GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

March 24, 2022

JN 20069

Dale Vogel and Nancy Bird
P.O. Box 1360
Mercer Island, Washington 98040
via email: dalejvogel@outlook.com; carly.birdvogel@gmail.com

Subject: **Slope Stability Analyses**
Proposed New Residence
4304 E Mercer Way
Mercer Island, Washington

Dear Mr. Vogel and Ms. Bird:

As indicated in our December 11, 2020 *Geotechnical Engineering Study*, we completed a slope stability analysis for your site under both static and seismic conditions. The results of those analyses, which showed the planned residence to be protected from undermining or slope instability under both conditions, were discussed in the *Study*. As required by the City of Mercer Island's Geotechnical Third-Party Reviewer, we have attached the results of our slope stability analyses to this letter, so they can be resubmitted.

Please contact us if you have any questions regarding this letter.

Respectfully submitted,

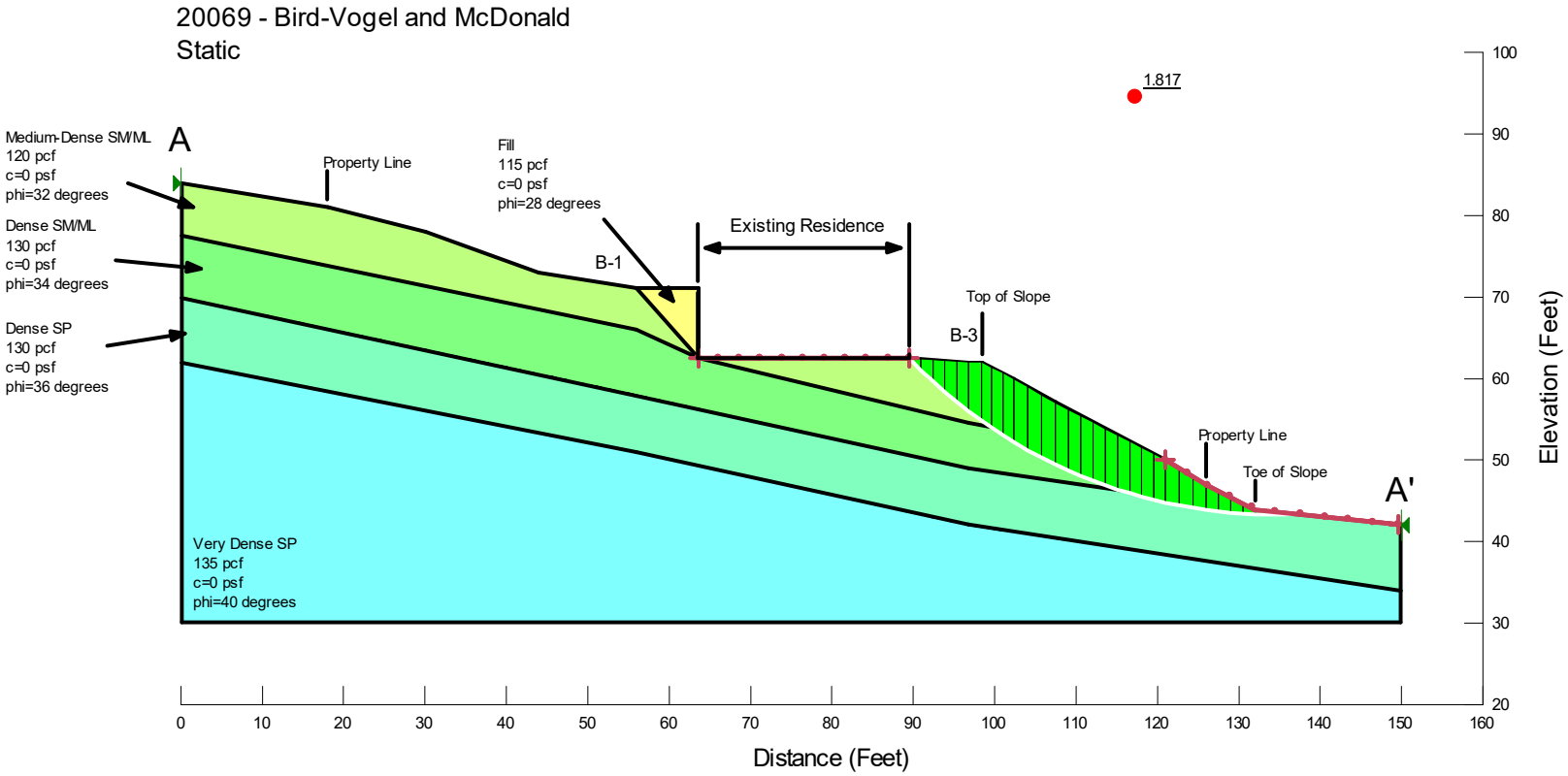
GEOTECH CONSULTANTS, INC.

