DEVELOPMENT SERVICES DEPARTMENT
ENVIRONMENTAL COORDINATOR
450 110th Ave NE., P.O. BOX 90012
BELLEVUE, WA 98009-9012

OPTIONAL DETERMINATION OF NON-SIGNIFICANCE (DNS) NOTICE MATERIALS

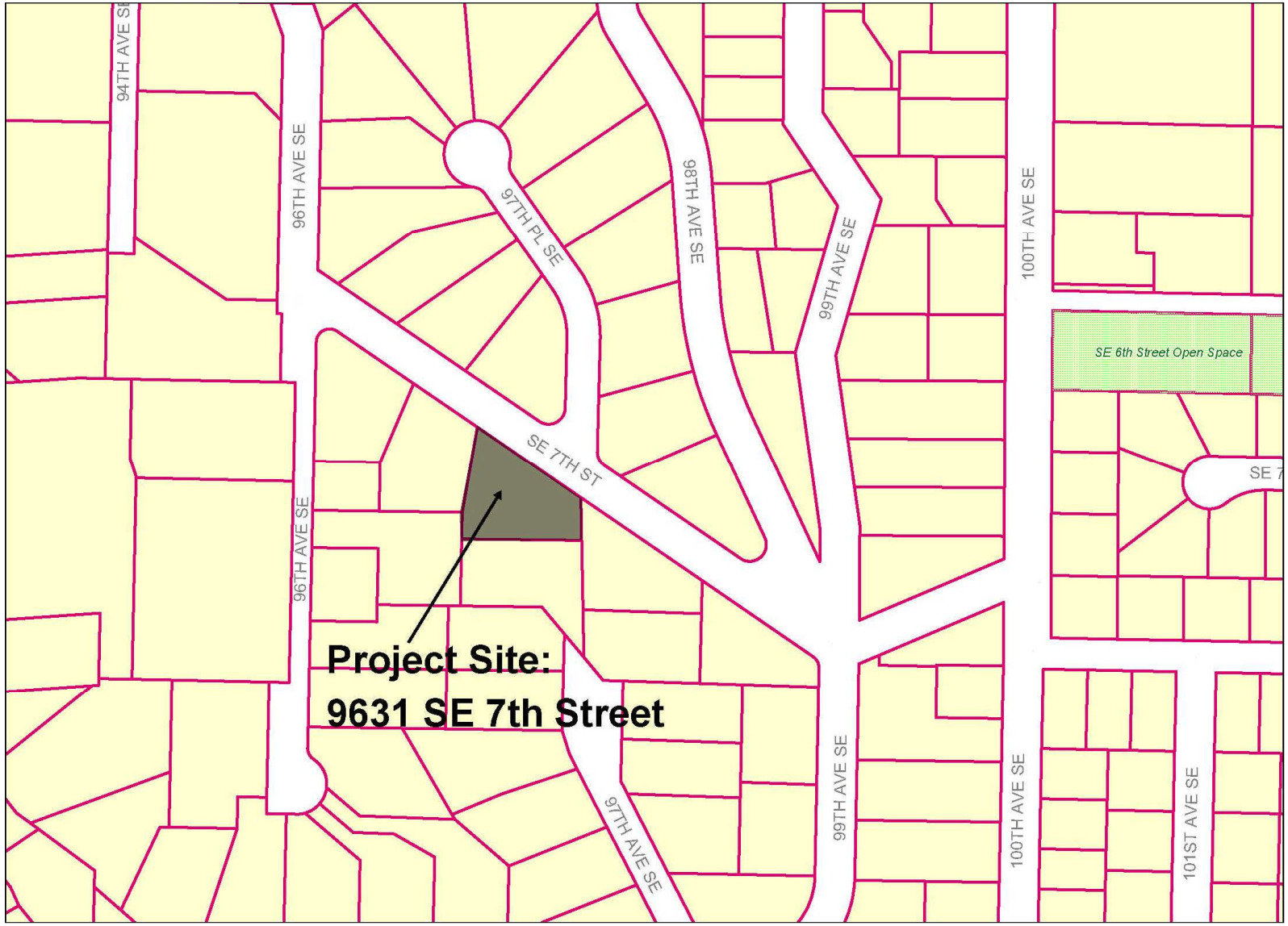
The attached materials are being sent to you pursuant to the requirements for the Optional DNS Process (WAC 197-11-355). A DNS on the attached proposal is likely. This may be the only opportunity to comment on environmental impacts of the proposal. Mitigation measures from standard codes will apply. Project review may require mitigation regardless of whether an EIS is prepared. A copy of the subsequent threshold determination for this proposal may be obtained upon request.

File No.	12-105651-LO
Project Name/Address:	Hansen Rockery 9631 SE 7th Street
Planner:	Reilly Pittman
Phone Number:	425-452-4350
Minimum Comment Period:	**March 22, 2012**

Materials included in this Notice:

- ☒ Blue Bulletin
- ☒ Checklist
- ☒ Vicinity Map
- ☒ Plans
- ☐ Other:

Hansen Rockery
File Number: 12-105651-LO



SEPA Checklist reviewed by Reilly Pittman on 3/6/2012

City of Bellevue Submittal Requirements | **27a**

ENVIRONMENTAL CHECKLIST

3/5/12

If you need assistance in completing the checklist or have any questions regarding the environmental review process, please visit or call the Permit Center (425-452-6864) between 8 a.m. and 4 p.m., Monday through Friday (Wednesday, 10 to 4). Our TTY number is 425-452-4636.

BACKGROUND INFORMATION

Property Owner: Stephen Hansen

Proponent: Stephen Hansen

Contact Person: Stephen Hansen- owner
(If different from the owner. All questions and correspondence will be directed to the individual listed.)

Address: 9631 SE 7th St Bellevue, WA 98004

Phone: 206-396-7962

Proposal Title:

Proposal Location: 9631 SE 7th St Bellevue, WA 98004 (98th is the cross St)
(Street address and nearest cross street or intersection) Provide a legal description if available.

Please attach an 8 ½" x 11" vicinity map that accurately locates the proposal site.

Give an accurate, brief description of the proposal's scope and nature:

1. General description: Rebuild two rockeries (walls)
2. Acreage of site: .48
3. Number of dwelling units/buildings to be demolished: none
4. Number of dwelling units/buildings to be constructed: none
5. Square footage of buildings to be demolished: none
6. Square footage of buildings to be constructed: none
7. Quantity of earth movement (in cubic yards): none

minor fill and rocks needed to construct rockery. RP

8. Proposed land use: n/a
9. Design features, including building height, number of stories and proposed exterior materials: n/a
10. Other

Received
MAR - 5 2012
Permit Processing

Estimated date of completion of the proposal or timing of phasing: *April 1st-5th*

RP

Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

No

List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

A soils report and a topo map have been submitted.

Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. List dates applied for and file numbers, if known.

None

List any government approvals or permits that will be needed for your proposal, if known. If permits have been applied for, list application date and file numbers, if known.

Critical Areas Land Use Permit. RP

Please provide one or more of the following exhibits, if applicable to your proposal.
(Please check appropriate box(es) for exhibits submitted with your proposal):

☐ Land Use Reclassification (rezone) Map of existing and proposed zoning

☐ Preliminary Plat or Planned Unit Development
Preliminary plat map

☐ Clearing & Grading Permit
Plan of existing and proposed grading
Development plans

☐ Building Permit (or Design Review)
Site plan
Clearing & grading plan

☐ Shoreline Management Permit
Site plan

A. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site: ☐ Flat ☐ Rolling ☐ Hilly ☒ Yes Steep slopes ☐ Mountains ☐ Other

b. What is the steepest slope on the site (approximate percent slope)? 35-40%

c. What general types of soil are found on the site (for example, clay, sand, gravel, peat, and muck)? If you know the classification of agricultural soils, specify them and note any prime farmland. Glacial Till

RP

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

None

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.
Yes, but none in the past 5 months

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

None

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Visquine has been put down along with hay

2. AIR

a. What types of emissions to the air would result from the proposal (i.e. dust, automobile odors, and industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

None

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

None

c. Proposed measures to reduce or control emissions or other impacts to the air, if any:

None

3. WATER

a. Surface

(1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If

RP

appropriate, state what stream or river it flows into.

