

**Critical Aquifer Recharge Area
Level 1 Site Evaluation Report**

**Green Mountain North
Subdivision**

Camas, Washington

May 31, 2017

Geotechnical ■ Environmental ■ Special Inspections

Columbia West
E n g i n e e r i n g , I n c



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**CRITICAL AQUIFER RECHARGE AREA
LEVEL 1 SITE EVALUATION REPORT
GREEN MOUNTAIN NORTH SUBDIVISION**

Site Location: 4601 NE Ingle Road
Parcel Numbers 17170400, 171727000,
172341000, and 17173000
Camas, Washington

Prepared By: Columbia West Engineering, Inc.
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Date Prepared: May 31, 2017

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CRITICAL AQUIFER RECHARGE AREA LEVEL 1 SITE EVALUATION REPORT GREEN MOUNTAIN NORTH SUBDIVISION CAMAS, WASHINGTON

1.0 INTRODUCTION

Columbia West Engineering, Inc. was retained to prepare a Critical Aquifer Recharge Area (CARA) Level 1 Site Evaluation Report for the proposed Green Mountain North subdivision project located at 4601 NE Ingle Road in Camas, Washington. The property's current and proposed use is residential. Due to the site's location in a Category I Aquifer Recharge Area, a CARA Level 1 Site Evaluation Report is required per the City of Camas' Code of Ordinances Critical Aquifer Recharge Areas Chapter 16.55.

This CARA report summarizes hydrogeologic information, groundwater data, critical areas, stormwater treatment, Best Management Practices (BMPs), and describes how Green Mountain North will limit risk of degradation of groundwater.

The purpose of this CARA report is to conduct a hydrogeologic assessment and identify procedures, processes, and protective and mitigative methods that will protect public health, safety, and welfare by limiting groundwater degradation and where possible, enhance the quality and quantity of groundwater which will be, or might likely be, used in the future for drinking water, agricultural use, or business purposes. The CARA report presents guidelines, methods, and equipment to limit risk of a release of hazardous or petroleum products to the ground, surface water, or groundwater.

1.1 Scope of Services

The scope of services for this CARA report consists of the following items:

Site Reconnaissance

Site reconnaissance, consisting of visual and physical observation of the subject site, was conducted to identify current environmental conditions and potential issues.

Interviews

Interviews were conducted with Olsen Engineering, Inc. (the site planner and civil engineer) to obtain relevant environmental information about the site. The purpose of interviewing knowledgeable personnel was to obtain information regarding proposed stormwater management and treatment and material and product use at the subject property.

Evaluation and Report Preparation

This report was prepared in accordance with Camas, Washington's Code of Ordinances Critical Aquifer Recharge Areas Chapter 16.55 and is subject to the limitations expressed in Section 8.0, *Conclusion and Limitations* and Appendix C, *Report Limitations and*

Important Information. The CARA report outlines procedures that follow relevant portions of the *State of Washington's Growth Management Act, Chapter 36.70A RCW, Public Water System Penalties and Compliance, Chapter 70.119A RCW, Well Head Protection Program and Public Water Supplies, Chapter 246-290 Washington Administrative Code (WAC), Water Quality Standards for Groundwater of the State of Washington, Chapter 173-200 WAC, Regulation of Public Groundwaters, Chapter 90.48 RCW, and Dangerous Waste Regulations, Chapter 173-303 WAC.*

2.0 SITE DESCRIPTION

2.1 Location and Legal Description

As indicated on Figure 1, the subject site is located at 4601 NE Ingle Road in Camas, Washington. The site is located east of the intersection of NE Ingle Road and NE 43rd Circle and consists of tax parcels 17170400, 171727000, 172341000, and 17173000. The legal description is a portion of the SE and SW $\frac{1}{4}$ of Section 17 and NE $\frac{1}{4}$ of Section 20, T2N, R3E, Willamette Meridian and the approximate latitude and longitude are N 45°39'10.93" and W 122°27'41.92. The regulatory jurisdictional agencies are the City of Camas and the State of Washington.

2.2 General Site Setting and Proposed Development

The approximately 124.5-acre site lies on the west and southwest flank of Green Mountain. The subject site is primarily undeveloped with the exception of two residential structures with detached outbuildings near the western site boundary (with site address 4601 NE Ingle Road), two Bonneville Power Administration (BPA) easements trending east-west at the northern boundary and northwest through the center of the site. The subject site is densely vegetated with large fir and deciduous trees and associated understory vegetation.

Proposed development is a residential subdivision consisting of approximately 160 lots, neighborhood streets, underground utilities, and stormwater conveyance and management facilities. The development area can generally be broken into three terrain areas from west to east: the western valley, a central basalt bench, and cinder cone slopes in the east. Elevations range from approximately 200 to 250 feet in the western valley area along Ingle Road, 250 to 400 feet in the central bench area, and 400 to 790 feet on the cinder cone. Proposed residential development is proposed up to approximately 550 feet in elevation in the southeast area. A site map with proposed layout of the subdivision is provided on Figure 2.

The property has been impacted previously by the construction of Bonneville Power Administration transmission towers, old road cuts, a well house with associated conveyance piping, and the power installation and easement to the residential parcel. A municipal water well and well house used by Clark Public Utilities (CPU) located in the central portion of the site supplies water to approximately 12 residential properties in the Mountain Glen subdivision, located immediately north of the Subject Site.

2.3 Site Soil and Groundwater Characteristics

2.3.1 Regional Geology

The subject site lies within the Willamette Valley/Puget Sound Lowland, a wide physiographic depression flanked by the mountainous Coast Range on the west and the Cascade Range on the east. Inclined or uplifted structural zones within the Willamette Valley/Puget Sound Lowland constitute highland areas and depressed structural zones form sediment-filled basins. The site is located within the central-eastern portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide. Specifically, the site is located on the western and southwest flank of a basaltic andesite cinder cone known as Green Mountain.

