



**PLANNING DEPARTMENT ADMINISTRATIVE PUBLIC HEARING
SUMMIT COUNTY, UTAH
July 25, 2024**

The Planning Department of Park City, Utah, will hold a Public Hearing in person at the Marsac Municipal Building, Planning Department Conference Room, at 445 Marsac Avenue, Park City, Utah 84060. Meetings will also be available online and may have options to listen, watch, or participate virtually.

1. REGULAR AGENDA - 12:00PM

- 1.A. 8945 Marsac Avenue Moonshadow Condominiums – Administrative Conditional Use Permit** – The Applicant Proposes a Retaining Wall Greater than Four Feet In The Front Setback. PL-24-06174
(A) Public Hearing; (B) Action

Pursuant to the Americans with Disabilities Act, individuals needing special accommodations during the meeting should notify the Planning Department at 435-615-5060 or planning@parkcity.org at least 24 hours prior to the meeting.

***Parking is available at no charge for meeting attendees who park in the China Bridge parking structure.**

Planning Department Staff Report



Subject: Moonshadow Condos Retaining Walls
Application: PL-24-06174
Author: Virgil Lund
Date: July 25, 2024
Type of Item: Administrative Conditional Use Permit

Recommendation

(I) Review the proposed retaining walls at the Moonshadow Condominiums, (II) conduct a public hearing, and (III) consider approving the Administrative Conditional Use Permit (ACUP) based on the Findings of Fact, Conclusions of Law, and Conditions of Approval outlined in the Draft Final Action Letter (Exhibit A).

Description

Applicant: Rhett Riding; Applicant Representative: Alliance Engineering

Location: 8903 - 8945 Marsac Ave Moonshadow Condominiums

Zoning District: Residential Development

Adjacent Land Uses: Multi-Family, Recreation Open Space

Reason for Review: Retaining walls greater than six feet in height from Final Grade require an ACUP in the Residential Development Zoning District.¹

ACUP Administrative Conditional Use Permit
LMC Land Management Code
MPD Master Planned Development
RD Residential Development

Terms that are capitalized as proper nouns throughout this staff report are defined in LMC [§ 15-15-1](#).

Summary

The Applicant is requesting retroactive approval of an Administrative Conditional Use Permit for two existing retaining walls ranging from six to seven feet in height from Final Grade, built in the front setback of the Moonshadow Condominiums property. The proposed plans also include construction of three retaining walls four feet in height from Final Grade. , The applicant submitted proposed plans, dated 6/14/2022 (Exhibit B) illustrating existing and proposed retaining walls (shown in Figure 1 and 2 below). The Applicant proposes the following:

¹ LMC [§ 15.2-13.2\(B\)](#)

- An ACUP for an existing stacked stone retaining wall that is seven feet in height from Final Grade, and 70 feet in width
- An ACUP for an existing stacked stone retaining wall that is six feet in height from Final Grade and 270 feet in width

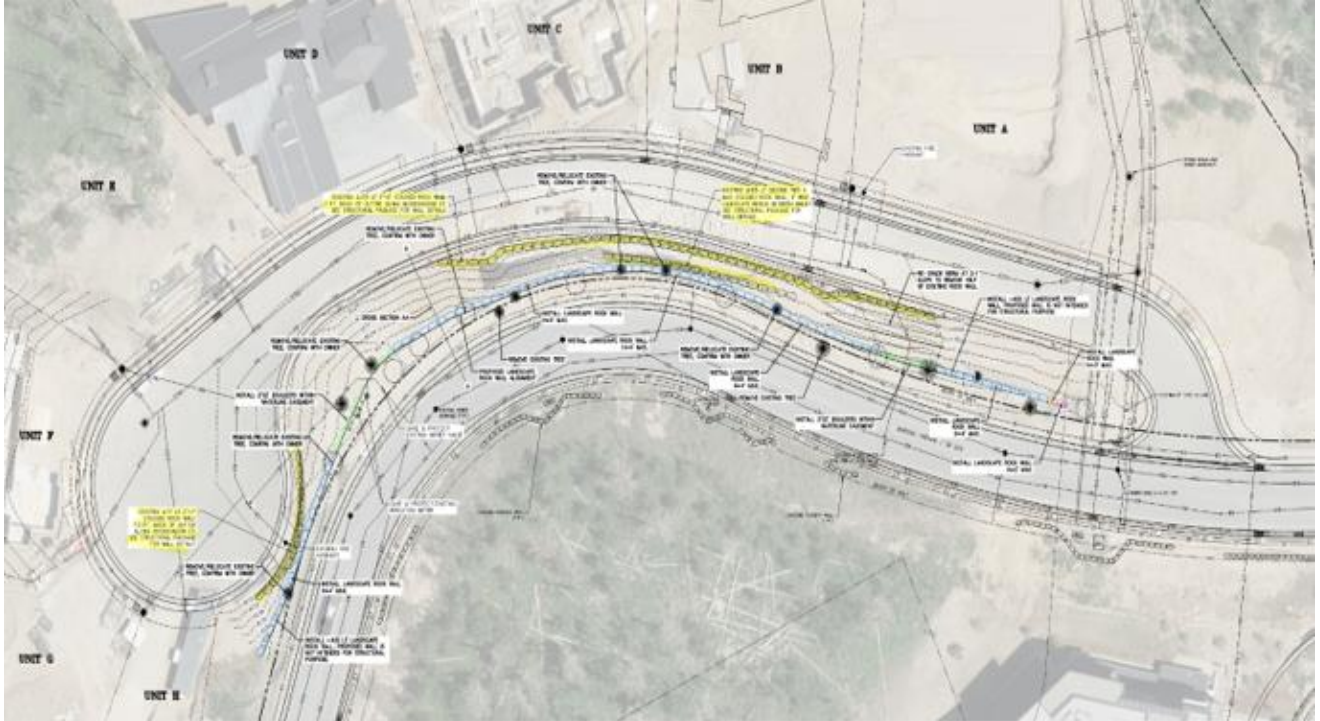


Figure 1: Proposed Retaining Walls Highlighted in Blue, Existing Retaining Walls Highlighted in Yellow

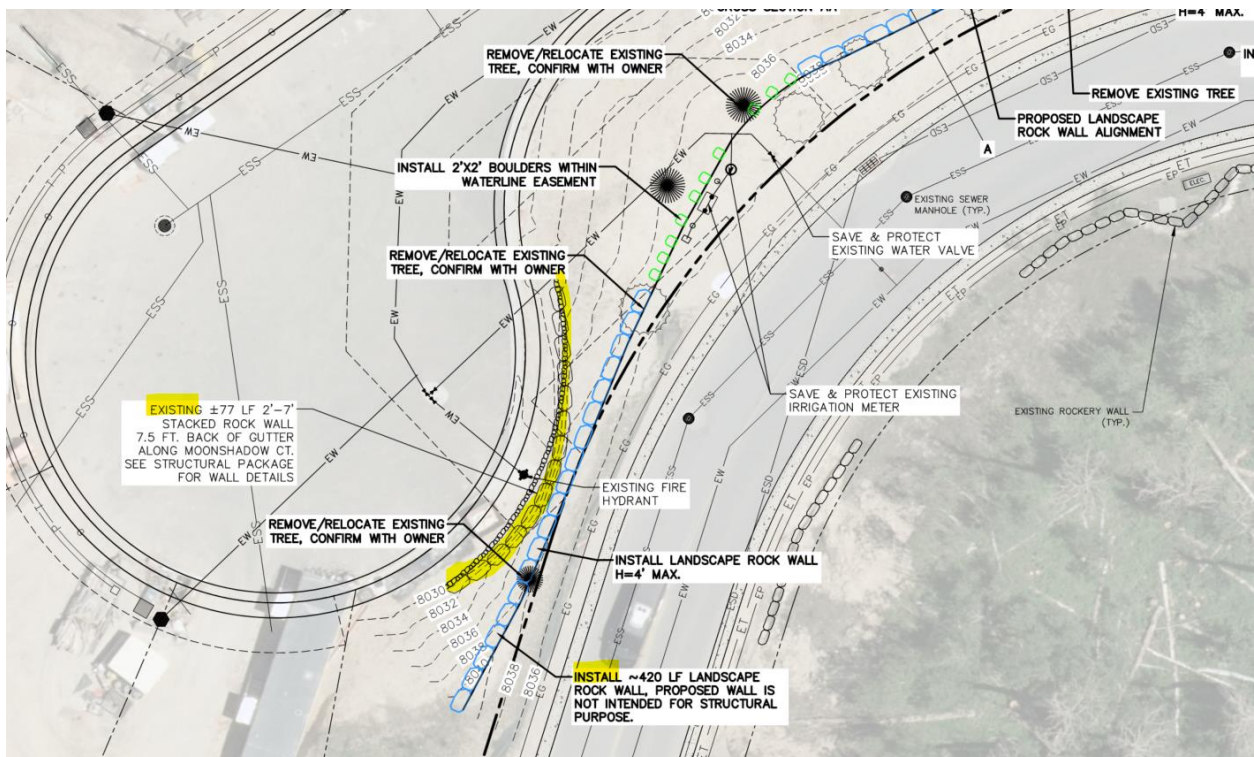


Figure 2: Detailed Image of Proposed Retaining Wall

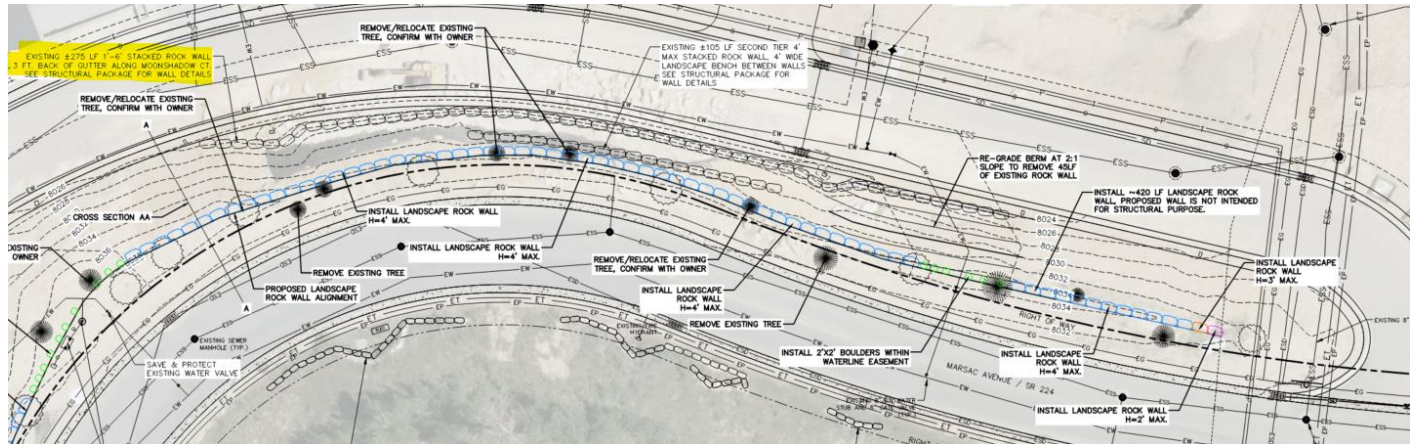


Figure 3: Detailed Image of Proposed Retaining Wall

Background

The Moonshadow Condominiums are part of the Flagstaff Annexation Area, governed by the Flagstaff Development Agreement, the Village at Empire Pass Master Planned Development (VEP MPD), within the Residential Development (RD) and Recreation Open Space (ROS) Zoning Districts.

The Moonshadow Condominiums contain eight PUD-style units, accessed from Moonshadow Court via Marsac Ave. The 2007 Amended Flagstaff Development Agreement describes PUD-style units as “clustered, detached, single-family or duplex units with common open space and coordinated architecture.”

The City Council adopted Ordinance 2018-54 approving the Moonshadow Condominiums on October 25, 2018. On July 1, 2019, the Moonshadow Condominiums Plat was recorded with Summit County, Summit County Recorder Entry No. 111351. The Plat created an eight-unit condominium. As part of the Village at Empire Pass Master Planned Development Approval and the Amended Flagstaff Development Agreement, the Planning Commission approved no more than 31 Unit Equivalents of residential density (62,000 square feet) for the Moonshadow Condominiums.

Construction has begun on the Condominium Units and, according to the Applicant, retaining walls are required to stabilize the slope separating Moonshadow Court and condominiums from Marsac Avenue.

Analysis

See Final Action Letter for Analysis.

The Development Review Committee reviewed the proposal on July 2, 2024 and

does not require Conditions of Approval.²

Department Review

The Planning Department reviewed this report.

Notice

Staff published notice on the City's website and the Utah Public Notice website and posted notice to the property on July 8, 2024. Staff mailed courtesy notice to adjacent property owners on June 8, 2024.³

Public Input

Staff did not receive any public input at the time this report was published.

Alternatives

- The Planning Director may approve the ACUP for retaining walls greater than six feet;
- The Planning Director may deny the ACUP for retaining walls greater than six feet and direct staff to make Findings for the denial; or
- The Planning Director may request additional information and continue the discussion to a date certain.

Exhibits

Exhibit A: Draft Final Action Letter

Exhibit B: Proposed Plans Dated 6/14/2024

² The Development Review Committee meets the first and third Tuesday of each month to review and provide comments on Planning Applications, including review by the Building Department, Engineering Department, Sustainability Department, Transportation Planning Department, Code Enforcement, the City Attorney's Office, Local Utilities including Rocky Mountain Power and Dominion Energy, the Park City Fire District, Public Works, Public Utilities, and the Snyderville Basin Water Reclamation District (SBWRD).

³ LMC [§ 15-1-21](#)



Planning Department

July 25, 2024

Alliance Engineering
Moonshadow Condominiums

CC: Rhett Riding

NOTICE OF PLANNING DIRECTOR ACTION

Description

Address:	8903 – 8945 Marsac Ave Moonshadow Condominiums
Zoning District:	Residential Development
Application:	Administrative Conditional Use Permit
Project Number:	PL-24-06174
Action:	APPROVED WITH CONDITIONS (See Below)
Date of Final Action:	July 25, 2024
Project Summary:	The Applicant Proposes an Administrative Conditional Use Permit for two existing retaining walls in the front setback, ranging from six to seven feet in height from Final Grade, for the Moonshadow Condominiums.

Action Taken

On July 25, 2024, the Planning Director conducted a public hearing and approved two retaining walls in the front setback greater than six feet in height from Final Grade, 70 feet and 257 feet in width, as illustrated on the proposed plans dated 6/14/2024 and attached as Attachment 1 to this Final Action Letter, according to the following findings of fact, conclusions of law, and conditions of approval:

Findings of Fact

1. The Applicant proposes an Administrative Conditional Use Permit (ACUP) for two retaining walls greater than six feet in height from Final Grade in the Front Setback as part of the Moonshadow Condominiums development. The proposed



Planning Department

retaining walls range in height from Final Grade from six feet to seven feet and are located within the front setback of the subject property.

2. The City has not issued a building permit for the proposed work, the existing retaining walls were constructed without an Approved Building Permit.
3. The applicant submitted and the Development Review Committee reviewed the proposed plans, dated 6/14/2024, attached hereto as Attachment 1 ("the Proposal"), which illustrate two retaining walls the Applicant already built without approval and three proposed retaining walls 4 feet in height, to be built. The Applicant requests this ACUP to validate all proposed and already-constructed retaining walls.
4. The Moonshadow Condominiums are part of the Flagstaff Annexation Area, governed by the Flagstaff Development Agreement, the Village at Empire Pass Master Planned Development (VEP MPD), within the Residential Development (RD) and Recreation Open Space (ROS) Zoning Districts.
5. The City Council adopted Ordinance 2018-54 approving the Moonshadow Condominiums on October 25, 2018.
6. On July 1, 2019, the Moonshadow Condominiums Plat was recorded with Summit County, Summit County Recorder Entry No. 111351. The Plat created an eight-unit condominium. As part of the Village at Empire Pass Master Planned Development Approval and the Amended Flagstaff Development Agreement, the Planning Commission approved no more than 31 Unit Equivalents of residential density (62,000 square feet) for the Moonshadow Condominiums.
7. Construction has begun on the access road, Moonshadow Court, and the Condominium Units.
8. According to the Applicant, retaining walls are required to stabilize the slope separating the access road and condominiums from Marsac Avenue.
9. The Applicant proposes the following:
 - a. An ACUP for an existing stacked stone retaining wall that is seven feet in height from Final Grade, and 70 feet in width
 - b. An ACUP for an existing stacked stone retaining wall that is six feet in height from Final Grade and 270 feet in width
10. The Proposal complies with the RD Zoning District requirements found in Land Management Code (LMC) Chapter 15-2.13:
 - a. Front Setback – 20 Feet
 - i. There are two existing retaining walls in the Front Setback: one stacked stone retaining wall that is seven feet in height from Final



Planning Department

Grade, and 70 feet in width and another existing stacked stone retaining wall that is six feet in height from Final Grade and 270 feet in width

- ii. The height of retaining walls in the Front Setback may exceed four feet in height from Final Grade subject to approval of an ACUP (LMC § 15-4-2(A)(1)).
 - b. Side Setback – 12 feet
 - i. The retaining walls are greater than 60 feet from any side property line, as measured on proposed plans
 - c. Rear Setback – 15 feet
 - i. The retaining walls are greater than 120 feet from the rear property line, as measured on proposed plans.
 - d. Vegetation Protection
 - i. No Significant Vegetation is or will be impacted by the already built and proposed retaining walls. The Significant Vegetation prior to development on the site has been disturbed with construction of the Moonshadow Condominiums. The Proposal includes planting new trees and shrubs to screen the condominiums from Marsac Avenue.
11. The Proposal complies with LMC § 15-4-2 *Fences and Retaining Walls*.
- a. The height of retaining walls in the Front Setback may exceed four feet in height from Final Grade subject to approval of an ACUP (LMC § 15-4-2(A)(1)).
 - b. The existing retaining walls range in height from six feet to a maximum height of seven and a half feet from Final Grade within the Front Setback. The Applicant proposes to install an additional retaining wall four feet in height along the front property line.
12. The Proposal complies with the Conditional Use Permit criteria outlined in LMC § 15-1-10(E)
- a. Size and Location of the Site
 - i. According to the Applicant, the size and location of the site warrant retaining walls to stabilize the hillside separating Moonshadow Court and the Condominiums uphill from Marsac Avenue.
 - b. Traffic
 - i. Not Applicable.
 - c. Utility Capacity



Planning Department

- i. The Development Review Committee reviewed the proposal on July 2, 2024, and confirmed the proposal conforms with their requirements.
- d. Emergency Vehicle Access
 - i. The Development Review Committee reviewed the proposal on July 2, 2024, and confirmed the proposal conforms with their requirements.
- e. Parking
 - i. No mitigation required.
- f. Internal Vehicular and Pedestrian Circulation System
 - i. No mitigation required.
- g. Fencing, Screening, and Landscaping
 - i. LMC Section 15-5-5(N) requires at least fifty percent (50%) of the Landscaped Area shall be Water Wise Landscaping containing approved non-invasive drought tolerant plants, and/or minimal irrigation. The proposed landscape plan contains plants and trees that are found on the Park City Waterwise Landscaping Plant List and is approximately 70 percent of the landscaped area.
- h. Building Mass, Bulk, and Orientation
 - i. The existing stacked stone retaining wall is seven feet in height from Final Grade, and 70 feet in width
 - ii. The other existing stacked stone retaining wall that is six feet in height from Final Grade and 270 feet in width
- i. Useable Open Space
 - i. Not applicable
- j. Signs and Lighting
 - i. No signs or lighting are proposed or approved with this ACUP.
- k. Physical Design and Compatibility with Surrounding Structures
 - i. The proposed retaining walls are designed with natural stacked stone and will be built into the hillside, blending with the natural slope. The proposed landscape plan contains plants and trees that are found on the Park City Waterwise Landscaping Plant List and is approximately 70 percent of the landscaped area.
- l. Noise, Vibration, Odors, Steam, or Other Mechanical Factors
 - i. Not Applicable



Planning Department

- m. Control of Delivery and Service Vehicles, Loading and Unloading Zones, and Screening of Trash and Recycling Pickup Areas
 - i. Not Applicable.
- n. Expected Ownership and Management
 - i. The Empire Pass Master Owner's Association currently owns the common area where the retaining walls are located/proposed, and on July 10, 2024, approved the proposed plans for the retaining walls. The Moonshadow Homeowners Association will provide ongoing maintenance of the retaining walls and landscaping.
- o. Environmentally Sensitive Lands, Physical Mine hazards, Mine Waste, Soils Ordinance, Steep Slopes and Appropriateness of the Proposed Structure to the Existing Topography of the Site
 - i. As conditioned, the proposed retaining walls over 4' shall be permitted through engineering review and an approved building permit to ensure appropriateness of the structure to the existing topography of the site.
- p. General Plan
 - i. Section 9.5 of the General Plan mentions retaining walls as a design characteristic of the Upper Deer Valley Neighborhood: "Grand entry ways, exposed post and beam construction, large retaining walls, and taller than normal buildings are repeated design characteristics throughout the neighborhood."

Conclusions of Law

1. The proposal complies with the LMC requirements outlined in Chapter 15-2.13 *Residential Development Zoning District*, Section 15-4-2 *Fences and Retaining Walls*, and Section 15-1-10 *Conditional Use Permit Criteria*.
2. The Use will be compatible with surrounding Structures in use, scale, mass, and circulation.
3. The effects of any difference in use or scale have been mitigated through careful planning.

Conditions of Approval

1. A building permit and engineering review for retaining walls over 4' shall be obtained prior to construction.



Planning Department

2. Any changes, modifications, or deviations from the approved Proposal that have not been approved in advance by the Planning Department may result in a stop work order.
3. The Applicant is responsible for notifying the Planning Department prior to making any changes to the approved retaining walls.
4. Any changes, modifications, or deviations from the approved scope of work shall be submitted in writing for review and approval/denial in accordance with the applicable standards by the Planning Director or designee prior to construction.

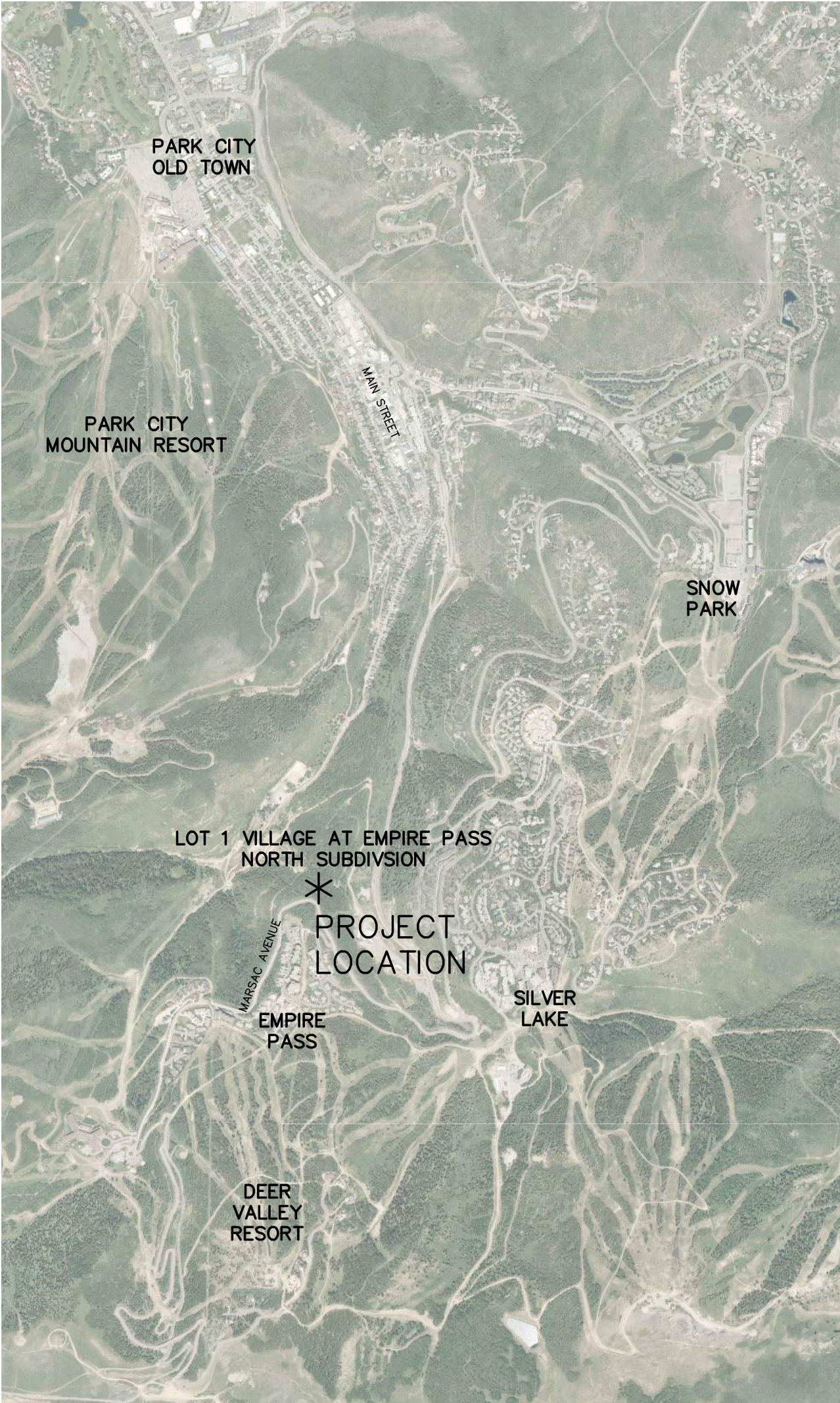
If you have questions or concerns regarding this Final Action Letter, please call 385-481-2036 or email virgil.lund@parkcity.org

Sincerely,

Rebecca Ward
Planning Director

CC: Virgil Lund

VICINITY MAP



GENERAL NOTES

- G-1
- ALL WORK PERFORMED SHALL BE DONE IN ACCORDANCE WITH THE FOLLOWING PLANS & SPECIFICATIONS:
- A.

All water construction to be in accordance with Park City Design Standards, Construction Specifications, and Standard Drawings, Latest Edition.
- B.

Manual of Uniform Traffic Control Devices 2009 Edition with 2012 revisions.
- C.

UDOT Standard Specifications for Road and Bridge Construction, latest edition. (for improvements in the UDOT right of way)
- D.

Special conditions of approval and/or permits as required and/or issued by regulatory bodies.
- E.

Approved construction plans and details.
- F.