None

(2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If Yes, please describe and attach available plans.

None

(3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None

(4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

None

(5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.
No

(6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

None

b. Ground

(1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description.

No

(2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals...; agricultural; etc.) Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

None

RP

c. Water Runoff (Including storm water)

(1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

None

(2) Could waste materials enter ground or surface waters? If so, generally describe.

None

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

Hay has been put down on the impacted area

4. Plants

a. Check or circle types of vegetation found on the site:

- [X] deciduous tree: alder, maple, aspen, other
- [X] evergreen tree: fir, cedar, pine, other
- [X] shrubs
- [X] grass
- [ ] pasture
- [ ] crop or grain
- [ ] wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other
- [ ] water plants: water lily, eelgrass, milfoil, other
- [ ] other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

See attached landscape plan

c. List threatened or endangered species known to be on or near the site.

None

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

See attached landscape plan

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5. ANIMALS

a. Check or circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

- [x] Birds: hawk, heron, eagle, songbirds, other:
- [x] Mammals: deer, bear, elk, beaver, other: rats & raccoons
- [ ] Fish: bass, salmon, trout, herring, shellfish, other:

b. List any threatened or endangered species known to be on or near the site. n/a

c. Is the site part of a migration route? If so, explain. No

d. Proposed measures to preserve or enhance wildlife, if any: vegetation

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy need? Describe whether it will be used for heating, manufacturing, etc.
None

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
No

c. What kinds of energy conservation features are included in the plans of the proposal? List other proposed measures to reduce or control energy impacts, if any:
None

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

No

(1) Describe special emergency services that might be required.

None

(2) Proposed measures to reduce or control environmental health hazards, if any.

None

b. Noise

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(1) What types of noise exist in the area which may affect your project (for example, traffic, equipment, operation, other)?

None

(2) What types and levels of noise would be created by or associated with the project on a short-term or long-term basis (for example, traffic, construction, operation, other)? Indicate what hours noise would come from the site.

A back hoe for two days

Noise regulated by BCC 9.18

(3) Proposed measures to reduce or control noise impacts, if any:

n/a

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Residential

b. Has the site been used for agriculture? If so, describe. No

c. Describe any structures on the site. A house

d. Will any structures be demolished? If so, what? No

e. What is the current zoning classification of the site? R 1.8

f. What is the current comprehensive plan designation of the site? Residential

g. If applicable, what is the current shoreline master program designation of the site? N/A

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify. Steep slope

I. Approximately how many people would reside or work in the completed project? N/a

j. Approximately how many people would the completed project displace? none

k. Proposed measures to avoid or reduce displacement impacts, if any:n/a

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i. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

n/a

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

n/a

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None

c. Proposed measures to reduce or control housing impacts, if any:

n/a

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

n/a

b. What views in the immediate vicinity would be altered or obstructed?

none

c. Proposed measures to reduce or control aesthetic impacts, if any:

n/a

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

n/a

b. Could light or glare from the finished project be a safety hazard or interfere with views?

none

c. What existing off-site sources of light or glare may affect your proposal?

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none

d. Proposed measures to reduce or control light or glare impacts, if any:

n/a

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

None

b. Would the proposed project displace any existing recreational uses? If so, describe.
No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

No

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.
No

b. Generally describe any landmarks or evidence of historic, archeological, scientific, or cultural importance known to be on or next to the site.
No

c. Proposed measures to reduce or control impacts, if any:
N/A

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.
SE 7th St.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?
No

c. How many parking spaces would be completed project have? How many would the project eliminate?
N/A

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not Including driveways? If so, generally describe (indicate whether public or private).
No

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.
No

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f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.
N/A

g. Proposed measures to reduce or control transportation impacts, if any:
N/A

15. Public Services

a. Would the project result in an increased need for the public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.
No

b. Proposed measures to reduce or control direct impacts on public services, if any.
N/A

16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.
N/A

Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature.....

Date Submitted.....3-5-12.....

RP

GEOTECHNICAL & CRITICAL AREAS REPORT

Hansen Rockery
9631 SE 7th Street
Bellevue, Washington
G-3244

Prepared For

Mr. Steve Hansen
9631 SE 7th Street
Bellevue, WA 98004

February 1, 2012

By

GEO GROUP NORTHWEST, INC.
13240 NE 20th Street, Suite 10
Bellevue, Washington 98005
Phone: (425) 649-8757

GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists
& Environmental Scientists

February 1, 2012 G-3244

Mr. Steve Hansen
9631 SE 7th Street
Bellevue, WA 98004

Subject: **Geotechnical & Critical Areas Report**
Hansen Rockery
9631 SE 7th Street
Bellevue, Washington 98004

Dear Mr. Hansen:

GEO Group Northwest, Inc., prepared this report to address the rockery landscape improvements at your residence. Two tiered rockery walls were constructed near the base of the slope along the east lot line and at the northeast corner of the lot. The rockeries are within the building setback and exceed the maximum height limit of 30-inches. We understand your intention is to acquire a permit for the rockeries by modifying them to comply with the code. The slope is classified as a steep slope critical area and the City of Bellevue has requested a geotechnical report and critical areas report be provided as part of the permit application.

SCOPE OF WORK

The scope of work to prepare this report included a site visit, site reconnaissance, review of the area geologic map, review of landslide and other critical area information available from the King County iMAP and nwmaps.net web sites, subsurface exploration, evaluation of slope stability, engineering analysis and preparation of this report.

SITE DESCRIPTION

The subject lot, Parcel Number 549170-0170, is located in the Meydenbauer Heights area of Bellevue, Washington, as illustrated on the Vicinity Map, Plate 1. The lot is irregular in shape and approximately 0.44 acres in size. The lot is bordered by SE 7th Street along the north property line, and residential developed lots to the west, south, and east. A residential driveway is located along the east property line.

The lot slopes up to the west along the east lot line and to the southwest along SE 7th Street. SE 7th Street slopes down to the southeast. Based on the Boundary/Topographic survey, Plate 2, ground elevations across the lot range from approximately 211 feet at the northeast corner, to 256 feet at the southwest corner. Building structures on the lot include a one-story house, carport, swimming pool, pump house, and decks. Located above the subject rockery is the swimming pool and elevated deck. The slope between the pool area and east property line has a height of roughly 24 to 28 feet and an average gradient of 42 to 51 percent.

Existing Rockery

We understand the slope was previously covered with ivy. The ivy was removed in order to replant the slope. After removing the ivy, a rockery was constructed to improve the landscaping and provide better access for maintaining the plants and slope.

The existing rockery consists of two tiers walls located at the base of the slope along the east property line and at the northeast property corner. The rockery is approximately 85 feet long. Top and bottom elevations recorded on the survey indicate the lower rockery has a height of 3.2 feet to 4.3 feet (39 inches to 42 inches) and the upper rockery has a height of 1.1 feet to 2.4 feet (13 inches to 29 inches). The walls are principally constructed of one-man size rock.

GEOLOGY

The site area is mapped as Vashon till (Qvt), according to the geologic map of King County[1] and the geologic map of Seattle and Vicinity[2]. Vashon till is described as a compact mixture of silt, sand and gravel, glacially transported and deposited under glacial ice during the Frasier glaciation period that ended some 10,000 years ago. Underlying the till is Advance Outwash Deposits (Qva).

[1] Booth D. B., Troost K. A., Wicher A. P., 2007, "Geologic Map of King County," GeoMapNW, Scale 1:100,000.

[2] Waldron H. H., Liesch B. A., Mullineaux D. R., Crandell, D. R., 1962, "Preliminary Geologic Map of Seattle and Vicinity, Washington," Dept. Of Interior, U. S. Geological Survey, Map I-354, Scale 1:31,680.

The Advance Outwash is described as a well-sorted sand and gravel deposited by streams issuing from the advancing ice sheet.

