

EXHIBIT B - APPROVED DESIGN

Page 1 of 5

1102 14TH STREET BASALT BOULDER ROCK WALL

Homeowner: Jason Davis
503-734-8022
jasor_x@outlook.com

Contractor: North West Landscape Care
Jose Villanueva, Owner
503-572-9324
Oregon CCB #200173

PROJECT DESCRIPTION:

Proposal to construct rock wall out of basalt boulders as shown on accompanying plans. The wall will provide structural stability of the property front yard facing 14th Street. The yard is on a slope and the house base is 6 feet above street level at the northeast end and 10 feet above street level at the southeast end. While the slope presents no signs of a slide or any level of failure since the house construction in 1974 the rock wall will provide additional structural integrity and enhance access and ability for the homeowner to continue maintenance of the yard and area.

The area of the proposed street level rock wall is within the Oregon City ROW and the homeowner seeks permission to complete construction. The placement of the rock wall will meet the conditions needed for a constrained sidewalk construction. Details are contained in the plans on the corresponding pages.

Jason Davis

City of Oregon City
Public Works Department
APPROVED FOR CONSTRUCTION

☐ Approved as Submitted
☒ Approved as Noted in Red

By: A. Parker

Date: 01/09/2019

MEASUREMENTS:

****Drawing not too scale****
****All distances field measured****

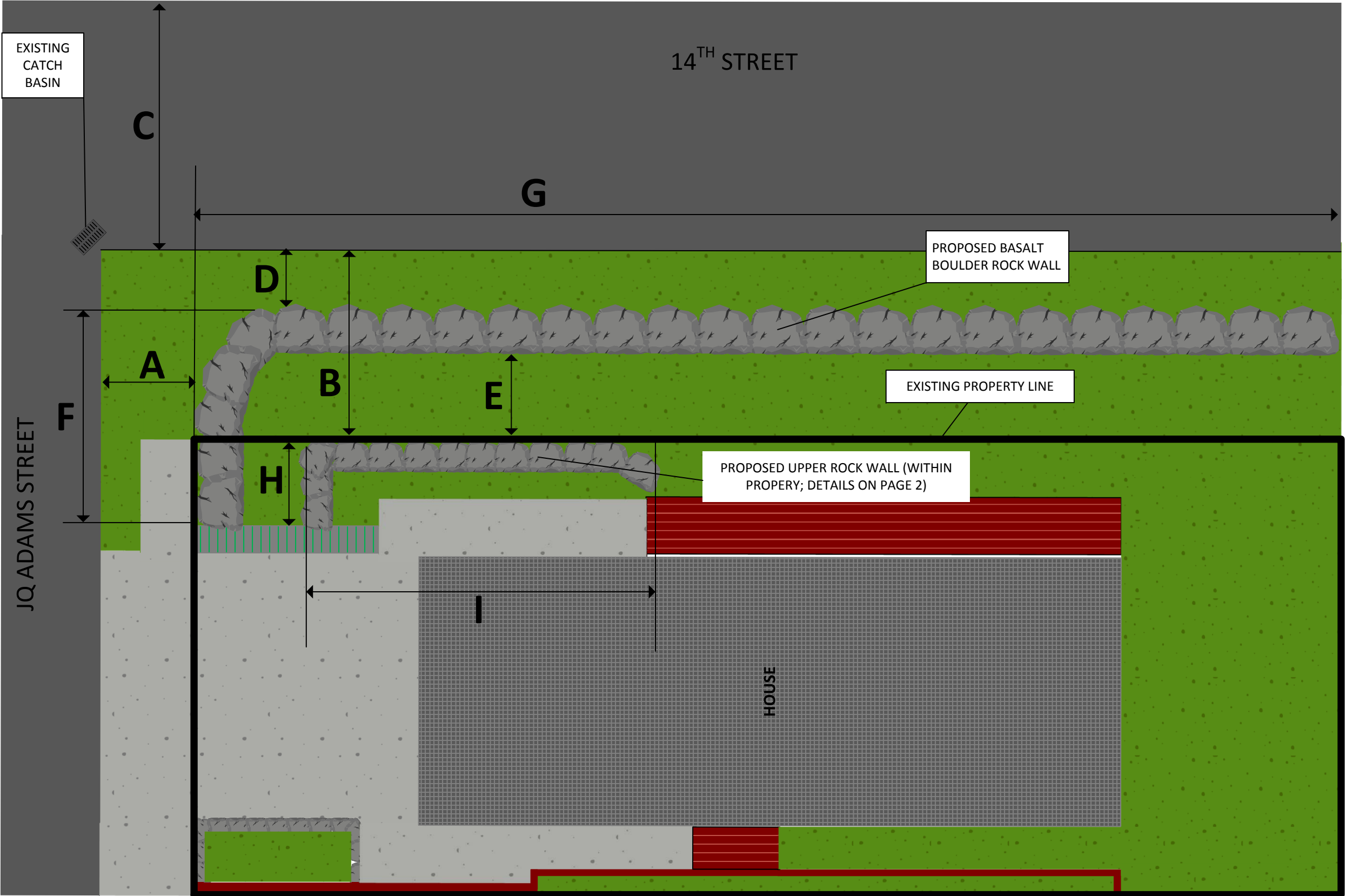
- MEASUREMENT A – 9.75 FT
Edge of Pavement (JQ Adams St) to face of rock wall at property line
- MEASUREMENT B – 16 FT
Property line to Edge of Pavement (14th Street)
- MEASUREMENT C – 30 FT
Width of 14th Street adjacent to property
- MEASUREMENT D – 7 FT
Edge of Pavement (14th Street) to face of rock wall
- MEASUREMENT E – 7 FT
Property line to back of rock wall (14th Street side)
- MEASUREMENT F – 17 FT
Length of NW face of basalt rock wall (JQ Adams St side)
- MEASUREMENT G – 106 FT
Length of NE face of basalt rock wall (14th Street side)
- MEASUREMENT H – 9 FT
Length of NW face of upper rock wall (JQ Adams St side)
- MEASUREMENT I – 34 FT
Length of NE face of upper rock wall (14th Street Side)

CONSTRUCTION NOTES:

- BASALT BOULDER ROCK WALL
 - > Proposed location as shown
 - > Proposed dimensions of wall are 36 inch height, 125 foot length, wall face 7 feet off edge of pavement (length of property facing 14th Street)
 - > Right-Of-Way between the face of proposed proposed rock wall and existing Edge of Pavement on 14th Street (7 FT, as proposed) is enough for the 6 foot constrained sidewalk section per Local Street Design Standard Drawing No. 500 (see following pages)
 - > Existing Catch Basin at corner of 14th Street and JQ Adams Street will allow for drainage of proposed wall
 - > Proposed Wall Detail and Materials provided on separate sheet (see following pages)

1102 14th STREET BASALT BOULDER ROCK WALL

Homeowner: Jason Davis Contractor: NW Landscape Care (Oregon CCB #200173)