Approved Traffic Control Plan.
- G.

Storm Water Pollution Prevention Plan. (SWPPP)
- G-2
- Contractor/Bidder shall obtain a copy of the specifications, at his cost. Copies of the specifications shall be kept at the job site by the contractor and be available for the contractor, subcontractor, owner or his agent, design engineer, city engineer, P.C.M.C. engineer, and their designated representatives and inspectors.
- G-3
- The Contractor shall be responsible for ground and surface water control during construction. This requirement shall include, but not be limited to the installation of utilities, manholes, vaults, catch basins, earthwork operations, and road construction.
- G-4
- The contractor shall maintain accurate records of "As Built" conditions of all underground work. The "As Builts" shall be tied to easily defined monuments and/or surface improvements or as required by accuracy for the as-built conditions. The as-built information shall be given to the owner and be incorporated in the final "As Built" drawings. Special as-built requirements for HDPE sewer mains are required per as outlined on the drawings.
- G-5
- Prior to any excavation work, the contractor shall contact Blue Stakes for location of existing utilities. The contractor shall be responsible for determining the location of utilities, whether shown on the plans or not, and protecting the utilities during construction. If existing utility lines conflict in location with new construction, the contractor shall notify the engineer in order to resolve the conflict.
- G-6
- The contractor shall have a qualified representative to handle grade determination, drainage flow, and connections to existing features using proper grade setting techniques such as, but not limited to, string line, rod and level, GPS, or Surveying.
- G-7
- All work performed shall be guaranteed by the contractor and/or his surety against all defects in materials and workmanship of whatever nature for a period of one (1) year from the date of final acceptance of the work by the project owner.
- G-8
- The contractor shall be responsible for the installation and maintenance of adequate signs, traffic devices, and warning devices to inform and protect the public during all phases of construction. The contractor shall submit to the Owner and Design Engineer for approval.
- G-9
- Compaction testing shall be an integral part of the project. Compaction testing shall include, but shall not be limited to earthwork, trench back-fill, base course, and asphalt pavement. Compaction testing shall be performed by a qualified, independent testing company retained by the contractor.

MOONSHADOW CONDOMINIUMS
LANDSCAPING AND RETAINING WALL
PERMIT SET

06/14/2024

SHEET INDEX

- LANDSCAPE PACKAGE
- L101.

SITE PLAN
- L102.

FIRE PROTECTION PLAN
- L103.

LANDSCAPE PLAN
- L104.

LANDSCAPE PLAN DETAILS
- L105.

AS-BUILT WATERLINE EXHIBIT
- L106.

LANDSCAPE ROCKWALL PLAN
- ROCK WALL PACKAGE
1.

COVER SHEET
2.

PLAN VIEW
3.

TYPICAL SECTION VIEW - ROCKERIES 1 & 2
4.

TYPICAL SECTION VIEW - ROCKERY 3
5.

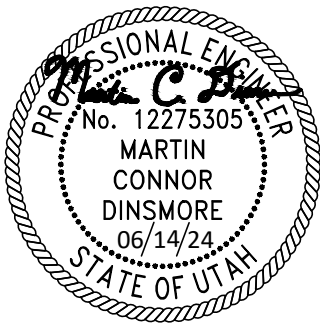
CONSTRUCTION SPECIFICATIONS & NOTES
6.

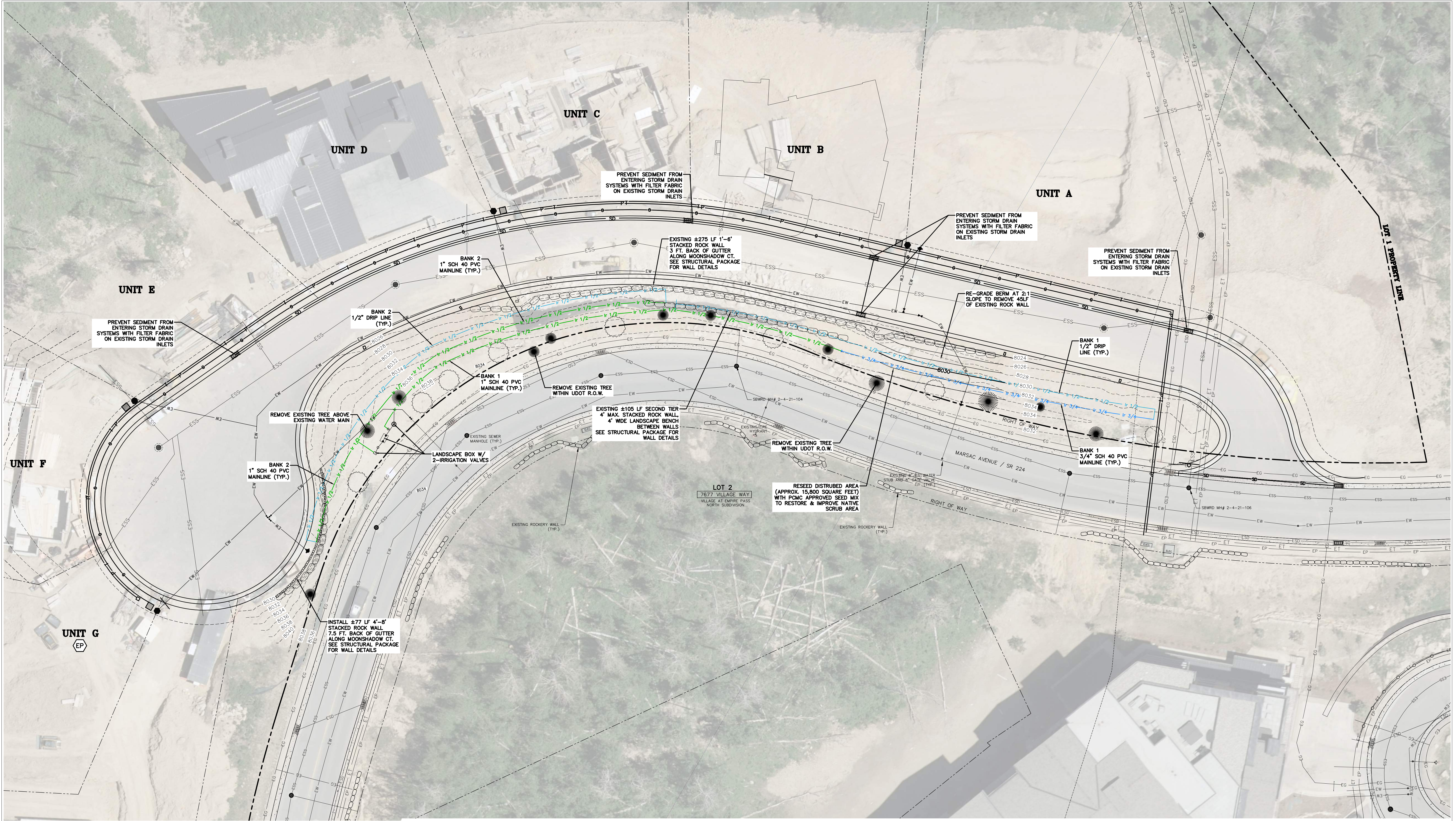
DESIGN CRITERIA
7.

SITE PHOTOS
- SECTION 2 - ASD ROCK WALL DESIGN & CALCULATIONS
- SECTION 3 - GLOBAL STABILITY ANALYSIS

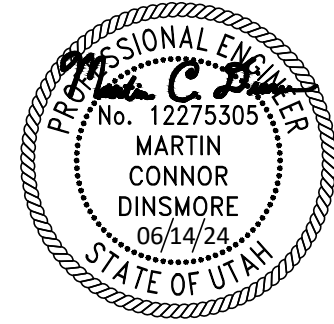
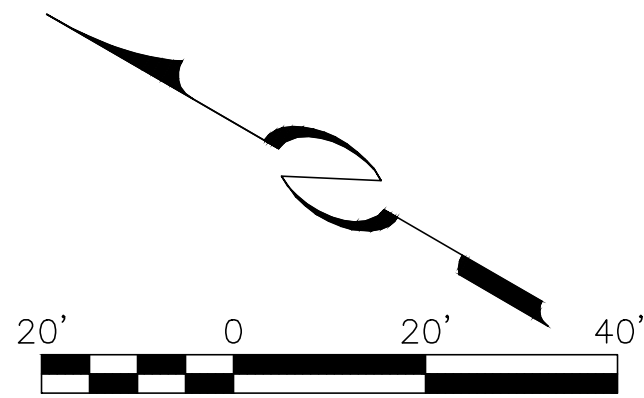
PREPARED FOR
STORIED DEER VALLEY, LLC.
9785 N TUHAYE PARK DR.
KAMAS, UT 84036

CIVIL ENGINEER





LEGEND			
	1/2" IRRIGATION DRILINE		EXISTING SEWER
	3/4" SCH 40 PVC MAIN IRR. LINE		EXISTING WATER
	1" SCH 40 PVC MAIN IRR. LINE		EXISTING STORM DRAIN
	PICEA PUNGENS/COLORADO SPRUCE		EXTG OVERHEAD POWER
	ABIES LASIOCARPA/ALPINE FIR		EXISTING GAS
	CORNUS SERICEA "ISANTI"/ISANTI		EXISTING TELECOMM
	REDOISE DOGWOOD		EXISTING POWER
	AMELANCHIER ALNIFOLIA/SERVICEBERRY		EXISTING SANITARY SEWER MANHOLE
			EXISTING STORM DRAIN GRATES
			EXISTING ELECTRICAL BOXES
			EXISTING FIRE HYDRANT
			EXISTING WATER VALVE
			SITE BENCHMARK



2700 W HOMESTEAD RD
STE 50 & 60
PARK CITY, UT 84098
435.256.6634

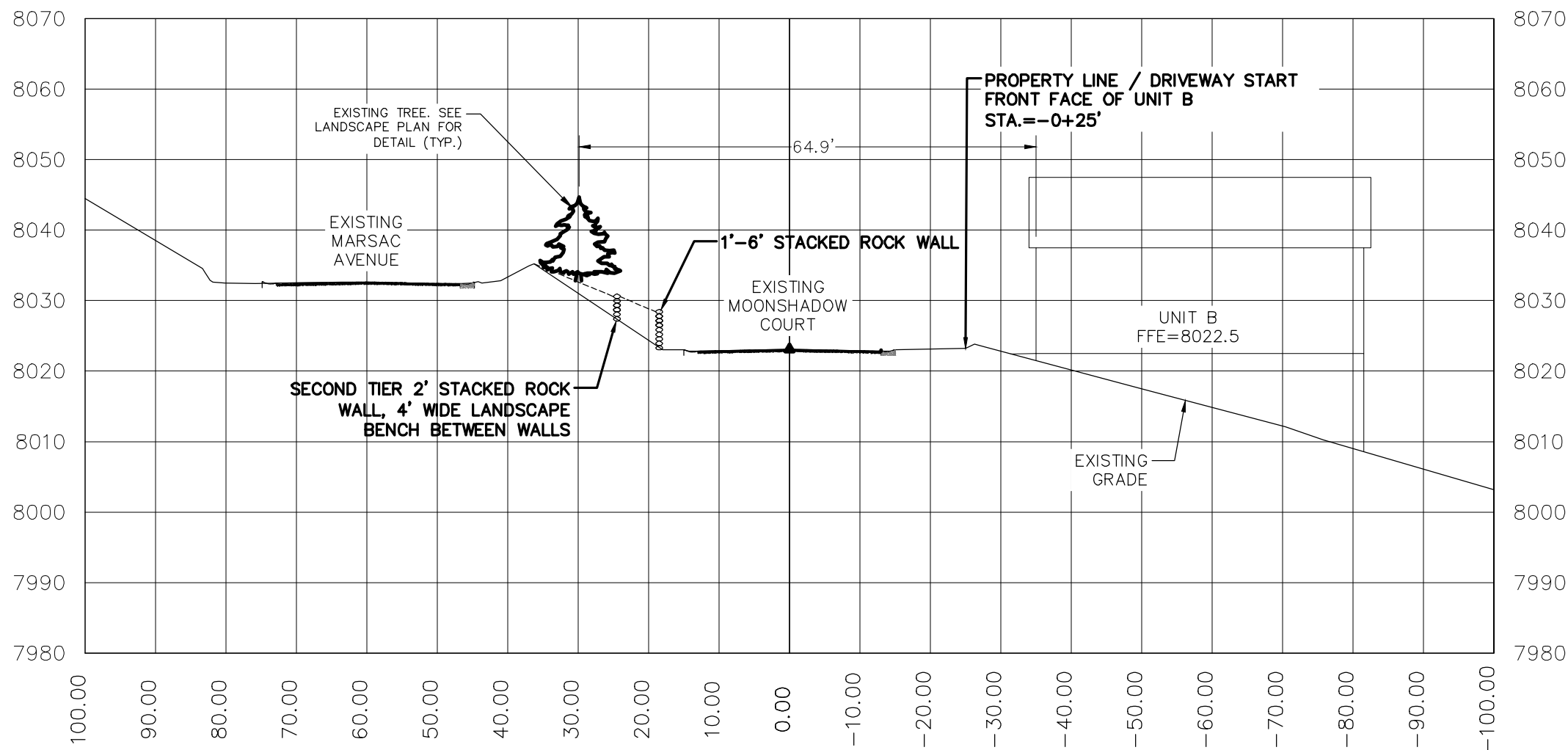
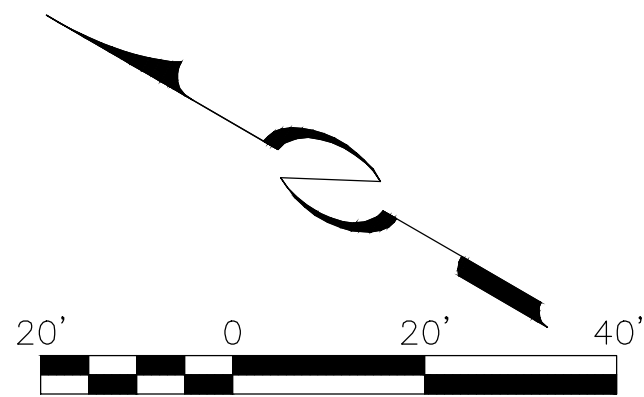
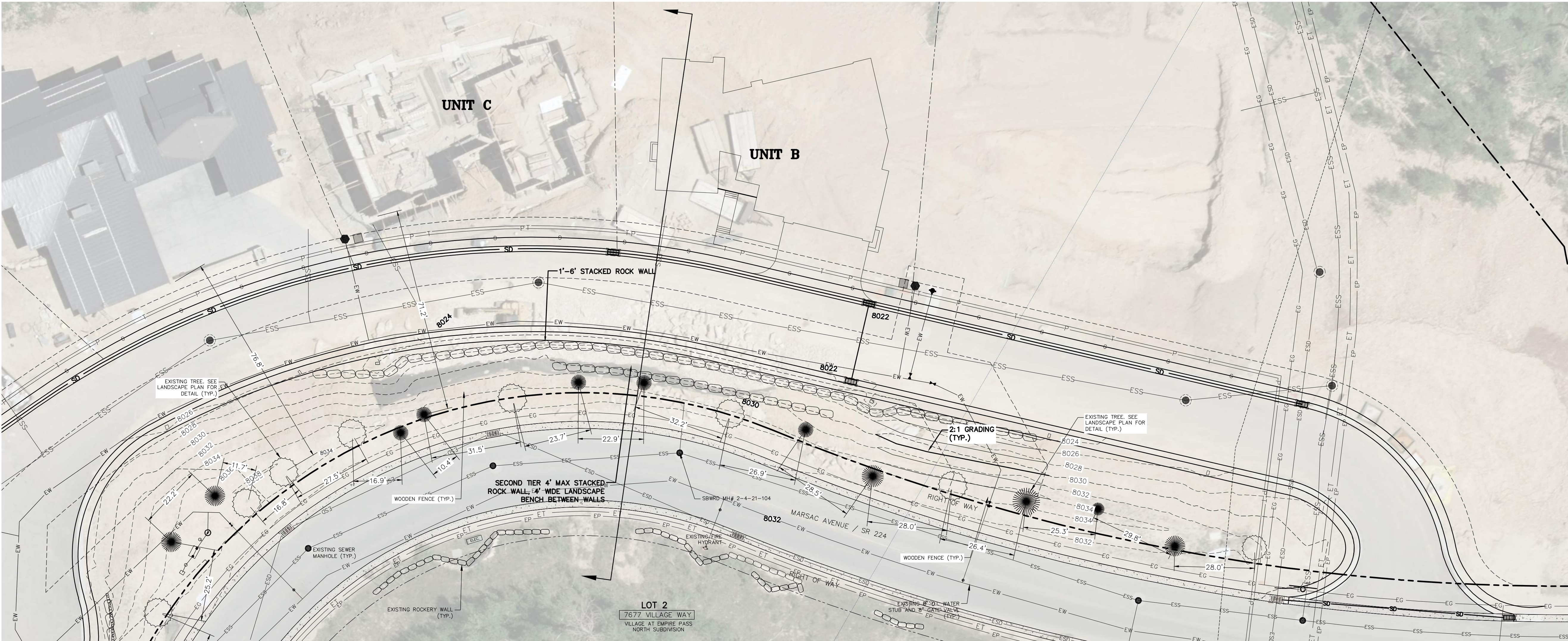
STAFF:
MICHAEL DEMKOWICZ
CONNOR DINSMORE
GREG WILLIAMS

DATE: 06/14/24

SITE PLAN
MOONSHADOW CONDOMINIUMS
LANDSCAPE/ROCKWALL PERMIT SET

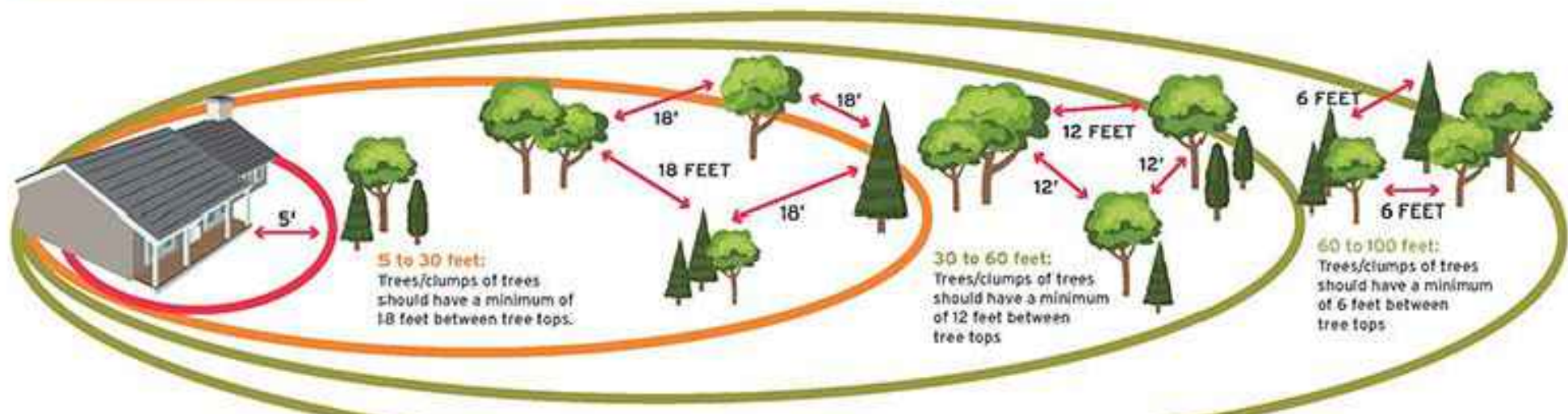
FOR: STORIED DEER VALLEY
JOB NO.: 15-2-18
FILE: X:\Empire\dwg\Storied Development\Lot 1 VE\NS\Civil\Landscape Permit\Moonshadow Landscape and Rock wall Plan.dwg

SHEET
L101
OF



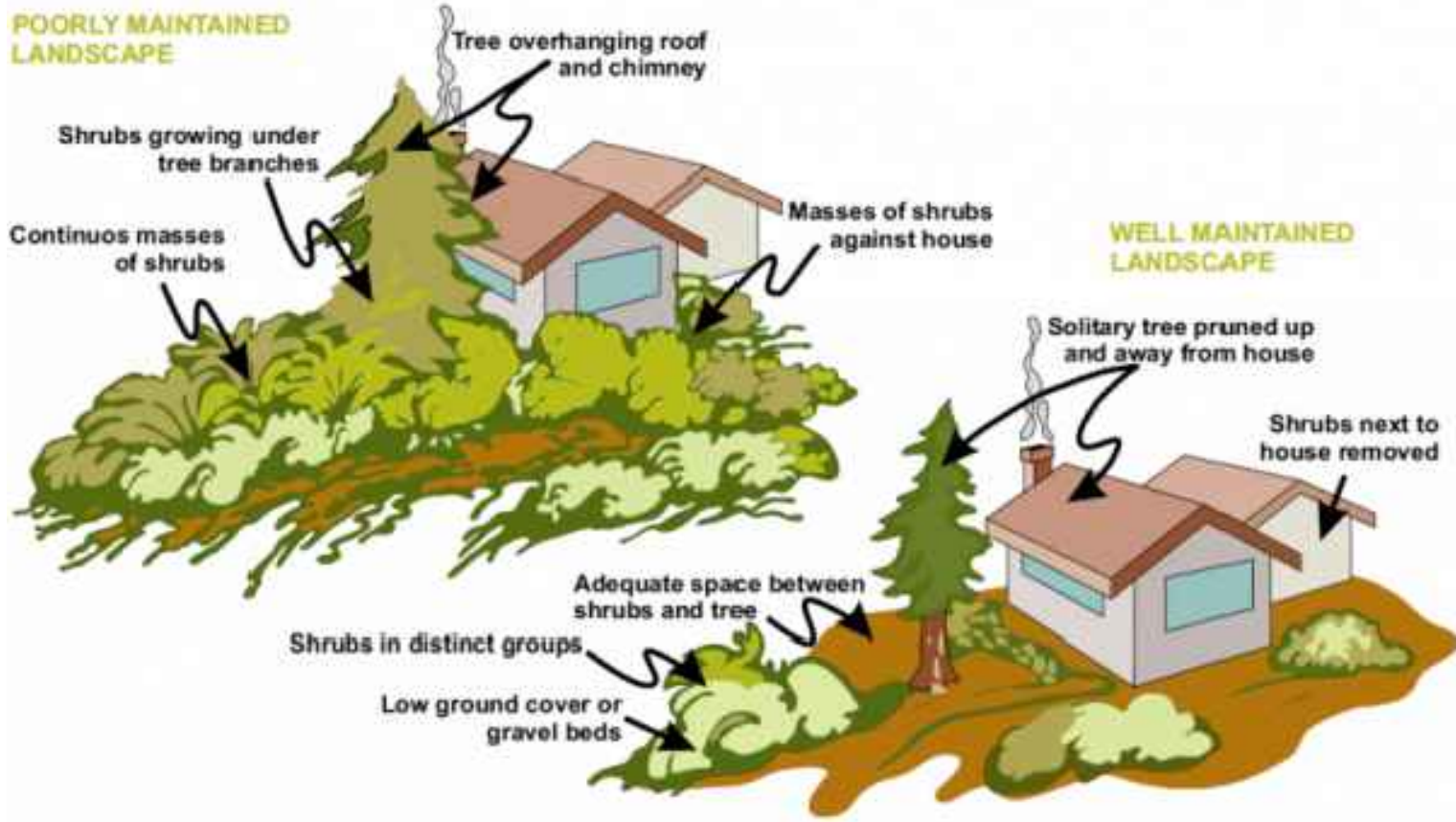
CROSS SECTION AT EXISTING MOONSHADOW COURT @ STA.3+50

TREE SPACING

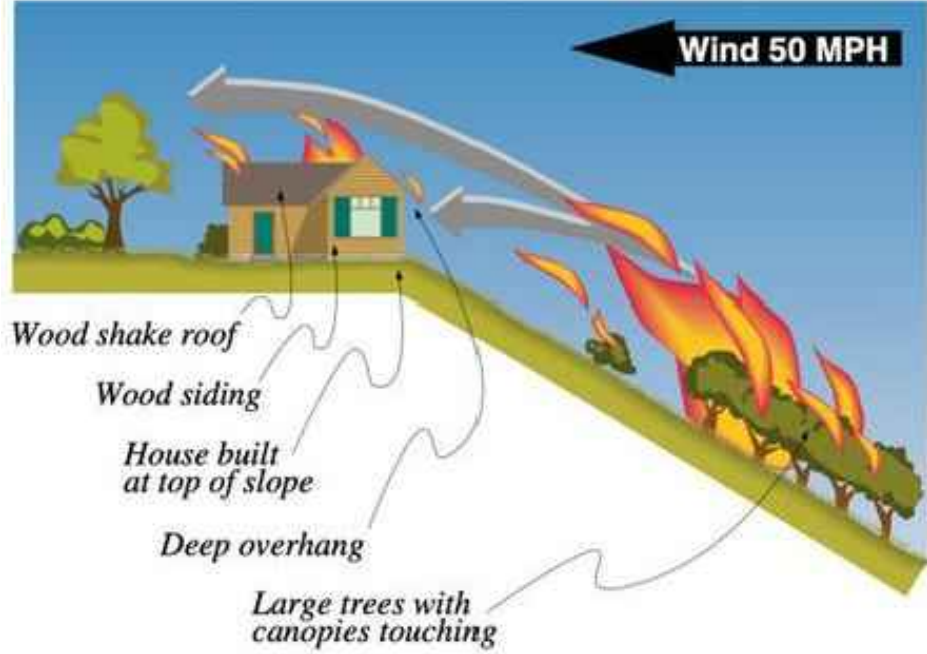


NOTES:

1. LANDSCAPE DESIGN BY OTHERS. SEE PLANS FOR MORE DETAILS.



Dangerous materials and conditions for sloped sites



FIRE-RESISTANT LANDSCAPE REQUIREMENTS:

1. CREATE FIREBREAKS SURROUNDING THE PROPOSED BUILDING.
2. NEW TREES WILL REMAIN A MINIMUM OF 5 FEET AWAY FROM BUILDING & 5 TO 30 FT TREE-TOP SEPARATION, AT TIME OF TREE MATURITY, WITHIN A 30 FT RADIUS OF PROPOSED BUILDING (ZONE 1).
3. AT <20% SLOPE: SPACE SHRUBS 2X THE HEIGHT, 20-40% SLOPE: SPACE SHRUBS 4X THE HEIGHT.
4. EMPLOY SMART IRRIGATION TECHNOLOGY WITHIN THE 20 FT CLEARANCE GIVEN WITH THE LIMITS OF DISTURBANCE, IN THE EVENT OF WILDFIRE.
5. 20 FT CONSTRUCTION ACCESS IS GIVEN BEHIND PROPOSED BUILDING. AREA MUST BE RESTORED TO NATURAL CONDITIONS WITH SOD AND NATIVE SEED TO ELIMINATE ALL EVIDENCE OF DISTURBANCE AND SERVE AS AN ADDITIONAL FIREBREAK.