SUBSURFACE INVESTIGATION

Soil conditions in the area of the rockery were investigated by hand augering two borings to depths of 3.5 feet. The boring locations, HA-1 and HA-2, are illustrated on the Site Plan, Plate 2. The site soils encountered included 13 to 20 inches of topsoil, underlain by silt with some sand and very fine sandy silt. Dense soil was encountered in the borings at a depth of 3 to 3.5 feet. Dense soil was confirmed a depth of 1.5 to 3.5 feet across the slope based on probing with a 4 foot long 1/2-inch steel rod. Groundwater seepage was encountered at a depth of 2 to 3 feet. Minor seepage was encountered in boring HA-1 and moderate seepage was encountered in boring HA-2. For a more detailed description of the soils encountered please refer to the hand boring logs in Appendix A.

SITE HISTORY

Landslides

The slope along the east property line and a portion of the north property line is identified as a steep slope with a gradient of 40 percent or greater, according to the critical area information available on the King County iMAP and nwmaps.net web site. The property is not identified as being in a landslide hazard area.

A site reconnaissance was conducted on January 27, 2012, that included the area of the rockery, the slope above the rockery, and pool area at the top of the slope. A soil slump (set-down feature) and small area of soil tension cracks were observed on the slope above the upper rockery, caused principally by loose backfill soils behind the wall. The top of the slump area was located about 10 feet from the upper rockery and had a 10-inch scarp (set-down). The width of the set-down feature was about 12 feet wide and the associated soil tension crack at the scarp was about 1 inch wide. No movement in the rockery was observed. The soil tension cracks were located about 7 feet from the upper rockery, were about 8 feet long, and had a width of about 1/2-inch. No movement in the rockery was observed. Groundwater seepage was not observed on the slope surface, however minor to moderate groundwater seepage was encountered in the hand

borings at a depth of 2 to 3 feet. No indicators were observed that would indicate larger scale historical slope movement.

Erosion

The site soil is partially comprised of fine-grained silty soil, which is susceptible to erosion. The disturbed area is covered with straw mulch. The area had received several periods of heavy precipitation, including a snow event the week of January 16th. Erosion was not observed, such as soil washing off the slope. We observed no evidence of past erosion problems.

Prior Grading

The steep slope along the north side of the Hansen property appears to have been created when SE 7th Street was cut and graded. The house was built in1966. Grading likely occurred during development of the lots, including the construction of the driveway on the adjacent lot to the east. We did not find fill soil that had been placed on the slope in the area of the rockery. The northern pool deck and east pump house are built out over the slope and supported by piers.

GEOLOGIC HAZARDS ASSESSMENT

The site is underlain by dense glacially consolidated soil. The site is seismically classified as Site Class C (very dense soil profile), in accordance with Table 1613.5.2 of the 2006 International Building Code (IBC). The potential for liquefaction and/or lateral spreading is very low. The glacially consolidated soil is stable and the risk of a deep seated slide is very low.

Potential impacts to the slope include small shallow slides or slumps occurring that could knock over the rockery and run-out onto the driveway below. The observed soil slump feature and soil tension crack areas above the upper rockery are small in size and appear to be shallow. Based on discussions with Mr. Hanson, we understand the slump feature first occurred when a tree stump was pulled prior to construction of the rockery, however additional soil movement has occurred. It is our opinion the soil movement and tension cracks occurred in response to the following conditions, or a combination:

a. Backfill soils in the upper 3 feet (±) above the rockery are loose and do appear to have been

compacted when the rockery was constructed.

b. The lower rockery is support by dense soil. The upper rockery is not. No movement in the rockery was observed, however soils below the bottom of the upper rockery are loose which could allow the rockery to move laterally in response to lateral earth pressure.
c. Shallow groundwater sheet-flow is present on top of the dense soil on the slope, based on the groundwater seepage encountered in the borings;
d. Precipitation saturated the loose backfill and the loose soil above the rockery, increasing the weight of the soil.

DISCUSSION & RECOMMENDATIONS

Based on our findings, the main geotechnical considerations concerning the existing rockeries are:

- Rock sizes of one-man and smaller rock was used to construct the rockeries. Larger rock size is recommended to provide more weight/mass.
- The upper rockery needs to extend down to and be keyed into dense soil;
- For proper drainage, a perforated drain pipe should be incorporated into the quarry spalls at the base of the wall.
- It appears that some of the onsite soil was used as backfill behind the quarry spalls. The uses of the onsite soil is not recommended. Backfill material should consist of the quarry spalls or a free-draining gravelly sand that is compacted.

Based on observations, it is our opinion that the best solution to improve the stability of the lower portion of the slope is to rebuild the rockery with larger rock. Additionally, the walls should be supported on dense soil and proper drainage installed behind the walls.

Rockery Design and Construction Recommendations

Due to the shallow groundwater conditions, we recommend work on the rockeries and slope occur during the drier months when the stability of the soil on the slope will be greater. In the interim, we recommend covering the lower portion of the slope with plastic where the soil slump and

tension cracks are located. Soils on the slope should be periodically monitored for signs of additional movement.

To aid in maintaining the stability of the slope, we recommend reconstructing the rockery in sections of about 20 feet and constructing the rockery concurrently as the cut is made. The new rockery should be constructed with three and two man size rock. The rock size can decrease toward the top of the wall. The base rock should be keyed a minimum of 8-inches into dense soil. The rock should be stacked so the face is battered at 1H:6V (Horizontal: Vertical), as illustrated on the Rockery Detail, Plate 3. Consideration should be given to constructing the new rockery with two or three tiered walls.

Install a 4-inch diameter rigid PVC perforated pipe at the base of the wall and backfill with clean 1 to 3- inch size crushed rock (quarry spalls) to provide drainage behind the wall. The rock drainage zone should be at least 12-inches wide. However, loose soil behind the wall should be removed and replaced with quarry spalls or granular material that is compacted. Because of the subsurface water on the slope, the rock should be protected with a geotextile filter fabric, such as Mirafi 140N, that is placed at the back of the cut and wraps over the rock, as illustrated on the Rockery Detail, Plate 3. A layer of topsoil can be placed over the spalls for landscaping.

Once the slope dries out, the soil across the areas of the set-down slump and soil tension cracks should be compacted, preferably with a hoe-pack mounted on a back-hoe or track-hoe. If a hoe-pack can not reach, a jumping jack compactor can be used. If using a jumping jack to compact, the 1.5 feet of soil should be removed, the underlying soil compacted, and the fill compacted as it is replaced.

Installing finger drains on the slope above the rockery is recommended to facilitate draining the slope during the wet season. The finger drains should be installed where the tension cracks are located, extend up the slope 10 feet ±, and to a depth of 3 feet. The finger drains may consist of a 2-inch perforated pipe bedded in drain rock and wrapped with geotextile filter fabric, or a prefabricated strip drain product used, such as manufactured by American Wick Drain.

On tiered walls, to prevent the upper wall from surcharging the lower wall, the base of the upper

wall should extend below a 1H:1V line projected up the back of the lower wall. The 4 to 5 feet of separation between the existing walls appears to be adequate for the two wall system. To help achieve the 30-inch maximum exposed height for the upper wall, topsoil between the walls may be sloped at up to 2H:1V.

A representative from GEO Group Northwest should periodically inspect the construction of the rockery and drainage, including monitoring the excavation and verifying dense base soil below the wall(s).

General Rockery Discussion

Rockeries are not engineered retaining walls. Their construction is to a large extent an art not entirely controllable by engineering methods. It is therefore imperative that rockeries be constructed by contractors with a proven capability in rockery construction. During construction, we recommend periodic construction monitoring by GEO Group Northwest to verify that subgrade soils will provide proper support and that the cut slopes are stable. We also recommend that the rockery walls be constructed in accordance with the "Standard Rockery Construction Guidelines" specified by the Association of Rockery Contractors (Appendix B).

The primary function of a rockery is to cover the face and retard the erosion process. However, lateral support is provided by virtue of the weight of the rock. Therefore, the larger the rock the greater the mass and the more lateral resistance available. However, since this support depends on the contact areas and characteristics between individual rocks, it is virtually impossible to predict or provide for a specific lateral resistance.