According to the *Geologic Map of the Lacamas Creek Quadrangle, Clark County, Washington*, (US Geological Survey, Science Investigations Map 2924, 2006), the majority of the proposed development area is underlain by the Basaltic Andesite of Green Mountain (Qbgm), a Pleistocene-aged cinder cone comprised of olivine-phyric, nonscoriaceous, platy lava and weathered basaltic ash. The cinder cone that forms Green Mountain represents the northern portion of the Quaternary Boring Volcanic Field which intruded vertically through the conglomeratic members, solidified, and weathered in place.

Geologic mapping indicates that a small portion of the study area located along the western base of Green Mountain is underlain by Pleistocene to Pliocene unconsolidated to semi-consolidated, pebble to cobble conglomerate (QTc). The unnamed conglomerate unit is lithologically similar to the Pliocene or late Miocene Troutdale Formation, differing primarily in age of emplacement, degree of weathering, and the presence of hyaloclastite interbeds. Previously published geologic mapping has identified this unit as the Troutdale Formation.

2.3.2 Site Soil Conditions

The *Web Soil Survey* (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2017 Website) indicates the site is underlain by Olympic stony clay loam series soils. Olympic stony clay loam soils are typically underlain by basaltic andesite bedrock. Although actual on-site soils may vary from the broad USDA descriptions, Olympic series soils generally consist of fine- to medium-textured, generally moderately drained, slowly permeable silts and clays with varying plasticity. They are generally moisture sensitive, have a high-water capacity, moderate shrink-swell potential, and slight erosion hazard based primarily upon slope grade.

Columbia West's 2017 Geotechnical Critical Areas Report prepared for the subject property (*DRAFT Geotechnical Critical Areas Report, Green Mountain North, Camas, Washington*, Columbia West Engineering, Inc., April 18, 2017) indicated the site is generally covered with 12 to 24 inches of topsoil and associated organic-rich root zone material at the locations observed. Underlying the topsoil layer, fine-textured silt and clay

soils resembling native USDA Olympic stony clay loam were encountered. Permeability of the unsaturated zone is expected to be moderate to low.

2.3.3 Site Hydrology and Groundwater Conditions

There are four primary hydrogeologic units identified in the region: (1) a surficial, unconsolidated sedimentary aquifer; (2) the Upper Troutdale Aquifer; (3) Lower Troutdale Aquifer, which may also be called the Troutdale Sandstone Aquifer, and (4) a deeper aquifer, known as the Sand and Gravel Aquifer.

Groundwater was encountered in two test pit explorations at depths of five and nine feet below ground surface during Columbia West's 2017 geotechnical investigation. Groundwater levels and flow near volcanic intrusions such as the Green Mountain cinder cone are often complex. According to *Clark County Maps Online*, shallow groundwater in the vicinity of the subject site ranges from approximately 10 to 30 feet below ground surface near Ingle Road and up to 150 feet bgs on the northeast boundary towards Green Mountain. Shallow groundwater flow is likely to the southwest or the south. Shallow groundwater in the upper unconsolidated sedimentary aquifer may be subject to seasonal changes in elevation.

According to review of *Washington Department of Ecology Well Logs*, depths of wells for groundwater primarily used for drinking water purposes in the site vicinity vary from approximately 80 to 467 feet below ground surface. Depth to groundwater varies from 78 to 221 feet depending upon the location, elevation, screened interval of the well, and aquifer pressure. Wells from 80 to 221 feet are typically screened in the second hydrogeological unit below ground surface (i.e., the Upper Troutdale Aquifer). A deeper drinking water well located onsite is 467 feet deep and is likely screened in the lower hydrogeological unit, the Lower Troutdale Aquifer. The well, originally owned by Lacamas Valley Milling Company, is now managed by Clark Public Utilities (CPU) and is situated in the central portion of the site. The well supplies water to approximately 12 residential properties in the Mountain Glen subdivision located east of NE 199th Avenue on NE 48th Circle. A well log water well report is located in Appendix A for the Mountain Glen well, Washington State Identification number WSID AA234G.

The Upper Troutdale Aquifer and other aquifers are shown on Figure 4, Hydrogeologic Cross Section obtained from Pacific Groundwater Group (PGG) Exhibit 3-2, *Salmon Creek Basin Management Plan, 2002*. Groundwater flow direction of the Upper Troutdale Aquifer is likely toward the southwest at a slight gradient. The Lower Troutdale Aquifer underlies the Upper Troutdale Aquifer, separated by a confining unit. Other deep wells may be screened in lower hydrogeological units (i.e., the Lower Troutdale Aquifer or the Sand and Gravel Aquifer).

2.4 Site Reconnaissance

Columbia West personnel conducted physical and visual reconnaissance of the subject site on February 14, March 2, and March 3, 2017. The objective of site reconnaissance

was to observe site conditions, observe geomorphic, topographic and hydrogeologic characteristics, observe roads, and obtain other relevant site information.

2.5 Site Activities

As described previously, the purpose of this CARA report is to evaluate site activity and identify BMPs and stormwater treatment methods that will reduce or limit groundwater degradation from proposed residential activity. The proposed Green Mountain North subdivision will contain residential housing and is not anticipated to contain injection wells, industrial activities, above-ground storage tanks, underground storage tanks, or agricultural use of pesticides, herbicides, or nutrients.

2.6 Impervious Area

As shown on Figure 2, the subject site encompasses approximately 124.5 acres. Impervious area is defined as area preventing or prohibiting the infiltration of rain and stormwater, and includes buildings, paved areas, concrete sidewalks, etc. Impervious ground surfaces may act as a barrier and decrease the risk of subsurface contamination. New houses, driveways, roads, and sidewalks will be impervious following construction of proposed improvements.

2.7 Stormwater Drainage

Stormwater from the property will infiltrate in moderate amounts or will be collected by catch basins and will drain to a proposed stormwater detention pond. Stormwater management is planned to comply with the City of Camas Design Standards Manual and the Western Washington Stormwater Management Manual.

