863  1.191965
2.100000  0.139270  0.273500  1.882627
2.133333  0.139562  0.278147  2.699565
2.166667  0.139853  0.282804  3.625344
2.200000  0.140144  0.287471  4.648102
2.233333  0.140436  0.292147  5.759001
2.266667  0.140728  0.296833  6.951031
2.300000  0.141020  0.301529  8.218364
2.333333  0.141313  0.306235  9.555974
2.366667  0.141605  0.310950  10.95939
2.400000  0.141898  0.315675  12.42452
2.433333  0.142191  0.320410  13.94755
2.466667  0.142484  0.325154  15.52487
2.500000  0.142777  0.329909  17.15299
2.533333  0.143071  0.334673  18.82849
2.566667  0.143365  0.339447  20.54802
2.600000  0.143659  0.344230  22.30826
2.633333  0.143953  0.349024  24.10588
2.666667  0.144247  0.353827  25.93756
2.700000  0.144542  0.358641  27.79995
2.733333  0.144837  0.363463  29.68969
2.766667  0.145132  0.368296  31.60339
2.800000  0.145427  0.373139  33.53761
2.833333  0.145722  0.377991  35.48893
2.866667  0.146018  0.382854  37.45386
2.900000  0.146314  0.387726  39.42890
2.933333  0.146610  0.392608  41.41056
2.966667  0.146906  0.397500  43.39531
3.000000  0.147202  0.402402  45.37961
END FTABLE  1
FTABLE      2
 36    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.000551  0.000000  0.000000  0.000000
0.100000  0.000551  0.000067  0.000000  0.004162
0.200000  0.000551  0.000202  0.000000  0.008324
0.300000  0.000551  0.000404  0.000000  0.012486
0.400000  0.000551  0.000673  0.000000  0.016648
0.500000  0.000551  0.001010  0.000000  0.020810
0.600000  0.000551  0.001413  0.000000  0.024971
0.700000  0.000551  0.001884  0.000000  0.029133
```

```
  0.800000  0.000551  0.002423  0.000000  0.033295
  0.900000  0.000551  0.003029  0.000000  0.037457
  1.000000  0.000551  0.003702  0.000000  0.041619
  1.100000  0.000551  0.004442  0.000000  0.045781
  1.200000  0.000551  0.005249  0.000000  0.049943
  1.300000  0.000551  0.006124  0.000000  0.054105
  1.400000  0.000551  0.007067  0.000000  0.058267
  1.500000  0.000551  0.008076  0.000000  0.062429
  1.600000  0.000551  0.009153  0.000000  0.066590
  1.700000  0.000551  0.010297  0.000000  0.070752
  1.800000  0.000551  0.011508  0.000000  0.074914
  1.900000  0.000551  0.012787  0.000000  0.079076
  2.000000  0.000551  0.014133  0.000000  0.083238
  2.100000  0.000551  0.015546  0.000000  0.087400
  2.200000  0.000551  0.017027  0.000000  0.091562
  2.300000  0.000551  0.018575  0.000000  0.095724
  2.400000  0.000551  0.020190  0.000000  0.099886
  2.500000  0.000551  0.021873  0.000000  0.104048
  2.600000  0.000551  0.023622  0.000000  0.108210
  2.700000  0.000551  0.025440  0.000000  0.112371
  2.800000  0.000551  0.027324  0.000000  0.116533
  2.900000  0.000551  0.029276  0.000000  0.120695
  3.000000  0.000551  0.031295  0.000000  0.124857
  3.100000  0.000551  0.033381  0.000000  0.129019
  3.200000  0.000551  0.035535  0.000000  0.133181
  3.300000  0.000551  0.037755  0.000000  0.137343
  3.400000  0.000551  0.040044  0.000000  0.141505
  4.400000  0.000551  0.042399  6.000000  0.141505
  END FTABLE  2
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM     22 IRRG     ENGL    0.7       SAME PERLND  64     EXTNL  SURLI
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      2 PREC     ENGL    1              RCHRES   2     EXTNL  PREC
WDM      1 EVAP     ENGL    1              RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    1              RCHRES   2     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1036 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1037 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

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

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

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

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

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

ERROR/WARNING ID: 341 6

DATE/TIME: 1969/ 2/ 6 6:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1744.3	1846.9	1850.5

ERROR/WARNING ID: 341 5

DATE/TIME: 1969/ 2/ 6 6:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-4.971E+01	1.0355	1.0355	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1983/ 3/ 1 10:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1744.3	1846.9	1854.3

ERROR/WARNING ID: 341 5

DATE/TIME: 1983/ 3/ 1 10:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-51.449	1.0718	1.0718E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1992/ 3/20 15:30

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1927.0

ERROR/WARNING ID: 341 5

DATE/TIME: 1992/ 3/20 15:30

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-85.499	1.7811	1.7811E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/ 1/25 15: 0

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1852.3

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/ 1/25 15: 0

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-5.053E+01	1.0526	1.0526E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/ 1/25 15:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1847.9

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/ 1/25 15:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-48.490	1.0102	1.0101E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/12/ 6 4:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1863.8

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/12/ 6 4:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-5.593E+01	1.1651	1.1651E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/12/ 6 4:30

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1979.2

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/12/ 6 4:30

RCHRES: 2

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0).

Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-109.93	2.2901	2.2901E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1997/12/ 6 5: 0

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1944.4

ERROR/WARNING ID: 341   5

DATE/TIME: 1997/12/ 6 5: 0

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-93.641	1.9507	1.9507E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1997/12/ 6 9:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1859.5

ERROR/WARNING ID: 341   5

DATE/TIME: 1997/12/ 6 9:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-53.886	1.1226	1.1226E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2003/ 3/15 13:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1856.8

ERROR/WARNING ID: 341 5

DATE/TIME: 2003/ 3/15 13:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-5.263E+01	1.0964	1.0964E+00	2

Disclaimer

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General Model Information

Project Name:	Garg Residence 2
Site Name:	Garg Residence
Site Address:	1 O'Hill Ridge
City:	Laguna Hills, CA
Report Date:	3/18/2019
Gage:	Laguna Beach
Data Start:	10/01/1949
Data End:	09/30/2006
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/02/19

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
D,Scrub,VSteep(>15%)	6.01
Pervious Total	6.01
Impervious Land Use	acre
Impervious Total	0
Basin Total	6.01

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
D,Urban,VSteep(>15%)	4.83
Pervious Total	4.83

Impervious Land Use	acre
Impervious,Flat(0-5)	1.18
Impervious Total	1.18
Basin Total	6.01

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1	Trapezoidal Pond 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length: 145.40 ft.
Bottom Width: 36.35 ft.
Depth: 3 ft.
Volume at riser head: 0.2596 acre-feet.
Side slope 1: 1 To 1
Side slope 2: 1 To 1
Side slope 3: 1 To 1
Side slope 4: 1 To 1
Discharge Structure
Riser Height: 2 ft.
Riser Diameter: 54 in.
Notch Type: Rectangular
Notch Width: 0.002 ft.
Notch Height: 0.117 ft.
Orifice 1 Diameter: 3.078 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2
MWS 6

Pond Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.121	0.000	0.000	0.000
0.0333	0.121	0.004	0.046	0.000
0.0667	0.121	0.008	0.066	0.000
0.1000	0.122	0.012	0.081	0.000
0.1333	0.122	0.016	0.093	0.000
0.1667	0.122	0.020	0.105	0.000
0.2000	0.123	0.024	0.115	0.000
0.2333	0.123	0.028	0.124	0.000
0.2667	0.123	0.032	0.132	0.000
0.3000	0.123	0.036	0.140	0.000
0.3333	0.124	0.040	0.148	0.000
0.3667	0.124	0.045	0.155	0.000
0.4000	0.124	0.049	0.162	0.000
0.4333	0.125	0.053	0.169	0.000
0.4667	0.125	0.057	0.175	0.000
0.5000	0.125	0.061	0.181	0.000
0.5333	0.125	0.065	0.187	0.000
0.5667	0.126	0.070	0.193	0.000
0.6000	0.126	0.074	0.199	0.000
0.6333	0.126	0.078	0.204	0.000
0.6667	0.126	0.082	0.209	0.000
0.7000	0.127	0.087	0.215	0.000
0.7333	0.127	0.091	0.220	0.000
0.7667	0.127	0.095	0.225	0.000
0.8000	0.128	0.099	0.230	0.000
0.8333	0.128	0.104	0.234	0.000
0.8667	0.128	0.108	0.239	0.000
0.9000	0.128	0.112	0.243	0.000
0.9333	0.129	0.116	0.248	0.000
0.9667	0.129	0.121	0.252	0.000
1.0000	0.129	0.125	0.257	0.000
1.0333	0.130	0.129	0.261	0.000

1.0667	0.130	0.134	0.265	0.000
1.1000	0.130	0.138	0.269	0.000
1.1333	0.130	0.142	0.273	0.000
1.1667	0.131	0.147	0.277	0.000
1.2000	0.131	0.151	0.281	0.000
1.2333	0.131	0.156	0.285	0.000
1.2667	0.132	0.160	0.289	0.000
1.3000	0.132	0.164	0.293	0.000
1.3333	0.132	0.169	0.296	0.000
1.3667	0.132	0.173	0.300	0.000
1.4000	0.133	0.178	0.304	0.000
1.4333	0.133	0.182	0.307	0.000
1.4667	0.133	0.187	0.311	0.000
1.5000	0.134	0.191	0.314	0.000
1.5333	0.134	0.196	0.318	0.000
1.5667	0.134	0.200	0.321	0.000
1.6000	0.134	0.205	0.325	0.000
1.6333	0.135	0.209	0.328	0.000
1.6667	0.135	0.214	0.331	0.000
1.7000	0.135	0.218	0.335	0.000
1.7333	0.136	0.223	0.338	0.000
1.7667	0.136	0.227	0.341	0.000
1.8000	0.136	0.232	0.344	0.000
1.8333	0.136	0.236	0.348	0.000
1.8667	0.137	0.241	0.351	0.000
1.9000	0.137	0.245	0.354	0.000
1.9333	0.137	0.250	0.357	0.000
1.9667	0.138	0.255	0.360	0.000
2.0000	0.138	0.259	0.363	0.000
2.0333	0.138	0.264	0.657	0.000
2.0667	0.139	0.268	1.192	0.000
2.1000	0.139	0.273	1.882	0.000
2.1333	0.139	0.278	2.699	0.000
2.1667	0.139	0.282	3.625	0.000
2.2000	0.140	0.287	4.648	0.000
2.2333	0.140	0.292	5.759	0.000
2.2667	0.140	0.296	6.951	0.000
2.3000	0.141	0.301	8.218	0.000
2.3333	0.141	0.306	9.556	0.000
2.3667	0.141	0.310	10.95	0.000
2.4000	0.141	0.315	12.42	0.000
2.4333	0.142	0.320	13.94	0.000
2.4667	0.142	0.325	15.52	0.000
2.5000	0.142	0.329	17.15	0.000
2.5333	0.143	0.334	18.82	0.000
2.5667	0.143	0.339	20.54	0.000
2.6000	0.143	0.344	22.30	0.000
2.6333	0.144	0.349	24.10	0.000
2.6667	0.144	0.353	25.93	0.000
2.7000	0.144	0.358	27.80	0.000
2.7333	0.144	0.363	29.69	0.000
2.7667	0.145	0.368	31.60	0.000
2.8000	0.145	0.373	33.53	0.000
2.8333	0.145	0.378	35.48	0.000
2.8667	0.146	0.382	37.45	0.000
2.9000	0.146	0.387	39.42	0.000
2.9333	0.146	0.392	41.41	0.000
2.9667	0.146	0.397	43.39	0.000

3.0000	0.147	0.402	45.38	0.000
3.0333	0.147	0.407	47.36	0.000

MWS 6

MWS Model Number: MWS-L-6-8
Media Filter Rate (in/hr): 25

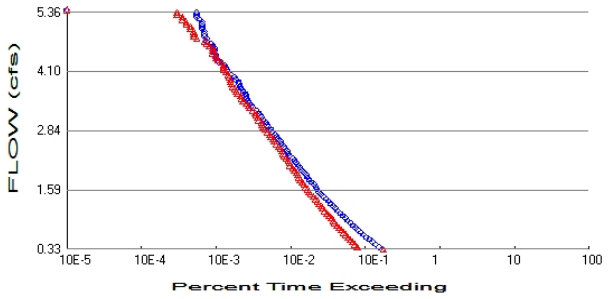
Element Flows To:
Outlet 1 Outlet 2

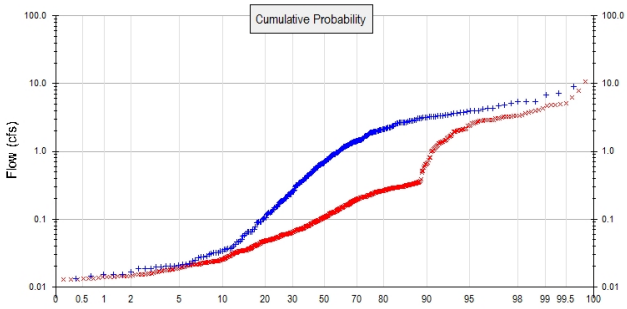
MWS Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
9.0000	0.000	0.000	0.000	0.000
9.0000	0.000	0.000	0.000	0.004
9.0000	0.000	0.000	0.000	0.008
9.0000	0.000	0.000	0.000	0.012
9.0000	0.000	0.000	0.000	0.016
9.0000	0.000	0.001	0.000	0.020
9.0000	0.000	0.001	0.000	0.025
9.0000	0.000	0.001	0.000	0.029
9.0000	0.000	0.002	0.000	0.033
9.0000	0.000	0.003	0.000	0.037
9.0000	0.000	0.003	0.000	0.041
9.0000	0.000	0.004	0.000	0.045
9.0000	0.000	0.005	0.000	0.049
9.0000	0.000	0.006	0.000	0.054
9.0000	0.000	0.007	0.000	0.058
9.0000	0.000	0.008	0.000	0.062
9.0000	0.000	0.009	0.000	0.066
9.0000	0.000	0.010	0.000	0.070
9.0000	0.000	0.011	0.000	0.074
9.0000	0.000	0.012	0.000	0.079
9.0000	0.000	0.014	0.000	0.083
9.0000	0.000	0.015	0.000	0.087
9.0000	0.000	0.017	0.000	0.091
9.0000	0.000	0.018	0.000	0.095
9.0000	0.000	0.020	0.000	0.099
9.0000	0.000	0.021	0.000	0.104
9.0000	0.000	0.023	0.000	0.108
9.0000	0.000	0.025	0.000	0.112
9.0000	0.000	0.027	0.000	0.116
9.0000	0.000	0.029	0.000	0.120
9.0000	0.000	0.031	0.000	0.124
9.0000	0.000	0.033	0.000	0.129
9.0000	0.000	0.035	0.000	0.133
9.0000	0.000	0.037	0.000	0.137
9.0000	0.000	0.040	0.000	0.141
9.0000	0.000	0.042	6.000	0.141

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 6.01
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 4.83
Total Impervious Area: 1.18

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	3.269045
5 year	4.234864
10 year	5.359338
25 year	6.890759

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	2.876352
5 year	3.883888
10 year	4.836778
25 year	6.637721

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.3269	3400	3478	102	Pass
0.3777	3062	1559	50	Pass
0.4286	2770	1453	52	Pass
0.4794	2492	1330	53	Pass
0.5302	2262	1247	55	Pass
0.5811	2049	1168	57	Pass
0.6319	1876	1089	58	Pass
0.6827	1734	1024	59	Pass
0.7336	1575	944	59	Pass
0.7844	1472	878	59	Pass
0.8352	1355	828	61	Pass
0.8861	1256	774	61	Pass
0.9369	1161	740	63	Pass
0.9877	1072	698	65	Pass
1.0386	988	653	66	Pass
1.0894	919	611	66	Pass
1.1402	851	568	66	Pass
1.1911	788	526	66	Pass
1.2419	732	511	69	Pass
1.2927	677	475	70	Pass
1.3436	636	458	72	Pass
1.3944	594	428	72	Pass
1.4452	546	401	73	Pass
1.4961	505	368	72	Pass
1.5469	475	346	72	Pass
1.5977	448	334	74	Pass
1.6486	430	314	73	Pass
1.6994	406	299	73	Pass
1.7502	377	285	75	Pass
1.8011	353	268	75	Pass
1.8519	337	258	76	Pass
1.9027	319	248	77	Pass
1.9535	304	237	77	Pass
2.0044	283	224	79	Pass
2.0552	268	211	78	Pass
2.1060	252	196	77	Pass
2.1569	238	190	79	Pass
2.2077	225	184	81	Pass
2.2585	212	173	81	Pass
2.3094	193	165	85	Pass
2.3602	185	158	85	Pass
2.4110	180	151	83	Pass
2.4619	169	144	85	Pass
2.5127	160	136	85	Pass
2.5635	151	126	83	Pass
2.6144	144	121	84	Pass
2.6652	137	117	85	Pass
2.7160	129	108	83	Pass
2.7669	123	104	84	Pass
2.8177	113	97	85	Pass
2.8685	108	89	82	Pass
2.9194	100	84	84	Pass
2.9702	96	81	84	Pass

3.0210	92	81	88	Pass
3.0719	86	74	86	Pass
3.1227	81	72	88	Pass
3.1735	79	68	86	Pass
3.2244	74	67	90	Pass
3.2752	69	62	89	Pass
3.3260	62	56	90	Pass
3.3769	59	54	91	Pass
3.4277	56	50	89	Pass
3.4785	54	46	85	Pass
3.5294	52	43	82	Pass
3.5802	51	42	82	Pass
3.6310	49	38	77	Pass
3.6819	46	37	80	Pass
3.7327	43	36	83	Pass
3.7835	42	33	78	Pass
3.8344	41	32	78	Pass
3.8852	40	31	77	Pass
3.9360	37	31	83	Pass
3.9869	35	30	85	Pass
4.0377	32	29	90	Pass
4.0885	29	27	93	Pass
4.1394	28	25	89	Pass
4.1902	27	25	92	Pass
4.2410	26	25	96	Pass
4.2919	22	24	109	Pass
4.3427	21	21	100	Pass
4.3935	20	20	100	Pass
4.4444	20	20	100	Pass
4.4952	19	18	94	Pass
4.5460	19	18	94	Pass
4.5968	19	18	94	Pass
4.6477	18	16	88	Pass
4.6985	17	15	88	Pass
4.7493	15	14	93	Pass
4.8002	15	11	73	Pass
4.8510	14	10	71	Pass
4.9018	14	10	71	Pass
4.9527	14	10	71	Pass
5.0035	13	9	69	Pass
5.0543	13	9	69	Pass
5.1052	13	8	61	Pass
5.1560	13	8	61	Pass
5.2068	12	7	58	Pass
5.2577	11	7	63	Pass
5.3085	11	6	54	Pass
5.3593	11	6	54	Pass

Water Quality

POC 2

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

Model Default Modifications

Total of 0 changes have been made.

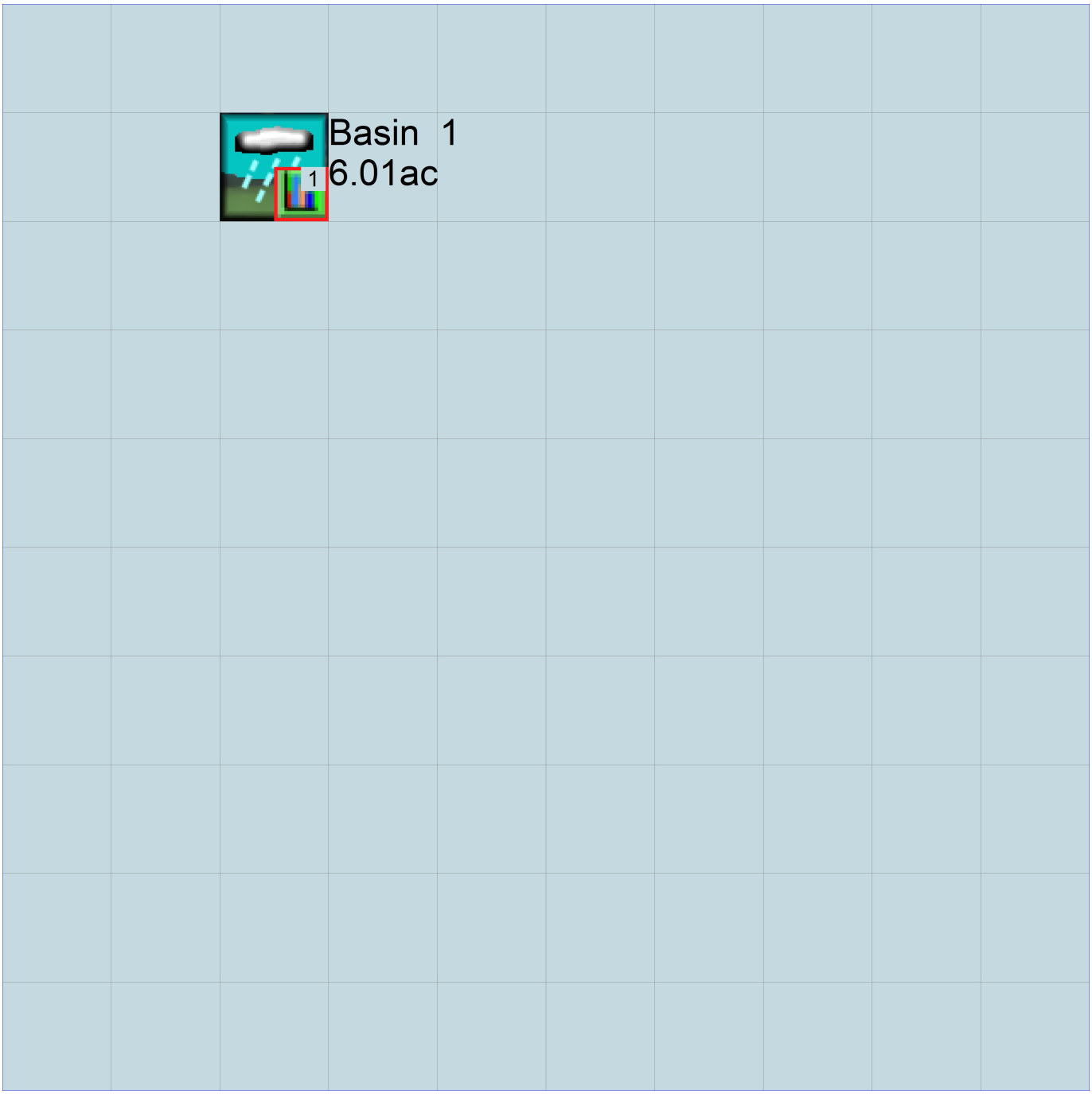
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1949 10 01        END    2006 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   Garg Residence 2.wdm
MESSU       25   MitGarg Residence 2.MES
            27   MitGarg Residence 2.L61
            28   MitGarg Residence 2.L62
            30   POCGarg Residence 21.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      64
      IMPLND       1
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Trapezoidal Pond  1         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   64     D,Urban,VSteep(>15%)    1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   64         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
```

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   64         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   64         0    0    0    1    0    0    0    0    1    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   64              0       3.6     0.012       250       0.2       0.8     0.955
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   64             40        35         4         2         0      0.03         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   64              0       0.2      0.25         1       0.3         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   64       0.5  0.5  0.5  0.6 0.65 0.65 0.65 0.65 0.65 0.65 0.55  0.5
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   64      0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12 0.12
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   64              0         0      0.02         0      0.72       0.3      0.01
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                    in  out           ***
    1     Impervious,Flat(0-5)    1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

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

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

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

```
    1         0    0    0    0    0
  END IWAT-PARM1

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

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

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  64                        4.83     RCHRES   1      2
PERLND  64                        4.83     RCHRES   1      3
IMPLND   1                        1.18     RCHRES   1      5