Erosion Control

Temporary erosion and sediment control measures should be used, consisting of a silt fence below the work area, if feasible to do so, covering the slope with plastic, and using straw mulch as ground cover. Permanent erosion control will be satisfied once final landscaping is completed with plants and mulch.

Land Use Code

Walls over 30 inches in height are considered structures in the City of Bellevue Land Use Code and are; therefore, not allowed in structure setbacks (LUC 20.20.025.D). An exception would be allowed if there is no feasible alternative to the walls location or height, based on existing grade. Tiered or stepped walls are considered acceptable in the setback, provided there is at least 30 inches separation between the walls and the exposed height of the individual walls does not exceed 30 inches.

The rockeries can be constructed as a tiered or stepped wall system that conforms to the height and separation requirements. The 30 inch maximum wall height is measured from the grade at the base of the wall to the top of the wall (exposed face of wall). The minimum 30 inch separation is measured from the face of one wall at its base grade to the face of the next wall at its base grade.

Stability Statement

A design plan of the proposed revision to the rockery walls and slope was not available for our review. Based on our discussions, we understand the height of the rockery walls will be reduced to 30-inches and some modification to the slope grade will occur immediately above or below the rockery walls to accommodate the revised wall heights.

Provided the rockery design and construction recommendations contained herein are implemented, it is our opinion that the risk is low for soil instability. It is our opinion that reconstructing and reducing the exposed height of the rockeries and modifying the grade of the slope immediately above and below the walls will not decrease the stability of the slope, will not impact the subject or adjacent properties, and will not impact the house, pool area or deck above.

LIMITATIONS

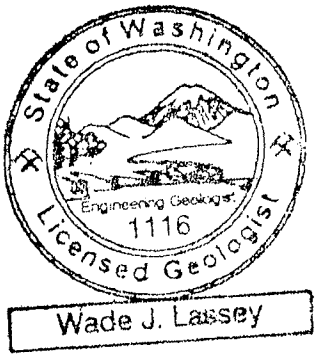
This report has been prepared for the specific application to the subject project. The findings and recommendations stated herein are based on our field observations, our experience, and judgement. The recommendations are our professional opinion derived in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under

similar conditions in this area and within the budget constraint. No warranty is expressed or implied. GEO Group Northwest, Inc., should be retained to review the final design plan to confirm the validity of the recommendations contained in this report if there are significant changes to the project as described herein.

Please contact us if you have any questions.

Sincerely,
GEO GROUP NORTHWEST, INC.

Wade J. Lassey, L.E.G.
Engineering Geologist



William Chang, P.E.
Principal

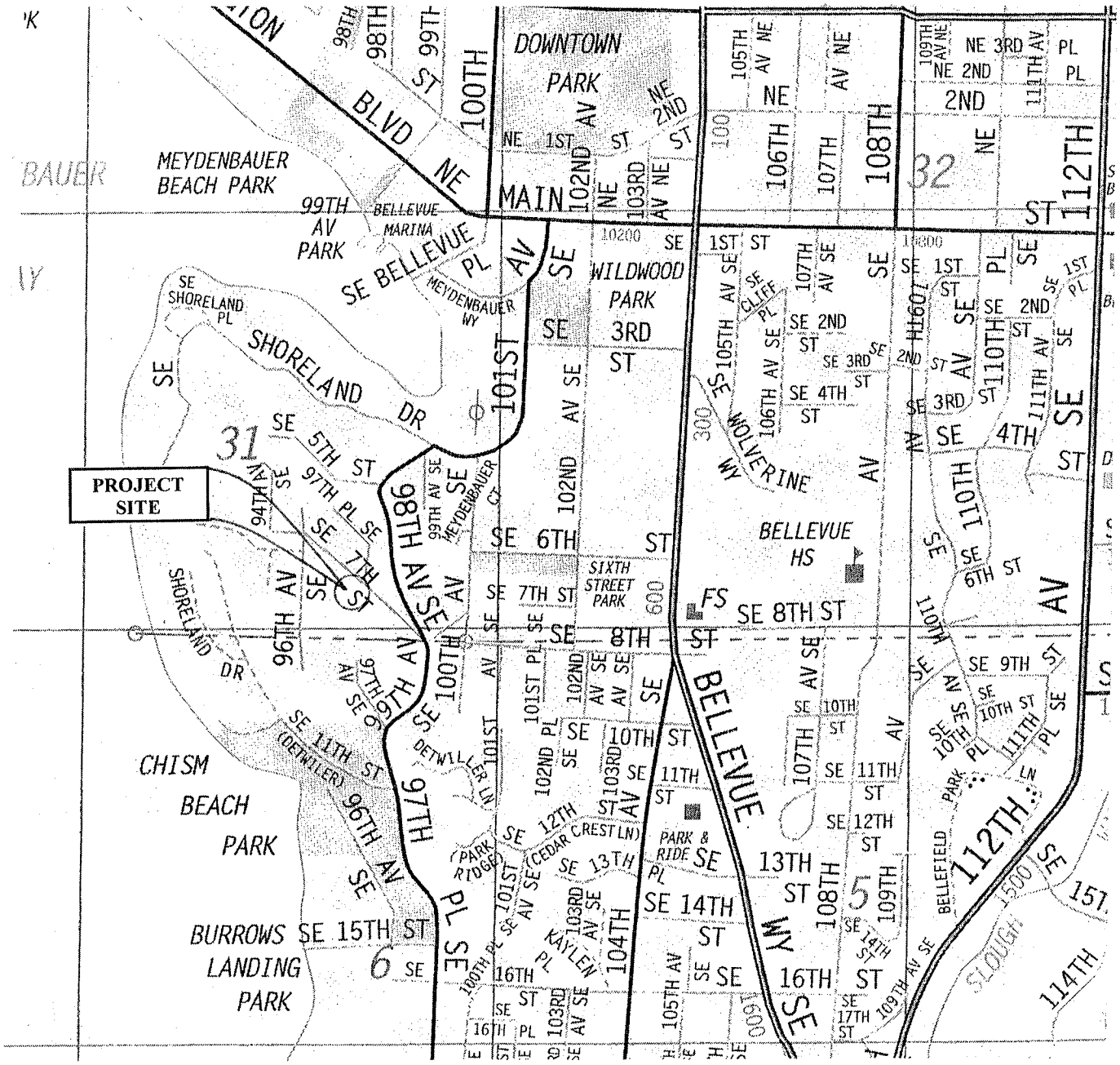
Attachments:

Plate 1 - Vicinity Map
Plate 2 - Site Plan
Plate 3 - Rockery Detail
Appendix A - USCS Soil Classification Legend and Hand Auger Boring Logs
Appendix B - Standard Rockery Construction Guidelines

Adapted from "The Thomas Guide," 2007.