3/24/2022
Marc R. McGinnis, P.E.
Principal

Attachment – Slope Stability Analyses

cc: **McClellan Architects –** Karen Kline
via email: karen@mccarch.com

MRM:kg


20069 - Bird-Vogel and McDonald
Static
1.817
Medium-Dense SM/ML
120 pcf
c=0 psf
phi=32 degrees
Dense SM/ML
130 pcf
c=0 psf
phi=34 degrees
Dense SP
130 pcf
c=0 psf
phi=36 degrees
A
Property Line
Fill
115 pcf
c=0 psf
phi=28 degrees
B-1
Existing Residence
Top of Slope
B-3
Property Line
Toe of Slope
A'
Very Dense SP
135 pcf
c=0 psf
phi=40 degrees
Elevation (Feet)
Distance (Feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
20
30
40
50
60
70
80
90
100

Static

File Information

File Version: 8.15
Title: 20069 Slope Stability - Vogel
Created By: Matt McGinnis
Last Edited By: Matt McGinnis
Revision Number: 24
Date: 3/9/2022
Time: 3:17:00 PM
Tool Version: 8.15.6.13446
File Name: 20069 Existing Conditions.gsz
Directory: C:\Users\MattM\Geotech Consultants\Shared Documents - Documents\2020 Jobs\20069 Bird-Vogel-McDonald (MRM)\
Last Solved Date: 3/9/2022
Last Solved Time: 3:17:01 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Static

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
    Side Function
        Interslice force function option: Half-Sine
    PWP Conditions Source: (none)
Slip Surface
    Direction of movement: Left to Right
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Resisting Side Maximum Convex Angle: 1 °
    Driving Side Maximum Convex Angle: 5 °
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
F of S Distribution

F of S Calculation Option: Constant

Advanced

Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Fill

Model: Mohr-Coulomb
Unit Weight: 115 pcf
Cohesion': 0 psf
Phi': 28 °
Phi-B: 0 °

Medium-Dense SM/ML

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 32 °
Phi-B: 0 °

Dense SM/ML

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

Dense SP

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 36 °
Phi-B: 0 °

Very Dense SP

Model: Mohr-Coulomb
Unit Weight: 135 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (63.5, 62.5) ft
Left-Zone Right Coordinate: (89.5, 62.5) ft

Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (121, 50) ft
Right-Zone Right Coordinate: (149.5, 42.05556) ft
Right-Zone Increment: 10
Radius Increments: 10

Slip Surface Limits

Left Coordinate: (0, 84) ft
Right Coordinate: (150, 42) ft

Seismic Coefficients

Horz Seismic Coef.: 0

Points

	X (ft)	Y (ft)
Point 1	0	84
Point 2	18	81
Point 3	30	78
Point 4	44	73
Point 5	56	71
Point 6	63.5	71
Point 7	89.5	62.5
Point 8	96.8	62
Point 9	102.4	60
Point 10	121	50
Point 11	126	47
Point 12	132	44
Point 13	150	42
Point 14	0	30
Point 15	150	30
Point 16	56	66
Point 17	56	58
Point 18	56	51
Point 19	56	44
Point 20	96.8	58
Point 21	96.8	54.5
Point 22	96.8	49
Point 23	96.8	42
Point 24	96.8	35.5
Point 25	107.5	57
Point 26	63.5	62.5
Point 27	0	77.5
Point 28	0	70
Point 29	150	34
Point 30	0	62

Point 31	98.4	62

Regions

	Material	Points	Area (ft²)
Region 1	Fill	7,8,31,9,25,20	40.9
Region 2	Fill	5,6,26	31.875
Region 3	Medium-Dense SM/ML	4,5,26,16,27,1,2,3	360.75
Region 4	Dense SM/ML	16,26,21,10,11,12,22,17,28,27	824.27
Region 5	Dense SP	12,13,29,23,18,30,28,17,22	1,094.8
Region 6	Very Dense SP	29,15,14,30,18,23	2,582.8
Region 7	Medium-Dense SM/ML	26,7,20,25,10,21	189.82

