City of Cannon Beach
Agenda

Meeting: Planning Commission
Date: **Tuesday December 19, 2023**
Time: **6:00 p.m.**
Location: Council Chambers, City Hall

CALL TO ORDER

(1) **Approval of Agenda**

(2) **Consideration of the Minutes for the Planning Commission Meeting of October 26, & November 1, 2023.**

If the Planning Commission wishes to approve the minutes, an appropriate motion is in order.

ACTION ITEMS

(3) **Public Hearing of CU#23-04, Red Crow LLC on behalf of Patrick/David LLC for a Conditional Use Permit.**

CU #23-04 Red Crow LLC/Jamie Lerma application on behalf of Patrick/Dave LLC for a Conditional Use Permit for the purpose of creating a private use boardwalk spanning a delineated wetland and its buffer area. The property is located on Forest Lawn Road, Taxlot 51030DA04100 and is zoned (R2) Residential Medium Density. The request will be reviewed under Municipal Code Section 17.80, Conditional Uses.

(4) **Public Hearing of CU#23-03, CIDA on behalf of the City of Cannon Beach for a Conditional Use Permit.**

CU #23-03 CIDA application for a Conditional Use Permit for a municipal building in a commercial zone at 163 E. Gower St., Taxlots 51030AD120000 and 51030AD11900. The property is a developed parcel with an existing municipal building that is zoned (C1) Limited Commercial. The request will be reviewed under Municipal Code Section 17.80, Conditional Uses.

(5) **Public Hearing of ZO#23-03, CIDA on behalf of the City of Cannon Beach for a proposed Comprehensive Plan Amendment & Zone Change.**

ZO #23-03 CIDA proposed Comprehensive Plan Amendment & Zone Change for Taxlot 41006B000200, an undeveloped property located at 81389 N HWY 101. The property is currently zoned (IR) Institutional Reserve, and the request is to change the zoning classification to (IN) Institutional. The request will be reviewed under Municipal Code section 17.86, Amendments, provisions established.

INFORMATIONAL ITEMS

(6) **Tree Report**

(7) **Good of the Order**

(8) **ADJOURNMENT**

Please note that agenda items may not be considered in the exact order listed, and all times shown are tentative and approximate. Documents for the record may be submitted prior to the meeting by email, fax, mail, or in person. For questions about the agenda, contact Administrative Assistant, Emily Bare at Bare@ci.cannon-beach.or.us or (503) 436-8054. The meeting is accessible to the disabled. If you need special accommodations to attend or participate in the meeting per the Americans with Disabilities Act (ADA), please contact the City Manager at (503) 436.8050. TTY (503) 436-8097. This information can be made in alternative format as needed for persons with disabilities.

Posted: December 12, 2023

Join Zoom Meeting:

Meeting URL: https://us02web.zoom.us/j/83508783839?pwd=Z0RlYnJFK2ozRmE2TkRBRUFJNlg0dz09
Meeting ID: 835 0878 3839
Password: 801463

Dial By Your Location:
+1 669 900 6833 US (San Jose)
+1 253 215 8782 US (Tacoma)
Meeting ID: 835 0878 3839
Password: 801463

View Our Live Stream: View our **Live Stream** on YouTube!

Minutes of the
CANNON BEACH PLANNING COMMISSION
Thursday November 1, 2023

Present: Chair Clay Newton Commissioners Erik Ostrander, Les Sinclair, and Anna Moritz attended via Zoom, Commissioner Bates attended in person.

Excused:

Staff: City Manager Bruce St. Denis, Director of Community Development Steve Sokolowski, City Planner Robert St. Clair and Administrative Assistant Emily Bare

CALL TO ORDER

Chair Newton called the meeting to order at 11:00 p.m.

ACTION ITEMS

(1) Approval of Findings

Commissioner Moritz wrote a clarification to the finding to ensure that the foot path that requires a CUP and is considered an accessory structure as defined by the code.

Discussion of the findings ensued.

Motion: Commissioner Bates moved to approve the finding as presented; Commissioner Sinclair seconded the motion.

Vote: Chair Clay Newton, Commissioners Erik Ostrander, Mike Bates, Les Sinclair, Anna Moritz and Aaron Matusick voted AYE; the motion passed

(2) Good of the Order

Move December's meeting to December 19, 2023.

ADJOURNMENT

The meeting adjourned at 11:16 pm.

Administrative Assistant, Emily Bare

Minutes of the
CANNON BEACH PLANNING COMMISSION
Thursday October 26, 2023

Present: Chair Clay Newton Commissioners Erik Ostrander, Mike Bates, Les Sinclair and Anna Moritz attended in person, Aaron Matusick attended via Zoom.

Excused: Dorian Farrow

Staff: City Manager Bruce St. Denis, Director of Community Development Steve Sokolowski, Land Use Attorney Bill Kabeiseman, City Planner Robert St. Clair and Administrative Assistant Emily Bare

CALL TO ORDER

Chair Newton called the meeting to order at 6:02 p.m.

ACTION ITEMS

(1) Approval of Agenda

Motion: Commissioner Moritz moved to approve the agenda as presented; Commissioner Sinclair seconded the motion.

Vote: Chair Newton, Commissioners Ostrander, Bates, Sinclair, Moritz and Matusick voted AYE; the motion passed.

(2) Consideration of the Minutes for the Planning Commission Meeting of August 24, 2023

Motion: Commissioner Sinclair moved to approve the minutes; Commissioner Moritz seconded the motion.

Vote: Chair Newton Commissioners Ostrander, Bates, Sinclair, Moritz, and Matusick voted AYE; the motion passed

(3) Public Hearing of CU 23-02, Red Crow LLC on behalf of Patrick/Dave LLC for the Conditional Use Permit.

CU 23-02, Red Crow LLC requests on behalf of Patrick/Dave LLC for the conditional Use Permit for the purpose of creating a private use board walk in an upland which spans 16’-6’ of wetland buffer. The property is located on South Hemlock and Forest Lawn Road (Tax Lot 4100, Map 51030DA). The property is currently zoned (R2) Residential Medium Density. The request will be reviewed under Municipal Code section 17.80, Conditional Uses.

No one objected to the jurisdiction of the Planning Commission to hear this matter at this time. Chair Newton asked if any Commissioner had any conflict of interest. There were none. Chair Newton asked if any Commissioner had personal bias to declare. There were none. Chair Newton asked if any commissioner had any ex parte contacts to declare. There were none. The commissioners declared their site visits.

St. Clair read the staff report.

Chair Newton asked if there was any additional correspondence. There was none.

Chair Newton called for public testimony.

Chair Newton stated that the pertinent criteria were listed in the staff report and criteria sheets next to the west door; testimony, arguments and evidence must be directed toward those criteria; failure to raise an issue accompanied by statements or evidence sufficient to afford the decision maker and the parties an opportunity to respond to the issue precludes appeal based on that issue; prior to the conclusion of the initial evidentiary hearing, any participant may request an opportunity to present additional testimony, arguments or evidence regarding the application. The Planning Commission shall grant such requests by continuing the public hearing or leaving the record open for additional written testimony, arguments, or evidence; persons who testify shall first receive recognition from the Chair, state their full name and mailing address, and if appearing in a representative capacity, identify whom they represent.

Chair Newton asked if the applicant wished to make a presentation.

Jamie Lerma
PO Box 825
Cannon Beach, OR 97110

Lerma explained the proposed project details and that none of the buildings are proposed to be in wetland areas. The boardwalk is in a buffer zone. The boardwalk is being used as a means for the homeowners, visitors, and emergency personnel to access the buildings.

Lerma spoke about the proposed project and how environmentally responsible and low impact the project is. Per the wetland expert, "the boardwalk will have no detrimental effect on the functions and values of the wetland buffer." The expert has worked on many projects involving boardwalks to successfully span wetlands and wetland buffers.

Moritz asked about the access availability to build the project, regarding exhibit A-3 and construction in a buffer zone. Clarification was sought to determine if a conditional use permit would be required for grading.

Bates asked about the dimensions and materials of the boardwalk. Both Jay Orloff and Lerma were able to clarify the concerns.

Ostrander asked where the southern edge of the walkway was in accordance with the property line.

Jay Orloff
PO Box 563
Cannon Beach, OR 97110

Orloff answered Bates' concerns regarding the difference in the width between the drawings and project proposal of the walkway which is dependent on railings of the walkway which are not required.

Chair Newton called for proponents of the request. None

Chair Newton called for opponents of the request.

Jan Siebert-Wahrmund
PO Box 778
Cannon Beach, OR 97110

Siebert-Wahrmund asked for denial of the project based on confusion of the application and that there does not appear to be realistic way to access the property.

Lolly Champion
PO Box 614
Cannon Beach, OR 97110

Champion read her comments as submitted.

No further response from staff.

Chair Newton asked if the applicant wished to make additional statements.

Chair Newton Closed the public hearing at 6:37 pm.

Chair Newton asked Director Sokolowski to clarify the memo considering the Conditional Use Permit. Sokolowski explained the Municipal Code Ordinance in question.

Several Commissioners voiced concerns that there wasn't a site plan that shows the actual location of the proposed building regarding the bridge, yet there are setback restrictions, and no Type 1 Development Permit has been submitted. Sokolowski suggested making a condition of approval that the Planning Commission review and approve the building plans prior to a permit being issued. Bates believes that the bridge is an accessory structure and that there are setback reduction violations.

Emergency access, and parking issues were discussed. Both Bates and Sinclair gave support for the changes in the plan.

Motion: Sinclair moved to deny the request based on lack of setback reduction and bring it back with answers (setback reduction, accessory structure with setbacks and a completed set of plans); Bates seconded the motion.

Vote: Chair Newton, Commissioners Ostrander, Bates, Sinclair, Moritz, and Matusick voted AYE; the motion passed.

(4) Public Hearing of ZO 23-02, The City of Cannon Beach request Zoning Ordinance text amendments.

ZO 23-02, City of Cannon Beach request for Zoning Ordinance text amendments to Chapter 17.43 Wetland Overlay Zone. The Zoning Text Amendment request will be reviewed against the criteria of the Municipal Code Section 17.86.070A, Amendments Criteria and the Statewide Planning Goals.

No one objected to the jurisdiction of the Planning Commission hearing this matter at this time. Chair Newton asked if any Commissioner had any conflict of interest. There were none. Chair Newton asked if any Commissioner had personal bias to declare. There were none. Chair Newton asked if any commissioner had any ex parte contacts to declare. There were none. The commissioners declared their site visits.

Sokolowski read his staff report and introduced Marcy McInelly from Urbworks.

Urbworks
1095 Duane St
Astoria, OR 97103

Urbworks went through the wetland overlay package for the group.

Moritz spoke with McInelly regarding the 1,000 SQ footprint limit. For example, if you had enough upland on your property to build a structure that fits within the City's FAR analysis that would be fine. The 1,000 SQ foot was to ensure that if you didn't have enough upland to build at least a 1,000 SQ foot house. This clause is used to be a backstop but is not a limit to all building on a wetland lot of record. Bates clarified that if you must use the buffer, then it is a limit on the size of your house.

Chair Newton called for public testimony.

Bob Lundy
PO Box 1357
Cannon Beach, OR 97110

Lundy expressed his concern to polish up the text as he is a text editor. He did not change any of the content.

Shawn Zavoshy
PO Box 105
Lake Oswego, OR 97034

If his house is 1,600 but within 10 feet of buffer if that changed and the house burned down could he rebuild the house as it would it have to be two story? If the house would have to be two story, then the insurance won't pay for it.

Kathy Kleczek
PO Box 602
Cannon Beach, OR 97110

Owner of property that will be severely affected by this ordinance as written. Many questions regarding FEMA, insurance, spoke about fees and financial hardships. Hardship provisions for variances, also concerned that additional planting in wetland buffer areas to keep land from sluffing off.

Leslie Dowd
PO Box 704
Tolovana Park, OR 97145

Totally in favor of this project. Concerned about buffer zone and being able to build a 1,000 sq ft home. Spoke about 2863 S Hemlock St where house was built on wetland property, very concerned that we preserve the wetlands and not develop. Dowd wants more restrictions on development of wetland lots of record. Builders cut through trees without permits, no building inspections seem to be happening.

Jan and Wes Siebert-Wahrmund

Please do all you can to further the protection of our Cannon Beach wetlands to be better preserved for both the present and the future. Thank you for your time on this project.

Bob Lundy

Mr. Lundy will transfer mark-ups to the most current version of the code.

Marlene Laws
PO Box 945
Cannon Beach, OR 97110

Born here, the whole town was wetlands, we have a history of filling in, and she agrees that it needs to stop.

Kathy Kleczek

Wanted to add that there were no previsions for pre-existing buildings that would be determined non-compliant.

Chair Newton asked if there was any additional correspondence.

Chair Newton called for public testimony at 7:33 pm.

Chair Newton explained the project, the reasoning and goals of the wetland overlay code updates.

Bates spoke to the questions regarding non-conforming uses and suggested looking into municipal code sections Chapter 17.82, Nonconforming Lots, Uses and Structured – Pre-existing Uses. Also, code section 17.84, for Variances. These sections should help the folks asking questions regarding their property specifically.

Moritz noted that clarification in the revised code stating that activities and uses in existence be allowed to be maintained. Furthermore, there was a question about vegetation which is not something that comes before planning commission; that would be a Type 2 Development Permit. The group did attempt to find a balance with property value.

Discussion ensued regarding a continuance and the lack of State Reports. Ostrander commented on the lack of time the public has had to make themselves aware of the suggested changes and the sentiment in the community to have more time for review of the proposed changes.

Individual public comments were discussed by the commission, praise to the map making skills of St. Clair. Liden and McInelly were advised of some fine tuning and updates.

INFORMATIONAL ITEMS

(6) Tree Report

St. Clair reviewed the tree reports for August and September 2023

Commissioner Bates requested that we go back to the previous for that we used to use. St. Clair agreed.

(7) Ongoing Planning Items

Regional Housing meeting in early October 2023, discussion regarding affordable housing within different communities.

The Cannon Beach Rejuvenation project is ongoing as well as the Police Station and City Hall building projects.

Design Review Board – A member of the DRB approached and asked Chair Newton about how the different Boards and Commissions work together. Sokolowski discussed with the Commission that he has met with the different members of DRB individually and continues to offer support ad clarification when he can. Newton suggested some training for the members of the DRB.

Dark Skys – The Commission wants to make sure that the City Council the information collected.

(8) Good of the Order

Housing

ADJOURNMENT

The meeting adjourned at 8:16 pm.

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Administrative Assistant, Emily Bare

CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

Cannon Beach Planning Commission

Staff Report:

PUBLIC HEARING AND CONSIDERATION OF CU 23-04, RED CROW LLC/JAMIE LERMA, APPLICANT, ON BEHALF OF PATRICK/DAVE LLC, REQUEST FOR AN ELEVATED PEDESTRIAN ACCESS IN A DELINEATED WETLAND AND ITS BUFFER AREA IN ORDER TO PROVIDE ACCESS TO PLANNED RESIDENTIAL DEVELOLPMENT. THE PROPERTY IS AN UNDEVELOPED PARCEL ON THE NORTHERN PART OF FOREST LAWN DR. (TAXLOT 04100, MAP 51030DA) IN A RESIDENTIAL MODERATE DENSITY (R2) ZONING DISTRICT AND THE WETLANDS OVERLAY (WO) ZONE. THE CONDITIONAL USE REQUEST WILL BE REVIEWED AGAINST THE CRITERIA OF CANNON BEACH MUNICIPAL CODE, SECTION 17.43.045, CONDITIONAL USES AND ACTIVITIES PERMITTED IN WETLAND BUFFER AREAS; AND 17.80, CONDITIONAL USES.

Agenda Date: December 19, 2023 **Prepared By**: Community Development Department

GENERAL INFORMATION

NOTICE

Public notice for this December 19, 2023 Public Hearing is as follows:

A. Notice was posted at area Post Offices on November 29, 2023;

B. Notice was mailed on November 29, 2023 to surrounding landowners within 250’ of the exterior boundaries of the property.

DISCLOSURES

Any disclosures (i.e. conflicts of interest, site visits or ex parte communications)?

EXHIBITS

The following Exhibits are attached hereto as referenced. All application documents were received at the Cannon Beach Community Development office on November 28, 2023 unless otherwise noted.

“A” Exhibits – Application Materials

A-1 CU#23-04 Application

A-2 Proposed boardwalk schematics

A-3 Site plan

A-4 Pacific Habitat Services letter, dated November 28, 2023

A-5 Type 2 Development Permit Application

A-6 Revised tree plan, dated November 27, 2023

A-7 K. LaBonte email regarding construction access, dated October 13, 2023

A-8 Utility plan, dated August 22, 2023

A-9 Geotechnical Investigation and Geotechnical Report, dated June 3, 3023

A-10 Supplemental Commentary on Landslide and Liquefaction Hazards, dated July 27, 2023

A-11 Wetland Delineation and DSL Concurrence Letter, dated June 8, 2021

"B" Exhibits – Agency Comments

None received as of this writing;

"C" Exhibits – Cannon Beach Supplements

C-1 CU#23-04 Completeness determination, November 29, 2023

C-2 CU#23-02 Planning Commission Findings of Fact, October 26, 2023

"D" Exhibits – Public Comment

D-1 W. Reiersgaard email, received December 4, 2023

SUMMARY & BACKGROUND

The applicant, Jamie Lerma of Red Crow LLC, on behalf of property owner Patrick/Dave LLC, requests the installation of a private use boardwalk that will span a portion of the subject property's wetland and its buffer area for the purpose of providing access to planned residential development on that property. Information regarding the design of the proposed boardwalk is included in Exhibit A-2, and its location is shown on the site plan in Exhibit A-3.

Information regarding the proposed residential development to be supported by the walkway on this application is included in Exhibit A-3. Residential development, including detached two-family dwellings, is a permitted use in the Residential Medium Density (R2) zoning district. Additionally the applicant has submitted an application for a Type 2 development permit for excavation and grading in conjunction with this application, material from the Type 2 application has been included to provide further context to this proposal.

During its October 2023 public hearing the Planning Commission denied a similar application (CU#23-02) for a pedestrian walkway as it found that the walkway met the definition of an accessory structure and was subject to setback requirements. This application differs from CU#23-02 in the placement of the walkway which has been moved 5 feet north of the property line with Taxlot 51030DA04104.

APPLICABLE CRITERIA

Wetlands Overlay (WO) Zone Requirements

17.43.045(G) Footpaths – Conditional Uses and Activities Permitted in Wetland Buffer Areas

Staff Comment: This provision of the Municipal Code indicates that access improvements such as roads, driveways, and footpaths within a wetland and its buffer area are subject to conditional use review. The City made this finding during its administrative review of development permit DP#23-28 and the Planning Commission made a similar finding during its review of CU#23-02, the two access improvement applications that precede this application.

17.43.050(A) General Standards

General Standards. Uses and activities in protected wetlands and in wetland buffer areas are subject to the following general standards. Development may also be subject to specific standards in subsequent subsections.

1. *Uses and activities in protected wetlands or wetland buffer areas may be approved only after the following list of alternative actions, listed from highest to lowest priority, have been considered:*

   a. *Avoiding the impact altogether by not taking a certain action or parts of an action (this would include, for example, having the use or activity occur entirely on uplands); and*

   b. *Minimizing impacts by limiting the degree or magnitude of action and its implementation (this would include, for example, reducing the size of the structure or improvement so that protected wetlands or wetland buffer areas are not impacted).*

2. *Where a use or activity can be located in either the protected wetland or the wetland buffer, preference shall be given to the location of the use or activity in the wetland buffer.*

Staff Comment: The planned residential developed that will be supported by the walkway proposed in this application is a permitted use in the underlying R2 Residential Moderate Density zoning classification. Duplex or two-family dwellings are defined as a building or buildings containing two dwelling units with or without a common wall or ceiling and where there are not direct interior connecting doorways. Due to a plat restriction the applicant is unable to establish access to the upland portion of the site from S. Hemlock St. and must access the property from Forest Lawn Dr.

In application DP#23-28 the City found that the natural terrain of the proposed walkway was unsuitable as a walkway and that fill would be required for this purpose. The June 20, 2023 Todd Prager and Associates report stated:

"Private access adjacent to trees 16 and 18 shall be constructed under arborist supervision without excavation below existing grade. At least four inches of base rock over geotextile fabric shall be placed over exposed surface roots to protect them from damage."

The access arrangement proposed in this application, CU#23-04, would avoid the placement of fill or other material in the wetland or its buffer area by providing an elevated walkway that would span the wetland affected area. Use of a pedestrian walkway versus a vehicle bridge limits the size of the area being impacted by the proposed improvement and largely avoids the potential for the improvement to need to span the delineated wetland area.

17.43.050(G) Footpaths and Bicycle Paths

Footpaths and Bicycle Paths. Development of new footpaths, and maintenance of existing footpaths may be permitted in protected wetlands and in wetland buffer areas subject to the use restrictions in the zone and the following standards. Development of new bicycle paths may be permitted in wetland buffer areas.

1. *Footpaths across protected wetlands may only be developed or maintained without the use of fill material. Bridges shall be used to cross open water areas.*

2. *Footpaths in protected wetlands shall not restrict the movement of water.*

3. *Routes for new footpaths shall be chosen to avoid traversing protected wetlands. Footpaths around the perimeter of protected wetlands, and in wetland buffer areas, are preferred.*

4. *Routes for new bicycle paths shall not be located in protected wetlands but may be located in wetland buffer areas.*

Staff Comment: The proposed pedestrian access will avoid the use of fill material and be constructed in the buffer area in order to avoid traversing the delineated wetland site. It is positioned in a way that satisfies the placement preferences established in item 3.

Conditional Uses, Chapter 17.80

17.80.110 Overall Use Standards

Before a conditional use is approved, findings will be made that the use will comply with the following standards:

A. *A demand exists for the use at the proposed location. Several factors which should be considered in determining whether or not this demand exists include: accessibility for users (such as customers and employees), availability of similar existing uses, availability of other appropriately zoned sites, particularly those not requiring conditional use approval, and the desirability of other suitably zoned sites for the use.*

   Staff Comment: The proposed boardwalk would provide a legal means of access to the upland portion of the subject property and allow for planned residential development of the property to take place. At present there is no means of access to the upland portion of the property as a plat restriction requires access to come from Forest Lawn Rd. The proposed boardwalk would provide access for residents, guests, emergency services, and other parties who may need access to the property.

B. *The use will not create excessive traffic congestion on nearby streets or overburden the following public facilities and services: water, sewer, storm drainage, electrical service, fire protection and schools.*

   Staff Comment: The proposed use on this application, a pedestrian access walkway, does not appear to have any apparent impacts on traffic, public facilities, or fire protection. Residential development that would be supported by the proposed walkway will be reviewed by City Community Development and Public Works staff as well as the Cannon Beach Rural Fire Protection District in order to ensure that such development does not have significant negative impacts or create an overburden to the items detailed in this criterion.

C. *The site has an adequate amount of space for any yards, buildings, drives, parking, loading and unloading areas, storage facilities, utilities or other facilities which are required by city ordinances or desired by the applicant.*

   Staff Comment: The proposed use on this application, a pedestrian access walkway, appears to satisfy this criterion by allowing the planned residential development to be arranged in a way that places structures, parking, on the upland portions of the subject property. As shown on Exhibit A-3, off-street parking would be provided in two areas on upland portions of the subject property adjacent to Forest Lawn Rd, one of these parking areas includes a detached garage.

   This proposal responds to the findings of the Planning Commission from its review of CU#23-02 which found the walkway to be an accessory structure subject to setback requirements. This proposal has shifted the location of the walkway 5 feet to the north in order to comply with side yard setbacks and provide a buffer to the adjacent property to the south.

D. *The topography, soils and other physical characteristics of the site are appropriate for the use. Potential problems due to weak foundation soils will be eliminated or reduced to the extent necessary for avoiding hazardous situations.*

Staff Comment: The proposed walkway will address this criterion by placing the footings in the upland portions on either side of the buffer area it will span, no portion of the structure will penetrate soils in the wetland or its buffer area.

E. *An adequate site layout will be used for transportation activities. Consideration should be given to the suitability of any access points, on-site drives, parking, loading and unloading areas, refuse collection and disposal points, sidewalks, bike paths or other transportation facilities required by city ordinances or desired by the applicant. Suitability, in part, should be determined by the potential impact of these facilities on safety, traffic flow and control and emergency vehicle movements.*

Staff Comment: This criterion does not apply to this application. Generally, the considerations detailed in this criterion apply to commercial or high-density residential uses which may generate a high level of traffic.

F. *The site and building design ensure that the use will be compatible with the surrounding area.*

Staff Comment: The uses surrounding the subject property are detached single-family dwellings on lots larger than 5,000 square feet. The planned residential development that would be supported by this proposal is consistent with that level of development.

Staff Recommendation

Staff recommends that the following conditions be applied to an approval of this application:

1. The applicant shall demonstrate legal means of access from S. Hemlock St. for the purpose of construction prior to the application for permits for residential development.

Procedural Requirements

This application is subject to ORS 227.178, requiring the City to take final action within 120 days after the application is deemed complete. It was submitted November 28, 2023; and determined to be complete on November 29, 2023. Based on this, the City must make a final decision before March 28, 2024.

The Planning Commission's December 19th meeting will be the first evidentiary hearing on this request. ORS 197.763(6) allows any party to request a continuance. If such a request is made, it should be granted. The Planning Commission's next regularly scheduled hearing date is Thursday, January 25, 2024.

DECISION, CONDITIONS AND FINDINGS

Motion: Having considered the evidence in the record, based on a motion from Commissioner NAME, seconded by Commissioner NAME, the Planning Commission moves to (approve/approve with conditions/or deny) the Red Crow LLC application, on behalf of Patrick/Dave LLC, the conditional use request for the placement of an elevated pedestrian access, application **CU# 23-04,** as discussed at this public meeting (subject to the following conditions):

Site Map – Taxlot 51030DA04100, Forest Lawn Dr.

GIS information taken from City of Cannon Beach GIS records. This map is for reference only and is not a survey product.

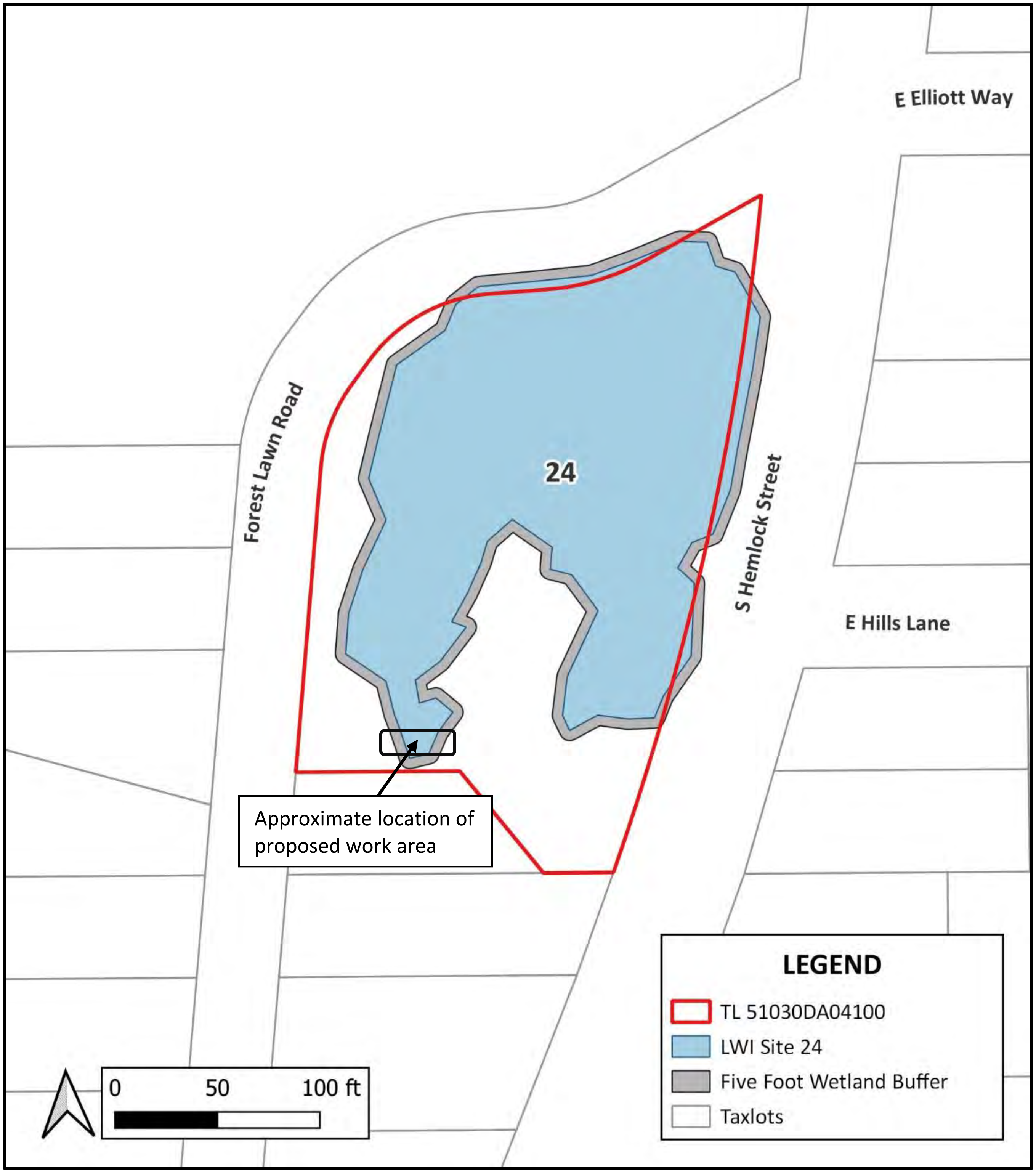


Exhibit A-1

CITY OF CANNON BEACH

CONDITIONAL USE APPLICATION

Please fill out this form completely. Please type or print.

Applicant Name: Red Crow, LLC/Jamie Lerma
Email Address: jamie@redcrowgc.com
Mailing Address: PO Box 825
Cannon Beach, OR 97110
Telephone: (503) 849-0258

Property-Owner Name: Patrick/Dave, LLC
(if other than applicant)
Mailing Address: 3514 NE US Grant Place, Portland, OR 97212
Telephone: 503-206-1071
Property Location: S. Hemlock and Forest Lawn Rd.
(street address)
Map No.: 51030DA Tax Lot No.: 04100

CONDITIONAL USE REQUEST:

1. Description of the proposal.

Private use boardwalk with footings in upland which spans wetland and wetland buffer as shown on attached site plan, boardwalk plan, and as recommended by the project wetland scientist. The proposed boardwalk is an accessory use to the proposed two-family detached dwelling. The boardwalk footings will be concrete, the beams will be pressure treated wood, and the walking surface will be composite decking. If included, railings will be wire attached to cedar posts. (Description continued on attached pages including site plan, floor plans, boardwalk plans, and support letter from wetlands scientist.)

2. Justification of the conditional use request. Explain how the request meets each of the following criteria for granting a conditional use.

   a. Explain how a demand exists for the use at the proposed location. Several factors which should be considered include: accessibility for users (such as customers and employees); availability of similar existing uses; availability of other appropriately zoned sites, particularly those not requiring conditional use approval; and the desirability of other suitably zoned sites for the use.

The subject property is zoned R-2. The proposed detached two-family home is an outright allowed use in the R-2 zone. The proposed boardwalk provides the only point of ingress to and egress from the proposed detached two-family home from Forest Lawn Road, the proposed garage and the proposed parking areas. Vehicle access to the property from Hemlock St. is prohibited. The proposed boardwalk will provide adequate access for residents, guests, emergency personnel, delivery services, and utility and/or service workers.

   b. Explain in what way(s) the proposed use will not create traffic congestion on nearby streets or over-burden the following public facilities and services: water, sewer, storm drainage, electrical service, fire protection and schools.

The proposed site development exceeds the off-street parking requirement. A private boardwalk to the homes will have no impact on the public facilities or services including water, sewer, or electric service, storm drainage, electric service, fire protection, or schools.

c. Show that the site has an adequate amount of space for any yards, buildings, drives, parking, loading and unloading areas, storage facilities, utilities, or other facilities which are required by City Ordinances or desired by the applicant.

See attached site plan. The proposed development, including the proposed boardwalk meets all R-2 zoning requirements including lot dimension, property line setback and wetland setback requirements. The boardwalk provides future owners with safe, convenient access to their garage, storage, and refuse container enclosure as shown on the site plan.

d. Show that the topography, soils, and other physical characteristics of the site are appropriate for the use. Potential problems due to weak foundation soils must be shown to be eliminated or reduced to the extent necessary for avoiding hazardous situations.

See geotechnical report submitted as part of development permit application. The boardwalk contemplated will follow all structural and geotechnical engineering recommendations.

e. Explain in what way an adequate site layout will be used for transportation activities. Consideration should be given to the suitability of any access points, on-site drives, parking, loading and unloading areas, refuse collection and disposal points, sidewalks, bike paths or other transportation facilities required by City ordinances or desired by the applicant. Suitability, in part, should be determined by the potential impact of these facilities on safety, traffic flow and control and emergency vehicle movements.

The proposed boardwalk will provide safe access for owners, guests, emergency personnel, delivery services, etc. The boardwalk will provide owners safe and convenient access to the refuse area near the proposed garage. The site exceeds off-street parking requirements for loading, unloading, and emergency vehicles.

f. Explain how the proposed site and building design will be compatible with the surrounding area.

This conditional use permit application is not for a building. the underlying proposed development is for a detached two-family home which is an outright allowed use. The underlying site and buildings meet all requirements of the R-2 zone.

Use extra sheets, if necessary, for answering the above questions. Attach a scale-drawing showing the dimensions of the property, adjacent street(s), dimensions of existing structure, and dimensions of proposed development.

Application Fee: $750.00

Applicant Signature: Jamie B Lerma Date: 11/29/2023

Property Owner Signature: See attached page Date: 11/29/23

David Pietka

If the applicant is other than the owner, the owner hereby grants permission for the applicant to act on his/her behalf. Please attach the name, address, phone number, and signature of any additional property owners.

For Staff Use Only:

Date Received: ____________ By: ____________

Fee Paid: ____________ Receipt No.: ____________

(Last revised March 2021)

Exhibit A-1

c. Show that the site has an adequate amount of space for any yards, buildings, drives, parking, loading and unloading areas, storage facilities, utilities, or other facilities which are required by City Ordinances or desired by the applicant.

[illegible]

d. Show that the topography, soils, and other physical characteristics of the site are appropriate for the use. Potential problems due to weak foundation soils must be shown to be eliminated or reduced to the extent necessary for avoiding hazardous situations.

[illegible]

e. Explain in what way an adequate site layout will be used for transportation activities. Consideration should be given to the suitability of any access points, on-site drives, parking, loading and unloading areas, refuse collection and disposal points, sidewalks, bike paths or other transportation facilities required by City ordinances or desired by the applicant. Suitability, in part, should be determined by the potential impact of these facilities on safety, traffic flow and control and emergency vehicle movements.

[illegible]

f. Explain how the proposed site and building design will be compatible with the surrounding area.

[illegible]

Use extra sheets, if necessary, for answering the above questions. Attach a scale-drawing showing the dimensions of the property, adjacent street(s), dimensions of existing structure, and dimensions of proposed development.

Application Fee: $750.00

Applicant Signature: ____________ Date: ____________

Property Owner Signature: David Beetka Date: 11/29/23

If the applicant is other than the owner, the owner hereby grants permission for the applicant to act on his/her behalf. Please attach the name, address, phone number, and signature of any additional property owners.