2700 W HOMESTEAD RD
STE 50 & 60
PARK CITY, UT 84098
435.256.6634

STAFF:
MICHAEL DEMKOWICZ
CONNOR DINSMORE
GREG WILLIAMS

DATE: 6/14/24

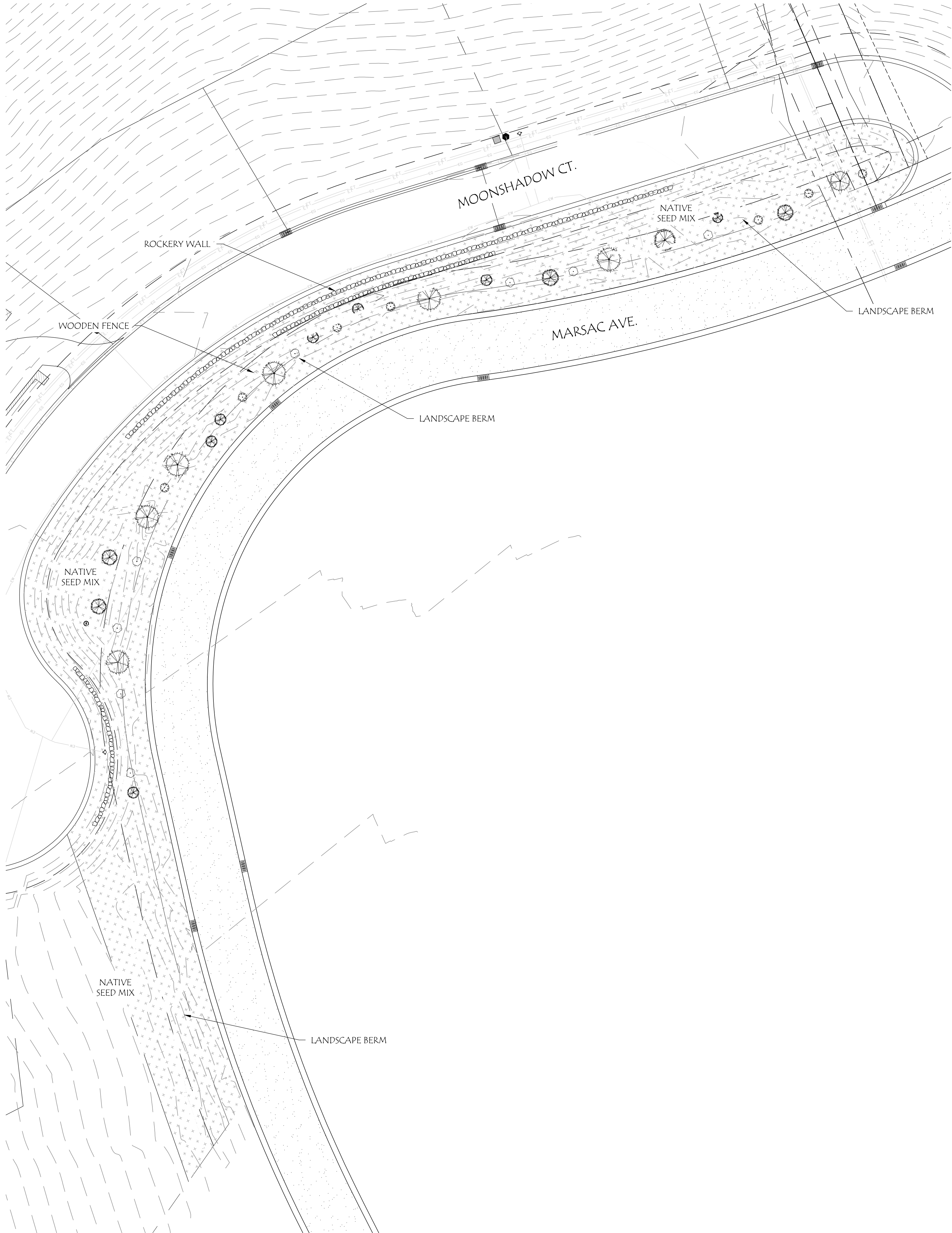
FIRE PROTECTION PLAN
MOONSHADOW CONDOMINIUMS
LANDSCAPE/ROCKWALL PERMIT SET

FOR: STORIED DEER VALLEY

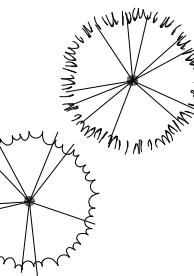
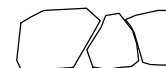
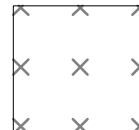
JOB NO.: 15-2-18

FILE: X:\Empire\dwg\Storied Development\Lot 1 VEPNS\Civil\Landscape Permit\Moonshadow Landscape and Rock wall Plan.dwg

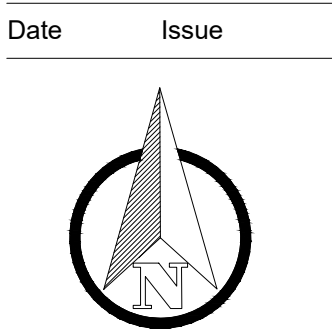
SHEET
L102
OF



PLANT SCHEDULE

CONIFERS	QTY	BOTANICAL NAME / COMMON NAME	CONT	CAL	SIZE	MATURE SIZE	DROUGHT TOLERANT
	12	Abies lasiocarpa / Alpine Fir	B & B		8'-14'	40'-50'	Yes
	7	Picea pungens / Colorado Spruce	B & B		8'-10'	50'-60'	Yes
SHRUBS	QTY	BOTANICAL NAME / COMMON NAME	SIZE	MATURE SIZE	DROUGHT TOLERANT		
	4	Amelanchier alnifolia / Serviceberry	5 gal	10'-15'	No		
	18	Cornus sericea `Isanti` / Isanti Redosier Dogwood	5 gal	5'-6'	No		
OTHER							
		Rockery Retaining Wall (see Rockery Wall Package, IGES)					
		Wooden Fence (see Fence Site Plan, LandSOLUTIONS)					
		Native Grass Seed Mix					
		Quickguard sterile triticale	3.2 Lbs/Acre				
		Western Wheatgrass	6.4 Lbs/Acre				
		Bluebunch Wheatgrass	1.6 Lbs/Acre				
		Thickspike Wheatgrass	4.8 Lbs/Acre				
		Sheep Fescue	1.6 Lbs/Acre				
		Sandberg Bluegrass	1.6 Lbs/Acre				
		Purple Coneflower	1.6 Lbs/Acre				
		Rocky Mountain penstemon	1.6 Lbs/Acre				
		Cornflower	1.6 Lbs/Acre				
		Blanket Flower	1.6 Lbs/Acre				
		Total:	25.6 Lbs				

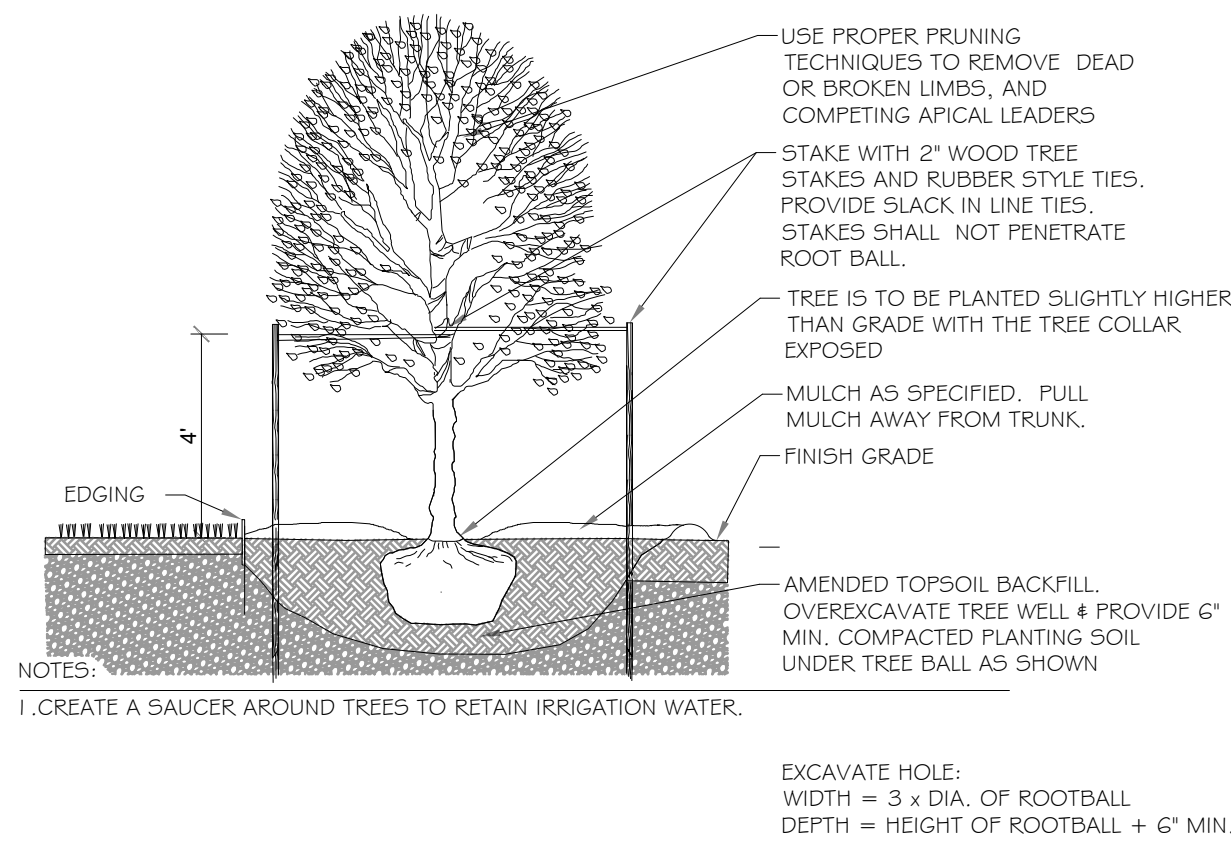
Project For:
MOONSHADOW COURT – LANDSCAPING PLAN
TUHAYE, UTAH



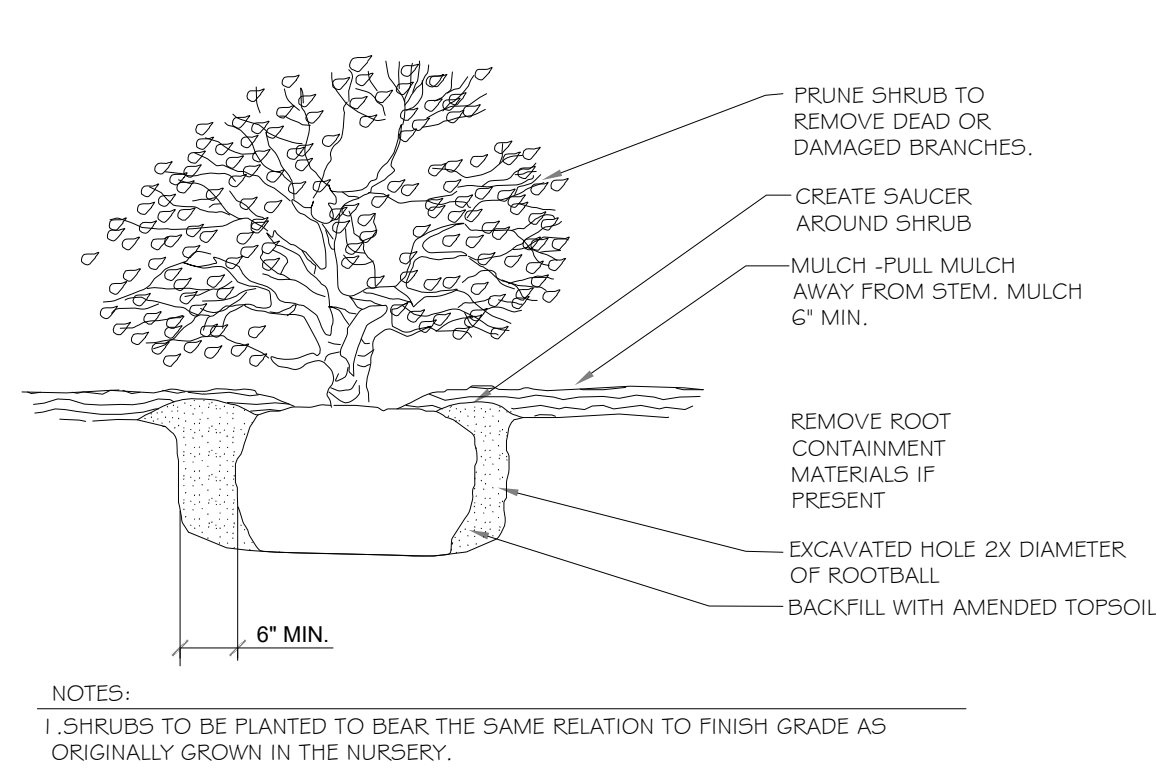
SCALE: 1" = 70'-0"

Landscape
Plan

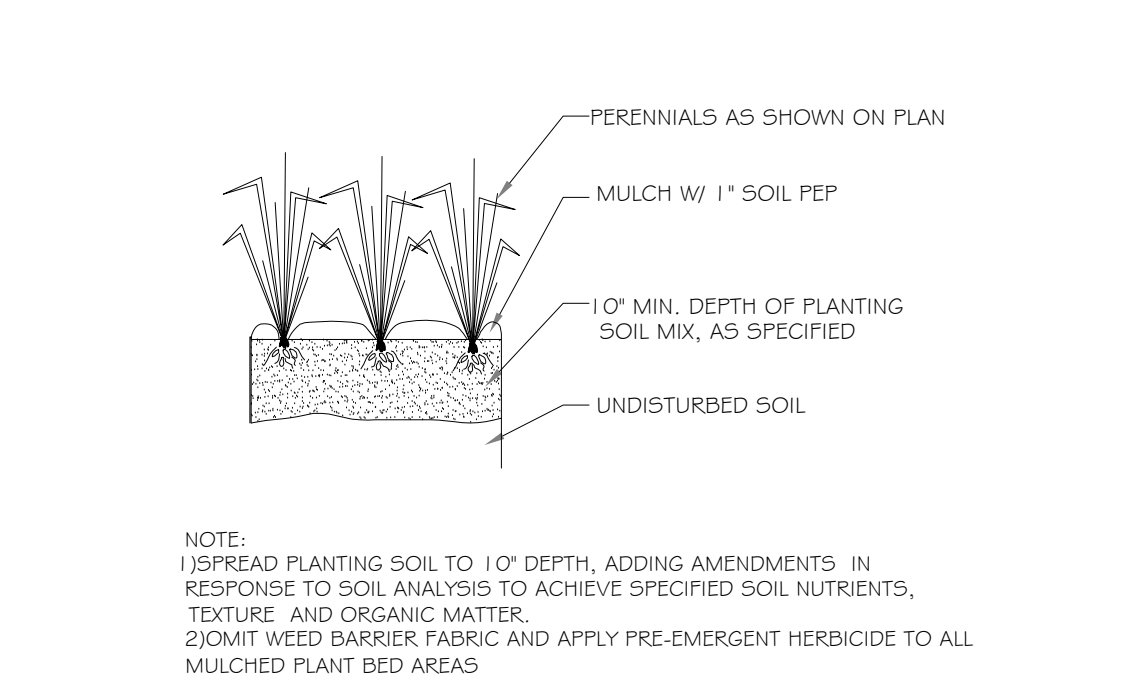
L103



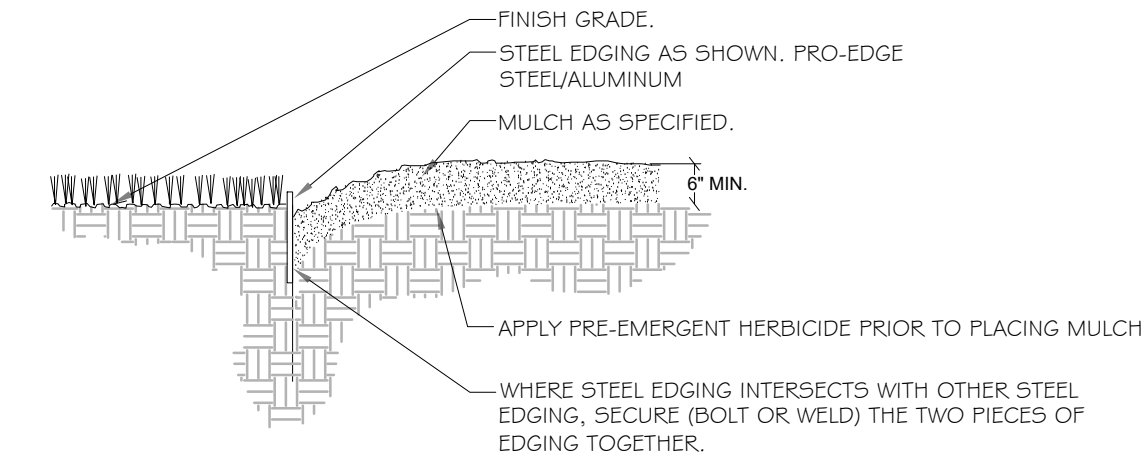
1 TREE PLANTING DETAIL NTS



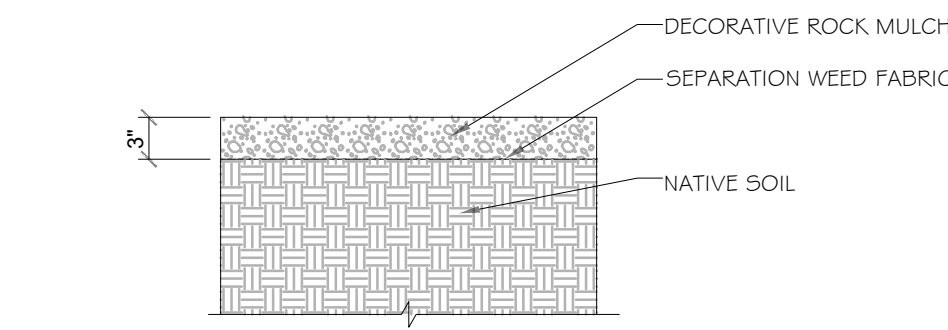
2 SHRUB PLANTING DETAIL NTS



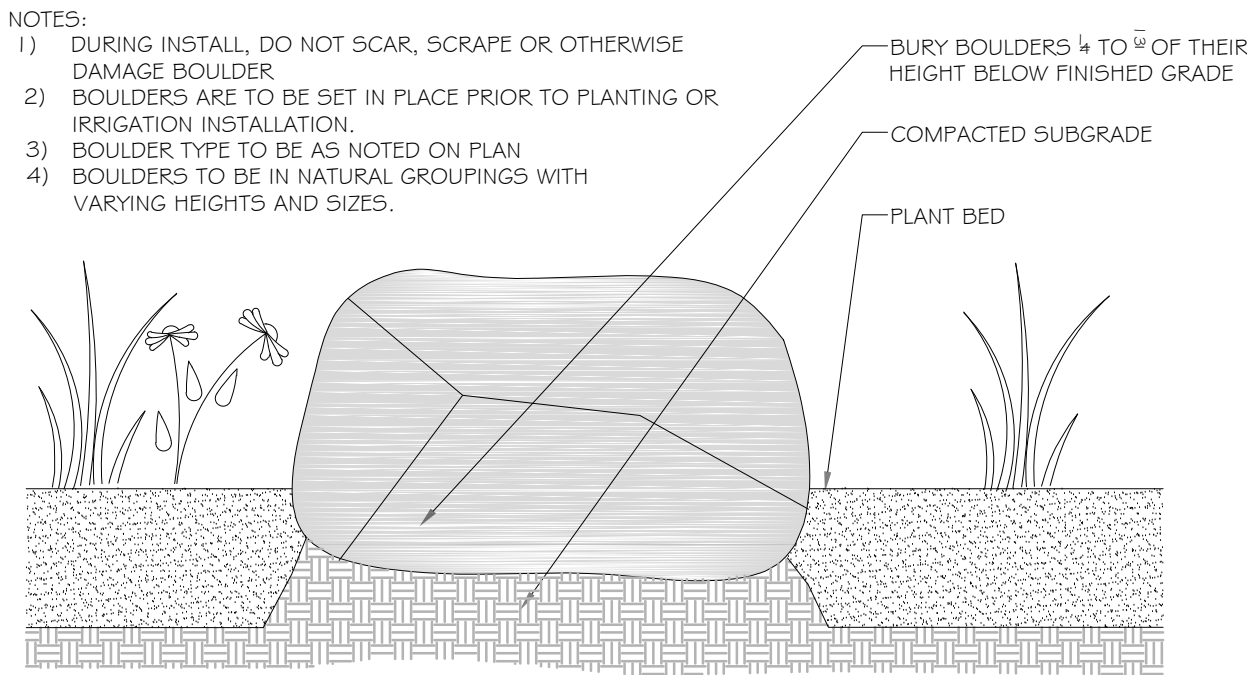
3 PERENNIAL / ORNAMENTAL GRASS PLANTING NTS



4 LANDSCAPE EDGING NTS



5 DECORATIVE ROCK MULCH 1\"=1'-0\" NTS



6 BOULDER PLACEMENT NTS

GENERAL NOTES

- ALL LAWN AND PLANT BED AREAS SHALL HAVE PERMANENT UNDERGROUND IRRIGATION INSTALLED TO ENSURE A HEALTHY LANDSCAPE.
- ALL TREES SHALL BE STAKED WITH WOOD STAKES (MIN OF 2 PER TREE). ANY TREE OR SHRUB PLANTED THAT IS NOT IN A LANDSCAPE BED SHALL HAVE A 3\" DIA. 4\" DEPTH ORGANIC MULCH RING AT THE BASE.
- CONTRACTOR TO VERIFY LOCATION OF ALL UTILITIES PRIOR TO INSTALLATION, EXCAVATION, OR PLANTING OPERATIONS. ANY DAMAGE TO EXISTING UTILITIES ON SITE OR ADJACENT TO PROPERTY SHALL BE CONTRACTOR'S RESPONSIBILITY TO REMEDY.
- TREES TO BE PLANTED SLIGHTLY HIGHER THAN GRADE AND WITH THE TREE COLLAR EXPOSED.THE HOLE EXCAVATED SHALL BE TWICE THE SIZE OF THE POT OR ROOT BALL OF THE TREE.
- ALL PLANT MATERIAL IS TO BE HEALTHY SPECIMENS FREE FROM DISEASE OR DAMAGE.
- ALL PLANTS SHALL BE GUARANTEED FOR ONE YEAR AFTER PROJECT COMPLETION.
- ALL AREAS DISTURBED BY CONSTRUCTION ON SITE SHALL BE RE-GRADED, ROCK HOUNDED AND SEEDED AND/OR PLANTED AND MAINTAINED TO PREVENT WEED GROWTH. CARE SHALL BE TAKING TO MINIMALLY DISTURB EXISTING VEGETATION.
- NO PLANT SUBSTITUTIONS WITHOUT WRITTEN APPROVAL FROM THE OWNER AND LANDSCAPE ARCHITECT.
- CONTRACTOR TO VERIFY PLANT QUANTITIES. IF THERE IS A DISCREPANCY BETWEEN THE PLAN AND TABLE, THE PLAN SHALL DICTATE COUNT.
- ALL LANDSCAPE BEDS SHALL BE MULCHED WITH 5-6\" DEPTH OF SHREDDED NATURAL WOOD MULCH.
- DECORATIVE ROCK MULCH TO BE A DEPTH OF 3\" MIN.
- ALL EDGING TO BE METAL (PRO-EDGE STEEL/ALUMINUM)
- BOULDERS ARE TO HAVE 1/4 OF THEIR HEIGHT BURIED BELOW FINISHED GRADE FOR A NATURAL LOOK.
- TREES ARE TO BE VARIED HEIGHTS AND SIZES FOR A NATURAL LOOK.
- SEE CIVIL FOR GRADING AND UTILITY PLANS.
- DRYSTACK RETAINING WALL BOULDERS TO BE LOCALLY QUARRIED BROWNS CANYON BOULDERS TO MATCH LANDSCAPE BOULDERS.

IRRIGATION NOTES

- ALL MULCHED PLANT BEDS ARE TO BE DRIP IRRIGATED. HIGH EFFICIENCY DRIP IRRIGATION ZONES SHALL HAVE 5 GALLON EMITTERS TO TREES, 2 GALLON EMITTERS TO ALL SHRUBS AND 1 GALLON EMITTERS TO ALL PERENNIALS AND ORNAMENTAL GRASSES.
- ON NORTH SIDES OF BUILDINGS OR IN HEAVY CLAY SOILS THE SIZE OF DRIP EMITTER MAY BE REDUCED TO MINIMIZE OVERWATERING DEPENDING ON SOIL CONDITIONS.
- IRRIGATION CONTRACTOR SHALL INSTALL A RAINBIRD (OR SIMILAR) RAIN SENSOR THAT WILL AUTOMATICALLY TURN OFF THE SYSTEM DURING RAIN EVENTS.
- LAWN AREAS TO BE SPRAY IRRIGATED. MPR NOZZLES OR SIMILAR SHALL BE INSTALLED TO MAXIMIZE EFFICIENCY.
- ALL TREES AND SHRUBS OUTSIDE OF MULCHED PLANT BEDS ARE TO BE DRIP IRRIGATED.
- NATIVE SEEDED AREAS ARE TO BE TEMPORARILY IRRIGATED 1-2 YEARS FOR ESTABLISHMENT.
- CARE SHALL BE TAKEN TO ENSURE IRRIGATION SYSTEM IS INSTALLED PROPERLY TO MINIMIZE/ELIMINATE WATER WASTE DUE TO OVERSPRAY ONTO PATIOS, WALKWAYS AND DRIVEWAYS.
- IRRIGATION SYSTEM SHALL BE DESIGNED AND INSTALLED BY A PROFESSIONAL IRRIGATION CONTRACTOR.