******Routing******
PERLND  64                        4.83     COPY     1     12
IMPLND   1                        1.18     COPY     1     15
PERLND  64                        4.83     COPY     1     13
RCHRES   1                           1     RCHRES   2      6
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                        in  out                             ***
    1     Trapezoidal Pond-035    1    1    1    1   28    0    1
    2     MWS  6                  2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

```
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------->      ***
    1              1      0.03       0.0       0.0       0.5       0.0
    2              2       1.0       0.0       9.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.121341  0.000000  0.000000
  0.033333  0.121619  0.004049  0.046939
  0.066667  0.121898  0.008108  0.066382
  0.100000  0.122176  0.012176  0.081301
  0.133333  0.122455  0.016253  0.093878
  0.166667  0.122734  0.020340  0.104959
  0.200000  0.123014  0.024435  0.114977
  0.233333  0.123293  0.028540  0.124189
  0.266667  0.123573  0.032655  0.132764
  0.300000  0.123853  0.036779  0.140817
  0.333333  0.124133  0.040912  0.148435
  0.366667  0.124413  0.045054  0.155680
  0.400000  0.124694  0.049206  0.162602
  0.433333  0.124974  0.053367  0.169242
  0.466667  0.125255  0.057538  0.175630
  0.500000  0.125536  0.061717  0.181795
  0.533333  0.125818  0.065907  0.187757
  0.566667  0.126099  0.070105  0.193535
  0.600000  0.126381  0.074313  0.199146
  0.633333  0.126663  0.078531  0.204603
  0.666667  0.126945  0.082757  0.209918
  0.700000  0.127227  0.086994  0.215102
  0.733333  0.127510  0.091239  0.220164
  0.766667  0.127793  0.095494  0.225112
  0.800000  0.128076  0.099759  0.229954
  0.833333  0.128359  0.104033  0.234696
  0.866667  0.128642  0.108316  0.239344
  0.900000  0.128926  0.112609  0.243903
  0.933333  0.129210  0.116911  0.248379
  0.966667  0.129494  0.121223  0.252775
  1.000000  0.129778  0.125544  0.257096
  1.033333  0.130062  0.129875  0.261346
  1.066667  0.130347  0.134215  0.265528
  1.100000  0.130632  0.138564  0.269645
```

```
1.133333  0.130917  0.142924  0.273700
1.166667  0.131202  0.147292  0.277696
1.200000  0.131487  0.151670  0.281635
1.233333  0.131773  0.156058  0.285520
1.266667  0.132059  0.160455  0.289352
1.300000  0.132345  0.164862  0.293135
1.333333  0.132631  0.169278  0.296869
1.366667  0.132917  0.173704  0.300557
1.400000  0.133204  0.178139  0.304201
1.433333  0.133491  0.182584  0.307801
1.466667  0.133778  0.187039  0.311359
1.500000  0.134065  0.191503  0.314877
1.533333  0.134352  0.195976  0.318357
1.566667  0.134640  0.200460  0.321799
1.600000  0.134928  0.204952  0.325204
1.633333  0.135216  0.209455  0.328574
1.666667  0.135504  0.213967  0.331910
1.700000  0.135793  0.218488  0.335213
1.733333  0.136081  0.223020  0.338483
1.766667  0.136370  0.227561  0.341722
1.800000  0.136659  0.232111  0.344931
1.833333  0.136949  0.236671  0.348110
1.866667  0.137238  0.241241  0.351261
1.900000  0.137528  0.245820  0.354398
1.933333  0.137818  0.250409  0.357557
1.966667  0.138108  0.255008  0.360715
2.000000  0.138398  0.259617  0.363867
2.033333  0.138689  0.264235  0.657646
2.066667  0.138979  0.268863  1.191965
2.100000  0.139270  0.273500  1.882627
2.133333  0.139562  0.278147  2.699565
2.166667  0.139853  0.282804  3.625344
2.200000  0.140144  0.287471  4.648102
2.233333  0.140436  0.292147  5.759001
2.266667  0.140728  0.296833  6.951031
2.300000  0.141020  0.301529  8.218364
2.333333  0.141313  0.306235  9.555974
2.366667  0.141605  0.310950  10.95939
2.400000  0.141898  0.315675  12.42452
2.433333  0.142191  0.320410  13.94755
2.466667  0.142484  0.325154  15.52487
2.500000  0.142777  0.329909  17.15299
2.533333  0.143071  0.334673  18.82849
2.566667  0.143365  0.339447  20.54802
2.600000  0.143659  0.344230  22.30826
2.633333  0.143953  0.349024  24.10588
2.666667  0.144247  0.353827  25.93756
2.700000  0.144542  0.358641  27.79995
2.733333  0.144837  0.363463  29.68969
2.766667  0.145132  0.368296  31.60339
2.800000  0.145427  0.373139  33.53761
2.833333  0.145722  0.377991  35.48893
2.866667  0.146018  0.382854  37.45386
2.900000  0.146314  0.387726  39.42890
2.933333  0.146610  0.392608  41.41056
2.966667  0.146906  0.397500  43.39531
3.000000  0.147202  0.402402  45.37961
END FTABLE  1
FTABLE      2
 36    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.000551  0.000000  0.000000  0.000000
0.100000  0.000551  0.000067  0.000000  0.004162
0.200000  0.000551  0.000202  0.000000  0.008324
0.300000  0.000551  0.000404  0.000000  0.012486
0.400000  0.000551  0.000673  0.000000  0.016648
0.500000  0.000551  0.001010  0.000000  0.020810
0.600000  0.000551  0.001413  0.000000  0.024971
0.700000  0.000551  0.001884  0.000000  0.029133
```

```
  0.800000  0.000551  0.002423  0.000000  0.033295
  0.900000  0.000551  0.003029  0.000000  0.037457
  1.000000  0.000551  0.003702  0.000000  0.041619
  1.100000  0.000551  0.004442  0.000000  0.045781
  1.200000  0.000551  0.005249  0.000000  0.049943
  1.300000  0.000551  0.006124  0.000000  0.054105
  1.400000  0.000551  0.007067  0.000000  0.058267
  1.500000  0.000551  0.008076  0.000000  0.062429
  1.600000  0.000551  0.009153  0.000000  0.066590
  1.700000  0.000551  0.010297  0.000000  0.070752
  1.800000  0.000551  0.011508  0.000000  0.074914
  1.900000  0.000551  0.012787  0.000000  0.079076
  2.000000  0.000551  0.014133  0.000000  0.083238
  2.100000  0.000551  0.015546  0.000000  0.087400
  2.200000  0.000551  0.017027  0.000000  0.091562
  2.300000  0.000551  0.018575  0.000000  0.095724
  2.400000  0.000551  0.020190  0.000000  0.099886
  2.500000  0.000551  0.021873  0.000000  0.104048
  2.600000  0.000551  0.023622  0.000000  0.108210
  2.700000  0.000551  0.025440  0.000000  0.112371
  2.800000  0.000551  0.027324  0.000000  0.116533
  2.900000  0.000551  0.029276  0.000000  0.120695
  3.000000  0.000551  0.031295  0.000000  0.124857
  3.100000  0.000551  0.033381  0.000000  0.129019
  3.200000  0.000551  0.035535  0.000000  0.133181
  3.300000  0.000551  0.037755  0.000000  0.137343
  3.400000  0.000551  0.040044  0.000000  0.141505
  4.400000  0.000551  0.042399  6.000000  0.141505
  END FTABLE  2
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM     22 IRRG     ENGL    0.7       SAME PERLND  64     EXTNL  SURLI
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      2 PREC     ENGL    1              RCHRES   2     EXTNL  PREC
WDM      1 EVAP     ENGL    1              RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    1              RCHRES   2     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1036 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1037 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

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

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

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

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

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

ERROR/WARNING ID: 341 6

DATE/TIME: 1969/ 2/ 6 6:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1744.3	1846.9	1850.5

ERROR/WARNING ID: 341 5

DATE/TIME: 1969/ 2/ 6 6:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-4.971E+01	1.0355	1.0355	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1983/ 3/ 1 10:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1744.3	1846.9	1854.3

ERROR/WARNING ID: 341 5

DATE/TIME: 1983/ 3/ 1 10:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-51.449	1.0718	1.0718E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1992/ 3/20 15:30

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1927.0

ERROR/WARNING ID: 341 5

DATE/TIME: 1992/ 3/20 15:30

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-85.499	1.7811	1.7811E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/ 1/25 15: 0

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1852.3

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/ 1/25 15: 0

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-5.053E+01	1.0526	1.0526E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/ 1/25 15:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1847.9

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/ 1/25 15:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-48.490	1.0102	1.0101E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/12/ 6 4:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1863.8

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/12/ 6 4:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-5.593E+01	1.1651	1.1651E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1997/12/ 6 4:30

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1979.2

ERROR/WARNING ID: 341 5

DATE/TIME: 1997/12/ 6 4:30

RCHRES: 2

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0).

Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-109.93	2.2901	2.2901E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1997/12/ 6 5: 0

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1944.4

ERROR/WARNING ID: 341   5

DATE/TIME: 1997/12/ 6 5: 0

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-93.641	1.9507	1.9507E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1997/12/ 6 9:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1859.5

ERROR/WARNING ID: 341   5

DATE/TIME: 1997/12/ 6 9:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-53.886	1.1226	1.1226E+00	2

ERROR/WARNING ID: 341   6

DATE/TIME: 2003/ 3/15 13:15

RCHRES: 2

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

NROWS	V1	V2	VOL
36	1.7443E+03	1846.9	1856.8

ERROR/WARNING ID: 341 5

DATE/TIME: 2003/ 3/15 13:15

RCHRES: 2

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

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	48.003	-5.263E+01	1.0964	1.0964E+00	2

Disclaimer

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Local (360)943-0304

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Attachment G: MODULAR WETLAND INFORMATION

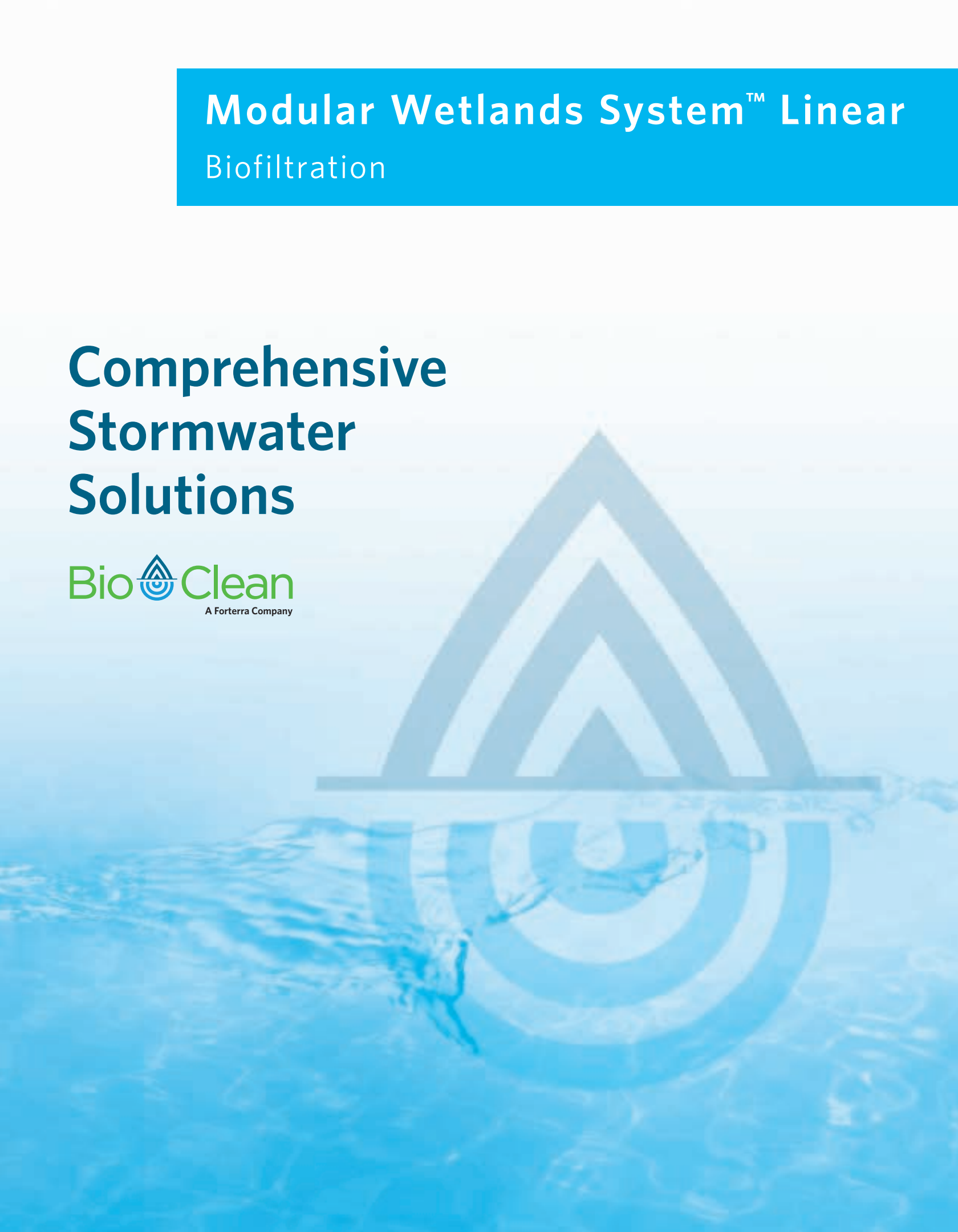
Attachment G: MODULAR WETLAND INFORMATION

Modular Wetlands System™ Linear

Biofiltration

Comprehensive Stormwater Solutions

Bio Clean
A Forterra Company



OVERVIEW

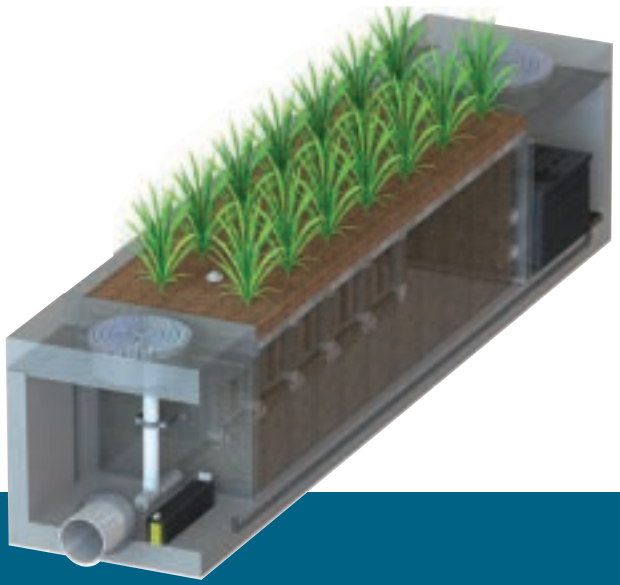
The Bio Clean Modular Wetlands System™ Linear (MWS Linear) represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pretreatment, the MWS Linear incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, in turn reducing maintenance costs and improving performance.

The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands, our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate waterways in urban areas.



PERFORMANCE

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With its advanced pretreatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses nature's ability to process, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world.

WASHINGTON STATE TAPE APPROVED

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

DEQ ASSIGNMENT

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Regulation technical criteria.

MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED

Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

MASTEP EVALUATION

The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

RHODE ISLAND DEM APPROVED

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

OPERATION

The MWS Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure 1 and Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

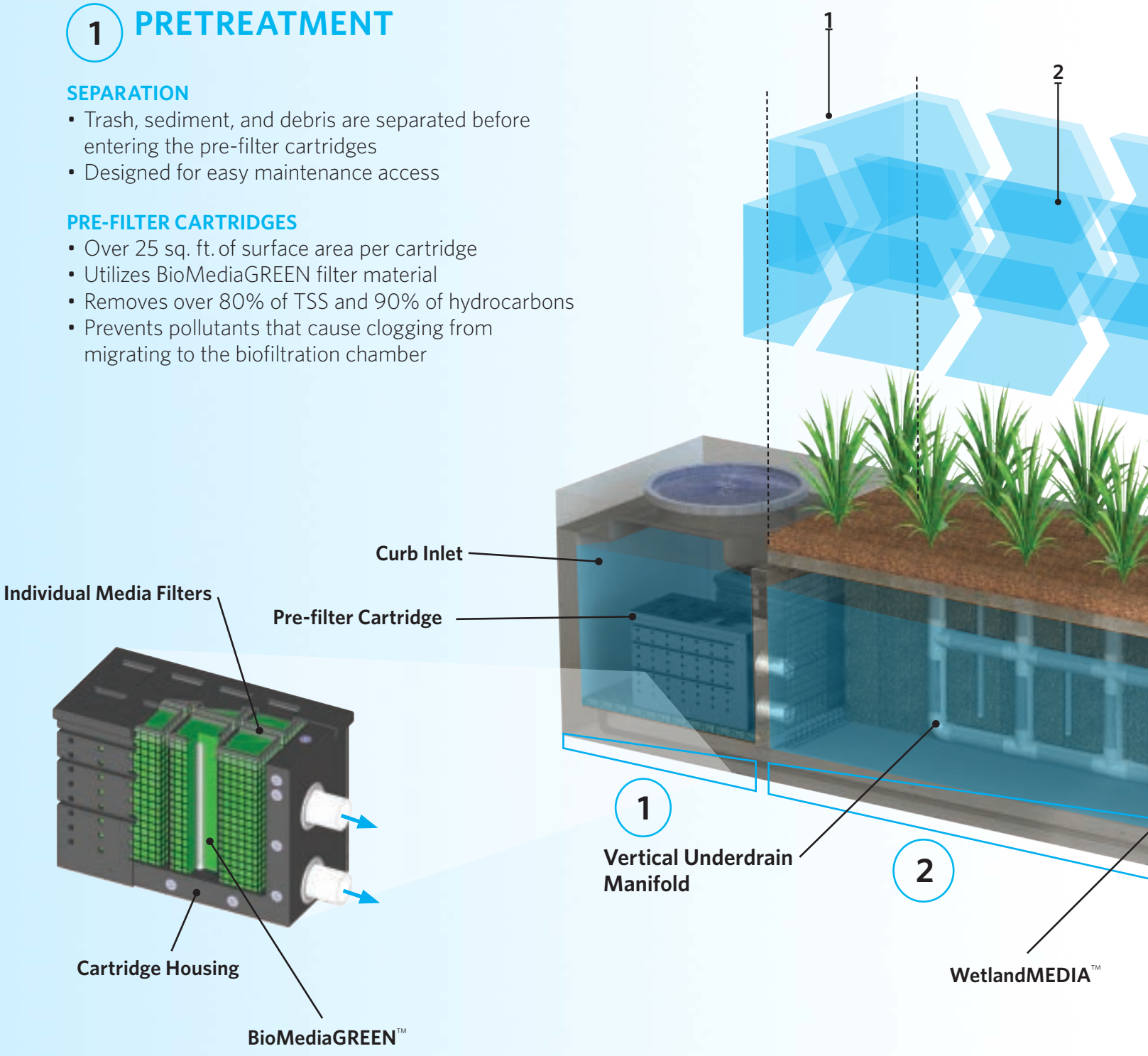
1 PRETREATMENT

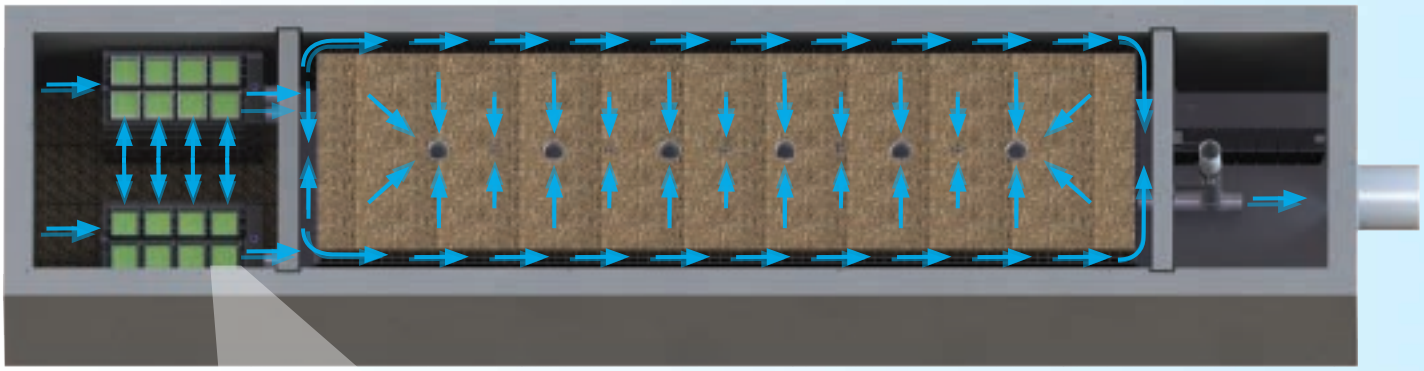
SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

PRE-FILTER CARTRIDGES

- Over 25 sq. ft. of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber





2x to 3x more surface area than traditional downward flow bioretention systems.

Figure 2, Top View



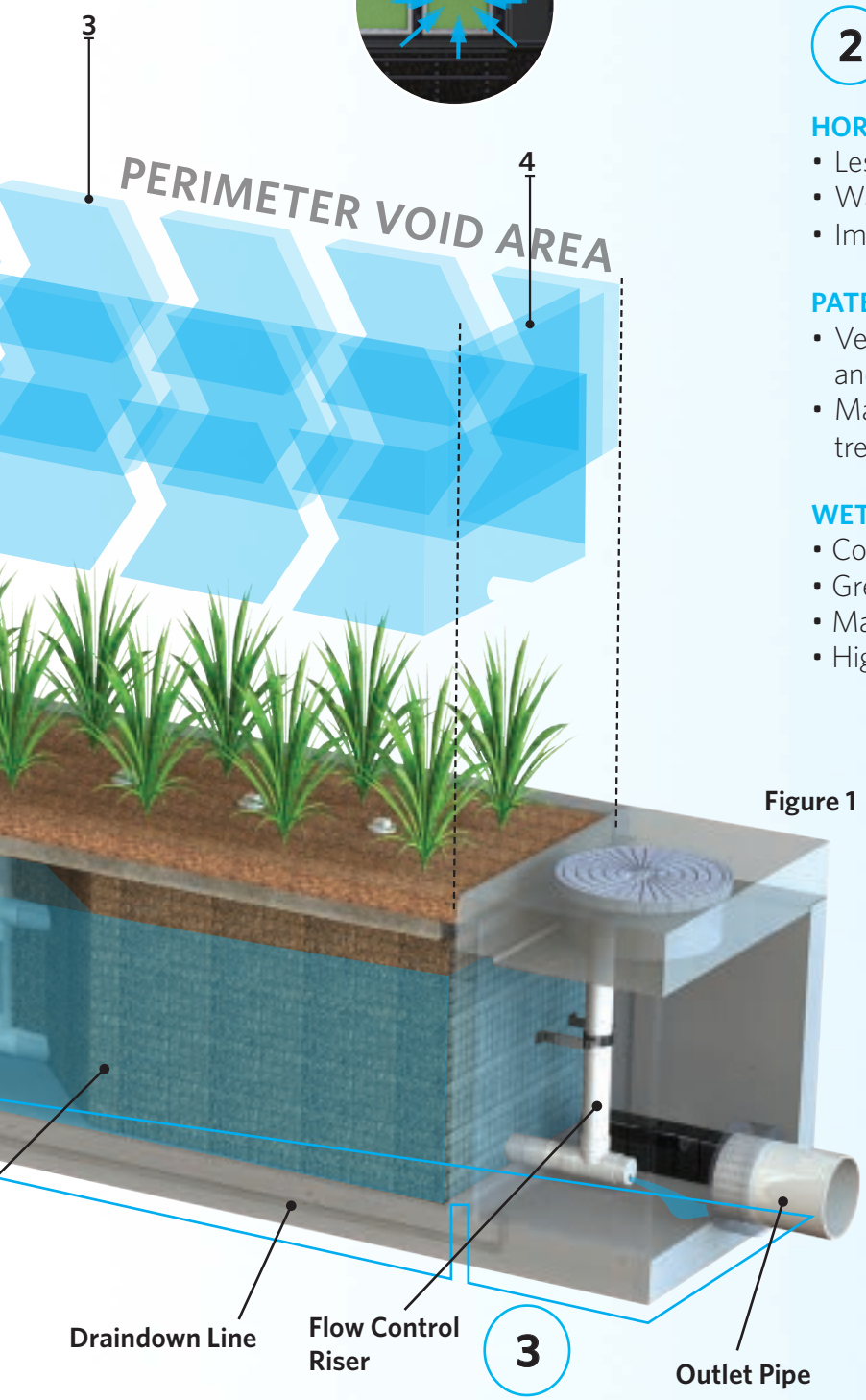