3.0 CRITICAL AQUIFER RECHARGE AREAS AND SURFACE WATER

Critical Aquifer Recharge Areas

Critical Aquifer Recharge Areas are areas with a critical recharging effect on aquifers used for potable water as defined by Washington Administrative Code (WAC) 365-190-030(2). Critical Aquifer Recharge Areas are divided into two categories based upon proximity to public drinking water sources. Category I Critical Aquifer Recharge Areas are located adjacent to public drinking water wells, and Category II Critical Aquifer Recharge Areas are areas that provide recharge effects to aquifers that are current or potentially will become potable water supplies and are vulnerable to contamination based on the type of land use activity.

According to review of Clark County GIS maps, the subject property is located in a Category 1 Recharge Area and within a 1 to 10-year groundwater protection area of public wells. The proposed Green Mountain North subdivision and area surrounding the Mountain Glen well WSID AA234G is designated a Category I Critical Aquifer Recharge Area.

Surface Water

Lacamas Creek and two man-made ponds are located southwest of the site. Wetlands are located west and south of the site. Surface water creeks, ponds, and wetlands are

located downgradient of the site and the Mountain Glen well. Critical areas for ground water, surface water, and wetlands are indicated on Figure 3.

4.0 WATER QUALITY DATA

Washington Department of Health regulates Group A public water systems under state law and a formal agreement with the U.S. Environmental Protection Agency (EPA) for carrying out the federal Safe Drinking Water Act, which establishes minimum standards for drinking water quality. Attached in Appendix B is a copy of water quality testing for Mountain Glen well WSID AA234G from Washington Department of Health.

5.0 POTENTIAL RELEASES

This section discusses potential releases of hazardous, petroleum products, or other substances to the ground or public waters. Significant materials are products or chemicals that could cause undue harm to the environment if spilled, uncontrollably released, or exposed. Materials may include gasoline, diesel fuel, lube oil waste oils, other hydrocarbon products, solvents, paints, primers, glues, and other chemicals that have the potential to impact soil, stormwater, or migrate to groundwater.

Under typical operating circumstances, the potential for release from the proposed site development is minimal. Incidental drips and spills are usually of such small quantity that potential release is easily contained in small areas or do not migrate deep into soils and may not pose a risk to groundwater. If not properly mitigated, addressed, or contained, overfilling, equipment malfunction, or collision could lead to release of petroleum products and potentially pose a risk of contact with soil or groundwater.

6.0 BEST MANAGEMENT PRACTICES (BMPS) AND STORMWATER TREATMENT

Best management practices, commonly referred to as “BMPs”, are stormwater treatment methods, source controls, or operational practices that reduce, eliminate, or limit pollution from entering soil, stormwater, or groundwater.

Columbia West has not reviewed final stormwater management plans for Green Mountain North subdivision, but anticipates site development will comply with the Western Washington Stormwater Management Manual and the City of Camas Design Standards Manual. Compliance with required stormwater management codes is anticipated to result in limited risk of groundwater contamination.

Best Management Practices - Pesticides, Herbicide, and Fertilizer Management

Pesticides, herbicides, and fertilizers application by future property owners or occupants should not exceed times and rates specified on the packaging and should be applied in accordance with federal law. Residential use of pesticides, herbicides, and fertilizers if used in accordance with manufacturer recommendations poses limited risk to groundwater.

7.0 FINDINGS AND CONCLUSIONS

This CARA report evaluates hydrogeology, the possibility of degradation of groundwater, and identifies BMPs and stormwater treatment measures that will limit or minimize potential impacts to onsite soils, surface water, and groundwater.

Depths of wells for groundwater primarily used for drinking water purposes in the site vicinity vary from approximately 80 to 467 feet depending upon the location, elevation, and screened interval of the well. The upper wells are typically screened in the second hydrogeological unit below ground surface (i.e., the Upper Troutdale Aquifer). The Mountain Glen subdivision WSID AA234G drinking water well located onsite is 467 feet deep and may be screened in a lower hydrogeological unit, the Lower Troutdale Aquifer. Lower aquifers are overlain by thick partially consolidated and cemented sedimentary deposits with low to moderate permeability. The significant depths to well screen intervals and the presence of thick overburden deposits limit risk of potential groundwater contamination.

Based upon Columbia West's investigation and review of available information examined and the assessment described herein, it is our opinion that site development will result in limited potential for environmental contamination or degradation of groundwater and will not adversely effect the recharging of the aquifer.

8.0 LIMITATIONS

Columbia West conducted a CARA Level 1 Site Evaluation Report in general accordance with City of Camas' Code of Ordinances Critical Aquifer Recharge Areas Chapter 16.55 and the scope of work identified in Section 1.1, *Scope of Services*. Project work was conducted in accordance with accepted professional engineering and consulting principles and practices.

This assessment did not include soil, water, or waste monitoring, sampling, exploratory subsurface boring, or laboratory analytical analysis. This report was prepared solely for the client, and is not to be reproduced without prior authorization from Columbia West. This assessment does not purport to address compliance with past or present environmental codes or regulations by subject property occupants and should not be construed as a legal opinion or document. Columbia West is not responsible for independent conclusions or recommendations made by others based on information presented in this report.

This report is based in part upon unsubstantiated information provided to Columbia West from third-party sources during interviews or written correspondence. Columbia West provides no warranty as to the validity of the information. This evaluation report is also based upon professional interpretations of acquired information relevant to the subject property at the time of investigation and the proposed future end use as described herein. This report should not be construed as a representative warranty of subsurface conditions. The above statements are in lieu conditions.

This CARA report should be periodically reviewed and evaluated to determine its applicability and effectiveness. Significant changes or modifications in residential activities or zoning at the site may require re-evaluation or revisions.

Sincerely,

COLUMBIA WEST ENGINEERING, Inc.