WILDFIRE DEFENSE

- ALL AREAS WITHIN THE 30' DEFENSIBLE SPACE ARE TO BE IRRIGATED.
- 30' DEFENSIBLE SPACE AROUND THE BUILDING IS TO BE REGULARLY MAINTAINED BY LIMBING TREES, REMOVING DEBRIS, AND PERIODICALLY MOWING DRY GRASSES AND VEGETATION.
- POTENTIAL FIRE FUEL IS TO BE REMOVED FROM AREAS IMMEDIATELY SURROUNDING THE HOME.
- ALL TREES TO BE KEPT A MINIMUM OF 10' FROM ANY STRUCTURE. TREES SHALL BE PRUNED TO MAINTAIN A MINIMUM HORIZONTAL CLEARANCE OF 10' FROM STRUCTURES.
- TREES WITHIN THE DEFENSIBLE SPACE SHALL BE PRUNED TO REMOVE LIMBS AND FUEL LADDERS TO A HEIGHT OF 6 FT ABOVE THE GROUND SURFACE ADJACENT TO THE TREES.

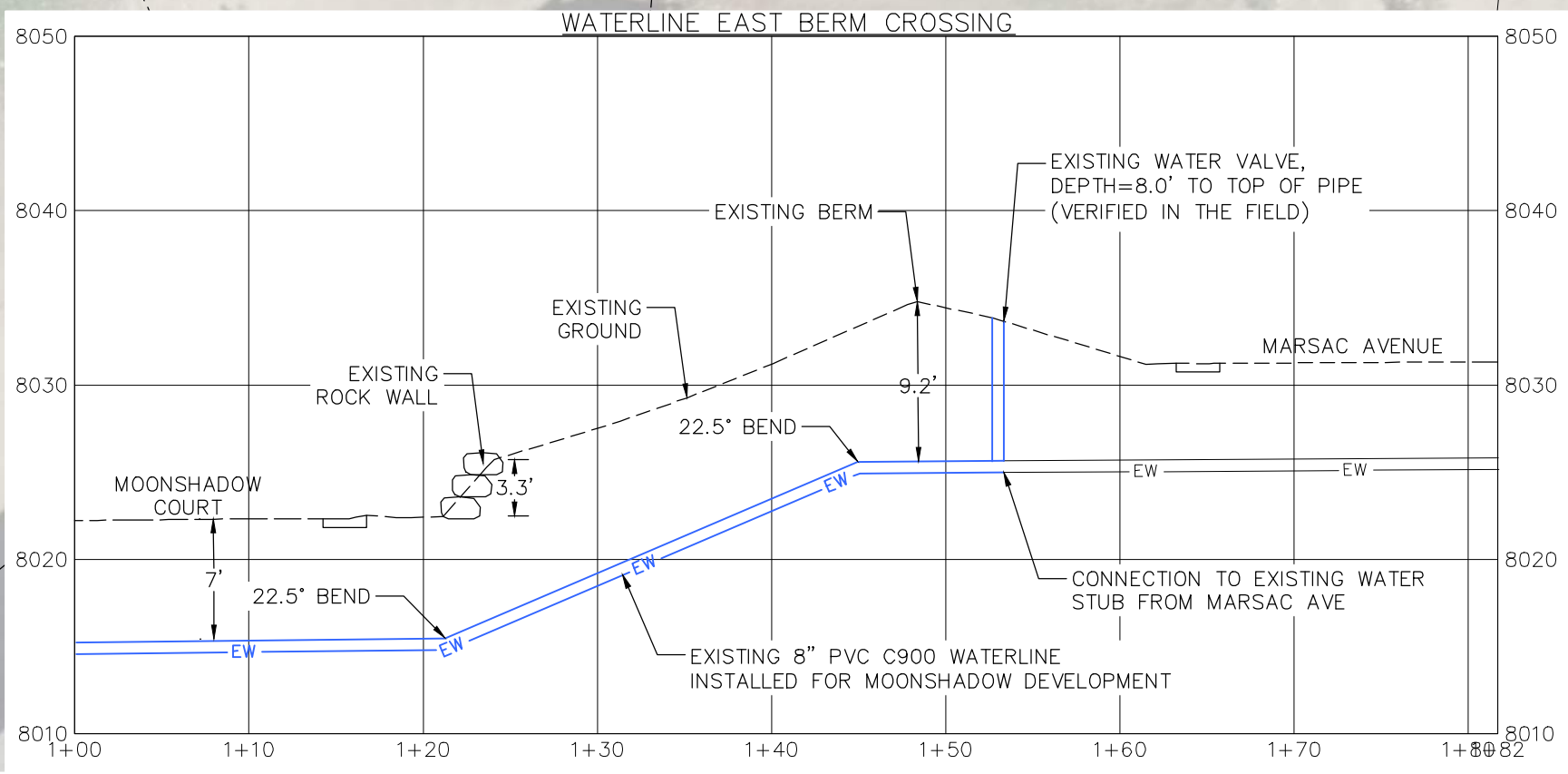
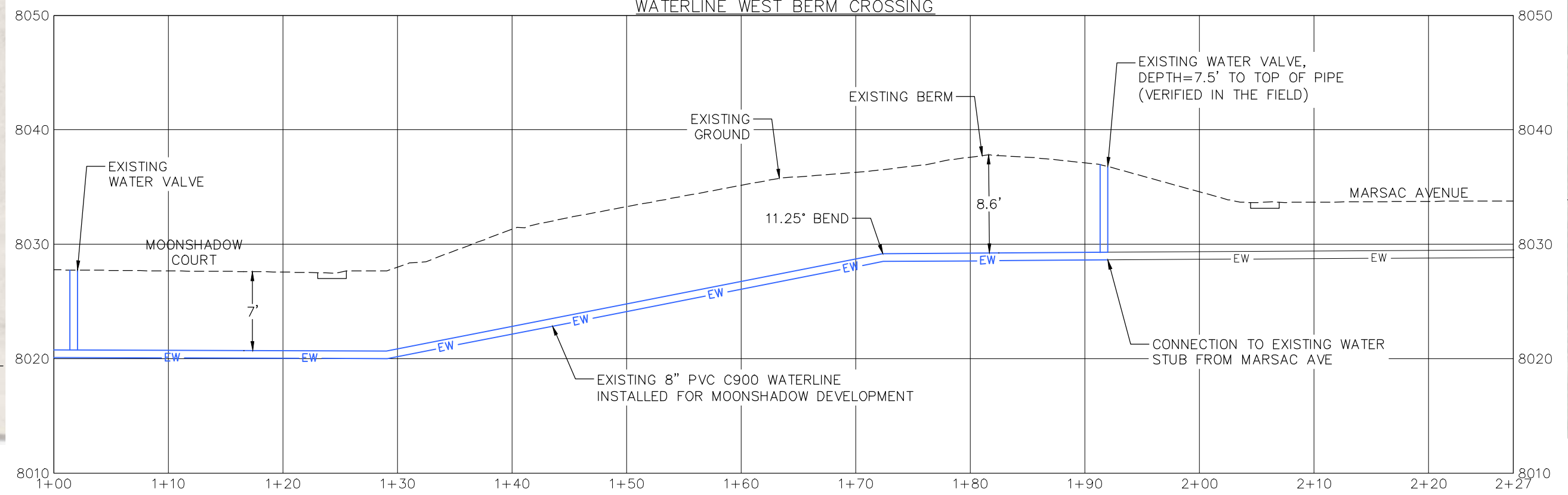
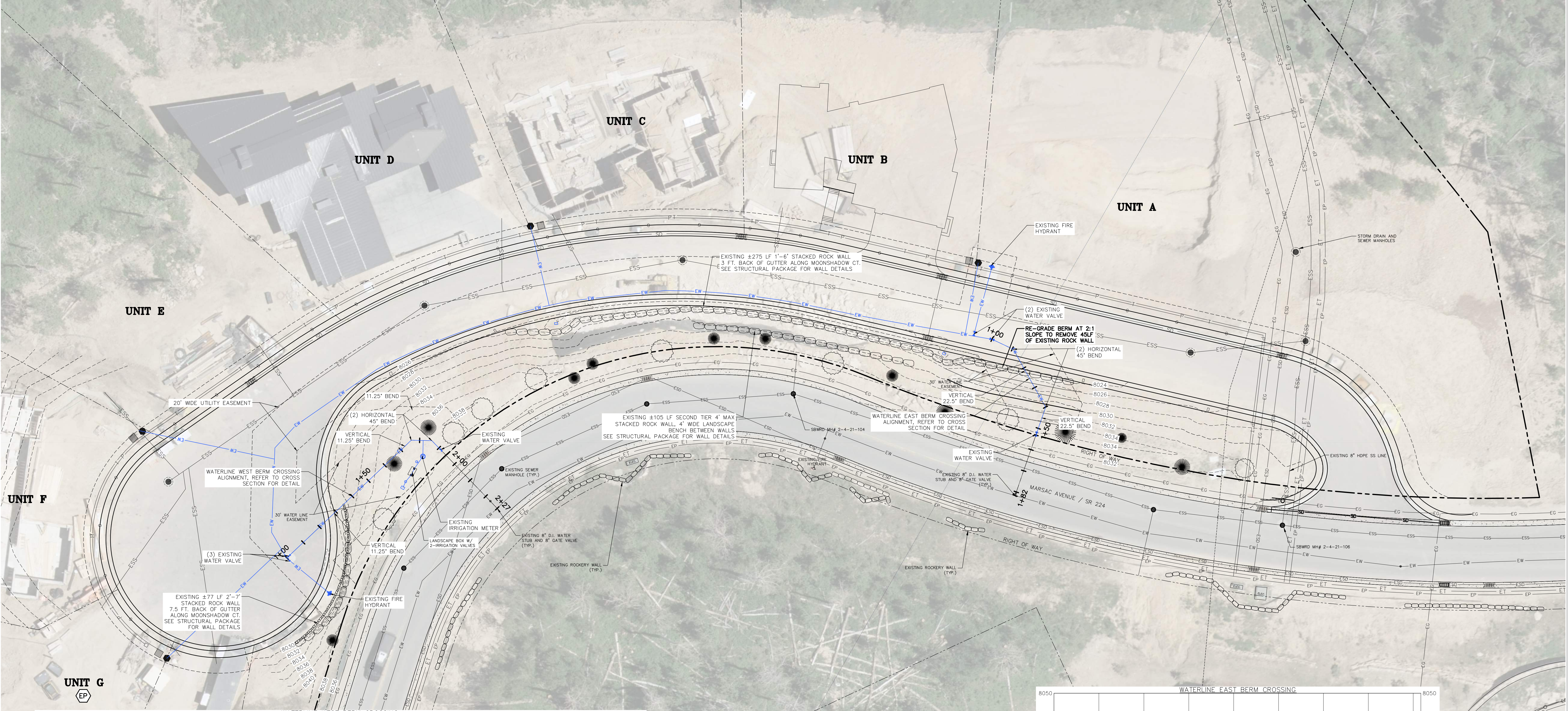
Project For:

MOONSHADOW COURT – LANDSCAPING PLAN
TUHAYE, UTAH

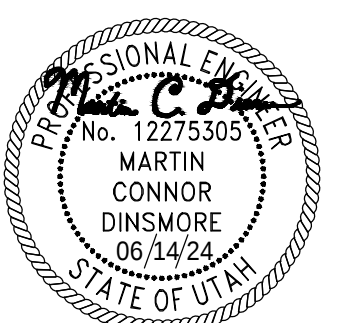
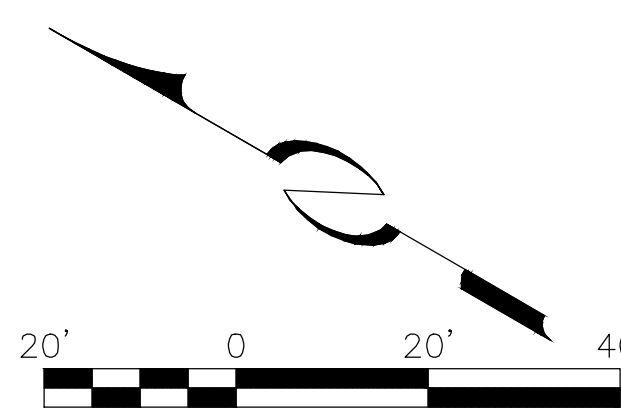
Date	Issue
------	-------

Landscape
Plan
Details

L104



LEGEND	
	1/2" IRRIGATION DRIPLINE
	3/4" SCH 40 PVC MAIN IRR. LINE
	1" SCH 40 PVC MAIN IRR. LINE
	PICEA PUNGENS/COLORADO SPRUCE
	ABIES LASIOCARPA/ALPINE FIR
	CORNUS SERICEA "ISANTI"/ISANTI
	REDOISE DOGWOOD
	AMELANCHIER ALNIFOLIA/SERVICEBERRY
	EXISTING SEWER
	EXISTING WATER
	EXISTING STORM DRAIN
	EXTG OVERHEAD POWER
	EXISTING GAS
	EXISTING TELECOMM
	EXISTING POWER
	EXISTING SANITARY SEWER MANHOLE
	EXISTING STORM DRAIN GRATES
	EXISTING ELECTRICAL BOXES
	EXISTING FIRE HYDRANT
	EXISTING WATER VALVE
	SITE BENCHMARK



ALLIANCE
ENGINEERING

2700 W HOMESTEAD RD
STE 50 & 60
PARK CITY, UT 84098
435.256.6634

STAFF:
MICHAEL DEMKOWICZ
CONNOR DINSMORE
GREG WILLIAMS

DATE: 06/14/24

AS-BUILT WATERLINE EXHIBIT
MOONSHADOW CONDOMINIUMS
LANDSCAPE/ROCKWALL PERMIT SET

FOR: STORIED DEER VALLEY

JOB NO.: 15-2-18

FILE: X:\Empire\dwg\Storied Development\Lot 1 VEPS\Civil\Landscape Permit\Moonshadow Landscape and Rock wall Plan.dwg

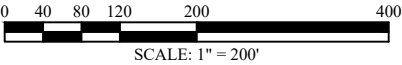
SHEET
L105
OF

ROCKERY DESIGN PACKAGE
MOONSHADOW SUBDIVISION
PARK CITY, UTAH



NOTE: THIS PLAN SET HAS BEEN PREPARED WITH COLOR LINE-TYPES TO MAKE SOME DETAILS AND SPECIFICATIONS MORE CLEAR. ANY COPIES OF THESE PLANS SHOULD BE MADE IN COLOR.

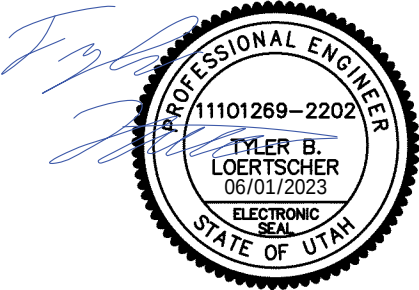
PROJECT AERIAL VIEW
REFERENCE IMAGE FROM GOOGLE EARTH PRO,
IMAGE TAKEN AUGUST 28, 2021.



DESIGN PACKAGE CONTENTS		
	SHEET NO.	DESCRIPTION
SHOP DRAWINGS	1	COVER SHEET
	2	PLAN VIEW
	3 - 4	TYPICAL SECTION VIEWS
	5	CONSTRUCTION SPECIFICATIONS & NOTES
	6	DESIGN CRITERIA
	7	SITE PHOTOS
DESIGN CALCULATION PACKAGE	SECTION 2	STABILITY CALCULATIONS
	SECTION 3	GLOBAL STABILITY RESULTS

PREPARED FOR:
STORIED DEER VALLEY, LLC
9785 NORTH TUHAYE PARK DRIVE
KAMAS, UTAH 84036
ATTN: RHETT RIDING

PREPARED BY: TYLER B. LOERTSCHER, P.E.



1	UPDATED TWO TIER RECOMMENDATIONS	6-1-2023	TBL	BMJ
REV	REVISION DESCRIPTION	DATE	BY	CHK
	REVISIONS			

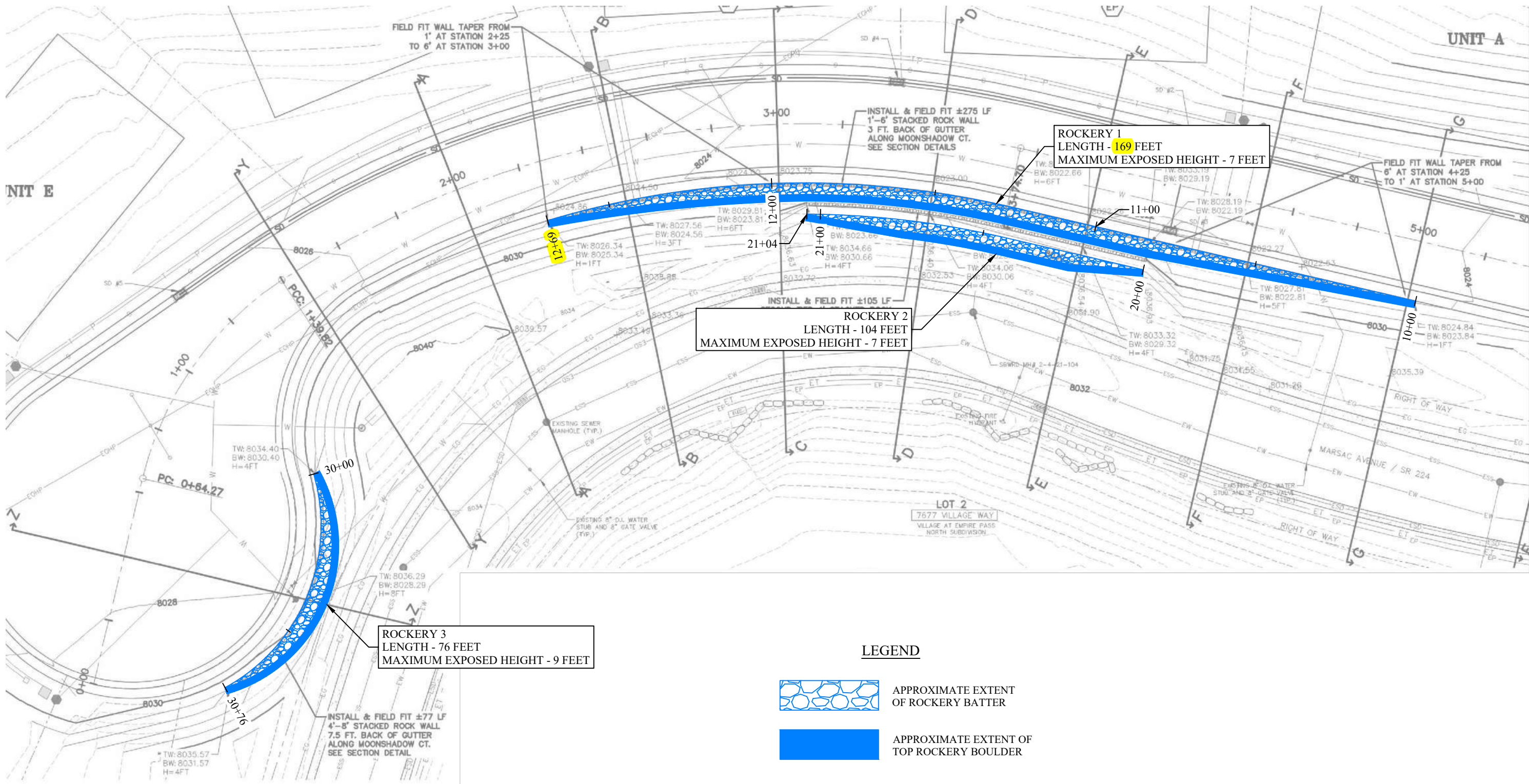


12429 SOUTH 300 EAST
DRAPER, UTAH 84020
(801) 748-4044

ROCKERY DESIGN PACKAGE
MOONSHADOW SUBDIVISION
PARK CITY, UTAH

COVER SHEET

DESIGNED BY: TBL	9-1-2022	PLOT SCALE
DRAWN BY: TBL	9-1-2022	1=1
CHECKED BY: BMJ	9-6-2022	DWG SCALE
APPROVED BY: TBL	9-6-2022	1"=200'
IGES PROJECT NO: 03511-020	SHEET NO: 1	REV 1



LEGEND



APPROXIMATE EXTENT OF ROCKERY BATTER



APPROXIMATE EXTENT OF TOP ROCKERY BOULDER

PLAN VIEW

REFERENCE IMAGE FROM ALLIANCE ENGINEERING, BERM WALL PLAN AND SECTIONS, LOT 1 VILLAGE AT EMPIRE PASS NORTH SUBDIVISION, SHEET 7 OF 11, SHEET DATED 8/25/2022.

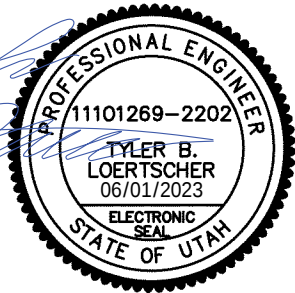


12429 SOUTH 300 EAST
DRAPER, UTAH 84020
(801) 748-4044

ROCKERY DESIGN PACKAGE
MOONSHADOW SUBDIVISION
PARK CITY, UTAH

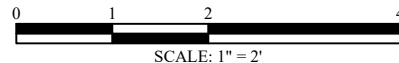
PLAN VIEW

DESIGNED BY:	TBL	9-1-2022	PLOT SCALE
DRAWN BY:	TBL	9-1-2022	1=1
CHECKED BY:	BMJ	9-6-2022	DWG SCALE
APPROVED BY:	TBL	9-6-2022	1"=30'
IGES PROJECT NO:	03511-020	SHEET NO:	2
		REV	1



1. SOIL CUT SHOULD BE BENCHMARKED AS NEEDED TO PROTECT WORKERS AND TO COMPLY WITH OSHA REQUIREMENTS.
2. ROCKERIES ARE VULNERABLE TO EROSION AND HYDROSTATIC PRESSURES IMMEDIATELY AFTER INSTALLATION BUT PRIOR TO THE PLACEMENT OF LANDSCAPING/FINISHING ELEMENTS (E.G., LANDSCAPING, HARDSCAPE, CURB & GUTTER, PAVEMENT, ETC.). TO PREVENT DAMAGE TO THE ROCKERY DURING ADDITIONAL SITE WORK, ALL SURFACE DRAINAGE SHOULD BE DIRECTED AWAY FROM THE ROCKERY. EXCESS WATER DURING HEAVY PRECIPITATION EVENTS, IF NOT DRAINED PROPERLY, CAN CAUSE WASHOUTS AT ROCKERY ENDS AND 'BLOWOUTS' OF INTERIOR SECTIONS. THESE PRECAUTIONS SHOULD BE TAKEN DURING WALL CONSTRUCTION, AND AFTER, UNTIL THE FINAL SITE DRAINAGE AND LANDSCAPING ARE COMPLETE.
3. WE RECOMMEND THAT AN APPROPRIATE SAFETY FENCE/BARRICADE BE CONSIDERED BY THE OWNER ABOVE THE ROCKERY. DESIGN OF THE FENCE/BARRICADE IS SPECIFICALLY EXCLUDED FROM THIS ENGINEERING. IF THE FENCE POST WILL BE PLACED WITHIN 3 FEET OF THE BACK OF THE BOULDERS, COMPLY WITH THE FOLLOWING RECOMMENDATIONS:
 - 3.1. IF CHAIN LINK FENCE OR RAILING, EXTEND POST A MINIMUM DEPTH OF 36 INCHES.
 - 3.2. IF VINYL, WOOD, PRECAST (OR SIMILAR), USE SLEEVE-IT TYPE SYSTEM TO RESIST OVERTURNING MOMENT OF FENCE SYSTEM (SEE STRATA.COM).
 - 3.3. WE RECOMMEND THAT ONCE THE FENCING SYSTEM IS DETERMINED THAT IGES, INC. BE CONTACTED TO ACCESS THE IMPACT OF THE FENCE ON THE ROCKERY.
4. ROCKERIES WILL HAVE SOIL PLACED BETWEEN BOULDERS TO ENSURE THAT THE BOULDERS FIRMLY REST ON AT LEAST TWO BOULDERS BENEATH (SEE CONSTRUCTION SPECIFICATIONS & NOTES SHEET FOR DETAILS). KEEPING THE SOIL FROM ERODING AWAY OVERTIME IS IMPORTANT FOR LONG-TERM STABILITY AS WELL AS AESTHETIC REASONS. TO HELP REDUCE THE POTENTIAL FOR THIS SOIL TO ERODE, WE RECOMMEND THAT THE SOIL BE PLANTED WITH HARDY, LOW MAINTENANCE, DROUGHT-TOLERANT VEGETATION. EXAMPLES OF VEGETATION THAT WORKS WELL WITH ROCKERIES (<https://www.daviddomoney.com/rockery-plants-top-10-plants-for-an-alpine-rock-garden/>) INCLUDE : SEDUM, AUBRIETA, SEMPERVIVUM, PULSATILLA VULGARIS, AND DIANTHUS.
5. INSTALL 6-OZ NON-WOVEN GEOTEXTILE FABRIC BEHIND THE UPPER BOULDER AND EXTEND A MINIMUM OF 4 INCHES BELOW THE TOP OF THE SECOND BOULDER DOWN.