Figure 1

2 BIOFILTRATION

HORIZONTAL FLOW

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides
- Maximizes surface area of the media for higher treatment capacity

WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

3 DISCHARGE

FLOW CONTROL

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity
- Extends the life of the media and improves performance

DRAINDOWN FILTER

- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated





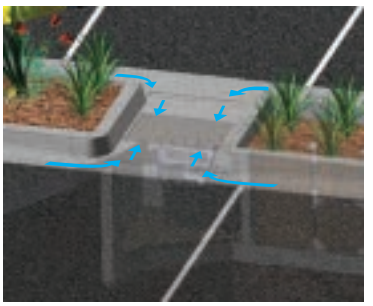
CONFIGURATIONS

The MWS Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.



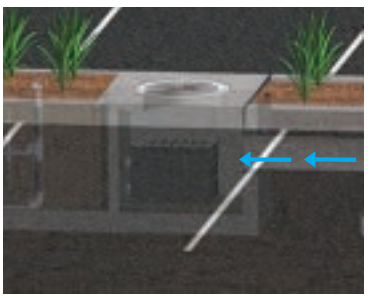
CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



VAULT TYPE

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/ bioretention systems. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.



DOWNSPOUT TYPE

The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

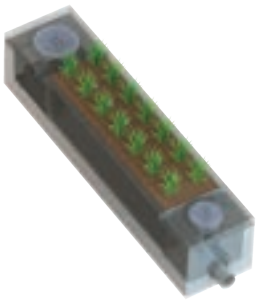
ORIENTATIONS

SIDE-BY-SIDE



The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side.This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

END-TO-END



The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.

BYPASS

INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

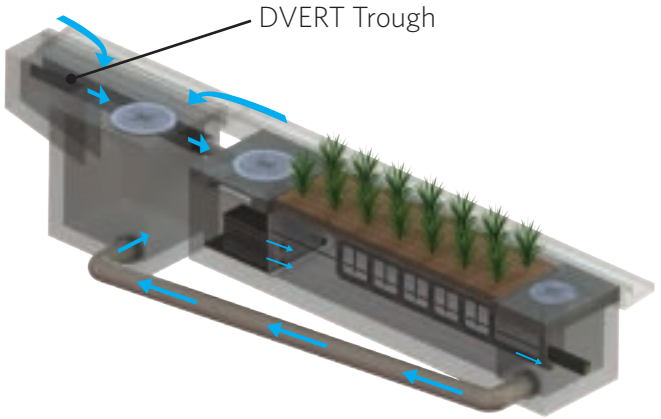
EXTERNAL DIVERSION WEIR STRUCTURE

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT LOW FLOW DIVERSION



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the MWS Linear to be installed anywhere space is available.

SPECIFICATIONS

FLOW-BASED

The MWS Linear can be used in stand-alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq.ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4′ x 4′	23	0.052
MWS-L-4-6	4′ x 6′	32	0.073
MWS-L-4-8	4′ x 8′	50	0.115
MWS-L-4-13	4′ x 13′	63	0.144
MWS-L-4-15	4′ x 15′	76	0.175
MWS-L-4-17	4′ x 17′	90	0.206
MWS-L-4-19	4′ x 19′	103	0.237
MWS-L-4-21	4′ x 21′	117	0.268
MWS-L-6-8	7′ x 9′	64	0.147
MWS-L-8-8	8′ x 8′	100	0.230
MWS-L-8-12	8′ x 12′	151	0.346
MWS-L-8-16	8′ x 16′	201	0.462
MWS-L-8-20	9′ x 21′	252	0.577
MWS-L-8-24	9′ x 25′	302	0.693

SPECIFICATIONS

VOLUME-BASED

Many states require treatment of a water quality volume and do not offer the option of flow-based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume-based design installed downstream of ponds, detention basins, and underground storage systems.

MODEL #	TREATMENT CAPACITY (cu. ft.) @ 24-HOUR DRAINDOWN	TREATMENT CAPACITY (cu. ft.) @ 48-HOUR DRAINDOWN
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-6-8	3191	6382
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145
MWS-L-8-20	12560	25120
MWS-L-8-24	15108	30216

APPLICATIONS

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.



INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.



RESIDENTIAL

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.



STREETS

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.



PARKING LOTS

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.



COMMERCIAL

Compared to bioretention systems, the MWS Linear can treat far more area in less space, meeting treatment and volume control requirements.



MIXED USE

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications include:

• Agriculture • Reuse • Low Impact Development • Waste Water

PLANT SELECTION



Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by visiting biocleanenvironmental.com/plants.

INSTALLATION



The MWS Linear is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

MAINTENANCE



Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pretreatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.

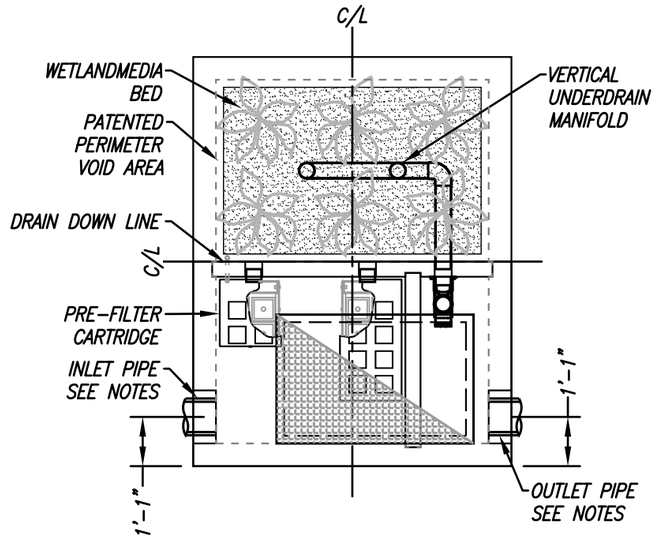


Bio Clean
A Forterra Company

398 Via El Centro
Oceanside, CA 92058
855.566.3938
stormwater@forterrabp.com
biocleanenvironmental.com

072318R1

SITE SPECIFIC DATA			
PROJECT NUMBER			
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	30"X48"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



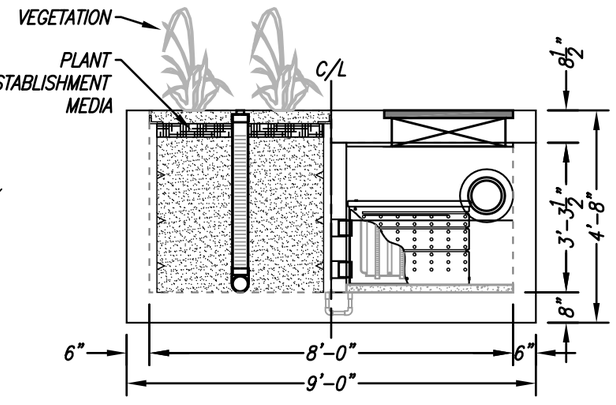
PLAN VIEW

INSTALLATION NOTES

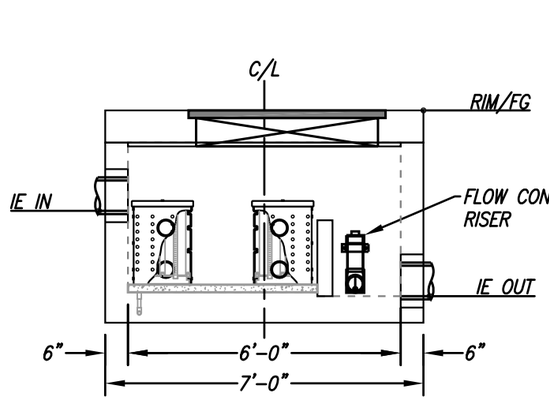
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

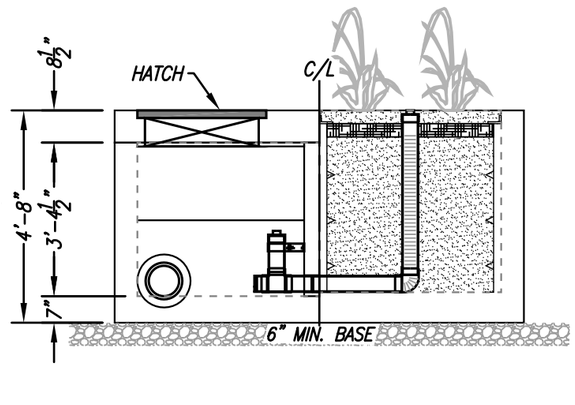
1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.147
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	1.7
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

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Bio Clean
A Forterra Company

MWS-L-6-8-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

Installation Guidelines for Modular Wetland System

Delivery & Unloading/Lifting

1. Modular Wetland Systems, Inc. shall deliver the unit(s) to the site in coordination with the Contractor.

2. The Contractor will require spreader bars and chains/cables to safely and securely lift the main structure, risers a set of suitable lifting hooks, knuckles, shackles and eye bolts.

3. The main structure and lid can be lifted together or separately.

   Please see Modular Wetland Weights and Lifting Details. Contact Modular Wetlands for additional lifting details.

Inspection

1. Inspection of the Modular Wetland unit and all parts contained in or shipped outside of the unit shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any non-conformance to approved drawings or damage to any part of the system shall be documented on the Modular Wetland shipping ticket. Damage to the unit during and after unloading shall be corrected at the expense of the Contractor. Any necessary repairs to the Modular Wetland unit shall be made to the acceptance of the Engineer/Inspector.

Site Preparation

1. The Contractor is responsible for providing adequate and complete site/inlet protection when the Modular Wetland unit is installed prior to final site stabilization (full landscaping, grass cover, final paving, and street sweeping completed).

2. The Contractor shall adhere to all jurisdictional and/or OSHA safety rules in providing temporary shoring of the excavation.

3. The Contractor or Owner is responsible for appropriately barricading the Modular Wetland unit from traffic (in accordance with local codes).

Installation Guidelines for Modular Wetland System

Installation

1. Each unit shall be constructed at the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.

2. The unit shall be placed on the compacted sub-grade with a minimum 6-inch gravel base matching the final grade of the curb line in the area of the unit. The unit is to be placed such that the unit and top slab match the grade of the curb in the area of the unit. Compact undisturbed sub-grade materials to 95% of maximum density at +1% to 2% of the optimum moisture. Unsuitable material below sub-grade shall be replaced to site engineer's approval. Please see Modular Wetlands Weights and Lifting Details. Contact Modular Wetlands for guidance where slope exceeds 5%.

3. Once the unit is set, the internal wooden forms and protective silt fabric cover must be left intact (if WetlandMedia pre-installed). The top lid(s) should be sealed onto the box section before backfilling, using a non-shrink grout, butyl rubber or similar waterproof seal. The boards on the top of the lid and boards sealed in the unit's throat must NOT be removed. The Supplier will remove these sections at the time of activation.

4. Outlet connections shall be aligned and sealed to meet the approved drawings with modifications necessary to meet site conditions and local regulations. The correct outlet will be marked on the Modular Wetland unit.

5. Backfilling should be performed in a careful manner, bringing the appropriate fill material up in 6-inch lifts on all sides. Precast sections shall be set in a manner that will result in a watertight joint. In all instances, installation of the Modular Wetland unit shall conform to ASTM specification C891 "Standard Practice for Installation of Underground Precast Utility Structures" unless specified otherwise in contract documents.

6. It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland unit for proper stormwater flow into the system through the throat, pipe or grate opening. A standard drawing of the throat and gutter detail is available in the following section; however the plans and contract documents supersede all standard drawings. Several variations of the standard design are available. Effective bypass for the Modular Wetland System is essential for correct operation (i.e. bypass to an overflow at lower elevation).

Installation Procedure

The contractor **MUST** provide all rigging And lifting apparatus, such as all cables, chains or straps and a set of lifting hooks, shackles, knuckles and eye bolts.



It is the contractor's responsibility to provide suitable lifting equipment to off-load the Modular Wetland unit.

Modular Wetland units are designed to be off-loaded using the contractor's spreader bar.



1. Apply Butyl Tape Seal

Apply butyl tape seal along the top of the box section. Butyl tape seal is provided with every unit.

Modular Wetland installed protective throat board and installed silt fabric must be left in place to protect the unit from construction sediment.



2. Unload and Set Box

Unload the Modular Wetland unit
the prepared hole with appropriate sub-grade.*

* Compacted sub-grade with a minimum
of six inches of gravel base which must match
the final grade of curb line the area of the unit.



3. Set Top On Box

Set the top slab on the box.

The Contractor is responsible for providing
adequate and complete site/inlet protection
when the Modular Wetland is installed prior
to final site stabilization (full landscaping,
grass cover, final paving, and street sweeping
completed).



4. Connect Outfall Pipe

The correct outlet will be marked on the
Modular Wetland.

Invert of outlet pipe **MUST** be even
with the floor of the system.



5. Install Curb & Gutter



It is the responsibility of the Contractor to provide curb and gutter and transition to the Modular Wetland for proper flow into the system through a 5”- 7” throat opening. A standard drawing of the throat and gutter detail in the following section. CONTRACTOR RESPONSIBLE FOR GROUTING IN ANY VISIBLE LIFTING POINTS.

6. Activation



Activation is performed **ONLY** by Modular Wetland personnel.

Activation can occur once the project site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed) and there is a 5” - 7” throat opening.

Call 760-433-7640 to schedule your activation.

NOTE: WetlandMedia Installation

For Larger models (MWS-L-4-13 and above) the system will be delivered without WetlandMedia pre-installed to minimize pick weight and prevent contamination of the media during construction. For these models the WetlandMedia will be delivered in bulk or in super sacks. It will be responsibility of the contractor to fill the system with the WetlandMedia during the installation process. Installation of the WetlandMedia can be done after the unit is fully installed to avoid contamination. See following pages for details.

WetlandMedia Install (if applicable)

1. Fill WetlandMedia

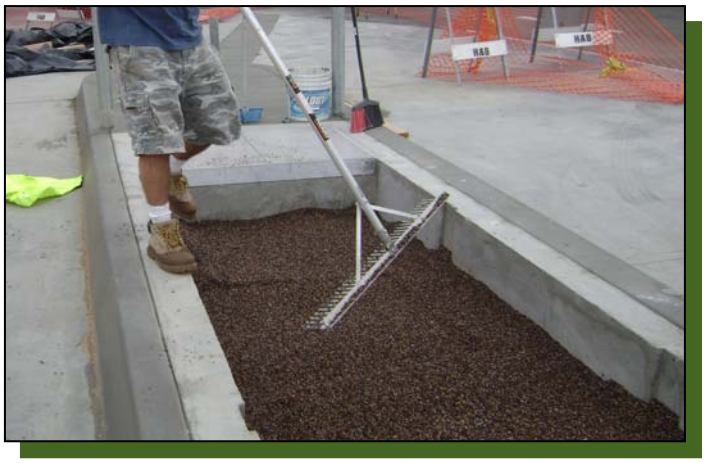
Position super sack of WetlandMedia over wetland chamber. Bottom of sack should not be more than 2' above top of system. Open sack and fill evenly*.

* One to several hundred cubic yards of WetlandMedia will be required based upon the model number and size of the system. For large scale jobs WetlandMedia will be delivered in bulk and will require a bobcat of similar to fill the system. All equipment is the responsibility of the contractor.



2. Install Plant Propagation Layer

Fill WetlandMedia up to 9" below the top of the wetland chamber. Level out the WetlandMedia as shown. Ensure that the level does not vary more than one inch or plant growth will be affected.



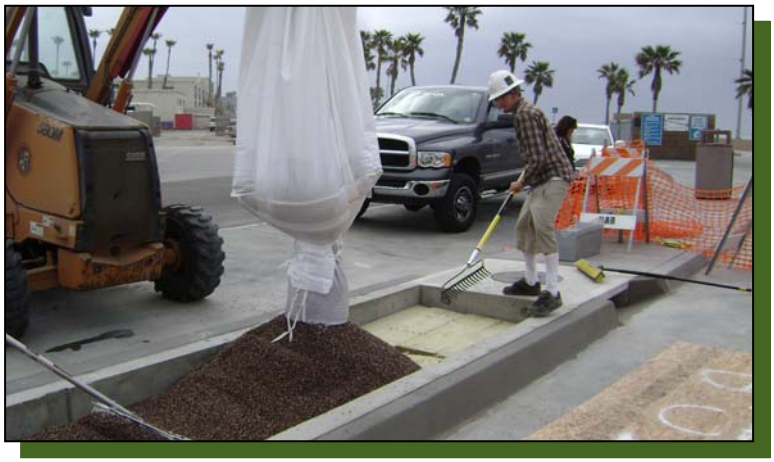
3. Install Plant Propagation Layer

Utilize plant propagation blocks provided by the manufacturer. Each block is approximately 40" by 6" by 3" thick. Blocks shall be placed side by side and end to end and cover the entire length and width of the wetland chamber unless specified.