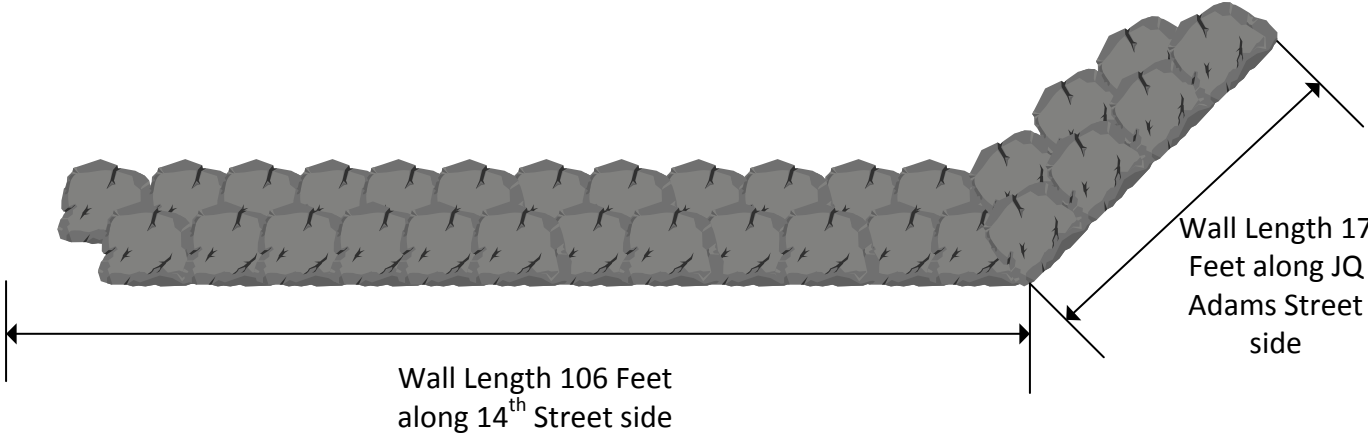


1102 14th STREET BASALT BOULDER ROCK WALL

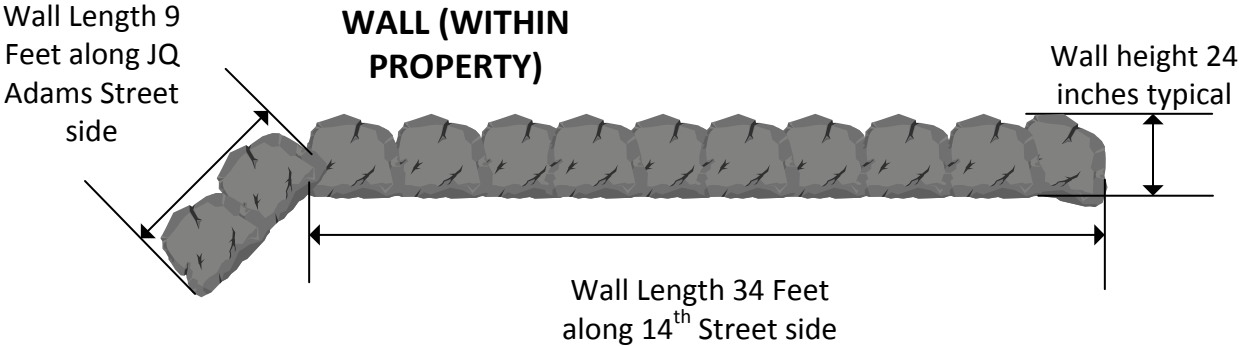
Homeowner: Jason Davis Contractor: NW Landscape Care (Oregon CCB #200173)

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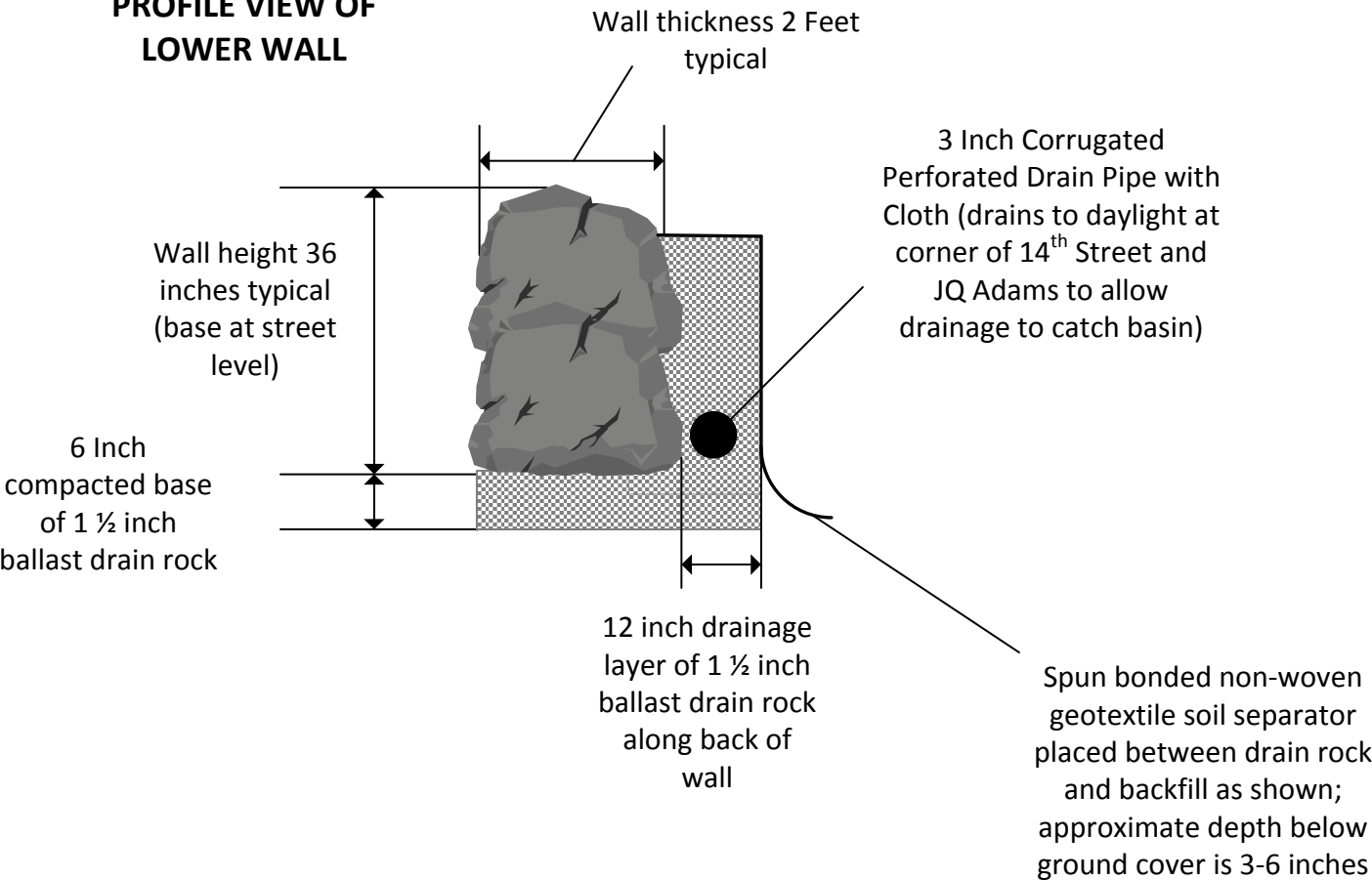
SIDE VIEW OF LOWER WALL