MINIMUM BOULDER DEPTH SCHEDULE ROCKERIES 1 & 2				
COURSE	BOULDER SIZE (DEPTH) FOR EACH COURSE (COURSE 1 IS BOTTOM COURSE) FOR VARIOUS EXPOSED WALL HEIGHTS [ADD 1-FOOT MINIMUM EMBEDMENT FOR ALL ROCKERY SECTIONS]			
	7-FOOT ROCKERY	6-FOOT ROCKERY	5-FOOT ROCKERY	4 FOOT ROCKERY OR LESS
4	2.0 FEET	2.0 FEET	2.0 FEET	-
3	2.5 FEET	2.0 FEET	2.0 FEET	2.0 FEET
2	3.0 FEET	3.0 FEET	2.5 FEET	2.0 FEET
1	4.0 FEET	3.5 FEET	3.0 FEET	3.0 FEET



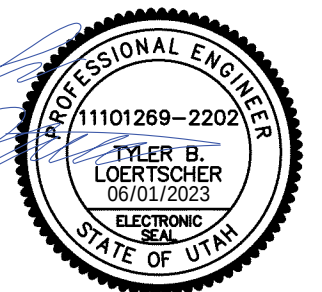
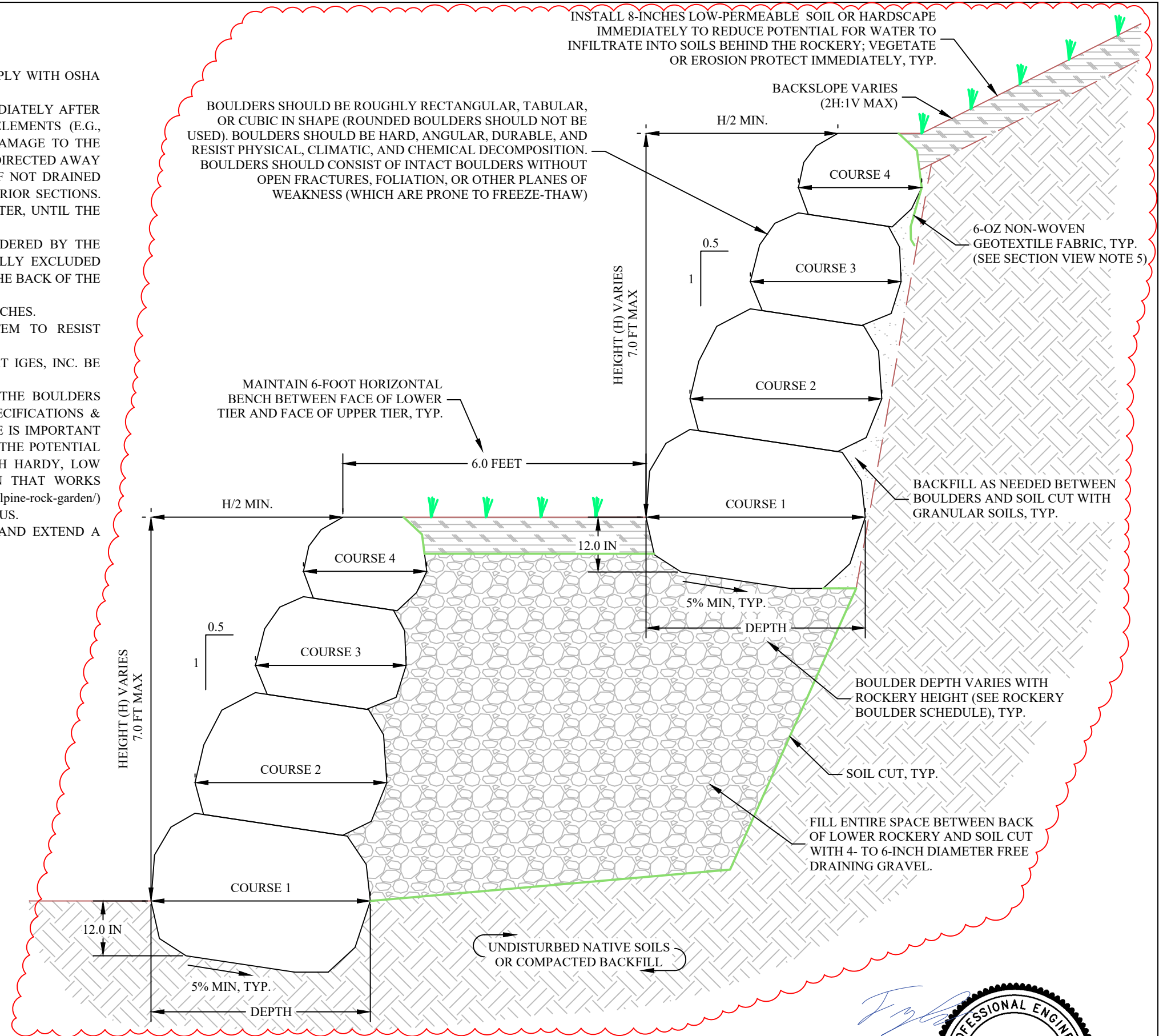
1	UPDATED TWO TIER RECOMMENDATIONS	6-1-2023	TBL	BMJ
REV	REVISION DESCRIPTION	DATE	BY	CHK
	REVISIONS			



12429 SOUTH 300 EAST
DRAPER, UTAH 84020
(801) 748-4044

ROCKERY DESIGN PACKAGE
MOONSHADOW SUBDIVISION
PARK CITY, UTAH

TYPICAL SECTION VIEW - ROCKERIES 1 & 2



SECTION VIEW NOTES:

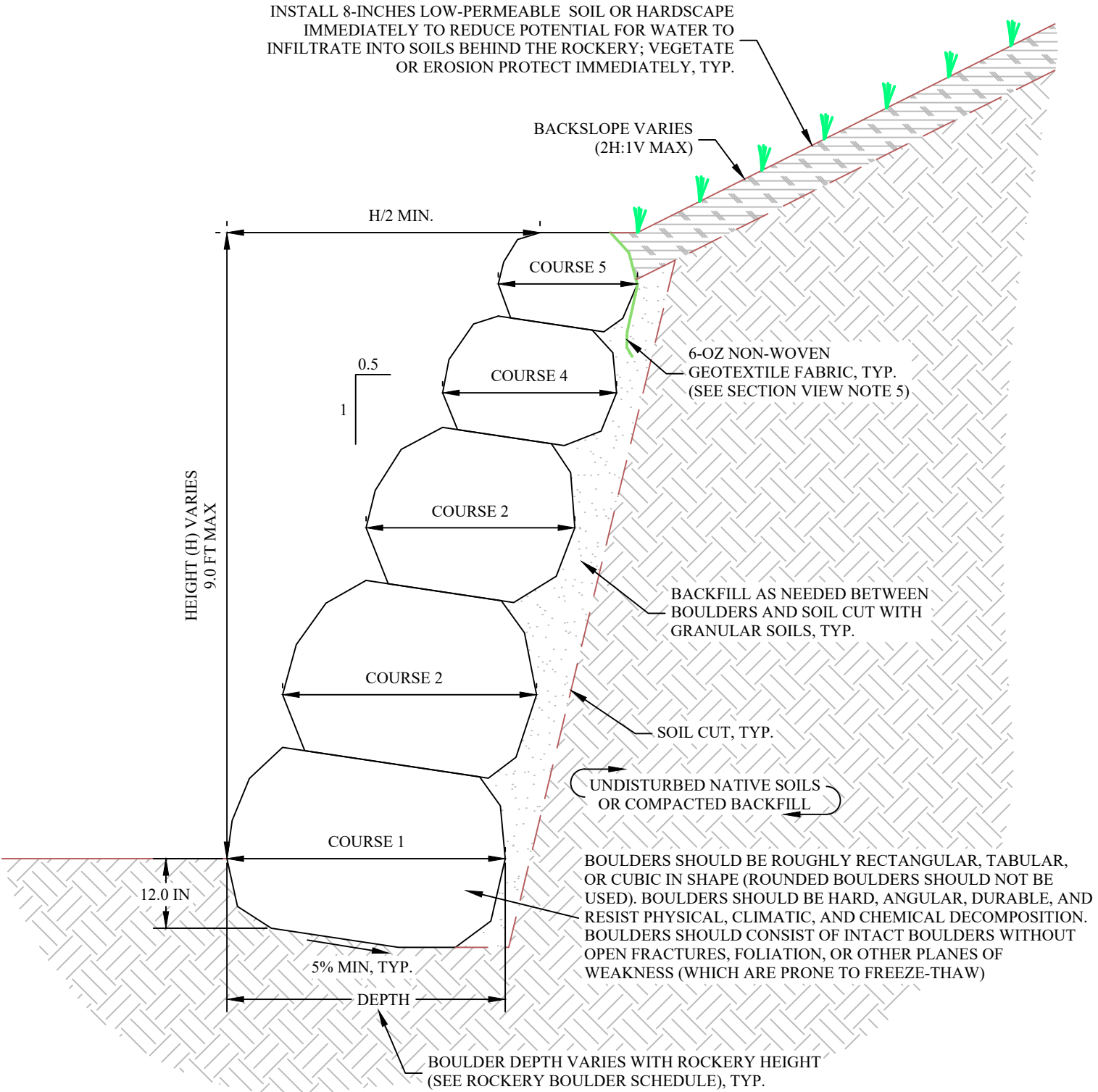
1. SOIL CUT SHOULD BE BENCHED AS NEEDED TO PROTECT WORKERS AND TO COMPLY WITH OSHA REQUIREMENTS.
2. ROCKERIES ARE VULNERABLE TO EROSION AND HYDROSTATIC PRESSURES IMMEDIATELY AFTER INSTALLATION BUT PRIOR TO THE PLACEMENT OF LANDSCAPING/FINISHING ELEMENTS (E.G., LANDSCAPING, HARDSCAPE, CURB & GUTTER, PAVEMENT, ETC.). TO PREVENT DAMAGE TO THE ROCKERY DURING ADDITIONAL SITE WORK, ALL SURFACE DRAINAGE SHOULD BE DIRECTED AWAY FROM THE ROCKERY. EXCESS WATER DURING HEAVY PRECIPITATION EVENTS, IF NOT DRAINED PROPERLY, CAN CAUSE WASHOUTS AT ROCKERY ENDS AND 'BLOWOUTS' OF INTERIOR SECTIONS. THESE PRECAUTIONS SHOULD BE TAKEN DURING WALL CONSTRUCTION, AND AFTER, UNTIL THE FINAL SITE DRAINAGE AND LANDSCAPING ARE COMPLETE.
3. WE RECOMMEND THAT AN APPROPRIATE SAFETY FENCE/BARRICADE BE CONSIDERED BY THE OWNER ABOVE THE ROCKERY. DESIGN OF THE FENCE/BARRICADE IS SPECIFICALLY EXCLUDED FROM THIS ENGINEERING. IF THE FENCE POST WILL BE PLACED WITHIN 3 FEET OF THE BACK OF THE BOULDERS, COMPLY WITH THE FOLLOWING RECOMMENDATIONS:

3.1. IF CHAIN LINK FENCE OR RAILING, EXTEND POST A MINIMUM DEPTH OF 36 INCHES.

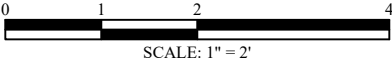
3.2. IF VINYL, WOOD, PRECAST (OR SIMILAR), USE SLEEVE-IT TYPE SYSTEM TO RESIST OVERTURNING MOMENT OF FENCE SYSTEM (SEE STRATA.COM).

3.3. WE RECOMMEND THAT ONCE THE FENCING SYSTEM IS DETERMINED THAT IGES, INC. BE CONTACTED TO ACCESS THE IMPACT OF THE FENCE ON THE ROCKERY.
4. ROCKERIES WILL HAVE SOIL PLACED BETWEEN BOULDERS TO ENSURE THAT THE BOULDERS FIRMLY REST ON AT LEAST TWO BOULDERS BENEATH (SEE CONSTRUCTION SPECIFICATIONS & NOTES SHEET FOR DETAILS). KEEPING THE SOIL FROM ERODING AWAY OVERTIME IS IMPORTANT FOR LONG-TERM STABILITY AS WELL AS AESTHETIC REASONS. TO HELP REDUCE THE POTENTIAL FOR THIS SOIL TO ERODE, WE RECOMMEND THAT THE SOIL BE PLANTED WITH HARDY, LOW MAINTENANCE, DROUGHT-TOLERANT VEGETATION. EXAMPLES OF VEGETATION THAT WORKS WELL WITH ROCKERIES (<https://www.daviddomoney.com/rockery-plants-top-10-plants-for-an-alpine-rock-garden/>) INCLUDE : SEDUM, AUBRIETA, SEMPERVIVUM, PULSATILLA VULGARIS, AND DIANTHUS.
5. INSTALL 6-OZ NON-WOVEN GEOTEXTILE FABRIC BEHIND THE UPPER BOULDER AND EXTEND A MINIMUM OF 4 INCHES BELOW THE TOP OF THE SECOND BOULDER DOWN.

MINIMUM BOULDER DEPTH SCHEDULE ROCKERY 3						
COURSE	BOULDER SIZE (DEPTH) FOR EACH COURSE (COURSE 1 IS BOTTOM COURSE) FOR VARIOUS EXPOSED WALL HEIGHTS [ADD 1-FOOT MINIMUM EMBEDMENT FOR ALL ROCKERY SECTIONS]					
	9-FOOT ROCKERY	8-FOOT ROCKERY	7-FOOT ROCKERY	6-FOOT ROCKERY	5-FOOT ROCKERY	4 FOOT ROCKERY OR LESS
5	2.0 FEET	2.0 FEET	-	-	-	-
4	2.5 FEET	2.0 FEET	2.0 FEET	2.0 FEET	2.0 FEET	-
3	3.0 FEET	2.5 FEET	2.5 FEET	2.0 FEET	2.0 FEET	2.0 FEET
2	3.5 FEET	3.5 FEET	3.0 FEET	3.0 FEET	2.5 FEET	2.0 FEET
1	4.5 FEET	4.0 FEET	4.0 FEET	3.5 FEET	3.0 FEET	3.0 FEET



TYPICAL SECTION VIEW - ROCKERY 3
SCALE: 1"=2'



1	UPDATED TWO TIER RECOMMENDATIONS	6-1-2023	TBL	BMJ
REV	REVISION DESCRIPTION	DATE	BY	CHK
	REVISIONS			

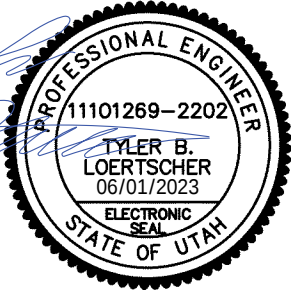


12429 SOUTH 300 EAST
DRAPER, UTAH 84020
(801) 748-4044

ROCKERY DESIGN PACKAGE
MOONSHADOW SUBDIVISION
PARK CITY, UTAH

TYPICAL SECTION VIEW - ROCKERY 3

DESIGNED BY: TBL	9-1-2022	PLOT SCALE
DRAWN BY: TBL	9-1-2022	1=1
CHECKED BY: BMJ	9-6-2022	DWG SCALE
APPROVED BY: TBL	9-6-2022	1"=2'
IGES PROJECT NO: 03511-020	SHEET NO: 4	REV 1



ROCKERY CONSTRUCTION SPECIFICATIONS: 1. GENERAL 1.1. DESIGN AND CONSTRUCTION INFORMATION IS BASED ON SITE GEOMETRY, THE REFERENCED CONSTRUCTION PLAN, AND THE ENGINEERING ANALYSIS PERFORMED AS PART OF THE SCOPE OF WORK FOR THIS PROJECT. 1.2. LOCATE AND FULLY RESOLVE ALL CONFLICTS WITH EXISTING AND/OR PROPOSED UTILITIES PRIOR TO ROCKERY CONSTRUCTION. 1.3. COMPLY WITH ALL ASPECTS OF OSHA 1926 SUBPART P APP B, SLOPING AND BENCHING FOR ALL EXCAVATED SLOPES. 1.4. IMPLEMENT THE FOLLOWING MEASURES TO REDUCE THE POTENTIAL FOR HYDROSTATIC PRESSURES TO BUILDUP BEHIND THE ROCKERY: 1.4.1. ESTABLISH HARDSCAPE OR LOW PERMEABLE SOIL ABOVE ROCKERY AS SHOWN ON TYPICAL SECTION VIEW. BEFORE FINAL LANDSCAPING ELEMENTS ARE COMPLETED AT THE SITE, VEGETATION OR EROSION CONTROL MEASURES MUST BE ESTIMATED ABOVE AND BELOW THE ROCKERY IMMEDIATELY FOLLOWING CONSTRUCTION. 1.4.2. INSTALL 6-OZ MINIMUM NON-WOVEN GEOTEXTILE FABRIC AS SHOWN IN THE TYPICAL SECTION VIEW TO REDUCE POTENTIAL FOR EROSION AND DRAINAGE CHANNELS TO FORM. 1.5. CONDITIONS SUCH AS LEAKY OR BROKEN IRRIGATION LINES AND/OR UNCONTROLLED RUNOFF FROM IMPROPER SITE GRADING CAN LEAD TO UNDERMINING OR HYDROSTATIC PRESSURES BUILDING UP BEHIND THE ROCKERY, WHICH CAN LEAD TO SLOPE OR BOULDER MOVEMENT. 1.5.1. HYDROSTATIC PRESSURES WERE NOT CONSIDERED IN THE ANALYSIS OF THE ROCKERY AND MUST BE AVOIDED. 1.5.2. ROCKERIES ARE VULNERABLE TO EROSION AND HYDROSTATIC PRESSURES IMMEDIATELY AFTER INSTALLATION BUT PRIOR TO THE PLACEMENT OF THE FINISHING LANDSCAPING ELEMENTS (E.G., LOW PERMEABLE SOIL OR HARDSCAPE). AS THESE ELEMENTS ARE CRITICAL TO THE OVERALL STABILITY OF THE ROCKERY, THE ROCKERIES ARE NOT CONSIDERED COMPLETE UNTIL THEY ARE IN PLACE. 1.5.3. THE OWNER SHALL BE AWARE OF THE RISKS IF THESE OR OTHER CONDITIONS OCCUR THAT COULD SATURATE OR ERODE THE SOIL BEHIND THE ROCKERY OR IF THE FINISHING/LANDSCAPING ELEMENTS ARE NOT INSTALLED IMMEDIATELY FOLLOWING THE INSTALLATION OF THE ROCKERY. 2. MATERIALS 2.1. RETAINED BACKFILL SOILS 2.1.1. APPROVED IMPORTED GRANULAR BACKFILL BORROW OR APPROVED NATIVE SOILS THAT HAVE BEEN SCREENED AND PROCESSED COMPLYING WITH THE FOLLOWING CRITERIA: 2.1.1.1. GRANULAR MATERIALS CONTAINING LESS THEN 35% FINES 2.1.1.2. MAXIMUM NOMINAL PARTICLE SIZE OF 4 INCHES 2.1.1.3. PI OF 6 OR LESS, pH GREATER THAN 3 BUT LESS THAN 9 2.1.1.4. REASONABLY FREE FROM ORGANIC OR OTHER DELETERIOUS MATERIALS 2.1.1.5. MINIMUM EFFECTIVE FRICTION ANGLE OF 34 DEGREES 2.2. USE DURABLE ANGULAR BOULDERS WITH A MINIMUM NOMINAL DIAMETER OF 24 INCHES. MEET ALL MINIMUM DIAMETERS IN ACCORDANCE WITH DESIGN DRAWINGS. ROCKS SHOULD FOLLOW FHWA GUIDELINES: 2.2.1. USE ROCKS THAT ARE HARD, ANGULAR, DURABLE, AND ABLE TO RESIST PHYSICAL, CLIMATIC, AND CHEMICAL DECOMPOSITION. 2.2.2. USE ROCKS THAT ARE ROUGHLY RECTANGULAR, TABULAR, OR CUBIC IN SHAPE; ROUNDED ROCKS AND COBBLES SHOULD NOT BE USED. 2.2.3. ROCKS SHOULD CONSIST OF INTACT BLOCKS WITHOUT OPEN FRACTURES, FOLIATION, OR OTHER PLANES OF WEAKNESS 2.3. GEOTEXTILE FABRIC 2.3.1. 6-OZ. MINIMUM NON-WOVEN 3. INSTALLATION 3.1. ROCKS SHOULD BE STACKED IN GENERAL ACCORDANCE WITH THE ASSOCIATED ROCKERY CONTRACTORS (ARC) AND FHWA ROCKERY CONSTRUCTION GUIDELINES. ARC GUIDELINES AND GIVEN ON THIS SHEET (SEE GUIDELINES TO THE RIGHT). FHWA GUIDELINES ARE SUMMARIZED AS FOLLOWS: 3.1.1. EACH ROCK SHOULD BEAR ON AT LEAST TWO OTHER ROCKS 3.1.2. EACH ROCK SHOULD HAVE AT LEAST THREE BEARING POINTS - TWO IN FRONT AND ONE IN BACK 3.1.3. THE FRONT-MOST BEARING POINTS FOR EACH ROCK SHOULD BE WITHIN 6 INCHES OF THE AVERAGE FACE OF THE ROCKERY 3.1.4. THE REAR OF THE ROCKS SHOULD BE ALIGNED ALONG AN IMAGINARY VERTICAL PLANE. IF ROCKS LARGER THAN THE MINIMUM SPECIFIED DIAMETERS ARE USED, THEY CAN EXTEND BEYOND THIS IMAGINARY PLANE PROVIDED THEY DO NOT INTERFERE WITH ROCKERY DRAINAGE 3.1.5. THE TOPS OF EACH ROCK SHOULD BE SLOPED BACK AT LEAST 5% TOWARDS THE BACK OF THE ROCKERY 3.1.6. ROCK FACING SHOULD BE STACKED AT A MAXIMUM STEEPNESS OF 1 HORIZONTAL TO 2 VERTICAL 3.1.7. THE BOTTOM ROW OF ROCKS SHOULD BE BURIED (EMBEDDED) A MINIMUM DEPTH OF 12 INCHES FOR ALL ROCKERIES. 3.2. PLACE ROCKERY BACKFILL MATERIAL IN 12-INCH MAXIMUM LOOSE LIFTS AND COMPACT TO A MINIMUM OF 95 PERCENT OF ASTM D1557 (MODIFIED PROCTOR) IN STRUCTURAL AREAS AND 90 PERCENT IN LANDSCAPE AREAS. THINNER LIFTS MAY BE NECESSARY TO ACHIEVE REQUIRED COMPACTION. 3.2.1. PERFORM DENSITY TESTING OF THE BACKFILL SOILS AT 50-FOOT INTERVALS ON EVERY LIFT. 3.2.2. USE ONLY SMALL, WALK-BEHIND TYPE COMPACTION EQUIPMENT WITHIN 3 FEET OF THE BACK OF THE ROCKERY BOULDERS. 3.2.3. IF ANY LOCATIONS EXIST WHERE THE ROCKERY WILL NOT BE PLACED UPON NATIVE SOILS, COMPACT THE FILL TO A MINIMUM OF 95 PERCENT OF ASTM D1557. 3.3. INSTALL 6-OZ NON-WOVEN GEOTEXTILE FABRIC BEHIND THE UPPER BOULDER AND DOWN TO THE UPPER GEOGRID LAYER AS SHOWN ON THE TYPICAL SECTION VIEW SHEET.					4. CONSTRUCTION OBSERVATION 4.1. TO FULFILL ANY APPLICABLE CITY, COUNTY AND/OR STATE AGENCY REQUIREMENTS, AND TO PROTECT THE CONTRACTOR AND DESIGN ENGINEER, IGES, INC., MUST PERFORM PERIODIC CONSTRUCTION OBSERVATIONS. 4.1.1. IF IGES, INC. DOES NOT OBSERVE THE ROCKERY DURING CONSTRUCTION, A FINAL LETTER REGARDING COMPLIANCE OF THE ROCKERY CONSTRUCTION WITH THE DESIGN CRITERIA AND RECOMMENDATIONS CANNOT BE PROVIDED. IF IGES, INC., DOES NOT PERFORM THE PERIODIC CONSTRUCTION OBSERVATIONS OUTLINED ON THIS SHEET, THE ROCKERY CONTRACTOR/OWNER ASSUMES ALL RESPONSIBILITY FOR THE ROCKERY. 4.2. ROCKERY OBSERVATION SCHEDULE: 4.2.1. OBSERVE AND ASSESS THE SUITABILITY OF THE OF THE FOUNDATION BEARING SOILS. 4.2.2. ASSESS THE MINIMUM EMBEDMENT REQUIREMENTS ARE MET. 4.2.3. OBSERVE THE SIZE, POSITION, BATTER, AND PLACEMENT FOR EACH COURSE OF BOULDERS. 4.2.4. OBSERVE THE PLACEMENT OF RETAINED FILL SOILS. OBSERVE THE COMPACTION OF THE RETAINED FILL AND ASSESS WHETHER MINIMUM COMPACTION REQUIREMENTS ARE MET. 4.2.5. OBSERVE THE COMPLETED ROCKERY TO ASSESS FINISHED ROCKERY WALL HEIGHTS, BATTER, BACKSLOPE AND TOESLOPE GRADING CONDITIONS, AND THE SUITABILITY OF EROSION CONTROL MEASURES INSTALLED ABOVE AND BELOW THE ROCKERY. 4.2.6. ALL BACKFILL SOILS CONSISTING OF FREE DRAINING GRANULAR SOILS. 4.2.7. THE CONTRACTOR IS RESPONSIBLE FOR ARRANGING THE CONSTRUCTION OBSERVATIONS AND QUALITY CONTROL.																								
ROCK STACKING CONSTRUCTION GUIDELINES: ROCKS SHOULD BE STACKED IN GENERAL ACCORDANCE WITH FHWA AND THE ASSOCIATED ROCKERY CONTRACTORS (ARC) ROCKERY CONSTRUCTION GUIDELINES, SUMMARIZED AS FOLLOWS: NO YES DETAIL A NO YES DETAIL B					DESIGNED BY: TBL9-1-2022 DRAWN BY: TBL9-1-2022 CHECKED BY: BMJ9-6-2022 APPROVED BY: TBL9-6-2022 IGES PROJECT NO: 03511-020 PLOT SCALE1=1 DWG SCALENTS SHEET NO: 5 REV1 CONSTRUCTION SPECIFICATIONS & NOTES																								
<table><tr><td>1</td><td>UPDATED TWO TIER RECOMMENDATIONS</td><td>6-1-2023</td><td>TBL</td><td>BMJ</td></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr><tr><td>REV</td><td>REVISION DESCRIPTION</td><td>DATE</td><td>BY</td><td>CHK</td></tr><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr></table> IGES EST. 1998 12429 SOUTH 300 EAST DRAPER, UTAH 84020 (801) 748-4044 ROCKERY DESIGN PACKAGE MOONSHADOW SUBDIVISION PARK CITY, UTAH PROFESSIONAL ENGINEER 11101269-2202 TYLER B. LOERTSCHER 06/01/2023 ELECTRONIC SEAL STATE OF UTAH Page 23 of 50					1	UPDATED TWO TIER RECOMMENDATIONS	6-1-2023	TBL	BMJ											REV	REVISION DESCRIPTION	DATE	BY	CHK					
1	UPDATED TWO TIER RECOMMENDATIONS	6-1-2023	TBL	BMJ																									
REV	REVISION DESCRIPTION	DATE	BY	CHK																									

RETAINING WALL ANALYSIS USED IN DESIGN	
ANALYSIS	DESIGN REFERENCES/SOFTWARE
EXTERNAL STABILITY	MACK, D.A., SANDERS, S.H., MILLHONE, W.L., FIPPIN, R.L., AND KENNEDY, D.G., 2006, ROCKERY DESIGN AND CONSTRUCTION GUIDELINES, SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING, INC., REPORT NO. FHWA-CFL/TD-06-006, REPORT DATED NOVEMBER 2006.
GLOBAL STABILITY	SLIDE 2: ROCSCIENCE, INC., 1998-2022, VERSION 9.024, BUILD DATE AUGUST 5, 2022

SOIL CONDITIONS USED IN DESIGN (ASSUMED)			
EARTH MATERIALS	FRICTION ANGLE	COHESION	UNIT WEIGHT
RETAINED SOIL	34°	50 PSF	135 PCF
FOUNDATION SOIL	34°	50 PSF	135 PCF

- SOURCES & NOTES:
- IGES, INC., 2022 FIELD OBSERVATIONS ON SEPTEMBER 1, 2022.
 - COHESION USED ONLY DURING GLOBAL STABILITY ANALYSES.