For Staff Use Only:

Date Received: ____________ By: ____________

Fee Paid: ____________ Receipt No.: ____________

(Last revised March 2021)

1. **Description of the proposal (CONTINUED FROM APPLICATION FORM)**

The subject property is in the Wetland Overlay Zone and must meet the standards of 17.43.050. The Planning Commission in its Finding of Fact and Conclusions of Law for CU 23-02, which proposed a similar boardwalk to this application, found that a boardwalk meets both the definition of an "accessory structure" and a "footpath" for the purposes of CBMC Chapter 17.43 (Wetland Overlay Zone). The applicable code sections for this permit are 17.43.050 Paragraph D for Accessory Structures, and 17.43.050 Paragraph G for Footpaths and Bicycle Paths.

The proposed boardwalk meets the General Standards of 17.43.050 set forth in Paragraph A because the construction of the footings takes place completely in upland. The boardwalk itself spans the wetland and wetland buffer. The boardwalk is supported as having no detrimental impact on the wetland or wetland buffer by project wetland scientist John VanStaveren of Pacific Habitat Services, Inc. in his September 16, 2023 memo, which is included as an exhibit with this application.

The proposed boardwalk meets the standards of 17.40.050 Paragraph D Accessory Structure or Building because the boardwalk will be built on piers and footings entirely in upland. The span of the boardwalk will allow the free flow of water beneath the structure.

The proposed boardwalk meets the standards of 17.40.050 Paragraph G Footpaths and Bicycle Paths because the boardwalk will be built on piers and footings entirely in upland. The span of the boardwalk will allow the free flow of water beneath the structure. No fill material will be used in the construction of the boardwalk.

In addition to the Wetland Overlay Zone requirements, as an accessory structure the boardwalk must meet the underlying 5-foot side yard setback requirements of the R-2 Zone per 17.54.030 Accessory Structure or Building. The boardwalk is designed at 5'-6" from the south property line and as such meets this requirement.

The proposed boardwalk must also meet the maximum area restriction of 120 Square Feet for an accessory structure under 17.54.030. The boardwalk as designed is 117 SF including the footings and therefore meets this requirement.

The proposed boardwalk also conforms with the restrictions of 17.54.030 because it is not metal clad, is less than 12 feet in height, does not obstruct views from adjacent buildings, and has no detrimental impact on the abutting property.

The subject property is an irregularly shaped lot. The abutting public streets – Forest Lawn Road to the west, north, and south, and Hemlock Street to the east – are not at right angles to the subject property or each other. As designed, and for the purposes of this permit application, the front yard for this project is considered Forest Lawn Road to the west. The orientation of the dwellings proposed in the underlying Type I and Type II applications is consistent with the project addressing, the orientations of existing homes along Forest Lawn Road, and with the plat, which prohibits access to Hemlock St. The proposed homes generally face the west. Based on these elements, the front yards of the existing home are to the west.

The south property line of the subject property is already designated and serves as the established north side yard of the southern abutting property at 1603 Forest Lawn Rd. It follows that the south property line of the subject property would be considered the side yard.

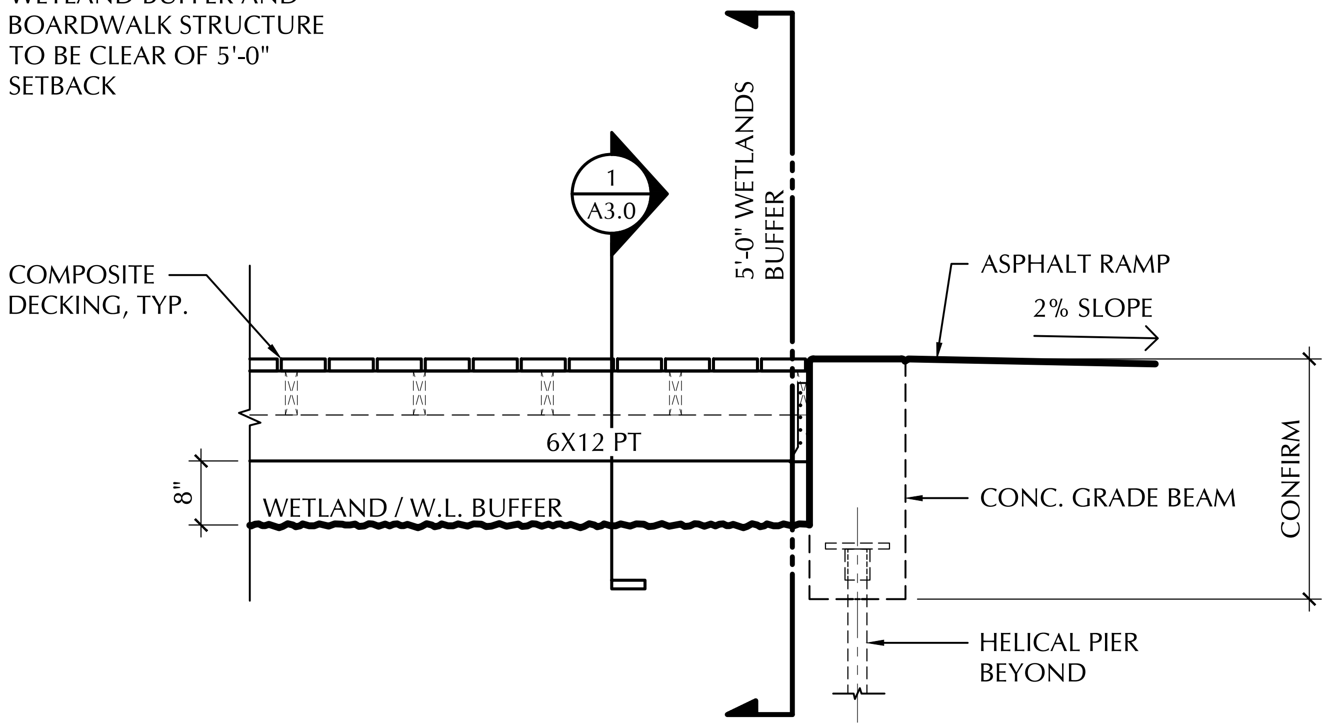
The proposed boardwalk meets the CBMC requirements as both an accessory structure and as a footpath in the Wetland Overlay Zone under 17.43.050 Paragraphs D & G. The boardwalk also meets the 5-foot side yard setback and area restriction of 120 square feet for an accessory structure in the R-2 Zone under 17.54.030.

This application includes the following:

1.) Site plan and floor plans for underlying development
2.) Proposed Boardwalk plans including optional railing
3.) Support letter from wetlands scientist
4.) Accompanying Type II Development permit application and supporting documents

Exhibit A-2

NOTE:
BOARDWALK FOOTINGS TO BE OUTSIDE OF 5'-0" WETLAND BUFFER AND BOARDWALK STRUCTURE TO BE CLEAR OF 5'-0" SETBACK



1 A2.0 PARTIAL
BOARDWALK ELEVATION
1/2" = 1'-0"

A2.0
1

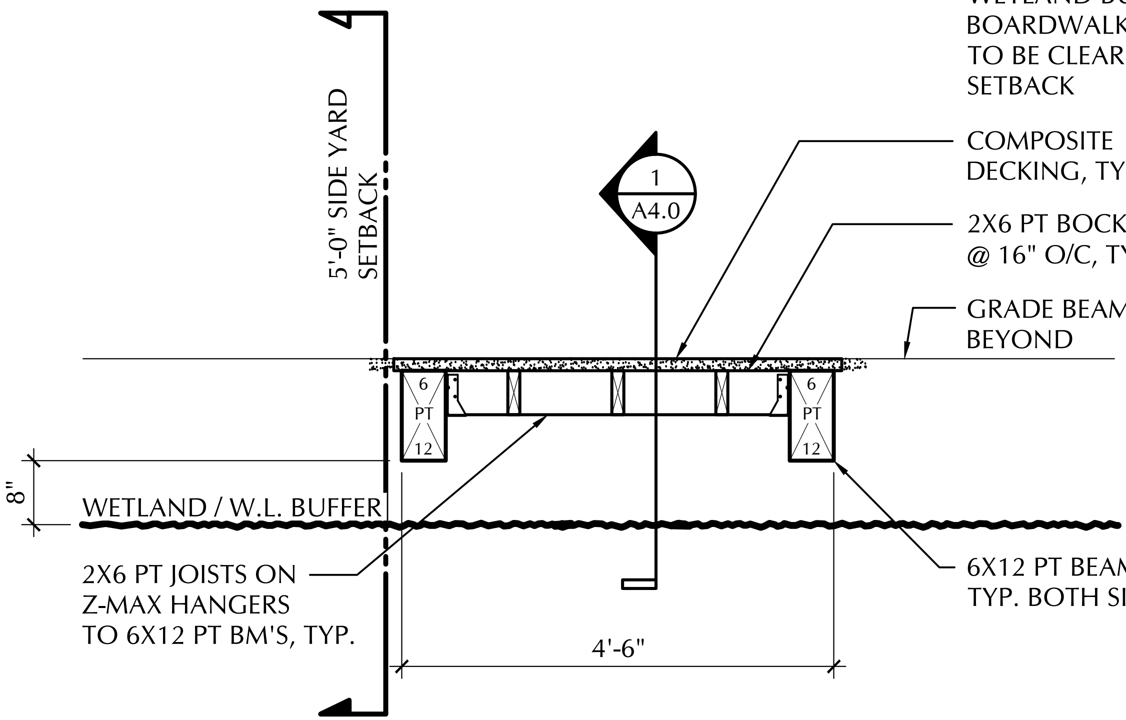
FOREST LAWN DEVELOPMENT
BOARDWALK ELEVATION

CANNON BEACH OR 97110
11-22-2023

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

REGISTERED ARCHITECT · STATE OF OREGON

Exhibit A-2



1
A3.0

BOARDWALK CROSS SECTION

1/2" = 1'-0"

A3.0

2

FOREST LAWN DEVELOPMENT
BOARDWALK CROSS SECTION

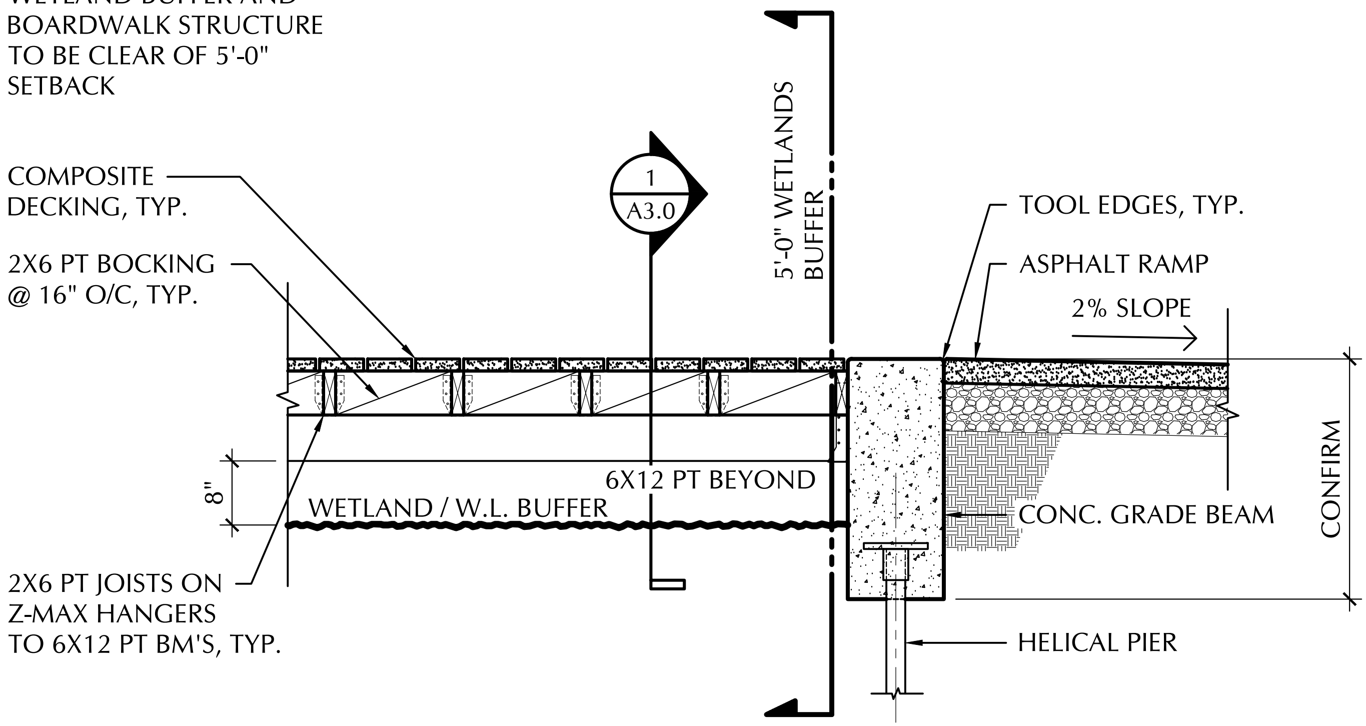
CANNON BEACH OR 97110
11-22-2023

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

REGISTERED ARCHITECT · STATE OF OREGON

Exhibit A-2

NOTE:
BOARDWALK FOOTINGS
TO BE OUTSIDE OF 5'-0"
WETLAND BUFFER AND
BOARDWALK STRUCTURE
TO BE CLEAR OF 5'-0"
SETBACK



1
A4.0

BOARDWALK SECTION @ RAMP

1/2" = 1'-0"

A4.0

3

FOREST LAWN DEVELOPMENT

BOARDWALK SECTION @ RAMP

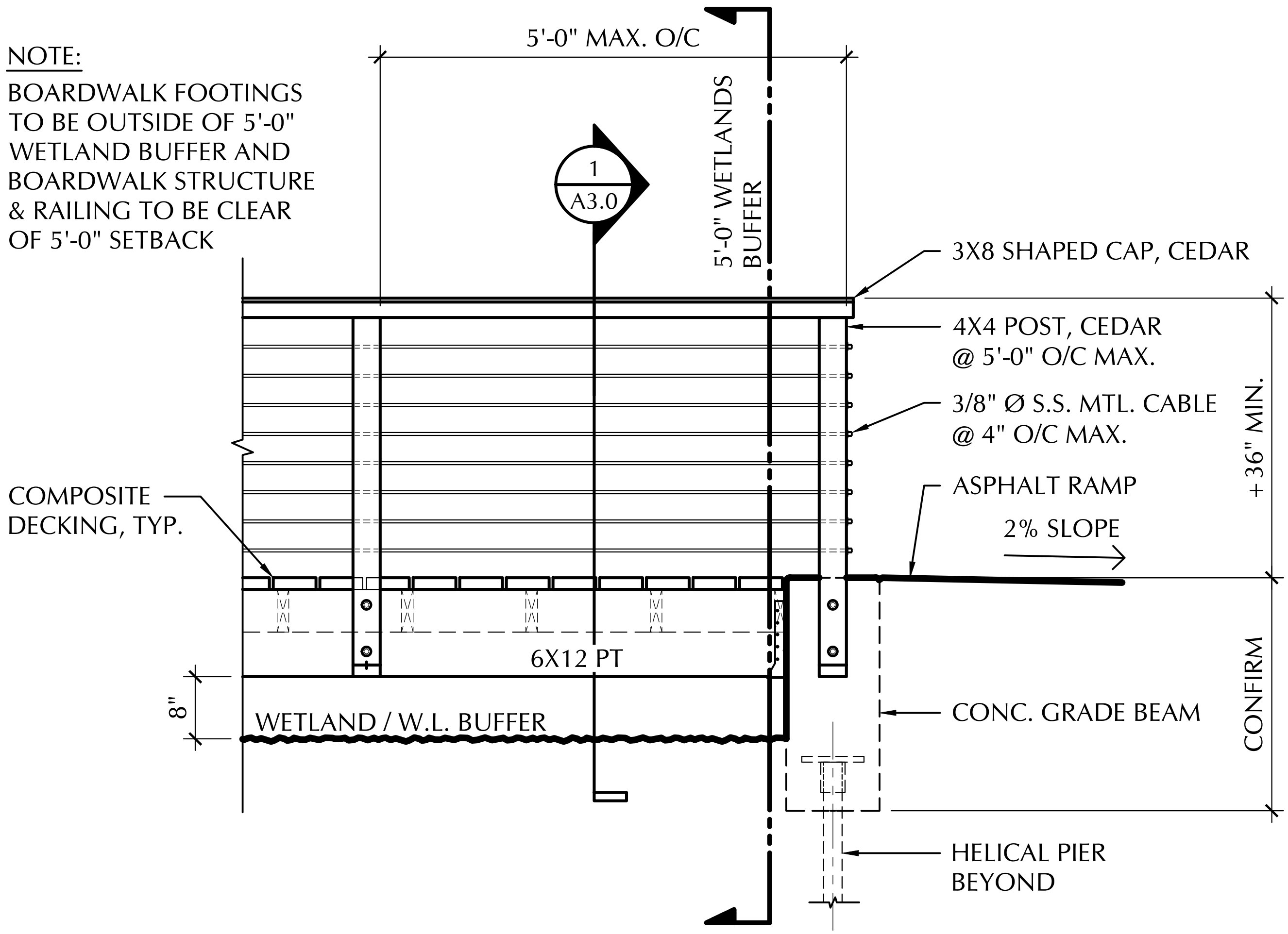
CANNON BEACH OR 97110

11-22-2023

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

REGISTERED ARCHITECT
STATE OF OREGON

Exhibit A-2



PARTIAL W/ OPTIONAL RAILING
BOARDWALK ELEVATION
1
A2.0
1/2" = 1'-0"

A2.0
OPTIONAL RAILING

4

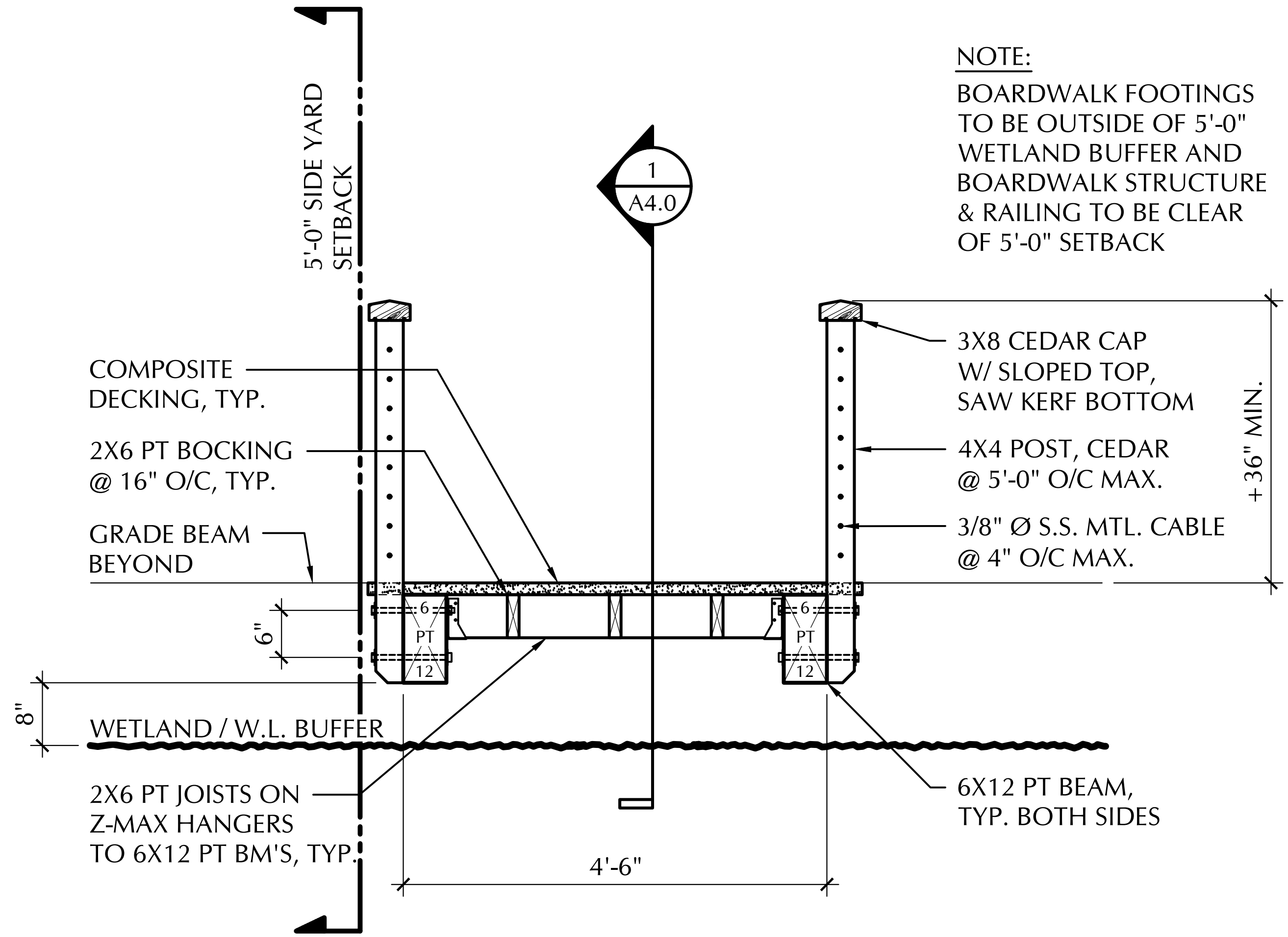
FOREST LAWN DEVELOPMENT
BOARDWALK ELEVATION

CANNON BEACH OR 97110
11-22-2023

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

REGISTERED ARCHITECT · STATE OF OREGON

Exhibit A-2



1
A3.0

W/ OPTIONAL RAILING
BOARDWALK CROSS SECTION
1/2" = 1'-0"

A3.0
OPTIONAL RAILING

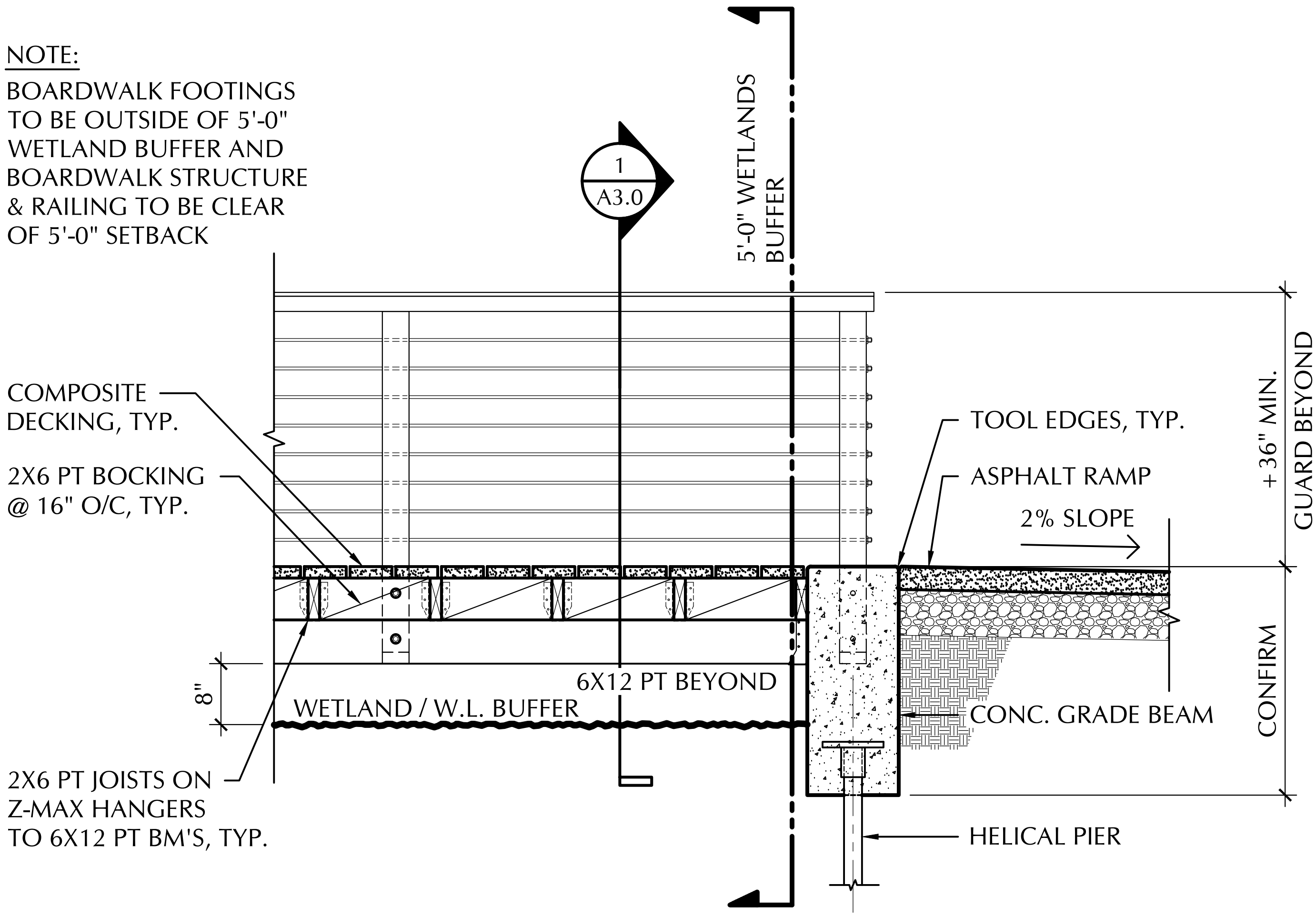
FOREST LAWN DEVELOPMENT
BOARDWALK CROSS SECTION

CANNON BEACH OR 97110
11-22-2023

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

REGISTERED ARCHITECT · STATE OF OREGON

Exhibit A-2



1
A4.0

W/ OPTIONAL RAILING

BOARDWALK SECTION @ RAMP

1/2" = 1'-0"

A4.0

OPTIONAL RAILING

6

FOREST LAWN DEVELOPMENT
BOARDWALK SECTION @ RAMP

CANNON BEACH OR 97110
11-22-2023

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

REGISTERED ARCHITECT · STATE OF OREGON

Exhibit A-3

1 SITE PLAN
AS1.1
1" = 20'-0"

REF. N

CONDITIONAL USE PERMIT
DEVELOPMENT PERMIT

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

CONDITIONAL USE PERMIT
DEVELOPMENT PERMIT

PLANS FOR
FOREST LAWN DEVELOPMENT

FOREST LAWN
CANNON BEACH, OREGON

MARK	DATE	DESCRIPTION

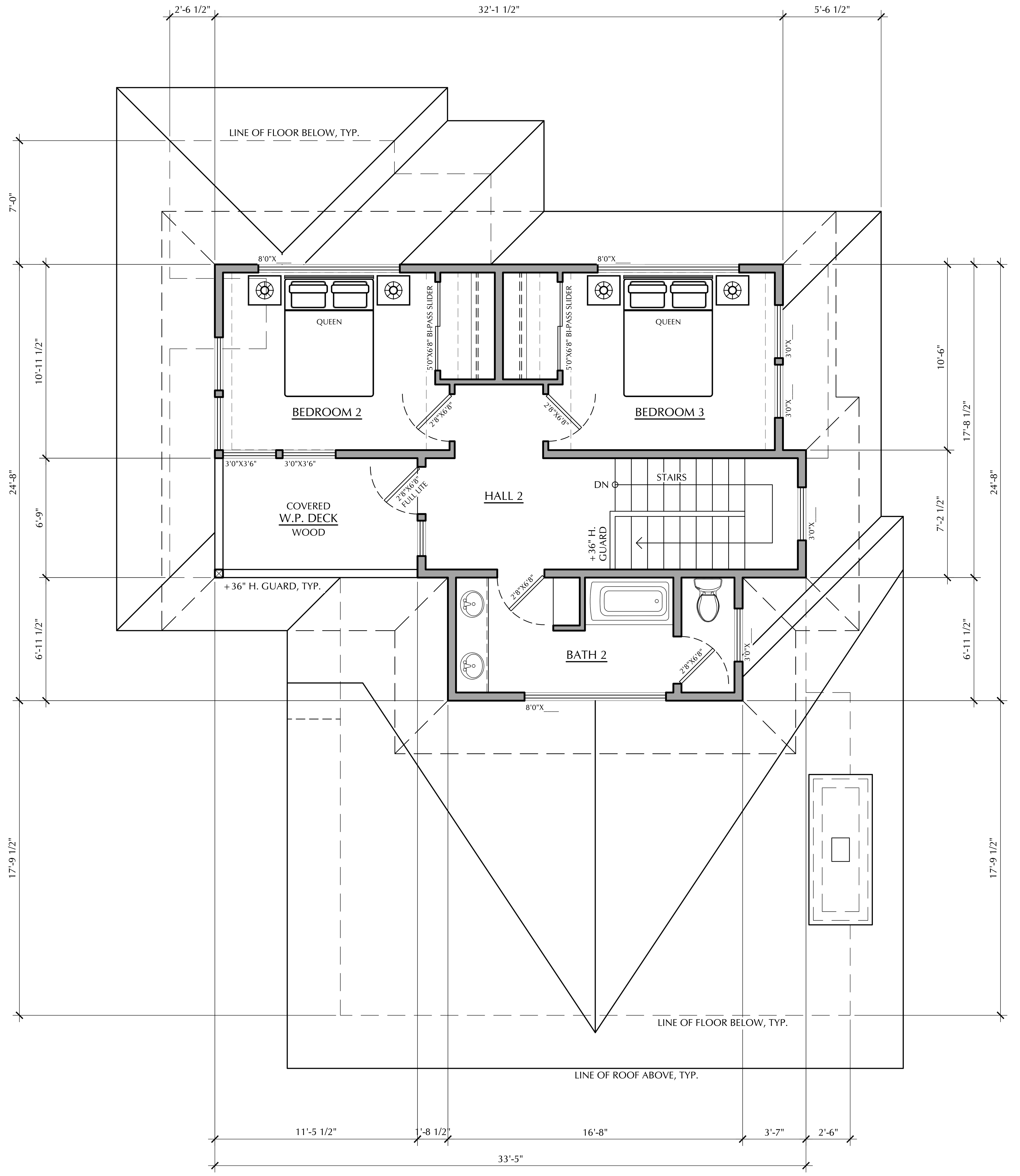
DATE: 2023-11-22
JOB:
FILE:
DRAWN: XX
CHECKED:

ELEVATIONS

AS1.0

Plotted on Nov 22, 2023 – 8:19pm XR_SITE PLAN_2023-11-14_JO DV_STAMP
Xrefs: XR_24x36 TITLE BLOCK_2023 XR_NORTH_FP-1_JO XR_SOUTH_FP-1 XR_GARAGE
D:\Tolovana Architects Dropbox\Projects_Active\Pielka Forrest Lawn\ACAD\SHEET SETS\

Exhibit A-3

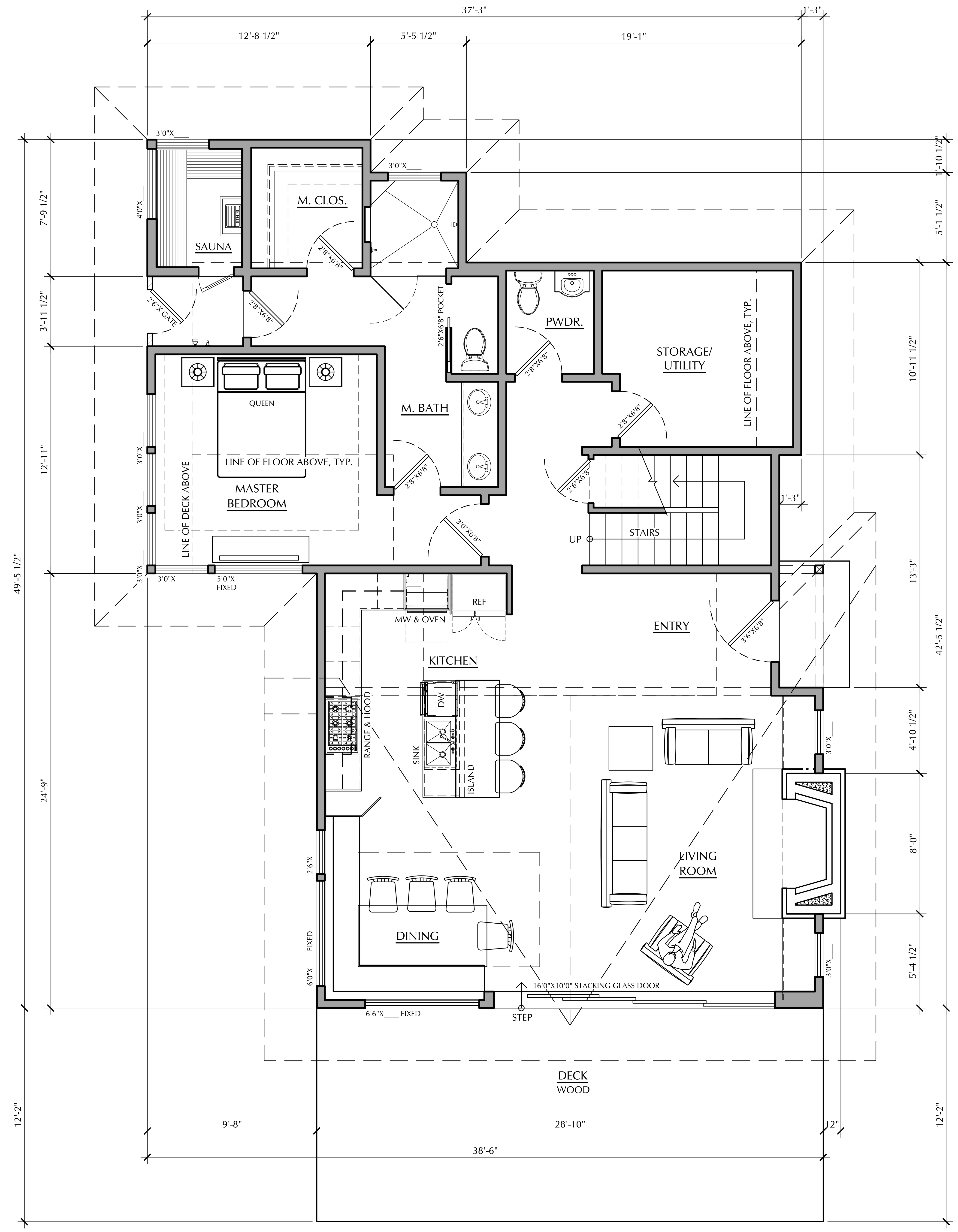


2
A1.1
NORTH RESIDENCE
UPPER FLOOR PLAN
1/4" = 1'-0"
UPPER FLOOR 616 SQ. FT.

REF.
N

WALL LEGEND

- EXTERIOR WALL: 2 X 6 @ 16" O/C
- INTERIOR WALL: 2 X 6 @ 16" O/C
- INTERIOR WALL: 2 X 4 @ 16" O/C
- PARTIAL HEIGHT WALLS 2 X 4 @ 16" O/C U.O.N.



1
A1.1
NORTH RESIDENCE
MAIN FLOOR PLAN
1/4" = 1'-0"
MAIN FLOOR 1,451 SQ. FT.
LOWER FLOOR 616 SQ. FT.
TOTAL LIVING 2,067 SQ. FT.