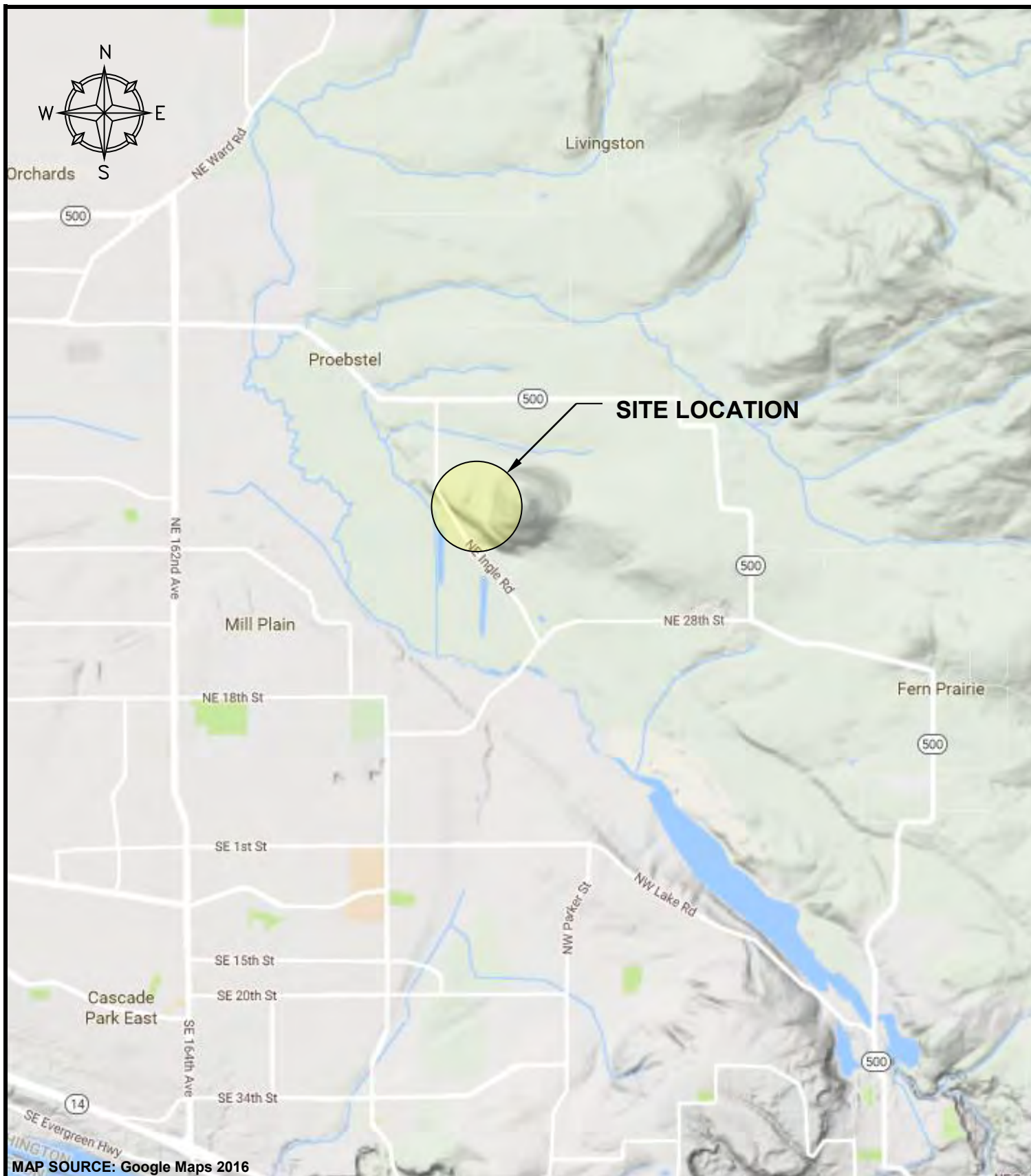


Lance V. Lehto, PE, MS
President

9.0 REFERENCES

1. Evarts, Russell C., Geologic Map of the Lacamas Creek Quadrangle, Clark County, Washington. USGS Geological Survey, Science Investigations Map 2924, 2006.
2. Evarts, Russell C, and O'Connor Jim E., Geologic Map of the Camas Quadrangle, Clark County, Washington, and Multnomah County, Oregon. US Geological Survey, Science Investigations Map 3017, 2008.
3. Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture 2017 website (<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>).
4. *Salmon Creek Basin Management Plan, Hydrogeologic Cross Section A-A'*, Pacific Ground Group, 2002.
5. *Groundwater Data for the Portland Basin, Oregon and Washington*, USGS Open File Report 90-126, 1990.
6. *A Description of Hydrogeologic Units in the Portland Basin, Oregon and Washington*. U. S. Geological Society. Swanson, R.D., McFarland, W.D., Gonthier, J.B. and Wilkinson, J.M., 1993.
7. *Washington Administrative Code (WAC) 173-340, Model Toxics Control Act Cleanup Regulation*, Washington Department of Ecology.
8. Washington Department of Ecology's Website (<http://www.ecy.wa.gov>).
9. Clark County GIS's Website (<http://gis.clark.wa.gov>).
10. *Guidance for UIC Wells that Manage Stormwater*, Publication Number 05-10-067, Washington Department of Ecology, December 2006.
11. *Stormwater Management Manual for Western Washington*, Publication Number 14-10-55, Washington Department of Ecology, 2012.
12. *Estimation of Ground-Water Recharge from Precipitation, Runoff into Dry-Wells, and On-Site Waste –Disposal Systems in the Portland Basin, Oregon and Washington*. Portland, OR: USGS Water-Resources Investigations Report 97-4010, 1994.
13. *Southwest Clark County generalized water table altitude and depth to groundwater mapping*. Clark County Water Quality Division. Swanson, Rodney D. and McCarley, Clifton. 1995.
14. South Clark County Groundwater Protection Areas Map, 2008.
15. Clark County, Washington *Critical Aquifer Recharge Area (CARA) CCC Chapter 40.010* Map, Department of Assessment and GIS, March 12, 2012.
16. *DRAFT Geotechnical Critical Areas Report, Green Mountain North, Camas, Washington*, Columbia West Engineering, Inc., April 18, 2017