GENERAL NOTES:

- THE ENGINEERING PRESENTED IN THIS DESIGN PACKAGE IS BASED ON SPECIFIC PRODUCTS (E.G., BOULDERS OF THE DIMENSIONS SPECIFIED ON THE TYPICAL SECTION VIEW, SOIL STRENGTHS GIVEN ABOVE, ETC.). ANY SUBSTITUTION OF THE SPECIFIED PRODUCTS WILL INVALIDATE THIS ENGINEERING. ANY CHANGES IN WALL LOCATION, ELEVATIONS OF LEVELING PAD, GRADES AT THE TOE OR TOP OF THE WALL, AND SOIL PARAMETERS AT THE SITE WILL ALSO INVALIDATE THE ENGINEERING. FIELD ADJUSTMENTS/CHANGES MAY BE NEEDED TO MEET ACTUAL CONDITIONS ONCE CONSTRUCTION COMMENCES. IGES SHOULD BE CONSULTED WHERE FIELD CHANGES ARE REQUIRED.
- THESE DOCUMENTS ARE INSTRUMENTS OF SERVICE AND SHALL REMAIN THE INTELLECTUAL PROPERTY OF IGES, INC. THE DESIGN PACKAGE HAS BEEN FURNISHED FOR THIS SPECIFIC PROJECT ONLY. ANY PARTY ACCEPTING THIS DOCUMENT DOES SO IN CONFIDENCE AND AGREES THAT NO USE OR RE-USE OF THESE DOCUMENTS (EITHER IN WHOLE OR IN PART) SHALL BE PERMITTED UNLESS EXPRESSLY AUTHORIZED IN WRITING BY IGES, INC.
- RETAINING WALLS ARE VULNERABLE TO EROSION AND HYDROSTATIC PRESSURES IMMEDIATELY AFTER INSTALLATION BUT PRIOR TO THE PLACEMENT OF LANDSCAPING/FINISHING ELEMENTS AT THE SITE (E.G., LANDSCAPING, HARDSCAPE, CURB & GUTTER, PAVEMENT, ETC.). TO PREVENT DAMAGE TO THE WALL DURING ADDITIONAL SITE WORK, ALL SURFACE DRAINAGE SHOULD BE DIRECTED AWAY FROM THE WALL. EXCESS WATER DURING HEAVY RAIN EVENTS, IF NOT DRAINED PROPERLY, CAN CAUSE WASHOUTS AT WALL ENDS AND 'BLOWOUTS' OF INTERIOR SECTIONS. THESE PRECAUTIONS SHOULD BE TAKEN DURING WALL CONSTRUCTION, AND AFTER, UNTIL THE FINAL SITE DRAINAGE, LANDSCAPING AND PAVING ARE COMPLETE.
- MINIMUM EMBEDMENT OF THE WALL VARIES AS SHOWN ON THIS ELEVATION VIEW SHEET. EMBEDMENT AT THE WALL TOE MUST BE MAINTAINED THROUGHOUT THE LIFE OF THE RETAINING WALL.
- WE RECOMMEND THAT AN APPROPRIATE SAFETY FENCE/BARRICADE BE CONSIDERED BY THE OWNER ABOVE THE RETAINING WALL. DESIGN OF THE FENCE/BARRICADE IS SPECIFICALLY EXCLUDED FROM THE ENGINEERING OF THIS WALL.

RETAINING WALL GEOMETRY AND LOADING CONDITIONS				
WALL	LENGTH (FT)	MAXIMUM EXPOSED HEIGHT (FT)	BACKSLOPE CONDITIONS	SURCHARGE LOADING
ROCKERY 1	169	7.0	VARIES (2H:1V MAX)	900 PSF (UPPER TIER)
ROCKERY 2	104	7.0	VARIES (2H:1V MAX)	NONE
ROCKERY 3	76	9.0	VARIES (2H:1V MAX)	NONE

SEISMIC PARAMETERS USED IN DESIGN		
SEISMIC CRITERIA	EXTERNAL & GLOBAL STABILITY	
	DESIGN PGA (As)	k _h
7% IN 75 YEARS	0.285g	0.119g (EXTERNAL) 0.143g (GLOBAL)

- SOURCES & NOTES:
- U.S. GEOLOGICAL SURVEY, U.S. SEISMIC DESIGNMAPS WEB APPLICATION, SITE: <http://earthquake.usgs.gov/ws/designmaps>, ACCESSED 9-1-2022
 - SITE CLASS D WAS ASSUMED FOR THE ONSITE SOILS USING 2009 AASHTO GUIDE SPECIFICATIONS. AASHTO SPECIFICATIONS WERE USED AS RECOMMENDED IN THE FHWA ROCKERY DESIGN MANUAL.
 - A MAXIMUM ALLOWABLE SEISMIC DISPLACEMENT THRESHOLD OF 2.85 INCHES (10*A_s) WAS USED TO REDUCE THE HORIZONTAL SEISMIC ACCELERATION COEFFICIENT IN ACCORDANCE WITH AASHTO LRFD DESIGN MANUAL METHODOLOGY.
 - ONE-HALF OF THE DESIGN PGA (A_s) WAS USED TO MODEL THE HORIZONTAL SEISMIC ACCELERATION FOR GLOBAL STABILITY ANALYSES (k_h = 0.119g).
 - SEISMIC PARAMETERS DEVELOPED FROM:

SITE INFORMATION

LATITUDE:	40.6251	DEGREES
LONGITUDE:	-111.4995	DEGREES
RETURN PERIOD:	1,033	YEARS (7PE75)
SITE SOIL CLASS:	D	STIFF SOIL PROFILE (TABLE 3.10.3.1-1)
S _s :	0.491	THE MAPPED SPECTRAL ACCELERATION FOR SHORT PERIODS
S _j :	0.176	THE MAPPED SPECTRAL ACCELERATION A 1-SECOND PERIOD
F _a :	1.41	TABLE 3.10.3.2-2
F _v :	2.09	TABLE 3.10.3.2-3

SEISMIC GROUND MOTION VALUES (DESIGN VALUES)

DESIGN VALUES		
S _{Ds} :	0.691	g (EQUATION 3.10.4.2-3)
S _{Dl} :	0.176	g (EQUATION 3.10.4.2-6)
PGA _{DESIGN} (As):	0.285	g (EQUATION 3.10.4.2-2)

1	UPDATED TWO TIER RECOMMENDATIONS	6-1-2023	TBL	BMJ
REV	REVISION DESCRIPTION	DATE	BY	CHK
	REVISIONS			

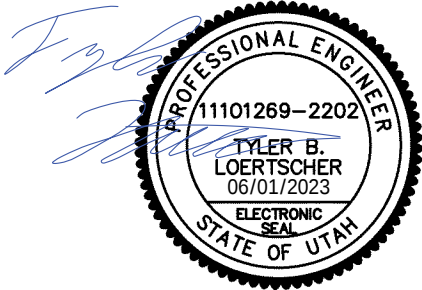


12429 SOUTH 300 EAST
DRAPER, UTAH 84020
(801) 748-4044

ROCKERY DESIGN PACKAGE
MOONSHADOW SUBDIVISION
PARK CITY, UTAH

DESIGN CRITERIA

DESIGNED BY:	TBL	9-1-2022	PLOT SCALE
DRAWN BY:	TBL	9-1-2022	1=1
CHECKED BY:	BMJ	9-6-2022	DWG SCALE
APPROVED BY:	TBL	9-6-2022	NTS
IGES PROJECT NO:	03511-020	SHEET NO:	6
		REV	1





SITE PHOTOS TAKEN SEPTEMBER 1, 2022

1	UPDATED TWO TIER RECOMMENDATIONS	6-1-2023	TBL	BMJ
REV	REVISION DESCRIPTION	DATE	BY	CHK
	REVISIONS			

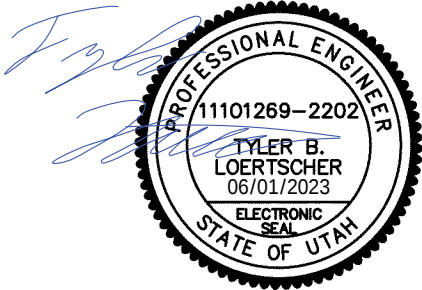


12429 SOUTH 300 EAST
 DRAPER, UTAH 84020
 (801) 748-4044

ROCKERY DESIGN PACKAGE
 MOONSHADOW SUBDIVISION
 PARK CITY, UTAH

SITE PHOTOS

DESIGNED BY: TBL	9-1-2022	PLOT SCALE
DRAWN BY: TBL	9-1-2022	1=1
CHECKED BY: BMJ	9-6-2022	DWG SCALE
APPROVED BY: TBL	9-6-2022	NTS
IGES PROJECT NO: 03511-020	SHEET NO: 7	REV 1



SECTION 2



PROJECT: Moonshadow Subdivision
PROJECT NO.: 03511-020
DATE: 9/1/2022

SECTION: 9-ft Exposed Rockery (Single/Top Tier)
SURCHARGE: None

Rockery Geometry & Soil Data:

$H_{\text{total}} =$	10	ft	Total Height of Rockery	Slope Geometry:	Backslope:	2.0	H	1.0	V
$H_R =$	9	ft	Exposed Height of Rockery	Backslope:	$\beta_{\text{eq}} =$	8.5	deg	Eq. Backslope Angle	
$\phi_s =$	34	deg	Soil Friction Angle - Effective	Soil Cut Angle:	$\alpha =$	82.9	deg	Soil Cut Angle	
$c_s =$	0	psf	Cohesion Intercept of soil	Rockery Face Slope:	1	H	2	V	
$\gamma_s =$	135	pcf	Unit weight of the soil						
$\gamma_R =$	150	pcf	Unit weight of the rock	Seismic Earth Pressure Coefficient:				(Mack et al., 2006)	
$\delta =$	34.0	deg	Interface Friction Angle	A =	0.285	Peak Ground Acceleration (7% in 75 years)			
$\psi =$	7.1	deg	Back Cut Inclination	d =	2.9	in (Allowable Displacement)			
$\mu =$	0.70		Frictional Component	$k_h =$	0.119	Use 1/2 of A? N			
$\mu_{\text{rock}} =$	0.55		Rock-to-Rock Friction	$k_v =$	0	(If "N" then use displacement-factored k_h)			
$K_A =$	0.229		Active Earth Pressure Coefficient	$\theta =$	6.76				
$v =$	63.4	deg	Rockery Face Angle	$K_{\text{AE}} =$	0.323				

Broken Back Slope: y		Backslope Rise: 3 ft	
Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.8	OK
External Overturning	2.0	4.5	OK
Individual Rock Overturning	2.0	5.8	OK
Individual Rock Sliding	1.5	2.6	OK
Bearing Capacity	2.0	5.1	OK
Seismic Overturning	1.5	2.0	OK
Seismic Sliding	1.1	1.6	OK
Seismic Bearing Capacity	1.5	6.4	OK

Surcharge:

Uniform: Uniform Applied Surcharge

$q_s =$ 0 psf
 $F_s =$ 0 lbf/ft (Horizontal Surcharge Load)
 $y_s =$ 5 ft (Surcharge load centroid)

Strip: Strip Load Surcharge

$q_s =$ 0 psf
 $x_s =$ 0 ft (Distance from soil cut)
 $W_s =$ 18 ft (Width of Strip Load)

$F_s =$ 0 lbf/ft (Horizontal Surcharge Load)
 $y_s =$ 0.0 ft

Factor of Safety against Bearing Capacity:

$e_{\text{max}} =$	0.750	$q_{\text{max}} =$	2,249	psf	$e_{s,s} =$	0.313	FS_{BC}	5.1
$e_s =$	-0.672	$q_{\text{ult}} =$	11,320	psf	$q_{\text{max},s} =$	1,772	FS_{BC,s}	6.4

Eccentricity Check (static): **OK**

Eccentricity Check (seismic): **OK**

Rocks = 5 (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _μ	F _{μ,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	4.5	0.7	2.9	10.0	4,642	16,740	1,369	2,645	3,735	3,989	4,553	11,151	20,151	22,054	2.8	4.5	1.6	2.0
2	3.5	0.7	2.3	7.1	2,777	7,852	684	1,371	1,718	1,818	1,607	4,148	9,167	9,897	2.6	5.8	1.4	2.4
3	3.0	0.7	2.0	4.8	1,668	3,622	314	676	1,005	1,050	499	1,398	4,131	4,410	3.3	8.3	1.6	3.2
4	2.5	0.7	1.6	2.8	863	1,351	110	270	506	522	103	337	1,497	1,576	4.7	>10	2.0	4.7
5	2.0	0.6	1.2	1.2	315	315	20	68	179	182	8	38	336	347	9.1	>10	2.7	9.2
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

10.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 8-ft Exposed Rockery (Single/Top Tier)

SURCHARGE: None

Rockery Geometry & Soil Data:

$H_{\text{total}} = 9$ ft Total Height of Rockery
 $H_R = 8$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{\text{rock}} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.231$ Active Earth Pressure Coefficient
 $v = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **2.0** H **1.0** V
 Backslope: $\beta_{\text{eq}} = 9.5$ deg Eq. Backslope Angle
 Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
 Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{\text{AE}} = 0.329$

Broken Back Slope: y		Backslope Rise: 3 ft	
Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.7	OK
External Overturning	2.0	4.4	OK
Individual Rock Overturning	2.0	5.7	OK
Individual Rock Sliding	1.5	2.6	OK
Bearing Capacity	2.0	4.9	OK
Seismic Overturning	1.5	2.0	OK
Seismic Sliding	1.1	1.5	OK
Seismic Bearing Capacity	1.5	6.6	OK

Surcharge:

Uniform: Uniform Applied Surcharge

$q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 4.5$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge

$q_s = 0$ psf
 $x_s = 0$ ft (Distance from soil cut)
 $W_s = 16$ ft (Width of Strip Load)

$F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 0.0$ ft

Factor of Safety against Bearing Capacity:

$e_{\text{max}} = 0.667$ $q_{\text{max}} = 2,138$ psf $e_{s,s} = 0.257$ **FS_{BC} 4.9**
 $e_s = -0.645$ $q_{\text{ult}} = 10,404$ psf $q_{\text{max},s} = 1,589$ **FS_{BC,s} 6.6**

Eccentricity Check (static): **OK**

Eccentricity Check (seismic): **OK**

Rocks = **5** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	4.0	0.7	2.6	9.0	3,776	12,383	1,128	2,173	3,044	3,255	3,385	8,300	14,884	16,299	2.7	4.4	1.5	2.0
2	3.5	0.7	2.3	6.4	2,314	5,819	571	1,147	1,432	1,516	1,217	3,128	6,908	7,517	2.6	5.7	1.4	2.5
3	2.5	0.7	1.6	4.1	1,205	2,285	237	505	729	764	326	913	2,606	2,785	3.1	8.0	1.6	3.1
4	2.0	0.7	1.3	2.5	656	956	87	211	385	398	73	239	1,048	1,099	4.5	>10	1.9	4.7
5	2.0	0.6	1.2	1.2	315	315	20	68	179	182	8	38	336	347	9.0	>10	2.7	9.2
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

9.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 8-ft Exposed Rockery (Single/Top Tier)

SURCHARGE: None

Rockery Geometry & Soil Data:

$H_{\text{total}} = 8$ ft Total Height of Rockery
 $H_R = 7$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{\text{rock}} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.261$ Active Earth Pressure Coefficient
 $v = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **2.0** H **1.0** V
 Backslope: $\beta_{\text{eq}} = 17.4$ deg Eq. Backslope Angle
 Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
 Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{\text{AE}} = 0.394$

Broken Back Slope: **y**
 Backslope Rise: **5** ft

Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.8	OK
External Overturning	2.0	4.7	OK
Individual Rock Overturning	2.0	6.4	OK
Individual Rock Sliding	1.5	2.6	OK
Bearing Capacity	2.0	6.6	OK
Seismic Overturning	1.5	2.0	OK
Seismic Sliding	1.1	1.5	OK
Seismic Bearing Capacity	1.5	7.0	OK

Surcharge:

Uniform: Uniform Applied Surcharge

$q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 4$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge

$q_s = 0$ psf
 $x_s = 0$ ft (Distance from soil cut)
 $W_s = 14$ ft (Width of Strip Load)

$F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 0.0$ ft

Factor of Safety against Bearing Capacity:

$e_{\text{max}} = 0.667$ $q_{\text{max}} = 1,688$ psf
 $e_s = -0.498$ $q_{\text{ult}} = 11,005$ psf

$e_{s,s} = 0.351$ **FS_{BC} 6.6**
 $q_{\text{max},s} = 1,573$ **FS_{BC,s} 7.0**

Eccentricity Check (static): **OK**

Eccentricity Check (seismic): **OK**

Rocks = **4** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	4.0	0.7	2.7	8.0	3,354	10,116	1,000	2,023	2,703	2,920	2,656	6,941	12,311	13,741	2.8	4.7	1.5	2.0
2	3.0	0.7	2.1	5.3	1,824	4,120	434	916	1,124	1,199	759	2,113	4,828	5,285	2.6	6.4	1.4	2.6
3	2.5	0.7	1.8	3.2	958	1,556	156	366	571	597	164	513	1,764	1,897	3.7	>10	1.7	3.7
4	2.0	0.7	1.4	1.4	368	368	31	93	211	216	14	61	400	420	6.9	>10	2.4	7.0
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

8.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 6-ft Exposed Rockery (Single/Top Tier)

SURCHARGE: None

Rockery Geometry & Soil Data:

$H_{\text{total}} =$	7	ft	Total Height of Rockery	Slope Geometry:	Backslope:	2.0	H	1.0	V
$H_R =$	6	ft	Exposed Height of Rockery	Backslope:	$\beta_{\text{eq}} =$	19.7	deg	Eq. Backslope Angle	
$\phi_s =$	34	deg	Soil Friction Angle - Effective	Soil Cut Angle:	$\alpha =$	82.9	deg	Soil Cut Angle	
$c_s =$	0	psf	Cohesion Intercept of soil	Rockery Face Slope:	1	H	2	V	
$\gamma_s =$	135	pcf	Unit weight of the soil	Seismic Earth Pressure Coefficient:					
$\gamma_R =$	150	pcf	Unit weight of the rock	(Mack et al., 2006)					
$\delta =$	34.0	deg	Interface Friction Angle	A =	0.285	Peak Ground Acceleration (7% in 75 years)			
$\psi =$	7.1	deg	Back Cut Inclination	d =	2.9	in (Allowable Displacement)			
$\mu =$	0.70		Frictional Component	$k_h =$	0.119	Use 1/2 of A? N			
$\mu_{\text{rock}} =$	0.55		Rock-to-Rock Friction	$k_v =$	0	(If "N" then use displacement-factored k_h)			
$K_A =$	0.273		Active Earth Pressure Coefficient	$\theta =$	6.76				
$v =$	63.4	deg	Rockery Face Angle	$K_{\text{AE}} =$	0.424				

Broken Back Slope: **y**

Backslope Rise: **5** ft

Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.7	OK
External Overturning	2.0	4.8	OK
Individual Rock Overturning	2.0	6.9	OK
Individual Rock Sliding	1.5	2.7	OK
Bearing Capacity	2.0	6.1	OK
Seismic Overturning	1.5	2.0	OK
Seismic Sliding	1.1	1.5	OK
Seismic Bearing Capacity	1.5	7.1	OK

Surcharge:

Uniform: Uniform Applied Surcharge

$q_s =$	0	psf
$F_s =$	0	lb/ft (Horizontal Surcharge Load)
$y_s =$	3.5	ft (Surcharge load centroid)

Strip: Strip Load Surcharge

$q_s =$	0	psf
$x_s =$	0	ft (Distance from soil cut)
$W_s =$	12	ft (Width of Strip Load)

$F_s =$	0	lb/ft (Horizontal Surcharge Load)
$y_s =$	0.0	ft

Factor of Safety against Bearing Capacity:

$e_{\text{max}} =$	0.583	$q_{\text{max}} =$	1,648	psf	$e_{s,s} =$	0.283	FS_{BC}	6.1	Eccentricity Check (static): OK
$e_s =$	-0.505	$q_{\text{ult}} =$	9,956	psf	$q_{\text{max},s} =$	1,406	FS_{BC,s}	7.1	Eccentricity Check (seismic): OK

Rocks = **4** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW_i	$\Sigma W_i * x_i$	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	3.5	0.7	2.5	7.0	2,681	7,302	807	1,655	2,163	2,351	1,882	5,071	8,852	9,934	2.7	4.8	1.5	2.0
2	3.0	0.7	2.0	4.6	1,487	2,998	341	741	913	975	517	1,485	3,549	3,928	2.7	6.9	1.4	2.7
3	2.0	0.7	1.3	2.6	683	1,015	111	265	406	427	96	316	1,134	1,216	3.7	>10	1.7	3.9
4	2.0	0.7	1.3	1.3	341	341	28	87	195	201	12	53	370	390	7.1	>10	2.4	7.5
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 5-ft Exposed Rockery (Single/Top Tier)

SURCHARGE: None

Rockery Geometry & Soil Data:

$H_{total} = 6$ ft Total Height of Rockery
 $H_R = 5$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{rock} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.293$ Active Earth Pressure Coefficient
 $v = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **2.0** H **1.0** V
 Backslope: $\beta_{eq} = 22.6$ deg Eq. Backslope Angle
 Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
 Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{AE} = 0.479$

Broken Back Slope: **y**
 Backslope Rise: **5** ft

Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.6	OK
External Overturning	2.0	4.6	OK
Individual Rock Overturning	2.0	6.4	OK
Individual Rock Sliding	1.5	2.5	OK
Bearing Capacity	2.0	6.0	OK
Seismic Overturning	1.5	1.9	OK
Seismic Sliding	1.1	1.4	OK
Seismic Bearing Capacity	1.5	7.0	OK

Surcharge:

Uniform: Uniform Applied Surcharge

$q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 3$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge

$q_s = 0$ psf
 $x_s = 0$ ft (Distance from soil cut)
 $W_s = 10$ ft (Width of Strip Load)

$F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 0.0$ ft

Factor of Safety against Bearing Capacity:

$e_{max} = 0.500$ $q_{max} = 1,523$ psf
 $e_s = -0.496$ $q_{ult} = 9,003$ psf

$e_{s,s} = 0.277$ **FS_{BC} 6.0**
 $q_{max,s} = 1,295$ **FS_{BC,s} 7.0**

Eccentricity Check (static): **OK**

Eccentricity Check (seismic): **OK**

Rocks = **4** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _O	M _{O,s}	M _T	M _{T,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	3.0	0.6	1.8	6.0	1,973	4,811	639	1,342	1,608	1,778	1,284	3,642	5,864	6,700	2.6	4.6	1.4	1.9
2	2.5	0.7	1.6	4.2	1,231	2,366	314	695	765	830	443	1,328	2,793	3,128	2.5	6.4	1.2	2.4
3	2.0	0.7	1.3	2.6	683	1,015	119	289	409	433	103	347	1,142	1,241	3.5	>10	1.5	3.6
4	2.0	0.7	1.3	1.3	341	341	30	92	196	202	13	57	372	396	6.6	>10	2.2	7.1
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

6.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 4-ft Exposed Rockery (Single/Top Tier)

SURCHARGE: None

Rockery Geometry & Soil Data:

$H_{total} = 5$ ft Total Height of Rockery
 $H_R = 4$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{rock} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.329$ Active Earth Pressure Coefficient
 $\nu = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **2.0** H **1.0** V
 Backslope: $\beta_{eq} = 26.6$ deg Eq. Backslope Angle
 Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
 Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{AE} = 0.661$

Broken Back Slope: y		Backslope Rise: 5 ft	
Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.7	OK
External Overturning	2.0	5.2	OK
Individual Rock Overturning	2.0	8.9	OK
Individual Rock Sliding	1.5	3.0	OK
Bearing Capacity	2.0	7.2	OK
Seismic Overturning	1.5	1.8	OK
Seismic Sliding	1.1	1.3	OK
Seismic Bearing Capacity	1.5	7.2	OK

Surcharge:

Uniform: Uniform Applied Surcharge
 $q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 2.5$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge
 $q_s = 0$ psf
 $x_s = 0$ ft (Distance from soil cut)
 $W_s = 8$ ft (Width of Strip Load)
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 0.0$ ft

Factor of Safety against Bearing Capacity:

$e_{max} = 0.500$ $q_{max} = 1,003$ psf $e_{s,s} = 0.452$ **FS_{BC} 9.8** Eccentricity Check (static): **OK**
 $e_s = -0.293$ $q_{ult} = 9,804$ psf $q_{max,s} = 1,364$ **FS_{BC,s} 7.2** Eccentricity Check (seismic): **OK**

Rocks = **3** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	3.0	0.7	2.2	5.0	1,646	3,421	495	1,244	1,327	1,524	825	2,919	4,225	5,172	2.7	5.2	1.3	1.8
2	2.0	0.7	1.5	2.8	730	1,093	153	411	444	492	142	548	1,257	1,449	3.0	8.9	1.2	2.7
3	2.0	0.7	1.3	1.3	341	341	33	111	197	207	14	70	376	416	5.9	>10	1.9	6.0
4	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

5.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 7-ft Exposed Rockery (Bottom Tier)

SURCHARGE: Upper Tier

Rockery Geometry & Soil Data:

$H_{\text{total}} = 8$ ft Total Height of Rockery
 $H_R = 7$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{\text{rock}} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.207$ Active Earth Pressure Coefficient
 $\nu = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **1.0** H **0.0** V
 Backslope: $\beta_{\text{eq}} = 0.0$ deg Eq. Backslope Angle
 Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
 Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{AE} = 0.284$