REF.
N

PRELIMINARY

Plotted on Nov 22, 2023 - 8:19pm TB_NORTH RESIDENCE DV_STAMP XR_NORTH_FP-1_J0
Xrefs: XR_NORTH_FP-2_J0 XR_24X36
D:\Tolovana Architects Dropbox\Projects_Active\Pielka Forrest Lawn\ACAD\SHEET SETS\

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

PRELIMINARY

PLANS FOR
FOREST LAWN DEVELOPMENT
NORTH RESIDENCE
FOREST LAWN
CANNON BEACH, OREGON

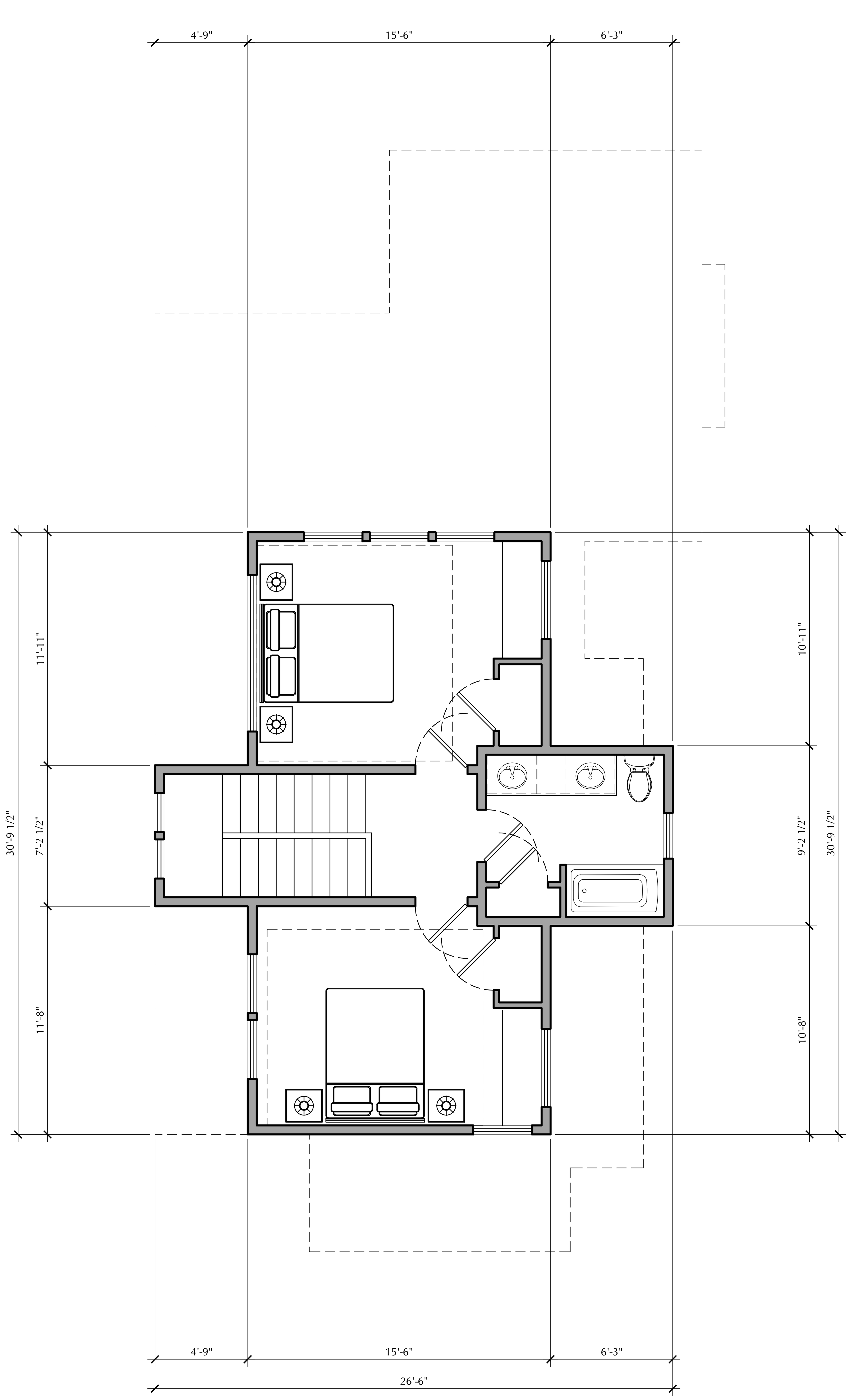
MARK	DATE	DESCRIPTION

DATE: 2023-11-22
JOB:
FILE:
DRAWN: XX
CHECKED:

NORTH
RESIDENCE
FLOOR PLANS

A1.1

Exhibit A-3



SOUTH RESIDENCE
UPPER FLOOR PLAN
2 A1.1 1/4" = 1'-0" UPPER FLOOR 569 SQ. FT.

REF. N

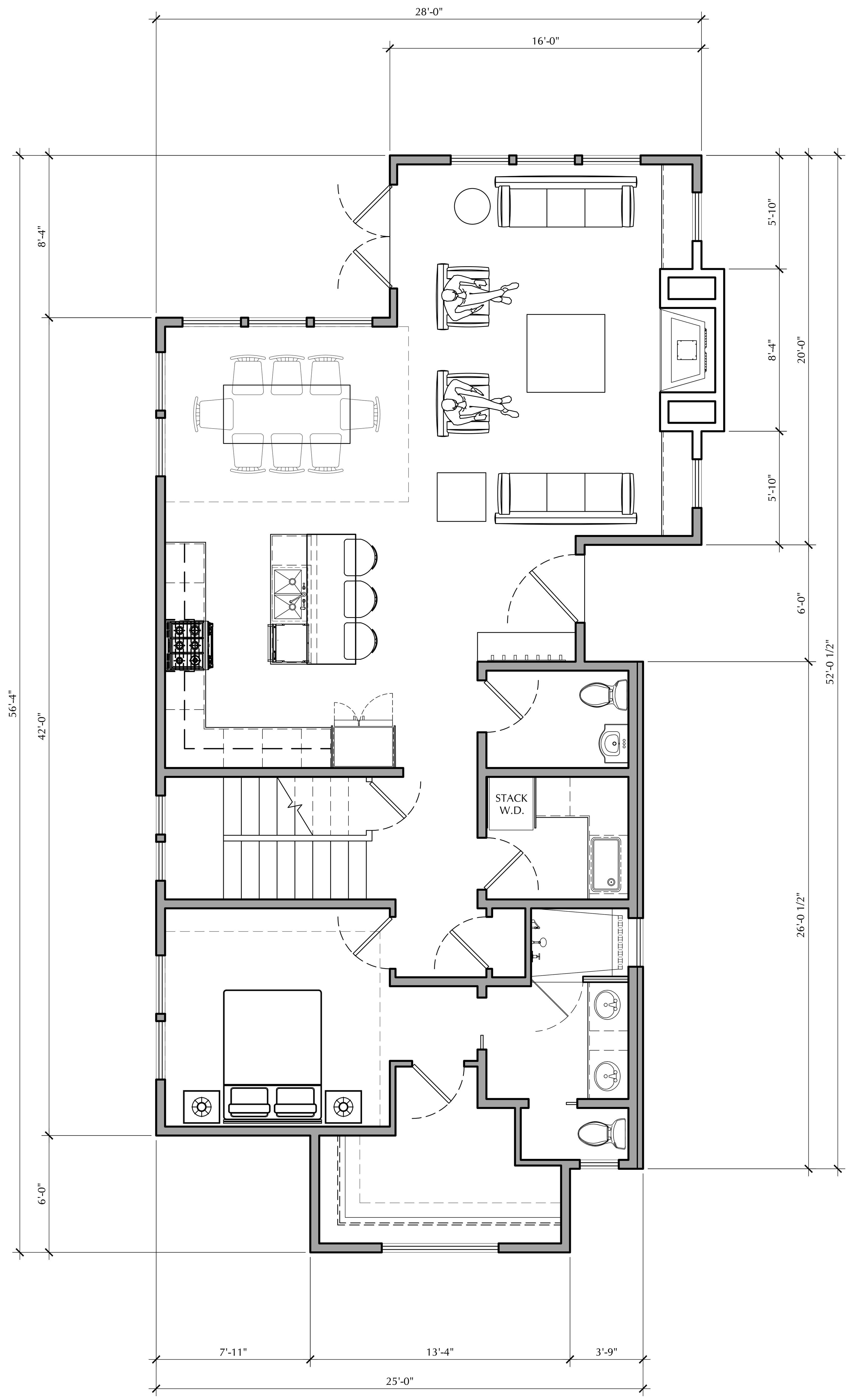
WALL LEGEND

EXTERIOR WALL: 2 X 6 @ 16" O/C

INTERIOR WALL: 2 X 6 @ 16" O/C

INTERIOR WALL: 2 X 4 @ 16" O/C

PARTIAL HEIGHT WALLS 2 X 4 @ 16" O/C U.O.N.



SOUTH RESIDENCE
MAIN FLOOR PLAN
1 A1.1 1/4" = 1'-0"

MAIN FLOOR 1,296 SQ. FT.
LOWER FLOOR 569 SQ. FT.
TOTAL LIVING 1,865 SQ. FT.

REF. N

PRELIMINARY

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

PRELIMINARY

PLANS FOR
FOREST LAWN DEVELOPMENT
SOUTH RESIDENCE
FOREST LAWN
CANNON BEACH, OREGON

MARK	DATE	DESCRIPTION

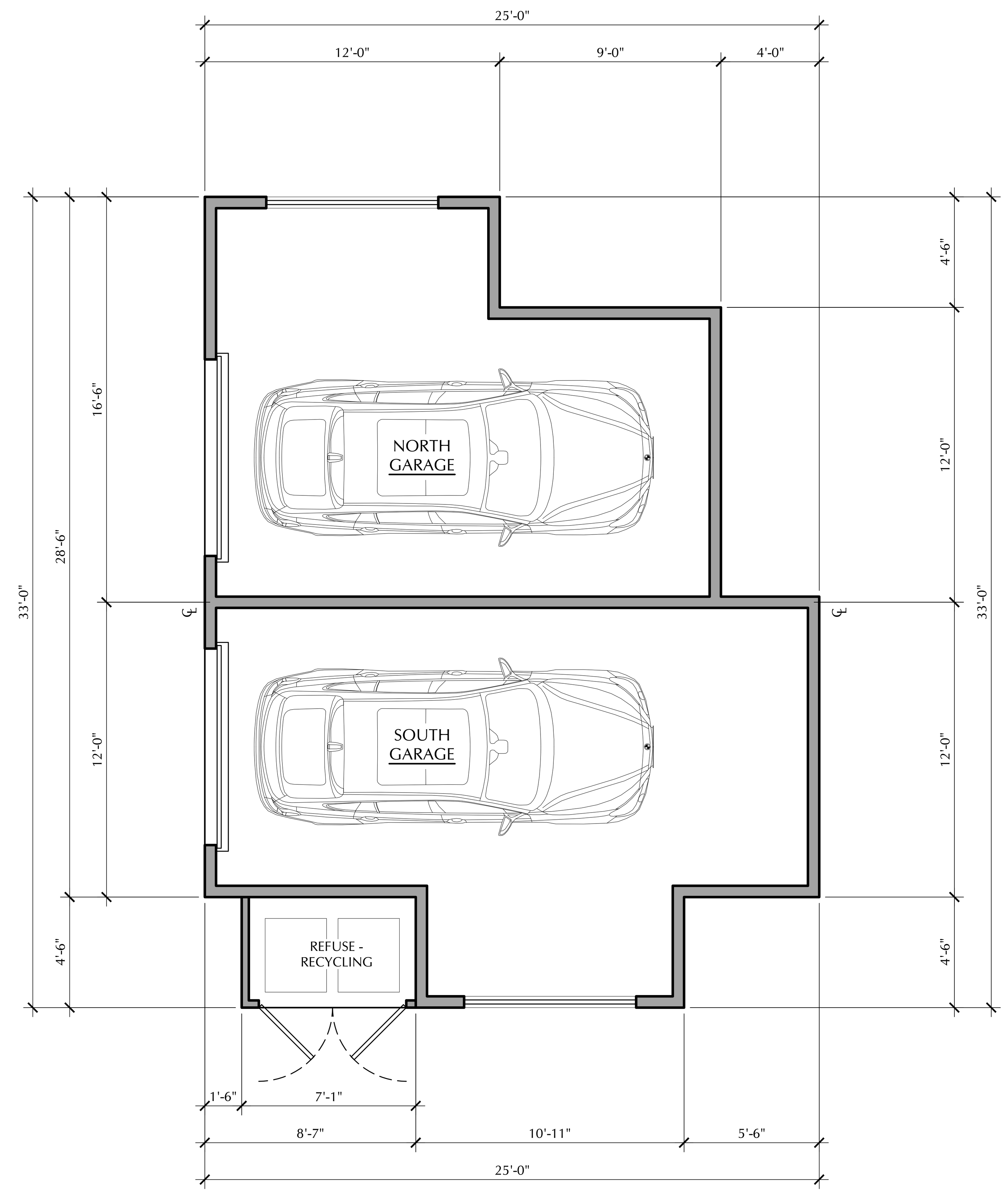
DATE: 2023-11-22
JOB:
FILE:
DRAWN: XX
CHECKED:

SOUTH RESIDENCE FLOOR PLANS

A1.1

Plotted on Nov 22, 2023 – 8:19pm XR_SOUTH RESIDENCE DV_STAMP XR_SOUTH_FP-1
Xrefs: XR_SOUTH_FP-2 XR_24x36 TB_SOUTH RESIDENCE
D:\Tolovana Architects Dropbox\Projects_Active\Pletka Forrest Lawn\ACAD\SHEET SETS\

Exhibit A-3



1
A1.1

GARAGE FLOOR PLAN

1/4" = 1'-0"

GARAGE 656 SQ. FT.

PRELIMINARY

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

PRELIMINARY

PLANS FOR
FOREST LAWN DEVELOPMENT
GARAGE
FOREST LAWN
CANNON BEACH, OREGON

MARK	DATE	DESCRIPTION

DATE: 2023-11-22
JOB:
FILE:
DRAWN: XX
CHECKED:

GARAGE
FLOOR PLAN

A1.1

Plotted on Nov 22, 2023 - 8:19pm XR_GARAGE
Xrefs: XR_24x36 TB_GARAGE DV_STAMP
D:\Tolovana Architects Dropbox\Projects_Active\Pietka Forrest Lawn\ACAD\SHEET SETS\

Exhibit A-4

PACIFIC HABITAT SERVICES, INC.

9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

(800) 871-9333 ● (503) 570-0800 ● Fax (503) 570-0855

November 28, 2023

Patrick/Dave, LLC
3514 NE US Grant Place
Portland, OR 97212

RE: Proposed boardwalk on Tax Lot 4100 on Forest Lawn Drive City of Cannon Beach. T5N R10W 30DA TL4100

I am a Senior Professional Wetland Scientist certified by the Society of Wetland Scientists with over 33 years of wetlands consulting experience in Oregon and the Pacific Northwest. I managed the first wetland delineation within the Forest Lawn property, which was conducted in 1999. I have visited the property on several occasions since then, and managed the latest delineation, which was conducted on December 9th, 2020. The 2020 wetland delineation was approved by the Oregon Department of State Lands and the US Army Corps of Engineers. In short, I am very familiar with the property and its wetland.

I have reviewed the proposed development plans for the property, which show 5 foot 6 inches wide wooden boardwalk that is proposed to span between 24 and 26 feet of the wetland buffer at the very southern edge of the property. The footings of the boardwalk will be located outside of the buffer in upland. The boardwalk will provide access between the proposed 1,200 square foot house to be constructed in the southeast corner of the property and the end of a 3-feet wide walkway to the west that will provide access to a garage and Forest Lawn Drive.

It is my opinion that the boardwalk will have no detrimental effect on the functions and values of the wetland or its buffer. The boardwalk is located along the southern border of the property adjacent to an existing dwelling. The boardwalk will be raised above the ground, allowing shade tolerant plant species to grow beneath the boardwalk. Although there is little habitat remaining on the lot to the south of the property, the raised boardwalk will allow smaller wildlife, such as salamanders and invertebrates, to freely access the wetland to the north. The boardwalk will also not disrupt the hydrology of the wetland.

I have worked on numerous trail projects that incorporate boardwalks into their designs to ensure that wetland and buffer impacts are minimized. Boardwalks are used in sensitive areas where an at-grade trail has the potential to detrimentally impact habitat. There are numerous studies that document the effectiveness of boardwalks[1]. I support the use of the boardwalk on the property and am available for site-specific questions regarding its siting.

Sincerely,

John van Staveren, SPWS
Senior Professional Wetland Scientist

[1] https://www.americantrails.org/resources/faq-vegetation-under-boardwalks
https://www.nawm.org/pdf_lib/2_boardwalk_6_26_06.pdf

Exhibit A-5

CITY OF CANNON BEACH

DEVELOPMENT PERMIT TYPE 2 APPLICATION

Please fill out this form completely. Please type or print.

Applicant Name: Red Crow, LLC/Jamie Lerma
Mailing Address: PO Box 825
Cannon Beach, OR 97110
Email Address: jamie@redcrowgc.com
Telephone: 503-849-0258

Property-Owner Name: Patrick/Dave, LLC
(if other than applicant)
Mailing Address: 3514 NE US Grant Place
Portland, OR 97212
Telephone: 503-206-1071
Property Location: Forest Lawn Rd. south of intersection with S. Hemlock St.
(street address)
Map No.: 51030DA Tax Lot No.: 04100

Nature of the Request

1. Description of proposed action which requires the development permit. On a separate sheet include a site diagram showing property dimensions, location of proposed activity or structure and its relationship to structures or improvements on the property.

Construction of a detached two-family home with a detached garage. There are no existing improvements on the property.
Please see additional attached supporting documentation:
1. Site Plan
2. Tree Report by Todd Prager of Prager & Associates
3. Geotechnical Report and Supplemental Report by Earth Engineers, Inc.
4. Wetland Delineation by Pacific Habitat Services, Inc., DSL Concurrence, and US Army Corps of Engineers Jurisdictional Determination
5. Utility plan by Civil Engineer Jason Morgan
6. Temporary Construction Access support letter from Cannon Beach Public Works Director
7. Conditional use permit application and supporting materials for boardwalk access spanning wetland and wetland buffer

2. Explain how the request meets the standards which are applicable to the proposal.

The project site is zoned Residential Medium Density (R2) and contains wetlands mapped on the City's local wetland inventory that are subject to Cannon Beach Municipal Code (CBMC) Chapter 17.43 (Wetlands Overlay Zone). A detached two-family home is an outright allowed use per CMBC 17.14.020 (R2 Zone). The lot meets the minimum R2 zone lot area, lot width, and lot depth requirements, as well as the minimum upland area requirement for lots proposed within the Wetland Overlay (WO) zone of 1,000 square feet. Building site envelopes are identified for each proposed dwelling, showing that applicable wetland buffer and front, rear, and side setback standards are met. The lot provides at least 25 feet of frontage along a public street for required access. The site plan meets parking standards by providing 6 off-street parking spaces.

Exhibit A-5

3. Attach a scale drawing showing the dimensions of the property, adjacent street(s), dimensions of existing structures, and the location and dimensions of the proposed accessory structure.

   See attached site plan. There are no existing improvements on the property.

4. Attach a drawing, photograph or other visual representation of the proposed structure. Include the dimensions of the structure and its height.

   Not required per City of Cannon Beach Community Development Department

Use Additional Sheets as Necessary.

Application Fee: $100.00

Applicant Signature: ______________ Date: 11/29/2023

Jamie B. Lerma

Property Owner Signature: See attached page Date: 9/20/2023

David Pietka

If the applicant is other than the owner, the owner hereby grants permission for the applicant to act on his/her behalf. Please attach the name, address, phone number, and signature of any additional property owners. As Property Owner, my signature or an authorized applicant's signature, allows any duly authorized employee of the City to enter upon all properties affected by this permit for the purpose of follow-up inspection, observation, or measurement.

For Staff Use Only:

Received on: ______________ By: ______________

Fee Paid: ______________ Receipt No.: ______________

(Last revised March 2021)

3. Attach a scale drawing showing the dimensions of the property, adjacent street(s), dimensions of existing structures, and the location and dimensions of the proposed accessory structure.

   See attached site plan. There are no existing improvements on the property.

4. Attach a drawing, photograph or other visual representation of the proposed structure. Include the dimensions of the structure and its height.

   Not required per City of Cannon Beach Community Development Department

Use Additional Sheets as Necessary.

Application Fee: $100.00

Applicant Signature: ______________ Date: 11/29/2023

Jamie B. Lerma

Property Owner Signature: David Pietka Date: 11/29/2023

David Pietka

If the applicant is other than the owner, the owner hereby grants permission for the applicant to act on his/her behalf. Please attach the name, address, phone number, and signature of any additional property owners. As Property Owner, my signature or an authorized applicant's signature, allows any duly authorized employee of the City to enter upon all properties affected by this permit for the purpose of follow-up inspection, observation, or measurement.

For Staff Use Only:

Received on: ______________ By: ______________

Fee Paid: ______________ Receipt No.: ______________

(Last revised March 2021)

Todd Prager & Associates LLC

MEMORANDUM

DATE:	November 27, 2023
TO:	Patrick/Dave, LLC
FROM:	Todd Prager, RCA #597, ISA Board Certified Master Arborist
RE:	Revised Site Plan for the Forest Lawn Project

The revised site plan for the Forest Lawn Project in Attachment 1 conforms to the tree protection recommendations in my June 22, 2023 tree plan for the project. Attachment 1 includes tree protection notes from my June 22, 2023 report. Tree protection recommendations from the report are also included below.

Note that parking adjacent to trees 29 and 40 needs to be shifted north to achieve the required clearances from these two trees.

Tree Protection Recommendations

The trees to be retained will require protection during construction. This section of the report includes my tree protection recommendations for the proposed construction.

- *Tree Protection Fencing*: Tree protection fencing shall be installed in the locations shown in Attachment 1 prior to construction. When fence adjustments or work is required in the tree protection zones, the project arborist shall be consulted to oversee the work.
- *Tree Removal*: The trees to be removed shall not contact or otherwise damage the trunks or branches of the trees to be retained. Piece removal of the trees will be required to protect the adjacent retained trees. No vehicles or heavy equipment shall be permitted within the tree protection zones during tree removal operations.
- *Stump Removal*: The stumps of the trees to be removed shall have their structural roots cut prior to removal to protect the root systems of the adjacent trees to be retained.
- *Underground utilities*: Underground utilities will need to be bored at a depth of at least five feet to avoid the typical minimum construction setback radii of the retained trees shown in Attachment 1.
- *Parking construction*: The parking area adjacent to trees 29 and 40 shall be constructed of clean crushed rock (with no fines) over geotextile fabric that is permeable to air and water. The surface litter layer shall be carefully removed under arborist supervision prior to fabric and rock placement to minimize damage and disturbance to any surface roots of trees to be retained. No excavation beyond the native soil surface is permitted. At least four inches of

crushed rock over geotextile fabric shall be placed over exposed surface roots to protect them from damage.

- *Private Access*: Private access adjacent to trees 16 and 18 shall be constructed under arborist supervision without excavation below existing grade. At least four inches of base rock over geotextile fabric shall be placed over exposed surface roots to protect them from damage.
- *Building Foundations*: The building foundations to be constructed within the typical minimum construction setback radii shown in Attachment 1 will need to be designed to protect structural roots that may be located within their footprints. This will involve pneumatic excavation to locate structural roots greater than 2-inches inches in diameter. Any pneumatic excavation or foundation construction within minimum construction setback radii will need to occur under the onsite supervision of the project arborist. After pneumatic excavation and depending on the roots that are uncovered, the arborist will advise to the best approach for completing the foundation construction in coordination with the project team.
- *Compaction Management and Root Protection*: Where needed for construction access, steel plates over a 6-inch layer of wood chips shall be placed on the ground surface and over visible surface roots in the approximate locations shown in Attachment 1. The project arborist will need to review and approve shifting of the fence locations and final placement of compaction management when required.
- *Crown Pruning Trees*: If the crowns of any trees need to be raised and/or reduced, it shall occur prior to construction. The pruning shall be conducted by an ISA certified arborist in accordance with ANSI A300 pruning standards in coordination with the project arborist. The pruning shall be the minimum necessary to achieve the required clearance for construction.
- *Erosion Control*: If erosion control is required within or directly adjacent to the tree protection fencing, straw wattles shall be used to avoid excavation.

Additional tree protection recommendations are included in Attachment 3.

Please contact me if you have questions, concerns, or need any additional information.

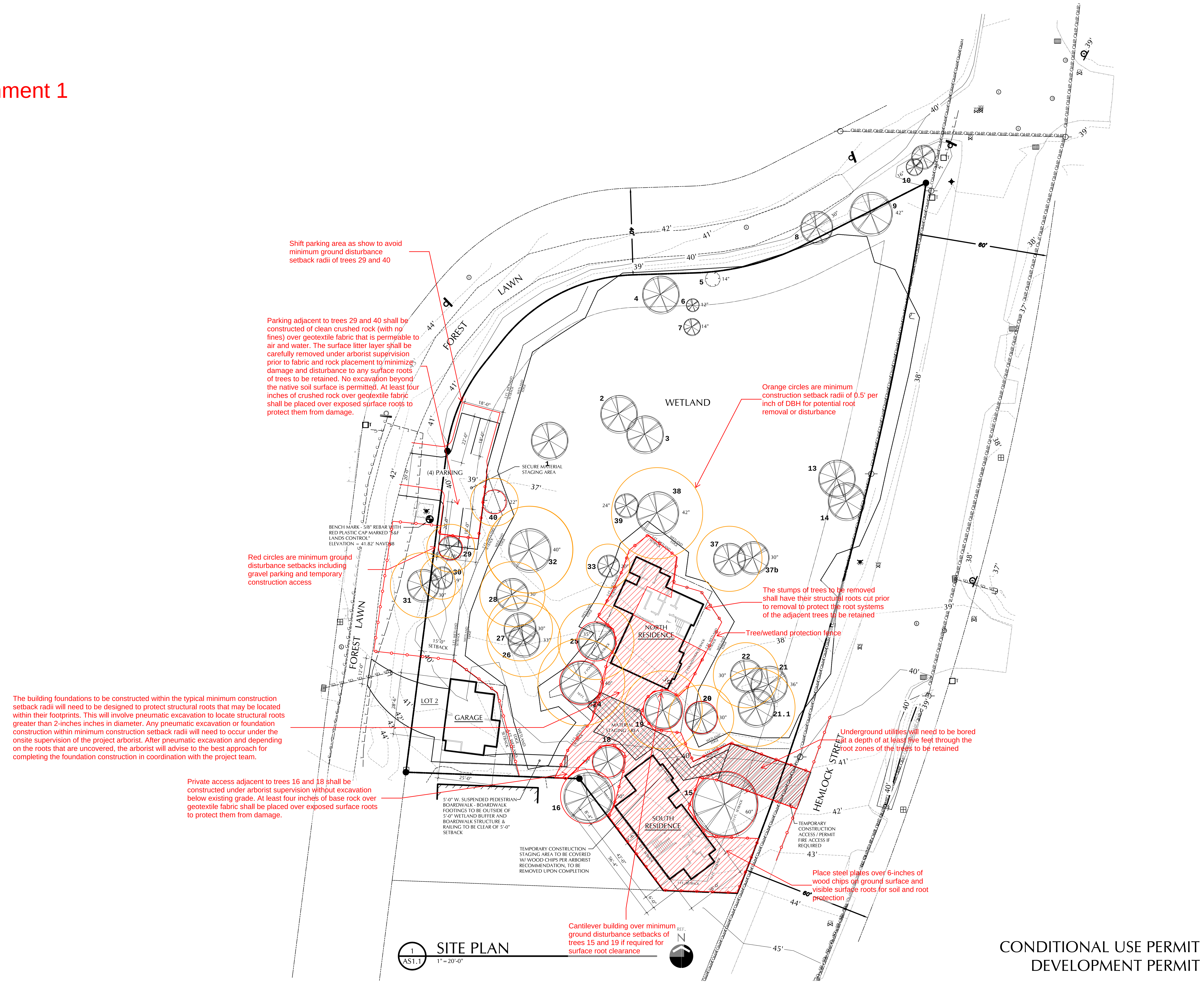
Sincerely,

Todd Prager

Todd Prager
ASCA Registered Consulting Arborist #597
ISA Board Certified Master Arborist, WE-6723B
ISA Qualified Tree Risk Assessor
AICP, American Planning Association

Attachment 1: Revised Site Plan with Trees and Tree Protection
Attachment 2: Tree Inventory
Attachment 3: Tree Protection Recommendations
Attachment 4: Assumptions and Limiting Conditions

Attachment 1



CONDITIONAL USE PERMIT
DEVELOPMENT PERMIT

Tolovana Architect LLC
P.O Box 563
Cannon Beach, Oregon 97110

CONDITIONAL USE PERMIT
DEVELOPMENT PERMIT

PLANS FOR
FOREST LAWN DEVELOPMENT

FOREST LAWN
CANNON BEACH, OREGON

MARK	DATE	DESCRIPTION

DATE: 2023-11-22
JOB:
FILE:
DRAWN: XX
CHECKED:

ELEVATIONS

AS1.0

Plotted on Nov 22, 2023 - 8:19pm
Xrefs: XR_24x36 TITLE BLOCK_2023 DV_STAMP XR_SITE PLAN_2023-11-14_JO XR_NORTH_FP-1_JO XR_SOUTH_FP-1 XR_GARAGE
D:\Tolovana Architects Dropbox\Projects_Active\Pielka Forrest Lawn\ACAD\SHEET SETS\

Todd Prager & Associates LLC

Attachment 2

Tree Number	Common Name	Scientific Name	Comments from Arbor Care Tree Specialists	DBH
1	Sitka spruce	*Picea sitchensis*	Ok	22
2	Sitka spruce	*Picea sitchensis*	Ok	22
3	Sitka spruce	*Picea sitchensis*	Ok	12
4	Red alder	*Alnus rubra*	Ok, tipped tree with horizontal trunk. Stable	12
5	Red alder	*Alnus rubra*	Large decay pocket. No target. No action required	9
6	Sitka spruce	*Picea sitchensis*	Ok	9
7	Sitka spruce	*Picea sitchensis*	Ok	12
8	Sitka spruce	*Picea sitchensis*	Ok	35
9	Sitka spruce	*Picea sitchensis*	Phaeolus schweinitzii at base. Leans into wetland.	50
10	Sitka spruce	*Picea sitchensis*	Ok	12
11	Sitka spruce	*Picea sitchensis*	Ok	27
12	Red alder	*Alnus rubra*	Remove. Growing over culvert and decay in plane of lean toward road.	11
13	Sitka spruce	*Picea sitchensis*	Ok	30
14	Crab apple	*Malus sp.*	Ok. Cluster of 5 trunks	6-8
15	Sitka spruce	*Picea sitchensis*	Ok	60
16	Sitka spruce	*Picea sitchensis*	Ok	50
17	Sitka spruce	*Picea sitchensis*	Remove. Poor live crown ratio and heavy lean with a heaving root plate	50
18	Sitka spruce	*Picea sitchensis*	Ok	29
19	Sitka spruce	*Picea sitchensis*	Ok	36
20	Western hemlock	*Tsuga heterophylla*	Remove. Heavy lean with a heaving root plate	30
21	Sitka spruce	*Picea sitchensis*	Ok	36
21.1	Sitka spruce	*Picea sitchensis*	Added by Todd Prager based on July 21, 2022 site visit. Good health condition and fair structural condition with codominant stems at approximately 50 feet above ground. Crown was moderately one sided due to competition with adjacent trees	36
22	Sitka spruce	*Picea sitchensis*	Ok	30
23	Sitka spruce	*Picea sitchensis*	Ok	32
24	Sitka spruce	*Picea sitchensis*	Ok	40
25	Sitka spruce	*Picea sitchensis*	Ok	35
26	Sitka spruce	*Picea sitchensis*	Ok	33

Todd Prager Associates, LLC
601 Atwater Road • Lake Oswego, OR 97034
Phone: 971.295.4835 • Email: todd@toddprager.com • Website: toddprager.com

Todd Prager & Associates LLC

Attachment 2

Tree Number	Common Name	Scientific Name	Comments from Arbor Care Tree Specialists	DBH
27	Sitka spruce	*Picea sitchensis*	Ok	30
28	Sitka spruce	*Picea sitchensis*	Ok	30
29	Sitka spruce	*Picea sitchensis*	Ok	21
30	Sitka spruce	*Picea sitchensis*	Ok	19
31	Sitka spruce	*Picea sitchensis*	Ok	40
32	Sitka spruce	*Picea sitchensis*	Ok	40
33	Sitka spruce	*Picea sitchensis*	Ok	20
34	Sitka spruce	*Picea sitchensis*	Ok	35
35	Sitka spruce	*Picea sitchensis*	Remove. Fomitopsis pinicola seen at 18ft.	35
36	Sitka spruce	*Picea sitchensis*	Ok	36
37	Sitka spruce	*Picea sitchensis*	Ok	30
37b	Sitka spruce	*Picea sitchensis*	Remove. Porodaedalea pini: multiple fruiting bodies extending up trunk	32
38	Sitka spruce	*Picea sitchensis*	Ok	42
39	Sitka spruce	*Picea sitchensis*	Ok	24
40	Red alder	*Alnus rubra*	Ok	22

*This tree inventory is adapted from information collected by Arbor Care Tree Specialists and compiled in their report dated 12-28-2021.

Attachment 3
Tree Protection Recommendations

Before Construction Begins

1. Notify all contractors of tree protection procedures. For successful tree protection on a construction site, all contractors must know and understand the goals of tree protection.
    a. Hold a tree protection meeting with all contractors to explain the goals of tree protection.
    b. Have all contractors sign memoranda of understanding regarding the goals of tree protection. The memoranda should include a penalty for violating the tree protection plan. The penalty should equal the resulting fines issued by the local jurisdiction plus the appraised value of the tree(s) within the violated tree protection zone per the current Trunk Formula Method as outlined in the current edition of the ***Guide for Plant Appraisal*** by the Council of Tree & Landscape Appraisers. The penalty should be paid to the owner of the property.
2. Fencing
    a. Trees to remain on site will be protected by installation of tree protection fencing as shown in Attachment 1.
    b. Unless otherwise noted, the fencing should be put in place before the ground is cleared to protect the trees and the soil around the trees from disturbances.
    c. Fencing should be established by the project arborist based on the needs of the trees to be protected and to facilitate construction.
    d. Fencing should consist of 6-foot-high steel fencing on concrete blocks or 6-foot metal fencing secured to the ground with 8-foot metal posts to prevent it from being moved by contractors, sagging, or falling down.
    e. Fencing should remain in the position that is established by the project arborist and not be moved without approval from the project arborist.
3. Signage
    a. All tree protection fencing should have signage as follows so that all contractors understand the purpose of the fencing:

TREE PROTECTION ZONE

DO NOT REMOVE OR ADJUST THE LOCATION OF THIS TREE PROTECTION FENCING
UNAUTHORIZED ENCROACHMENT MAY RESULT IN FINES

Please contact the project arborist if alterations to the location of the tree protection fencing are necessary.

Todd Prager, Project Arborist, Todd Prager & Associates, 971-295-4835

    b. Signage should be placed every 75-feet or less.