4. Finish Filling WetlandMedia

After plant propagation blocks are installed repeat step 1 and fill the system to the top of the wetland chamber as shown. WetlandMedia must be filled within 2” of the top of the unit.



5. Planting

After system is filled with WetlandMedia planting of vegetation can begin. Utilizing 1 gallon plants dig down until The plant propagation blocks are reached. Remove plant and it’s root ball from the container. Set the bottom of the root ball on the tops of the blocks. Fill hole back in with WetlandMedia. After planting a thorough watering of the plants is necessary. The plant propagation blocks must be saturated to provide a water source for the plants during the establishment phase. It is recommended that hand watering is done three times a week for the first two months. Hand water can be supplemented with drip or spray irrigation after the second week. Please call the manufacturer for more details on plants, planting arrangement and irrigation options.

NOTE: planting is required on all units, including units delivered with WetlandMedia pre-installed.



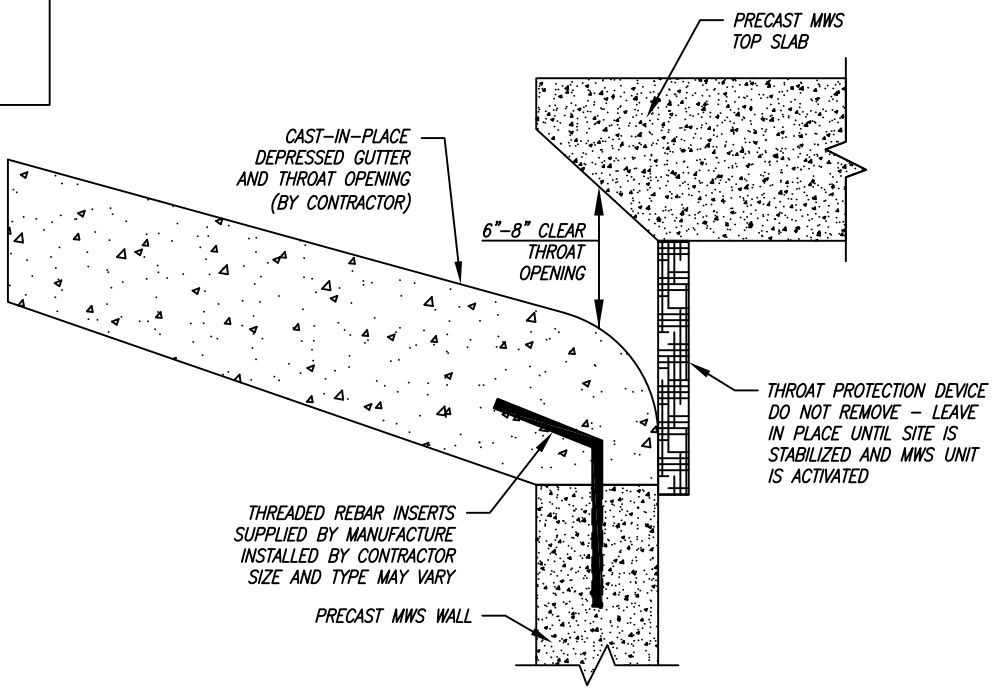


Curb and Gutter Details

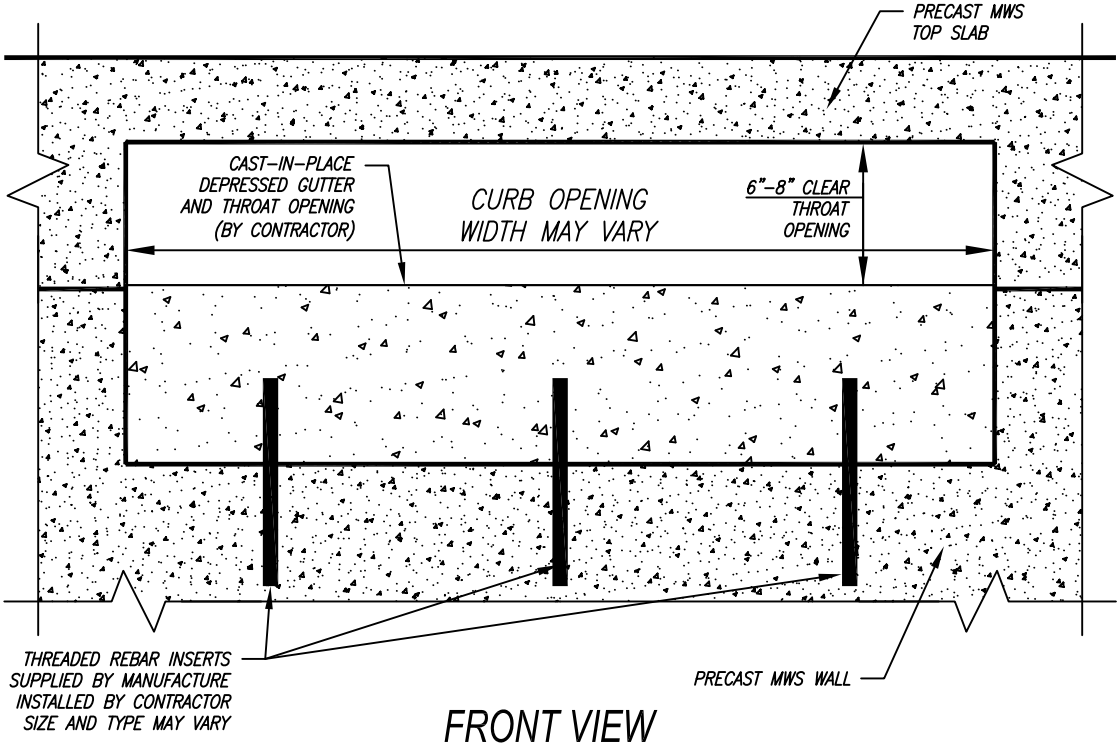


Modular Wetland System, Inc.
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E. Info@modularwetlands.com

www.modularwetlands.com



SECTION VIEW
STANDARD MODULAR WETLAND CURB OPENING



FRONT VIEW
STANDARD MODULAR WETLAND CURB OPENING

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

	NAME	DATE
DRAWN	John	5/3/13
EDITED		

TITLE: MWS LINEAR 2.0 CURB INLET DETAILS

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COMMENTS:

SIZE	DWG. NO.	REV

SCALE NTS	UNITS = INCHES	SHEET 1 OF 1

Weights and Lifting Details



Modular Wetland System, Inc.
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E. Info@modularwetlands.com

www.modularwetlands.com

MWS-L 2.0 Max Pick Weights

Model #	Size (O.D)	Size (I.D)	Unit Weight (lbs)	Media Weight (lbs)	Total Weight (lbs)
MWS-L-4-4	5' x 5'	4' x 4'	7500.0	1607.7	9107.7
MWS-L-4-6 MWS-L-4-6.5	5' x 7' 5 x 7.5'	4' x 6' 4' x 6.5'	11,000 11,500	1798.9	12,619.2 13,119.2
MWS-L-4-8	5' x 9'	8' x 4'	12500	3966	16466
MWS-L-4-13	5' x 14'	13' x 4'	21200	5895	27095
MWS-L-4-15	5' x 16'	15' x 4'	23700	8039	31739
MWS-L-4-17	5' x 18'	17' x 4'	26500	10182	36682
MWS-L-4-19	5' x 20'	19' x 4'	28300	12326	40626
MWS-L-4-21	5' x 22'	21' x 4'	30000	14470	44470
MWS-L-6-8	7' x 9'	6' x 8'	24000	6109	30109
MWS-L-8-8	9' x 9'	8' x 8'	32000	8253	40253
MWS-L-8-12	9' x 13'	8' x 12'	44000	12540	56540
MWS-L-8-16	9' x 17'	8' x 16'	47000	16828	63828
			Max Pick Weight if Shipped Without Media Installed		Max Pick Weight if Shipped With Media Installed

Note: All weights listed hereon are standard max pick weights, actual pick weights may vary based upon state and local regulations and variation in concerte and rebar standards. For project specific pick weights contact the manufacturer prior to shipping of the unit(s). Is is the contractors responsibility to off-load the unit with an adequate size crane. Units are shipped with WetlandMEDIA in superbags and installed by contractor.

When Available see project contract terms, if lifting points are on the inside of the unit due to custom designs or installations requiring pionts to be on the inside the media will be shipped in bags and the contractor will be reponsibile to install after the unit is installed. For example, units places against a wall.

For Questions or Comments Please Call 888-566-3938 or email: info@modularwetlands.com

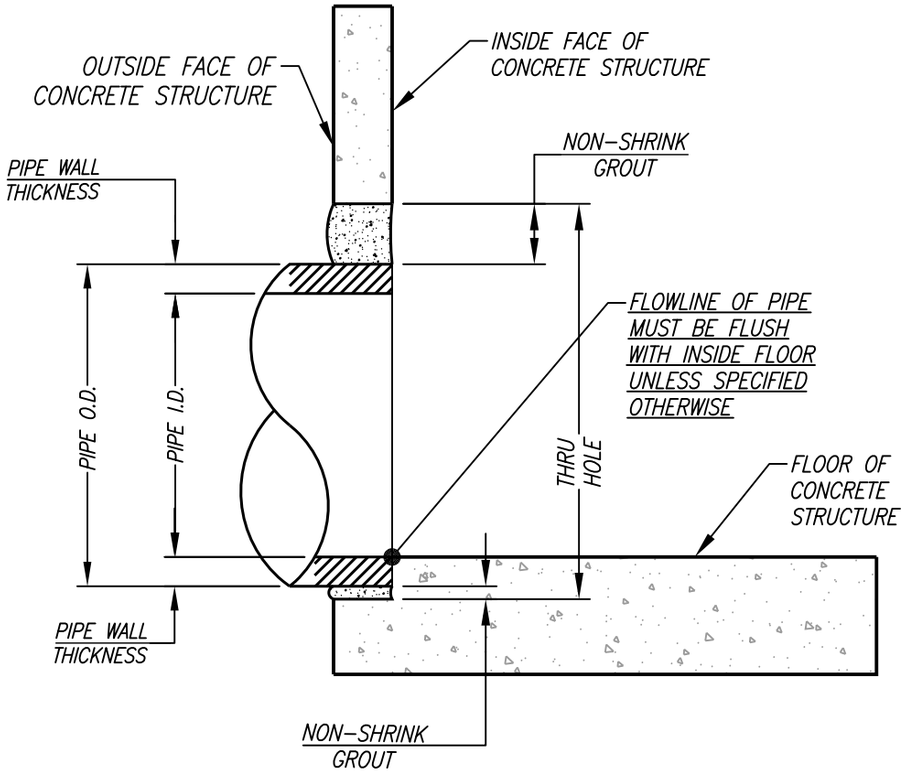
MODULAR WETLANDS™

Connection Details

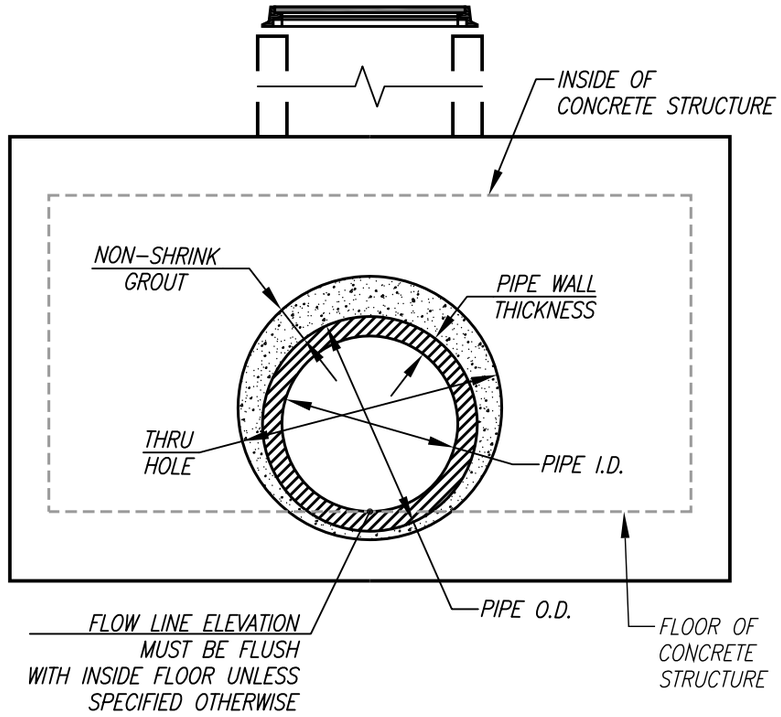


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ELEVATION VIEW



END VIEW

INSTALLATION NOTES

1. ALL CONNECTION PIPES SUPPLIED AND INSTALLED BY CONTRACTOR. MODULAR WETLAND UNIT WILL BE DELIVERED WITH A THRU HOLE AND ITS THE CONTRACTORS RESPONSIBILITY TO SUPPLY PIPE, AND ALL LABOR AND MATERIAL TO CONNECT PIPE AND SEAL UNIT WATER TIGHT INCLUDING BUT NOT LIMITED TO GROUT, CONCRETE LUG, REBAR, PLUG, ANCHORS, COUPLER, FITTINGS AND/OR ALL SUPPORT AND CONNECTING HARDWARE.
2. ALL CONNECTIONS ARE TO BE FLUSH WITH THE INSIDE SURFACE OF THE CONCRETE STRUCTURE. (CAN NOT INTRUDE BEYOND FLUSH) ALL PIPE FLOWLINES SHALL BE FLUSH WITH INSIDE FLOOR UNLESS SPECIFIED OTHERWISE.
3. ALL GROUT AND/OR CONCRETE SHALL BE NON–SHRINK AND MEET OR EXCEED LOCAL PIPE CONNECTION STANDARDS.
4. REFER TO AGENCY SPECIFICATIONS WHERE APPLICABLE.

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MODULAR WETLANDS

PIPE CONNECTION
STANDARD DETAIL

Section [_____]
Modular Subsurface Flow Wetland System

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for Modular Subsurface Flow Wetland Systems used for biofiltration of stormwater runoff including dry weather flows and other contaminated water sources. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Modular Subsurface Flow Wetland Systems (MSFWS) are used for filtration of stormwater runoff including dry weather flows. The MSFWS is a pre-engineered biofiltration system composed of a pretreatment chamber containing filtration cartridges, a horizontal flow biofiltration chamber with a peripheral void area and a centralized and vertically extending underdrain, the biofiltration chamber containing a sorptive media mix which does not contain any organic material and a layer of plant establishment media, and a discharge chamber containing an orifice control structure . Treated water flows horizontally in series through the pretreatment chamber cartridges, biofiltration chamber and orifice control structure.

01.03.00 Manufacturer
The manufacturer of the MSFWS shall be one that is regularly engaged in the engineering design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the MSFWS(s) shall be a filter device Manufactured by Bio Clean Environmental Services, Inc., or Modular Wetland Systems, Inc., or assigned distributors or licensees. Bio Clean Environmental Services Inc., and Modular Wetland Systems, Inc., can be reached at:

Corporate Headquarters:
Bio Clean Environmental Service, Inc.
2972 San Luis Rey Road
Oceanside, CA 92058
Phone: (760) 433-7640
Fax: (760) 433-3176
www.biocleanenvironmental.net

Corporate Headquarters:
Modular Wetland Systems, Inc.
P.O. Box 869
Oceanside, CA 92049
Phone: (760) 433-7650
www.modularwetlands.net

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and consulting engineer.

01.04.02 Shop drawings are to detail the MSFWS and all components required and the sequence for installation, including:

- System configuration with primary dimensions
- Interior components
- Any accessory equipment called out on shop drawings

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of MSFWS.

01.05.02 Manufacturer to supply components of the MSFWS(s):

- Pretreatment chamber components (pre-assembled)
- Concrete Structure(s)
- Biofiltration chamber components (pre-assembled)
- Flow control discharge structure (pre-assembled)

01.06.00 Reference Standards

ASTM C 29	Standard Test Method for Unit Weight and Voids in Aggregate
ASTM C 88	C 88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C131	C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregates by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 330	C 330 Standard Specification for Lightweight Aggregate for Structural Concrete
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft.-lbf/ft3 (600 kN-m/m3)
ASTM D 1621	10 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D 1777	ASTM D1777 - 96(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 4716	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
AASHTO T 99-01	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
AASHTO T 104	Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials.
AASHTO T 288	Standard Method of Test for Determining Minimum Laboratory Soil Resistivity
AASHTO T 289	Standard Method of Test for Determining ph of Soil for Use in Corrosion Testing
AASHTO T 291	Standard Method of Test for Determining Water Soluble Chloride Ion Content in Soil
AASHTO T 290	T 290 Standard Method of Test for Determining Water Soluble Sulfate Ion Content in Soil

PART 2 – COMPONENTS

The Modular Subsurface Flow Wetland Systems (MSFWS) and all of its components shall be self-contained within a concrete structure constructed of concrete with a minimum 28 day compressive strength of 5,000 psi, with reinforcing per ASTM A 615, Grade 60, and supports and H20 loading as indicated by AASHTO. Each Chamber shall have appropriate access hatches for easy maintenance and sized to allow removal of all internal components without disassembly. All water transfer system components shall conform with the following;

- Filter netting shall be 100% Polyester with a number 16 sieve size, and strength tested per ASTM D 3787.
- Drainage cells shall be manufactured of lightweight injection-molded plastic and have a minimum compressive strength test of 6,000 psi and a void area along the surface making contact with the filter media of 75% or greater. The cells shall be at least 2" in thickness and allow water to freely flow in all four directions.

02.01.00 Pretreatment Chamber Components

02.01.01 Filter Cartridges shall operate at a loading rate not to exceed 3 gallons per minute per square foot surface area.

02.01.02 Drain Down System shall include a pervious floor that allows water to drain into the underdrain pipe that is connected to the discharge chamber.

02.02.00 Biofiltration Chamber Components

02.02.01 Media shall consist of ceramic material produced by expanding and vitrifying select material in a rotary kiln. Media must be produced to meet the requirements of ASTM C330, ASTM C331, and AASHTO M195. Aggregates must have a minimum 24-hour water absorption of 10.5% mass. Media shall not contain any organic material. Flow through media shall be horizontal from the outer perimeter of the chamber toward the centralized and vertically extending underdrain. The retention time in the media shall be at least 3 minutes. Downward flow filters are not acceptable alternatives. The thickness of the media shall be at least 19" from influent end to effluent end. The loading rate on the media shall not exceed 1.1 gallons per minute per square foot surface area. Media must be contained within structure that spaces the surface of the media at least 2" from all vertically extending walls of the concrete structure.

02.02.02 Planting shall be native, drought tolerant species recommend by manufacturer and/or landscape architect.

02.02.03 Plant Support Media shall be made of a 3" thick moisture retention cell that is inert and contains no chemicals or fertilizers, is not made of organic material and has an internal void percentage of 80%.

02.03.00 Discharge Chamber

The discharge device shall house a flow control orifice plate that restricts flows greater than designed treatment flow rate. All piping components shall be made of a high-density polyethylene. The discharge chamber shall also contain a drain down filter if specified on the drawing.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The MSFWS has no moving internal components and functions based on gravity flow, unless otherwise specified. The MSFWS is composed of a pretreatment chamber, a biofiltration chamber and a discharge chamber. The pretreatment device houses cartridge media filters, which consist of filter media housed in a perforated enclosure. The untreated runoff flows into the system via subsurface piping and or surface inlet. Water entering the system is forced through the filter cartridge enclosures by gravity flow. Then the flow contacts the filter media. The flow through the media is horizontal toward the center of each individual media filter. In the center of the media shall be a round slotted PVC pipe of no greater than 1.5" in diameter. The slotted PVC pipe shall extend downward into the water transfer cavity of the cartridge. The slotted PVC pipe shall be threaded on the bottom to connect to the water transfer cavity. After pollutants have been removed by the filter media the water discharges the pretreatment chamber and flows into the water transfer system and is conveyed to the biofiltration chamber. Once runoff has been filtered by the biofiltration chamber it is collected by the vertical underdrain and conveyed to a discharge chamber equipped with a flow control orifice plate. Finally the treated flow exits the system.