Broken Back Slope: **N**
 Backslope Rise: **0** ft

Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.4	OK
External Overturning	2.0	4.9	OK
Individual Rock Overturning	2.0	7.6	OK
Individual Rock Sliding	1.5	2.5	OK
Bearing Capacity	2.0	5.8	OK
Seismic Overturning	1.5	2.3	OK
Seismic Sliding	1.1	1.5	OK
Seismic Bearing Capacity	1.5	8.5	OK

Surcharge:

Uniform: Uniform Applied Surcharge
 $q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 4$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge
 $q_s = 900$ psf
 $x_s = 4$ ft (Distance from soil cut)
 $W_s = 10$ ft (Width of Strip Load)
 $F_s = 326$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 2.0$ ft

Factor of Safety against Bearing Capacity:

$e_{\text{max}} = 0.667$ $q_{\text{max}} = 1,827$ psf $e_{s,s} = 0.179$ **FS_{BC} = 5.8** Eccentricity Check (static): **OK**
 $e_s = 0.622$ $q_{\text{ult}} = 10,495$ psf $q_{\text{max},s} = 1,246$ **FS_{BC,s} = 8.5** Eccentricity Check (seismic): **OK**

Rocks = **4** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _μ	F _{μ,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	4.0	0.7	2.8	8.0	3,375	10,153	1,123	1,907	2,645	2,780	2,448	5,636	11,902	12,790	2.4	4.9	1.5	2.3
2	3.0	0.7	2.0	5.2	1,800	4,054	437	811	1,084	1,128	612	1,614	4,602	4,878	2.5	7.6	1.4	3.1
3	2.5	0.7	1.8	3.2	958	1,556	124	297	561	578	130	410	1,721	1,803	4.6	>10	2.0	4.4
4	2.0	0.7	1.4	1.4	368	368	24	80	209	212	11	52	393	405	8.6	>10	2.7	7.9
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

8.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 6-ft Exposed Rockery (Bottom Tier)

SURCHARGE: Upper Tier

Rockery Geometry & Soil Data:

$H_{\text{total}} = 7$ ft Total Height of Rockery
 $H_R = 6$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{\text{rock}} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.207$ Active Earth Pressure Coefficient
 $v = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **1.0** H **0.0** V
 Backslope: $\beta_{\text{eq}} = 0.0$ deg Eq. Backslope Angle
 Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
 Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{AE} = 0.284$

Broken Back Slope: **N**
 Backslope Rise: **0** ft

Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.5	OK
External Overturning	2.0	5.3	OK
Individual Rock Overturning	2.0	8.6	OK
Individual Rock Sliding	1.5	3.0	OK
Bearing Capacity	2.0	7.2	OK
Seismic Overturning	1.5	2.4	OK
Seismic Sliding	1.1	1.6	OK
Seismic Bearing Capacity	1.5	10.8	OK

Surcharge:

Uniform: Uniform Applied Surcharge

$q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 3.5$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge

$q_s = 900$ psf
 $x_s = 4$ ft (Distance from soil cut)
 $W_s = 8$ ft (Width of Strip Load)

$F_s = 230$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 1.5$ ft

Factor of Safety against Bearing Capacity:

$e_{\text{max}} = 0.583$ $q_{\text{max}} = 1,448$ psf
 $e_s = 0.405$ $q_{\text{ult}} = 10,361$ psf

$e_{s,s} = 0.049$ $FS_{BC} = 7.2$
 $q_{\text{max},s} = 962$ $FS_{BC,s} = 10.8$

Eccentricity Check (static): **OK**

Eccentricity Check (seismic): **OK**

Rocks = **4** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	3.5	0.7	2.5	7.0	2,681	7,302	842	1,452	2,094	2,198	1,600	3,790	8,477	9,074	2.5	5.3	1.6	2.4
2	3.0	0.7	2.0	4.6	1,487	2,998	302	602	890	924	398	1,091	3,416	3,625	3.0	8.6	1.6	3.4
3	2.0	0.7	1.3	2.6	683	1,015	84	206	399	410	73	241	1,105	1,150	4.8	>10	2.0	4.8
4	2.0	0.7	1.3	1.3	341	341	21	72	194	196	9	43	363	374	9.2	>10	2.8	8.7
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)



PROJECT: Moonshadow Subdivision

PROJECT NO.: 03511-020

DATE: 9/1/2022

SECTION: 5-ft Exposed Rockery (Bottom Tier)

SURCHARGE: Upper Tier

Rockery Geometry & Soil Data:

$H_{\text{total}} = 6$ ft Total Height of Rockery
 $H_R = 5$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{\text{rock}} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.207$ Active Earth Pressure Coefficient
 $\nu = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **1.0** H **0.0** V
 Backslope: $\beta_{\text{eq}} = 0.0$ deg Eq. Backslope Angle
 Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
 Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{\text{AE}} = 0.284$

Broken Back Slope: N		Backslope Rise: 0 ft	
Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	2.7	OK
External Overturning	2.0	5.8	OK
Individual Rock Overturning	2.0	8.5	OK
Individual Rock Sliding	1.5	3.1	OK
Bearing Capacity	2.0	9.6	OK
Seismic Overturning	1.5	2.5	OK
Seismic Sliding	1.1	1.6	OK
Seismic Bearing Capacity	1.5	12.1	OK

Surcharge:

Uniform: Uniform Applied Surcharge
 $q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 3$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge
 $q_s = 900$ psf
 $x_s = 4$ ft (Distance from soil cut)
 $W_s = 6$ ft (Width of Strip Load)
 $F_s = 130$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 1.0$ ft

Factor of Safety against Bearing Capacity:

$e_{\text{max}} = 0.500$ $q_{\text{max}} = 1,055$ psf $e_{s,s} = -0.052$ **FS_{BC} 9.6** Eccentricity Check (static): **OK**
 $e_s = 0.219$ $q_{\text{ult}} = 10,104$ psf $q_{\text{max},s} = 841$ **FS_{BC,s} 12.1** Eccentricity Check (seismic): **OK**

Rocks = **4** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW _i	ΣW _i *x _i	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _o	M _{o,s}	M _r	M _{r,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	3.0	0.6	1.8	6.0	1,973	4,811	583	1,028	1,542	1,619	975	2,390	5,557	5,936	2.7	5.8	1.6	2.5
2	2.5	0.7	1.6	4.2	1,231	2,366	244	496	739	769	315	875	2,668	2,820	3.1	8.5	1.6	3.3
3	2.0	0.7	1.3	2.6	683	1,015	84	206	399	410	73	241	1,105	1,150	4.8	>10	2.0	4.8
4	2.0	0.7	1.3	1.3	341	341	21	72	194	196	9	43	363	374	9.2	>10	2.8	8.7
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

6.0 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)

PROJECT: Moonshadow Subdivision
PROJECT NO.: 03511-020
DATE: 9/1/2022

SECTION: 4-ft Exposed Rockery (Bottom Tier)
SURCHARGE: Upper Tier



Rockery Geometry & Soil Data:

$H_{total} = 5$ ft Total Height of Rockery
 $H_R = 4$ ft Exposed Height of Rockery
 $\phi_s = 34$ deg Soil Friction Angle - Effective
 $c_s = 0$ psf Cohesion Intercept of soil
 $\gamma_s = 135$ pcf Unit weight of the soil
 $\gamma_R = 150$ pcf Unit weight of the rock
 $\delta = 34.0$ deg Interface Friction Angle
 $\psi = 7.1$ deg Back Cut Inclination
 $\mu = 0.70$ Frictional Component
 $\mu_{rock} = 0.55$ Rock-to-Rock Friction
 $K_A = 0.207$ Active Earth Pressure Coefficient
 $v = 63.4$ deg Rockery Face Angle

Slope Geometry: Backslope: **1.0** H **0.0** V
Bedslope: $\beta_{eq} = 0.0$ deg Eq. Backslope Angle
Soil Cut Angle: $\alpha = 82.9$ deg Soil Cut Angle
Rockery Face Slope: **1** H **2** V

Seismic Earth Pressure Coefficient: (Mack et al., 2006)
 $A = 0.285$ Peak Ground Acceleration (7% in 75 years)
 $d = 2.9$ in (Allowable Displacement)
 $k_h = 0.119$ Use 1/2 of A? **N**
 $k_v = 0$ (If "N" then use displacement-factored k_h)
 $\theta = 6.76$
 $K_{AE} = 0.284$

Broken Back Slope: **N**
Bedslope Rise: **0** ft

Failure Mechanism	FS Required	FS Obtained	OK
External Sliding	1.5	3.4	OK
External Overturning	2.0	7.2	OK
Individual Rock Overturning	2.0	>10	OK
Individual Rock Sliding	1.5	4.3	OK
Bearing Capacity	2.0	>10	OK
Seismic Overturning	1.5	2.9	OK
Seismic Sliding	1.1	1.9	OK
Seismic Bearing Capacity	1.5	16.5	OK

Surcharge:

Uniform: Uniform Applied Surcharge
 $q_s = 0$ psf
 $F_s = 0$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 2.5$ ft (Surcharge load centroid)

Strip: Strip Load Surcharge
 $q_s = 900$ psf
 $x_s = 4$ ft (Distance from soil cut)
 $W_s = 4$ ft (Width of Strip Load)
 $F_s = 59$ lbf/ft (Horizontal Surcharge Load)
 $y_s = 0.5$ ft

Factor of Safety against Bearing Capacity:

$e_{max} = 0.500$ $q_{max} = 752$ psf $e_{s,s} = 0.008$ **FS_{BC} 14.0** Eccentricity Check (static): **OK**
 $e_s = 0.117$ $q_{ult} = 10,519$ psf $q_{max,s} = 640$ **FS_{BC,s} 16.5** Eccentricity Check (seismic): **OK**

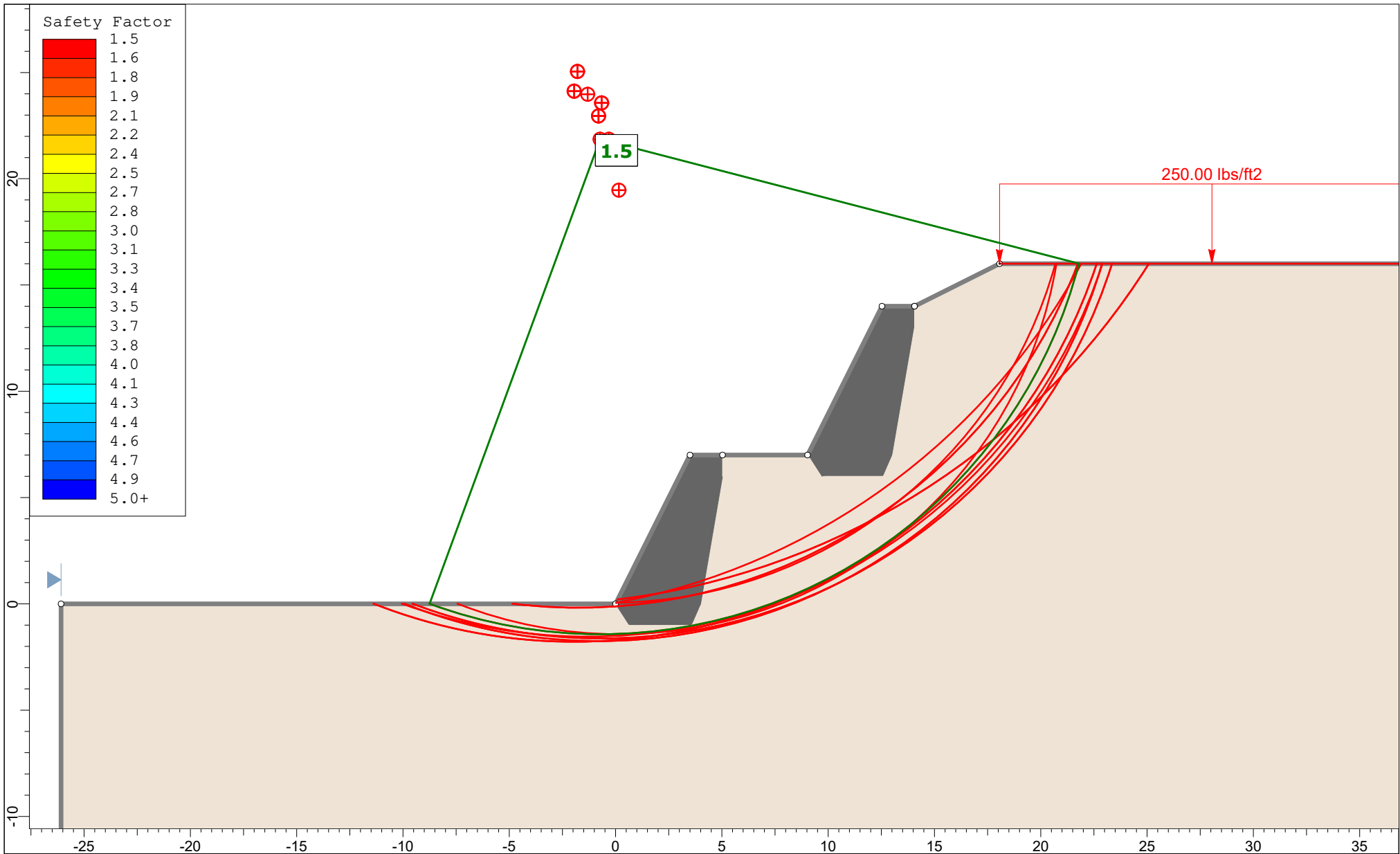
Rocks = **3** (R* - Boulder Height to Width Ratio)

Boulder	B' (ft)	R*	H _R (ft)	H-H' (ft)	ΣW_i	$\Sigma W_i * x_i$	F _H	F _{H,s}	F _{IL}	F _{IL,s}	M _O	M _{O,s}	M _T	M _{T,s}	FS _{SL}	FS _{OT}	FS _{SL,s}	FS _{OT,s}
1	3.0	0.7	2.2	5.1	1,672	3,513	384	720	1,285	1,340	567	1,490	4,042	4,308	3.4	7.2	1.9	2.9
2	2.0	0.7	1.5	2.9	756	1,157	104	243	445	458	99	314	1,268	1,323	4.3	>10	1.9	4.3
3	2.0	0.7	1.4	1.4	368	368	24	80	209	212	11	52	393	405	8.6	>10	2.7	7.9
4	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	0.0	0.0	0.0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

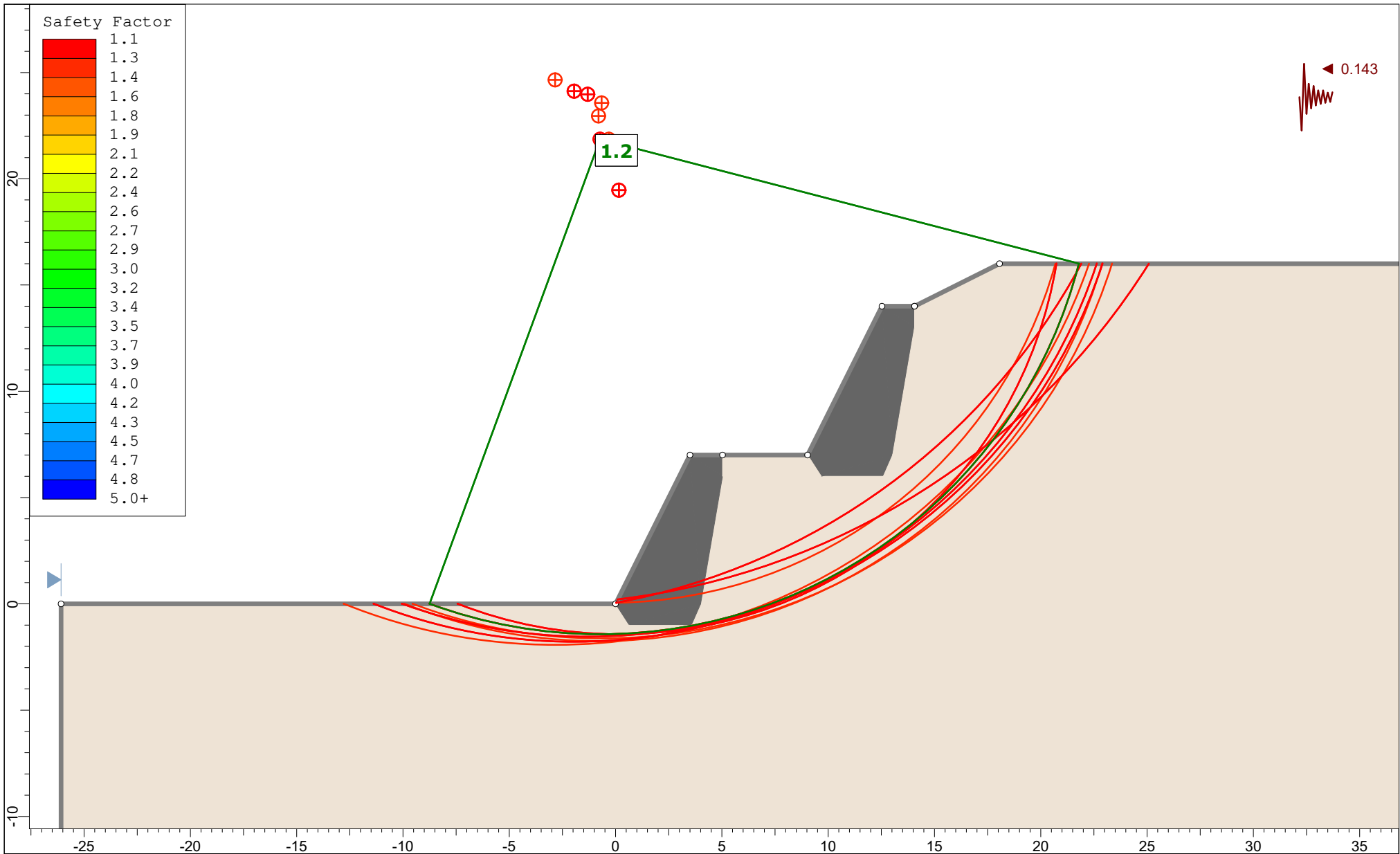
5.1 Total Estimated Height of Rockery

(See Mack, et. al [2006], Rockery Design and Construction Guidelines, Report No. FHWA-CFL/TD-06-006, Report Dated November 2006 - for term definitions and equations)

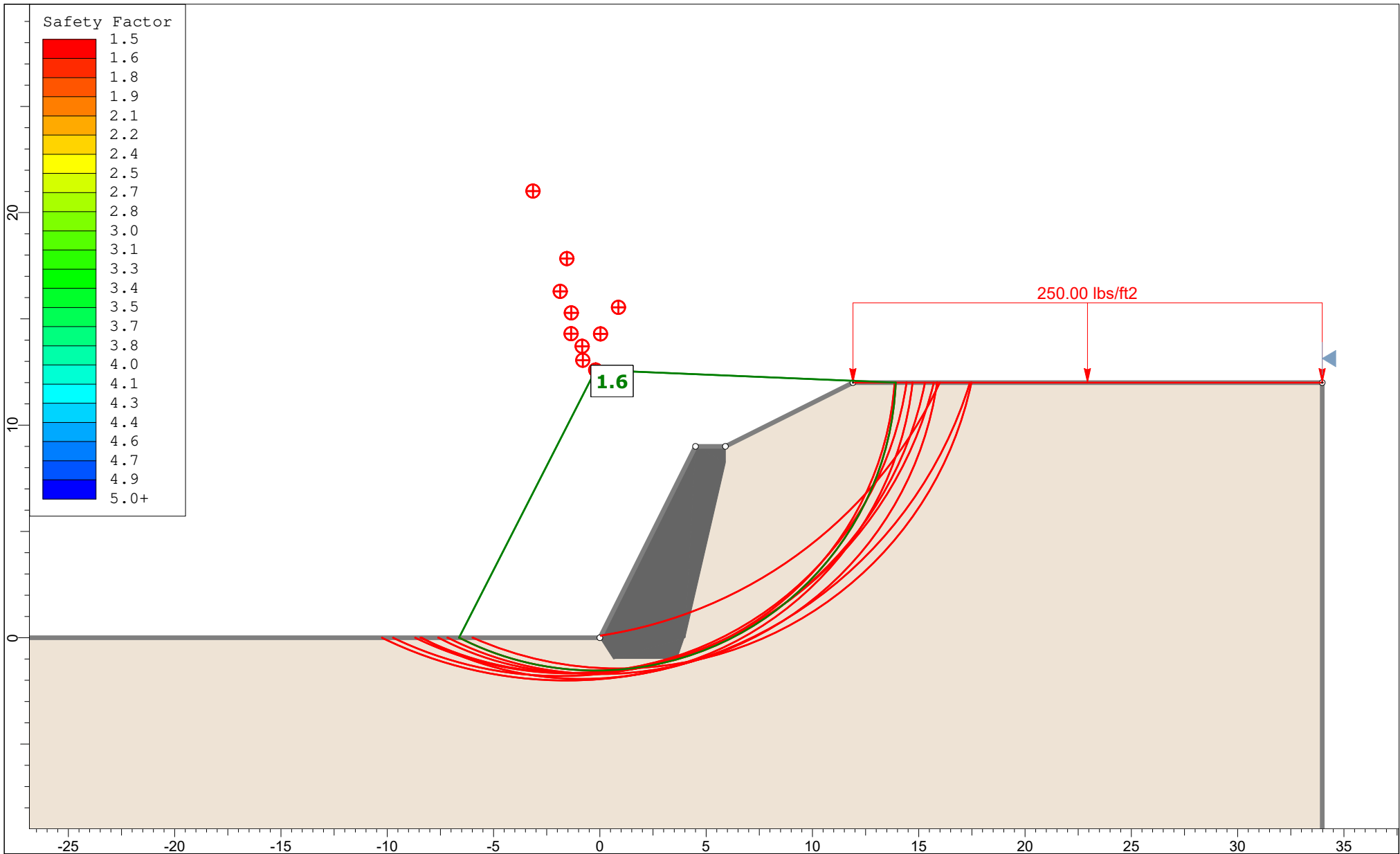
SECTION 3



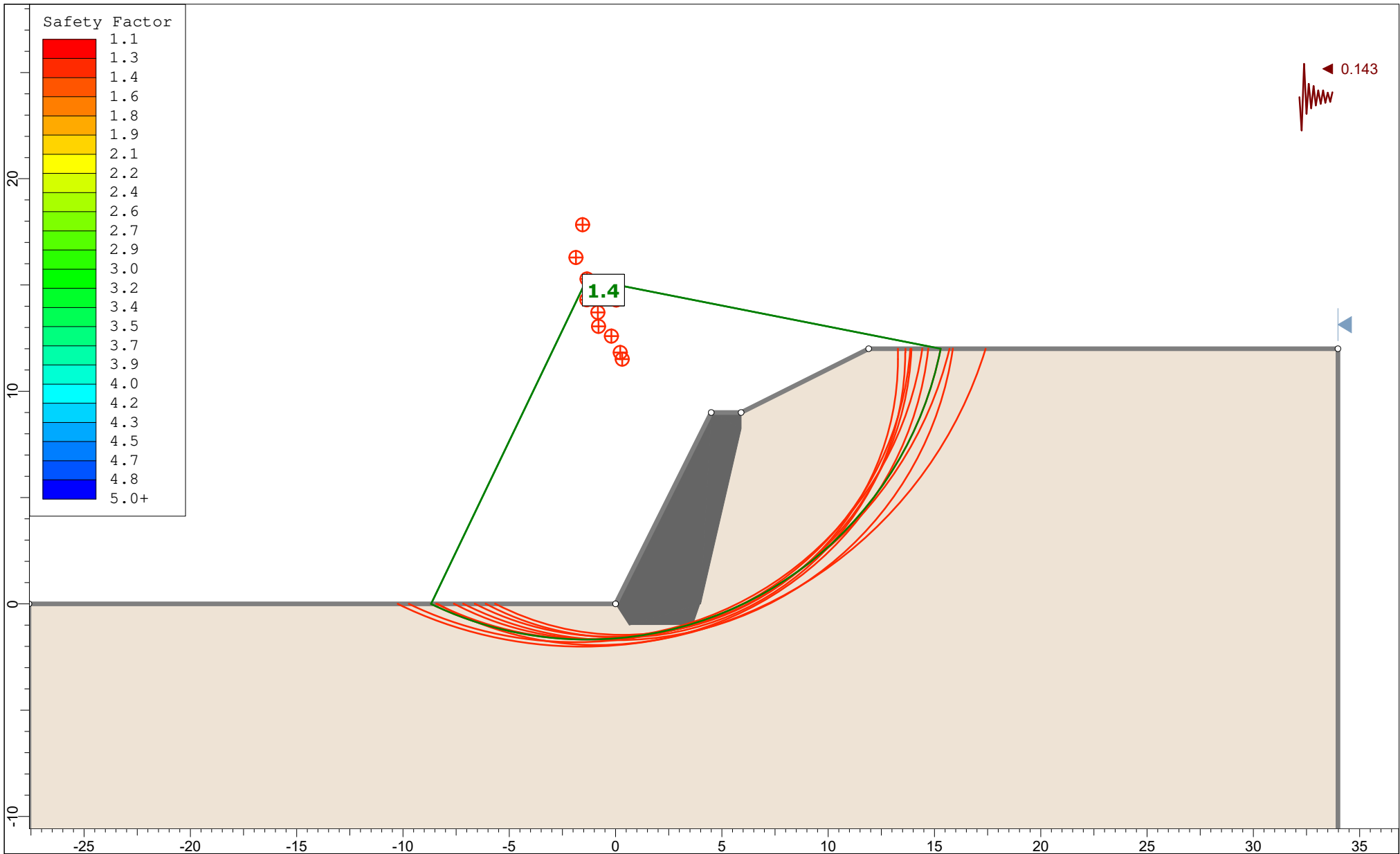
Project			
Moonshadow Development - Rockeries			
Analysis Description			
Global Stability Analysis - Rockeries 1 & 2 - Static			
Drawn By	Tyler Loertscher	Scale	1:75
		Company	IGES, Inc.
Date	9/1/2022	File Name	03511-020.slmd



Project			
Moonshadow Development - Rockeries			
Analysis Description			
Global Stability Analysis - Rockeries 1 & 2 - Seismic			
Drawn By	Tyler Loertscher	Scale	1:75
		Company	IGES, Inc.
Date	9/1/2022	File Name	03511-020.slmd



Project			
Moonshadow Development - Rockeries			
Analysis Description			
Global Stability Analysis - Rockery 3 - Static			
Drawn By	Tyler Loertscher	Scale	1:75
Date	9/1/2022	Company	IGES, Inc.
		File Name	03511-020.slmd