During Construction

1. Protection Guidelines Within the Tree Protection Zones:
    a. No new buildings; grade change or cut and fill, during or after construction; new impervious surfaces; or utility or drainage field placement should be allowed within the tree protection zones.
    b. No traffic should be allowed within the tree protection zones. This includes but is not limited to vehicle, heavy equipment, or even repeated foot traffic.
    c. No storage of materials including but not limiting to soil, construction material, or waste from the site should be permitted within the tree protection zones. Waste includes but is not limited to concrete wash out, gasoline, diesel, paint, cleaner, thinners, etc.
    d. Construction trailers should not to be parked/placed within the tree protection zones.
    e. No vehicles should be allowed to park within the tree protection zones.
    f. No other activities should be allowed that will cause soil compaction within the tree protection zones.
2. The trees should be protected from any cutting, skinning or breaking of branches, trunks or woody roots.
3. The project arborist should be notified prior to the cutting of woody roots from trees that are to be retained to evaluate and oversee the proper cutting of roots with sharp cutting tools. Cut roots should be immediately covered with soil or mulch to prevent them from drying out.
4. Trees that have woody roots cut should be provided supplemental water during the summer months.
5. Any necessary passage of utilities through the tree protection zones should be by means of boring with oversight by the project arborist.
6. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

After Construction

1. Carefully landscape the areas within the tree protection zones. Do not allow trenching for irrigation or other utilities within the tree protection zones.
2. Carefully plant new plants within the tree protection zones. Avoid cutting the woody roots of trees that are retained.
3. Do not install permanent irrigation within the tree protection zones unless it is drip irrigation to support a specific planting or the irrigation is approved by the project arborist.
4. Provide adequate drainage within the tree protection zones and do not alter soil hydrology significantly from existing conditions for the trees to be retained.
5. Provide for the ongoing inspection and treatment of insect and disease populations that can damage the retained trees and plants.
6. The retained trees may need to be fertilized if recommended by the project arborist.
7. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

Attachment 4
Assumptions and Limiting Conditions

1. Any legal description provided to the consultant is assumed to be correct. The information provided by Patrick/Dave, LLC and their consultants was the basis of the information provided in this report.
2. It is assumed that this property is not in violation of any codes, statutes, ordinances, or other governmental regulations.
3. The consultant is not responsible for information gathered from others involved in various activities pertaining to this project. Care has been taken to obtain information from reliable sources.
4. Loss or alteration of any part of this delivered report invalidates the entire report.
5. Drawings and information contained in this report may not be to scale and are intended to be used as display points of reference only.
6. The consultant's role is only to make recommendations. Inaction on the part of those receiving the report is not the responsibility of the consultant.
7. The purpose of this report is to review the revised site plan for the Forest Lawn project and determine whether it conforms to the recommendations in my June 22, 2023 tree plan.

Gmail

Jamie Lerma <jamie@redcrowgc.com>

Site plan

Karen La Bonte <labonte@ci.cannon-beach.or.us> Fri, Oct 13, 2023 at 1:35 PM
To: Jamie Lerma <jamie@redcrowgc.com>
Cc: Steve Sokolowski <sokolowski@ci.cannon-beach.or.us>, Karen La Bonte <labonte@ci.cannon-beach.or.us>, Trevor Mount <mount@ci.cannon-beach.or.us>

Jamie,

Upon approval for the development, I will support this path of access off Hemlock during construction. I would like you to outline the material you'll be putting down on the access path so I'm clear and it will most likely come up as a question. Lastly, according to your plan diagram, it does not appear any trees have to be removed in order to have the access off Hemlock; is that accurate?

Other than that, I'm not seeing an issue with this request from a Public Works perspective.

Karen

Public Works Director

City of Cannon Beach

503.436.8068 503.436.8097 503.436.2050

. PO Box 368 Cannon Beach, OR 97110

From: Jamie Lerma <[redacted]>
Sent: Friday, October 13, 2023 12:36 PM
To: Karen La Bonte <[redacted]>
Cc: Steve Sokolowski <[redacted]>
Subject: Re: FW: Site plan

Karen,

I'm writing to confirm that upon approval of the required permits for development of TL 51030DA04100 on Forest Lawn Rd., City of Cannon Beach Public Works will allow temporary construction access to S. Hemlock Street during site development and vertical construction.

The access would be at the location marked Fire Department and Utility Access" on the attached site plan. We are modifying the attached site plan to properly identify the temporary construction access as such, and I wanted to confirm that you still support that approach. There is no access from Forest Lawn Rd. to the proposed home sites for construction equipment or delivery vehicles.

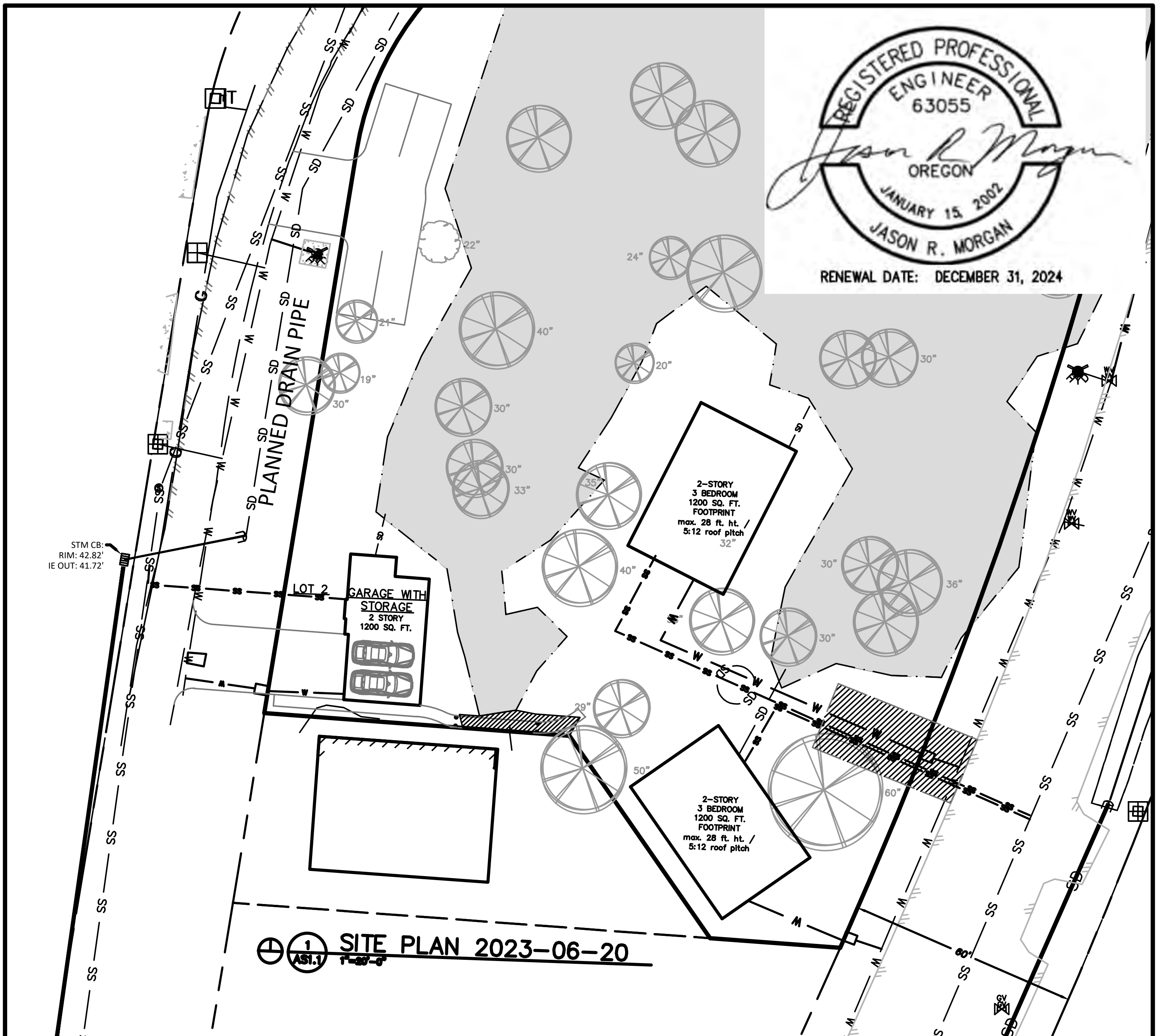
The construction access will follow all tree and root protection measures as specified in the arborist report that was submitted as part of the development permit.

Please let me know if you have any questions.

Thank you,

Jamie

Exhibit A-8



SCALE

0 20 40 80

1 inch = 40 ft.

N

S

SCALE: 1"=40'

EXISTING
- W — WATER MAIN
- SS — SEWER MAIN
- STORM PIPE

PROPOSED
- W — WATER SERVICE
- SS — SEWER SERVCIE
- SD — STORM MAIN

AUG 22, 2023

PATRICK GEMMA

TAX LOT 4100
FOREST LAWN DRIVE
UTILITY LAYOUT

CANNON BEACH/MAP 5N 10W 30DA

MORGAN CIVIL ENGINEERING, INC.

PO BOX 358
MANZANITA, OR 97130
(503) 801-6016
www.morgancivil.com

- CIVIL ENGINEERING
- INSPECTION
- PLANNING

Exhibit A-9

Earth Engineers, Inc.

2411 Southeast 8th Avenue • Camas • WA 98607
Phone: 360-567-1806
www.earth-engineers.com

June 3, 2022

Patrick/Dave LLC
3514 Northeast U.S. Grant Place
Portland, Oregon 97212
Attention: David Pietka, Owner

Phone: (503) 206-1071
E-mail: dpietka@msn.com

Subject: **Geotechnical Investigation and Geologic Hazard Report**
Proposed Forest Lawn Subdivision, Lots 1 - 3
Clatsop County Tax Lot No. 51030DA04100
Intersection of Forest Lawn Road and Hemlock Street
Cannon Beach, Clatsop County, Oregon
EEI Report No. 22-103-1

Dear Mr. Pietka,

Earth Engineers, Inc. (EEI) is pleased to transmit our report for the above referenced project. This report includes the results of our field investigation, an evaluation of geotechnical factors and geologic hazards that may influence the proposed construction, and geotechnical recommendations for the proposed subdivision and general site development.

We appreciate the opportunity to perform this geotechnical study and look forward to continued participation during the design and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Sincerely,
Earth Engineers, Inc.

Troy Hull, P.E., G.E.	Ken Andrieu, R.G.	Jacqui Boyer
Principal Geotechnical Engineer	Senior Geologist	Geotechnical Engineering Associate

Attachment: Geotechnical Investigation and Geologic Hazard Report

Distribution (electronic copy only): Addressee
Jamie Lerma, Red Crow, LLC (jamie@redcrowgc.com)

GEOTECHNICAL INVESTIGATION AND GEOLOGIC HAZARD REPORT

for the

Proposed Forest Lawn Subdivision, Lots 1 - 3
Clatsop County Tax Lot No. 51030DA04100
Intersection of Forest Lawn Road
and South Hemlock Street
Cannon Beach, Clatsop County, Oregon

Prepared for

Patrick/Dave LLC
3514 Northeast U.S. Grant Place
Portland, Oregon 97212
Attention: David Pietka, Owner

Prepared by

Earth Engineers, Inc.
2411 Southeast 8th Avenue
Camas, Washington 98607
Telephone (360) 567-1806

EEI Report No. 22-103-1

June 3, 2022

Earth Engineers, Inc.

Jacqui Boyer
Geotechnical Engineering Associate

REGISTERED PROFESSIONAL ENGINEER
19206PE
OREGON
JULY 15, 1997
TROY M. HULL
EXPIRES: 6/30 23

Troy Hull, P.E., G.E.
Principal Geotechnical Engineer

REGISTERED PROFESSIONAL
OREGON
KENNETH DAVID ANDRIEU
#G1988
GEOLOGIST
EXP: 12/1/2022

Ken Andrieu, R.G.
Senior Geologist

TABLE OF CONTENTS

1.0 PROJECT INFORMATION

1.1 Project Authorization

Earth Engineers, Inc. (EEI) has completed a geotechnical investigation report for the proposed 3 residential lot development on Clatsop County Tax Lot No. 51030DA04100 in Cannon Beach, Clatsop County, Oregon. Our services were authorized by David Pietka, owner of Patrick/Dave LLC, on April 19, 2022 by signing EEI Proposal No. 22-P182 dated April 18, 2022.

1.2 Project Description

Our current understanding of the project is based on the information Jamie Lerma with Red Crow, LLC provided to EEI Principal Geotechnical Engineer Troy Hull and Principal Engineering Geologist Adam Reese. We were also provided the following document via e-mail:

- **Partition Plan titled "Preliminary Haystack Views Subdivision Exhibit" prepared by S&F Land Services, dated November 9, 2021.** This map shows the proposed boundaries of the 3 lots on the subject property with respect to the surrounding properties and streets. See Figure 1 below.

Briefly, we understand the plan is to develop a 3-lot residential subdivision. It is our understanding that this project is in its preliminary stages. We have not been provided any detailed construction plans for the project. For the purposes of this report, we are assuming maximum foundation loads of 4 kips per linear foot for wall footings, 40 kips for column footings, and 150 psf for floor slabs. With regard to design grades, we are assuming that cuts and fills will be negligible (i.e. less than 2 feet). Finally, we have assumed that the homes will be constructed in accordance with the 2021 Oregon Residential Specialty Code (ORSC), or the 2019 Oregon Structural Specialty Code (OSSC).

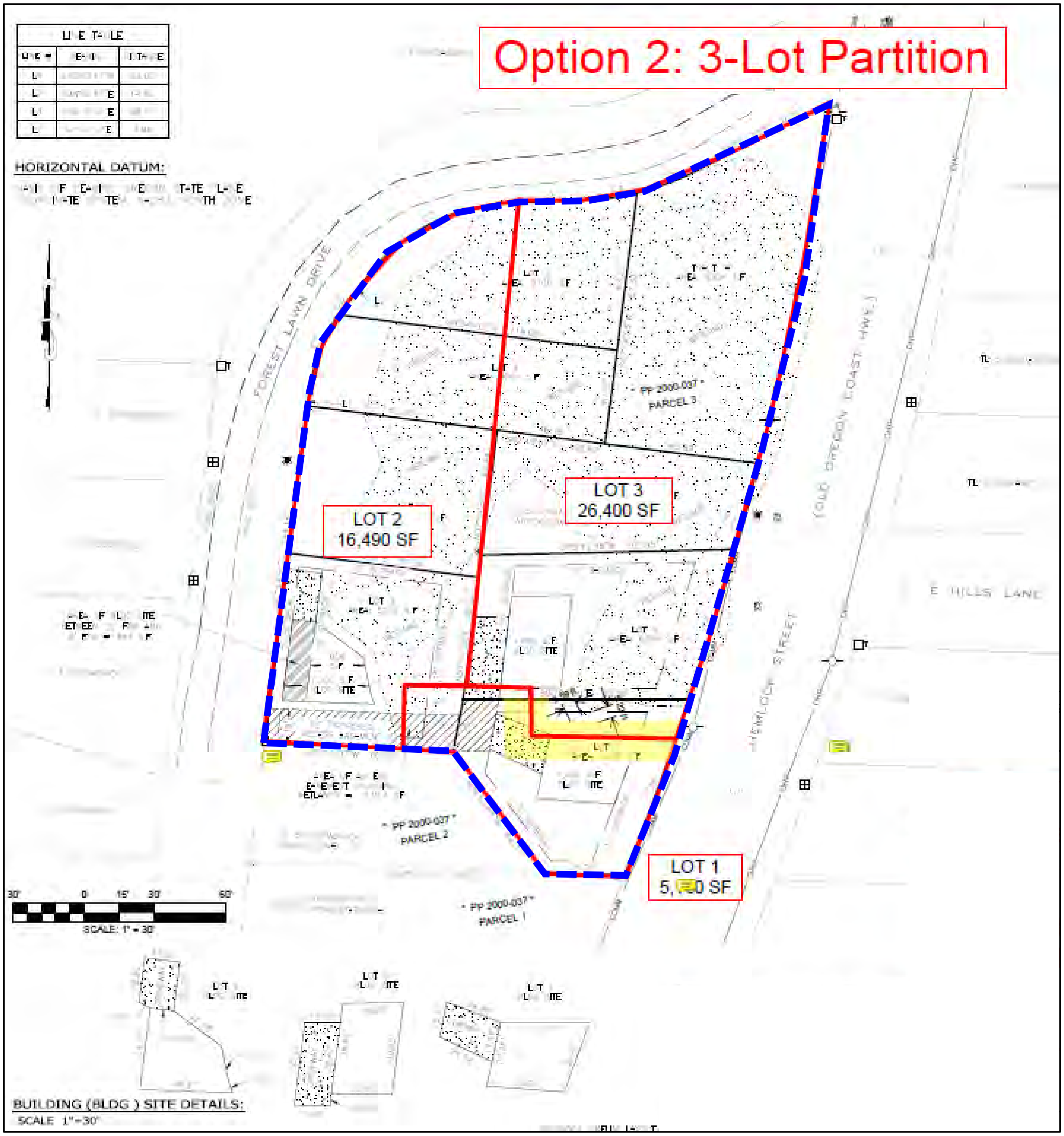


Figure 1: Partition plan referenced above showing the project vicinity. The subject property is outlined in blue and the proposed lot boundaries are outlined in red.

1.3 Purpose and Scope of Services

The purpose of our services was to explore the subsurface conditions at the site of the 3 residential lots to better define the soil, rock, and groundwater properties in order to provide geotechnical related recommendations related to the proposed construction. Our site investigation consisted of advancing two Standard Penetration Test (SPT) borings (B-1 and B-2) located on the subject property using a trailer mounted Big Beaver drill rig subcontracted from Dan J Fischer, Inc of Forest Grove, Oregon. SPT samples were taken at regular intervals and transported to our laboratory for testing. We supplemented our drilled borings with three hand auger borings (HA-1 through HA-3) and drive probe testing. Laboratory testing was accomplished in general accordance with ASTM procedures.

This report briefly outlines the testing procedures, presents available project information, describes the site, assumed subsurface conditions, and presents recommendations regarding the following:

- A discussion of subsurface conditions encountered including pertinent soil and groundwater conditions.
- Seismic design parameters in accordance with ASCE 7-16.
- Geotechnical related recommendations for deep foundation design.
- Structural fill recommendations, including an evaluation of whether the in-situ soils can be used as structural fill.
- Retaining wall design parameter recommendations, including coefficient of friction and earth pressures.
- Floor slab support recommendations.
- A Geologic Hazard Report (GHR) in accordance with Clatsop County requirements
- Other discussion on geotechnical issues that may impact the project.

It should be noted, we consider this report to be preliminary for the project area as a whole. Due to accessibility issues, we were only able to advance deep borings on the perimeter of the project area, and limited hand tool explorations on the southern portion of the property. Once the project is further along and the site is more accessible, we can perform additional drilled borings on the 3 lots (if requested). EEI should be informed when detailed construction drawings are made for the proposed residences so we can revise our report for each individual lot, if necessary.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 Site Location and Description

The site for the proposed development is located at Clatsop County Tax Lot No. 51030DA04100 in Cannon Beach, Oregon. The site is bound to the north and west by Forest Lawn Road, to the south by residential properties and to the east by South Hemlock Street. See Figure 2 below for project vicinity.

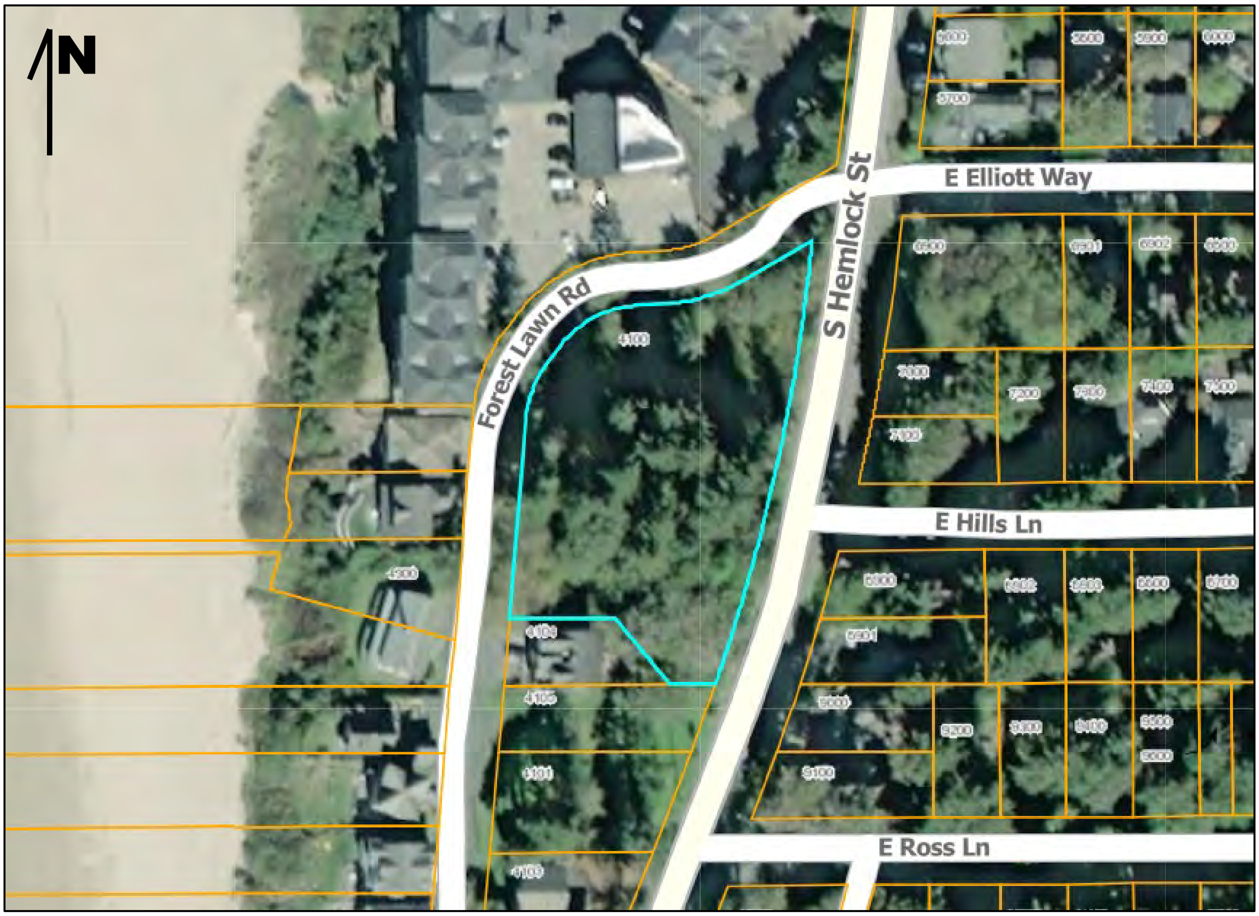


Figure 2: Project vicinity showing the subject property (outlined in blue).
Source: https://delta.co.clatsop.or.us/apps/ClatsopCounty/.

The subject property is currently vacant, vegetated with grass, brush and mature trees. It should be noted, the northern portion of the property is densely vegetated with brush and trees; as a result, we were unable to advance any explorations in those areas. We also observed vegetation indicative of a wetland or a marsh along the northern portion of the property. In terms of topography, the subject property is level. According to Google Earth, the elevation ranges from 39 feet above mean sea level (msl) to 46 feet msl. While on site, we did not observe any signs of soil movement (i.e. cracking in the soil, leaning trees, landscape head scarps etc.). See Photos 1 through 5 below for the current site conditions.

Photo 1: Current site conditions, taken from the southern property line facing north (looking at Lot 1).

Photo 2: Current site conditions, facing northwest (looking at Lot 2).

Photo 3: Current site conditions, facing northeast (looking at Lot 3).

Photo 4: Current site conditions taken from the western property line, facing east (looking at Lot 2).

Photo 5: Current site conditions taken from the northwestern property line, facing southeast.

2.2 Subsurface Materials

The site was explored with two SPT borings (B-1 and B-2). For approximate exploration locations see the Exploration Location Plan in Appendix B. The SPT borings were advanced with a subcontracted trailer mounted drill rig subcontracted from Dan J. Fischer Excavating, Inc. of Forest Grove, Oregon. Boring B-1 was advanced to a depth of 33.5 feet below ground surface (bgs) and B-2 was advanced to a depth of 51.5 feet bgs. SPT samples were generally taken at regular intervals within the boring and transported to our laboratory for testing.

In addition, we supplemented our drilled borings with three hand auger explorations (HA-1 through HA-3) and drive probe testing. The three hand tool explorations were advanced in each of the three proposed subdivision lots. For approximate exploration locations see the Exploration Location Plan in Appendix B. The hand auger explorations were each advanced to a depth of 5 feet bgs and the drive probe testing was advanced to a depth of 8 feet bgs.

The drive probe test is based on a "relative density" exploration device used to determine the distribution and to estimate strength of the subsurface soil units. The resistance to penetration is measured in blows-per-½-foot of an 11-pound hammer which free falls roughly 39 inches driving a 3/4-inch outside diameter pipe with a 1-inch diameter endcap into the ground. This measure of resistance to penetration can be used to estimate relative density of soils. For a more detailed description of this geotechnical exploration method, please refer to the Slope Stability Reference Guide for National Forests in the United States, Volume I, USDA, EM-7170-13, August 1994, P 317-321. Results of the drive probe tests are reported in the hand auger logs in Appendix C.

Select soil samples were tested in the laboratory to determine material properties for our evaluation. Results of the explorations are reported in the Exploration Logs in Appendix C. Laboratory testing was accomplished in general accordance with ASTM procedures. The testing performed included moisture content tests (ASTM D 2216), fines content determinations (ASTM D1140) and Atterberg limit testing (ASTM D4318). The test results have been included on the Exploration Logs in Appendix C and the Report of Atterberg Limits Testing in Appendix E.

In general, we encountered a surficial layer of topsoil overlying compressible, organic soils which eventually transitioned to dense sandstone with depth. Each individual stratum encountered is discussed in further detail below.

TOPSOIL

In all of our explorations, we encountered topsoil as the surficial layer. The topsoil stratum was generally dark brown to black sandy silt with heavy organics (i.e. roots, rootlets and wood chips). The thickness of this stratum was 6-inches to 12-inches in our explorations.

COMPRESSIBLE, ORGANIC SOILS

In all of our explorations we encountered a thick layer of compressible soils underlying the topsoil described above. In B-2, the upper layer of compressible soils was generally a gray-brown sand with broken rock fragments, wood chips and rootlets. Laboratory moisture content testing on samples obtained within this stratum ranged from 21 to 32 percent. Fines content laboratory testing for a sample obtained within this stratum yielded a result of 8 percent passing the #200 sieve. Based on SPT sampling data, this stratum ranged from very loose to loose (N-value average of 5). This sand stratum extended to a depth of 5.5 feet bgs in B-2.

In all of our explorations (except for B-2), we encountered low plasticity silt underlying the topsoil described above. In B-2, this silt was underlying the upper sand stratum described above. This stratum was generally a blue-gray to gray-brown to dark brown silt with orange and gray mottling. We also encountered rootlets within this stratum. Laboratory moisture content testing on samples obtained within this stratum ranged from 53 to 72 percent. Fines content laboratory testing for samples obtained within this stratum ranged from 93 to 94 percent passing the #200 sieve. We also conducted Atterberg testing on a sample retrieved within this stratum from B-2 at 5 feet bgs. The testing indicated this stratum is a low plasticity silt (ML). Based on SPT sampling data, this stratum ranged from very soft to soft (N-value average of 2). This low plasticity silt stratum extended to the terminal depth of our hand tool explorations (i.e. 5 feet bgs), and to a depth of 10 feet bgs in of our drilled borings.

In our drilled borings, we encountered high plasticity silt underlying the low plasticity silt described above. This stratum was generally a blue-gray to gray to brown silt. We also encountered heavy organics (i.e. wood chips and rootlets) within this stratum. Laboratory moisture content testing on samples obtained within this stratum ranged from 50 to 388 percent. It should be noted the very high moisture readings are likely due to the presence of organics. Fines content laboratory testing for sample a sample obtained within this stratum yielded a result of 97 percent passing the #200 sieve. We also conducted Atterberg testing on a sample retrieved within this stratum from B-2 at 10 feet bgs. The testing indicated this stratum is a high plasticity silt (MH). Based on SPT sampling data, this stratum ranged from very soft to soft (N-value average of 2). This high plasticity silt stratum extended to a depth of 25 feet bgs in both of our explorations.

In our drilled borings, we encountered a layer of silty sand underlying the high plasticity silt described above. In B-2, we encountered silty sand and sandy silt underlying the high plasticity silt described above. This stratum was generally a brown to gray brown to blue gray silty sand/sandy silt with trace organics. Laboratory moisture content testing on samples obtained within this stratum ranged from 60 to 124 percent. It should be noted the very high moisture readings are likely due to the presence of organics. Fines content laboratory testing for samples obtained within this stratum ranged from 26 to 81 percent passing the #200 sieve. Based on SPT sampling data, the silty sand stratum ranged from very loose to medium dense and the sandy silt stratum was generally medium stiff (N-value average of 5). This stratum extended to a depth of 30 feet bgs in B-1 and 45 feet bgs in B-2.

DENSE SANDSTONE

In both of our boring explorations, we encountered a dense sandstone layer underlying the compressible, organic soils described above. This stratum was generally a gray to blue-gray sandstone with varying amounts of silt. Laboratory moisture content testing on samples obtained within this stratum ranged from 11 to 76 percent. Fines content laboratory testing for samples obtained within this stratum ranged from 9 to 39 percent passing the #200 sieve. Based on SPT sampling data, this stratum ranged from medium dense to very dense (N-value average of 42). This sandstone stratum extended to the terminal depths of our explorations (i.e. 33.5 feet bgs in B-1 and 51.5 feet bgs in B-2).

The classifications noted above were made in general accordance with the USCS as shown in Appendix D. The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The exploration logs included in the Appendix should be reviewed for specific information. These records include soil descriptions, stratifications, and locations of the samples. The stratifications shown on the logs represent the conditions only at the actual exploration location. Variations may occur and should be expected across the site. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these logs. The samples that were not altered by laboratory testing will be retained for 90 days from the date of this report and then will be discarded.

2.4 Groundwater Information

During our subsurface investigation, we encountered groundwater at depths ranging from 1 to 4 feet bgs.

In addition, we reviewed publicly available well logs from the Oregon Water Resources Department website (http://apps.wrd.state.or.us/apps/gw/well_log/) for historic information. We found two historical logs for a property located approximately 550 feet north of the subject property, advanced on June 1, 2015. The logs indicate that groundwater was encountered at a depth of 7 feet below ground surface. See Appendix F for a copy of these well log reports.

It should be noted that groundwater elevations can fluctuate seasonally and annually, especially during periods of extended wet or dry weather, or from changes in land use.

3.0 GEOLOGIC HAZARD ASSESSMENT

3.1 Soil Survey

The United States Department of Agriculture (USDA) Soil Survey provides geographical information of the soils in Clatsop County as well as summarizing various properties of the soils. The USDA maps the surface soils on site as Unit 61E (Templeton-Ecola silt loams on 30 to 60 percent slopes) and Unit 71C (Walluski medial silt loam on 7 to 15 percent slopes.[1]

The Templeton-Ecola silt loam covers the western majority of the project area (i.e. the entirety of Lot 2, and the western portions of Lots 1 and 3). The soil unit consists of well-drained soils formed on hillslopes and mountain slopes with a parent material of colluvium and residuum derived from sedimentary rock. A typical profile consists of slightly decomposed plant material overlying medial silt to silty clay loam which eventually transitions to weathered bedrock with depth. Although the USDA indicates this unit is mapped on 30 to 60 percent slopes we did not encounter any slopes up to 30 to 60 percent on the subject property.

The Walluski medial silt loam covers the eastern portion of the property (i.e. the eastern portions of Lots 1 and 3). The soil unit consists of moderately well-drained soils formed on stream terraces with a parent material of mixed alluvium and/or fluviomarine deposits derived from sedimentary rock. A typical profile consists of slightly decomposed plant material overlying medial silt loam overlying silty clay loam.

3.2 Geology

The site is located approximately 120 feet east of a coastal bluff overlooking Cannon Beach on the Oregon Coast. The bluff is approximately 20 feet tall with a slope of approximately 2.1H:1V. The region is underlain by a framework of Miocene aged (23 to 5 million years ago) volcanic rocks and Oligocene (33 to 23 million years ago) to Miocene aged marine sedimentary deposits that have been deposited over a basement rock of Eocene-aged (54 to 33 million years ago) volcanic arc deposits. Overlying this framework are Quaternary–aged (1.8 million years ago to present) marine terrace deposits, beach and dune deposits, and landslide deposits.

More specifically, Niem and Niem (1985)[2] maps the underlying geology on the subject property as middle to lower Miocene aged Cannon Beach member (informal) of the Astoria Formation from the Astoria Group. This formation is described as a “well-bedded sequence of laminated to

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[1] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed 5/24/2022.

[2] Niem, A.R., and Niem, W., 1985, Geologic map of the Astoria Basin, Clatsop and northernmost Tillamook Counties, northwest Oregon: Portland, Oregon, Oregon Department of Geology and Mineral Industries Oil and Gas Investigation Map OGI-14, Plate 1, scale 1:100,000.

massive micaceous mudstone, with subordinate, rhythmically thin-bedded feldspathic sandstone and mudstone in the lower part of the unit". See Figure 3 below.

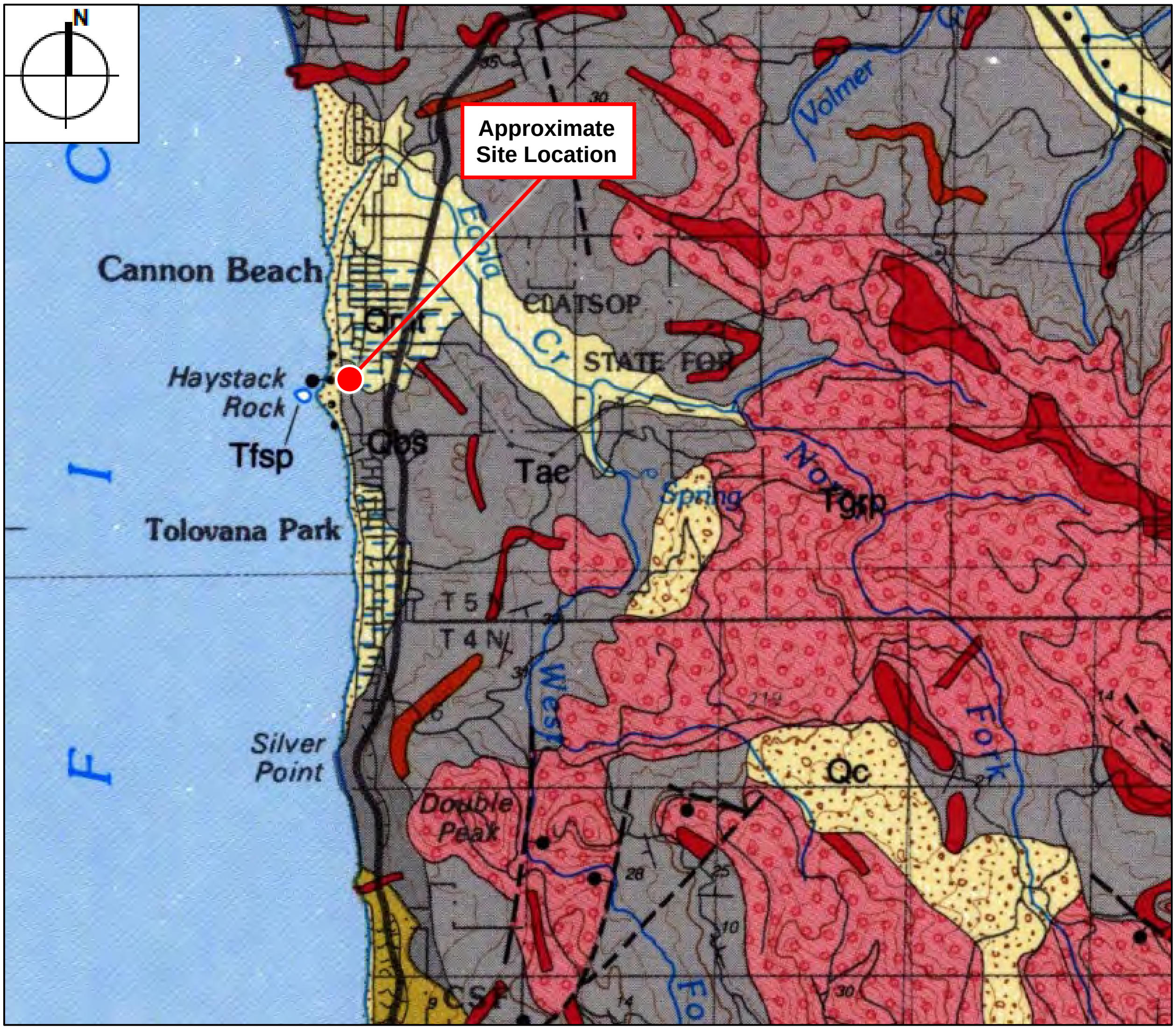

Figure 3: Geologic map of the subject property and its surrounding areas (base map source: Niem and Niem, 1985).