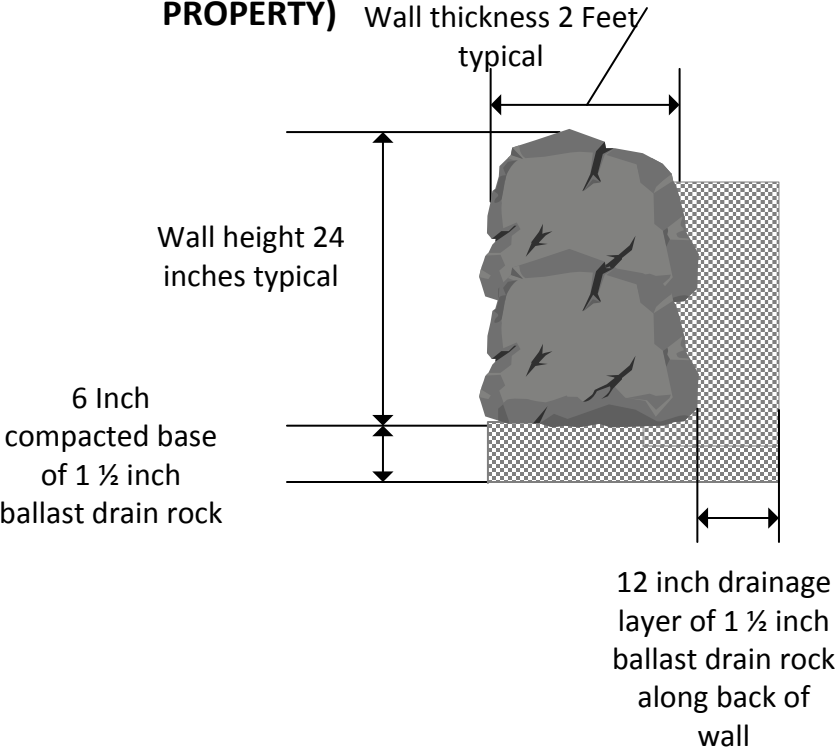
SIDE VIEW OF UPPER WALL (WITHIN PROPERTY)



PROFILE VIEW OF LOWER WALL



PROFILE VIEW OF UPPER WALL (WITHIN PROPERTY)

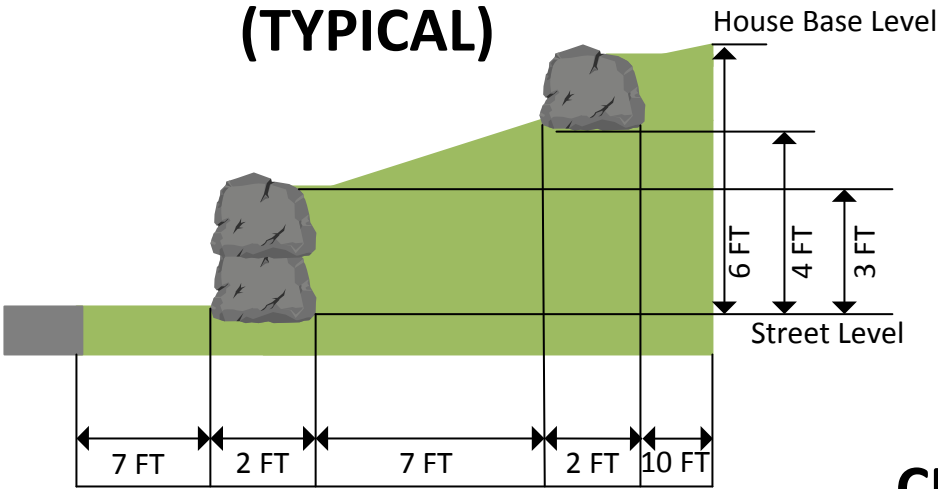


****Drawing not too scale****
****All distances field measured****

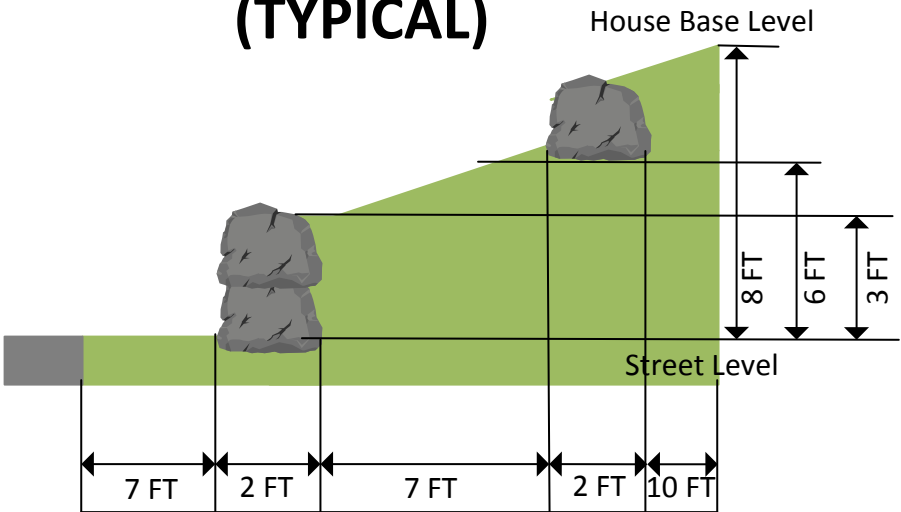
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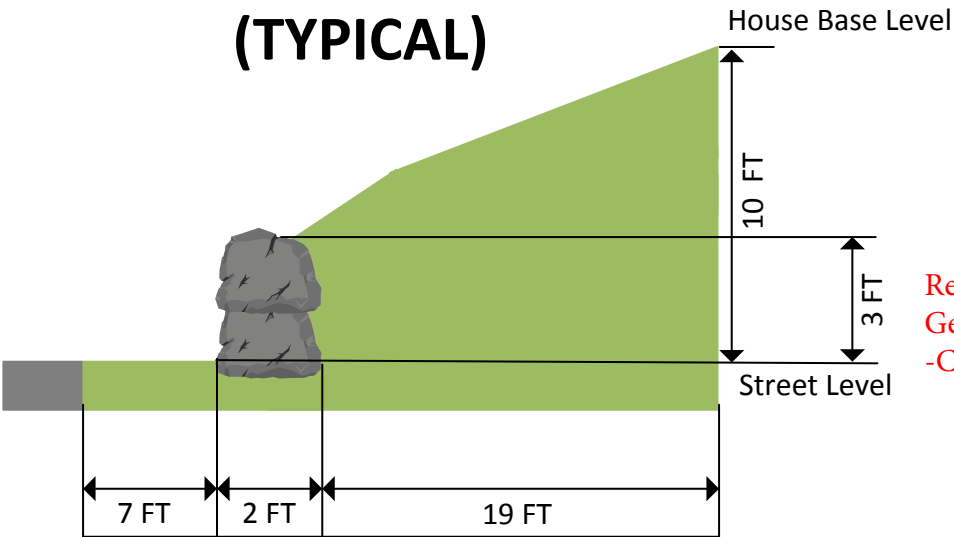
**CROSS SECTION A
(TYPICAL)**