03.01.02 Pollutants - The MSFWS will remove and retain debris, sediments, TSS, dissolved and particulate metals and nutrients including nitrogen and phosphorus species, bacteria, BOD, oxygen demanding substances, organic compounds and hydrocarbons entering the filter during frequent storm events and continuous dry weather flows.

03.01.03 Treatment Flow Rate and Bypass - The MSFWS operates in-line. The MSFWS will treat 100% of the required water quality treatment flow based on a minimum filtration capacities listed in section 03.02.00. The size of the system must match those provided on the drawing to ensure proper performance and hydraulic residence time.

Minimum Treatment Capabilities

• System must be capable of treating flows to the specified treatment flow rate on the drawings. The flow rate shall be controlled by an orifice plate.

PART 4 - EXECUTION

04.01.00 General

The installation of the MSFWS shall conform to all applicable national, state, state highway, municipal and local specifications.

04.02.00 Installation

The Contractor shall furnish all labor, equipment, materials and incidentals required to install the (MSFWS) device(s) and appurtenances in accordance with the drawings and these specifications.

04.02.01 Grading and Excavation site shall be properly surveyed by a registered professional surveyor, and clearly marked with excavation limits and elevations. After site is marked it is the responsibility of the contractor to contact local utility companies and/or DigAlert to check for underground utilities. All grading permits shall be approved by governing agencies before commencement of grading and excavation. Soil conditions shall be tested in accordance with the governing agencies requirements. All earth removed shall be transported, disposed, stored, and handled per governing agencies standards. It is the responsibility of the contractor to install and maintain proper erosion control measures during grading and excavation operations.

04.02.02 Compaction – All soil shall be compacted per registered professional soils engineer's recommendations prior to installation of MSFWS components.

04.02.03 Backfill shall be placed according to a registered professional soils engineer's recommendations, and with a minimum of 6" of gravel under all concrete structures.

04.02.04 Concrete Structures – After backfill has been inspected by the governing agency and approved the concrete structures shall be lifted and placed in proper position per plans.

04.02.05 Subsurface Flow Wetland Media shall be carefully loaded into area so not to damage the Wetland Liner or Water Transfer Systems. The entire wetland area shall be filled to a level 9 inches below finished surface.

04.02.06 Planting layer shall be installed per manufacturer's drawings and consist of a minimum 3" grow enhancement media that ensures greater than 95% plant survival rate, and 6" of wetland media. Planting shall consist of native plants recommended by manufacturer and/or landscape architect. Planting shall be drip irrigated for at least the first 3 months to insure long term plant growth. No chemical herbicides, pesticides, or fertilizers shall be used in the planting or care and maintenance of the planted area.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – MSFWS shall be shipped to the contractor's address or job site, and is the responsibility of the contractor to offload the unit(s) and place in the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the MSFWS and all components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be born by the contractor. The MSFWS(s) and all components shall always be stored indoors and transported inside the original shipping container until the unit(s) are ready to be installed. The MSFWS shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the MSFWS has been properly installed at the correct location(s), elevations, and with appropriate components. All components associated with the MSFWS and its installation shall be subject to inspection by the engineer at the place of installation. In addition, the contractor shall demonstrate that the MSFWS has been installed per the manufacturer's specifications and recommendations. All

components shall be inspected by a qualified person once a year and results of inspection shall be kept in an inspection log.

04.04.02 Maintenance – The manufacturer recommends cleaning and debris removal maintenance of once a year and replacement of the Cartridge Filters as needed. The maintenance shall be performed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the MSFWS. A Maintenance/Inspection record shall be kept by the maintenance operator. The record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured by the MSFWS shall be transported and disposed of at an approved facility for disposal in accordance with local and state requirements. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

PART 5 – QUALITY ASSURNACE

05.01.00 Warranty

The Manufacturer shall guarantee the MSFWS against all manufacturing defects in materials and workmanship for a period of (5) years from the date of delivery to the _____. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The MSFWS is limited to recommended application for which it was designed.

05.02.00 Performance Certification

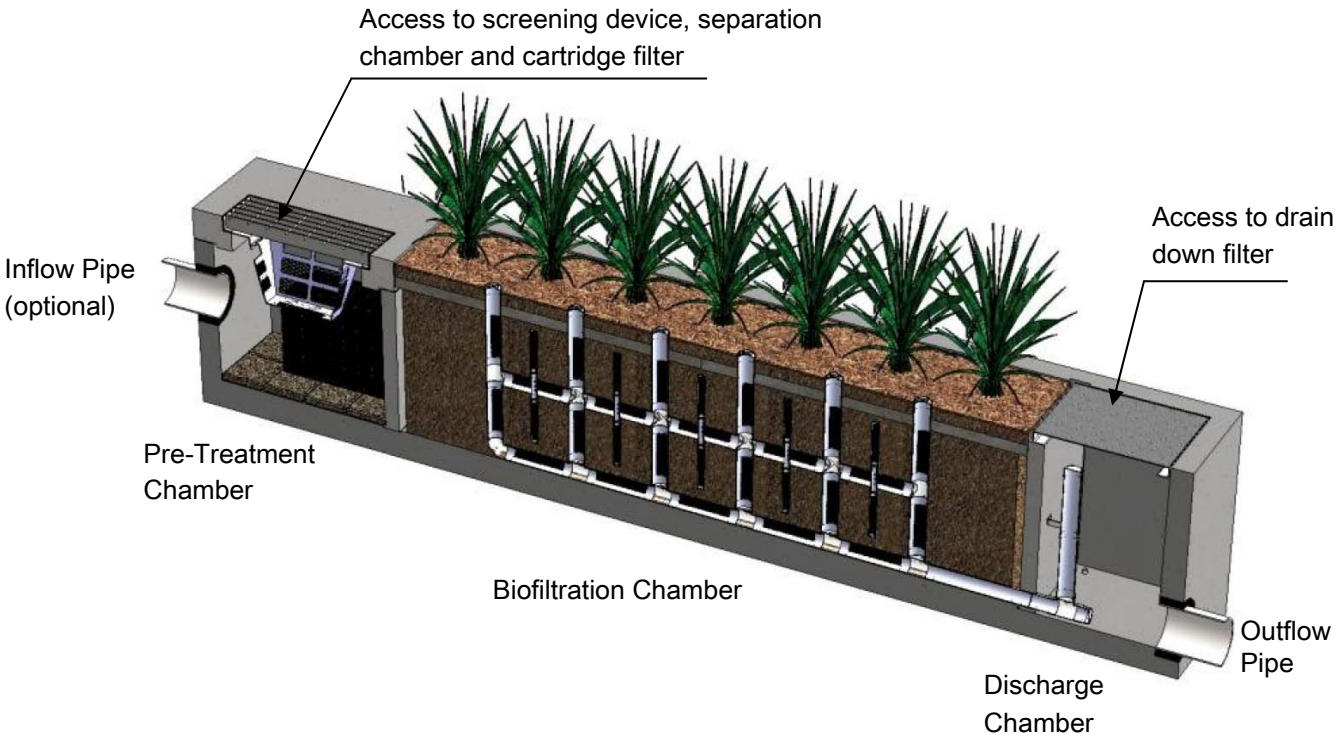
The MSFWS manufacturer shall submit to the Engineer of Record a “Manufacturer’s Performance Certificate” certifying the MSFWS is capable of achieving the specified removal efficiency for suspended solids, phosphorous and dissolved metals.

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
  - (*5 minute average service time*).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
  - (*10 minute average service time*).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
  - (*10-15 minute per cartridge average service time*).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
  - (*5 minute average service time*).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
  - (*Service time varies*).

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.



Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.







Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.







Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.



Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.









Inspection Form



Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes:

2972 San Luis Rey Road, Oceanside, CA 92058 P (760) 433-7640 F (760) 433-3176

Maintenance Report



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E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

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Attachment H: Bio Clean Kraken Style Catch Basin Insert

Curb Inlet Filter

PROVEN STORMWATER TREATMENT TECHNOLOGY

Bio Clean
A Forterra Company

Overview

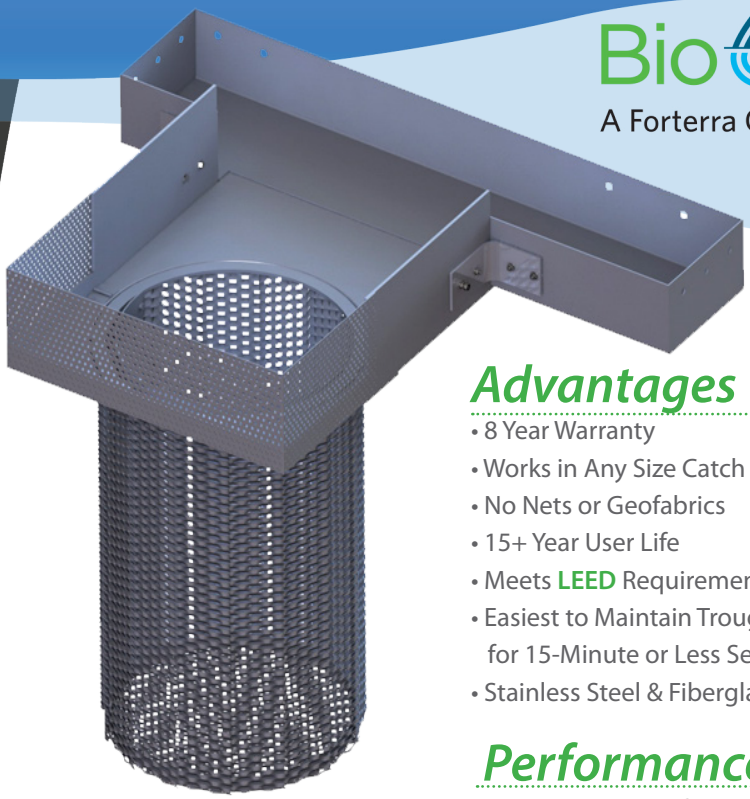
The Bio Clean Curb Inlet Filter is a favorite amongst cities and municipalities nationwide. Many agencies have chosen this system as their standard due to its quick cleaning time and large storage capacity.

Its 'Trough System' allows cleaning to be done in less than 15 minutes, and its larger storage capacity allows for maximized cleaning intervals and minimized attention required by maintenance crews.

The modularized design of the 'Trough System' for curb inlets makes it adaptable to any size or type catch basin.

Its non-clogging filtration screens allow this device to meet "full trash capture" requirements by removing 100% of trash & debris 5 mm and greater. Made of marine grade fiberglass and high grade stainless steel these filters come in standard and custom designs.

This filtration system addresses a wide array of pollutants including trash and debris, sediments, TSS, nutrients, metals, and hydrocarbons.



Advantages

- 8 Year Warranty
- Works in Any Size Catch Basin
- No Nets or Geofabrics
- 15+ Year User Life
- Meets **LEED** Requirements
- Easiest to Maintain Trough System Allows for 15-Minute or Less Service Time
- Stainless Steel & Fiberglass Construction

Performance

- 100% Removal of Trash & Debris
- Meets Full Capture requirements

Specifications

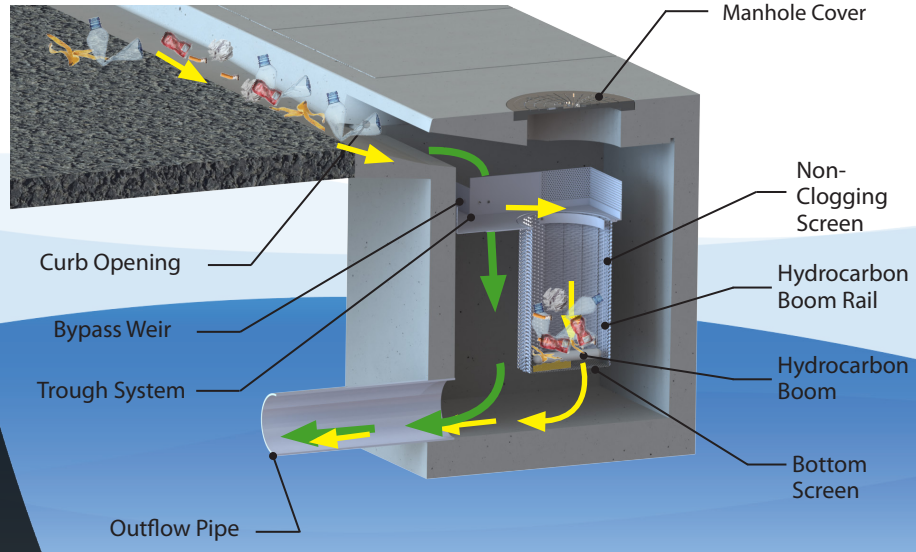
Model #	Treatment Flow (CFS)	Bypass Flow (CFS)
BC-CURB	2.85	Unlimited

Note: *Treatment flow rate limited to the weir capacity - actual flow rates of the filter basket is greater than 2.85 cfs. Various depth filter baskets available.*

Operation

Bypass Flow Path

Treatment Flow Path



Curb Inlet Media Filter

PROVEN STORMWATER TREATMENT TECHNOLOGY

Kraken Type

The Bio Clean Kraken Curb Inlet Media Filter is an advanced membrane filter for increased removal efficiencies.

Performance

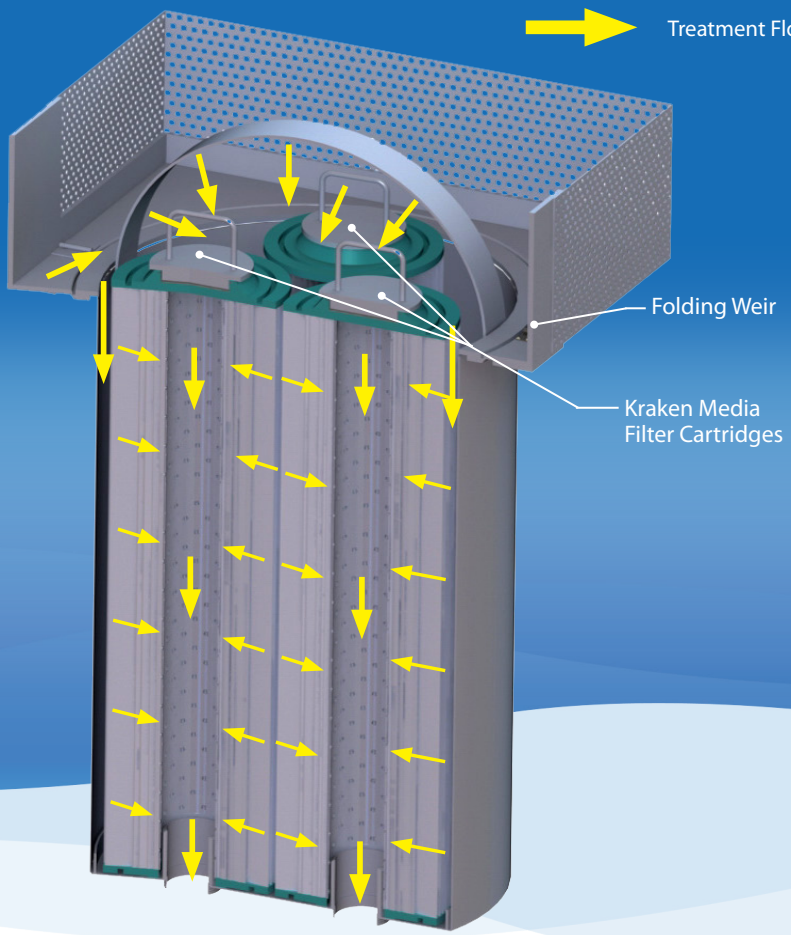
- 85% Removal of Fine TSS
- 72% Removal of Dissolved Phosphorus
- 52% Removal of Copper
- 87% Removal of Lead
- 58% Removal of Zinc
- 81% to 95% Removal of Oils & Grease (motor oil)
- 60% Removal of Fecal Coliform (bacteria)

Specifications

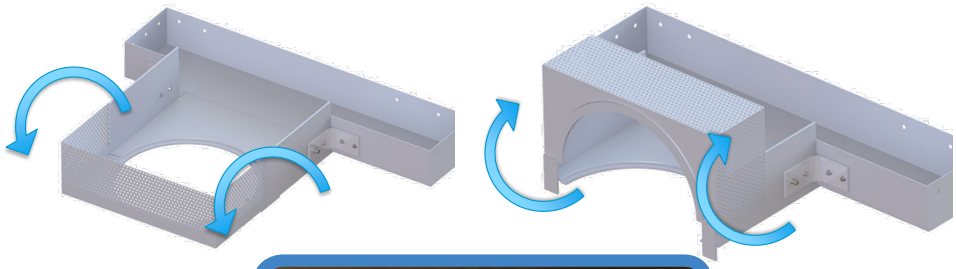
Model #	Media Treatment Flow (CFS)	Bypass Flow (CFS)
BC-CURB-KF-30	0.11	Unlimited

Note: Media treatment flow rate based on three 30" tall Kraken Filter Cartridges. Various filter basket and Kraken Filter Cartridge heights available.

Operation



NEW The Bio Clean Curb Inlet Filters feature a folding weir - it hinges up after the basket is removed to allow easy access to the catch basin if needed.





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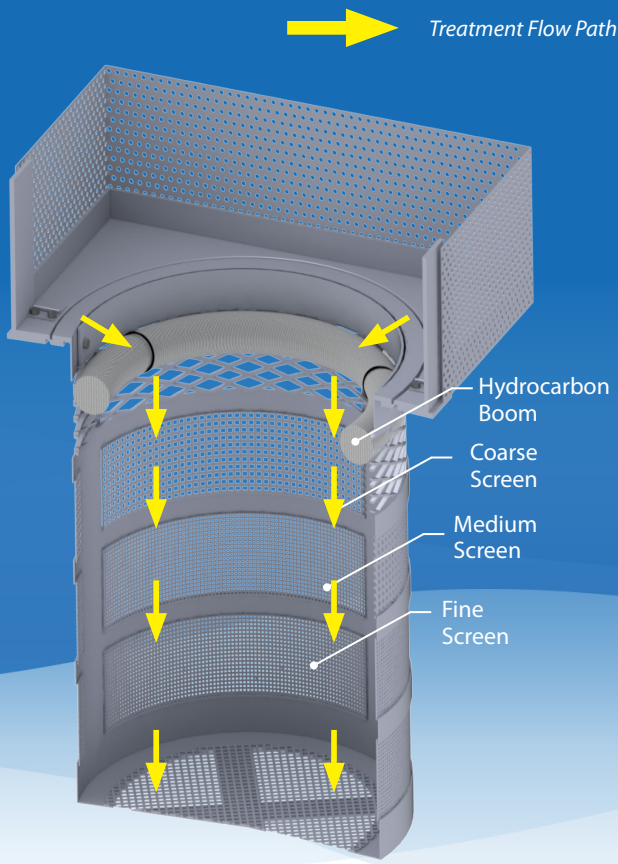
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Curb Inlet Filter MLS

PROVEN STORMWATER TREATMENT TECHNOLOGY

Multi-Level Screening Type

The Bio Clean Multi-Level Screening Curb Inlet Filter is the standard configuration used for more than a decade and provides the best overall performance for all pollutants of concern.



Performance

- 80% Removal of Sediments
- 100% Removal of Trash
- 100% Removal of Foliage
- Medium Level Removal for Particulate Metals and Nutrients
- Includes Hydrocarbon Boom for Removal of Oils & Grease

Specifications

Model #	Treatment Flow (CFS)	Bypass Flow (CFS)
BC-CURB-MLS	2.85	Unlimited

Note: Treatment flow rate limited to the weir capacity - actual flow rates of the filter basket is greater than 2.85 cfs. Various depth filter baskets available.

Application

- Parking Lots
- Roadways



Easily Removed without Entry into Basin

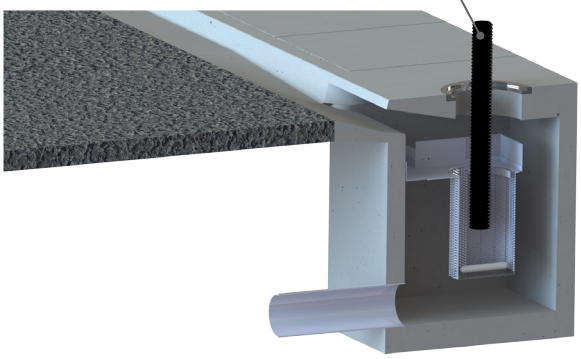


Always Positioned Under Manhole Opening

Installation & Maintenance



- Cleaned Without Catch Basin Entry
- Cleaned Easily With Vac Truck
- 15 Minute Service Time



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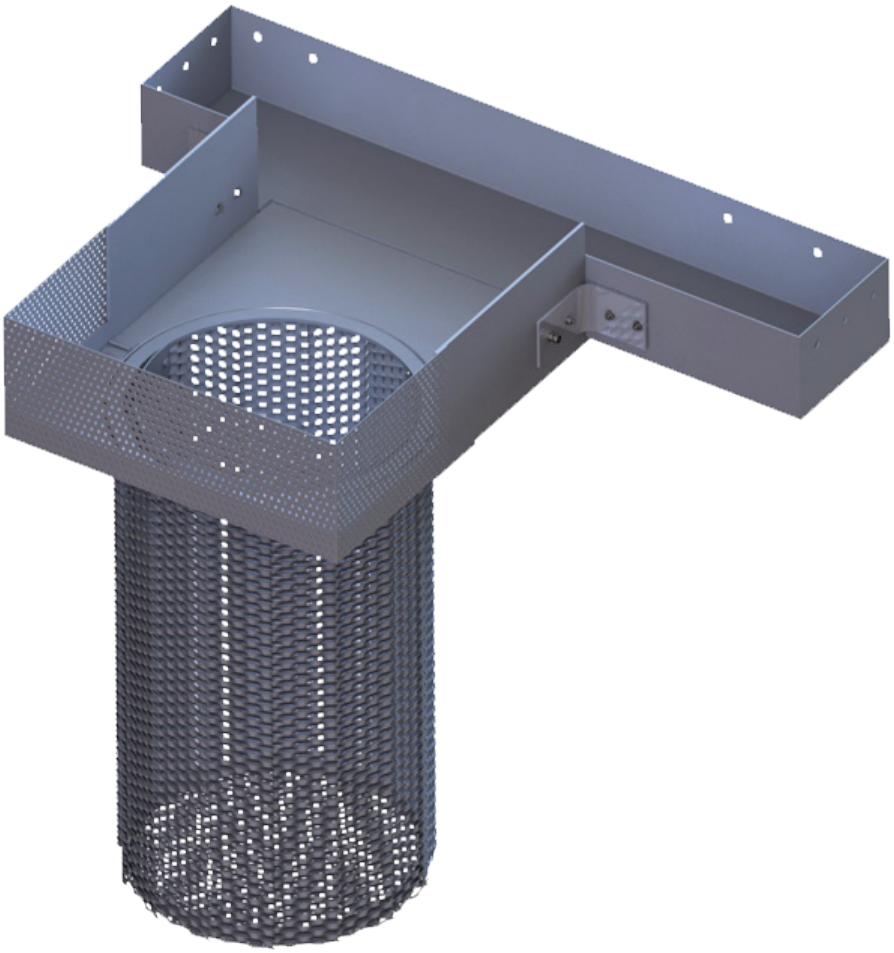
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Curb Inlet Filter

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OPERATION & MAINTENANCE



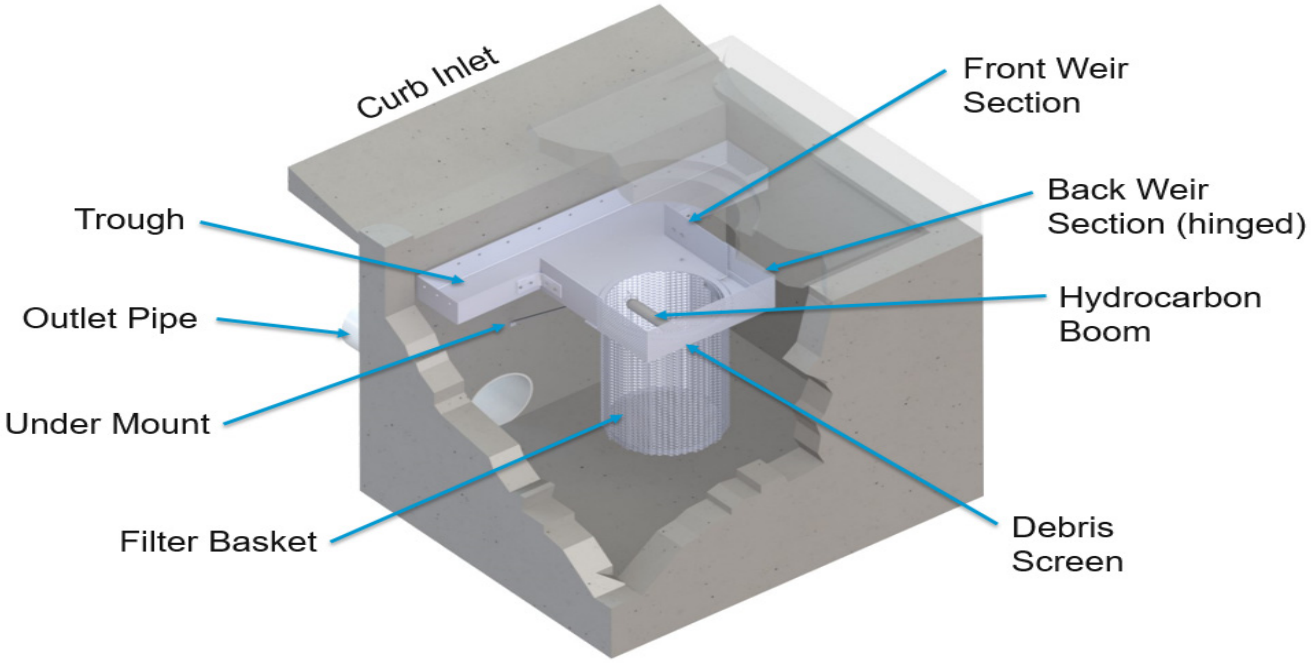
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OPERATION & MAINTENANCE

The Bio Clean Curb Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the trash full capture and multi-level screening configurations. A supplemental manual is available for the Kraken and media filter variations. The innovative trough & weir system is mounted along the curb face and directs incoming stormwater toward the filter basket which is positioned "directly" under the manhole access opening regardless of its location in the catch basin. This innovative design allows the filter to be cleaned from finish surface without access into the catch basin, therefore drastically reducing maintenance time and eliminating confined space entry. The filter has a lifting handle allowing for the filter to be removed easily through the manhole. The weir also folds up to allow for unimpeded access into the basin for routine maintenance or pipe jetting.