FIGURES



MAP SOURCE: Google Maps 2016

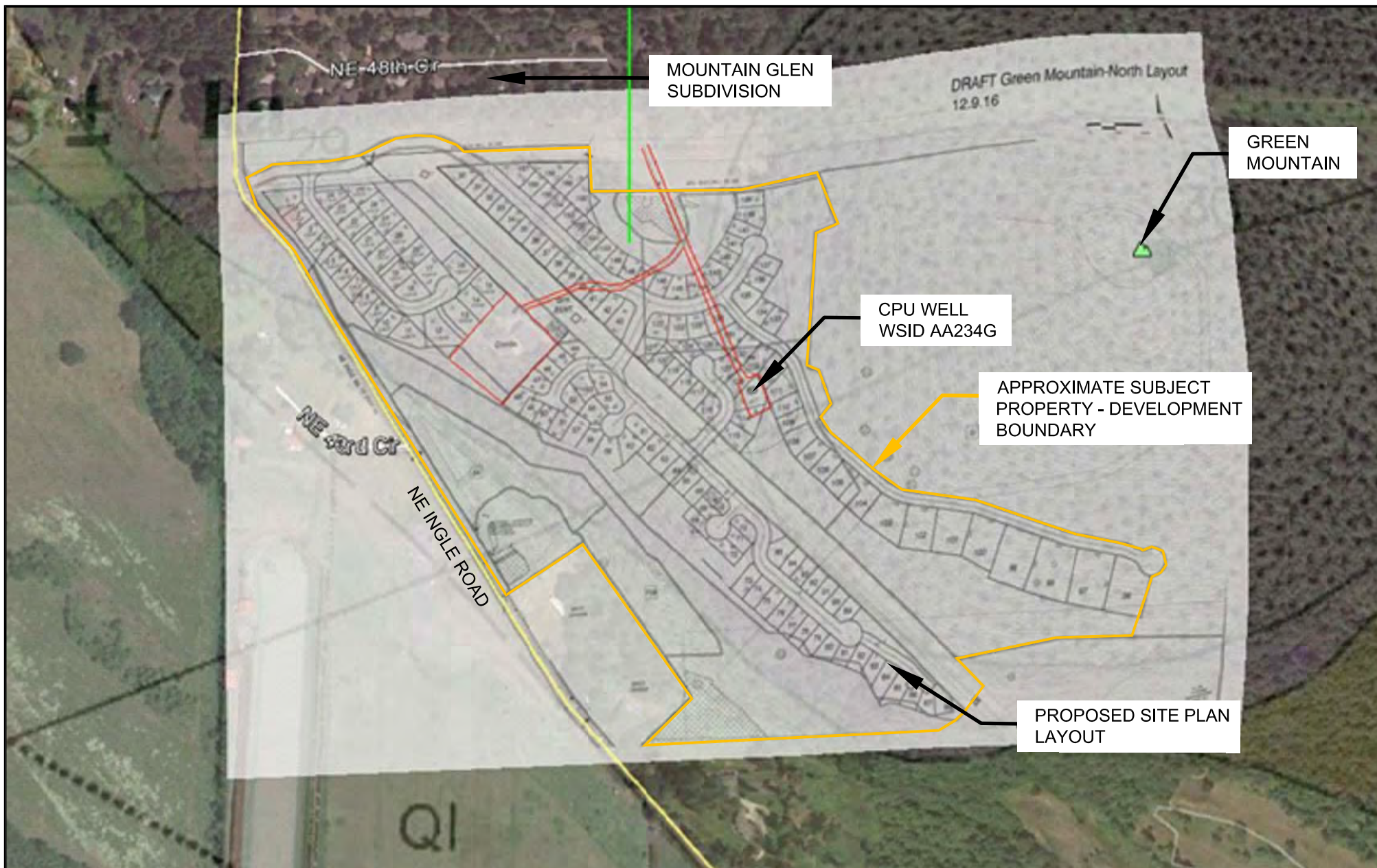
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Design	Drawn: TTR		
Checked: LVL	Date: 5/11/17		
Client: Green Mtn	Rev	By	Date
Job No.: 17012			
CAD File: Figure 1			
Scale: Not to scale			

SITE LOCATION MAP

GREEN MOUNTAIN NORTH
 NE INGLE ROAD & NE 43rd CIRCLE
 CAMAS, WASHINGTON

FIGURE
 1



NOTES:

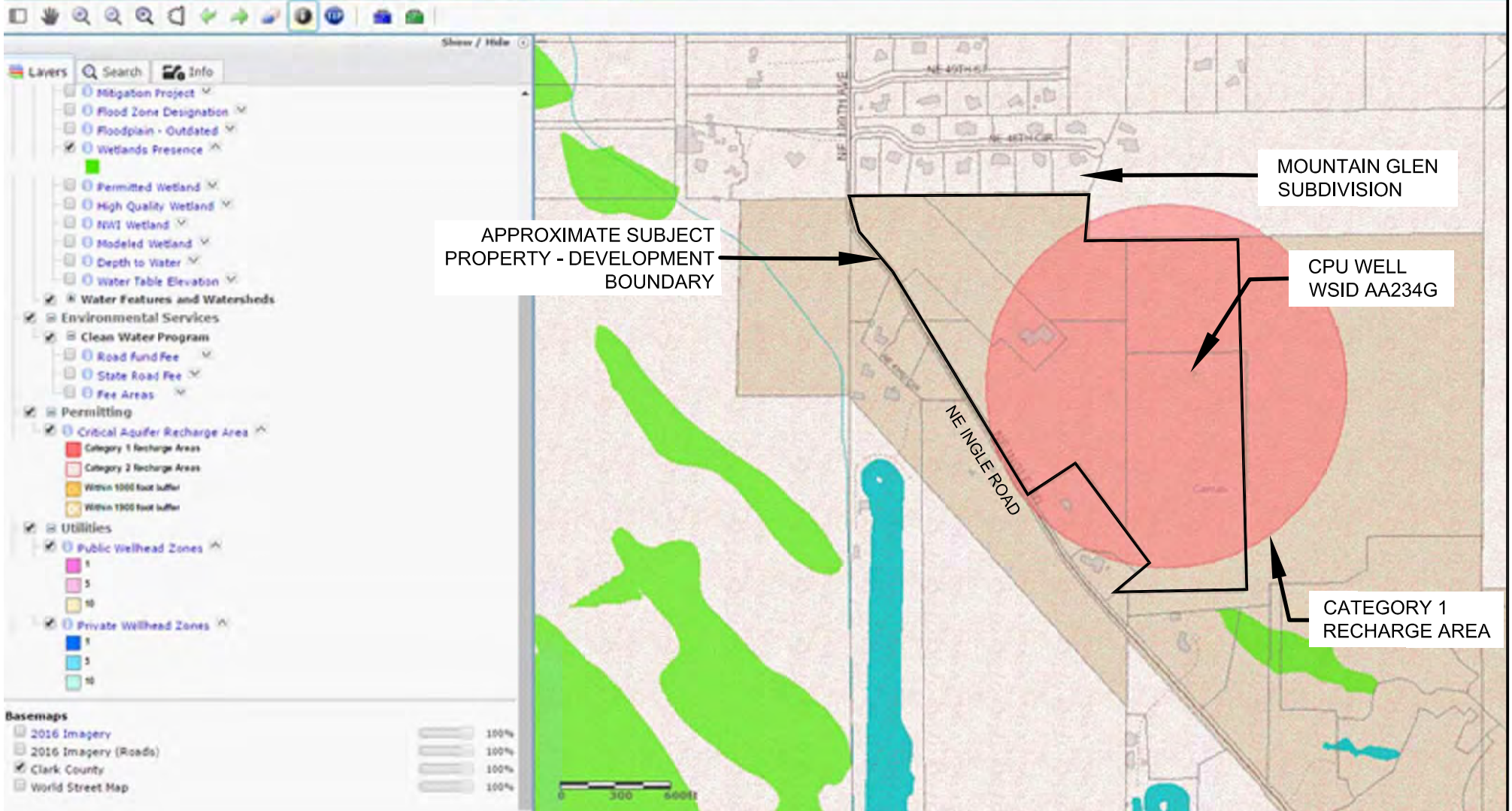
1. SITE LOCATION: EAST OF NE INGLE ROAD AND NE 43RD CIRCLE, CAMAS, WASHINGTON.
2. SITE CONSISTS OF PARCELS 17170400, 171727000, 172341000, and 17173000 TOTALING TO APPROXIMATELY 124.5 ACRES.
3. BASE MAP OBTAINED FROM GOOGLE EARTH, APPROXIMATELY 2016.
4. PROPOSED SITE PLAN OVERLAY PROVIDED BY OLSEN ENGINEERING.

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Design:	Drawn: TTR
Checked: LVL	Date: 5/31/17
Client: Green Mountain	Rev By Date
Job No: 17012	
CAD File: Figure 2	
Scale: Not to scale	