**CROSS SECTION B
(TYPICAL)**



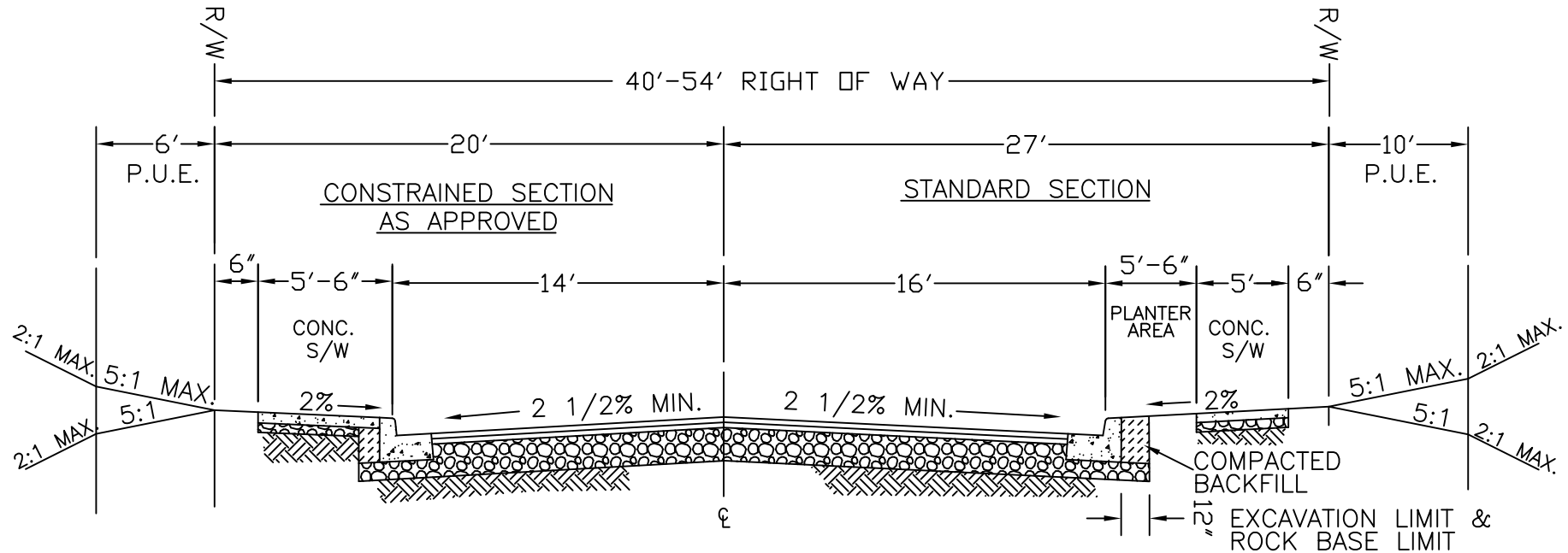
**CROSS SECTION C
(TYPICAL)**



Revised wall height: see included Central Geotechnical Services, Inc. wall revision document.
-City of Oregon City



Homeowner: Jason Davis Contractor: NW Landscape Care (Oregon CCB #200173)



NOTES:

- HOT MIXED ASPHALT CONCRETE (HMAC) FOR ALL LOCAL STREET SECTIONS SHALL BE CLASS $\frac{1}{2}$ " DENSE, PG 64-22, ESAL 3 TO 30 MIX DESIGN.
- AASHTO SOIL TYPES:
 - FOR SOIL TYPES A-1 TO A-6, PLACE ASPHALT CONCRETE IN TWO LIFTS. EACH LIFT THICKNESS SHALL BE 2 INCHES FOR A TOTAL ASPHALT THICKNESS OF 4 INCHES. SECOND FINAL LIFT SHALL BE PLACED WITH A CONTINUOUS PAVING OPERATION FOLLOWING THE PLACEMENT OF THE FIRST BASE LIFT, UNLESS OTHERWISE APPROVED BY CITY. COMPACT PER ODOT SPECIFICATIONS.
 - FOR SOIL TYPE A-7 (CLAY SOILS), A PAVEMENT DESIGN REPORT SHALL BE REQUIRED TO ACCOMMODATE ANTICIPATED TRAFFIC LOADINGS AND EXISTING SOIL CONDITIONS. THE REPORT SHALL BE SUBMITTED TO THE CITY ENGINEER FOR APPROVAL.
- AGGREGATE BASE ROCK THICKNESS SHALL BE 2 INCHES OF $\frac{3}{4}$ " - 0 LEVELING COURSE OVER 10 INCHES OF 1" - 0 BASE FOR A TOTAL BASE ROCK THICKNESS OF 12 INCHES.
- SUBGRADE AND BASE ROCK SHALL BE COMPACTED TO 95% RELATIVE DENSITY, PER AASHTO T-180.
- STANDARD AND CONSTRAINED SECTIONS SHALL BE SYMMETRICAL ABOUT THE CENTER LINE.
- USE MONOLITHIC CURB AND GUTTER, UNLESS OTHERWISE NOTED (SEE DWG. NUMBER 511)
- DESIGN SPEED EQUALS 25 MILES PER HOUR.

DRAWN JRF

ENGR. J.W.H.

REV. DATE

1 11/08

APPR. NJK

City of Oregon City
Public Works Standard Drawings
LOCAL STREET SECTION

SCALE N.T.S.

DATE JULY 1993

APPR.

DWG. NO. 500

October 2, 2018

Mr. Jason Davis
1102 14th Street
Oregon City, Oregon 97225

Attention: Jason Davis (jasor_x@outlook.com)

**Re: Geotechnical Evaluation and Rockery Design
Davis Residence – 1102 14th Street
Oregon City, Oregon**

Dear Mr. Davis,

This letter presents the results of Central Geotechnical Services, LLC (CGS) geotechnical evaluation of rockeries constructed at the Davis Residence and adjacent right-of-way of 14th Street in Oregon City, Oregon. The rockeries were recently constructed by Northwest Landscape Care. We understand that the City Building Department has required a geotechnical assessment of the rockeries with regard to stability.

The purpose of our work was to: (1) evaluate soil and slope conditions, (2) evaluate the existing rockeries constructed on the property and in the right-of-way, and (3) provide a design for a replacement rockery in the street right-of-way along the eastern portion of the property.

Our scope of work included review of the site conditions, evaluation of soil conditions exposed in recent excavations and probing with a steel rod soil probe, and preparation of a brief letter report with rockery design. The work was performed in accordance with our Geotechnical Services Agreement of September 6, 2018, and amended scope authorized by you in an e-mail dated September 21, 2018.