0 1000' 2000'

Approximate Scale: 1 inch =1000 feet



VICINITY MAP

HANSEN ROCKERY
9631 SE 7TH STREET
BELLEVUE, WASHINGTON

GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

SCALE	DATE	MADE	CHKD	JOB NO.	PLATE
As Shown	1/31/12	WJL	WC	G-3244	1

TREE LEGEND

- CEDAR TREE
- MAPLE TREE
- TREE (UNSPECIFIED)

SET REBAR AND CAP LS#1132
12"
16"
MAIL BOX
230
30
S.E. 7TH STREET
30'
BLOCK WALL
GATE
LOT 18
14"
CONCRETE WALL
POWER PEDESTAL
240
WOOD GUARDRAIL
S55°42'58"E 187.76'
220
(6)6"
FOUND 1" IRON PIPE
8"
(4)6"
N10°03'E 131.92'
TOP=218.0
TOE=212.9
~CARPORT~
240
230
TOP=219.3
TOE=217.6
FOUND REBAR AND CAP LS# 29537 0.15'SWLY
CATV PED
TOP=216.2
TOE=211.9
6"
7.1'
CONCRETE BLOCK WALL, TYP.
8"
TOP=219.4
TOE=215.1
TOP=223.3
TOE=222.2
TOP=222.4
TOE=220.2
TOP=220.7
TOE=218.3
HA-1
YARD DRAIN
210
250
EX HOUSE 1ST FLOOR
LOT 17
DECK
DECK
DECK
2ND FLOOR
8"
3.1'
2.9'
SPORTCOURT
Setdown
FOUND MAG & WASHER LS# 29537 0.04'N 0.07'W
TOP=216.4
TOE=212.5
SET 'X' IN WALL
PLANTER
8"
SWIMMING POOL
HOT TUB
PLANTER
PLANTER
Tension Cracks
TOP=220.4
TOE=218.1
S01°01'11"E 56.52'
TOP=222.1
TOE=219.8
TOP=218.4
TOE=214.5
N01°13'32"E 30.00'
LOT 3
FOUND REBAR AND CAP LS#30427
HA-2
TOP=223.6
TOE=221.5
TOP=219.8
TOE=216.6
179.84'
N89°14'21"W
FOUND IRON PIPE AND TACK 0.59'S 0.38'W
FOUND REBAR AND CAP LS# 18909
OVERHANG 7"x10' FREE STANDING WALL
ROCK FIREPLACE
GAS METER
FOUND REBAR AND CAP
LOT 1
HEYDENBAUER HEIGHTS
BLOCK 1
250

LEGEND

HA-1 **Hand Auger Boring Number And Approximate Location**

N

0 20' 40'

Approx. Scale: 1 inch = 20 ft +/-

This Site Plan adapted from "Boundary/Topographic Plan" prepared for Steve Hansen.," dated 20/25/2011 by Encompass Engineering & Surveying.

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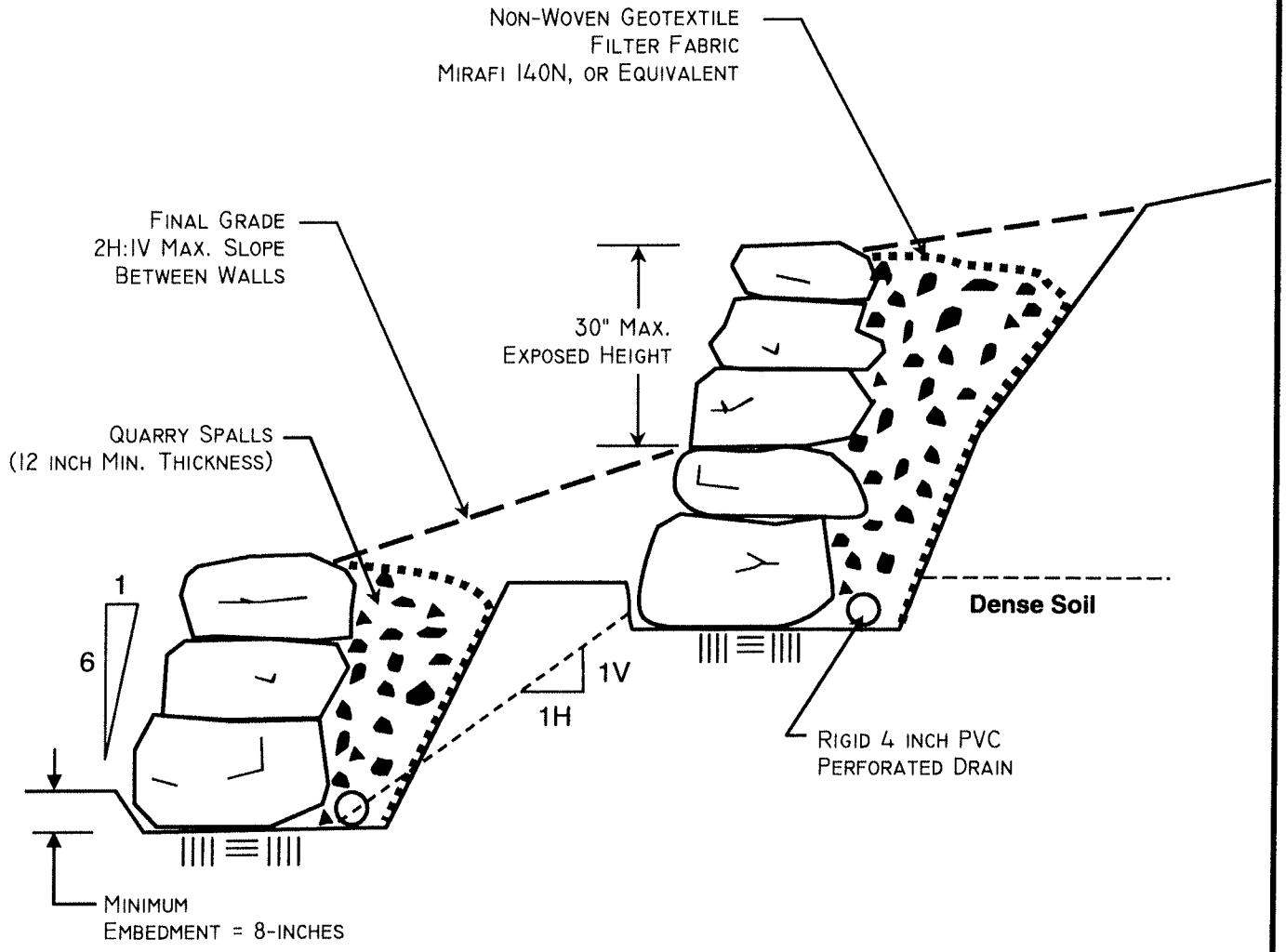
SITE PLAN

HANSEN ROCKERY
9631 SE 7TH STREET
BELLEVUE, WASHINGTON

SCALE	As Shown	DATE	1/31/12	MADE	WJL	CHKD	WC	JOB NO.	G-3244	PLATE	2

TIERED ROCKERY WALL DETAIL



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TIERED ROCKERY DETAIL

HANSEN ROCKERY
9631 SE 7TH STREET
BELLEVUE, WASHINGTON

SCALE	DATE	MADE	CHKD	JOB NO.	PLATE
NONE	01/31/2012	WJL	WC	G-3244	3

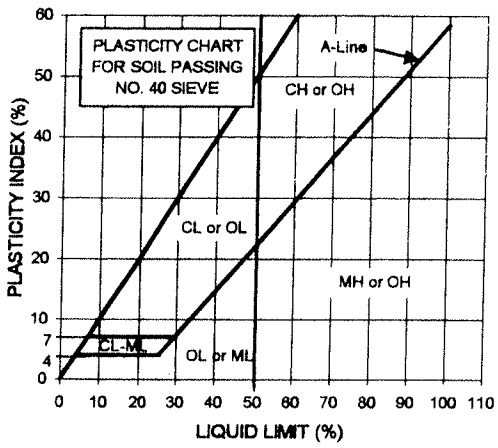
APPENDIX A

Hand Auger Boring Logs

LEGEND OF SOIL CLASSIFICATION AND PENETRATION TEST

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE-GRAINED SOILS (More Than Half by Weight Larger Than No. 200 Sieve)	GRAVELS (More Than Half Coarse Grains Larger Than No. 4 Sieve)	CLEAN GRAVELS (little or no fines)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	DETERMINE PERCENTAGES OF GRAVEL AND SAND FROM GRAIN SIZE DISTRIBUTION CURVE	Cu = (D60 / D10) greater than 4 Cc = ($D30^2$) / (D10 * D60) between 1 and 3	
			GP	POORLY GRADED GRAVELS, AND GRAVEL-SAND MIXTURES LITTLE OR NO FINES		NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (with some fines)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES		CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE or P.I. LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS:		ATTERBERG LIMITS ABOVE "A" LINE or P.I. MORE THAN 7
	SANDS (More Than Half Coarse Grains Smaller Than No. 4 Sieve)	CLEAN SANDS (little or no fines)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		Cu = (D60 / D10) greater than 6 Cc = ($D30^2$) / (D10 * D60) between 1 and 3	
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	< 5% Fine Grained: GW, GP, SW, SP	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY SANDS (with some fines)	SM	SILTY SANDS, SAND-SILT MIXTURES	> 12% Fine Grained: GM, GC, SM, SC	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE with P.I. LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	5 to 12% Fine Grained: use dual symbols		ATTERBERG LIMITS ABOVE "A" LINE with P.I. MORE THAN 7
FINE-GRAINED SOILS (More Than Half by Weight Larger Than No. 200 Sieve)	SILTS (Below A-Line on Plasticity Chart, Negligible Organic)	Liquid Limit < 50%	ML	INORGANIC SILTS, ROCK FLOUR, SANDY SILTS OF SLIGHT PLASTICITY			
		Liquid Limit > 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOIL			
	CLAYS (Above A-Line on Plasticity Chart, Negligible Organic)	Liquid Limit < 30%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, CLEAN CLAYS			
		Liquid Limit > 50%	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS			
	ORGANIC SILTS & CLAYS (Below A-Line on Plasticity Chart)	Liquid Limit < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY			
		Liquid Limit > 50%	OH	ORGANIC CLAYS OF HIGH PLASTICITY			
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS			