In addition, Schlicker and others (1972)[3] indicates that the subject property is mapped adjacent to an active landslide area. Active landslide areas are described as "areas where ground movement is continuous or periodic or areas in which historic movement has taken place. The area includes debris and rockfalls on the headlands, shallow slump failures along terraces fronting the ocean and bays, and areas of local slump in upland areas". The underlying bedrock unit in

[3] Schlicker, H.G., Deacon, R.J., Beaulieu, J.D., and Olott, G.W., 1972. Environmental Geology of the Coastal Region of Tillamook and Clatsop Counties, Oregon, Oregon Department of Geology and Mineral Industries, Bulletin 74, 1:62,500.

the active landslide area is mapped as Pleistocene aged marine terrace deposits (Qmt). See Figure 4 below.

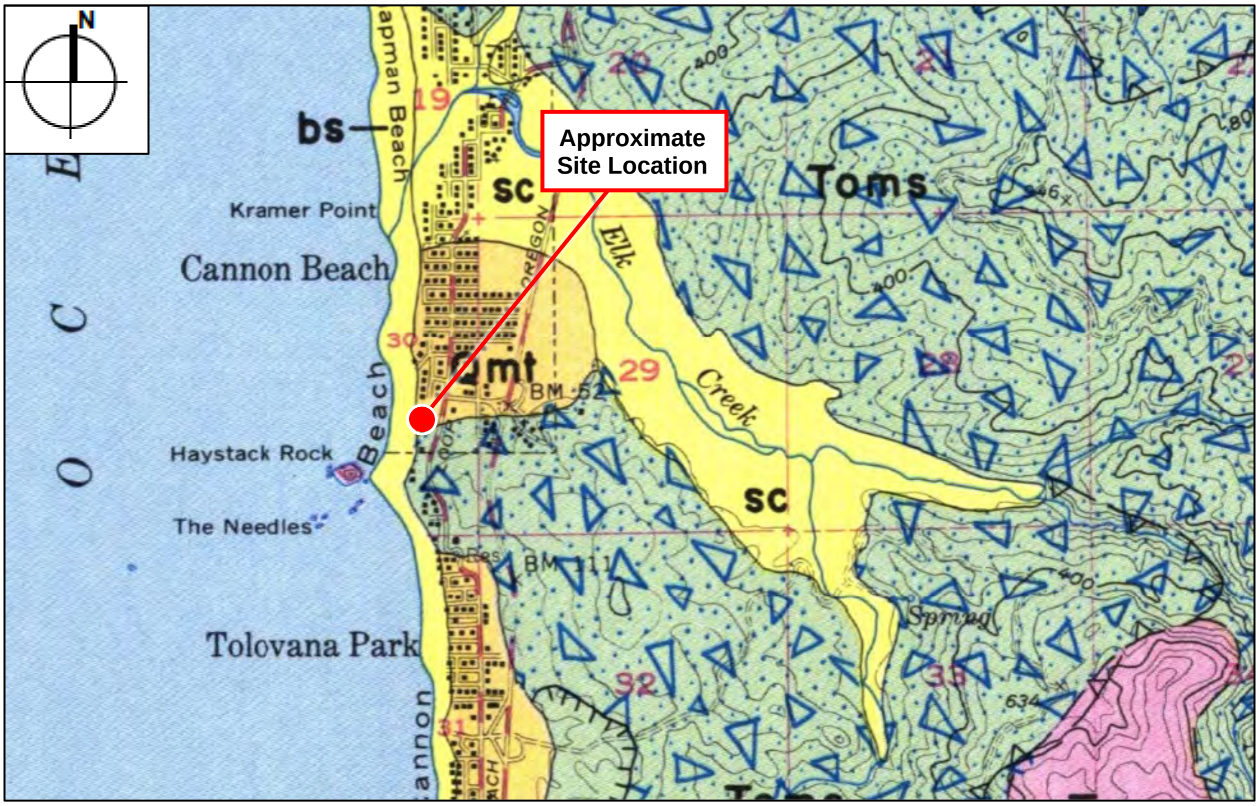

Figure 4: Geologic map of the area; the blue triangle pattern is symbolic of landslide topography (base map source: Schlicker and others, 1972).

We did not observe signs of recent or active landslides from our reconnaissance of the immediate area. Based on our observations of exposed and subsurface soils, as well as the geomorphic features of the site and nearby properties, it is our professional opinion that the site is likely at risk from shallow and deep global landsliding.

The upper, roughly 30 to 40 feet of soft soil is at risk of localized shallow landsliding or soil creep. Adding the weight of a home to this soil layer could increase that risk. As such, we recommend that any house foundations be supported on a deep foundation that extends through this soil layer.

The second landslide risk is from deep-seated block failure given the property may be sitting on a relatively deep portion of the landslide debris. Based on our explorations, it is our professional opinion that the sandstone encountered is the stable layer, therefore extending deep foundations through the upper, compressible soils and bearing them on the sandstone will mitigate the risk of deep global landsliding.

In summary, our recommended approach is to employ a deep foundation system that extends through the compressible, organic soils, and protects the house foundations from shallow, localized landsliding or slope creep that might occur in the future.

3.3 Seismicity

Oregon's position at the western margin of the North American Plate and its location relative to the Pacific and Juan de Fuca plates have had a major impact on the geologic development of the state. The interaction of the three plates has created a complex set of stress regimes that influence the tectonic activity of the state. The western part of Oregon is heavily impacted by the influence of the active subduction zone formed by the Juan de Fuca Oceanic Plate converging upon and subducting beneath the North American Continental Plate off the Oregon coastline.

The Cascadia Subduction Zone, located approximately 100 kilometers off of the Oregon and Washington coasts, is a potential source of earthquakes large enough to cause significant ground shaking at the subject site. Research over the last several years has shown that this offshore fault zone has repeatedly produced large earthquakes, on average, every 300 to 700 years. It is generally understood that the last great Cascadia Subduction Zone earthquake occurred about 300 years ago, in 1700 AD. Although researchers do not necessarily agree on the likely magnitude, it is widely believed that an earthquake moment magnitude (M_w) of 8.5 to 9.5 is possible. The duration of strong ground shaking is estimated to be greater than 1 minute, with minor shaking lasting on the order of several minutes.

Additionally, earthquakes resulting from movement in upper plate local faults are considered a possibility. Crustal earthquakes are relatively shallow, occurring within 10 to 20 kilometers of the surface. Oregon has experienced at least two significant crustal earthquakes in the past decade—the Scotts Mills (Mt. Angel) earthquake (M_w 5.6) on March 25, 1993 and the Klamath Falls earthquake (M_w 5.9) on September 20, 1993. Based on limited data available in Oregon, it would be reasonable to assume a M_w 6.0 to 6.5 crustal earthquake may occur in Oregon every 500 years (recurrence rate of 10 percent in 50 years). There are no mapped crustal faults in the immediate vicinity of the property, but there is a marine crustal fault approximately 3 miles west of the property[4].

3.3.1 Seismic Design Parameters

In accordance with ASCE 7-16, we recommend a Site Class E (soft soil with an average standard penetration resistance less than 15 blows per foot) when considering the average of the upper 100 feet of bearing material beneath the proposed foundations. This recommendation is based on the SPT N-values in our boring B-1 and our local knowledge of the area geology.

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[4] USGS U.S. Quaternary Faults Interactive Map, https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf.

Inputting our recommended Site Class as well as the site latitude and longitude into the Structural Engineers Association of California (SEAOC) – OSHPD Seismic Design Maps website (http://seismicmaps.org) which is based on the United States Geological Survey, we obtained the seismic design parameters shown in Table 1 below. Note that the values for F_a and F_v in Table 1 were obtained from ASCE's Supplement 3 dated November 5, 2021 and issued for ASCE 7-16 to correct some seismic design issues in the original publication.

Table 1: Seismic Design Parameter Recommendations (ASCE 7-16, including Supplement 3 dated November 5, 2021)

PARAMETER	RECOMMENDATION
Site Class	E
S_s	1.317g
S_1	0.691g
F_a	1.200
F_v	2.000
S_{MS} (=S_s x F_a)	1.580g
S_{M1} (=S_1 x F_v)	1.382g
S_{DS} (=2/3 x S_s x F_a)	1.054g
S_{D1} (=2/3 x S_1 x F_V)	0.921g
Design PGA (=S_{DS} / 2.5)	0.422g
MCE_G PGA	0.664g
F_{PGA}	1.100
PGA_M (=MCE_G PGA * F_{PGA})	0.731g

Note: Site latitude = 45.8866, longitude = -123.963

The return interval for the ground motions reported in the table above is 2 percent probability of exceedance in 50 years.

Per Section 11.4.8 of ASCE 7-16 a site-specific ground motion hazard analysis shall be performed in accordance with Section 21.2 for the following conditions:

1. Structures on Site Class D sites with S_1 greater than or equal to 0.2g.

   Exception: ASCE 7-16 does not require a site-specific ground motion hazard analysis when the value of S_{M1} is elected to be increased by 50% for all applications of S_{M1} by the Structural Engineer. If S_{M1} is increased by 50% to avoid having to perform the seismic response analysis, then the resulting value of S_{D1} shall be equal to 2/3 * [1.5*S_{M1}])

2. Structures on Site Class E sites with values of S_s greater than or equal to 1.0, or values of S_1 greater than or equal to 0.2.

   Exception: ASCE 7-16 does not require a site-specific ground motion hazard analysis when:

1. The Structural Engineer uses the equivalent lateral force design procedure and the value of Cs is determined by Eq. 12.8-2 for all values of T, or
2. Where (i) the value of S_{ai} is determined by Eq. 15.7-7 for all values of T_i, and (ii) the value of the parameter S_{D1} is replaced with $1.5*S_{D1}$ in Eq. 15.7-10 and 15.7-11.

We classified this site as Site Class E. Because the S_s value is greater than 1.0 as shown in Table 1 above, a ground motion hazard analysis is required unless the Structural Engineer elects to increase the S_{M1} value by 50 percent (which results in increasing the S_{D1} value by 50 percent). **If the Structural Engineer elects not to utilize the 50 percent increase on S_{M1} and S_{D1}, then EEI should be retained to perform a site-specific ground motion hazard analysis in accordance with Section 21.2 of ASCE 7-16.**

3.3.2 Liquefaction

Based on our investigation, we consider the soils encountered in our exploration to be liquefiable. Liquefaction occurs when a saturated sand or silt soil starts to behave like a liquid. Liquefaction occurs because of the increased pore pressure and reduced effective stress between solid particles generated by the presence of liquid. It is often caused by severe ground shaking, especially that associated with earthquakes. For the purpose of our hazard evaluation, we consider only the saturated soils within the upper 50 feet of the ground surface to be potentially liquefiable. The liquefaction potential was evaluated based on the SPT N_{60}-values.

Assuming 2 to 3 percent vertical strain, we estimate that total dynamic settlement caused by an earthquake could be on the order of 9 to 13 inches. This assumes the potentially liquefiable layer is 36 feet thick (i.e. reference boring B-2 where it is potentially liquefiable from 4 to 40 feet). We estimate differential dynamic settlement due to liquefaction could be on the order of 50 to 75 percent of the total dynamic settlement; meaning anywhere from approximately 4.5- to 10-inches of differential dynamic settlement due to liquefaction could occur across the building footprints.

3.4 Geologic Hazards

The Oregon Department of Geology and Mineral Resources (DOGAMI) maps various geologic hazards, such as 100-year flooding, earthquake ground shaking, costal erosion, and landslides.[5] This service, generally referred to as Oregon's HazVu, shows the geologic hazards associated with development of this region of the site to include the following:

- Severe Cascadia earthquake expected shaking
- Very strong crustal earthquake expected shaking
- Low liquefaction (soft soil) hazard area
- Moderate landslide hazard area (i.e. landsliding possible)

[5] Oregon HazVu: Statewide Geohazards Viewer, available online at: http://www.oregongeology.org/sub/hazvu/ accessed 5/31/2022.

- In close proximity to mapped landslide deposits
- In close proximity to mapped coastal erosion hazard area

Figures 5 through 10 below show mapping of the geologic hazards as presented by Oregon's HazVu.

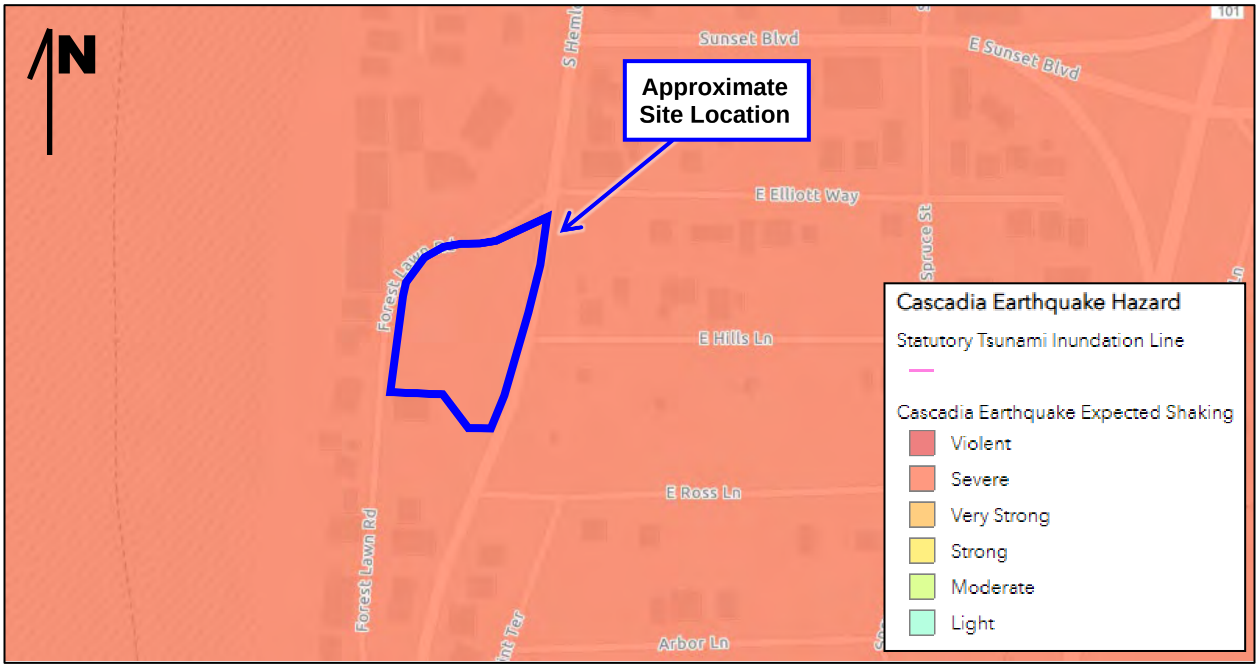


Figure 5: HazVu map showing the Cascadia earthquake expected shaking hazard zones.

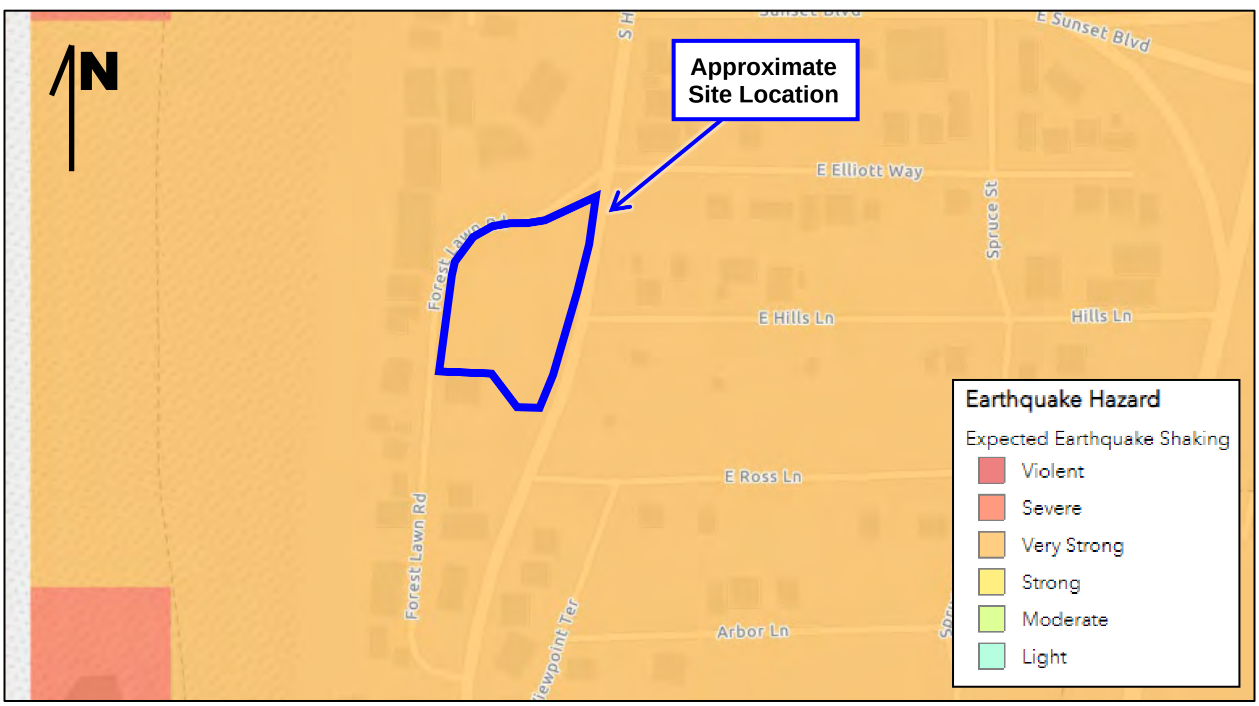


Figure 6: HazVu map showing the crustal earthquake expected shaking hazard zones.

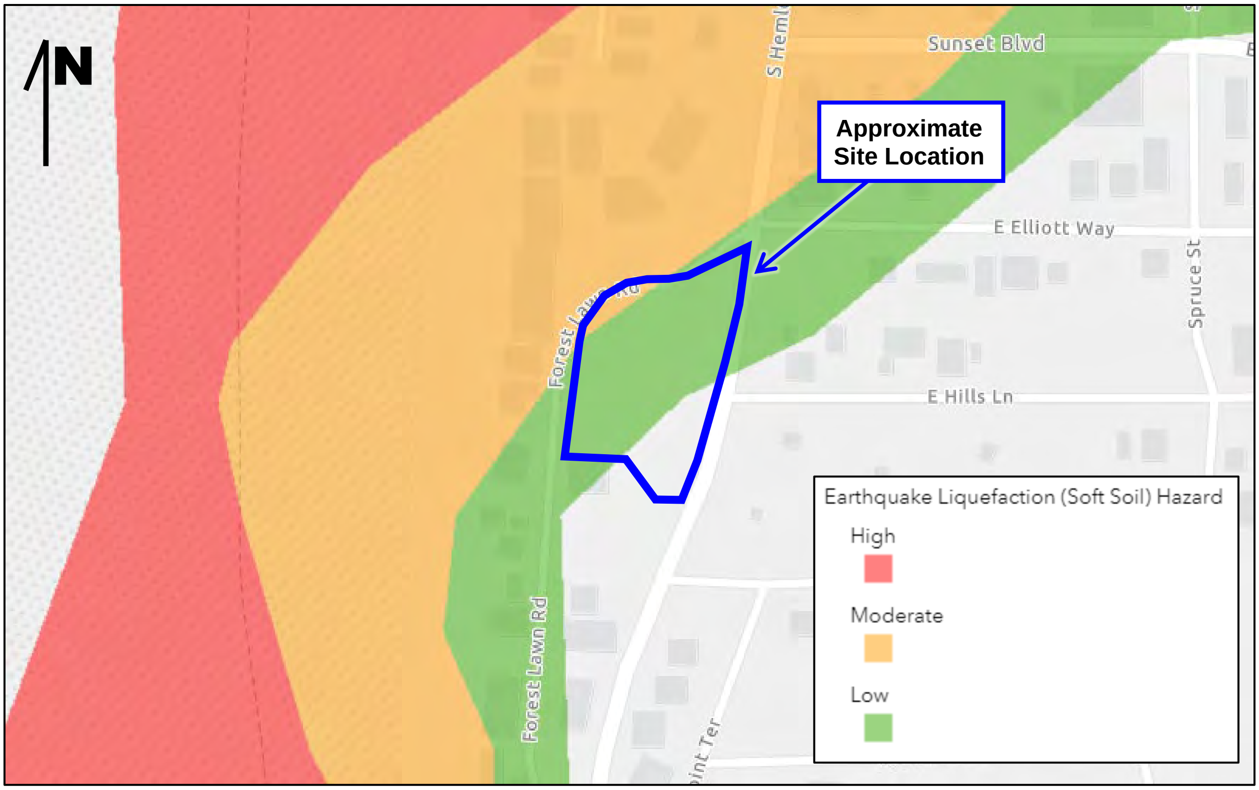


Figure 7: HazVu map showing the liquefaction (soft soil) hazard area.

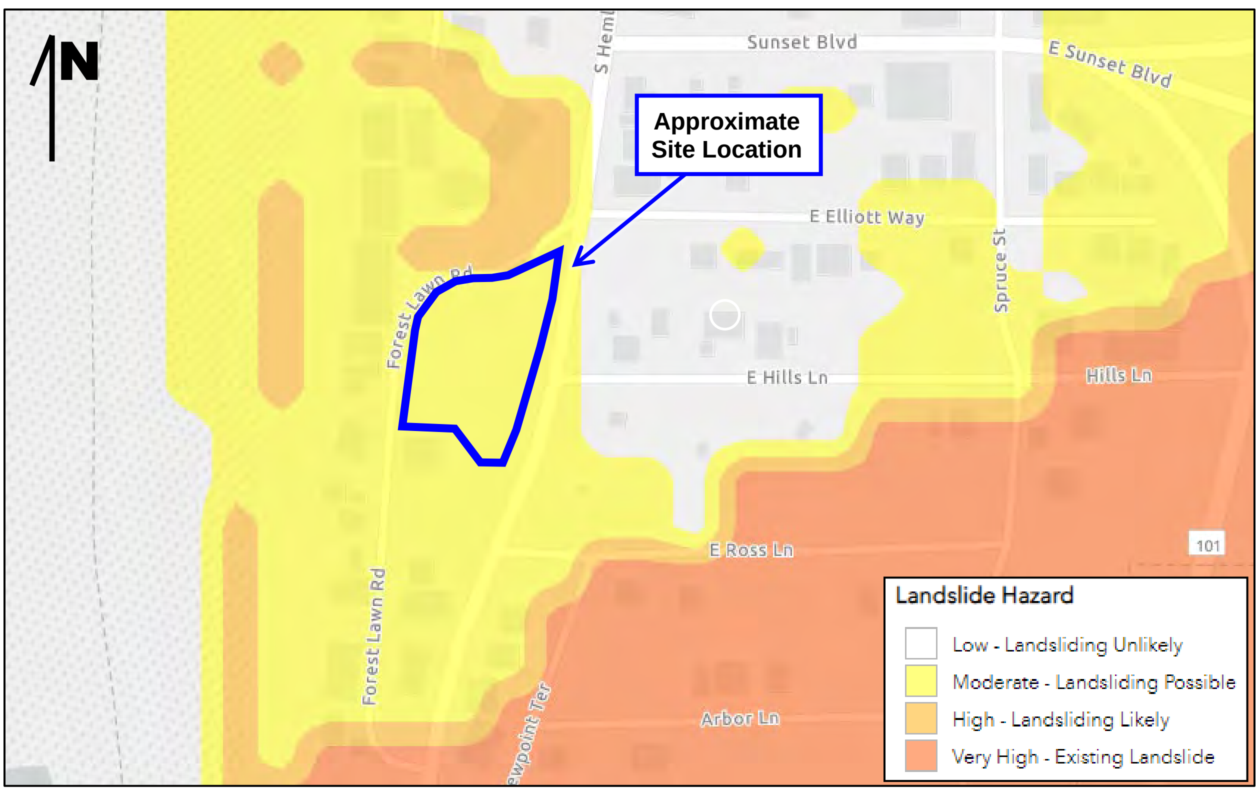


Figure 8: HazVu map showing the landslide hazard zones.

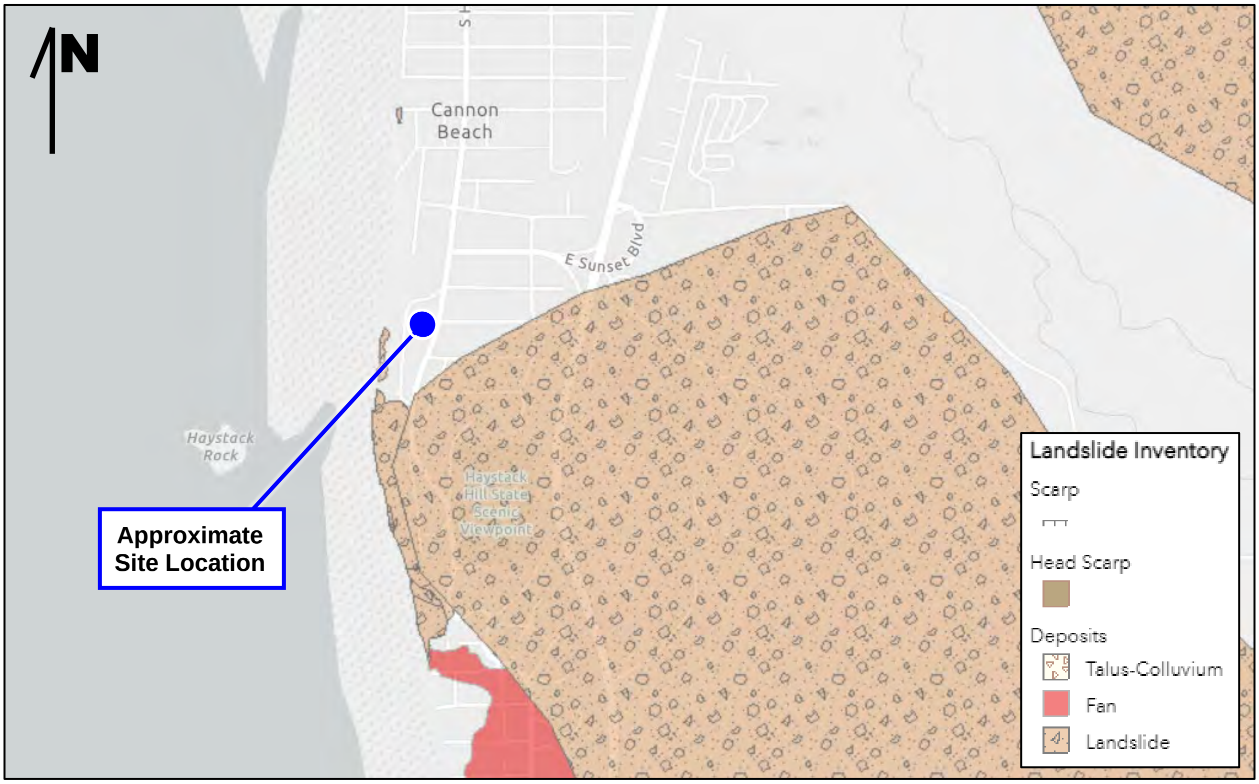


Figure 9: HazVu map showing the mapped landslide deposits.

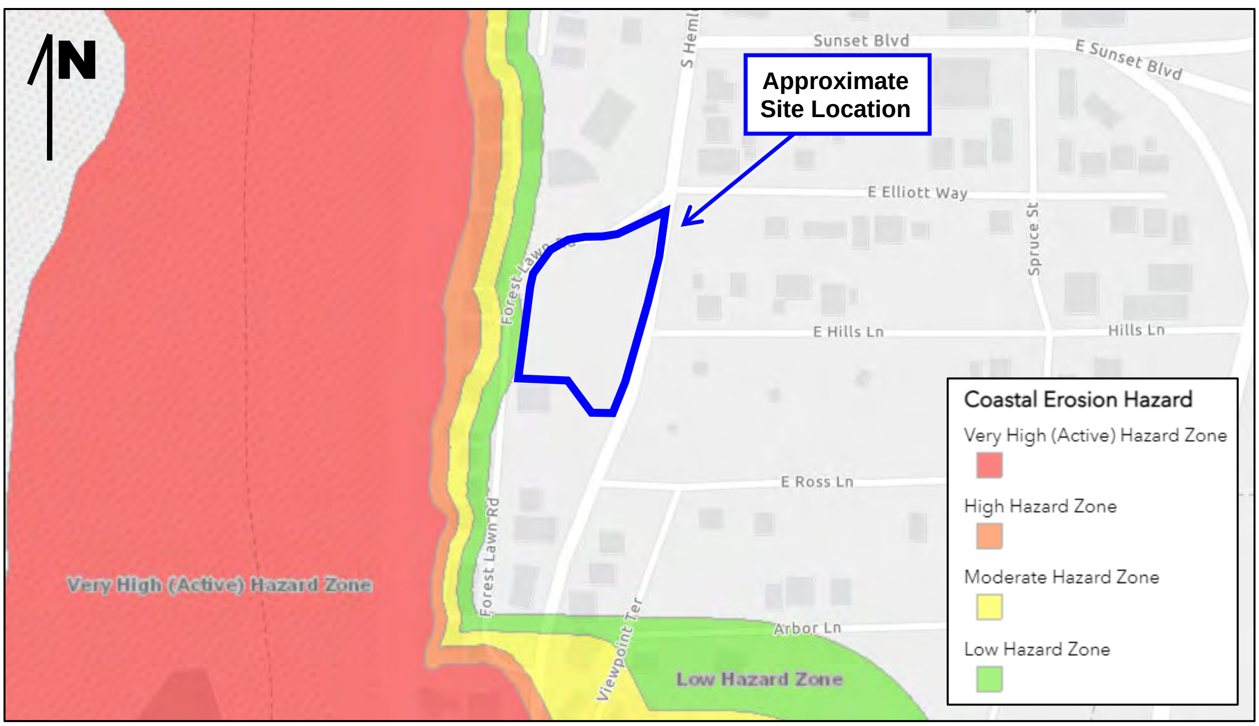


Figure 10: HazVu map showing the mapped coastal erosion hazard.

In addition, we reviewed the Northwest Association of Networked Ocean Observing Systems (NANOOS) Visualization System (NVS) for information on tsunami hazard in proximity to the subject property.[6] The NVS maps the subject property within a local earthquake and tsunami region. See Figure 11 below.

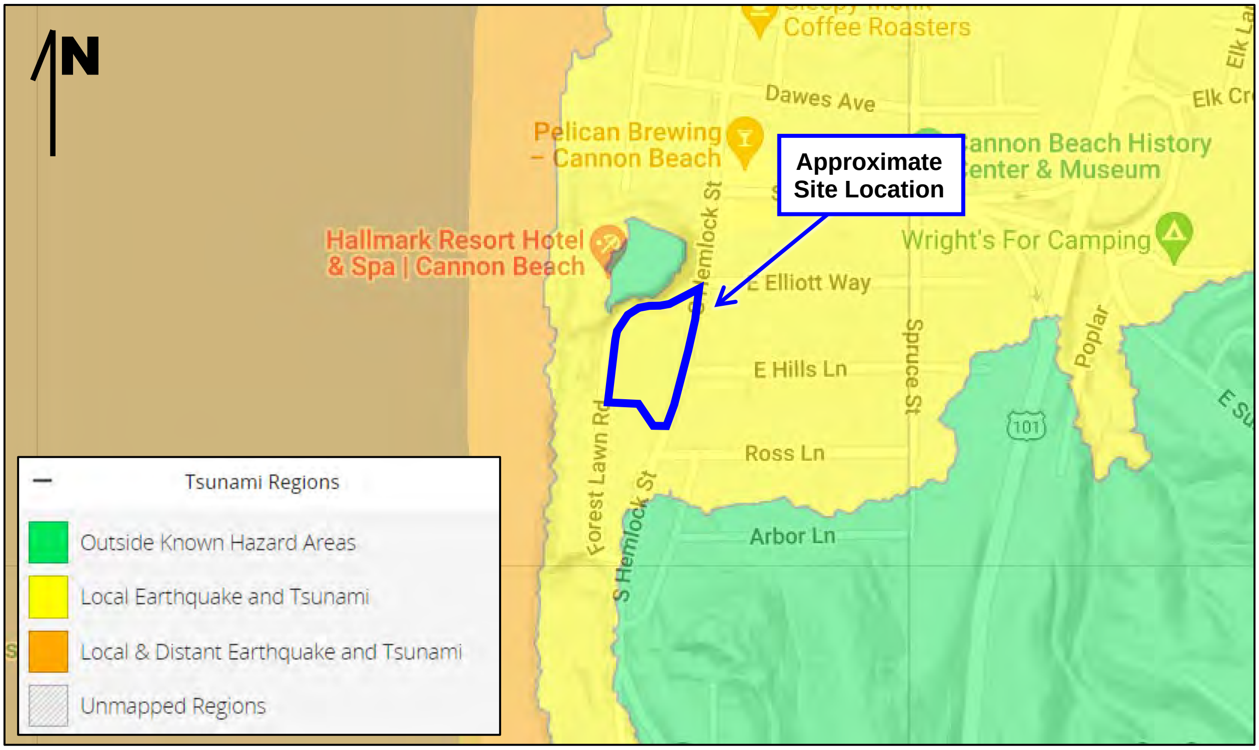


Figure 11: NVS map showing the mapped tsunami hazard region.

Based on our site reconnaissance, subsurface explorations, and office research, we consider the site to have the following geologic hazards:

- Earthquake shaking from regional seismic activity.
- Landslide hazard.
- Potential settlement/movement associated with compressible, near surface soils and liquefaction potential.
- Coastal erosion.
- Tsunami hazard from a local CSZ earthquake.

As stated above, the subject property is surrounded by ancient landslides, and is mapped within a moderate landslide hazard area (i.e. landsliding possible). Although the subject property is not mapped within an ancient landslide, the compressible, variable soils we encountered to depths of 30 to 40 feet are consistent with landslide material we have observed in the area. It is very normal/typical for the shallow, compressible soils to slide after wet winter weather or a seismic

[6] Northwest Association of Networked Ocean Observing Systems (NANOOS) Visualization System (NVS), available online at http://nvs.nanoos.org/TsunamiEvac accessed 5/31/2022.

event. We do not believe this property is at any greater risk from this hazard than the other numerous existing developed lots in the neighborhood. That being said, we recommend that at a minimum, any house foundations be designed to protect life-safety (i.e. the house is allowed to be damaged by landsliding but the structure stays intact long enough for the occupants to evacuate).