SITE CONDITIONS

On September 14, 2018, Central Geotechnical Services Engineering Geologist, Paul Crenna, visited the project site and performed a reconnaissance observation. While on site, we met with you and discussed the project. We evaluated soil conditions in shallow excavations adjacent to the rockeries and in the crawl space of the home. The soil is silt. We probed the subgrade with a steel rod soil probe at various locations to depths of 3 feet below the ground surface. The subgrade was generally stiff to very-stiff silt.

On the west side of the home along 14th Street, there are two, tiered rockeries that are 1.5 to 3.5 feet tall. The boulders are generally 1 to 2 feet in diameter and well-stacked. Slopes above and below the rockeries are gentle inclining at about 4H:1V (horizontal to vertical) or less. The total slope height between the street and home is about 6 feet. The approximate location of existing rockeries are shown on Sheet 1 of the attached plan set.

On the east side of the home along 14th Street, there is a single rockery that is 3.5 feet tall constructed in the street right-of-way with a 7-foot-tall slope above that ascends to the yard and rear of the home. The slope above the rockery is inclined at about 1.1H:1V. This slope is oversteepened beyond the maximum

recommended slope inclination for silt and is, therefore, subject to shallow-seated slope movement. The rear yard at the top of the oversteepened slope is gentle (about 10H:1V).



Figure 1 – Photograph of Existing Rockeries. View is from the west looking towards the east.

The face of the single rockery on the eastern portion of the site is about 16 feet horizontal from the home. Based on our observations in the home's crawl space, the perimeter footing of the home is embedded about 4 feet below the ground surface, approximately 6 feet vertically above the street. The total slope height is about 10 feet.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our geotechnical evaluation, it is our opinion that an engineered rockery is needed to retain the slope on the eastern portion of the site. We recommend that the existing rockery on the eastern portion of the site be removed and replaced with an approximate 40-foot-long, engineered rockery that is a maximum of 8-feet tall with a maximum slope above of 2H:1V. The approximate location of the recommended replacement rockery is shown on Sheet 1 of the attached rockery design plans.

Based on our reconnaissance observations and soil probing, we consider the potential for movement of the slope and tiered rockeries on the western portion of the site to be low. The existing rockeries on the western portion of the site are less than 3 feet tall, are well-constructed, and adjacent slopes are gentle. In our opinion, these rockeries may remain as constructed.

Rockery Design

We designed a replacement rockery for the project site in general accordance with the USDOT Federal Highway Administration Rockery Design and Construction Guidelines Publication No. FHWA-CFL/TD-06-006 and the local standard of practice. Central Geotech's rockery design detail is presented as an attachment to this letter in plan sheets 1 through 3.

For design purposes, we used a phi angle of 31 degrees and static equivalent fluid pressure of 55 pcf ($K_a = 0.48$) for a maximum 8-foot-tall rockery with a 3-foot-tall 2H:1V slope above. For evaluating seismic forces on the rockery, we used a pseudo-static seismic surcharge of 15 pcf derived from the Mononobe-Okabe methodology. Our analysis indicates a static factor of safety of 2.0 against overturning and 1.5 against sliding, and a seismic factor of safety of 1.6 against overturning and 1.2 against sliding. These values result from an estimated horizontal thrust force acting on the back of the rockery of 0.5 of the peak ground acceleration (0.443g) and an allowable movement of boulders of about 4.5 inches as recommended in the USDOT Design Manual.

The excavation for the rockery should maintain a minimum setback from the home's foundation footing of 1.4H:1V so that lateral support for the foundation is not compromised, and so no footing loads are exerted on the rockery. The setback is measured from base of the footing to the base of the rockery excavation backcut as shown on sheet 2.

Based on our calculations, the proposed rockery will have adequate factors of safety against sliding and overturning during static and seismic conditions, provided that it is constructed in accordance with our plan specifications. It should be noted that rockeries are flexible retaining systems, and should be expected to move slightly before the retained soil reaches equilibrium.

Rockery integrity is highly dependent on the skills of the builder so only an experienced contractor should be employed. Properly designed and constructed rockeries have a low probability of requiring localized future maintenance or partial restacking.

We recommend that Central Geotech (CGS) observe and document the replacement rockery during construction.

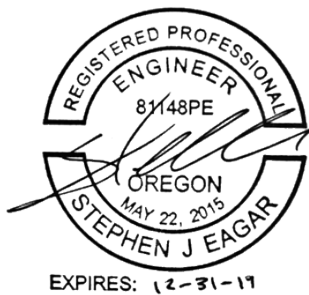
LIMITATIONS

We have prepared this report for the exclusive use the Jason Davis and members of the design team, for this specific project only. The report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, CGS should be notified for review of the recommendations of this report, and revision of such if necessary.



Within the limitations of scope, schedule and budget, the analysis, conclusions and recommendations presented in this report were prepared in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology in this area at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