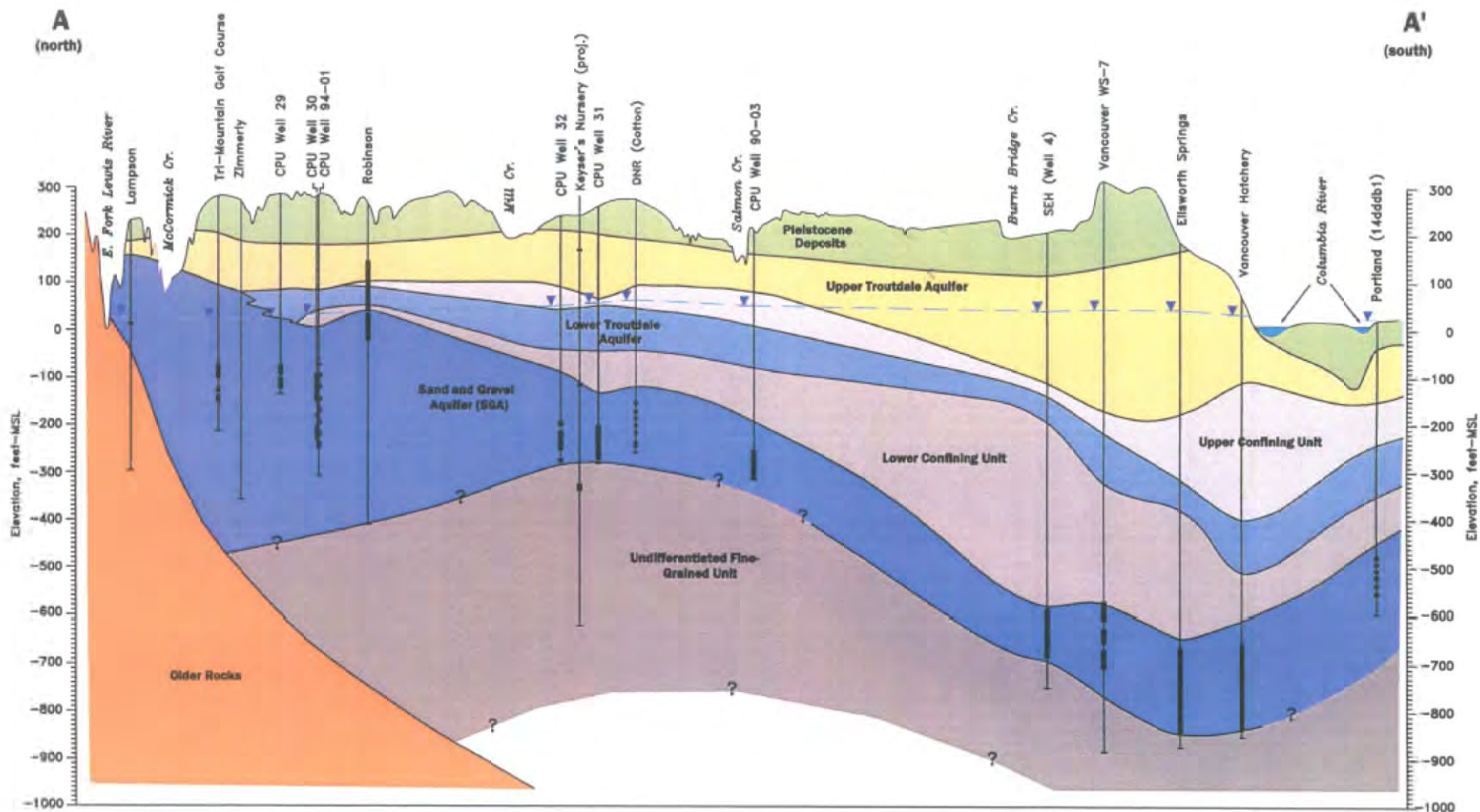
SITE MAP
GREEN MOUNTAIN NORTH CAMAS, WASHINGTON

FIGURE 2



NOTES:

1. SITE LOCATION: EAST OF NE INGLE ROAD AND NE 43RD CIRCLE, CAMAS, WASHINGTON.
2. SITE CONSISTS OF PARCELS 17170400, 171727000, 172341000, and 171730000 TOTALING TO APPROXIMATELY 124.5 ACRES.
3. BASE MAP OBTAINED FROM CLARK COUNTY GIS.



LEGEND

Pleistocene Deposits
 Upper Troutdale Aquifer
 Upper Confining Unit
 Lower Troutdale Aquifer

Lower Confining Unit
 Sand and Gravel Aquifer (SGA)
 Undifferentiated Fine-Grained Unit
 Older Rocks

Well Water Level
 Well Completion Interval

Piezometric Surface
 Sand and Gravel Aquifer (SGA)
 Horizontal Scale in Miles
 Vertical Exaggeration X 52

PGG

SALMON CREEK
BASIN MANAGEMENT PLAN

Exhibit 3-2 Hydrogeologic Cross Section A-A'

Prepared for Clark Public Utilities
by Pacific Groundwater Group

NOTES:
 1. BASE MAP OBTAINED FROM PACIFIC GROUND WATER GROUP, SALMON CREEK BASIN MANAGEMENT PLAN, 2002.

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Design:	Drawn: TR
Checked: LVL	Date: 5/31/17
Client: Green Mount	Rev By Date
Job No: 08104	
CAD File: Figure 4	
Scale: Not to scale	

HYDROGEOLOGIC CROSS SECTION

GREEN MOUNTAIN NORTH
 CAMAS, WASHINGTON

FIGURE
 4

APPENDIX A
CPUD (MOUNTAIN GLEN SUBDIVISION)
WELL LOG WATER WELL REPORT

WATER WELL REPORT

STATE OF WASHINGTON

Application No. G2-22990

Permit No. G2-22990

(1) OWNER: Name LaCamas Valley Milling Co. Address 18110 Fourth Plain Vancouver
(2) LOCATION OF WELL: County Clark NW 1/4 SE 1/4 Sec. 17 T. 2 N. R. 3E W.M.
Bearing and distance from section or subdivision corner 6600' W. E/650' N. from the SE COR.

(3) PROPOSED USE: COMM. Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☒ Other ☒

(4) TYPE OF WORK: Owner's number of well (if more than one) 8
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 480 ft. Depth of completed well 466 ft.

(6) CONSTRUCTION DETAILS: +1 1/2' above G.I.
Casing installed: 12 " Diam. from 0 ft. to 95 ft.
Threaded ☐ 8 " Diam. from 0 ft. to 334 ft.
Welded ☒ see below from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name UOP Johnson
Type S/S Model No.
Diam. Slot size see from below ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 95 ft.
Material used in seal cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 187 ft. below top of well Date 8-6-74
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level Hansen
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Drilling
Yield: 495 gal./min. with 30 ft. drawdown after 1 hrs.
" 495 " " 62 " 4 "
" " " " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
0	244	3	211	30	200
1M	207	5	205	1 H	190
2	214	10	204	2	186

Date of test 12-19-74
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow 55 g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
brown/dirt, reddish	0	15
greyish broken rock S to M	15	120
brown grey broken lavas rock	120	130
clay, brown, grey, green	135	150
cemented gravel	150	180
cemented sand, gravel, w/clay	180	254
brown/clay, sandstone	254	270
broken black rock, boulders	270	278
brown/sand, gravel, boulders	278	305
cemented sand, gravel, clay bin.	305	322
sandstone & gravel	322	329
sand, gravel, cemented	329	404
sandy layers, bits gravel	404	430
black & brown sand	430	438
black sand layer, gravel	438	456
brown sandy clay	456	460
brk. bl. rock, br. clay bin.	460	466
brown & black sand, w/br. clay	466	480

SCREENS:	CASING:
8" #50 334'9"-345	8" 345-362
8" #50 362-382'6"	8" 382'6"-394'9"
8" #40 394'9"-405	8" 405-435
8" #35 435-455'6"	8" 455'6"-466'6"

7-1-74	8-8-74
Work started <u>12-18-</u> <u>1974</u>	Completed <u>12-19</u> <u>1974</u>

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Hansen Drilling Co., Inc.
(Person, firm, or corporation) (Type or print)
Address 6711 NE 58th Ave. Vancouver
0098 Gerald Desmet
[Signed] Gerald Desmet (Well Driller) H.M. Hansen
C 51 223 02 1155 Date Dec. 30 1974
License No.

Hansen Drilling Co., Inc.

6711 N.E. 58th Avenue
Vancouver, Washington 98661
Phone 694-6242

December 30, 1974

Department of Ecology
Southwest Regional Office
Olympia, Washington
98504

Dear Sirs:

A test hole was drilled with mud rotary, then electric logged. Verbal permission was requested and granted by your department to complete as a production well, with the understanding that it would not be put to use until a permit was granted. Site was approved by the Department of Health as to location and the well was constructed to State Standards for a Public Water Supply. Developing and testing was completed in December, after the owners application for Water Rights had been published in the local paper.