As shown in Figure 10 above, the western property line is mapped within a low risk of coastal erosion hazard. Although we do not believe that the subject property is at immediate risk from coastal erosion, it could recede back towards the home gradually over time. We envision that it would occur in several sequences that would allow for addressing the issue before it ever reached the house. In addition, any structures would be protected from erosion if supported on a foundation that bears directly on the more stable sandstone stratum (i.e. piles).

As shown in Figure 11 above, the property is at risk of being inundated by a tsunami. We are not providing any geotechnical recommendations for mitigating that risk from tsunami level events. Developing on the lot means that the property owner needs to accept the risk of damage to the residences in the event of a tsunami.

In summary, it is our professional opinion that the proposed residential development on this property is feasible, subject to the geotechnical engineering recommendations and acceptance of geologic hazards risk presented in this report. Primary considerations should be made to not placing any new fill to raise site grades, and maintaining adequate site surface and subsurface drainage. Vegetation should also be maintained to prevent excessive erosion, and should only be removed where needed to complete the proposed construction. Additionally, the house foundations should extend to the native sandstone and be engineered with the idea of resisting the effects of earthquake shaking. These recommendations are discussed in more detail in Section 4 below. Ultimately, owning a home in this area means there is an acceptance of risk that the property is located among very large ancient landslide deposits and within a landslide hazard area that could reactivate at some time in the future, possibly en masse due to a Cascadia Subduction Zone earthquake event.

4.0 EVALUATION AND FOUNDATION RECOMMENDATIONS

4.1 Geotechnical Discussion

Based on our site reconnaissance, it is our professional opinion that the primary factors impacting the proposed development include the following:

1. **Presence of weak, compressible, organic soils** – As discussed above, we encountered compressible, organic soils to a depth of approximately 30 to 40 feet bgs. The compressible soils encountered had an N-value average of 2 (i.e. generally loose). It is our professional opinion that these compressible soils are not sufficient for shallow foundation support. As such, we recommend all foundations penetrate through these variable soils to bear on the medium dense to very dense sandstone first encountered in our borings at a depth of 30 to 40 feet bgs. See Section 4.5 below for detailed deep foundation recommendations (i.e. pin piles or helical piers).

2. **Presence of potentially liquefiable soils** – As stated above, there are potentially liquefiable soils located at the project site. Based on our analysis, approximately 9- to 13-inches of total dynamic settlement due to liquefaction could occur with potential differential settlements up to approximately 4.5- to 10-inches across the proposed buildings' footprints. This much settlement precludes the use of shallow foundations. As stated above, we are recommending deep foundations for the proposed development that will mitigate risk of settlement in a design level earthquake event.

3. **Presence of organics** – As stated above, we encountered heavy organics (i.e. wood chips and rootlets) in all of our explorations. The presence of organics extended to depths of 25 to 30 feet bgs. It is our professional opinion that this material is not sufficient to provide shallow foundation support without risking excess total and differential settlements. As such, we are providing deep foundation recommendations that penetrate through these organic soils to bear on the medium dense to very dense sandstone stratum encountered at a depth of approximately 30 to 40 feet bgs. In addition, the organic soils are unsuitable for use as structural fill.

4. **Shallow groundwater** – As previously mentioned, we encountered groundwater at depths ranging from 1 to 6 feet bgs across the subject property at the time of our subsurface investigation. The contractor should anticipate the need to dewater for any excavations deeper than about 1-foot. The need to dewater can be lessened if the construction occurs in the dry summer and early fall months. Detailed dewatering design is typically left up to the contractor's means and methods, and is not part of our current scope of services.

5. **Limited explorations** – As stated above, the project is in its preliminary stages. As a result, the property has not been cleared for accessibility and we were therefore only able

to advance drilled borings on the outer portion of the proposed development (i.e. along the property line). It should be noted we did advance hand tool explorations in the southern portion of the property (i.e. where it is not as densely vegetated), however based on the limited nature of hand tool explorations, we were unable to determine the depth to sandstone in these areas. Once the project is further along and the site is more accessible, we would be available to perform additional drilled borings on the 3 lots. This is not a requirement; it is just a suggestion if there is a desire by the project team to better define the depth the piles will need to go to reach the dense sandstone stratum.

6. **Lack of detailed design drawings** – Given this project is in its preliminary stages, we have not been provided with a detailed design drawing set for the proposed construction. One the drawings are complete, we should be forwarded a copy to review for compliance with our geotechnical engineering recommendations.

In summary, this site appears to be developable provided our geotechnical engineering recommendations are followed and the geologic hazard risks are acceptable.

4.2 Site Preparation

Minimal site preparation will be required to install the piles. Any utilities present beneath the proposed construction will need to be located and rerouted as necessary and any abandoned pipes or utility conduits should be removed to inhibit the potential for subsurface erosion. Utility trench excavations should be backfilled with properly compacted structural fill as discussed in Section 4.3 below.

4.3 Structural Fill

Any structural fill placed should be granular, free of organic or other deleterious materials, have a maximum particle size less than 3 inches, be relatively well graded, and have a liquid limit less than 45 and plasticity index less than 25. In our professional opinion, on-site soils are **not** appropriate for use as fill due to the presence of organics. As such, we recommend importing granular, well graded, crushed rock structural fill. Typically, we recommend fill be moisture conditioned to within 3 percentage points below and 2 percentage points above optimum moisture as determined by ASTM D1557 (Modified Proctor). If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying.

Fill should be placed in a relatively uniform horizontal lift on the prepared subgrade. Each loose lift should be about 1 foot. The type of compaction equipment used will ultimately determine the maximum lift thickness. Structural fill should be compacted to at least 92 percent of the Modified Proctor maximum dry density as determined by ASTM D1557.

Each lift of compacted engineered fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts. The fill should extend horizontally outward beyond the exterior perimeter of the building and pavements at least 5 and 3 feet, respectively, prior to sloping.

4.4 Foundation Recommendations

4.4.1 Pin Pile Recommendations

Once the site has been prepared, we recommend the proposed building be supported by 6-inch diameter, schedule 80 steel pipe piles driven to practical refusal using a hydraulic 2,000-pound hammer or equivalent. We also recommend the pin piles all be connected by an integrated, gridded system of rigid grade beams. Refusal for a 6-inch diameter pipe pile using a hammer of this size should be defined as less than 1-inch of penetration in 10 seconds or more. When practical, this refusal criteria should be met for the last 60 seconds of pile driving.

Assuming the piles are driven to refusal using these criteria, the allowable axial capacity for a pile installed vertically would be 30 kips in compression. This allowable axial capacity assumes a factor of safety of 2.0. We recommend a maximum lateral load resistance of 1.0 kip for each vertical pile as long as they are spaced a distance of at least 6D (measured from center to center) where D represents the diameter of the pile. If additional lateral load resistance is needed, we can provide battered pile recommendations.

Based on the known subsurface conditions we anticipate that properly constructed pin pile foundations driven to refusal will experience static settlements less than 1-inch and 1/2-inch of total and differential settlement, respectively. We estimate that the average pile driving refusal depth will be encountered at approximately 40 to 50 feet bgs.

4.4.2 Helical Pier Recommendations

We are also providing helical pier recommendations for the subject site to minimize noise disturbance (i.e. from driving the pin piles). It should be noted that helical piers can hit shallow refusal due to subsurface obstructions (i.e. rocks and/or debris). We encountered heavy organics and trace gravel in our explorations. As such, the contractor should anticipate the need to put in additional effort to get through the debris.

We recommend galvanized round shaft helical piers with a 12-inch diameter single helix. The helical piers should be installed so that the helix is embedded into the medium dense to very dense sandstone encountered at depths of 30 to 40 feet bgs in both of our explorations. In order to achieve the design loads outlined below, the helix needs to be embedded at least 1 foot. For preliminary budgeting purposes, we recommend the helical piers be planned for lengths of 35 to 45 feet.

We have assumed a 2-7/8 inch diameter round shaft helical piers will be used. The 2-7/8-inch diameter helical piers are typically manufactured to have a maximum axial compressive load capacity of 80 kips. Applying a FOS of 2, the piers can be designed for an allowable load capacity of 40 kips. If greater load capacity is needed, a larger shaft diameter can be selected. If requested, we can provide load capacities for larger shaft diameters. In order to use a FOS of 2, at least one helical pier should be load tested in compression for the project. If no load test is performed, then a FOS of 3 should be used..

Any helical piles installed vertically (i.e. not battered) may be designed for an allowable lateral load of up to 1 kip. If additional lateral loads are required the piles should be battered to achieve the necessary loads.

To utilize the fully recommended capacity, the helical piers should be laterally spaced no closer than 3 pier diameters, measured center to center (i.e. 3 feet for a piers with a 12-inch lead helical).

EEI should be scheduled to be on site when each helical pier is installed to inspect the installation and verify our recommendations are met. We also should be scheduled to be on site to inspect and approve the pile load test.

4.5 Floor Slab Recommendations

For the purposes of this report, we have assumed that maximum floor slab loads will not exceed 150 psf. Based on the existing soil conditions, the design of the floor slab can be based on a subgrade modulus (k) of 100 pci. This subgrade modulus value represents an anticipated value which would be obtained in a standard in-situ plate test with a 1-foot square plate. Use of this subgrade modulus for design or other on-grade structural elements should include appropriate modification based on dimensions as necessary.

In order to fully mitigate the risk of settlement, the concrete floor slab would need to be tied into the grade beams and supported on the deep foundation elements recommended above (i.e. designed as a structural floor slab). However, if a conventional, less expensive floor slab-on-grade is preferred, to at least partially mitigate the risk of potential settlement, the floor slab should be supported on at least 12-inches of properly compacted crushed rock gravel structural fill overlying the existing soils. This approach means that there is some acceptance of risk that there could be settlement cracking in floor slabs on grade. The structural fill recommendations are outlined in Section 4.3 above. The floor slabs should have an adequate number of joints to reduce cracking resulting from any differential movement and shrinkage.

Prior to placing the structural fill, the exposed subgrade surface should be prepared as discussed in Section 4.2. In addition, we recommend a proof-roll utilizing a fully loaded, dual axle dump truck or water truck in order to identify any unstable areas that should be removed prior to structural fill placement. The proofroll should be observed by a representative of the Geotechnical Engineer. If the subgrade cannot be accessed with a dump truck, then the subgrade will need to be visually evaluated by a representative of the Geotechnical Engineer by soil probing. If fill is required, the structural fill should be placed on the prepared subgrade after it has been approved by the Geotechnical Engineer.

The 12-inch thick crushed rock structural fill should provide a capillary break to limit migration of moisture through the slab. If additional protection against moisture vapor is desired, a moisture vapor retarding membrane may also be incorporated into the design. Factors such as cost, special considerations for construction, and the floor coverings suggest that decisions on the use of vapor retarding membranes be made by the project design team, the contractor and the owner.

4.6 Retaining Wall Recommendations

As stated above, the project is currently in its preliminary stages. As such, we have not been made aware of any proposed retaining walls. Once more detailed plans are known about retaining walls (if any), we should be provided the drawings so that we can update our recommendations as necessary. For the purposes of this report, we have assumed that no walls will be greater than 10 feet tall.

Retaining wall footings should be designed in general accordance with the recommendations contained in Section 4.4 above (i.e. pin piles or helical piers). For insignificant landscape retaining walls not greater than 4 feet tall, where excessive wall movement due to ground movement is acceptable and not a risk to life-safety, they may be supported on conventional shallow foundations designed for an allowable soil bearing capacity of up to 1,500 pounds per square foot.

Lateral earth pressures on walls, which are not restrained at the top, may be calculated on the basis of an “active” equivalent fluid pressure of 35 pcf for level backfill, and 60 pcf for sloping backfill with a maximum 2H:1V slope. Lateral earth pressures on walls that are restrained from yielding at the top (i.e. stem walls) may be calculated on the basis of an “at-rest” equivalent fluid pressure of 55 pcf for level backfill, and 90 pcf for sloping backfill with a maximum 2H:1V slope. The stated equivalent fluid pressures do not include surcharge loads, such as foundation, vehicle, equipment, etc., adjacent to walls, hydrostatic pressure buildup, or earthquake loading. Surcharge loads on walls should be calculated based on the attached calculations/formulas shown in Appendix H.

We recommend that retaining walls be designed for an earth pressure determined using the Mononobe-Okabe method to mitigate future seismic forces. Our calculations were based on one-half of the Design Peak Ground Acceleration (PGA) value of 0.422g, which was obtained from Table 1 above. We have assumed that the retained soil/rock will have a minimum friction angle of 29 degrees and a total unit weight of about 115 pounds per cubic foot. For seismic loading on retaining walls with level backfill, new research indicates that the seismic load is to be applied at 1/3 H of the wall instead of 2/3 H, where H is the height of the wall[7]. We recommend that a Mononobe-Okabe earthquake thrust per linear foot of 13.7 psf * H^2 be applied at 1/3 H, where H is the height of the wall measured in feet. Note that the recommended earthquake thrust value is appropriate for slopes behind the retaining wall of up to 10 degrees.

Any minor amount of backfill for retaining walls should be select granular material, such as sand or crushed rock with a maximum particle size between ¾ and 1 ½ inches, having less than 5 percent material passing the No. 200 sieve. As stated above, the onsite soils do not meet the requirement for structural fill, and it will be necessary to import material to the project for structure backfill. Silty soils can be used for the last 18 to 24 inches of backfill, thus acting as a seal to the granular backfill.

All backfill behind retaining walls should be moisture conditioned to within ± 2 percent of optimum moisture content, and compacted to a minimum of 90 percent of the material's maximum dry density as determined in accordance with ASTM D1557. Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches. Care in the placement and compaction of fill behind retaining walls must be taken in order to ensure that undue lateral loads are not placed on the walls.

[7] Lew, M., et al (2010). "Seismic Earth Pressures on Depp Building Basements," SEAOC 2010 Convention Proceedings, Indian Wells, CA.

5.0 CONSTRUCTION CONSIDERATIONS

EEI should be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. EEI cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the foundations if not engaged to also provide construction observation for this project.

5.1 Moisture Sensitive Soils/Weather Related Concerns

The upper soils encountered at this site are expected to be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. While not required, it will be advantageous to perform earthwork and foundation construction activities during dry weather.

5.2 Drainage and Groundwater Considerations

Water should not be allowed to collect in the foundation excavations or on prepared subgrades for the floor slab during construction. Positive site drainage should be maintained throughout construction activities. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff.

The site grading plan should be developed to provide rapid drainage of surface water away from the building areas and to inhibit infiltration of surface water around the perimeter of the building and beneath the floor slab. The grades should be sloped away from the building area. Stormwater should be piped (tightlined) to an existing city storm sewer or to a drainage ditch.

5.3 Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document and subsequent updates were issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. EEI does not assume responsibility for construction site safety or the contractor's compliance with local, state, and federal safety or other regulations.

6.0 REPORT LIMITATIONS

As is standard practice in the geotechnical industry, the conclusions contained in our report are considered preliminary because they are based on assumptions made about the soil, rock, and groundwater conditions exposed at the site during our subsurface investigation. A more complete extent of the actual subsurface conditions can only be identified when they are exposed during construction. Therefore, EEI should be retained as your consultant during construction to observe the actual conditions and to provide our final conclusions. If a different geotechnical consultant is retained to perform geotechnical inspection during construction, then they should be relied upon to provide final design conclusions and recommendations, and should assume the role of geotechnical engineer of record, as is the typical procedure required by the governing jurisdiction.

The geotechnical recommendations presented in this report are based on the available project information, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform EEI in writing so that we may amend the recommendations presented in this report, if appropriate, and if desired by the client. EEI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

Once construction plans are finalized and a grading plan has been prepared, EEI should be retained to review those plans, and modify our existing recommendations related to the proposed construction, if determined to be necessary.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

This report has been prepared for the exclusive use of Patrick/Dave, LLC for the specific application to the proposed Forest Lawn Subdivision, Lots 1-3, located on County Tax Lot No. 51030DA04100 in Cannon Beach, Clatsop County, Oregon. EEI does not authorize the use of the advice herein nor the reliance upon the report by third parties without prior written authorization by EEI.

APPENDICES

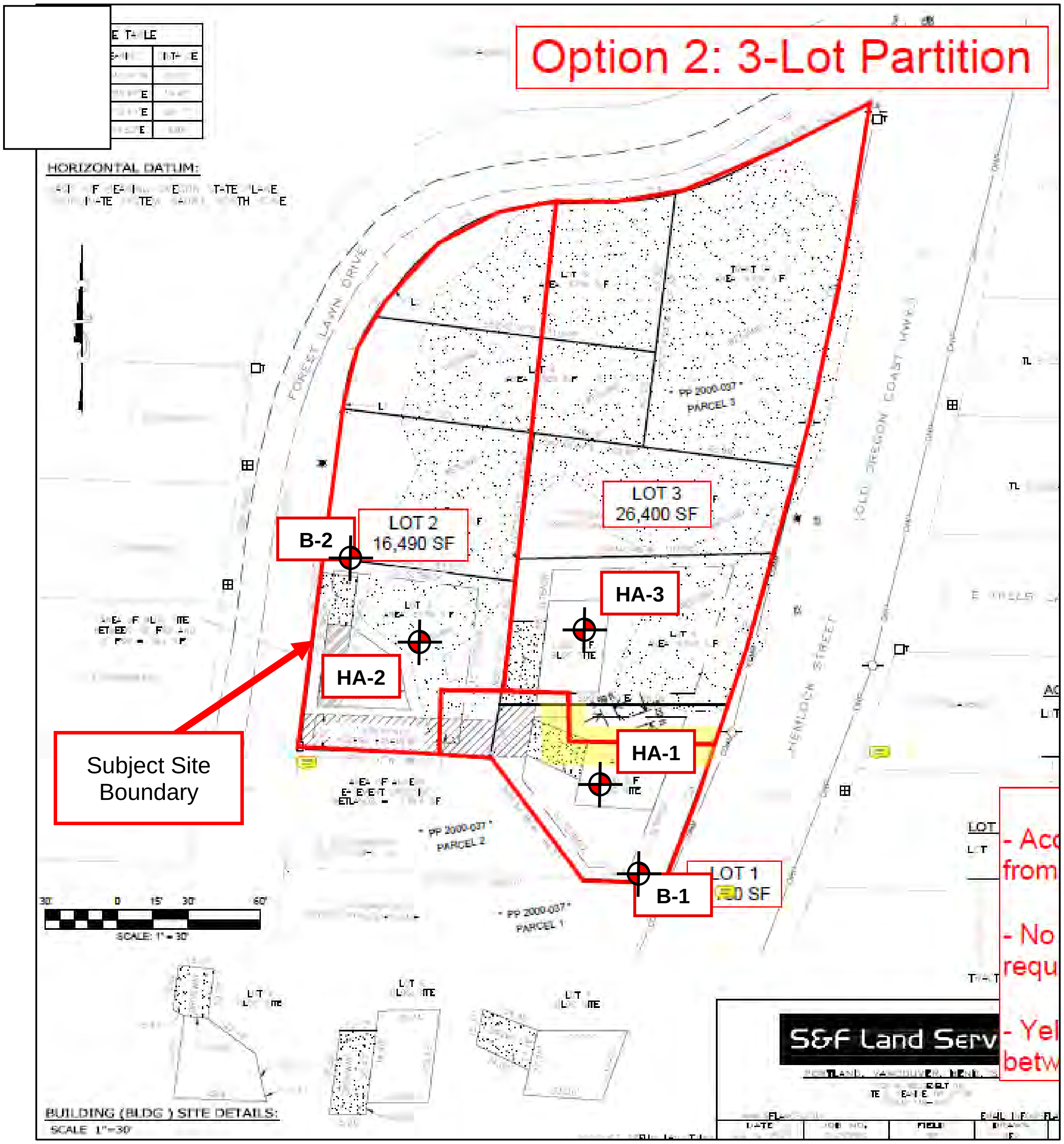
Exhibit A-9

APPENDIX A – SITE LOCATION PLAN

Base Map Source: https://livingatlas.arcgis.com/topoexplorer/

Earth Engineers, Inc.	**Proposed Forest Lawn Subdivision, Lots 1-3** **Tax Lot #51030DA04100** **Intersection of Forest Lawn Road and South Hemlock Street** **Cannon Beach, Clatsop County, Oregon**	**Report No. 22-103-1** **June 3, 2022**

APPENDIX B – EXPLORATION LOCATION PLAN



 = Approximate Boring Location

Base image source: "Google Earth.

Earth Engineers, Inc.	**Proposed Forest Lawn Subdivision, Lots 1-3** **Tax Lot #51030DA04100** **Intersection of Forest Lawn Road and South Hemlock Street** **Cannon Beach, Clatsop County, Oregon**	**Report No. 22-103-1** **June 3, 2022**

Exhibit A-9

Earth Engineers, Inc.

Appendix C: Boring B-1

Client: Red Crow, LLC
Project: Proposed Forest Lawn Subdivision
Site Address: Tax Lot No. 51030AA04402
Forest Lawn Road, Clatsop County, Cannon Beach, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-103-1
Drilling Contractor: Dan J Fischer Excavating, Inc.
Drilling Method: Solid Stem Auger
Drilling Equipment: Big Beaver w/ SPT Cathead Hammer
Approximate Ground Surface Elevation (ft msl): 46
Date of Exploration: 5/4/2022

Depth (ft)	Water Level	Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
0		Topsoil - dark brown sandy silt with organics, moist									
		Silt (ML) - gray-brown to dark brown silt with orange and gray mottling, rootlets, moist to wet, soft	SPT-1	1, 0, 2	2	64					
2.5			SPT-2	2, 1, 1	2	68					
5	▼ (6 ft)		SPT-3	2, 1, 1	2	65				0.5	
7.5		chunks of dry, orange soil encountered	SPT-4	1, 2, 2	4	53				0.75	
10		Silt (MH) - blue-gray to dark brown, high plasticity silt, moist to wet, very soft to soft	SPT-5	2, 0, 1	1	211				0	
12.5		heavy organics (wood chips and rootlets) encountered in split spoon	SPT-6	1, 1, 1	2	89				0.75	
15		heavy organics encountered in split spoon	SPT-7	1, 1, 1	2	388				1	
20		heavy organics encountered in split spoon	SPT-8	1, 1, 2	3	191				0.75	
25		Sand (SM) - gray to blue-gray silty sand, moist to wet, very loose	SPT-9	2, 2, 2	4	76					
30											

Notes : Boring terminated at a depth of approximately 33.5 feet below ground surface (bgs) due to practical drilling refusal. Groundwater encountered at a depth of 6 feet bgs at the time of our exploration. Boring backfilled with bentonite chips on 5/4/22. N-values reported are based on the use of a cathead hammer (i.e. no correction factor). Approximate elevation from Google Earth.

Exhibit A-9

Earth Engineers, Inc.

Appendix C: Boring B-1

Client: Red Crow, LLC
Project: Proposed Forest Lawn Subdivision
Site Address: Tax Lot No. 51030AA04402
Forest Lawn Road, Clatsop County, Cannon Beach, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-103-1
Drilling Contractor: Dan J Fischer Excavating, Inc.
Drilling Method: Solid Stem Auger
Drilling Equipment: Big Beaver w/ SPT Cathead Hammer
Approximate Ground Surface Elevation (ft msl): 46
Date of Exploration: 5/4/2022

Depth (ft)	Water Level	Lithologic Symbol	Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
30			Sandstone - blue-gray sandstone with few to little silt, moist, dense to very dense	SPT-10	9, 14, 21	35	26					drilling difficulty increased
32				SPT-11	26, 31, 34	65	11					drilling refusal
34												
36												
38												
40												
42												
44												
46												
48												
50												
52												
54												
56												
58												
60												

Notes : Boring terminated at a depth of approximately 33.5 feet below ground surface (bgs) due to practical drilling refusal. Groundwater encountered at a depth of 6 feet bgs at the time of our exploration. Boring backfilled with bentonite chips on 5/4/22. N-values reported are based on the use of a cathead hammer (i.e. no correction factor). Approximate elevation from Google Earth.

Exhibit A-9

Earth Engineers, Inc.

Appendix C: Boring B-2

Client: Red Crow, LLC
Project: Proposed Forest Lawn Subdivision
Site Address: Tax Lot No. 51030AA04402
Forest Lawn Road, Clatsop County, Cannon Beach, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-103-1
Drilling Contractor: Dan J Fischer Excavating, Inc.
Drilling Method: Solid Stem Auger
Drilling Equipment: Big Beaver w/ SPT Cathead Hammer
Approximate Ground Surface Elevation (ft msl): 42
Date of Exploration: 5/4/2022

Depth (ft) scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30. Water level symbol (▼) at approximately 4 ft.

Lithology: Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value (0–80)	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
Topsoil - dark brown sandy silt with organics, moist									
Sand (SM) - gray-brown to dark brown sand with trace broken rock fragments, woodchips and rootlets, moist to wet, very loose to loose	SPT-1	2 4 4	8	21					
	SPT-2	2 2 1	3	32	8				
Silt (ML) - blue-gray silt with trace rootlets, moist to wet, very soft	SPT-3	0 0 0	0	72	93	42	32	0	
	SPT-4	0 0 1	1	59	94			0	
Silt (MH) - gray to brown, high plasticity silt, moist to wet, very soft	SPT-5	1 1 1	2	50	97	58	46	0.75	
heavy organics (wood chips and rootlets) encountered in split spoon	SPT-6	1 1 1	2	125				0.5	
heavy organics encountered in split spoon	SPT-7	1 1 1	2	165				0.5	
Sand (SM) - brown silty sand with trace organics, wet, very loose	SPT-8	1 2 2	4	124	26				

Notes : Boring terminated at a depth of approximately 51.5 feet below ground surface (bgs). Groundwater encountered at a depth of 4 feet bgs at the time of our exploration. Boring backfilled with bentonite chips on 5/4/22. N-values reported are based on the use of a cathead hammer (i.e. no correction factor). Approximate elevation from Google Earth.

Exhibit A-9

Earth Engineers, Inc.

Appendix C: Boring B-2

Client: Red Crow, LLC
Project: Proposed Forest Lawn Subdivision
Site Address: Tax Lot No. 51030AA04402
Forest Lawn Road, Clatsop County, Cannon Beach, OR
Location of Exploration: See Appendix B
Logged By: Jacqui Boyer

Report Number: 22-103-1
Drilling Contractor: Dan J Fischer Excavating, Inc.
Drilling Method: Solid Stem Auger
Drilling Equipment: Big Beaver w/ SPT Cathead Hammer
Approximate Ground Surface Elevation (ft msl): 42
Date of Exploration: 5/4/2022

Depth (ft)	Water Level	Lithologic Symbol	Geologic Description of Soil and Rock Strata	Sample Number	Blows per 6 Inches	N-value	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Pocket Pen (tsf)	Remarks
30			Silt (ML) - gray-brown sandy silt, moist to wet, medium stiff	SPT-9	2 2 3	5	60	81				
35				SPT-10	3 3 4	7	83	68				
40			Sandstone - gray to blue-gray sandstone with few to some silt and trace gravel, moist to wet, medium dense to very dense	SPT-11	10 13 9	22	76	39				drilling difficulty increased
45			broken rock encountered at base of split spoon	SPT-12	5 5 9	14	76	9				
50				SPT-13	6 24 50	74	30	15				

Notes : Boring terminated at a depth of approximately 51.5 feet below ground surface (bgs). Groundwater encountered at a depth of 4 feet bgs at the time of our exploration. Boring backfilled with bentonite chips on 5/4/22. N-values reported are based on the use of a cathead hammer (i.e. no correction factor). Approximate elevation from Google Earth.

Exhibit A-9

Earth Engineers, Inc.

Appendix C: Hand Auger HA-1

Client: Red Crow, LLC	Report Number: 22-103
Project: Forest Lawn Subdivision	Drilling Contractor: EEI
Site Address: Tax Lot No. 51030AA04402	Drilling Method: N/A
Forest Lawn Road, Clatsop County, Cannon Beach, OR	Drilling Equipment: Hand Auger and Drive Probe
Location of Exploration: See Appendix B	Approximate Ground Surface Elevation (ft msl): 41
Logged By: Matt Enos	Date of Exploration: 5/4/2022

Depth (ft)	Water Level	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Drive Probe Blows Per 6 Inches	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Remarks
0–1	▼ (1 ft)	Topsoil - dark brown to black organic silt, moist, soft, non-plastic		1, 1					
1–5		Silt with some clay (ML) - brown to gray to light gray, wet, very soft to medium stiff, low plasticity		1, 2, 2, 1, 1, 2, 1, 2					
5–8				3, 2, 4, 5, 4, 4					

Notes : Hand auger terminated at 5 feet bgs and drive probe terminated at 8 feet bgs. Groundwater encountered at a depth of 1-foot bgs at the time of our exploration. Boring loosely backfilled with excavated soils on 5/4/2022. Approximate elevation based on Google Earth.

Exhibit A-9

Earth Engineers, Inc.

Appendix C: Hand Auger HA-2

Client: Red Crow, LLC
Project: Forest Lawn Subdivision
Site Address: Tax Lot No. 51030AA04402
Forest Lawn Road, Clatsop County, Cannon Beach, OR
Location of Exploration: See Appendix B
Logged By: Matt Enos

Report Number: 22-103
Drilling Contractor: EEI
Drilling Method: N/A
Drilling Equipment: Hand Auger and Drive Probe
Approximate Ground Surface Elevation (ft msl): 40
Date of Exploration: 5/4/2022

Depth (ft)	Water Level	Geologic Description of Soil and Rock Strata	Sample Number	Moisture Content (%)	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Remarks
0–1		Topsoil - dark brown to black organic silt, moist, soft, non-plastic						
1–5	▼ 1	Silt with some clay (ML) - brown to gray to light gray, wet, very soft to medium stiff, low plasticity						

Drive Probe Blows Per 6 Inches

Depth (ft)	Blows
0.25	1
0.75	1
1.25	1
1.75	2
2.25	1
2.75	2
3.25	2
3.75	2
4.25	3
4.75	2
5.25	4
5.75	4
6.25	5
6.75	4
7.25	5
7.75	6

Notes : Hand auger terminated at 5 feet bgs and drive probe terminated at 8 feet bgs. Groundwater encountered at a depth of 1-foot bgs at the time of our exploration. Boring loosely backfilled with excavated soils on 5/4/2022. Approximate elevation based on Google Earth.

Exhibit A-9

Earth Engineers, Inc.

Appendix C: Hand Auger HA-3

Sheet 1 of 1

Client: Red Crow, LLC
Project: Forest Lawn Subdivision
Site Address: Tax Lot No. 51030AA04402
Forest Lawn Road, Clatsop County, Cannon Beach, OR
Location of Exploration: See Appendix B
Logged By: Matt Enos

Report Number: 22-103
Drilling Contractor: EEI
Drilling Method: N/A
Drilling Equipment: Hand Auger and Drive Probe
Approximate Ground Surface Elevation (ft msl): 39
Date of Exploration: 5/4/2022

Depth (ft)	Water Level	Lithology: Lithologic Symbol	Lithology: Geologic Description of Soil and Rock Strata	Sampling Data: Sample Number	Sampling Data: Drive Probe Blows Per 6 Inches (0, 20, 40, 60)	Sampling Data: Moisture Content (%)	Sampling Data: % Passing #200 Sieve	Sampling Data: Liquid Limit	Sampling Data: Plastic Limit	Sampling Data: Remarks
0–1	▼ (1 ft)		Topsoil - dark brown to black organic silt, moist, soft, non-plastic		1, 1					
1–5			Silt with some clay (ML) - brown to gray to light gray, wet, very soft to medium stiff, low plasticity		1, 1, 1, 2, 3, 4, 3, 3					
5–8					4, 3, 5, 4, 4, 5					

Notes : Hand auger terminated at 5 feet bgs and drive probe terminated at 8 feet bgs. Groundwater encountered at a depth of 1-foot bgs at the time of our exploration. Boring loosely backfilled with excavated soils on 5/4/2022. Approximate elevation based on Google Earth.

Exhibit A-9

APPENDIX D: SOIL CLASSIFICATION LEGEND

APPARENT CONSISTENCY OF COHESIVE SOILS (PECK, HANSON & THORNBURN 1974, AASHTO 1988)				
Descriptor	**SPT N_{60} (blows/foot)***	**Pocket Penetrometer, Qp (tsf)**	**Torvane (tsf)**	**Field Approximation**
Very Soft	< 2	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	2 – 4	0.25 – 0.50	0.12 – 0.25	Easily penetrated several inches by thumb
Medium Stiff	5 – 8	0.50 – 1.0	0.25 – 0.50	Penetrated several inches by thumb w/moderate effort
Stiff	9 – 15	1.0 – 2.0	0.50 – 1.0	Readily indented by thumbnail
Very Stiff	16 – 30	2.0 – 4.0	1.0 – 2.0	Indented by thumb but penetrated only with great effort
Hard	> 30	> 4.0	> 2.0	Indented by thumbnail with difficulty

* Using SPT N_{60} is considered a crude approximation for cohesive soils.

APPARENT DENSITY OF COHESIONLESS SOILS (AASHTO 1988)	
Descriptor	**SPT N_{60} Value (blows/foot)**
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE (ASTM D2488-06)	
Descriptor	**Criteria**
Dry	Absence of moisture, dusty, dry to the touch, well below optimum moisture content (per ASTM D698 or D1557)
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table, well above optimum moisture content (per ASTM D698 or D1557)

PERCENT OR PROPORTION OF SOILS (ASTM D2488-06)	
Descriptor	**Criteria**
Trace	Particles are present but estimated < 5%
Few	5 – 10%
Little	15 – 25%
Some	30 – 45%
Mostly	50 – 100%
Percentages are estimated to nearest 5% in the field. Use "about" unless percentages are based on laboratory testing.	