Central Geotechnical Services, LLC



Stephen Eagar, P.E.
Principal Engineer



EXPIRES 11/1/19

Paul A. Crenna, C.E.G.
Principal Engineering Geologist

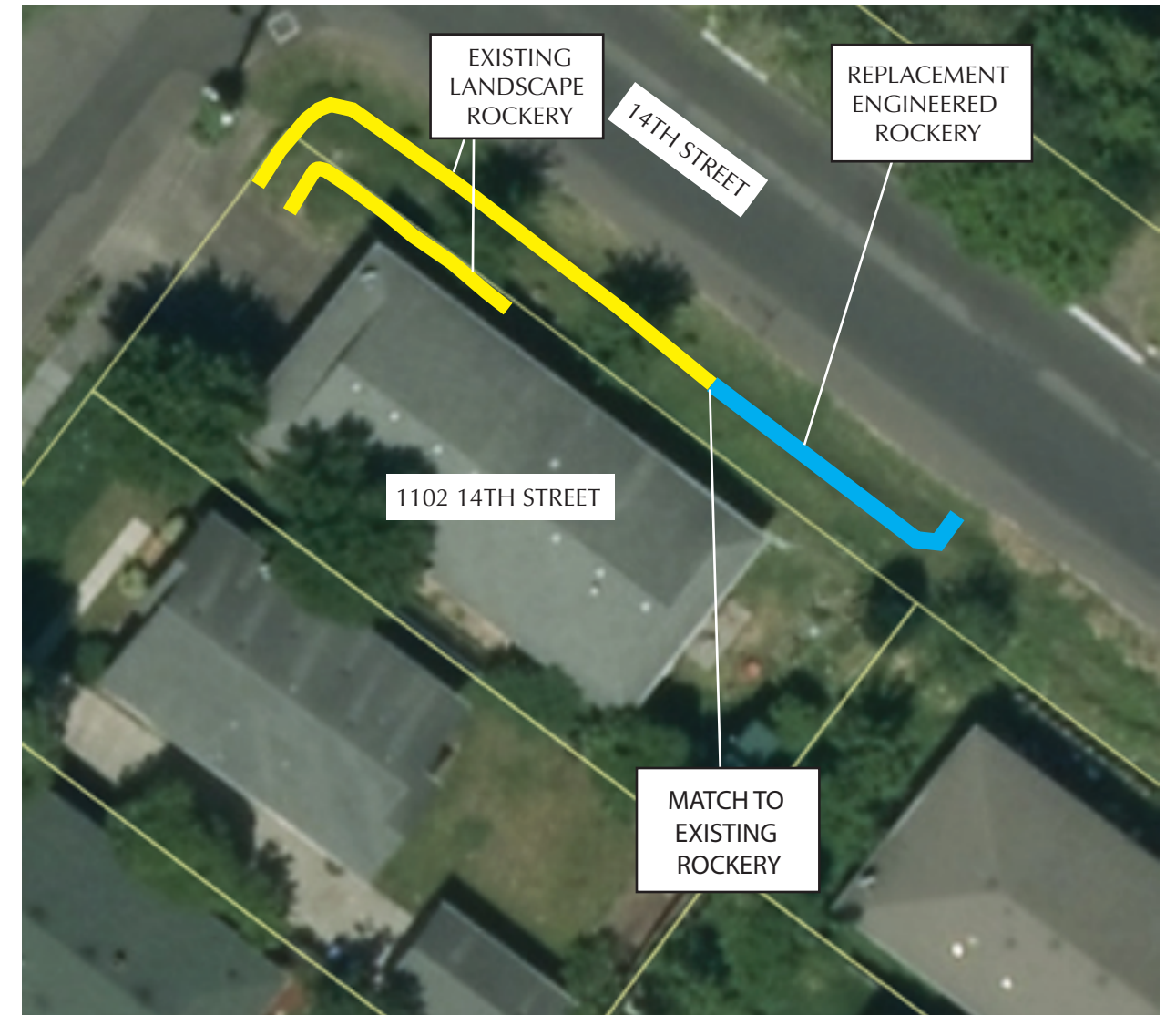
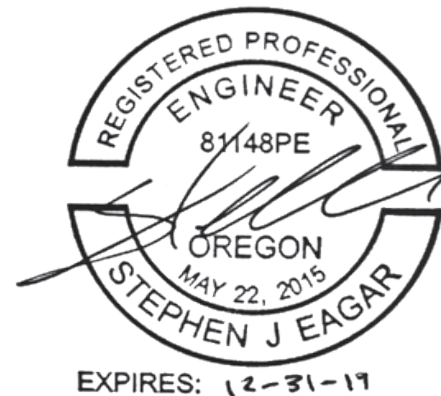
Attachments: Rockery Design Detail Sheets 1 through 3





GENERAL NOTES

- (1). EXISTING CONDITIONS AND INFORMATION SHOULD BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
- (2). THE CONTRACTOR SHALL COMPLY WITH THE PROVISIONS OF O.R.S. 757.541 TO 757.571, INCLUDING NOTIFICATION OF ALL OWNERS OF UNDERGROUND FACILITIES AT LEAST 48 BUSINESS DAY HOURS PRIOR TO EXCAVATION.
- (3). FIELD VERIFY LOCATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION. PROVISIONS SHALL BE MADE BY THE CONTRACTOR TO KEEP ALL EXISTING UTILITIES IN SERVICE AND PROTECT THEM DURING CONSTRUCTION. CONTRACTOR SHALL POT HOLE TO VERIFY LOCATION OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION.
- (4). EXISTING MONUMENTS, PROPERTY CORNERS, AND SURVEY MARKERS SHALL BE PROTECTED. REPLACEMENT SHALL BE AT THE CONTRACTOR'S EXPENSE.
- (5). AT THE END OF EACH WORK DAY THE CONTRACTOR SHALL CLEAN UP THE PROJECT AREA AND LEAVE IT IN A NEAT AND SECURED MANNER. UPON COMPLETION, THE CONTRACTOR SHALL LEAVE THE PROJECT AREA FREE OF DEBRIS AND UNUSED MATERIAL.



SITE PLAN NOT TO SCALE. ALL LOCATIONS ARE APPROXIMATE AND SHOULD BE VERIFIED IN THE FIELD BY CONTRACTOR.

BASEMAP PROPERTY BOUNDARY ON 2016 AERIAL PHOTOGRAPH PROVIDED BY CLACKAMAS COUNTY GIS

NORTH



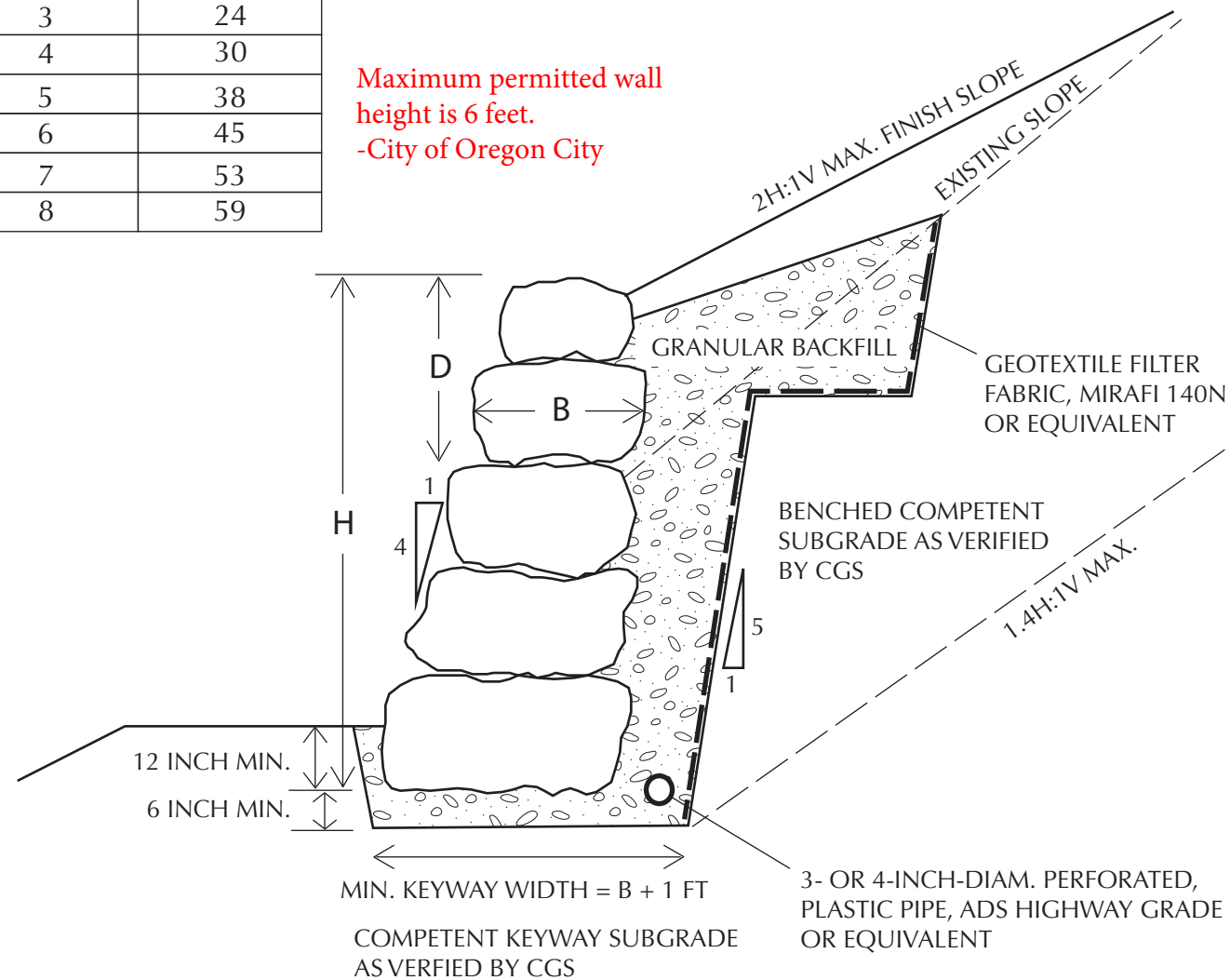
BOULDER SIZE SCHEDULE
(See Note 4)