Project			
Moonshadow Development - Rockeries			
Analysis Description			
Global Stability Analysis - Rockery 3 - Seismic			
Drawn By	Tyler Loertscher	Scale	1:75
		Company	IGES, Inc.
Date	9/1/2022	File Name	03511-020.slmd

Slide2 Analysis Information

03511-020

Project Summary

File Name: 03511-020.slmd
Slide2 Modeler Version: 9.024
Project Title: Moonshadow Development - Rockeries
Analysis: Global Stability Analysis
Author: Tyler Loertscher
Company: IGES, Inc.
Date Created: 9/1/2022

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Rockeries 1 & 2 	Static	Spencer: 1.474700	00h:00m:01.20s
	Seismic	Spencer: 1.234070	00h:00m:01.44s
Rockery 3 	Static	Spencer: 1.573550	00h:00m:01.16s
	Seismic	Spencer: 1.357970	00h:00m:00.996s

Seismic Loading

Rockeries 1 & 2 - Static

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Rockeries 1 & 2 - Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No
Seismic Load Coefficient (Horizontal): 0.143

Rockery 3 - Static

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Rockery 3 - Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No
Seismic Load Coefficient (Horizontal): 0.143

Loading

Rockeries 1 & 2 - Static

 Distribution: Constant
Magnitude [psf]: 250
Orientation: Normal to boundary

Rockery 3 - Static

Distribution: Constant
 Magnitude [psf]: 250
 Orientation: Normal to boundary

Materials

Native

Color 
 Strength Type Mohr-Coulomb
 Unit Weight [lbs/ft3] 135
 Cohesion [psf] 50
 Friction Angle [deg] 34
 Water Surface Assigned per scenario
 Ru Value 0

Rockery

Color 
 Strength Type Anisotropic strength
 Unit Weight [lbs/ft3] 150
 Cohesion 1 [psf] 0
 Cohesion 2 [psf] 3000
 Friction Angle 1 [deg] 45
 Friction Angle 2 [deg] 0
 Angle from 1 [deg] -10
 Water Surface Assigned per scenario
 Ru Value 0

Materials In Use

Material		Static	Seismic	Static	Seismic
Native		✓	✓	✓	✓
Rockery		✓	✓	✓	✓

Global Minimums

Rockeries 1 & 2 - Static

Method: spencer

	FS	1.474700
Center:	-0.731, 21.857	
Radius:	23.283	
Left Slip Surface Endpoint:	-8.754, -0.000	
Right Slip Surface Endpoint:	21.804, 16.000	
Resisting Moment:	404419 lb-ft	
Driving Moment:	274239 lb-ft	
Resisting Horizontal Force:	14417.6 lb	
Driving Horizontal Force:	9776.64 lb	
Total Slice Area:	166.489 ft2	
Surface Horizontal Width:	30.5584 ft	
Surface Average Height:	5.44821 ft	

Rockeries 1 & 2 - Seismic

Method: spencer

	FS	1.234070
Center:	-0.731, 21.857	
Radius:	23.283	
Left Slip Surface Endpoint:	-8.754, -0.000	
Right Slip Surface Endpoint:	21.804, 16.000	
Resisting Moment:	377170 lb-ft	
Driving Moment:	305632 lb-ft	
Resisting Horizontal Force:	13811.6 lb	
Driving Horizontal Force:	11191.9 lb	
Total Slice Area:	166.489 ft ²	
Surface Horizontal Width:	30.5584 ft	
Surface Average Height:	5.44821 ft	

Rockery 3 - Static

Method: spencer

	FS	1.573550
Center:	-0.208, 12.594	
Radius:	14.137	
Left Slip Surface Endpoint:	-6.631, 0.000	
Right Slip Surface Endpoint:	13.917, 12.000	
Resisting Moment:	160317 lb-ft	
Driving Moment:	101882 lb-ft	
Resisting Horizontal Force:	9270.52 lb	
Driving Horizontal Force:	5891.45 lb	
Total Slice Area:	105.175 ft ²	
Surface Horizontal Width:	20.5479 ft	
Surface Average Height:	5.11852 ft	

Rockery 3 - Seismic

Method: spencer

	FS	1.357970
Center:	-1.348, 15.283	
Radius:	16.954	
Left Slip Surface Endpoint:	-8.686, 0.000	
Right Slip Surface Endpoint:	15.285, 12.000	
Resisting Moment:	200621 lb-ft	
Driving Moment:	147736 lb-ft	
Resisting Horizontal Force:	10110.9 lb	
Driving Horizontal Force:	7445.59 lb	
Total Slice Area:	115.162 ft ²	
Surface Horizontal Width:	23.9715 ft	
Surface Average Height:	4.80413 ft	

Global Minimum Support Data

All Open Scenarios

No Supports Present

Slice Data

Rockeries 1 & 2 - Static

Global Minimum Query (spencer) - Safety Factor: 1.4747

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.22234	33.8844	-18.5713	Native	50	34	91.0715	134.303	124.985	0	124.985	94.3867	94.3867
2	1.22234	95.594	-15.4242	Native	50	34	128.955	190.17	207.81	0	207.81	172.231	172.231
3	1.22234	145.453	-12.3242	Native	50	34	151.807	223.87	257.773	0	257.773	224.607	224.607
4	1.22234	183.931	-9.26062	Native	50	34	163.951	241.778	284.323	0	284.323	257.591	257.591
5	1.22234	211.373	-6.22357	Native	50	34	168.12	247.927	293.439	0	293.439	275.105	275.105
6	1.22234	228.017	-3.20403	Native	50	34	166.124	244.983	289.074	0	289.074	279.774	279.774
7	1.22234	234.003	-0.193401	Native	50	34	159.204	234.778	273.945	0	273.945	273.408	273.408
8	1.22234	397.305	2.81669	Native	50	34	225.49	332.53	418.868	0	418.868	429.962	429.962
9	1.22234	832.149	5.83461	Native	50	34	401.31	591.812	803.27	0	803.27	844.279	844.279
10	1.22234	1254.34	8.86892	Native	50	34	551.726	813.63	1132.13	0	1132.13	1218.22	1218.22
11	1.22234	1418.07	11.9286	Native	50	34	585.361	863.232	1205.67	0	1205.67	1329.33	1329.33
12	1.22234	1267.84	15.0233	Native	50	34	499.903	737.207	1018.83	0	1018.83	1152.99	1152.99
13	1.22234	1197.61	18.1637	Native	50	34	449.889	663.451	909.478	0	909.478	1057.08	1057.08
14	1.22234	1125.07	21.3619	Native	50	34	403.102	594.455	807.187	0	807.187	964.852	964.852
15	1.22234	1088.27	24.6317	Native	50	34	370.913	546.985	736.811	0	736.811	906.877	906.877
16	1.22234	1383.5	27.9899	Native	50	34	437.586	645.308	882.577	0	882.577	1115.15	1115.15
17	1.22234	1716.52	31.4567	Native	50	34	505.168	744.971	1030.34	0	1030.34	1339.38	1339.38
18	1.22234	1946.58	35.0576	Native	50	34	535.229	789.302	1096.06	0	1096.06	1471.63	1471.63
19	1.22234	1741.63	38.8261	Native	50	34	452.171	666.816	914.471	0	914.471	1278.37	1278.37
20	1.22234	1604.49	42.8074	Native	50	34	390.563	575.963	779.775	0	779.775	1141.53	1141.53
21	1.22234	1503.52	47.0664	Native	50	34	339.955	501.331	669.127	0	669.127	1034.53	1034.53
22	1.22234	1368.07	51.7023	Native	50	34	288.121	424.892	555.798	0	555.798	920.653	920.653
23	1.22234	1130.15	56.8836	Native	50	34	265.403	391.39	506.129	0	506.129	913.003	913.003
24	1.22234	778.066	62.946	Native	50	34	178.167	262.743	315.404	0	315.404	664.263	664.263
25	1.22234	290.296	70.8422	Native	50	34	89.0059	131.257	120.468	0	120.468	376.666	376.666

◆ Rockeries 1 & 2 - Seismic

Global Minimum Query (spencer) - Safety Factor: 1.23407

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.22234	33.8844	-18.5713	Native	50	34	162.083	200.022	222.417	0	222.417	167.96	167.96
2	1.22234	95.594	-15.4242	Native	50	34	210.167	259.361	310.39	0	310.39	252.405	252.405
3	1.22234	145.453	-12.3242	Native	50	34	231.621	285.837	349.643	0	349.643	299.039	299.039
4	1.22234	183.931	-9.26062	Native	50	34	237.498	293.089	360.394	0	360.394	321.67	321.67
5	1.22234	211.373	-6.22357	Native	50	34	233.582	288.257	353.23	0	353.23	327.758	327.758
6	1.22234	228.017	-3.20403	Native	50	34	223.091	275.31	334.036	0	334.036	321.548	321.548
7	1.22234	234.003	-0.193401	Native	50	34	207.914	256.58	306.268	0	306.268	305.566	305.566
8	1.22234	397.305	2.81669	Native	50	34	284.946	351.643	447.205	0	447.205	461.224	461.224
9	1.22234	832.149	5.83461	Native	50	34	491.851	606.979	825.757	0	825.757	876.018	876.018
10	1.22234	1254.34	8.86892	Native	50	34	661.068	815.804	1135.35	0	1135.35	1238.51	1238.51
11	1.22234	1418.07	11.9286	Native	50	34	688.835	850.071	1186.15	0	1186.15	1331.67	1331.67
12	1.22234	1267.84	15.0233	Native	50	34	579.772	715.479	986.611	0	986.611	1142.21	1142.21
13	1.22234	1197.61	18.1637	Native	50	34	514.731	635.214	867.618	0	867.618	1036.49	1036.49
14	1.22234	1125.07	21.3619	Native	50	34	455.53	562.156	759.302	0	759.302	937.472	937.472
15	1.22234	1088.27	24.6317	Native	50	34	414.246	511.209	683.771	0	683.771	873.705	873.705
16	1.22234	1383.5	27.9899	Native	50	34	481.773	594.541	807.316	0	807.316	1063.37	1063.37
17	1.22234	1716.52	31.4567	Native	50	34	548.775	677.227	929.9	0	929.9	1265.62	1265.62
18	1.22234	1946.58	35.0576	Native	50	34	574.388	708.835	976.761	0	976.761	1379.81	1379.81
19	1.22234	1741.63	38.8261	Native	50	34	480.537	593.016	805.058	0	805.058	1191.78	1191.78
20	1.22234	1604.49	42.8074	Native	50	34	411.004	507.208	677.837	0	677.837	1058.53	1058.53
21	1.22234	1503.52	47.0664	Native	50	34	354.165	437.065	573.848	0	573.848	954.527	954.527
22	1.22234	1368.07	51.7023	Native	50	34	293.533	362.24	462.915	0	462.915	834.623	834.623
23	1.22234	1130.15	56.8836	Native	50	34	219.348	270.691	327.187	0	327.187	663.457	663.457
24	1.22234	778.066	62.946	Native	50	34	137.263	169.392	177.005	0	177.005	445.772	445.772
25	1.22234	290.296	70.8422	Native	50	34	58.4232	72.0983	32.7622	0	32.7622	200.929	200.929

◆ Rockery 3 - Static

Global Minimum Query (spencer) - Safety Factor: 1.57355

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.821915	21.4399	-25.182	Native	50	34	99.2196	156.127	157.34	0	157.34	110.689	110.689
2	0.821915	60.8879	-21.5502	Native	50	34	133.984	210.831	238.442	0	238.442	185.528	185.528
3	0.821915	93.7189	-18.0076	Native	50	34	153.514	241.562	284.002	0	284.002	234.1	234.1
4	0.821915	120.364	-14.5351	Native	50	34	163.729	257.636	307.834	0	307.834	265.384	265.384
5	0.821915	141.147	-11.1166	Native	50	34	167.625	263.766	316.921	0	316.921	283.984	283.984
6	0.821915	156.303	-7.73785	Native	50	34	166.9	262.626	315.23	0	315.23	292.552	292.552
7	0.821915	165.996	-4.38609	Native	50	34	162.606	255.868	305.212	0	305.212	292.74	292.74
8	0.821915	170.329	-1.04936	Native	50	34	155.434	244.583	288.481	0	288.481	285.634	285.634
9	0.821915	264.154	2.28381	Native	50	34	205.616	323.547	405.55	0	405.55	413.751	413.751
10	0.821915	465.673	5.62475	Native	50	34	313.331	493.042	656.837	0	656.837	687.696	687.696
11	0.821915	656.636	8.98507	Native	50	34	402.367	633.145	864.548	0	864.548	928.169	928.169
12	0.821915	842.082	12.377	Native	50	34	477.928	752.044	1040.82	0	1040.82	1145.7	1145.7
13	0.821915	1018.32	15.8137	Native	50	34	539.659	849.181	1184.83	0	1184.83	1337.68	1337.68
14	0.821915	1137.18	19.3102	Native	50	34	566.366	891.206	1247.14	0	1247.14	1445.59	1445.59
15	0.821915	1087.81	22.8834	Native	50	34	513.81	808.505	1124.53	0	1124.53	1341.39	1341.39
16	0.821915	1020.25	26.5538	Native	50	34	457.243	719.495	992.567	0	992.567	1221.08	1221.08
17	0.821915	1011.37	30.3464	Native	50	34	427.652	672.932	923.535	0	923.535	1173.9	1173.9
18	0.821915	999.18	34.2932	Native	50	34	397.443	625.397	853.061	0	853.061	1124.11	1124.11
19	0.821915	977.493	38.4364	Native	50	34	364.299	573.242	775.739	0	775.739	1064.86	1064.86
20	0.821915	944.626	42.8351	Native	50	34	327.894	515.958	690.811	0	690.811	994.818	994.818
21	0.821915	898.052	47.5766	Native	50	34	287.76	452.805	597.183	0	597.183	912.062	912.062
22	0.821915	833.675	52.8023	Native	50	34	243.18	382.656	493.183	0	493.183	813.588	813.588
23	0.821915	739.281	58.7726	Native	50	34	212.954	335.093	422.667	0	422.667	773.916	773.916
24	0.821915	567.954	66.1018	Native	50	34	163.89	257.889	308.208	0	308.208	678.078	678.078
25	0.821915	232.523	78.9047	Native	50	34	63.5727	100.035	74.1797	0	74.1797	398.354	398.354

◆ Rockery 3 - Seismic

Global Minimum Query (spencer) - Safety Factor: 1.35797

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.00502	30.0623	-23.7939	Native	50	34	158.49	215.224	244.955	0	244.955	175.073	175.073
2	1.00502	85.1135	-20.1285	Native	50	34	205.201	278.657	338.997	0	338.997	263.788	263.788
3	1.00502	130.36	-16.5475	Native	50	34	224.911	305.422	378.678	0	378.678	311.854	311.854
4	1.00502	166.398	-13.0322	Native	50	34	230.409	312.888	389.748	0	389.748	336.418	336.418
5	1.00502	193.669	-9.56623	Native	50	34	227.559	309.018	384.01	0	384.01	345.659	345.659
6	1.00502	212.489	-6.13543	Native	50	34	219.299	297.801	367.38	0	367.38	343.807	343.807
7	1.00502	223.065	-2.72667	Native	50	34	207.224	281.404	343.07	0	343.07	333.201	333.201
8	1.00502	225.512	0.672425	Native	50	34	192.269	261.096	312.962	0	312.962	315.219	315.219
9	1.00502	240.688	4.0739	Native	50	34	187.003	253.945	302.361	0	302.361	315.68	315.68
10	1.00502	479.912	7.48987	Native	50	34	301.407	409.301	532.686	0	532.686	572.312	572.312
11	1.00502	761.722	10.933	Native	50	34	420.014	570.366	771.474	0	771.474	852.607	852.607
12	1.00502	1034.05	14.4167	Native	50	34	517.111	702.221	966.955	0	966.955	1099.89	1099.89
13	0.311812	374.779	16.7206	Rockery	606.528	35.9021	1084.97	1473.36	1197.39	0	1197.39	1523.32	1523.32
14	0.966615	1290.33	18.9985	Native	50	34	602.881	818.694	1139.63	0	1139.63	1347.2	1347.2
15	0.966615	1282.19	22.4944	Native	50	34	561.779	762.879	1056.89	0	1056.89	1289.52	1289.52
16	0.966615	1187.79	26.0814	Native	50	34	490.387	665.931	913.156	0	913.156	1153.2	1153.2
17	0.966615	1175.48	29.7826	Native	50	34	454.48	617.17	840.864	0	840.864	1100.96	1100.96
18	0.966615	1160.51	33.6269	Native	50	34	419.185	569.24	769.805	0	769.805	1048.59	1048.59
19	0.966615	1132.97	37.6523	Native	50	34	381.134	517.568	693.198	0	693.198	987.265	987.265
20	0.966615	1090.77	41.9112	Native	50	34	340.104	461.851	610.594	0	610.594	915.872	915.872
21	0.966615	1030.81	46.4793	Native	50	34	295.779	401.659	521.355	0	521.355	832.816	832.816
22	0.966615	940.302	51.4752	Native	50	34	245.874	333.889	420.883	0	420.883	729.714	729.714
23	0.966615	771.385	57.1077	Native	50	34	182.547	247.893	293.389	0	293.389	575.646	575.646
24	0.966615	545.574	63.8217	Native	50	34	116.144	157.72	159.701	0	159.701	395.963	395.963
25	0.966615	208.64	73.1808	Native	50	34	48.7325	66.1773	23.9839	0	23.9839	185.199	185.199

Interslice Data

◆ Rockeries 1 & 2 - Static

Global Minimum Query (spencer) - Safety Factor: 1.4747

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	-8.75448	-1.21996e-12	0	0	0
2	-7.53214	-0.410681	162.37	83.3884	27.1837
3	-6.3098	-0.747925	389.683	200.13	27.1837
4	-5.08746	-1.01498	643.616	330.543	27.1838
5	-3.86513	-1.21428	900.183	462.308	27.1837
6	-2.64279	-1.34758	1144.28	587.67	27.1838
7	-1.42045	-1.416	1366.61	701.853	27.1838
8	-0.198115	-1.42013	1561.85	802.124	27.1838
9	1.02422	-1.35999	1811.6	930.385	27.1837
10	2.24656	-1.23508	2200.57	1130.15	27.1837
11	3.4689	-1.04435	2657.34	1364.73	27.1837
12	4.69123	-0.786127	3059.72	1571.38	27.1837
13	5.91357	-0.45807	3335	1712.76	27.1837
14	7.13591	-0.0570433	3518.81	1807.16	27.1837
15	8.35825	0.421047	3624.39	1861.39	27.1838
16	9.58058	0.981496	3663.69	1881.57	27.1838
17	10.8029	1.63115	3623.86	1861.11	27.1837
18	12.0253	2.37893	3469.33	1781.75	27.1838
19	13.2476	3.23665	3181.8	1634.08	27.1837
20	14.4699	4.22035	2833.55	1455.23	27.1837
21	15.6923	5.35254	2426.91	1246.39	27.1837
22	16.9146	6.66639	1962.28	1007.77	27.1837
23	18.1369	8.21426	1453.26	746.354	27.1838
24	19.3593	10.0882	828.425	425.456	27.1838
25	20.5816	12.4815	290.774	149.333	27.1837
26	21.804	16	0	0	0

 Rockeries 1 & 2 - Seismic**Global Minimum Query (spencer) - Safety Factor: 1.23407**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	-8.75448	-1.21996e-12	0	0	0
2	-7.53214	-0.410681	285.033	178.608	32.0722
3	-6.3098	-0.747925	633.473	396.948	32.0722
4	-5.08746	-1.01498	989.761	620.206	32.0722
5	-3.86513	-1.21428	1326.2	831.024	32.0721
6	-2.64279	-1.34758	1629.17	1020.87	32.0721
7	-1.42045	-1.416	1892.68	1186	32.0723
8	-0.198115	-1.42013	2115.16	1325.41	32.0722
9	1.02422	-1.35999	2380.48	1491.66	32.0721
10	2.24656	-1.23508	2760.81	1729.99	32.0722
11	3.4689	-1.04435	3174.63	1989.3	32.0723
12	4.69123	-0.786127	3509.31	2199.01	32.0722
13	5.91357	-0.45807	3714.51	2327.59	32.0721
14	7.13591	-0.0570433	3825.81	2397.34	32.0722
15	8.35825	0.421047	3859.89	2418.69	32.0721
16	9.58058	0.981496	3828.46	2399	32.0722
17	10.8029	1.63115	3696.27	2316.16	32.0721
18	12.0253	2.37893	3427.64	2147.83	32.0721
19	13.2476	3.23665	3015.05	1889.3	32.0722
20	14.4699	4.22035	2562.68	1605.83	32.0721
21	15.6923	5.35254	2069.23	1296.63	32.0723
22	16.9146	6.66639	1534.1	961.3	32.0721
23	18.1369	8.21426	981.478	615.016	32.0722
24	19.3593	10.0882	475.433	297.917	32.0722
25	20.5816	12.4815	108.66	68.0889	32.0722
26	21.804	16	0	0	0

 Rockery 3 - Static**Global Minimum Query (spencer) - Safety Factor: 1.57355**

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	-6.63083	1.53038e-12	0	0	0
2	-5.80891	-0.386448	142.44	69.701	26.0742
3	-4.987	-0.711041	330.077	161.518	26.0741
4	-4.16508	-0.978218	532.265	260.456	26.0741
5	-3.34317	-1.19132	732.578	358.476	26.0741
6	-2.52125	-1.35282	921.68	451.01	26.0741
7	-1.69934	-1.4645	1094.21	535.434	26.0741
8	-0.877421	-1.52754	1247.24	610.317	26.0741
9	-0.0555061	-1.54259	1379.47	675.023	26.0741
10	0.766409	-1.50982	1535.36	751.302	26.074
11	1.58832	-1.42887	1739.99	851.437	26.0741
12	2.41024	-1.29891	1958.7	958.458	26.0741
13	3.23215	-1.11855	2164.2	1059.02	26.0741
14	4.05407	-0.885754	2332.41	1141.33	26.0741
15	4.87598	-0.59776	2439.24	1193.6	26.074
16	5.6979	-0.25085	2471.88	1209.58	26.0742
17	6.51981	0.159906	2440.39	1194.17	26.0742
18	7.34173	0.641089	2347.87	1148.89	26.074
19	8.16364	1.20162	2196.71	1074.93	26.0742
20	8.98556	1.85391	1990.44	973.993	26.0741
21	9.80747	2.61595	1733.81	848.412	26.0741
22	10.6294	3.51532	1433.48	701.452	26.0741
23	11.4513	4.59824	1099.49	538.017	26.074
24	12.2732	5.95392	701.699	343.366	26.0741
25	13.0951	7.80884	264.846	129.598	26.074
26	13.917	12	0	0	0

Rockery 3 - Seismic

Global Minimum Query (spencer) - Safety Factor: 1.35797

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	-8.68631	2.00479e-12	0	0	0
2	-7.68129	-0.443141	263.446	152.093	29.9988
3	-6.67626	-0.811495	582.26	336.152	29.9988
4	-5.67124	-1.1101	902.607	521.095	29.9988
5	-4.66622	-1.34273	1200.91	693.312	29.9988
6	-3.66119	-1.5121	1466.83	846.834	29.9988
7	-2.65617	-1.62014	1696.41	979.375	29.9988
8	-1.65114	-1.668	1889.08	1090.61	29.9988
9	-0.646121	-1.65621	2046.26	1181.35	29.9988
10	0.358903	-1.58463	2178.04	1257.43	29.9988
11	1.36393	-1.45249	2341.77	1351.96	29.9989
12	2.36895	-1.25836	2504.96	1446.17	29.9988
13	3.37398	-1	2626.68	1516.44	29.9988
14	3.68579	-0.90633	2799.04	1615.95	29.9988
15	4.6524	-0.573526	2817.67	1626.71	29.9989
16	5.61902	-0.173252	2753.99	1589.94	29.9988
17	6.58563	0.299899	2625.82	1515.95	29.9989
18	7.55225	0.853093	2431.62	1403.83	29.9988
19	8.51886	1.49596	2175.75	1256.11	29.9988
20	9.48548	2.24177	1864.94	1076.67	29.9988
21	10.4521	3.1094	1507.75	870.459	29.9988
22	11.4187	4.12726	1115.42	643.957	29.9988
23	12.3853	5.34139	707.483	408.445	29.9988
24	13.3519	6.83598	335.029	193.42	29.9988
25	14.3186	8.80229	55.1933	31.8643	29.9988
26	15.2852	12	0	0	0

Discharge Sections

Entity Information

◆ Rockeries 1 & 2

Shared Entities

Type	Coordinates (x,y)
External Boundary	-26.0869, -22.085 38.0364, -22.085 38.0364, 16 18.0616, 16 14.0616, 14 14.0616, 14 12.5308, 14 9.03082, 6.99998 5.03082, 6.99998 3.5, 7 0, 0 -26.0869, -3.6353e-12
Material Boundary	0, 0 0.639277, -1 3.55495, -1 4.00004, -3.638e-12 5.03082, 6.01169 5.03082, 6.99998
Material Boundary	9.03082, 6.99998 9.6701, 5.99998 12.5858, 5.99998 13.0309, 6.99998 14.0616, 13.0117 14.0616, 14

Scenario-based Entities

Type	Coordinates (x,y)	Static	Seismic
Distributed Load	38.0364, 16 18.0616, 16	Constant DistributionOrientation: Normal to boundaryMagnitude: 250 lbs/ft2Creates Excess Pore Pressure: No	

◆ Rockery 3

Shared Entities

Type	Coordinates (x,y)
External Boundary	5.9, 9 4.5, 9 -2.80329e-09, 0 -27.5999, 6.37e-12 -27.5999, -17.8606 33.9734, -17.8606 33.9734, 12 11.9, 12
Material Boundary	-2.80329e-09, 0 0.639277, -1 3.65331, -1 4, 4.6748e-10 5.9, 8.24551 5.9, 9

Scenario-based Entities

Type	Coordinates (x,y)	Static	Seismic
Distributed Load	33.9734, 12 11.9, 12	Constant DistributionOrientation: Normal to boundaryMagnitude: 250 lbs/ft2Creates Excess Pore Pressure: No	

EMPIRE PASS
MASTER OWNERS ASSOCIATION

July 10, 2024

Mr. Rhett Riding
Storied Deer Valley, LLC
10105 N. Tuhaye Park Drive
Kamas, UT 84036

RE: EPMOA Snowplowing Agreement

Dear Mr. Riding,

Please allow this letter to verify that the EPMOA has approved the berm landscape plans at Moonshadow, which includes the new landscape boulder wall.

Let me know if you have any questions.

Sincerely,

Trish Waterman
EPMOA Director