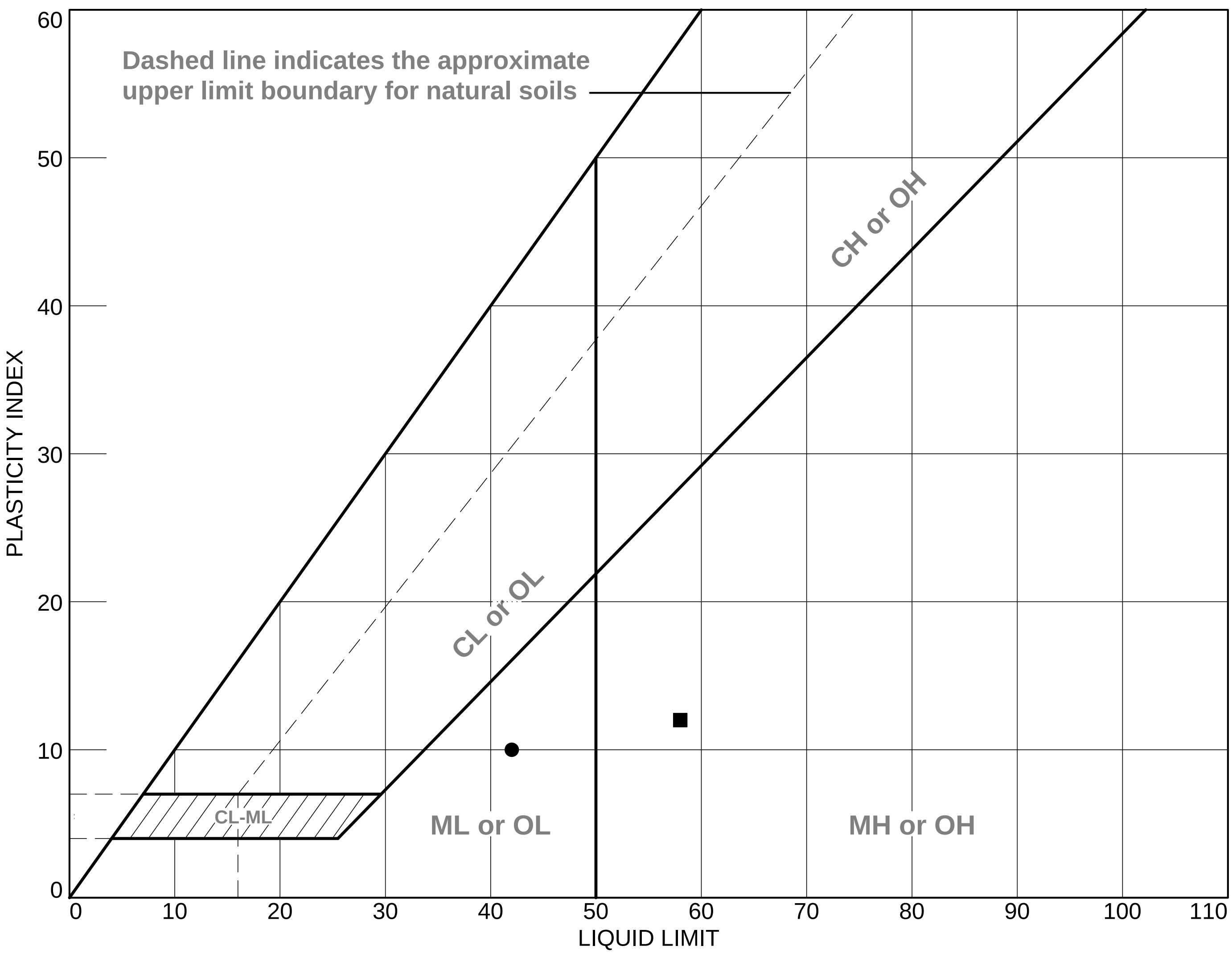
SOIL PARTICLE SIZE (ASTM D2488-06)	
Descriptor	**Size**
Boulder	> 12 inches
Cobble	3 to 12 inches
Gravel - Coarse Fine	¾ inch to 3 inches No. 4 sieve to ¾ inch
Sand - Coarse Medium Fine	No. 10 to No. 4 sieve (4.75mm) No. 40 to No. 10 sieve (2mm) No. 200 to No. 40 sieve (.425mm)
Silt and Clay ("fines")	Passing No. 200 sieve (0.075mm)

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2488)				
Major Division			**Group Symbol**	**Description**
Coarse Grained Soils (more than 50% retained on #200 sieve)	**Gravel** (50% or more retained on No. 4 sieve)	Clean Gravel	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with fines	GM	Silty gravels and gravel-sand-silt mixtures
			GC	Clayey gravels and gravel-sand-clay mixtures
	Sand (> 50% passing No. 4 sieve)	Clean sand	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		Sand with fines	SM	Silty sands and sand-silt mixtures
			SC	Clayey sands and sand-clay mixtures
Fine Grained Soils (50% or more passing #200 sieve)	**Silt and Clay** (liquid limit < 50)		ML	Inorganic silts, rock flour and clayey silts
			CL	Inorganic clays of low-medium plasticity, gravelly, sandy & lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silt and Clay (liquid limit > 50)		MH	Inorganic silts and clayey silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Earth Engineers, Inc.

GRAPHIC SYMBOL LEGEND	
GRAB	Grab sample
SPT	Standard Penetration Test (2" OD), ASTM D1586
ST	Shelby Tube, ASTM D1587 (pushed)
DM	Dames and Moore ring sampler (3.25" OD and 140-pound hammer)
CORE	Rock coring

APPENDIX E - LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring 2	1	5	72.0	32	42	10	ML
■	Boring 2	2	10	49.9	46	58	12	MH

Earth Engineers, Inc.

Client: Red Crow LLC
Project: Forest Lawn Subdivison

Project No.: 22-103 **Figure No.**

Tested By: J. Hill

APPENDIX F

NEARBY HISTORIC WELL LOGS

Exhibit A-9

CLAT 54498

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-0035)

6/8/2015

(1) OWNER/PROJECT

Hole Number: CPT-1

PROJECT NAME/NBR: MARSAM 060115

First Name: Last Name:
Company: PELICAN BREWING
Address: PO BOX 189
City: PACIFIC CITY State: OR Zip: 97135

(2) TYPE OF WORK

[X] New [ ] Deepening [X] Abandonment
[ ] Alteration (repair/recondition)

(3) CONSTRUCTION

[ ] Rotary Air [ ] Hand Auger [X] Hollow stem auger
[ ] Rotary Mud [ ] Cable [X] Push Probe
[ ] Other

(4) TYPE OF HOLE:

(●) Uncased Temporary ( ) Cased Permanent
( ) Uncased Permanent ( ) Slope Stablity
( ) Other
Other:

(5) USE OF HOLE

GEOTECHNICAL

RECEIVED BY OWRD
JUL 27 2015
SALEM, OR

(6) BORE HOLE CONSTRUCTION

Special Standard [ ] (Attach copy)

Depth of Completed Hole: 20.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/lbs
8	0	2	Concrete	0	1	1	S
2	2	20	Bentonite Chips	1	2	1	S
			Bentonite Grout	2	20	1	S

Backfill placed from ft. to ft. Material
Filter pack from ft. to ft. Material Size

(7) CASING/SCREEN

Casing	Screen	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(8) WELL TESTS

( ) Pump ( ) Bailer ( ) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration(hr)

Temperature °F Lab analysis [ ] Yes By

Supervising Geologist/Engineer

Water quality concerns? [ ] Yes (describe below) TDS amount

From	To	Description	Amount	Units

(9) LOCATION OF HOLE (legal description)

County: CLATSOP Twp: 5.00 N N/S Range: 10.00 W E/W WM
Sec: 30 ~~[illegible]~~ NE 1/4 of the ~~[illegible]~~ SE 1/4 Tax Lot: 300
Tax Map Number: Lot:
Lat ° ' " or DMS or DD
Long ° ' " or DMS or DD

(●) Street address of hole ( ) Nearest address

1371 S. HEMLOCK ST. CANNON BEACH, OREGON 97110

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well				

Flowing Artesian? [ ]

WATER BEARING ZONES

Depth water was first found: 7.00

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) SUBSURFACE LOG

Ground Elevation:

Material	From	To
ASPHALT / BASE ROCK	0	1
SILT W/ GRAVELS	1	2
CLAY	2	15
SILTY SAND TO SANDY SILT	15	20

Date Started: 6/1/2015 Completed: 6/1/2015

(12) ABANDONMENT LOG:

Material	From	To	Amt	sacks/lbs
Concrete	0	1	1	S
Bentonite Chips	1	2	1	S
Bentonite Grout	2	20	1	S

Date Started: 6/1/2015 Completed: 6/1/2015

Professional Certification (to be signed by an Oregon licensed water or monitoring well constructor, Oregon registered geologist or professional engineer).

I accept responsibility for the construction, deepening, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License/Registration Number: 10400 Date: 6/8/2015

First Name: ALLEN Last Name: MEEUWSEN
Affiliation: SUBSURFACE TECHNOLOGIES

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

Exhibit A-9

GEOTECHNICAL HOLE REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

CLAT 54498

6/8/2015

Map of Hole

Exhibit A-9

CLAT 54497

STATE OF OREGON
GEOTECHNICAL HOLE REPORT
(as required by OAR 690-240-0035)

6/8/2015

(1) OWNER/PROJECT

Hole Number B-1

PROJECT NAME/NBR: MARSAM060115

First Name ______ Last Name ______
Company PELICAN BREWING
Address PO BOX 189
City PACIFIC CITY State OR Zip 97135

(2) TYPE OF WORK

[X] New [ ] Deepening [X] Abandonment
[ ] Alteration (repair/recondition)

(3) CONSTRUCTION

[ ] Rotary Air [ ] Hand Auger [ ] Hollow stem auger
[X] Rotary Mud [ ] Cable [ ] Push Probe
[ ] Other

(4) TYPE OF HOLE:

(•) Uncased Temporary ( ) Cased Permanent
( ) Uncased Permanent ( ) Slope Stablity
( ) Other
Other:

(5) USE OF HOLE

GEOTECHNICAL

(6) BORE HOLE CONSTRUCTION

Special Standard [ ] (Attach copy)

Depth of Completed Hole 40.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/lbs
5	0	40	Concrete	0	1	1	S
			Bentonite Chips	1	10	2	S
			Bentonite Grout	10	40	1	S

Backfill placed from ______ ft. to ______ ft. Material ______
Filter pack from ______ ft. to ______ ft. Material ______ Size ______

(7) CASING/SCREEN

Casing	Screen	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(8) WELL TESTS

( ) Pump ( ) Bailer ( ) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration(hr)

Temperature ______ °F Lab analysis [ ] Yes By ______

Supervising Geologist/Engineer ______

Water quality concerns? [ ] Yes (describe below) TDS amount ______

From	To	Description	Amount	Units

(9) LOCATION OF HOLE (legal description)

County CLATSOP Twp 5.00 N N/S Range 10.00 W E/W WM
Sec 30 ~~SE~~ NE 1/4 of the ~~NE~~ SE 1/4 Tax Lot 300
Tax Map Number ______ Lot ______
Lat ° ' " or ______ DMS or DD
Long ° ' " or ______ DMS or DD

(•) Street address of hole ( ) Nearest address

1371 S. HEMLOCK ST. CANNON BEACH, OREGON 97110

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well				

Flowing Artesian? [ ]

WATER BEARING ZONES

Depth water was first found 7.00

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) SUBSURFACE LOG

Ground Elevation ______

Material	From	To
ASPHALT / BASE ROCK	0	2
SANDY SILT	2	29
FINE SAND	29	40

Date Started 6/1/2015 Completed 6/1/2015

(12) ABANDONMENT LOG:

Material	From	To	Amt	sacks/lbs
Concrete	0	1	1	S
Bentonite Chips	0	10	2	S
Bentonite Grout	10	40	1	S

Date Started 6/1/2015 Completed 6/1/2015

Professional Certification (to be signed by an Oregon licensed water or monitoring well constructor, Oregon registered geologist or professional engineer).

I accept responsibility for the construction, deepening, alteration, or abandonment work performed during the construction dates reported above. All work performed during this time is in compliance with Oregon geotechnical hole construction standards. This report is true to the best of my knowledge and belief.

License/Registration Number 10400 Date 6/8/2015

First Name ALLEN Last Name MEEUWSEN

Affiliation SUBSURFACE TECHNOLOGIES

RECEIVED BY OWRD
JUL 27 2015
SALEM, OR

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

Exhibit A-9

GEOTECHNICAL HOLE REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

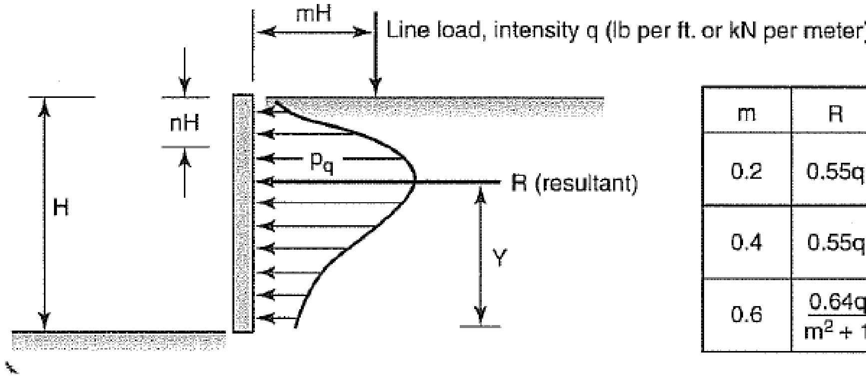
CLAT 54497

6/8/2015

Map of Hole

APPENDIX A-9 SURCHARGE-INDUCED LATERAL EARTH PRESSURES FOR WALL DESIGN

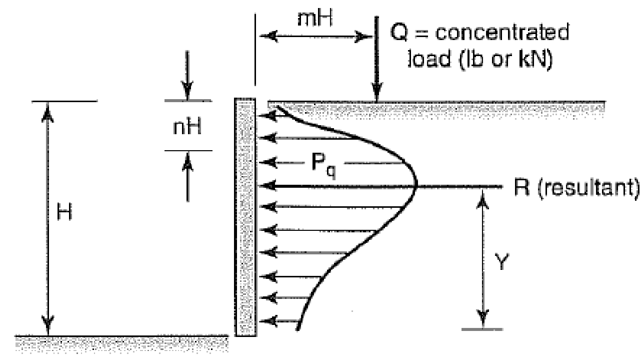
LINE LOAD (applicable for retaining walls not exceeding 20 feet in height):



m	R	Y
0.2	0.55q	0.60 H
0.4	0.55q	0.58 H
0.6	$\frac{0.64q}{m^2+1}$	0.52 H

Figure 16-28 Pressure distribution against vertical wall resulting from line load of intensity *q*.

CONCENTRATED POINT LOAD (applicable for retaining walls not exceeding 20 feet in height):



m	R	Y
0.2	$0.78\,\frac{Q}{H}$	0.59 H
0.4	$0.78\,\frac{Q}{H}$	0.59 H
0.6	$0.48\,\frac{Q}{H}$	0.48 H

Figure 16-27 Pressure distribution against vertical wall resulting from point load, *Q*.

AREAL LOAD:

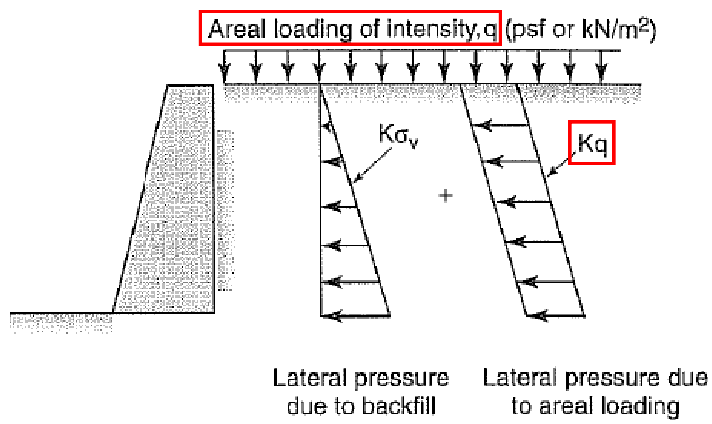
Figure 16-26 Influence of areal loading on wall pressures.

use K=0.4 for active condition (i.e. top of wall allowed to deflect laterally)

use K=0.9 for at-rest condition (i.e. top of wall not allowed to deflect laterally)

Resultant, R = K * q * H

Where H = wall height (feet)



Source of Figures: McCarthy, D.F., 1998, "Essentials of Soil Mechanics and foundations, Basic Geotechnics, Fifth Edition."

Earth Engineers, Inc.	Proposed Forest Lawn Subdivision, Lots 1-3 Tax Lot #51030DA04100 Intersection of Forest Lawn Road and South Hemlock Street Cannon Beach, Clatsop County, Oregon	Report No. 22-103-1 June 3, 2022

Exhibit A-10

Earth Engineers Inc.

2411 Southeast 8th Avenue ▪ Camas ▪ WA 98607
Phone: 360-567-1806
www.earth-engineers.com

July 27, 2022

Patrick/Dave LLC
3514 Northeast U.S. Grant Place
Portland, Oregon 97212
Attention: David Pietka, Owner

Phone: (503) 206-1071
E-mail: dpietka@msn.com

Subject: **Supplemental Commentary on Landslide and Liquefaction Hazards**
Proposed Forest Lawn 3-Lot Partition
Clatsop County Tax Lot No. 51030DA04100
Intersection of Forest Lawn Road and Hemlock Street
Cannon Beach, Clatsop County, Oregon
EEI Report No. 22-103-2

Dear Mr. Pietka,

As requested by Jamie Lerma with Red Crow, LLC, Earth Engineers, Inc. (EEI) is pleased to provide additional commentary on the landslide and liquefaction hazards identified in our Geotechnical Investigation Report (reference EEI Report No. 22-103-1-R1 dated June 10, 2022). We understand that at the last Planning Commission meeting to discuss the proposed 3-lot partition, there was some concern expressed about landslide and liquefaction hazards.

Our scope of services for the above referenced project was to perform a geotechnical investigation and evaluate geologic hazards in accordance with the Cannon Beach Municipal Code (CBMC) 17.050. **To be clear, Section 17.50.010 of the code essentially states that the purpose of evaluating geologic hazards is so that the project can be engineered to properly address the potential hazards—the purpose is not to determine if the project should be constructed or not.**

Two of the hazards identified in our June 10, 2022 report were landsliding and soil liquefaction during an earthquake. We should note that just because geologic hazards are identified for a property, does not mean that the property is not developable from a geotechnical standpoint. The key is to identify potential hazards and provide recommendations on how to properly mitigate those hazards so that the hazard is not made worse on adjacent properties, and that the subject property can be constructed without risk to life-safety.

Section 17.50.040(3) of the CBMC provides the critical standard for the City's review of geologic hazards, and is noted below:

3. The burden of proof shall be upon the applicant to show construction feasibility. A proposed use will be permitted only where:

a. The geologic site investigation report indicates that there is not a hazard to the use proposed on the site or to properties in the vicinity; or

b. The geologic site investigation report and engineering report specifies engineering and construction methods which will eliminate the hazard, or will minimize the hazard to an acceptable level.

As identified through our original report and investigation, and described in greater detail within this letter, the project site has been mapped by the City as having a "moderate" landslide potential and "low" liquefaction potential. These mapping indicators are not unique to the site and are pervasive throughout Cannon Beach. For example, nearly the entire City is mapped as having a moderate or high potential for liquefaction and significant areas through the City have either a "moderate," "high," or "very high" landslide potential designation.

For that reason, these mapping indicators are not intended to inherently prohibit development. Rather, they are intended to ensure that—consistent with CBMC 17.50.040.3(b)—engineering and construction methods are applied to mitigate the concern. Consistent with that intent, EEI has prescribed design measures that, based on our professional recommendation, will protect the life-safety of future structures on the subject property and not worsen the potential for liquefaction or landslide hazards on the adjacent properties, thereby minimizing the hazard to an acceptable level. Specific mitigation measures prescribed include:

- Granulated, well graded, crushed rock as structural fill, as necessary; and
- Pin pile or helical pier foundation systems for the future residential dwellings

LANDSLIDING HAZARD

Landsliding was identified because the property is mapped near a very large landslide. There are two applicable landslide maps that were included in our June 10, 2022 report (see Figures 1 through 4 below). Figure 1 shows that the subject property is mapped in a "moderate" hazard area. Figure 2 is the same map, but zoomed out to show that the majority of Cannon Beach is mapped in a landslide hazard area.

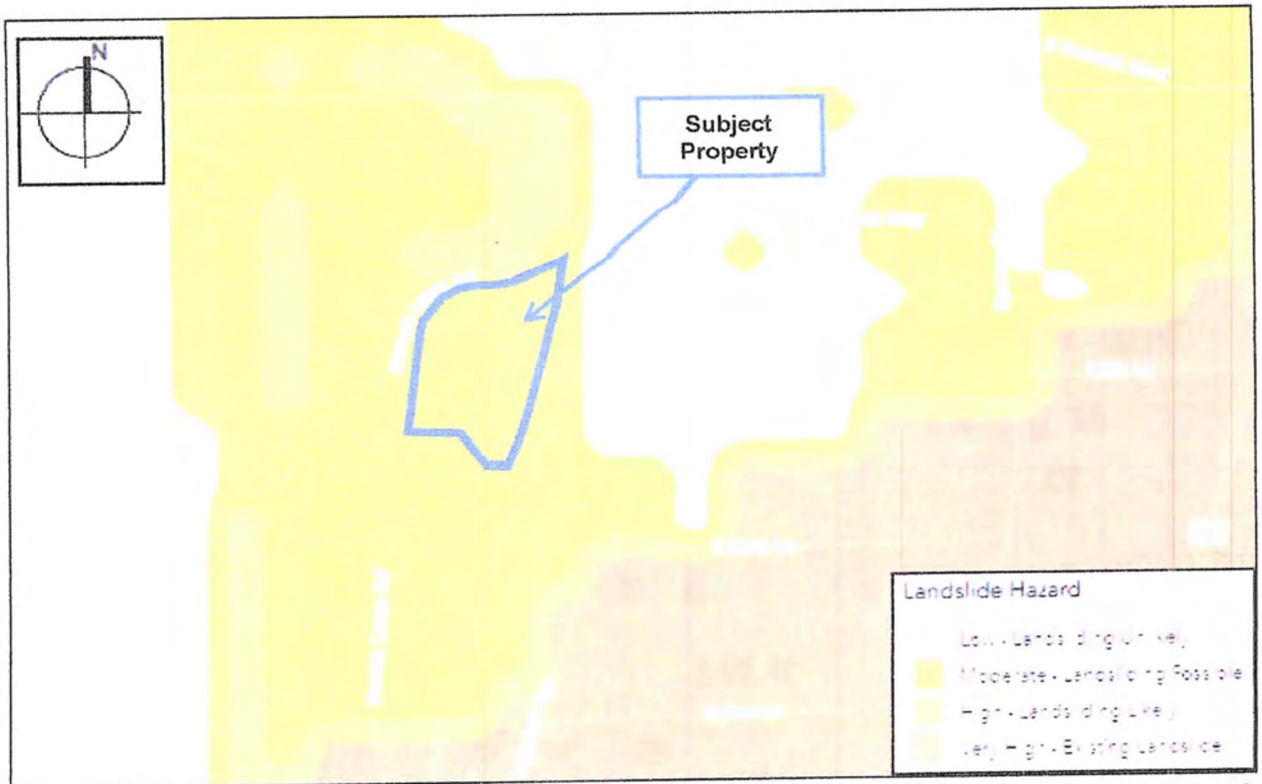


Figure 1: HazVu map showing the landslide hazard zones deposits in the immediate vicinity of Forest Lawn Road.

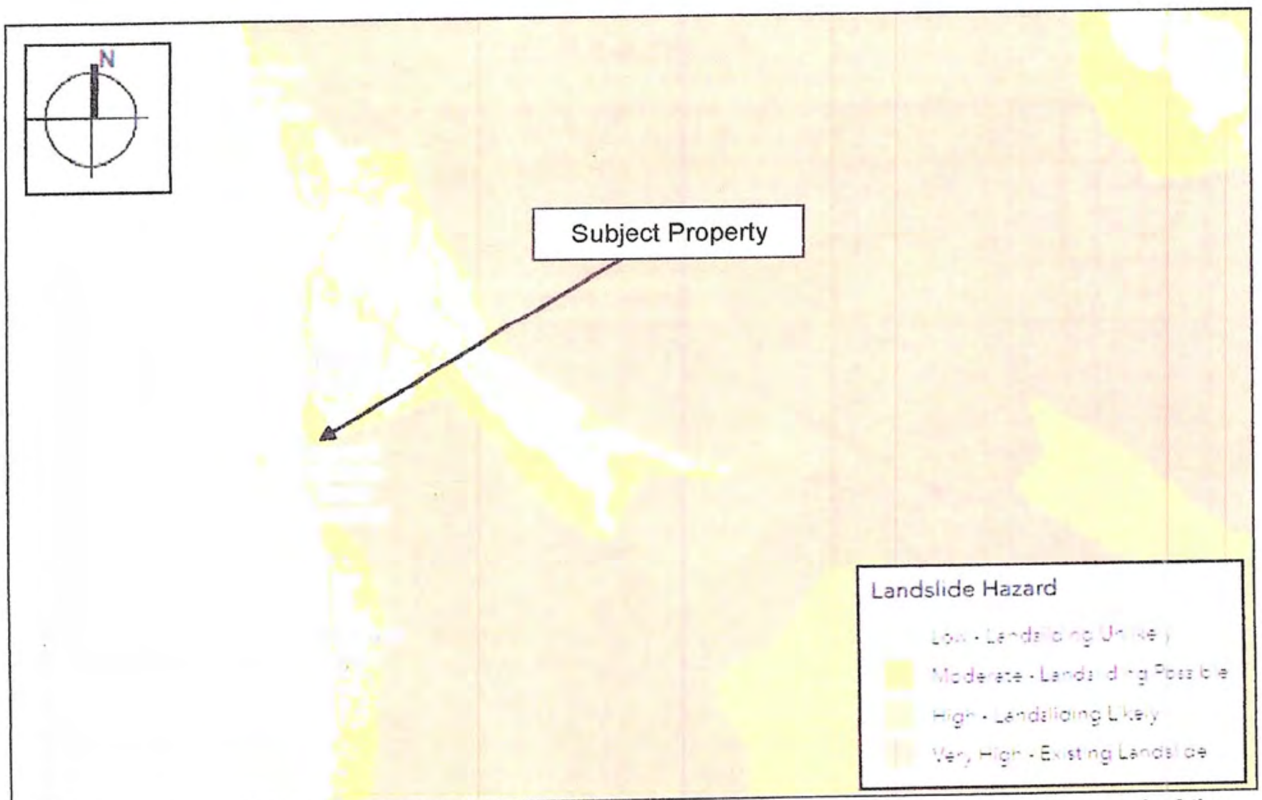


Figure 2: The same HazVu map as Figure 1 above, but showing the landslide hazard of the greater Cannon Beach area.

Figure 3 shows that the subject property is mapped adjacent to, but not within, a very large landslide mass. Figure 4 is the same map, but zoomed out to show that the majority of Cannon Beach is mapped in a very large ancient landslide area.

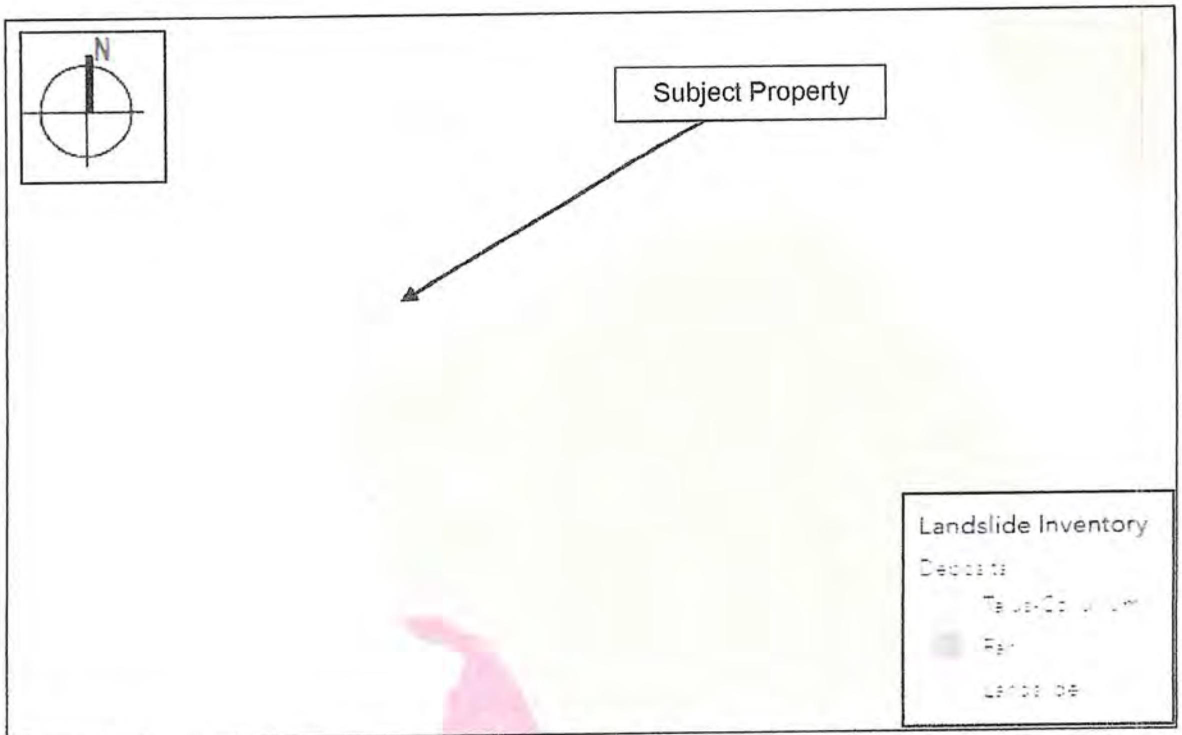


Figure 3: HazVu map showing the mapped landslide deposits in the immediate vicinity of Forest Lawn Road.

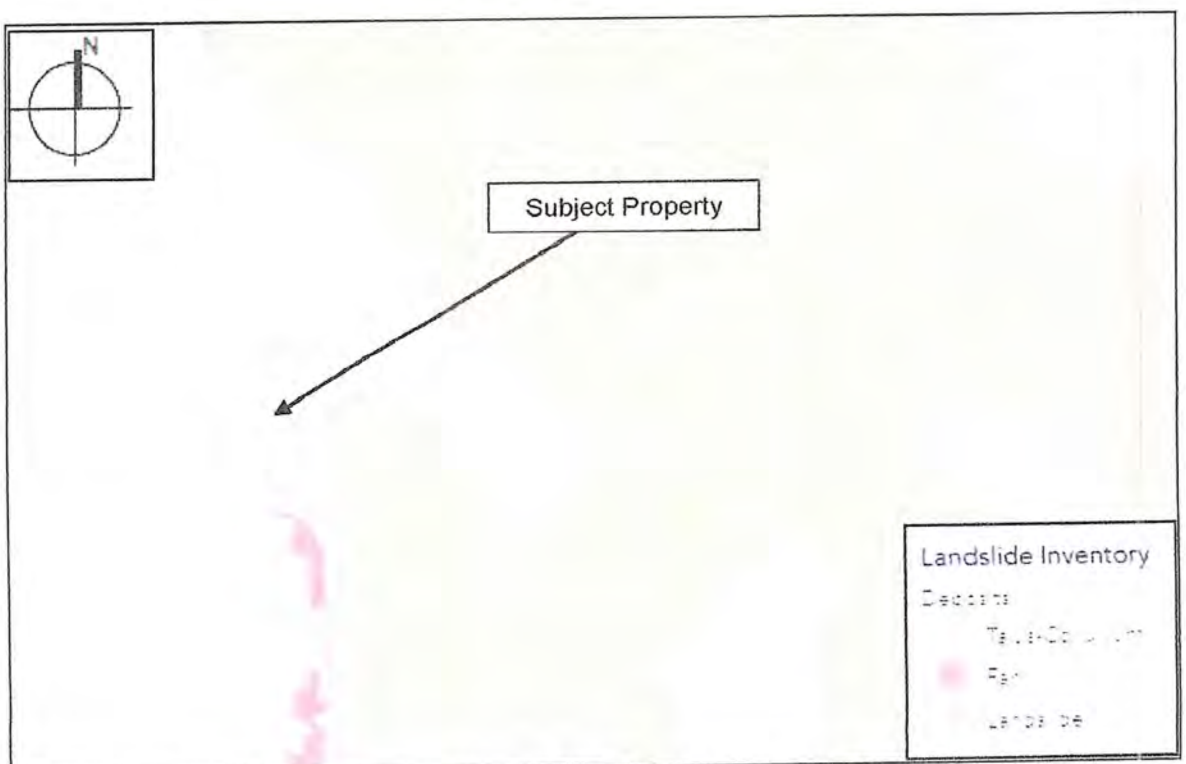


Figure 4: The same HazVu map as Figure 3, showing the mapped historic landslide deposits in the greater Cannon Beach area.

Ultimately, we identified that the property is mapped in a landslide hazard area, as shown in the mapping above, we investigated the subsurface soil conditions with borings and lab testing as required, and we determined that the hazard mitigation should include a more robust foundation system to support the future homes (i.e. a pile foundation system that are estimated to be 30 to 50 feet deep, depending upon the type of deep foundation system selected). A deep foundation system will take the building loads down to the stable sandstone stratum. No other mitigation recommendations are necessary to protect life-safety for the subject 3-lot development or ensure that the landslide risk is not made worse on adjacent lots as a result of this proposed development.

LIQUEFACTION HAZARD

There is one applicable liquefaction hazard map that was included in our June 10, 2022 report (see Figures 5 and 6 below). Figure 5 shows that the subject property is generally mapped in a "low" hazard area. Figure 6 is the same map, but zoomed out to show that the majority of Cannon Beach is mapped in a liquefaction hazard area. Based on our drilled borings, we would concur with the mapping that soil liquefaction is a potential hazard at the property.

Similarly to the landslide hazard, we identified that the property is mapped in a liquefaction hazard area, we investigated the subsurface soil conditions with borings and lab testing as required, and we determined that the hazard mitigation should include a more robust foundation system to support the future homes (i.e. a pile foundation system that are estimated to be 30 to 50 feet deep, depending upon the type of deep foundation system selected). A deep foundation system will take the building loads down through the potentially liquefiable soils to the stable sandstone stratum. No other mitigation recommendations are necessary to protect life-safety for the subject 3-lot development or ensure that the liquefaction risk is not made worse on adjacent lots as a result of this proposed development.

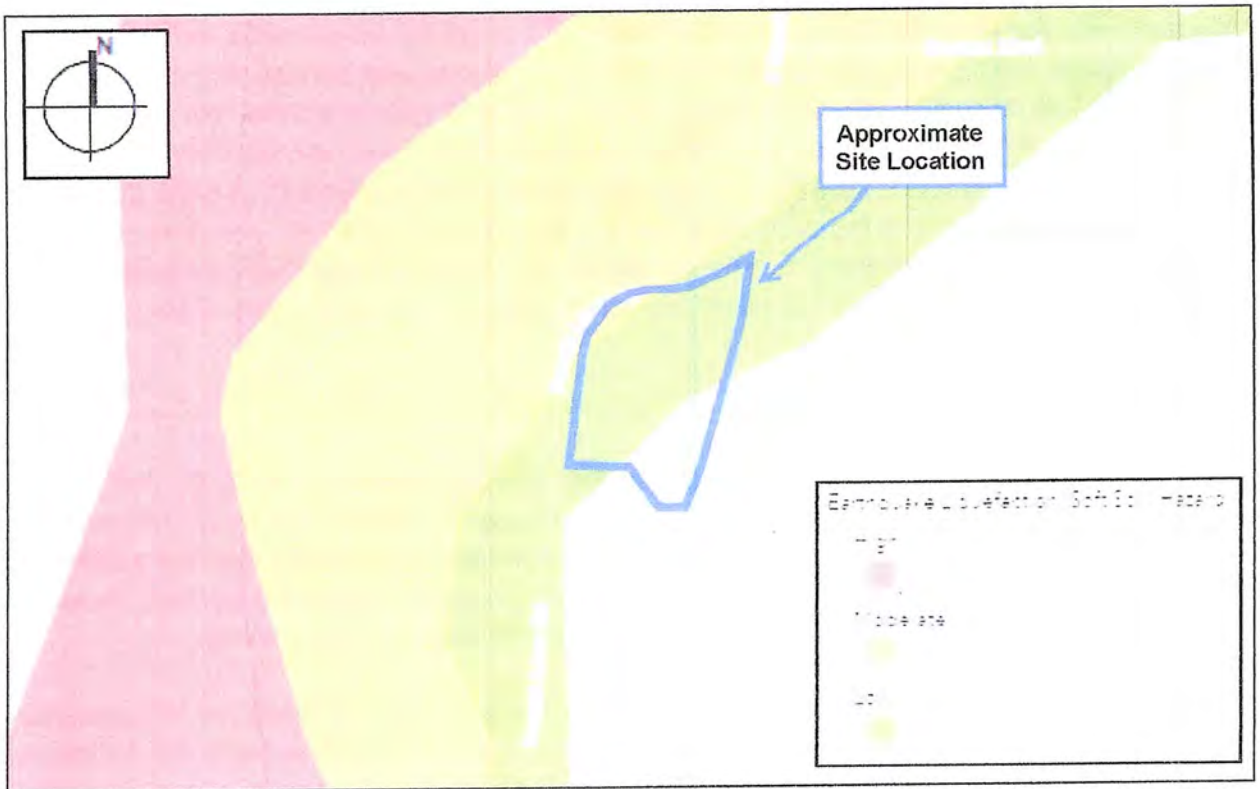


Figure 5: HazVu map showing the liquefaction (soft soil) hazard area in the immediate vicinity of Forest Lawn Road.