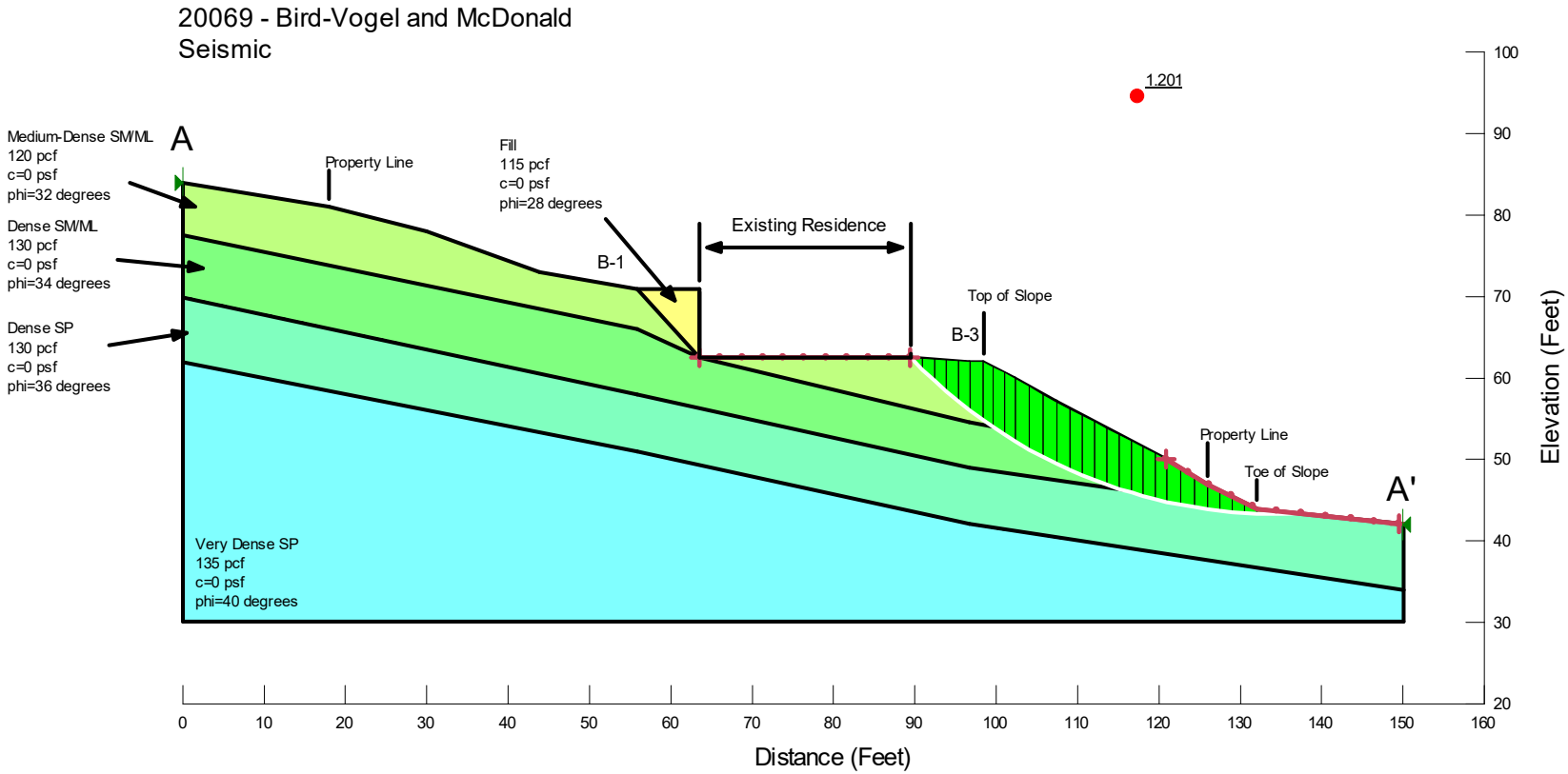
Current Slip Surface

Slip Surface: 1,280
F of S: 1.817
Volume: 227.41913 ft³
Weight: 28,156.042 lbs
Resisting Moment: 1,255,353.6 lbs-ft
Activating Moment: 691,159.48 lbs-ft
Resisting Force: 18,139.161 lbs
Activating Force: 9,982.9282 lbs
F of S Rank (Analysis): 1 of 1,331 slip surfaces
F of S Rank (Query): 1 of 1,331 slip surfaces
Exit: (137.51501, 43.387221) ft
Entry: (89.5, 62.5) ft
Radius: 62.330975 ft
Center: (134.48555, 105.64453) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	90.23	61.763765	0	19.835087	12.394338	100
Slice 2	91.69	60.337988	0	137.98202	86.220737	100
Slice 3	93.15	59.001513	0	246.14294	153.80718	100
Slice 4	94.61	57.746843	0	346.47185	216.49964	100
Slice 5	96.07	56.56769	0	440.75272	275.41286	100
Slice 6	97.6	55.408872	0	540.72478	337.88234	100
Slice 7	99.011313	54.398302	0	609.30952	380.73885	100
Slice 8	100.31697	53.519977	0	643.06519	433.75295	50
Slice 9	101.70566	52.635453	0	675.46926	455.60977	50
Slice 10	103.25	51.713781	0	701.93712	473.46256	50
Slice 11	104.95	50.764026	0	721.8795	486.91387	50
Slice 12	106.65	49.882269	0	737.82786	497.67118	50
Slice 13	108.26226	49.104425	0	752.68814	507.69456	50
Slice	109.78679	48.421874	0	766.52338	517.02655	50