D (FEET)	B (INCHES)
1	24
2	24
3	24
4	30
5	38
6	45
7	53
8	59

Maximum permitted wall height is 6 feet.
-City of Oregon City

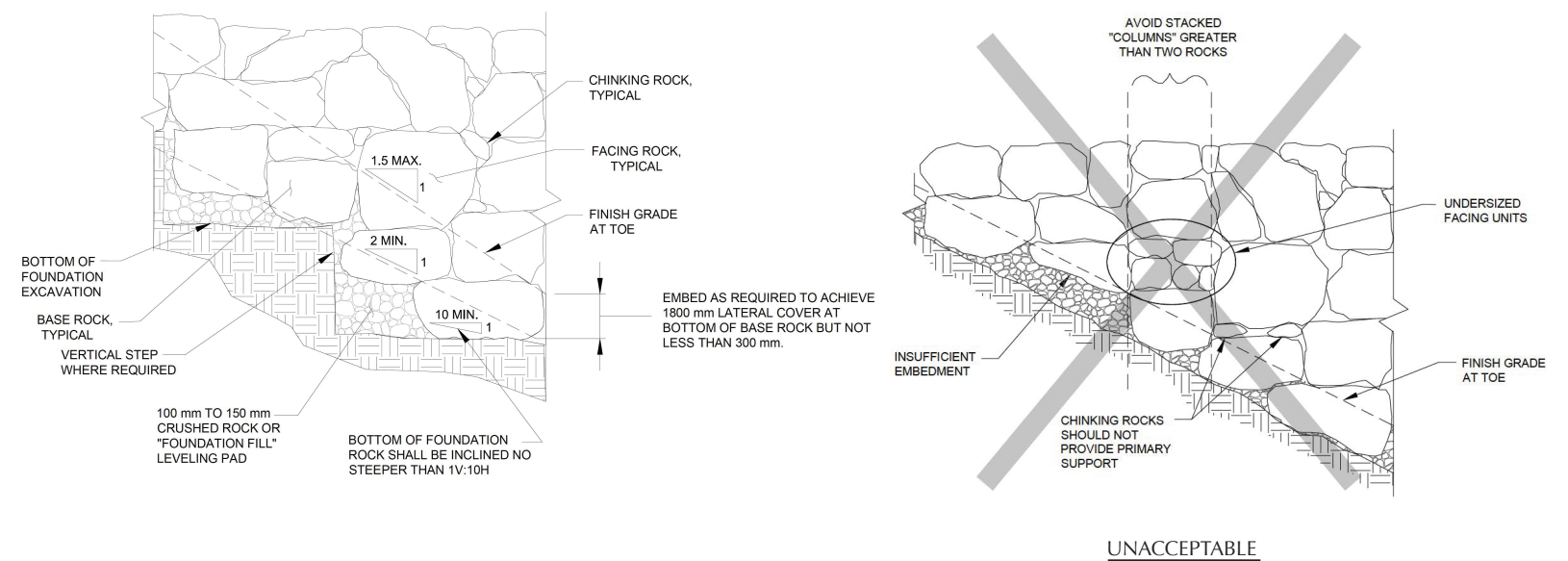
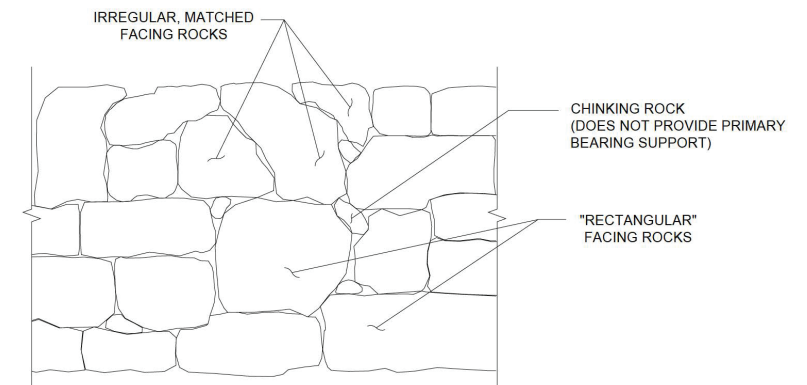
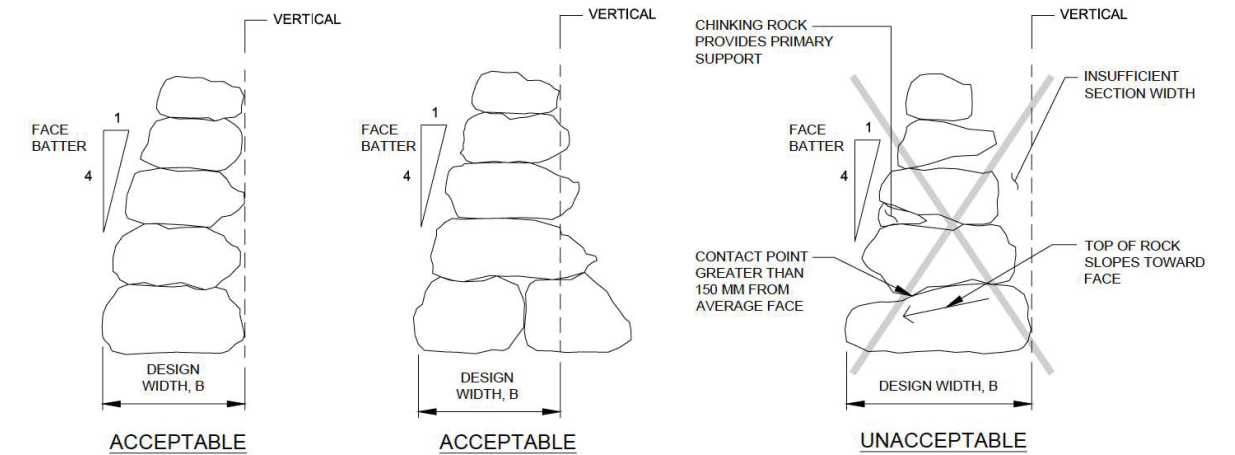
MAXIMUM ROCKERY HEIGHT (H) = 8 FEET
DRAWING NOT TO SCALE

B is boulder length, D is distance from base of boulder to top of rockery (D=H for base boulder)

HOUSE
FOOTING

CONSTRUCTION NOTES

1. Actual width of granular backfill zone necessary for rockery and backslope stability to be determined by CGS based on soil conditions observed at the time of construction.
2. Keyway subgrade and embedment should be verified by CGS prior to placement of base boulder.
3. Rockery should be constructed in accordance with guideline drawings on this Sheet and ROCKERY, SPECIAL ROCK EMBANKMENT, AND ROCK BUTTRESS specifications on Sheet 3 as modified from the USDOT Federal Highway Administration Rockery Design and Construction Guidelines.
4. Boulder sizing, stacking, and construction should be verified by CGS as rockery is being built.
5. Do not excavate below a 1.4H:1V plane projected downward from the bottom of the house foundation. Deeper excavation may require mitigating measures to maintain lateral footing support.