SOIL PARTICLE SIZE

FRACTION	U.S. STANDARD SIEVE			
	Passing		Retained	
	Sieve	Size (mm)	Sieve	Size (mm)
SILT / CLAY	#200	0.075		
SAND				
FINE	#40	0.425	#200	0.075
MEDIUM	#10	2.00	#40	0.425
COARSE	#4	4.75	#10	2.00
GRAVEL				
FINE		19	#4	4.75
COARSE		76		19
COBBLES	76 mm to 203 mm			
BOULDERS	> 203 mm			
ROCK FRAGMENTS	> 76 mm			
ROCK	>0.76 cubic meter in volume			

GENERAL GUIDANCE OF SOIL ENGINEERING PROPERTIES FROM STANDARD PENETRATION TEST (SPT)

SANDY SOILS				SILTY & CLAYEY SOILS		
Blow Counts N	Relative Density %	Friction Angle ϕ, degree	Description	Blow Counts N	Unconfined Strength q_u, tsf	Descnption
0 - 4	0 -15		Very Loose	< 2	< 0.25	Very soft
4 - 10	15 - 35	26 - 30	Loose	2 - 4	0.25 - 0.50	Soft
10 - 30	35 - 65	28 - 35	Medium Dense	4 - 8	0.50 - 1.00	Medium Stiff
30 - 50	65 - 85	35 - 42	Dense	8 - 15	1.00 - 2.00	Stiff
> 50	85 - 100	38 - 46	Very Dense	15 - 30	2.00 - 4.00	Very Stiff
				> 30	> 4.00	Hard

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Phone (425) 649-8757 Fax (425) 649-8758

PLATE A1

HAND AUGER BORING NO. HA-1

LOGGED BY: WJL DATE: 1/27/12 GROUND ELEV: 226 FT (+/-)

DEPTH ft.	USCS	SOIL DESCRIPTION	SAMPLE No.	
1	ML	**TOPSOIL,** brown organic silt with some sand and occasional gravel, moist	S1	
2	ML	**SILT** with some very fine sand, light brown with some mottling, loose, moist, and occasional gravel	S2	
3	ML	Minor seepage at 34"	S3	- Minor Seepage
4	ML	**Sandy SILT,** light brown with some mottling, very fine sand, occasional fine gravel, medium dense, dense at 3.5 feet, moist	S4	
5		Total Depth = 3.5 feet below ground surface. Minor groundwater seepage encountered at 34".		
6				

HAND AUGER BORING NO. HA-2

LOGGED BY: WJL DATE: 1/21/09 GROUND ELEV: 224 FT (+/-)

DEPTH ft.	USCS	SOIL DESCRIPTION	SAMPLE No.	
1	ML	**TOPSOIL**, brown, sandy SILT with organics, loose, occasional gravel, moist. abundant roots	S1	
2	ML	**SILT** with some sand, light brown, loose to medium dense, moist, wet below 2 feet, moderate seepage at 2 feet	S2	- Moderate Seepage
3	ML	**Sandy SILT**, light brown, very fine sand, wet, medium dense, dense at 3 feet	S3	
4		Total Depth = 43 inches below ground surface (bgs). No groundwater or water seepage encountered. Location: Approximately 8.9' N and 7.9' E of the NE corner of garage (1.5' south of top of slope).		
5				
6				

GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

HAND AUGER BORING LOGS

STEVE HANSEN RESIDENCE
9631 SE 7TH STREET
BELLEVUE, WASHINGTON

APPENDIX B

Standard Rockery Construction Guidelines

GEO Group Northwest, Inc.

ARC STANDARD ROCKERY CONSTRUCTION GUIDELINES

1.01 Introduction:

1.01.1 Historical Background These standard rock wall construction guidelines have been developed in an effort to provide a more stringent degree of control on materials and construction methodology in the Pacific Northwest. They have been assembled from numerous other standards presently in use in the area, from expertise provided by local geotechnical engineers, and from the wide experience of the members of the Associated Rockery Contractors (ARC).

1.01.2 Goal The primary goals of this document are to standardize the methods of construction for rock walls over four feet in height, and to provide a means of verifying the quality of materials used in construction and the workmanship employed in construction. This standard has also been developed in a manner that makes it, to the best of ARC's knowledge, more stringent than the other standards presently in use by local municipalities.

2.01 Materials:

2.01.1 Rock Quality All rock shall be sound, angular ledge rock that is resistant to weathering. The longest dimension of any individual rock should not exceed three times its shortest dimension. Acceptability of rock will be determined by laboratory tests as hereinafter specified, geologic examination and historical usage records.

All rock delivered to and incorporated in the project shall meet the following minimum specifications:

a. Absorption ASTM C127 AASHTO T-85	*Not more than 2.0% for igneous and metamorphic rock types and 3.0% for sedimentary rock types.*
b. Accelerated Expansion *(15 days)* CRD-C-148 *1, *2	*Not more than 15% breakdown.*
c. Soundness *(MsS04 at 5 cycles)* ASTM C88 CRD-C-137	*Not greater than 5% loss.*
d. Unconfined Compressive Strength ASTM D 2938	*Intact strength of 6,000 psi, or greater.*
e. Bulk Specific Gravity (155pcf) ASTM C127 AASHTO T-85	*Greater than 2.48*

*1. The test sample will be prepared and tested in accordance with Corps of Engineers Testing procedure CRD-C-148, "Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol.".

*2. Accelerated expansion tests should also include analyses of the fractures and veins found in the rock.

2.01.2 Frequency of Testing Quarry sources shall begin a testing program when either becoming a supplier or when a new area of the source pit is opened. The tests described in Section 2.01.1 shall be performed for every four thousand (4000) tons for the first twelve thousand (12,000) tons of wall rock supplied to establish that specific rock source. The tests shall then be performed once a year, every 40,000 tons, or at an apparent change in material. If problems with a specific area in a pit or with a particular material are encountered, the initial testing cycle shall be restarted.

2.01.3 Rock Density Recognizing that numerous sources of rock exist, and that the nature of rock will vary not only between sources but also within each source, the density of the rock shall be equal to, or greater than, one hundred fifty-five (155) pcf. Typically, rocks used for rock wall construction shall be sized approximately as follows:

Rock Size	Rock Weight	Average Dimension
One man	50-200 pounds	12 to 18 inches
Two man	200-700 pounds	18 to 28 inches
Three man	700-2000 pounds	28 to 36 inches
Four man	2000-4000 pounds	36 to 48 inches
Five Man	4000-6000 pounds	48 to 54 inches
Six Man	6000-8000 pounds	54 to 60 inches

In rock walls eight feet and over in height, it should not be possible to move the large sized rocks (four to six-man size) with a pry bar. If these rocks can be moved, the rock wall should not be considered capable of restraining any significant lateral load. However, it is both practical and even desirable that smaller rocks, particularly those used for "chinking" purposes, can be moved with a pry bar to achieve the "best fit".