14						
Slice 15	111.31132	47.787541	0	775.98843	523.4108	50
Slice 16	112.83585	47.199855	0	780.39978	526.3863	50
Slice 17	114.36038	46.65742	0	778.98962	525.43513	50
Slice 18	115.85732	46.167253	0	770.45491	559.76826	0
Slice 19	117.32666	45.726766	0	755.68208	549.03517	0
Slice 20	118.79599	45.325282	0	733.32464	532.79154	0
Slice 21	120.26533	44.962027	0	702.78772	510.60516	0
Slice 22	121.83333	44.617099	0	648.97937	471.51111	0
Slice 23	123.5	44.295111	0	569.69179	413.90532	0
Slice 24	125.16667	44.019874	0	478.75789	347.83797	0
Slice 25	126.75	43.800046	0	392.56145	285.21259	0
Slice 26	128.25	43.630822	0	313.47006	227.74933	0
Slice 27	129.75	43.498259	0	227.75581	165.47428	0
Slice 28	131.25	43.402122	0	136.60815	99.251631	0
Slice 29	132.91917	43.340026	0	78.177134	56.799012	0
Slice 30	134.75751	43.320928	0	51.310724	37.279423	0
Slice 31	136.59585	43.35608	0	18.011954	13.086451	0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phi=32 degrees
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40
30
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0
10
20
30
40
50
60
70
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120
130
140
150
160

Seismic

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File Version: 8.15
Title: 20069 Slope Stability - Vogel
Created By: Matt McGinnis
Last Edited By: Matt McGinnis
Revision Number: 23
Date: 3/9/2022
Time: 3:15:52 PM
Tool Version: 8.15.6.13446
File Name: 20069 Existing Conditions.gsz
Directory: C:\Users\MattM\Geotech Consultants\Shared Documents - Documents\2020 Jobs\20069 Bird-Vogel-McDonald (MRM)\
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Pressure(p) Units: psf
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Element Thickness: 1

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Seismic

Kind: SLOPE/W
Method: Morgenstern-Price
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    Direction of movement: Left to Right
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Resisting Side Maximum Convex Angle: 1 °
    Driving Side Maximum Convex Angle: 5 °
    Optimize Critical Slip Surface Location: No
    Tension Crack
        Tension Crack Option: (none)
F of S Distribution

F of S Calculation Option: Constant

Advanced

Number of Slices: 30
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Slice 3	93.15	59.001513	0	202.36917	126.45429	100
Slice 4	94.61	57.746843	0	287.56965	179.69346	100
Slice 5	96.07	56.56769	0	365.9328	228.66019	100
Slice 6	97.6	55.408872	0	448.03258	279.96183	100
Slice 7	99.011313	54.398302	0	503.88483	314.86218	100
Slice 8	100.31697	53.519977	0	530.62214	357.90915	50
Slice 9	101.70566	52.635453	0	557.23097	375.85703	50
Slice 10	103.25	51.713781	0	581.13069	391.9776	50
Slice 11	104.95	50.764026	0	602.89432	406.65735	50
Slice 12	106.65	49.882269	0	624.97906	421.5537	50
Slice 13	108.26226	49.104425	0	649.26191	437.93268	50
Slice	109.78679	48.421874	0	675.25851	455.46762	50

14						
Slice 15	111.31132	47.787541	0	700.28042	472.34511	50
Slice 16	112.83585	47.199855	0	723.13407	487.76009	50
Slice 17	114.36038	46.65742	0	742.23345	500.64278	50
Slice 18	115.85732	46.167253	0	750.8244	545.50586	0
Slice 19	117.32666	45.726766	0	756.55988	549.67292	0
Slice 20	118.79599	45.325282	0	752.93961	547.04265	0
Slice 21	120.26533	44.962027	0	737.92948	536.13715	0
Slice 22	121.83333	44.617099	0	695.43766	505.26504	0
Slice 23	123.5	44.295111	0	621.02252	451.19927	0
Slice 24	125.16667	44.019874	0	527.89215	383.5361	0
Slice 25	126.75	43.800046	0	434.80153	315.9018	0
Slice 26	128.25	43.630822	0	346.62415	251.83719	0
Slice 27	129.75	43.498259	0	250.55767	182.04081	0
Slice 28	131.25	43.402122	0	149.63849	108.71873	0
Slice 29	132.91917	43.340026	0	84.694348	61.534046	0
Slice 30	134.75751	43.320928	0	54.111266	39.314136	0
Slice 31	136.59585	43.35608	0	18.550879	13.478003	0