As with all stormwater BMPs, inspection and maintenance on the Curb Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.



System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Curb Inlet Filter:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.



Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Curb Inlet Fitler are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Curb Inlet Filter can be inspected though visual observation without entry into the catch basin. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open access hatch or manhole. Once the manhole has been safely opened the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the inside of the catch basin through the manhole. If minimal light is available and vision into the unit is impaired utilize a flashlight to see inside the catch basin.
- Look for any out of the ordinary obstructions in the catch basin, trough, weir, filter basket, basin floor our outlet pipe. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.

- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the trough, weir, filter basket or catch basin.
- Excessive accumulation of trash, foliage and sediment in the filter basket and/or trough and weir sections. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-CURB-30	18	30	2.21	4.42
BC-CURB-24	18	24	1.77	3.53
BC-CURB-18	18	18	1.33	2.65
BC-CURB-12	18	12	0.88	1.77

Maintenance Equipment

It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter though it can easily cleaned by hand:

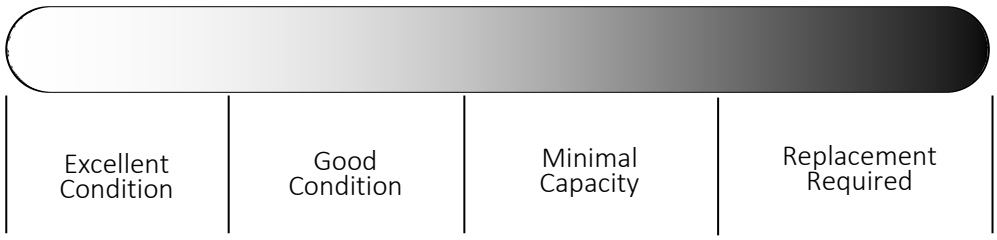
- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to access hatches and covers.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Curb Inlet Filter can be performed from finish surface without entry into catch basin utilizing a vacuum truck. Some unique

and custom configurations may create conditions which would require entry for some or all of the maintenance procedures. Once all safety measures have been set up cleaning of the Curb Inlet Filter can proceed as followed:

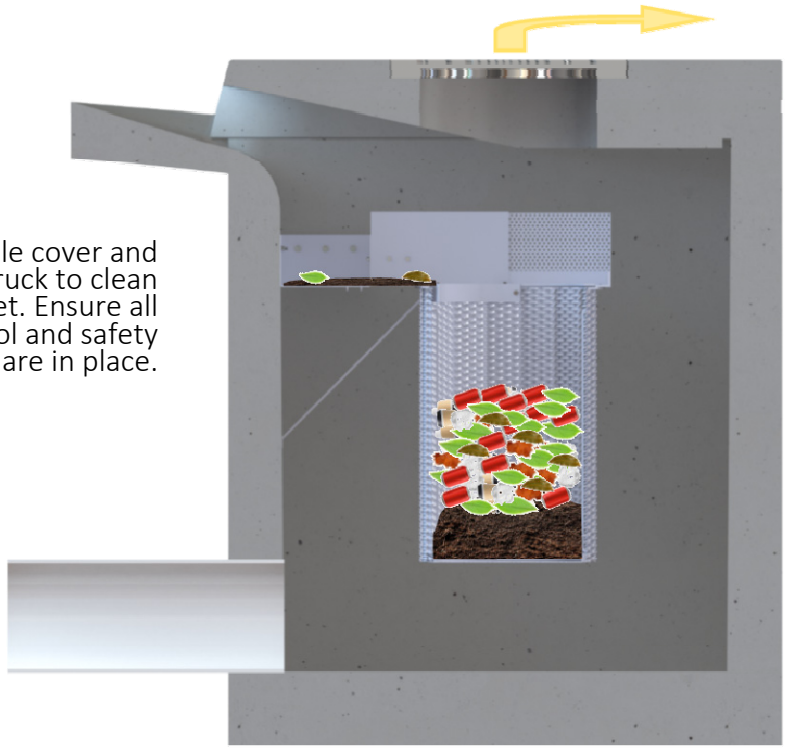
- Remove all manhole cover or access hatches (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened manhole or hatch opening. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying of any debris stuck on the side or bottom of the filter basket. If the filter basket is full, trash, sediment, and debris will accumulate inside the trough and weir sections of the system. Once the filter basket is clean power wash the weir and trough pushing these debris into the filter basket (leave the hose in the filter basket during this process so entering debris will be sucked out). Power wash off the trough, weir, debris screen, and filter basket sides and bottom.
- Next remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- Follow is a replacement indication color chart for the hydrocarbon booms:



- The last step is to close up and replace the manhole or hatch and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

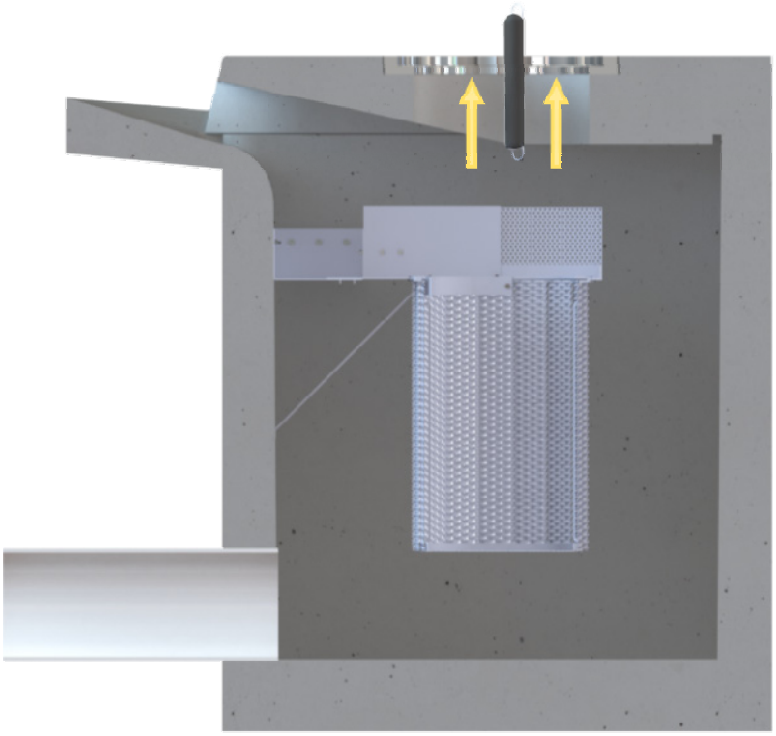
Maintenance Sequence

Remove manhole cover and set up vacuum truck to clean the filter basket. Ensure all traffic control and safety measures are in place.



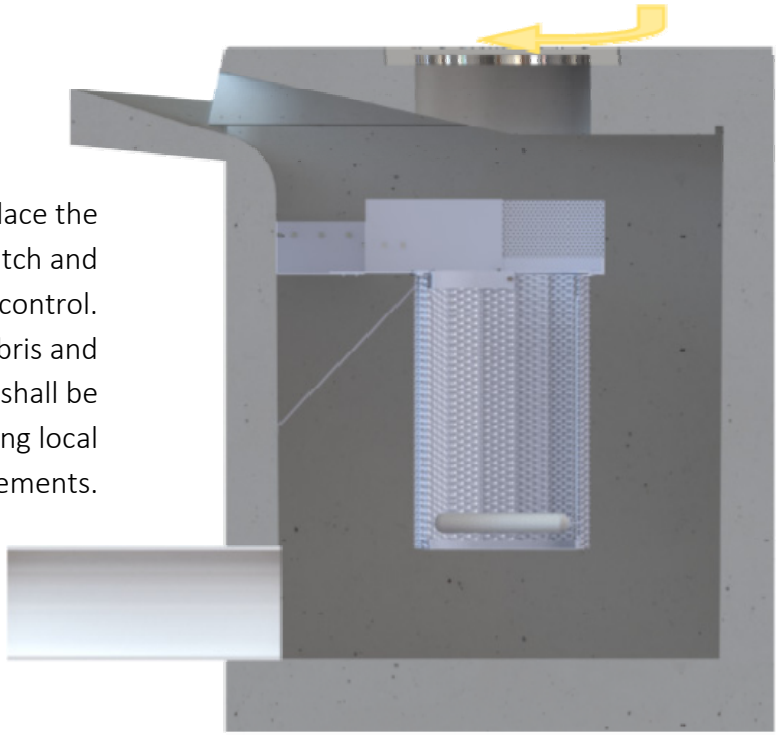


Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off the weir and trough and vacuum out any remaining debris.



Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom.

Close up and replace the manhole or hatch and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.



For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email: info@biocleanenvironmental.com

Bio Clean
A Forterra Company

Inspection and Maintenance Report
Catch Basin Only

Project Name _____

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ollow Up ☐omplaint ☐torm Storm Event in Last 72-hours? ☐ ☐s

Weather Condition _____ Additional Notes _____

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
2	Lat: Long:							
3	Lat: Long:							
4	Lat: Long:							
5	Lat: Long:							
6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							

Comments:

398 Via El Centro, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

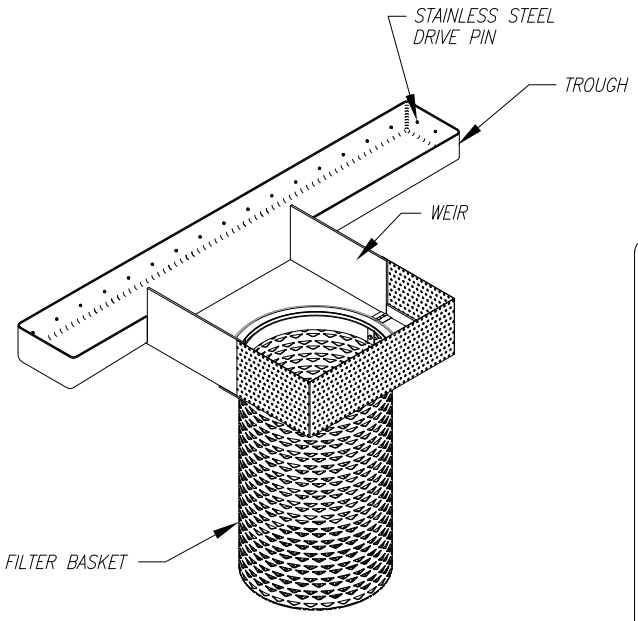


FIGURE 1:
DETAIL OF PARTS

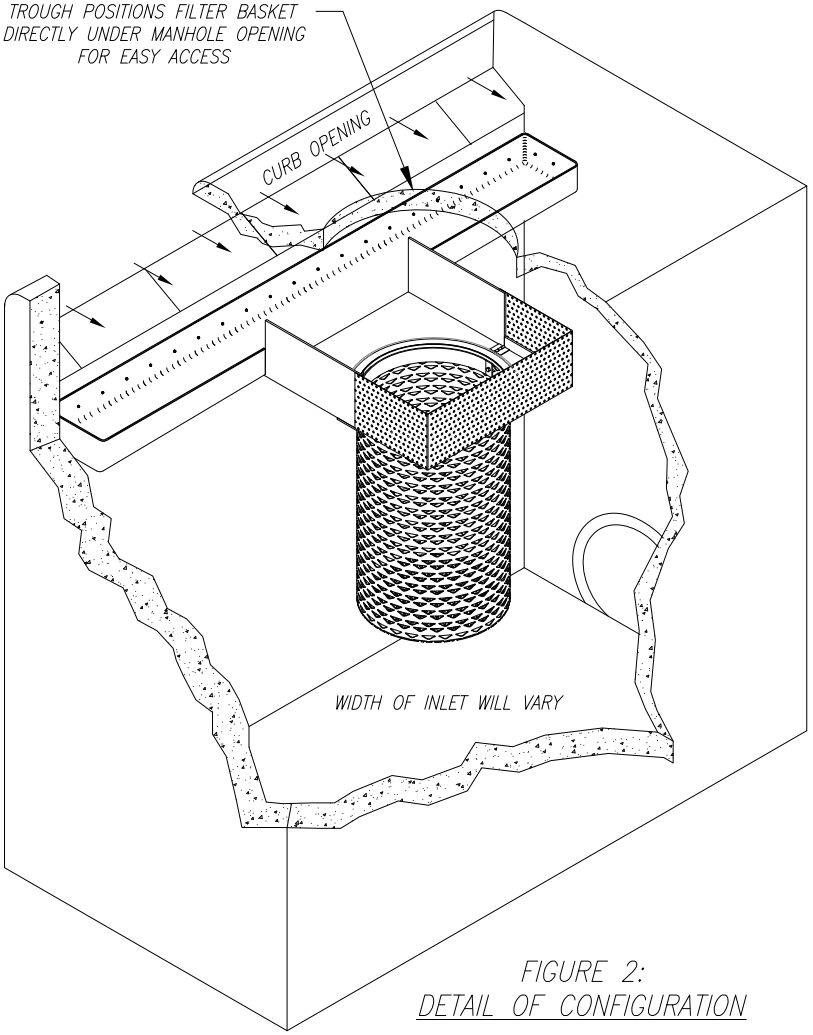


FIGURE 2:
DETAIL OF CONFIGURATION

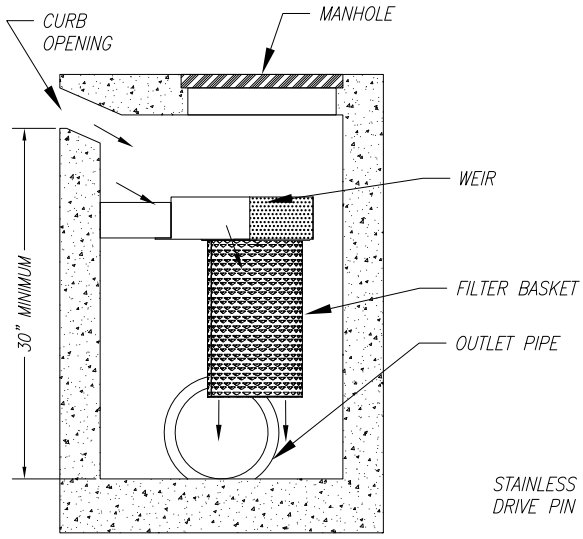


FIGURE 4:
DETAIL OF PROFILE

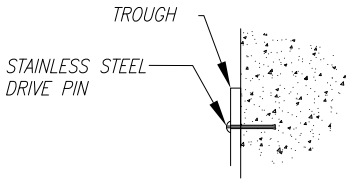


FIGURE 3:
DETAIL OF MOUNTING

NOTES:

1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 100% STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGIN SCREEN WITH 4.7 MM OPENINGS AND MEETS FULL CAPTURE REQUIREMENTS.
6. FILTER CAN BE FITTED WITH HYDROCARBON ABSORBENT BOOM
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE - CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS A SAFETY FACTOR OF 2.0
11. BYPASS IS FACILITATED VIA OVERFLOW OF THE TROUGH SYSTEM AND IS EQUAL TO THE CAPACITY OF THE CURB OPENING
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BC-CURB-FC-30	2.85	2.21
BC-CURB-FC-24	2.85	1.77
BC-CURB-FC-18	2.85	1.33
BC-CURB-FC-12	2.85	0.88

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS	MEETS FULL CAPTURE REQUIREMENTS
TREATMENT FLOW RATE: 2.85 cfs	MODEL #: BC-CURB-FC
WARRANTY: 5 YEAR MANUFACTURERS	PROJECT:

BIO CLEAN ENVIRONMENTAL SERVICES, INC.
398 VIA EL CENTRO, OCEANSIDE CA 92058
PHONE:760-433-7640 FAX:760-433-3176

REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:
REVISIONS:	DATE:

DATE: 10/12/2017	SCALE: NTS
DRAFTER: M.C.P.	UNITS = INCHES

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MODEL # BC-CURB-FC FILTER

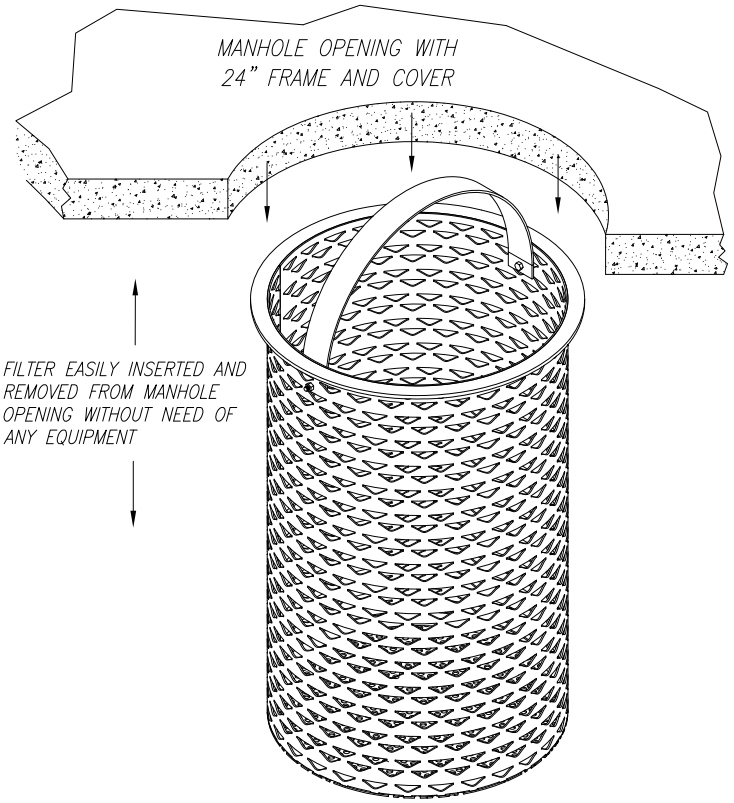


FIGURE 1:
DETAIL OF INSTALLATION

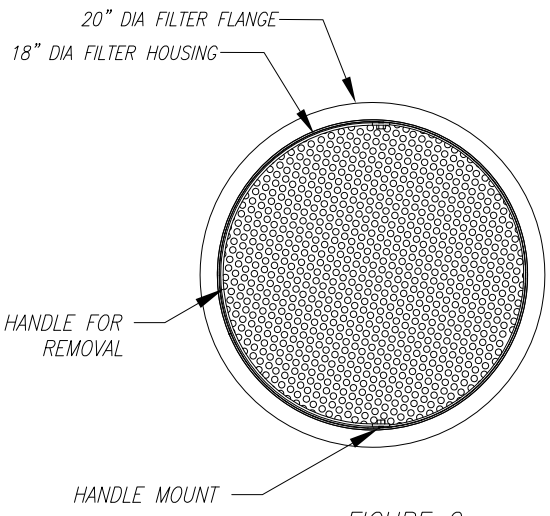


FIGURE 2:
DETAIL OF DIAMETERS

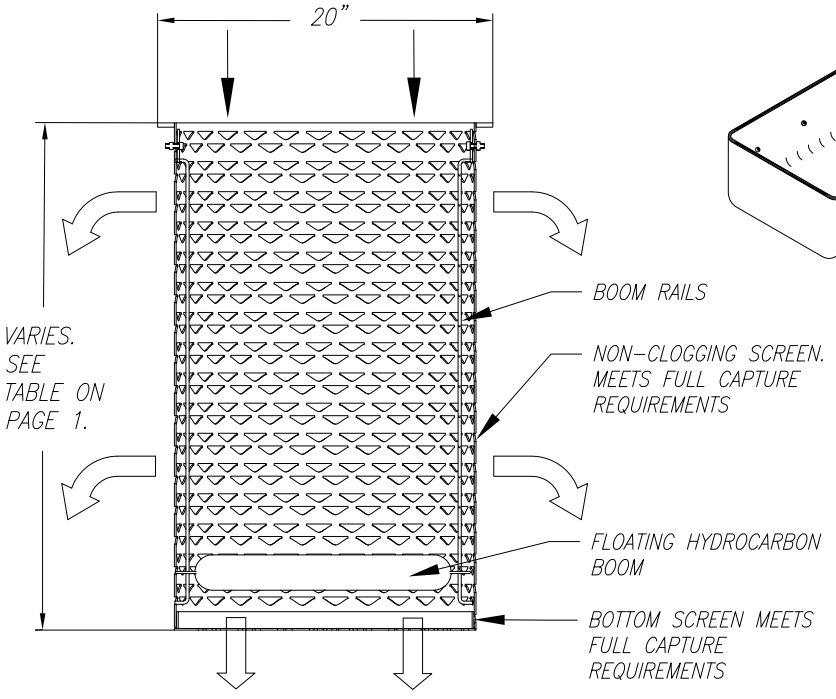


FIGURE 3:
DETAIL OF PARTS

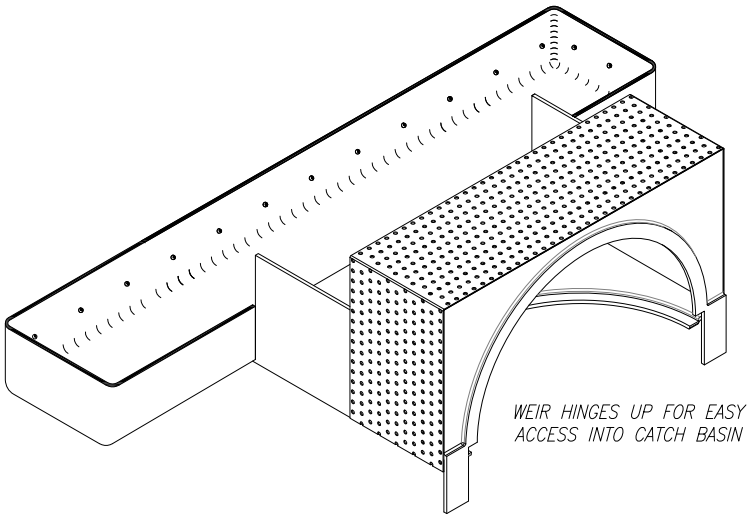


FIGURE 4:
DETAIL OF WEIR

FLOW RATES – CURB FILTER		
TREATMENT FLOW RATE	2.85 cfs	SAFETY FACTOR OF 2X
*TREATMENT FLOW RATE IS BASED ON THE CRITICAL POINT OF RESTRICTION, WHICH IS EITHER THE WEIR OR THE SCREEN CAPACITIES.		WEIR CAPACITY=2.85 CFS SCREEN CAPACITY=4.82 CFS

**FLOW RATES CALCULATED USING THE FOLLOWING EQUATION

$Q = SO * c_d * A \sqrt{2 * g * h}$ $\quad c_d = \frac{\text{COEFFICIENT of DISCHARGE}}{} = .62$

DRAWING: BC-CURB-FC FILTER		MEETS FULL CAPTURE REQUIREMENTS	SEE PAGE 1 FOR NOTES
TREATMENT FLOW RATE: 2.85 cfs		MODEL #: BC-CURB-FC	
WARRANTY: 5 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE:760-433-7640 FAX:760-433-3176		REVISIONS: / DATE:	
		REVISIONS: / DATE:	
DATE: 10/12/2017	SCALE: NTS	REVISIONS: / DATE:	
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS: / DATE:	PAGE 2

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BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS WITH WINGS

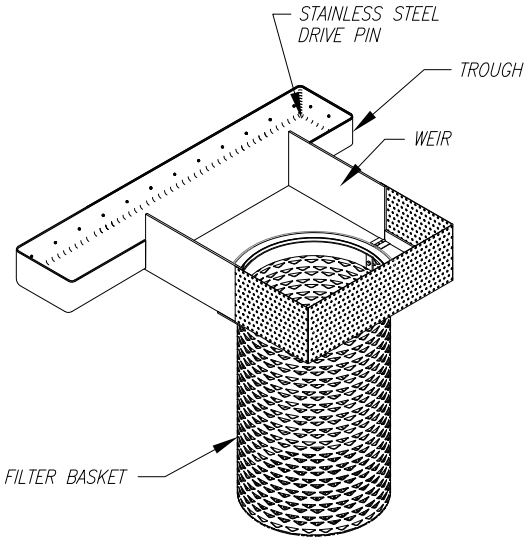


FIGURE 1:
DETAIL OF PARTS

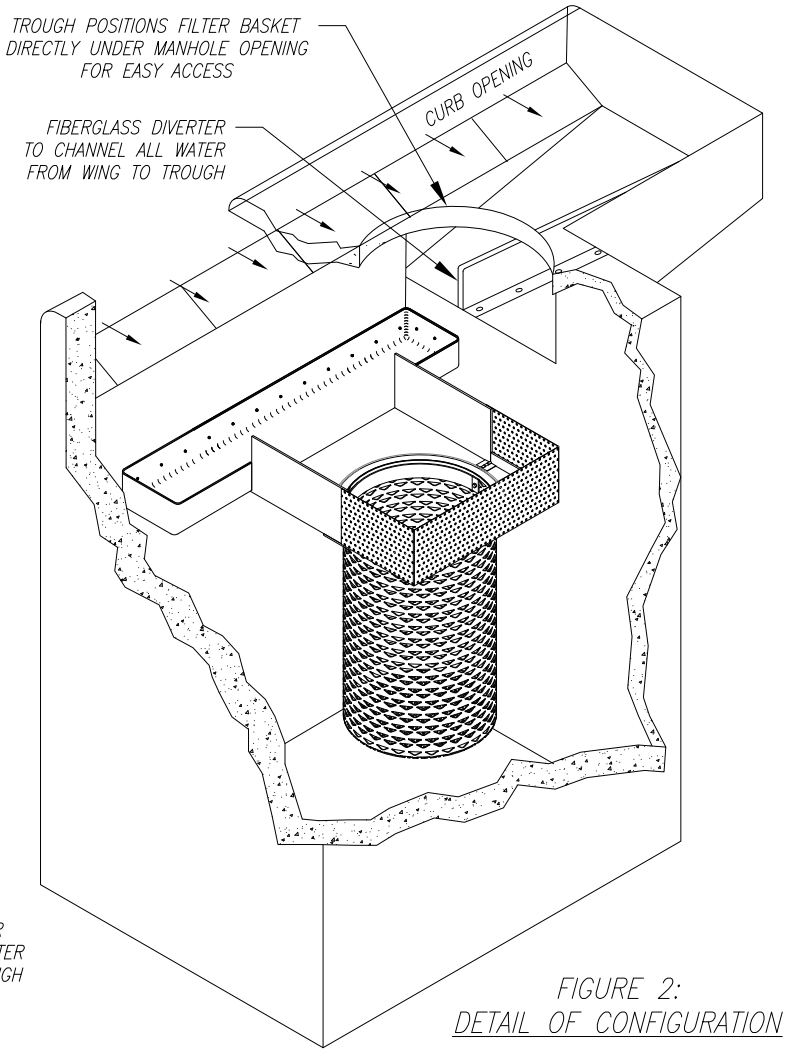


FIGURE 2:
DETAIL OF CONFIGURATION

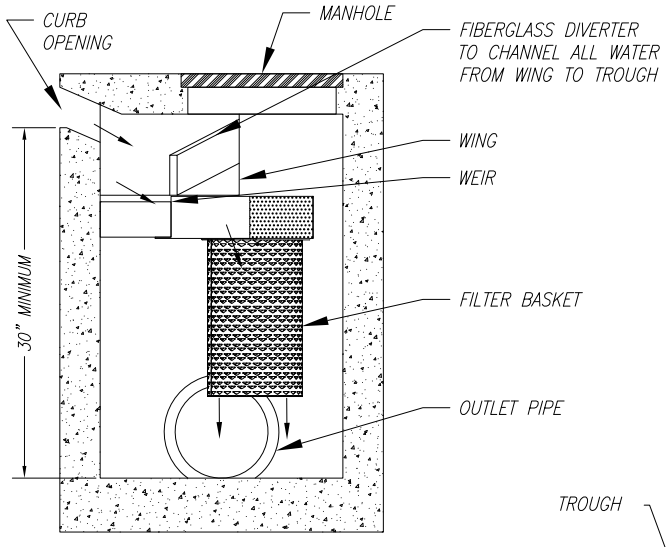


FIGURE 4:
DETAIL OF PROFILE

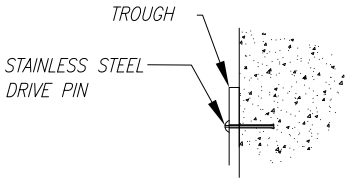


FIGURE 3:
DETAIL OF MOUNTING

NOTES:

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13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS		MEETS FULL CAPTURE REQUIREMENTS	
TREATMENT FLOW RATE: 2.85 cfs		MODEL #: BC-CURB-FC	
WARRANTY: 5 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA AL CENTRO, OCEANSIDE CA 92058 PHONE:760-433-7640 FAX:760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 10/12/2017	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
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Curb Inlet Filter

Bio Clean
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INSTALLATION MANUAL



Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

www.BioCleanEnvironmental.com
p: 760.433.7640
f: 760.433.3176

Bio Clean
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INSTALLATION PROCEDURES

The Bio Clean Curb Inlet Filter is a stormwater catch basin filter designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers installation procedures of all configurations. The innovative trough & weir system is mounted along the curb face and directs incoming stormwater toward the filter basket which is positioned "directly" under the manhole access opening regardless of its location in the catch basin. This simple yet profound design allows the filter to be cleaned from finish surface without access into the catch basin, therefore drastically reducing maintenance time and eliminating confined space entry. The filter lifting handle allows for the filter to be removed easily through the manhole. The weir also folds up to allow for unimpeded access into the basin for routine maintenance or pipe jetting.

Delivery

- Bio Clean Environmental Services, Inc. shall deliver the filter(s) to the site in coordination with the Contractor.

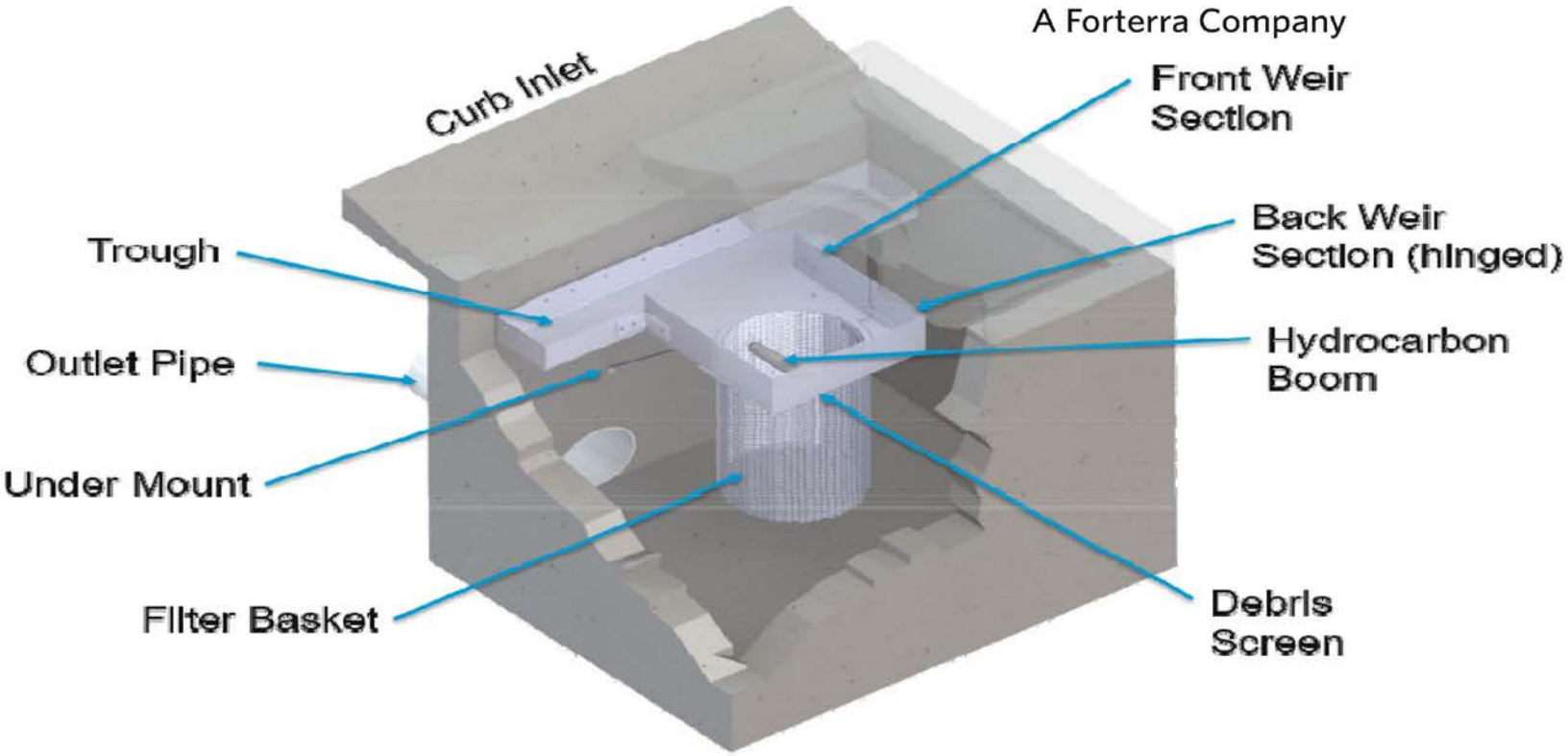
Inspection

- Inspection of the Curb Inlet Filter and all parts contained in or shipped shall be inspected at time of delivery by the site Engineer/Inspector and the Contractor. Any non-conformance to approved drawings or damage to any part of the system shall be documented on the Bio Clean shipping ticket.

Catch Basin Preparation

- The Contractor is responsible for providing adequate and complete catch basin and fall protection including gas metering and other safety equipment when installing the Curb Inlet Filter.
- The Contractor shall adhere to all jurisdictional and/or OSHA safety rules during installation of the filter.
- The Contractor or Owner is responsible for appropriately barricading the catch basin from traffic (in accordance with local codes).





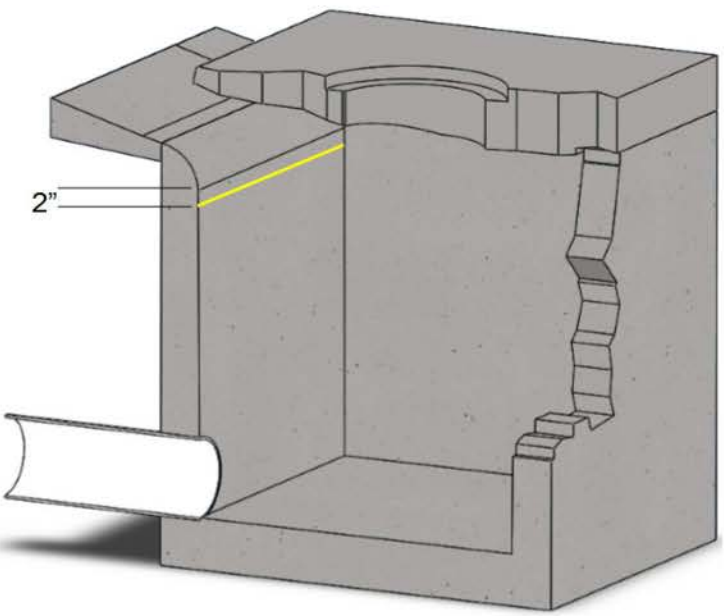
Filter Diagram:

Installation

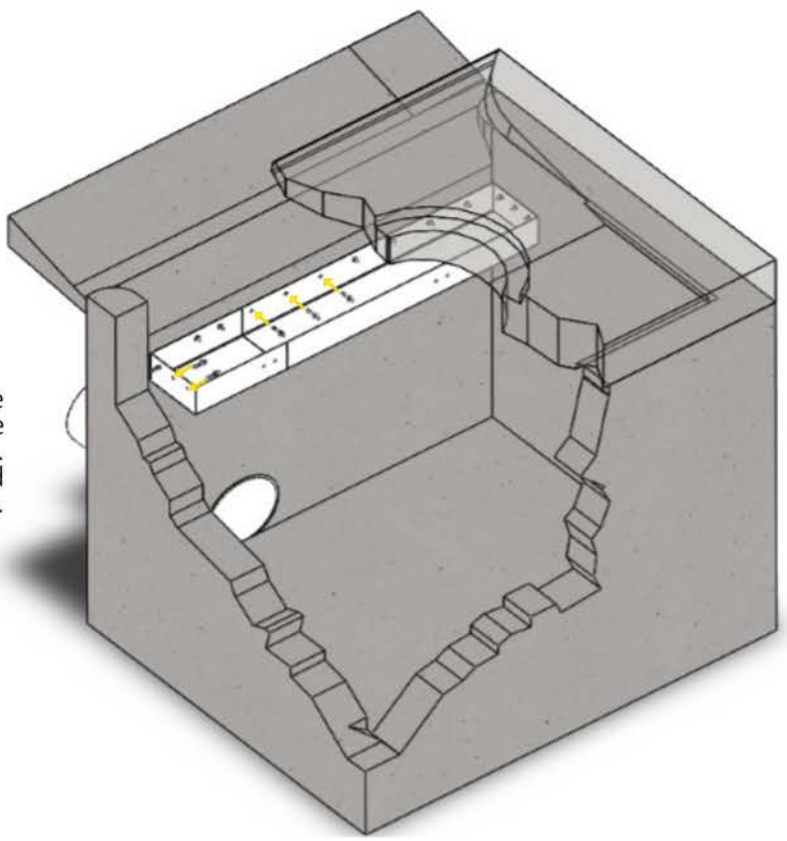
- Each Curb Inlet Filter shall be installed based on the locations and elevations according to the sizes shown on the approved drawings. Any modifications to the elevation or location shall be at the direction of and approved by the Engineer.
- It is recommended that the catch basin is properly cleaned and inspected for any damage prior to installing the Curb Inlet Filter. The trough and weir system mount directly to the walls of the catch basin using concrete wedge and/or drive anchors.
- Step one involves positioning and mounting the trough under the face of the curb. The top of the trough should be approximately 2" below the end of the local depression transition into the catch basin where the catch basin wall is vertical to allow for a flush mounting surface as shown below and enough vertical clearance from the ceiling of the catch basin to allow for proper maintenance access. Use chalk or a large marker to mark this position on the basin wall. Next use a tape measure and a level to measure a slope of 0.5% from the corners of the catch basin sloping toward the position where the filter basket and weir will be located. Use chalk or a large marker to draw a guideline along where the top of the trough wall will be located for proper mounting. Next, while holding the trough in place use a rotary hammer with a 1/4"

diameter concrete drill bit to drill holes 2 ¾" deep (minimum) at each location along the trough that there is a pre-drilled hole on the front and end sides. As each hole is drilled insert a ¼" diameter by 2 ¾" long stainless steel drive pin into each hole. This will temporarily support the weight of the trough. Next drive the wedge anchors tight using the hammer. For longer catch basin openings several sections of trough will need to be joined together. The installation kit will include trough section coupler pieces and end pieces if required. Repeat the process for the other end of the trough system if the manhole is in the center of the basin:

STEP 1



The yellow line represents the plane at which the top of the trough should be mounted to the wall of the catch basin. Make sure it is mounted to a vertical section of the wall and not above any curb opening transition.

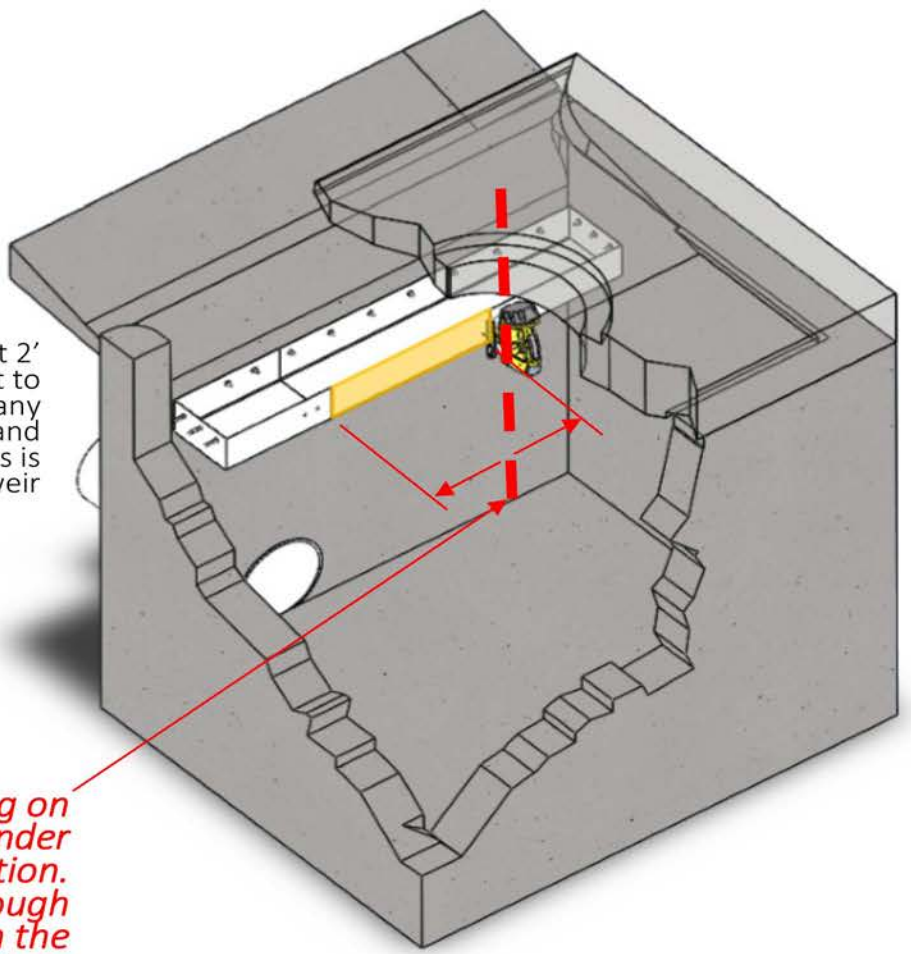


The trough is mounted along the line from above. Use drive pins to secure the trough to the wall on all three sides. Ensure drive pins are fully secured and hammered down tightly.

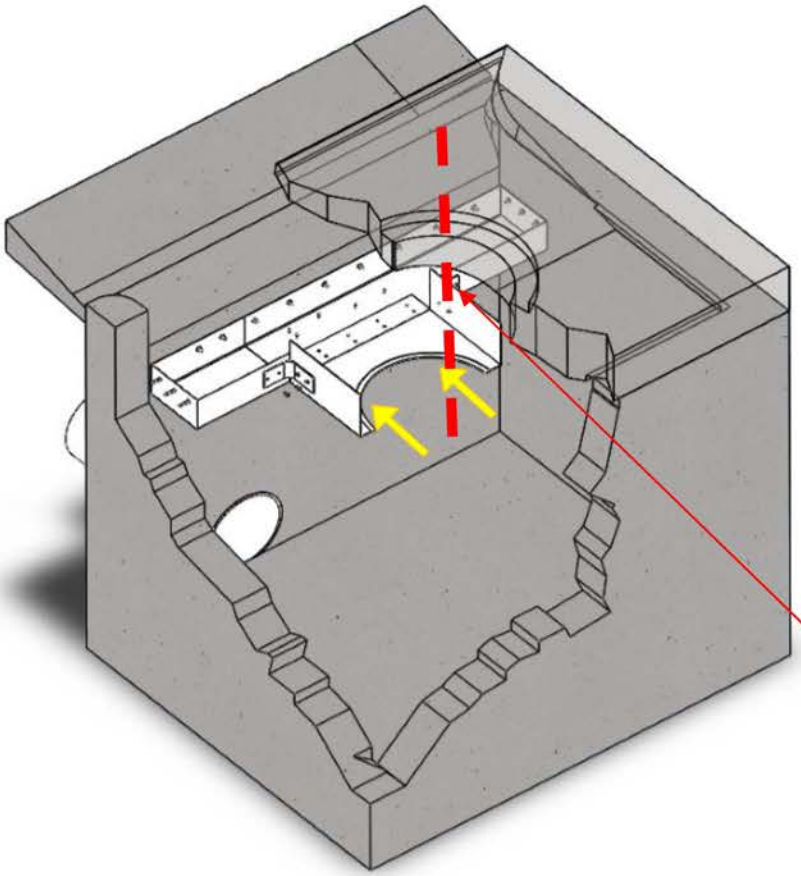
- Step 2 requires notching out a side of the trough where the front weir section will mount. This is done with a jigsaw or reciprocating saw. The side of the trough shall be cut out to the bottom as shown below to a width of 2'. Once the side of the trough is removed the front weir section can be attached to the trough using pop rivets and the two side mounting brackets. Next, position the front weir section into the cut out portion of the trough. The mounting flange of the weir will rest on the floor of the trough. Line up so that the walls of the trough intercept the walls of the weir at 90 degrees. Holes are pre-drilled in the mounting flange of the front weir section. Using a drill bit size #11, drill through the fiberglass trough via the pre-drilled holes. Using pop rivets (3/16" diameter by 1' long large flange dome head stainless steel) placed in the holes and a cordless or air powered rivet gun, fasten the weir to the trough. See below images for details on this step.

STEP 2

Ensure that the cut is accurate at 2' wide and the side is fully cut out to the bottom of the trough. If any upward protrusions remain sand flat with floor of trough. This is crucial for install of front weir



NOTE: It is critical that the opening on the weir for the basket is directly under the manhole for proper installation. Therefore the side cut out on the trough must be perfectly centered with the manhole opening center. Using a tape measure ensure these two centers are lined up before making the cut.



STEP 2 Con't

Make sure the walls of the trough intercept the walls of the weir at their ends. There should be no gap or overlap between these two surfaces. The mounting brackets are pre-drilled for these surfaces to properly align.

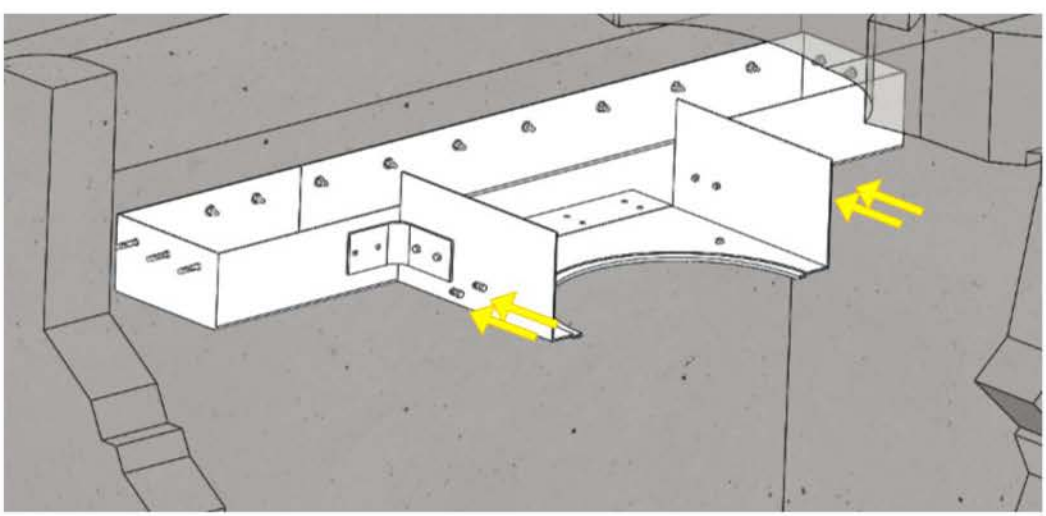
NOTE: It is critical that the opening on the weir for the basket is directly under the manhole for proper installation. The weir section length is customized for each basin. If they opening does not line up STOP installation and request the appropriate length weir from the manufacturer.

- Step 3 requires using the mounting brackets to connect the side of the trough to the side of the weir. The mounting brackets will be pre-bolted to the weir. The brackets will have slides on this side for adjustability. The side of the mounting bracket the attaches to the trough will have holes pre-drilled. Once lined up use a ¼" diameter drill bit to drill through the fiberglass wall of trough behind the pre-drilled holes of the mounting bracket. Using a stainless steel bolt ¼" diameter x 20 x 1" length with washer and nylon nut fasten the pieces together. See below for details on this step. All mounting hardware will be provided with the unit:

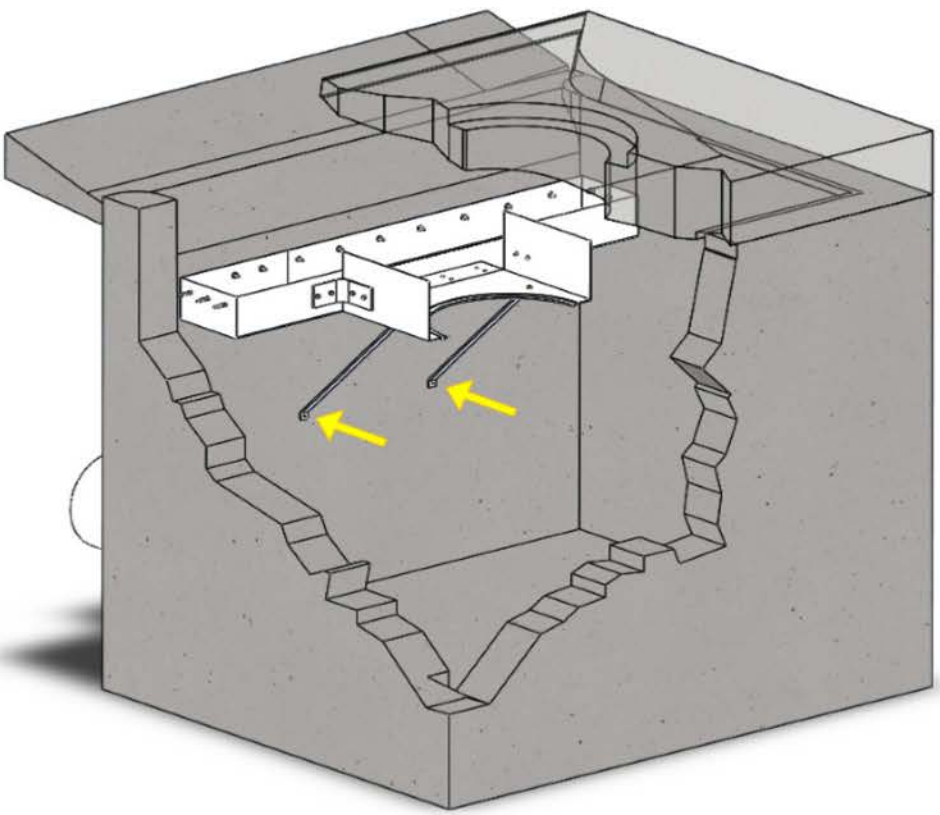
STEP 3

Proper fastening of the mounting brackets are a must and this connection ensures the weir and trough does not pull apart during operating conditions. Also, double check to ensure all revits have been secured between the floor of the weir and trough.

NOTE: Use anti-seize on all nuts and bolts.



- Step 4 requires attaching the 45 degree under mounts (two – one on each side) from the bottom of the front weir section to the walls of the catch basin. The hole will be pre-drilled in the floor of the weir. Fasten the under mount to the weir with a stainless steel bolt ¼" diameter x 20 x 1" length with washer and nylon nut. Next use a level to make sure the horizontal plane of the weir is at 1% slope from the trough sloping down toward the back of the catch basin. Mark the hole position on the opposite side of the under mount where it will attach to the wall of the catch basin. Next, while holding the under mount in place use a rotary hammer with a 1/4" diameter concrete drill bit to drill holes 2 ¾" deep (minimum). Next, insert a ¼" diameter by 2 ¾" long stainless steel drive pins into each hole and use a hammer to fasten in place.

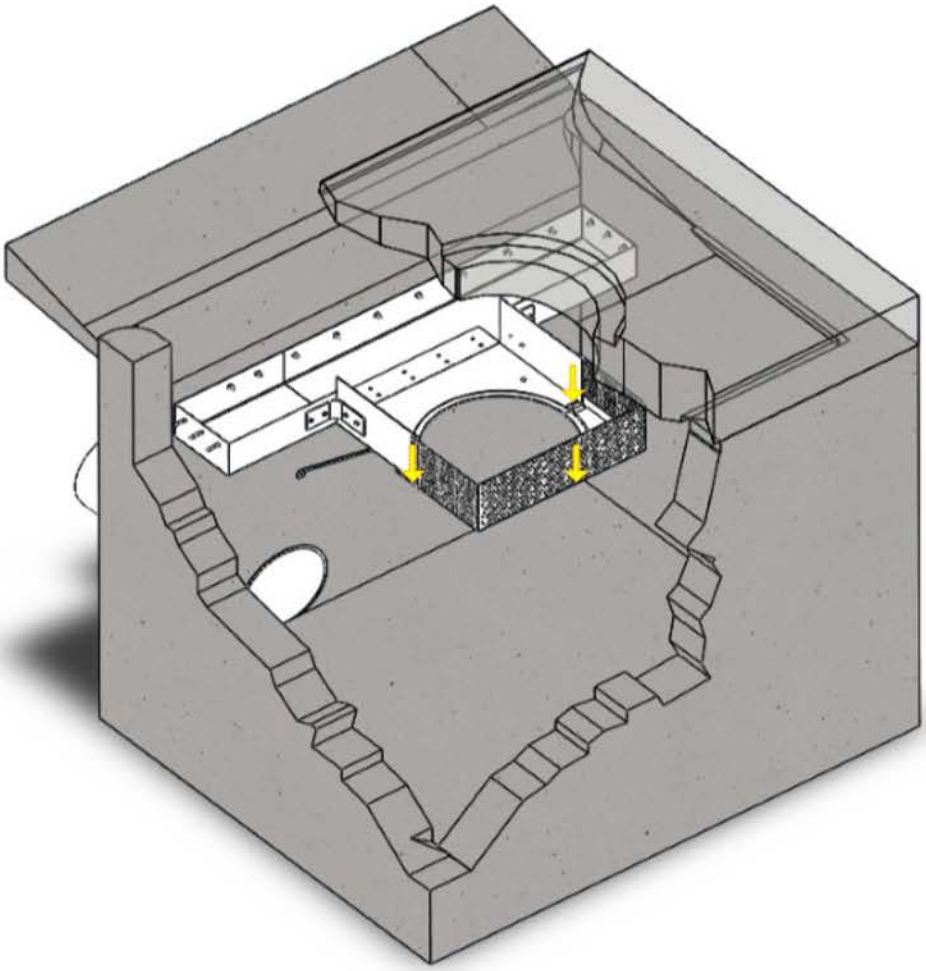


STEP 4

Under mounts help support the weight of the weir, trough and filter basket under operating conditions. They also ensure the slope and level of the weir. It is critical that the weir is sloping at 0.5% toward the basket. There can absolutely be no negative slope on the weir from trough the basket.

NOTE: Use anti-seize on all nuts and bolts.

- Step 5 requires attaching the back weir section to the front weir section and trough assembly. The back weir section has two hinges welded to it. The other side of the hinges bolt to the front weir section. Use 2 stainless steel bolt ¼" diameter x 20 x 1/2" length with washer and nylon nut to fasten the pieces together. Once fastened make sure the back weir piece hinges up and down freely.



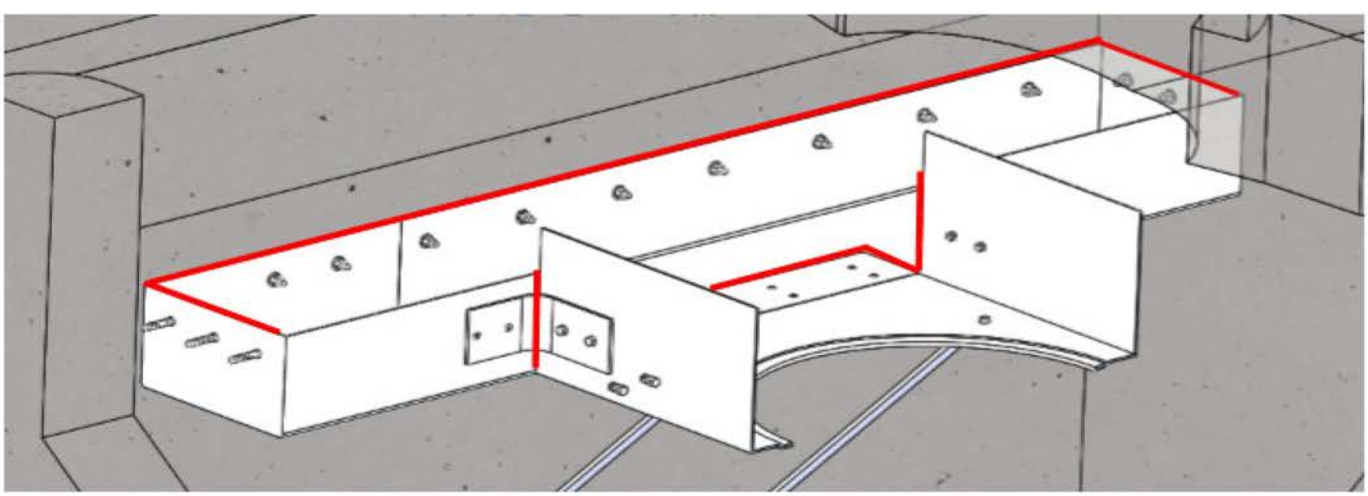
STEP 5

The back weir section is supplied with the hinges pre-welded. The hinges need only be bolted to the front weir section. Ensure the proper bolts and washer are used and tightened. The bolts should be torqued to at least 40 in-lbs.

NOTE: Use anti-seize on all nuts and bolts.

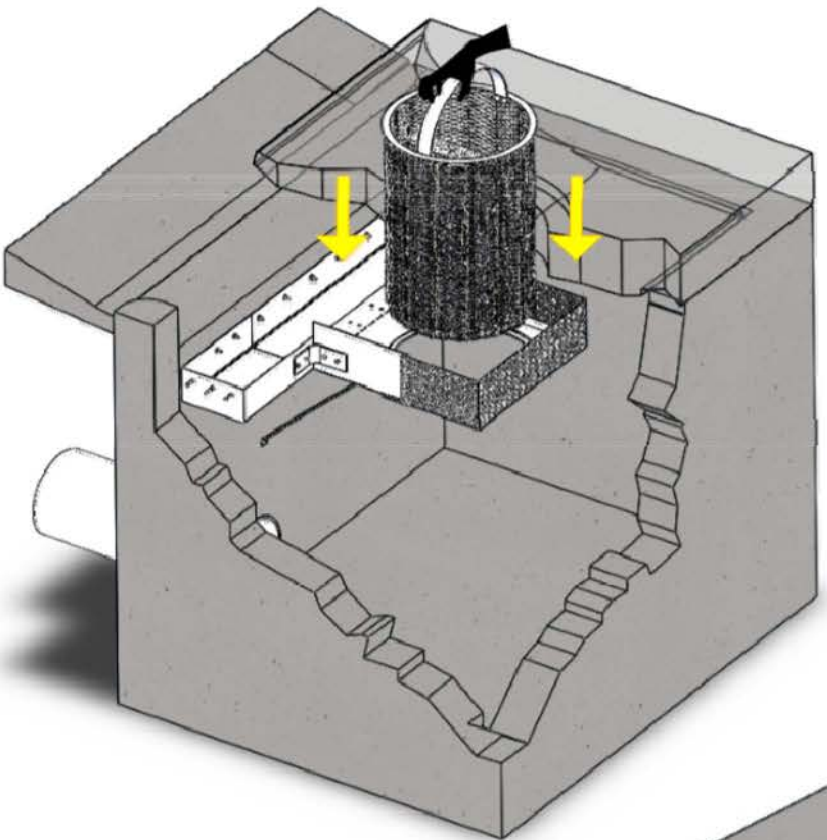
- Step 6 requires using sealant to seal all seams, gaps and joints to ensure no leakage. All surfaces in which the fiberglass and stainless steel trough and wier make contact with a concrete surface or each other must be fully filled with sealant and made completely watertight. Sealant must be Sil-Flx (RTV 7500). See below for diagram highlighting all areas where sealant is required:

STEP 6



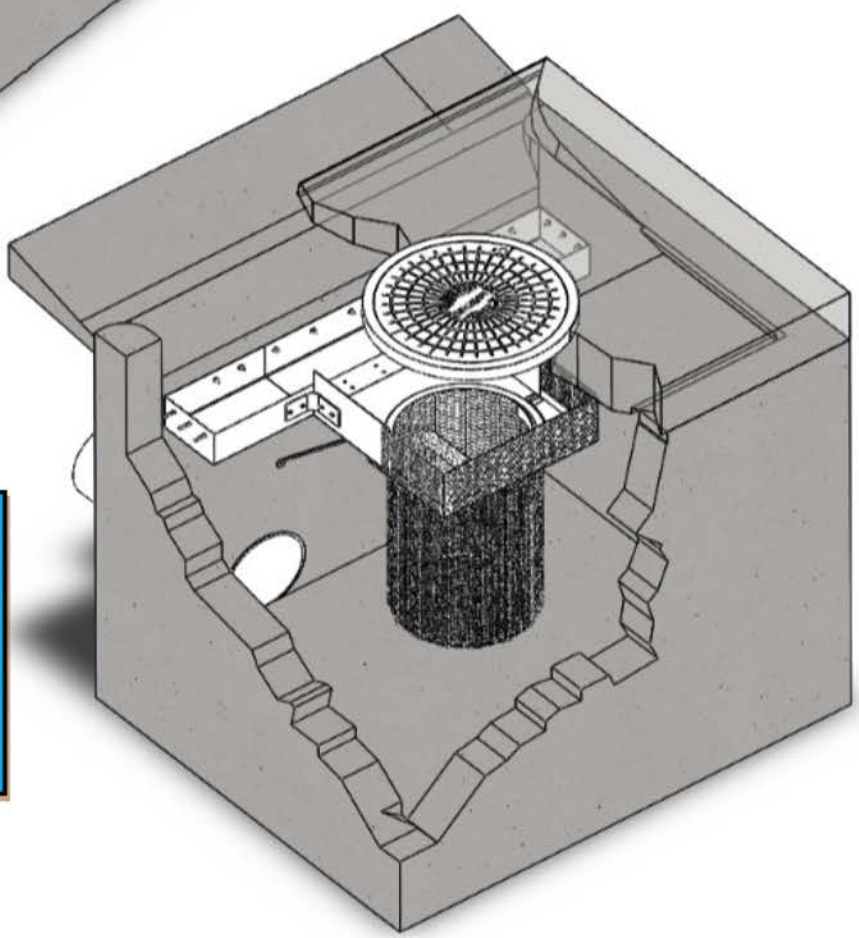
The back weir section is supplied with the hinges pre-welded. The hinges need only be bolted to the front weir section. Ensure the proper bolts and washer are used and tightened. The bolts should be torqued to at least 40 in-lbs.

- Step 7 installation is now complete. The last step is to drop the basket into weir and clean up and left over debris. Be sure to remove all tools and seal up the catch basin by replacing the manhole cover and take down any traffic control.



STEP 7

Not that installation of the shelf and weir section is complete the filter basket can be dropped into place by hand. The opening in the weir section should be directly under the manhole opening to easy installation. Once the basket is in place ensure that the manhole lid is replaced and the install site is returned to its original condition.



For Installation Support or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com



Product Warranty



BIO CLEAN CURB & GRATE TYPE INLET FILTERS

Bio Clean Environmental Services, Inc. products are engineered and manufactured with the intent to be considered as permanent infrastructure. Bio Clean Environmental Services, Inc. warranties its products to be free of manufacturer's defects for a period of 8 years from the date of purchase. Bio Clean Environmental Services, Inc. warranties that the materials used to manufacture its products will be able to withstand and remain durable to environmental conditions for a period of 8 years from the date of purchase. If a warranty claim is made and determined to be valid, Bio Clean Environmental Services, Inc. will either repair or replace the product, at the discretion of Bio Clean Environmental Services, Inc. Warranty claims must be submitted, evaluated, and approved by Bio Clean Environmental Services, Inc. for the claim to be determined to be valid. All warranty work and/or corrective action must be authorized by Bio Clean Environmental Services, Inc. prior to beginning the work not covered by this warranty. There are no other warranties either expressed or implied other than what is specifically specified herein. Abusive treatment, neglect, or improper use of Bio Clean Environmental Services, Inc. products will not be covered by this warranty.

760-433-7640

Bio Clean
A Forterra Company

info@biocleanenvironmental.com

Section [_____]
Stormwater Catch Basin Filtration Device

PART 1 – GENERAL

01.01.00 Purpose
The purpose of this specification is to establish generally acceptable criteria for devices used for filtration of stormwater runoff captured by catch basins with curb openings. It is intended to serve as a guide to producers, distributors, architects, engineers, contractors, plumbers, installers, inspectors, agencies and users; to promote understanding regarding materials, manufacture and installation; and to provide for identification of devices complying with this specification.

01.02.00 Description
Stormwater Catch Basin Filtration Devices (SCBFD) are used to filter stormwater runoff captured by catch basins. The SCBFD is a filter system composed of a filter basket, media filtration boom and a trough system. SCBFDs are used to remove various pollutants from stormwater by means of screening, separation and media filtration.

01.03.00 Manufacturer
The manufacturer of the SCBFD shall be one that is regularly engaged in the engineering, design and production of systems developed for the treatment of stormwater runoff for at least (10) years, and which have a history of successful production, acceptable to the engineer of work. In accordance with the drawings, the SCBFD(s) shall be a filter device manufactured/distributed by Bio Clean Environmental Services, Inc. or assigned distributors or licensees. Bio Clean Environmental Services, Inc. can be reached at:

Corporate Headquarters:
398 Via El Centro
Oceanside, CA 92058
Phone: (855) 566-3938
Fax: (760) 433-3176
www.BioCleanEnvironmental.com

01.04.00 Submittals

01.04.01 Shop drawings are to be submitted with each order to the contractor and engineer of work.

01.04.02 Shop drawings are to detail the SCBFD, its components and the sequence for installation, including:
- SCBFD configuration with primary dimensions
- Various SCBFD components
- Any accessory equipment

01.04.03 Inspection and maintenance documentation submitted upon request.

01.05.00 Work Included

01.05.01 Specification requirements for installation of SCBFD.

01.05.02 Manufacturer to supply SCBFD(s):
- Filter Basket
- Trough System (weir and trough)
- Media Filtration Boom

01.05.03 Media Filtration Boom shall be provided with each Filter Basket housed in nylon netting and securely fastened entrance to the Filtration basket. Each media boom shall contain polymer beads to permanently absorb hydrocarbons.

01.06.00 Reference Standards

ASTM A 240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM F 716	Testing Sorbent Performance of Absorbents
ASTM F 726	Sorbent Performance of Absorbents
ASTM D3787 - 07	Standard Test Method for Bursting Strength of Textiles-Constant-Rate-of-Traverse (CRT) Ball Burst Test
ASTM D2690-98	Standard Test Method for Isophthalic Acid in Alkyd and Polyester Resins
ASTM C 582-02	Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment
ASTM D 638	Standard Test Method for Tensile Properties of Plastics
ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 648	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
ASTM D 2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 4097	Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM D3409	Standard Test Method for Adhesion of Asphalt-Roof Cement to Damp, Wet, or Underwater Surfaces
IFI 114	Break Mandrel Blind Rivets

PART 2 – COMPONENTS

02.01.00 Trough System Components

02.01.01 Trough shall be manufactured from 100% marine grade polyester resin and fiberglass strands and stainless steel.

- The entire fiberglass structure must be coated with a polyester gel coating with ultra violet inhibitors incorporated into the coating for maximum ultra violet protection.