2.01.4 Submittals The rock source shall present current geologic and test data for the minimum guidelines described in Section 2.01.1 on request by either the rock wall contractor, the owner, or the applicable agency.

3.01 Rock Wall Construction:

3.01.1 General Rock wall construction is a craft and depends largely on the skill and experience of the builder. A rock wall is a protective system which helps to retard the weathering and erosion process acting on an exposed cut or fill soil face. While by its nature (the mass, size and shape of the rocks) it will provide some undetermined degree of retention, it is not a designed or engineered system in the sense a reinforced concrete retaining wall would be considered designed or engineered. The degree of retention achieved is dependant on the size of rock used; that is, the "mass" or weight, and the height of the rock wall being constructed. The larger the rock, the more competent the rock wall. To accomplish an appropriate

degree of competency, all rock walls in excess of four feet in height should be built on a "mass" basis, i.e. by the ton.

To provide a competent and adequate rock wall structure, all rock walls constructed in front of either cuts or fills eight feet and over in height should be bid and constructed in accordance with these standard guidelines and the geotechnical engineer's supplemental recommendations. Both the standard guidelines and the supplemental geotechnical recommendations should be provided to prospective bidders before bidding and the start of construction.

3.01.2 Geotechnical Engineer The geotechnical engineer retained to provide necessary supplemental rock wall construction guidelines shall be a practicing geotechnical/civil engineer licensed as a professional civil engineer in the State of Washington who has had at least four years of professional employment as a geotechnical engineer in responsible charge, including experience with fill construction and stability and rock wall construction. The geotechnical engineer should be hired either by the rock wall contractor or the owner.

3.01.3 Responsibility The ultimate responsibility for standard rock wall construction should remain with the rock wall builder. However, rock walls protecting moderate to thick fills, with steep sloping surfaces above or below them, with multiple steps, with foundation or other loads affecting them, protecting sandy or gravelly soils subject to ravelling, with seepage or wet conditions, or that are eight feet or more in height, all represent special design conditions and require consultation and/or advice from qualified experts.

3.01.4 Workmanship All workmanship is guaranteed by the rock wall contractor and all materials are guaranteed by the supplying quarry for a period of six years from the date of completion of erection, providing no modification or changes to the conditions existing at the time of completion are made.

3.01.5 Changes to Finished Product Such changes include, but are not necessarily limited to, temporary excavation of ditches or trenches for any utility within a distance of less than five feet from the back of the top of the rock wall; excavation made either within a distance equal to at least two thirds of the free-standing wall height in front of the toe of a rock wall, or that will penetrate an imaginary line extended at a 1H:1V (Horizontal: Vertical) slope from the front edge of the rock wall toe (see Figure A); removal of any material from the subgrade in front of the wall, excavation of material from any location behind the rock wall within a distance at least equal to the rock wall's height, the addition of any surcharge or other loads within a similar distance of the top of the rock wall, or surface or subsurface water forced, directed, or otherwise caused to flow behind the rock wall in any quantity.

3.01.6 Slopes Slopes above rock walls should be kept as flat as possible, but should not exceed 2H:1V unless the rock wall is designed specifically to provide some restraint to the load imposed by the slope. Any slope existing above a completed rock wall should be covered with vegetation by the owner to help reduce the potential for surface water flow induced erosion. It should consist of a deep rooted, rapid growth vegetative mat, will typically be placed by hydroseeding and covered with a mulch. It is often useful to overlay the seed and mulch with either pegged

in-place jute matting, or some other form of approved geotextile, to help maintain the seed in-place until the root mat has an opportunity to germinate and take hold.

3.01.7 Monitoring

All rock walls constructed against cuts or fills eight feet and over in height shall be periodically monitored during construction by the geotechnical engineer to verify that the nature and quality of the materials being used are appropriate, that the construction procedures are appropriate, and that the rock wall is being constructed in a generally professional manner and in accordance with this ARC guideline and any supplemental recommendations.

On completion of the rock wall, the geotechnical engineer should submit to the client, the rock wall contractor, and to the appropriate municipality, copies of his rock wall examination reports along with a final report summarizing rock wall construction.

3.01.8 Fill Compaction

Where rock walls are constructed in front of a fill, it is imperative that the owner ensure the fill be placed and compacted in a manner that will provide a competent fill mass. To achieve this goal, all fills should consist of relatively clean, organic and debris free granular materials with a maximum size of four inches. Ideally, but particularly if placement and compaction is to take place during the wet season, they should contain no more than seven percent fines (silt and clay sized particles) passing the number 200 mesh sieve.

All fills should be placed in thin lifts not exceeding ten (10) inches in loose thickness. Each lift should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM Test Method D-1557-78 (Modified Proctor), before any additional fill is placed and compacted. In-place density tests should be performed at random locations within each lift of the fill to verify that this degree of compaction is being achieved.

3.01.9 Fill Construction Reinforcement

There are two methods of constructing a fill. The first, which typically applies to rock walls of less than eight feet in height, is to overbuild and then cut back the fill. The second, which applies to all rock walls eight feet and over in height, is to construct the fill using a geogrid or geotextile reinforcement.

Overbuilding the fill allows for satisfactory compaction of the fill mass out beyond the location of the fill face to be protected. Overbuilding also allows the earthwork contractor to use larger and more effective compaction equipment in his compactive efforts, thereby typically achieving a more competent fill mass. Cutting back into the well compacted fill also typically results in construction of a competent near vertical fill face against which to build the rock wall.

For the higher rock walls the use of a geogrid or geotextile fabric to help reinforce the fill results in construction of a more stable fill face against which to construct the rock wall. This form of construction leads to a longer lasting and more stable rock wall and helps reduce the risk of significant long term maintenance.

This latter form of construction requires a design by the geotechnical engineer for each specific case. The vertical spacing of the reinforcement, the specific type of reinforcement and the distance to which it must extend back into the fill, the amount of lapping and the construction sequence must be determined on a case by case basis.

3.01.10 Rock Wall Keyway

The first step in rock wall construction, after general excavation, is to construct a keyway in which to build the rock wall. The keyway shall comprise a shallow trench of at least twelve (12) inches in depth, extending for the full length of the rock wall. The keyway subgrade should be slightly inclined back towards the face being protected. It is typically dug as wide as the rock wall (including the width of the rock filter layer). If the condition of the cut face is of concern, the keyway should be constructed in sections of manageable length, that is, of a length that can be constructed in one shift or one day's work.

The competency of the keyway subgrade to support the rock wall shall be verified by probing with a small diameter steel rod. The rod shall have a diameter of between three-eighths and one-half inch, and shall be pushed into the subgrade in a smooth unaided manner under the body weight of the prober only. Penetration of up to six inches, with some difficulty, shall indicate a "competent" keyway subgrade unless other factors in the geotechnical engineer's opinion shall indicate otherwise.

Penetration in excess of six inches, with ease, shall indicate a "soft" subgrade and one that could require treatment. Shallow soft areas of the subgrade can be "firmed up" by tamping a layer of coarse quarry spalls into the subgrade.

3.01.11 Keyway Drainage

Upon completion of keyway excavation, a shallow ditch or trench, approximately twelve (12) inches wide and deep, should be dug along the rear edge of the key way. A minimum four-inch diameter perforated or slotted rigid ADS drain pipe, or equivalent, approved by an engineer, should be placed in this shallow trench and should be bedded on and surrounded by a free-draining crushed rock. Burial of the drain pipe in this shallow trench provides protection to the pipe and helps prevent it from being inadvertently crushed by pieces of the rock wall rock. This drain pipe should be installed with sufficient gradient to initiate flow, and the outfall should be connected to a positive and permanent discharge.

Positive and permanent drainage should be considered to mean an existing or to be installed storm drain system, a swale, ditch or other form of surface water flow collection system, a detention or retention pond, or other stable native site feature or previously installed collection system.