UNACCEPTABLE

ROCKERY, SPECIAL ROCK EMBANKMENT, AND ROCK BUTTRESS

Description

This work consists of constructing rockeries at the locations and to the dimensions shown on the plans. Rockeries are formed of interlocking, dry-stacked rocks without reinforcing steel, mortar, or concrete. Rockeries may be constructed as either single structures or in tiers.

Special rock embankment work consists of furnishing and placing hand-placed or mechanically-placed rock in fill sections. Rock buttress work consists of furnishing and placing hand-placed or mechanically-placed rock in cut sections.

Special rock embankments and rock buttresses are designated as hand-placed or mechanically-placed.

Material

(1). Granular Rock Backdrain: Furnish granular rock back drain conforming to the table below.

Opening or Sieve Size	Perecent by Mass Passing
6 inch	100
4 inch	0 to 25
3/4 inch	0 to 15
No. 4	0 to 5
No. 200	0 to 2

- (2). Rock for Rockery:
- (A). General. Furnish hard, angular, and durable rock boulders that consist of intact blocks without open fractures, foliation, or other planes of weakness. Conform to the following:
- (1) Rock has sufficient hardness so that it cannot be scratched with a knife or scratched only with difficulty
 - (2) Apparent specific gravity, AASHTO T 85 2.5 min.
 - (3) Absorption, AASHTO T 85 4.2% max.
 - (4) Los Angeles abrasion, AASHTO T 96 (500 rev) 40% max.
 - (5) Coarse durability index, AASHTO T 210 50 min.
 - (6) Sodium sulfate soundness (5 cycles), AASHTO T 104 10% max.
 - (7) Freeze-thaw loss (12 cycles), AASHTO T 103 10% max.
- (B). Sizes and shapes. Furnish angular rocks that are generally cubical, tabular, or rectangular in shape. Conform to the following:
- (1) The minimum rock length is shown in the Boulder Size Schedule.
 - (2) Rock boulder width and height are greater than or equal to one-third of the rock length.
 - (3) The minimum rock dimension is 18 inches.
 - (4) The minimum cap rock weight is 200 pounds.
 - (5) Furnish rocks with a color indigenous to the area. Furnish rocks free of machine-made scratches, mars, or other damage to the visible face.

(3). GEOTEXTILE. Furnish a non-woven with an apparent opening size (AOS) equal to the U.S. Standard No. 70 Sieve and a water permittivity of greater than 1.5 sec-1.

- (4). FOUNDATION FILL: Furnish 4-inch minus crushed quarry rock conforming to ODOT 03630.10
- (5). PLASTIC PIPE: Furnish corrugated polyethylene drainpipe and polyethylene solid pipe conforming to ODOT 02410.60

Construction Requirements

- (1). Qualifications. Prior to the start of rockery construction, submit the following:
- (A). References citing satisfactory completion of at least three (3) rockeries of similar height and face area. Include photographs of completed rockeries.
 - (B). A summary of the experience of the primary equipment operator responsible for placement of base, facing, and cap rocks.
 - (C). Contractor to furnish an excavator with a rotating clamshell attachment for erecting the rockery.
- (2). General. Survey the rockery and verify the limits of the rockery installation.
- (3). Definitions. The following definitions apply to rockery construction:
- (A). Base Rock: The base rock is the lowermost rock in the rockery, and bears directly on the foundation fill.
 - (B). Rock Face: The rock face comprises the bulk of the rockery and rocks used in the face are stacked above the base rock.
 - (C). Cap Rock: The cap rock is the uppermost rock in the rockery section and “caps” the rockery.
- (4). Rockery Foundation Excavation. Excavate a foundation trench at least 18 inches deep, running the full length of the proposed rockery. Excavate the foundation to a minimum width equal to the specified base rock width, B plus 12 inches to include the granular rock back drain behind the rockery. Exercise care during excavation of the back cut (temporary cut slope).

- (5). Rockery Erection. Place the first course of rock (base rock) on a 6-inch thick base of 4-inch minus crushed rock. Compact the crushed rock until well keyed. Conform to the following:
- (A). As the rockery is constructed, offset the rock to produce a random pattern with no joints in either the vertical or lateral direction. Construct the exposed face of the rock mass uniformly with no projections beyond the line of the slope that are more than 6 inches.
 - (B). Avoid placing rocks which have shapes that create voids with a linear dimension greater than 12 inches.
 - (C). Place each rock so that it bears on at least two rocks below it. Locate at least one bearing point a distance no greater than 6 inches from the average face of the rockery.
 - (D). The allowable tolerance for base rock widths (Dimension B) is 3 inches; however, do not place two or more consecutive base rocks with a width less than specified on the plans.
 - (E). Slope the top surface of each rock towards the back of the rockery at an inclination of at least five (5) percent.

- (F). Construct the exposed face of the rockery with a face batter of 1H:4V.
- (G). The minimum rockery thickness is based on minimum base rock width (Dimension B), as specified on the plans, and allowable face batter.
- (H). Securely place rocks so that they are unable to be moved with a pry bar after the rockery is complete.

- (6). Voids. Where voids with a linear measurement of 6 inches or greater, in any dimension, exist in the face of the rockery, chink the voids with smaller rock.
- (A). If there is no rock contact within the rockery thickness, chink the void with a smaller piece of rock.
 - (B). Chinking rocks do not provide primary structural support for the overlying rock.
 - (C). Grout chinking rocks that are able to be moved or removed by hand. Do not allow grout to be readily visible from the face of rockery.

- (7). Rockery Drainage. Install the granular rock back drain between the rockery and the back cut face being supported. The granular rock back drain layer is at least 12 inches wide, measured horizontally from the back of the base rock to the face of the back cut. Place granular rock back drain concurrent with rockery placement so that at no time is either more than 24 inches higher than the other.
- (A). Separate the granular rock back drain from the back cut by non-woven geotextile. Overlap the non-woven geotextile at least 12 inches at all seams.
 - (B). Place a 3- or 4-inch diameter perforated drain pipe as shown in the plans. Surround the pipe on all sides by at least 3 inches of granular rock back drain material.
 - (C). Connect the perforated drain pipe to a non-perforated collector pipe. Connect the collector pipe to a storm drain or suitable outlet.
 - (D). Cap the granular rock back drain with at least 6 inches of native soil. Place non-woven geotextile between the native soil and the granular rock back drain.