Thank You for your assistance and cooperation.

Sincerely

Hansen Drilling Co., Inc.

M. Sample

APPENDIX B
WASHINGTON DEPARTMENT OF HEALTH
WATER QUALITY TESTING FOR
MOUNTAIN GLEN SUBDIVISION WELL
WSID AA234G


[Help](#)
View Sample Detail - WSID AA234G - MOUNTAIN GLEN
SATELLITE

Collect Date 10/17/2002
 Lab Number 017
 Lab Name ALS Environmental - Kelso
 Sample Number 74742
 Source 01
 Analyte Group IOC-INORGANIC CONTAMINANTS
 Test Panel IOC-COMPLETE INORGANIC ANALYSIS
 Sample Location ph
 Sample Type Post-Treatment / Finished

Analyte DOH				Maximum Contaminant Level		State Reporting Limit
Num	Analyte Name	Result Range	Result Quantity		Units	
0004	ARSENIC	EQ	0.0006	0.0104	mg/L	0.0010
0007	CHROMIUM	EQ	0.0008	0.1000	mg/L	0.0200
0009	LEAD	EQ	0.0002		mg/L	0.0010
0014	SODIUM	EQ	7.5000		mg/L	5.0000
0015	HARDNESS	EQ	54.1000		mg/L	10.0000
0016	CONDUCTIVITY	EQ	130.0000	700.0000	Umhos/cm	70.0000
0020	NITRATE-N	EQ	0.3000	10.0000	mg/L	0.2000
0021	CHLORIDE	EQ	1.8000	250.0000	mg/L	20.0000
0022	SULFATE	EQ	0.5000	250.0000	mg/L	50.0000
0024	ZINC	EQ	0.0600	5.0000	mg/L	0.2000
0026	TDS-TOTAL DISSOLVED SOLIDS	EQ	142.0000	500.0000	mg/L	100.0000
0161	TOTAL NITRATE/NITRITE	EQ	0.3000		mg/L	0.5000
0171	ORTHOPHOSPHATE	EQ	0.1400		mg/L	0.1000
0172	SILICA	EQ	27.1000		mg/L	1.0000
0403	ALKALINITY-LAB	EQ	69.0000		mg/L	5.0000
0404	MAGNESIUM	EQ	5.4000		mg/L	0.1000
0405	CALCIUM	EQ	12.8000		mg/L	0.0500
0005	BARIUM	LT	0.0050	2.0000	mg/L	0.4000
0006	CADMIUM	LT	0.0001	0.0050	mg/L	0.0020
0008	IRON	LT	0.0200	0.3000	mg/L	0.1000
0010	MANGANESE	LT	0.0050	0.0500	mg/L	0.0100
0011	MERCURY	LT	0.0005	0.0020	mg/L	0.0004
0012	SELENIUM	LT	0.0010	0.0500	mg/L	0.0100
0013	SILVER	LT	0.0001	0.1000	mg/L	0.1000
0017	TURBIDITY	LT	0.1000		NTU	0.1000

⏪ ⏩ ⏴ ⏵

Records 1 - 25 of 35

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*Links to external resources are provided as a public service and do not imply endorsement
by the Washington State Department of Health*

Department of Health, Office of Drinking Water

Street Address:

243 Israel Road S.E. 2nd floor
Tumwater, WA 98501

Mail:

PO BOX 47822
Olympia, WA 98504-7822

Phone: (360) 236-4357

Toll Free: (800) 521-0323

Send inquiries about DOH and its programs to the [Health Consumer Assistance Office](#)
Comments or questions regarding this Web site? Send email to [Environmental Health Application Support](#) or
call 888-457-2467.

APPENDIX C
REPORT LIMITATIONS AND IMPORTANT INFORMATION

Date: May 31, 2017
Project: Green Mountain North Subdivision
Camas, Washington

Geotechnical and Environmental Report Limitations and Important Information

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction QA/QC

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future

performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples

Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents

This geotechnical or environmental report should not be copied or duplicated unless in full, and even then only under prior written consent by Columbia West, as indicated in further detail in the following text section entitled *Report Ownership*. The recommendations, interpretations, and suggestions presented in this report are only understandable in context of reference to the whole report. Under no circumstances should the soil boring or test pit excavation logs, monitor well logs, or laboratory analytical reports be separated from the remainder of the report. The logs or reports should not be redrawn or summarized by other entities for inclusion in architectural or civil drawings, or other relevant applications.

Report Limitations for Contractors

Geotechnical or environmental reports, unless otherwise specifically noted, are not prepared for the purpose of developing cost estimates or bids by contractors. The extent of exploration or investigation conducted as part of this report is usually less than that necessary for contractor's needs. Contractors should be advised of these report limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this report, but should rely upon their own interpretations as to how subsurface conditions may affect cost, feasibility, accessibility and other components of the project work. If believed necessary or relevant, contractors should conduct additional exploratory investigation to obtain satisfactory data for the purposes of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface ground conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

Report Ownership

Columbia West retains the ownership and copyright property rights to this entire report and its contents, which may include, but may not be limited to, figures, text, logs, electronic media, drawings, laboratory reports, and appendices. This report was prepared solely for the client, and other relevant approved users or parties, and its distribution must be contingent upon prior express written consent by Columbia West. Furthermore, client or approved users may not use, lend, sell, copy, or distribute this document without express written consent by Columbia West. Client does not own nor have rights to electronic media files that constitute this report, and under no circumstances should said electronic files be distributed or copied. Electronic media is susceptible to unauthorized manipulation or modification, and may not be reliable.

Consultant Responsibility

Geotechnical and environmental engineering and consulting is much less exact than other scientific or engineering disciplines, and relies heavily upon experience, judgment, interpretation, and opinion often based upon media (soils) that are variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical or environmental consultant. To reduce potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical and environmental reports often provide definitive statements or clauses defining and outlining consultant responsibility. The client is encouraged to read these statements carefully and request additional information from Columbia West if necessary.