3.01.12 Rock Wall Thickness

The individual rock wall thickness should be equal to the thickness of the recommended size of rock plus the thickness of the drain rock layer. This thickness, which will be determined on a case by case basis, will be dependant on the specific rock sizes recommended for each individual rock wall. For example, if four-man rock is used the rock wall thickness will be approximately five feet.

3.01.13 Rock Selection The contractor should have sufficient space available so that he can select from among a number of stockpiled rocks for each space in the rock wall to be filled. Rocks which have shapes which do not match the spaces offered by the previous course of rock should be placed elsewhere to obtain a better fit. Rock should be of a generally cubical, tabular or rectangular shape and selected in accordance with Section 2.01.3. Any rocks of basically rounded or tetrahedral form should be rejected or used for filling large void spaces.

3.01.14 Rock Placement The first course of rock should be placed on firm unyielding soil. There should be full contact between the rock and soil, which may require shaping of the ground surface or slamming or dropping the rocks into place so that the soil foundation conforms to the rock face bearing on it. The bottom of the first course of rock should be a minimum of twelve (12) inches below the lowest adjacent site grade.

As the rock wall is constructed, the rocks should be placed so that there are no continuous joint planes in either the vertical or lateral direction. Wherever possible, each rock should bear on at least two rocks below it. Rocks should be placed so that there is some bearing between flat rock faces rather than on joints. Joints between courses (the top surface of rock), should slope back towards the cut face and away from the face of the rock wall.

Smaller rocks (one to two-man size) are often used to create an aesthetically pleasing "top edge" to a rock wall. This is an acceptable practice provided none of the events described in Section 3.01.5 occur, and that people are prevented from climbing or walking on the finished wall. ***This is the owner's responsibility.***

3.01.15 Face Inclination The face of the rock wall should be inclined at a gradient of about 1H:6V back towards the face being protected. The inclination should not be constructed flatter than 1H:4V.

3.01.16 Voids Because of the nature of the product used to construct a rock wall, it is virtually impossible to avoid creating void spaces between individual rocks. However, it should be recognized that voids do not necessarily constitute a problem in rock wall construction. As the size of rock used to build a rock wall increases, i.e. to six-man size, the void spaces between individual rocks should be expected to be larger.

Where voids of greater than six inches in dimension exist in the face of a rock wall they should be visually examined to determine if contact between the rocks exists within the thickness of the rock wall. If contact does exist, no further action is required. However, if there is no rock contact within the rock wall thickness the void should be "chinked" with a smaller piece of rock.

3.01.17 Drain Rock Layer In order to provide some degree of drainage control behind the rock wall, and as a means of helping to prevent loss of soil through the face of the rock wall, a rock drainage filter shall be installed between the rear face of the rock wall and the soil face being protected. This drain rock layer should be at least twelve (12) inches thick; and for rock walls eight feet in height or higher, it should be at

least eighteen (18) inches thick. It should be composed of 4 to 2-inch sized crushed rock quarry spalls, crushed concrete, or other material approved by the geotechnical engineer. If a random wall rock extends back to the exposed soil face, it is not necessary that the filter rock layer extend between it and the soil face.

Depending on soil type and potential water seepage, a geotextile fabric may or may not be required. This can be determined on a case by case basis by the geotechnical engineer during design and prior to bidding.

3.01.18 Surface Drainage

It is the owner's responsibility to intercept surface drainage from above the rock wall and direct it away from the rock wall to a positive and permanent discharge well below and beyond the toe of the rock wall. Use of other drainage control measures should be determined on a case-by-case basis by the geotechnical engineer prior to bidding on the project.

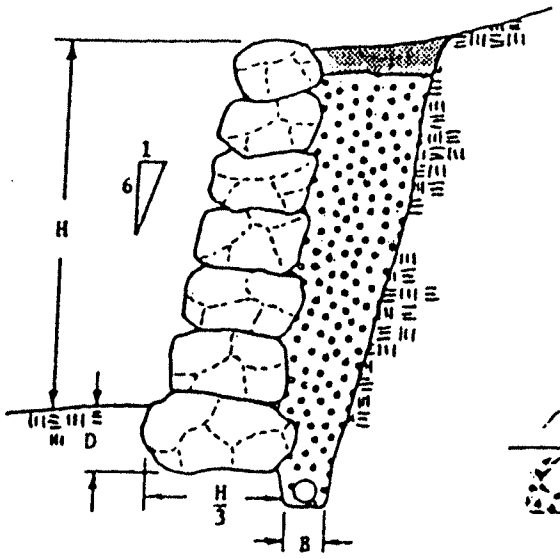

Fig. A. ROCKERY SECTION

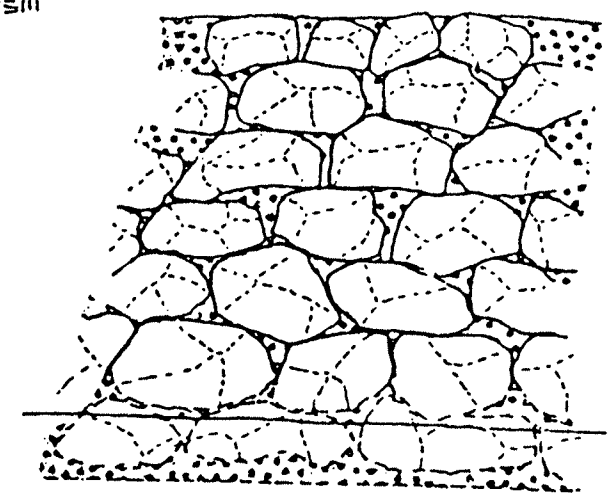

Fig. B. ROCKERY ELEVATION

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

NOTES:

Rockery construction ia a craft and depends largely on the skill and experience of the builder.

A rockery is a protective system which helps retard the weathering and erosion process on an exposed soil face. While by its nature (mass, size and shape of the rocks) it will provide some degree of retention, it is not a designed or engineered system in the sense a reinforced concrete retaining wall would be considered designed or engineered.

The degree of retention achieved is dependent on the size of the rock used; that is, the mass or weight, and the height of the wall being constructed. The larger the rock, the more competent the wall.

Rockeries should be considered maintenance items that will require periodic inspection and repair. They should be located so that they can be reached by a contractor if repairs become necessary.

Maximum inclination of slopes behind rock walls is 2:1 (Horizontal:Vertical)

Minimum embedment D = 12 inches undisturbed native soil or compacted fill placed in accordance with report recommendations.

Maximum rock wall height H = feet.

Rockeries greater than 8 feet in height to be installed under periodic observation of the geotechnical engineer.

Rocks placed in the lower two-thirds of the wall should be 5 to 6 man rock, 5000 lbs. or larger. Rocks placed above this level should gradually decrease in size with increasing wall height using 3 to 5 man rock, 760 to 5000 lbs.

The long dimension of the rocks should extend into the earth to provide maximum stability.

Rocks should be placed to avoid continuous joint planes in vertical or lateral directions. Each rock should bear on two or more rocks below it, with good flat-to-flat contact.

All rockeries over 4 feet in height should be constructed on basis of wall mass, not square footage of face.

	Approximate Weight - lbs.	Approximate Volume (ft^3)
1 Man	58,210	0.9 - 4.0
2 Man	265,580	4.1 - 8.25
3 Man	760 - 1830	12.3 - 27.1
4 Man	3000 - 7000	49.0 - 76.0
5 Man	5000	76
6 Man	7000	100

Reference: Local quarry weight study using average weights of no less than six rocks of each man size conducted in January, 1988.

LEGEND:

Drainage materials to consist of clean angular well-graded quarry spalls, with 3-inch maximum size, or other material approved by the geotechnical engineer

Surface seal; may consist of impervious soil or asphalt

Undisturbed firm Native Soil

Drain pipe; 4-inch minimum diameter, perforated or slotted rigid plastic ADS pipe laid with a positive gradient to discharge under control well away from the wall.

ARC Association of Rockery Contractors

TYPICAL ROCKERY DETAILS

Proj. No.	Date	Plate

New Zealand Flax

Red twig dogwood

Hebe or simalar Flowering Shrub

Winter green ground cover

Heather