- Fiberglass must have a minimum thickness of 3/16".

02.01.02 Weir portion of the Trough System shall be manufactured from 100% stainless steel.

- The Weir shall fully surround the Filter Basket on all sides. On the end of the weir the sides shall be made of screen with perforated round openings less than 5 mm in size.
- Water flows in access of the capacity of the Filter Basket shall pass through the additional weir screen for added treatment and retention of trash and debris during higher bypass flows.
- The Weir shall be hinged in the middle along the centerline of the Filter Basket and hinge upward to allow for access into the catch basin.

02.01.03 Mounting Hardware shall be 100% non-corrosive metals.

- Nuts and bolts
- Rivets
- Support brackets
- Concrete anchors

02.01.04 Concrete Filler and Sealant shall be made of Acrylic Emulsion and have a minimum service temperature range of -30°F to 150°F.

02.02.00 Filter Basket Components

02.02.01 Filter Basket Housing shall be manufactured of 100% stainless steel.

02.02.02 Side Screens shall be manufactured of 100% stainless steel louver expanded metal with openings equal to or less than 4.7 mm in size.

- Screens shall be oriented with openings opposite to the flow of water into the filter and be non-clogging based on perpetual deflective shielding.

02.02.03 Bottom Screens shall be manufactured of 100% stainless steel perforated round openings less than 5 mm in size.

02.02.03 Handle shall be manufactured entirely of 100% stainless steel and be mounted to the Filter Basket Housing using mounting hardware per section 02.01.03

02.02.04 Media Filtration Boom shall be made up of granulated oil absorbing polymers that have been tested in accordance with section 11.2 of ASTM F 716.07 and held within a netting.

- Oil absorbing polymers must be proven to absorb 180% of its weight within a 300 second contact time, and at this absorption percentage the physical increase in the size of the granules is not more that 50%.
- Netting shall be 100% polyester with a number 16 sieve size, and strength tested per ASTM D 3787.

PART 3 – PERFORMANCE

03.01.00 General

03.01.01 Function - The SCBFD has no moving internal components and functions based on gravity flow, unless otherwise specified. The SCBFD is composed of a Trough System, Media Filtration Boom and a Filter Basket. Runoff enters the SCBFD from a curb opening and flows into the Trough System which is mounted under the face of the curb opening. It then flows horizontally inside the System's Trough to the Weir which holds the Filter Basket. This Trough System positions the Filter Basket directly under the catch basin access point (manhole cover, grate or hatch). The Filter Basket can be removed through the access point without disassembly. The Filter Basket can also be cleaned without entering the access point by using a vacuum truck. Within the Filter Basket is a Media Filtration Boom. Water flows through the Weir and into the Filter Basket. Stormwater enters the inside of the Filter Basket and flows downward toward the bottom portion of the Basket. The non-clogging screen has openings that are facing upward. As water flows downward the screening continuously removes debris from the screen's surface. Flowing water also makes contact with the Media Filtration Boom which absorbs free floating oils. Stormwater flow up to the peak treatment flow rate is processed through the

filtration screens. During the heaviest flows the Filter Basket fills with water and spills over the top to bypass directly into the bottom of the catch basin, while previously captured debris and solids are contained by the weir screens which prevents re-suspension.

03.01.02 Pollutants - The SCBFD will remove and retain debris, sediments, metals, nutrients, oxygen demanding substances, bacteria and hydrocarbons entering the filter during frequent storm events and specified flow rates. For pollutant removal performance see section 03.02.00.

03.01.03 Treatment Flow Rate - The SCBFD operates using gravity flow. The SCBFD treatment flow rate varies by size and is provided on the drawings for each model. Flow rates must be supported by independent lab results.

03.01.04 Bypass Flow Rate – The SCBFD is designed to fit within the catch basin in a way not to affect the hydraulics. The area over the top of the Trough System is always greater than the curb opening area and/or the area of the outflow pipe. Therefore, the SCBFD does not create a critical point of restriction.

03.01.05 Pollutant Load – The SCBFD must be designed to have minimum storage capacity as documented on the drawing for each particular size and model.

03.01.06 Performance Protocol and Results – All lab testing on filtration media must be performed by an independent third party consultant and testing lab.

03.02.00 Test Performance

At a minimum, the SCBFD shall be tested, according to section 03.01.03 & 03.01.06, and meet these performance specifications:

03.02.01 Filter Pollutant Removal Table

POLLUTANT	REMOVAL EFFICIENCY
Trash and Debris - (down to 5 mm)	100%

03.02.02 Maintenance Performance – The Filter Basket must be able to be maintained and cleaned from finish surface using a vacuum hose inserted through the manhole or hatch opening and not the curb face. All cleaning shall be done without entering the catch basin. The Filter Basket shall be removable from finish surface and reinstalled from finish surface without entrance into the catch basin.

PART 4 - EXECUTION

04.01.00 General

The installation and use of the SCBFD shall conform to all applicable national, state, municipal and local specifications.

04.02.00 Installation

The contractor shall furnish all labor, equipment, materials and incidentals required to install the (SCBFD) device(s) and appurtenances in accordance with the drawings, installation manual, and these specifications, and be inspected and approved by the local governing agency. Installation contractor should possess a Confined Space Entry Certification Permit, pursuant to OSHA standards. Any damage to catch basin and surrounding infrastructure caused by the installation of the SCBFD is the responsibility of the installation contractor.

04.02.01 Trough System will be installed in accordance with manufactures' recommendations. The Trough component will be installed the complete width of the curb opening, or underneath any wings as to provide 100% coverage of incoming stormwater. The Weir component of the Trough System must be located directly under the manhole opening or other access point (not including the curb opening) regardless of its position relative of the curb opening. The Trough System must be properly mounted and assembled inside the catch basin with drive pins and pop rivets per manufacture's recommendations. Once the Trough System is secured to the walls of the catch basin all seams must be filled with sealant per section 02.01.03.

04.02.02 Filter Basket will be inserted through the manhole opening or access point of the catch basin directly without entry into the basin. The Filter Basket shall be fully visible from finish surface while looking into the access point for ease of inspection and maintenance. The curb opening itself is not a point of access as maintenance personnel cannot enter.

04.03.00 Shipping, Storage and Handling

04.03.01 Shipping – SCBFD shall be shipped to the contractor's address and is the responsibility of the contractor to transport the unit(s) to the exact site of installation.

04.03.02 Storage and Handling– The contractor shall exercise care in the storage and handling of the SCBFD(s) and its components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted, and unloading has commenced shall be born by the contractor. The SCBFD(s) and its components shall always be stored indoors and transported inside the original shipping container(s) until the SCBFD(s) are ready to be installed. The SCBFD shall always be handled with care and lifted according to OSHA and NIOSA lifting recommendations and/or contractor's workplace safety professional recommendations.

04.04.00 Maintenance and Inspection

04.04.01 Inspection – After installation, the contractor shall demonstrate that the SCBFD has been properly installed at the correct location(s), elevations, and with appropriate supports and fasteners. All components associated with the SCBFD and its installation shall be subject to inspection by the engineer of work, governing agency, and the manufacture at the place of installation. In addition, the contractor shall demonstrate that the SCBFD has been installed per the manufacturer's specifications and recommendations. SCBFD(s) shall be physically inspected regularly in accordance to owner's Stormwater Pollution Prevention Plans (SWPPP) and manufacture's recommendations. An inspection record shall be kept by the inspection operator. The record shall include the condition of the SCBFD and its appurtenances. The most current copy of the inspection record shall always be copied and placed in the owner's SWPPP.

04.04.02 Maintenance – SCBFD(s) must be completely maintained from outside the catch basin. The SCBFD(s) shall be inspected, maintained and cleaned 1 to 4 times a year and/or in accordance to owner's Stormwater Pollution Prevention Plans (SWPPP). The maintenance shall be preformed by someone qualified. A Maintenance Manual is available upon request from the manufacturer. The manual has detailed information regarding the maintenance of the SCBFD. A Maintenance Record shall be kept by the

maintenance operator. The Maintenance Record shall include any maintenance activities preformed, amount and description of debris collected, and the condition of the filter. The most current copy of the Maintenance Record shall always be copied and placed in the owner's SWPPP.

04.04.03 Material Disposal - All debris, trash, organics, and sediments captured and removed from the SCBFD shall be transported and disposed of at an approved facility for disposal in accordance with local and state regulations. Please refer to state and local regulations for the proper disposal of toxic and non-toxic material.

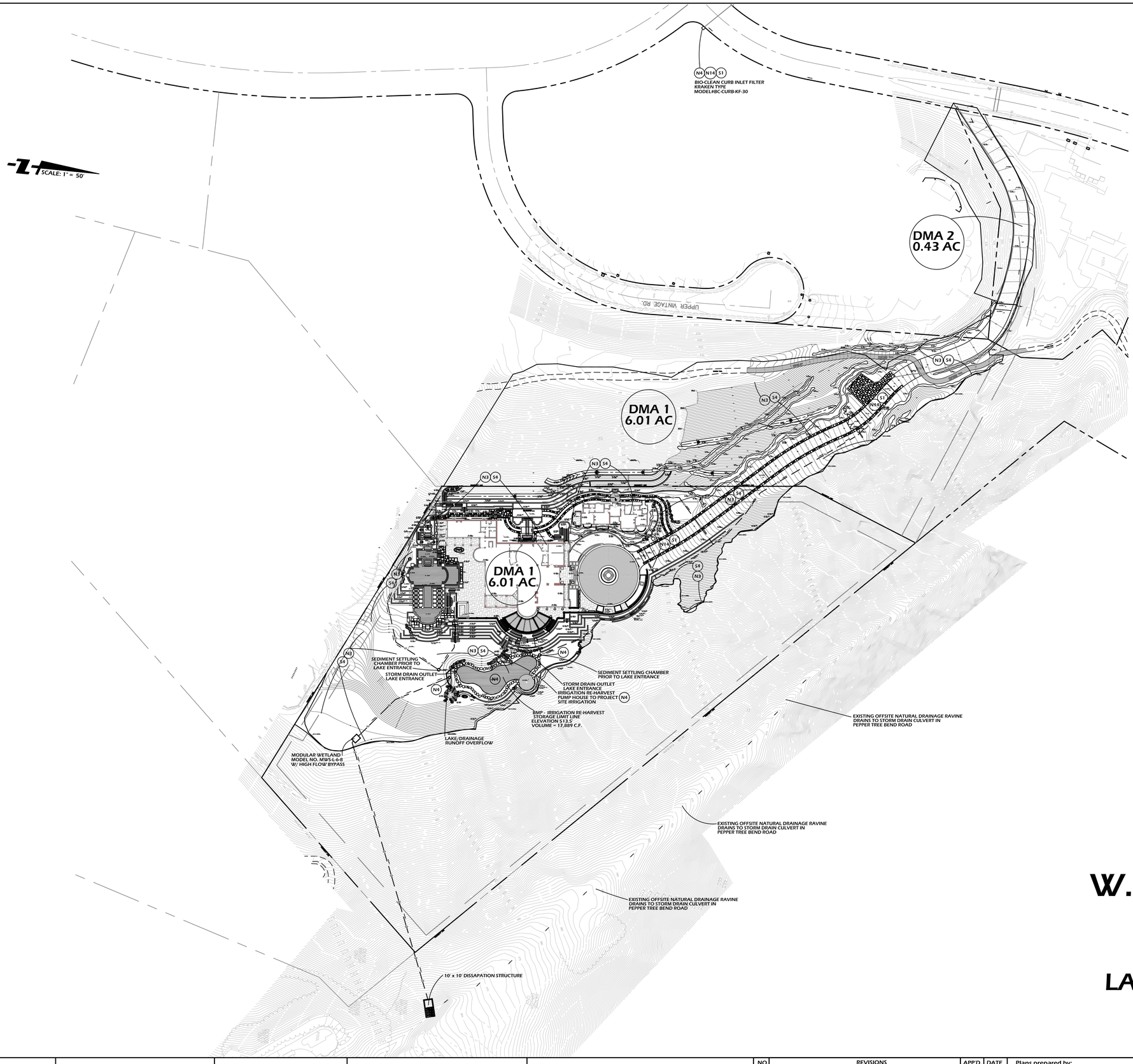
PART 5 – QUALITY ASSURANCE

05.01.00 Warranty

The manufacturer shall guarantee the SCBFD against all manufacturing defects in materials and workmanship for a period of (8) years from the date of delivery to the contractor. The manufacturer shall be notified of repair or replacement issues in writing within the warranty period. The SCBFD is limited to recommended application for which it was designed.

[End of This Section]

Attachment I: WQMP Exhibit



LEGEND:

DMA 1	ENTIRE SITE IS DMA 1 - 6.00 ACRES
N3	COMMON AREA LANDSCAPE MANAGMENT
N4	BMP MAINTENANCE
N14	COMMON AREA CATCH BASIN INSPECTION
S1	CATCHBASIN STENCIL "NO DUMPING DRAINS TO OCEAN"
S4	EFFICIENT IRRIGATION AND LANDSCAPE DESIGN
CB	CATCH BASIN
SD	STORM DRAIN

AREAS:

DMA 1 TOTAL PROPERTY AREA = 261,551 S.F.
TOTAL PERVIOUS AREA = 212,267 S.F.
TOTAL IMPERVIOUS AREA = 49,283 S.F.

DMA 2 TOTAL ROADWAY AREA = 18,781 S.F.
TOTAL PERVIOUS AREA = 13,190 S.F.
TOTAL IMPERVIOUS AREA = 5,591 S.F.

W.Q.M.P. EXHIBIT

FOR
1 O'HILL RIDGE
IN
LAGUNA NIGUEL, CA

GARG RESIDENCE
WQMP EXHIBIT

07-08-19

Underground Service Alert
Call: TOLL FREE
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SOILS ENGINEER:

OWNER/DEVELOPER:

MR. AND MRS. GARG

27261 HIDDEN TRAILS ROAD
LAGUNA HILLS, CA 92653

NO.	REVISIONS	APP'D.	DATE

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CIVIL ENGINEERING, SURVEYING AND LAND DEVELOPMENT SERVICES
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RAYMOND W. GILBERT
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Exp. 06/30/21
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STATE OF CALIFORNIA

WQMP EXHIBIT
FOR
1 O'HILL RIDGE
LAGUNA NIGUEL, CA

DRAWN:	R.W.G.
DESIGN:	R.W.G.
CHECKED:	R.W.G.
SCALE:	1" = 50'
JOB NO.:	423.000

SHEET 1 OF 1