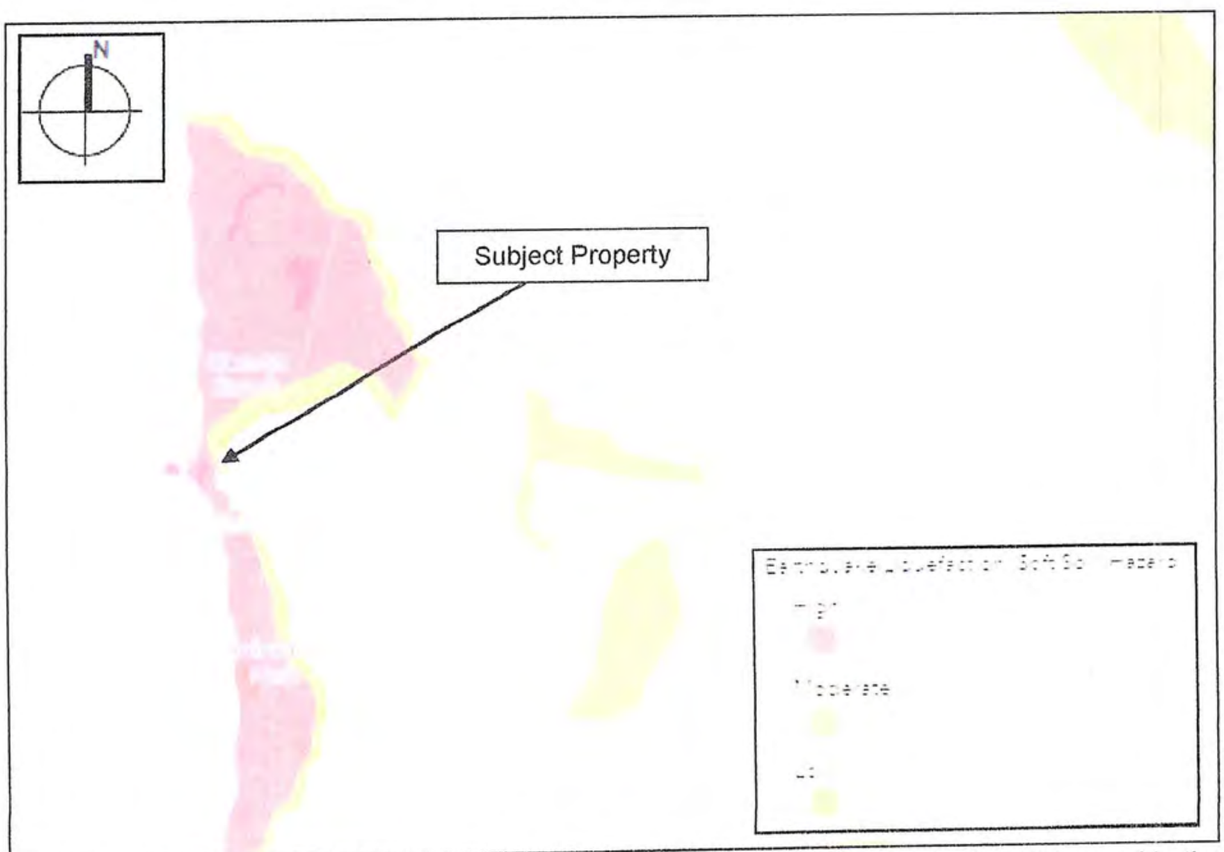


Figure 6: The same HazVu map as Figure 5, showing the liquefaction (soft soil) hazard in the greater Cannon Beach area

CONCLUSION

In conclusion, it is our professional opinion that we have met the City of Cannon Beach requirements for addressing geologic hazards. We identified the potential hazards that are present, we performed a thorough site investigation to evaluate those hazards, and we provided engineering recommendations to address the hazards. The recommendations we provided protect life-safety for the subject property and ensure that the hazard on adjacent properties is not made any worse as a result of the proposed development. Note that the City's July 21, 2022 Staff Report concurs with us that we have met the criteria for evaluating and addressing the geologic hazards and the City staff is recommending the conditional approval, without any conditions related to the geologic hazards (other than following the recommendations in our geotechnical report during construction).

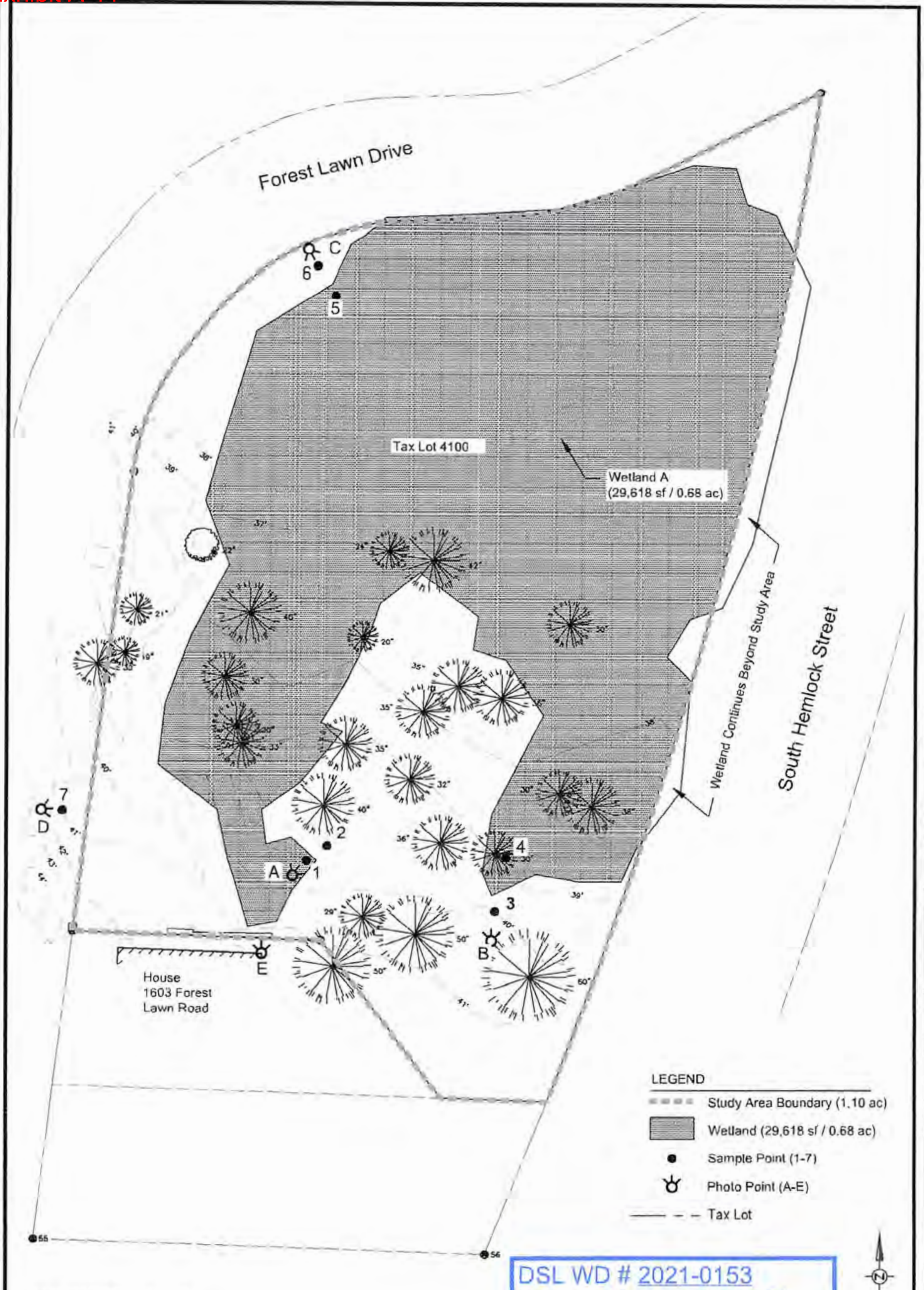
Again, the intent of the City's code is not to identify geologic hazards so that construction can be prevented, but to identify the geologic hazards so that they can be properly addressed during construction.

If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Sincerely,
Earth Engineers, Inc.

Troy Hull, P.E., G.E.
Principal Geotechnical Engineer

Jacqui Boyer
Geotechnical Engineering Associate



Survey provided by S&F Land Services, 2020. Accuracy of Survey, Sample Points, and Tax Lot boundaries is sub-centimeter.

DSL WD # 2021-0153
Approval Issued 6/8/2021
Approval Expires 6/8/2026

PHS Pacific Habitat Services, Inc.

Wetland Delineation

Tax Lot 4100 - Cannon Beach, Oregon

FIGURE 6

3-19-2021

Exhibit A-11

[redacted]
WETLAND DELIN. CONCUR.

Oregon

Kate Brown, Governor

Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
(503) 986-5200
FAX (503) 378-4844
www.oregon.gov/dsl

State Land Board

Kate Brown
Governor

Shemia Fagan
Secretary of State

Tobias Read
State Treasurer

June 8, 2021

Patrick/Dave, LLC
Attn: Patrick Gemma
2575 38th Avenue West
Seattle, WA 98199

Re: WD # 2021-0153 **Approved**
Wetland Delineation Report for Tax Lot 4100 on Forest Lawn Drive
Clatsop County; T5N R10W 30DA TL4100
Cannon Beach Local Wetlands Inventory, Wetland 24

Dear Mr. Gemma:

The Department of State Lands has reviewed the wetland delineation report prepared by Pacific Habitat Services for the site referenced above. Based upon the information presented in the report, we concur with the wetland boundaries as mapped in revised Figure 6 of the report. Please replace all copies of the preliminary wetland map with this final Department-approved map.

Within the study area, one wetland (Wetland A, totaling approximately 0.68 acres) was identified. This wetland is subject to the permit requirements of the state Removal-Fill Law. Under current regulations, a state permit is required for cumulative fill or annual excavation of 50 cubic yards or more in wetlands or below the ordinary high-water line (OHWL) of the waterway (or the 2-year recurrence interval flood elevation if OHWL cannot be determined).

This concurrence is for purposes of the state Removal-Fill Law only. We recommend that you attach a copy of this concurrence letter to any subsequent state permit application to speed application review. Federal or local permit requirements may apply as well. The U.S. Army Corps of Engineers will determine jurisdiction under the Clean Water Act, which may require submittal of a complete Wetland Delineation Report.

Please be advised that state law establishes a preference for avoidance of wetland impacts. Because measures to avoid and minimize wetland impacts may include reconfiguring parcel layout and size or development design, we recommend that you work with Department staff on appropriate site design before completing the city or county land use approval process.

This concurrence is based on information provided to the agency. The jurisdictional determination is valid for five years from the date of this letter unless new information necessitates a revision. Circumstances under which the Department may change a determination are found in OAR 141-090-0045 (available on our web site or upon request). In addition, laws enacted by the legislature and/or rules adopted by the Department may result in a change in jurisdiction; individuals and applicants are subject to the regulations that are in effect at the time of the removal-fill activity or complete permit application. The applicant, landowner, or agent may submit a request for reconsideration of this determination in writing within six months of the date of this letter.

Thank you for having the site evaluated. If you have any questions, please contact the Jurisdiction Coordinator, Jessica Imbrie, at (503) 986-5250.

Sincerely,

Pete Ryan

Peter Ryan, SPWS
Aquatic Resource Specialist

Enclosures

ec: John van Staveren, SPWS, Pacific Habitat Services
City of Cannon Beach Planning Department (Maps enclosed for updating LWI)
Brad Johnson, Corps of Engineers
Dan Cary, SPWS, DSL
Oregon Coastal Management Program (coast.permits@state.or.us)

Exhibit A-11

WETLAND DELINEATION / DETERMINATION REPORT COVER FORM

Fully completed and signed report cover forms and applicable fees are required before report review timelines are initiated by the Department of State Lands. Make the checks payable to the Oregon Department of State Lands. To pay fees by credit card, go online at: https://apps.oregon.gov/DSL/EPS/program?key=4.

Attach this completed and signed form to the front of an unbound report or include a hard copy with a digital version (single PDF file of the report cover from and report, minimum 300 dpi resolution) and submit to, **Oregon Department of State Lands, 775 Summer Street NE, Suite 100, Salem, OR 97301-1279.** A single PDF of the completed cover form and report may be e-mailed to **Wetland_Delineation@dsl.state.or.us**. For submittal of PDF files larger than 10 MB, e-mail DSL instructions on how to access the file from your ftp or other file sharing website.

Contact and Authorization Information

☒ Applicant ☒ Owner Name, Firm and Address:
Patrick Gemma
Patrick/Dave, LLC
2575 38th Avenue West
Seattle, WA 98199

Business phone #
Mobile phone # (optional) 206.419.2218
E-mail: **pgemma@prologis.com**

☒ Authorized Legal Agent, Name and Address:

Business phone #
Mobile phone #
E-mail:

I either own the property described below or I have legal authority to allow access to the property. I authorize the Department to access the property for the purpose of confirming the information in the report, after prior notification to the primary contact.

Typed/Printed Name: **Patrick Gemma** Signature:
Date: **3/19/2021** Special instructions regarding site access:

Project and Site Information

Project Name: **Tax Lot 4100 on Forest Lawn Drive**	Latitude: **45.8864** Longitude: **-123.9628** decimal degree - centroid of site or start & end points of linear project Tax Map # **5 10 30 DA** Tax Lot(s) **4100**
Proposed Use: **Residential subdivision**	Tax Map # Tax Lot(s)
Project Street Address (or other descriptive location): **SW of the intersection of Forest Lawn Dr and South Hemlock Street**	Township **5N** Range **10W** Section **30** QQ **DA** Use separate sheet for additional tax and location information Waterway: **N/A** River Mile: **N/A**
City: **Cannon Beach** County: **Clatsop**	NWI Quad(s): **Tillamook Head, Oregon**

Wetland Delineation Information

Wetland Consultant Name, Firm and Address:
Pacific Habitat Services
Attn: John van Staveren
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

Phone # **503-570-0800**
Mobile phone # **503-708-8320**
E-mail: **jvs@pacifichabitat.com**

The information and conclusions on this form and in the attached report are true and correct to the best of my knowledge.
Consultant Signature: John van Staveren Date: **3/19/2021**

Primary Contact for report review and site access is ☒ Consultant ☐ Applicant/Owner ☐ Authorized Agent

Wetland/Waters Present? ☒ Yes ☐ No | Study Area size: **1.10 acres** Total Wetland Acreage: **0.68**

Check Applicable Boxes Below

☐ R-F permit application submitted	☒ Fee payment submitted **$475**
☐ Mitigation bank site	☐ Fee ($100) for resubmittal of rejected report
☐ Industrial Land Certification Program Site	☐ Request for Reissuance. See eligibility criteria (no fee)
☐ Wetland restoration/enhancement project (not mitigation)	DSL # ______ Expiration Date ______
☐ Previous delineation/application on parcel?	☒ LWI shows wetlands or waters on parcel?
If Known, previous DSL #	Wetland ID Code **W24**

For Office Use Only

DSL Reviewer: JJ ______ Fee Paid Date: ___ / ___ / ___ DSL WD # 2021-0153
Date Delineation Received: 3 / 23 / 21 Scanned: ☐ Final Scan: ☐ DSL App. # ______

Electronic Submittal

March 2018

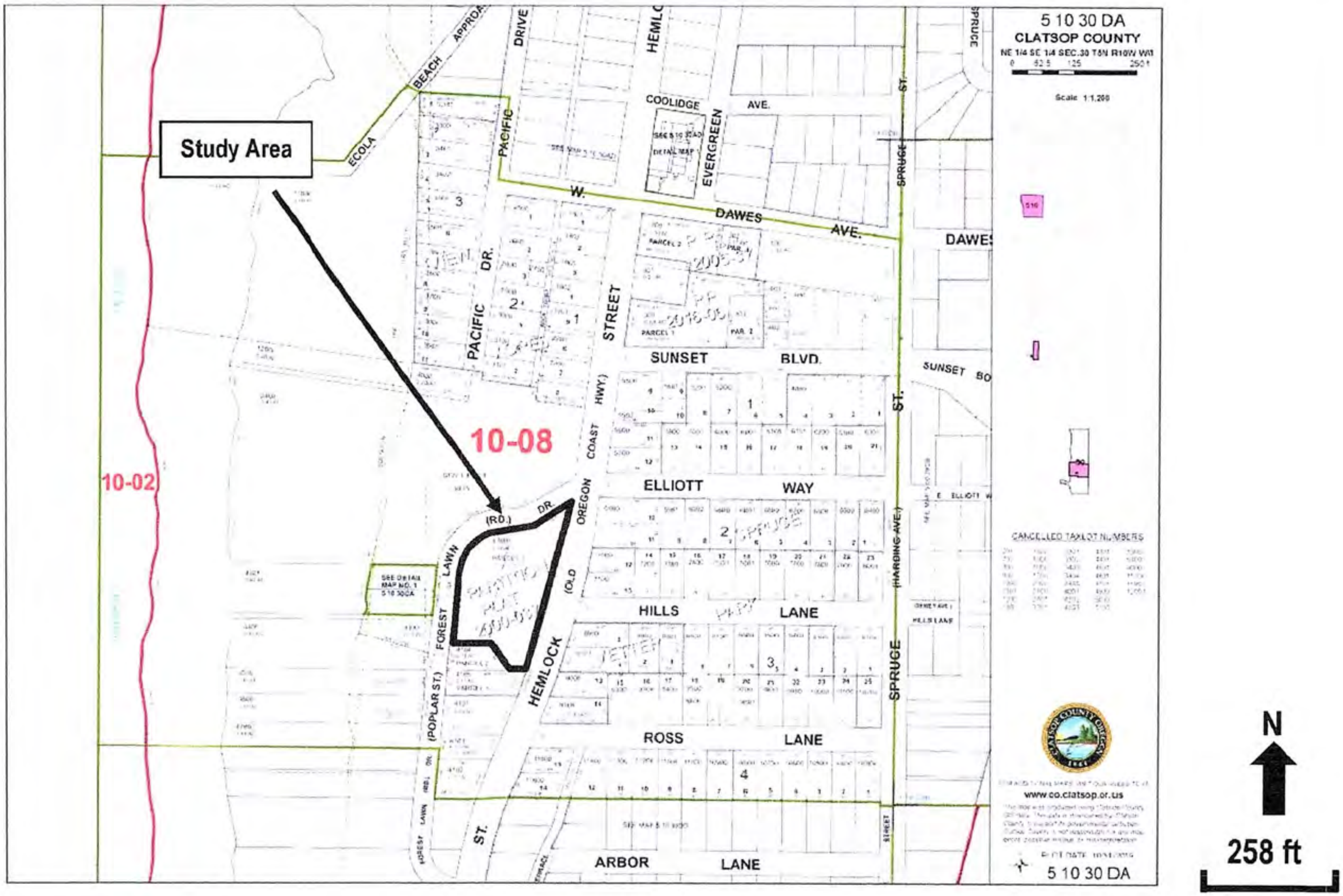
Exhibit A-11

Project #6978
2/16/2021

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

General Location and Topography
Tax Lot 4100 - Cannon Beach, Oregon
United States Geological Survey (USGS) Tillamook Head, Oregon 7.5 quadrangle, 2020
(viewer.nationalmap.gov/basic)

FIGURE 1



Project #6978
2/16/2021

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

Tax Lot Map
Tax Lot 4100 - Cannon Beach, Oregon
The Oregon Map (ormap.net)

FIGURE
2

Exhibit A-11

[redacted]
JURIS. DETERM.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, PORTLAND DISTRICT
P.O. BOX 2946
PORTLAND, OR 97208-2946

April 15, 2021

Regulatory Branch
Corps No.: NWP-2021-159

Patrick Gemma
Patrick/Dave, LLC
2575 38th Avenue West
Seattle, Washington 98199
pgemma@prologis.com

Dear Mr. Gemma:

The U.S. Army Corps of Engineers (Corps) received your request for an Approved Jurisdictional Determination (AJD) of the waters or water features, including wetlands, within the review area as shown on the enclosed drawings (Enclosure 1). The review area is located between Forest Lawn Road and South Hemlock Street Cannon Beach, Clatsop County, Oregon at Latitude/Longitude: 45.8864°, -123.9628°. Other waters or water features, including wetlands, that may occur on this property or on adjacent properties outside the review area are not the subject of this determination.

The Corps has determined Wetland A within the review area is not a water of the U.S. The enclosed drawings (Enclosure 1) identify the size and boundaries of the delineated wetland. The enclosed *Approved Jurisdictional Determination Form (Interim)* (Enclosure 2) provides the basis for jurisdiction. A copy of the AJD Form can also be found on our website at: http://www.nwp.usace.army.mil/Missions/Regulatory/Appeals/.

If you object to the enclosed AJD, you may request an administrative appeal under 33 CFR Part 331 as described in the enclosed *Notification of Administrative Appeal Options and Process and Request for Appeal* (*RFA*) form (Enclosure 3). To appeal this AJD, you must submit a completed *RFA* form to the Corps Northwestern Division (NWD) office at the address listed on the form. In order for the request for appeal to be accepted, the Corps must determine that the form is complete, that the request meets the criteria for appeal under 33 CFR Part 331.5, and the form must also be received by the NWD office within 60 days from the date on the form. It is not necessary to submit the form to the NWD office if you do not object to the enclosed AJD.

The delineation included herein has been conducted to identify the location and extent of the aquatic resource boundaries and/or the jurisdictional status of aquatic resources for purposes of the Clean Water Act for the particular site identified in this request. This delineation and/or jurisdictional determination may not be valid for the Wetland Conservation Provisions of the Food Security Act of 1985, as amended. If you or your tenant are U.S. Department of Agriculture (USDA) program participants, or anticipate participation in USDA programs, you should discuss the applicability of a certified wetland determination with the local USDA service center, prior to starting work.

This AJD is valid for a period of five years from the date of this letter unless new information warrants revisions of the determination.

We would like to hear about your experience working with the Portland District, Regulatory Branch. Please complete a customer service survey form at the following address: https://corpsmapu.usace.army.mil/cm_apex/f?p=136:4.

If you have any questions regarding our Regulatory Program or permit requirements for work in waters of the U.S., please contact Mr. Brad Johnson by telephone at (503) 808-4383 or e-mail at: Brad.A.Johnson2@usace.army.mil.

Sincerely,

Kristen Hafer

For: William D. Abadie
Chief, Regulatory Branch

Enclosures

cc with drawings:
Oregon Department of State Lands (Dan Cary, dan.cary@dsl.state.or.us)
Oregon Department of Environmental Quality (401applications@deq.state.or.us)
Pacific Habitat Services (John van Staveren, jvs@pacifichabitat.com)

CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

November 29, 2023

Jamie Lerma
Red Crow LLC
P.O. Box 825
Cannon Beach, OR 97110

RE: Completeness Determination for Conditional Use Application at Taxlot 51030DA04100 on Forest Lawn Rd., (File: CU 23-04)

Dear Mr. Lerma:

Your application for a Conditional Use Permit for the construction of a pedestrian boardwalk in a wetland and its associated buffer area was received on November 28, 2023 and found to be complete on November 29th. The City has 120 days from the date of determination to exhaust all local review, that period ends on Thursday, March 28, 2024. The first evidentiary hearing for this application will be held on December 19, 2023 at 6:00pm, you may participate in person or by Zoom.

The materials received with this application include:

- Conditional Use application with supplemental project description
- Schematics for the proposed pedestrian boardwalk
- Site plan and preliminary architectural schematics for the residential development the proposed elevated walkway is intended to support
- Project letter from Pacific Habitat Services, Inc. dated November 28, 2023

Additionally a Type 2 Development Permit application was submitted in addition to the Conditional Use application. The materials received with this application include:

- Type 2 Development Permit application
- Site plan
- Todd Prager & Associates revised tree plan dated November 27, 2023
- K. LaBonte email regarding construction access from S. Hemlock St. dated October 13, 2023
- Morgan Civil Engineering utility plan dated August 22, 2023
- Earth Engineers Inc. Geotechnical Investigation and Geologic Hazard Report dated June 3, 2022
- Earth Engineers Inc. Supplemental Commentary on Landslide and Liquefaction Hazards dated July 27, 2022
- Oregon DLCD wetland delineation concurrence WD# 2021-0153 dated June 8, 2021

For the purpose of review the Type 2 application is considered complete and it and its supporting documentation will be included in the materials being presented to the Planning Commission for their review of the Conditional Use application. As the proposed residential development on the Type 2 application cannot be approved without a legal means of access to the subject property the City will not be able to review this application until the Planning Commission has rendered a decision on the Conditional Use application.

Please be aware that the determination of a complete application is not a decision or a guarantee of outcome for the application.

Please feel free to contact my office at (503) 436-8053, or by email at stclair@ci.cannon-beach.or.us if you have questions regarding this information.

Sincerely,

Robert St. Clair
Planner

CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

Cannon Beach Planning Commission

Findings of Fact and Conclusions of Law

PUBLIC HEARING AND CONSIDERATION OF CU 23-02, RED CROW LLC/JAMIE LERMA, APPLICANT, ON BEHALF OF PATRICK/DAVE LLC, REQUEST FOR AN ELEVATED PEDESTRIAN ACCESS IN A WETLAND BUFFER AREA IN ORDER TO PROVIDE ACCESS TO PLANNED RESIDENTIAL DEVELOPMENT. THE PROPERTY IS AN UNDEVELOPED PARCEL ON THE NORTHERN PART OF FOREST LAWN DR. (TAXLOT 04100, MAP 51030DA) IN A RESIDENTIAL MODERATE DENSITY (R2) ZONING DISTRICT AND THE WETLANDS OVERLAY (WO) ZONE. THE CONDITIONAL USE REQUEST WILL BE REVIEWED AGAINST THE CRITERIA OF CANNON BEACH MUNICIPAL CODE, SECTION 17.43.045, CONDITIONAL USES AND ACTIVITIES PERMITTED IN WETLAND BUFFER AREAS; AND 17.80, CONDITIONAL USES.

Agenda Date: October 26, 2023

Exhibits

The following Exhibits are attached hereto as referenced. All application documents were received at the Cannon Beach Community Development office on September 21, 2023 unless otherwise noted.

"A" Exhibits – Application Materials

A-1 Conditional use application with project description and site plan

A-2 Type 2 Development Permit application, File #DP23-35, with site plan, Todd Prager & Associates tree plan (June 22, 2023), Earth Engineers Inc geotechnical report (June 10, 2022), Oregon DSL wetland delineation concurrence WD# 2021-0153 (June 8, 2021), USACE Approved Jurisdictional Determination (April 15, 2021), and Morgan Civil Engineering utility plan (August 22, 2023)

A-3 Schematic drawings, received October 19, 2023

A-4 Site access correspondence, received October 19, 2023

A-5 Pacific Habitat Services letter, received October 19, 2023

A-6 Chenoweth Law Group letter, received October 25, 2023

"C" Exhibits – Cannon Beach Supplements

C-1 CU#23-02 Completeness determination, September 28, 2023;

C-2 Signed order and Findings of Fact for DP#23-28, August 9, 2023;

C-3 Photos of proposed work area from DP#23-28 review, August 1, 2023;

C-4 Memorandum regarding status of DP#23-35 Application, October 26. 2023

"D" Exhibits – Public Comment

D-1 L. Champion comment, received October 26, 2023

Summary & Background

The applicant, Jamie Lerma of Red Crow LLC, on behalf of property owner Patrick/Dave LLC, requests the installation of a private use boardwalk that will span an approximately 16 foot 6 inch portion of a delineated wetland buffer area for the purpose of providing pedestrian access to planned residential development on the subject property, information about which is included in Exhibit A-2 to provide context for this application. That application, DP#23-35, proposes two detached dwelling units on one upland portion of the subject property with a separate off-street parking area located on a separate upland portion adjacent to Forest Lawn Rd with these areas connected by the proposed walkway.

Previously the applicant requested a Type 2 permit for vegetation management in order to install a pedestrian walkway along the portion of the property adjacent to TL 4104. This application, DP#23-28 included as exhibits C-2 and C-3, was denied in August 2023 as the Type 2 permit was not the appropriate application type for the proposed activity and a conditional use review would be required.

Findings

The Planning Commission finds that the proposed elevated walkway would be 20 feet long from footing to footing and 5 feet wide with possible railings on either side that would increase the structure's overall width to approximately 5 feet 10 inches. The walkway would be located adjacent to the property line abutting 1603 Forest Lawn Rd. The Commission finds that the walkway meets both the definition of an "accessory structure" and a "footpath" for the purposes of CBMC Chapter 17.43 (Wetland Overlay Zone) as detailed below.

CBMC Section 17.04.010 – Accessory Structure, Use states: *"Accessory structure" or "accessory use" means a structure or use incidental and subordinate to the main use of property and located on the same lot as the main use.*

CBMC Section 17.05.540 – Structure states: *"Structure" means any man-made assemblage of materials extending above the surface of the ground and permanently affixed or attached, or where not permanently affixed or attached to the ground not readily portable, but not including landscape improvements such as rock walls, retaining walls less than four feet in height, flag poles, and other minor incidental improvements similar to those described above.*

The minimum setbacks for properties in the R2 Residential Medium Density zone are 15 feet for front and back yards and 5 feet for side yards. Due to the proposed walkway's location immediately adjacent to the property line it would not comply with these requirements.

Because the accessory structure has only one intended purpose, which is to carry foot traffic between the two dwelling units and the garage/parking area, it is also footpath within the meaning of 17.43.040. Because uses permitted under 17.43.035 can only be permitted "subject to applicable standards," the walkway must also comply with the standards applicable to footpaths as conditional uses under CBMC Section 17.43.045.

The Commission additionally finds that the City has not yet received a Type 1 development permit application for the proposed residential development. This permit type is for the construction of a structure or building that requires a building permit pursuant to State building codes. The City has received a Type 2 development permit application for excavation and grading in conjunction with construction, DP23-35, which shows a conceptual site plan as well as the location of utilities. The City had determined DP23-35 application to be complete with review pending the Planning Commission's decision of this conditional use application. As a Type 1 permit had not been submitted the Commission finds that there is insufficient information about the proposed residential development and as such there is no demonstrated demand for the proposed walkway as required by CMBC Section 17.80.110(A).

The Commission concludes that as the application meets the definition of an accessory structure it cannot be approved as presented because that structure would not comply with the minimum setback requirements of the subject property.

Decision

Motion: Having considered the evidence in the record, based on a motion from Commissioner Sinclair, seconded by Commissioner Moritz, the Planning Commission unanimously moves to deny the Red Crow LLC application, on behalf of Patrick/Dave LLC, the conditional use request for the placement of an elevated pedestrian access, application CU# 23-02, as discussed at this public meeting.

Exhibit D-1

Robert St. Clair

From:	Emily Bare
Sent:	Tuesday, December 5, 2023 7:09 AM
To:	Steve Sokolowski; Robert St. Clair
Subject:	FW: CU #23-04 Violation of delineated wetlands

Emily Bare
Administrative Assistant – Planning Department
City of Cannon Beach
p: 503.436.8054 | tty: 503.436.8097 | f: 503.436.2050
a: 163 E. Gower St. | PO Box 368 | Cannon Beach, OR 97110
w: www.ci.cannon-beach.or.us | e: bare@ci.cannon-beach.or.us

From: William Reiersgaard <rackerbill@aol.com>
Sent: Monday, December 4, 2023 5:20 PM
To: Emily Bare <bare@ci.cannon-beach.or.us>
Cc: LESLIE FRANCE <franbat86@msn.com>
Subject: CU #23-04 Violation of delineated wetlands

As a home owner across the street from the wetlands I am concerned about this continuous attempt to violate a delineated wetland. It is making me wonder what is really being covered up?
Wetlands are protected for very good reasons as they perform some very essential functions.
Wetlands lessen the the damage from flooding by temporarily storing the excess water.
They also provide a habitat for wild life.
I own tax lot 4200
I am very concerned about these continual attempts to violate the wetlands.
Bill

William Reiersgaard
rackerbill@aol.com

NOTICE OF PUBLIC HEARING
CANNON BEACH PLANNING COMMISSION

The Cannon Beach Planning Commission will hold a public hearing on **Tuesday, December 19, 2023,** at **6:00 p.m.** at City Hall, 163 E Gower Street, Cannon Beach, regarding the following:

> ZO #23-03 CIDA proposed Comprehensive Plan Amendment & Zone Change for Taxlot 41006B000200, an undeveloped property located at 81389 N HWY 101. The property is currently zoned (IR) Institutional Reserve, and the request is to change the zoning classification to (IN) Institutional. The request will be reviewed under Municipal Code section 17.86, Amendments, provisions established.

All interested parties are invited to attend the hearings and express their views. Statements will be accepted in writing or orally at the hearing. Failure to raise an issue at the public hearing, in person or by letter, or failure to provide statements or evidence sufficient to afford the decision maker an opportunity to respond to the issue precludes appeal to the Land Use Board of Appeals based on that issue.

Correspondence should be mailed to the Cannon Beach Planning Commission, Attn. Community Development, PO Box 368, Cannon Beach, OR 97110 or via email at planning@ci.cannon-beach.or.us. Written testimony received one week prior to the hearing will be included in the Planning Commissioner's meeting materials and allow adequate time for review. Materials and relevant criteria are available for review at Cannon Beach City Hall, 163 East Gower Street, Cannon Beach, or may be obtained at a reasonable cost. Staff reports are available for inspection at no cost or may be obtained at a reasonable cost seven days prior to the hearing. Questions regarding the applications may be directed to Robert St. Clair, 503-436-8053, or at stclair@ci.cannon-beach.or.us.

The Planning Commission reserves the right to continue the hearing to another date and time. If the hearing is continued, no further public notice will be provided. The hearings are accessible to the disabled. Contact City Manager, the ADA Compliance Coordinator, at (503) 436-8050, if you need any special accommodations to attend or to participate in the meeting. TTY (503) 436-8097. Publications may be available in alternate formats and the meeting is accessible to the disabled.

Robert St. Clair
City Planner

Posted/Mailed: 11/29/23

NOTICE TO MORTGAGEE, LIEN-HOLDER, VENDOR OR SELLER:
PLEASE PROMPTLY FORWARD THIS NOTICE TO THE PURCHASER

CONDUCT OF PUBLIC HEARINGS BEFORE CANNON BEACH CITY COUNCIL and PLANNING COMMISSION

A. At the start of the public hearing, the Mayor or Planning Commission Chair will ask the following questions to ensure that the public hearing is held in an impartial manner:

1. Whether there is a challenge to the jurisdiction of the City Council or Planning Commission to hear the matter;

2. Whether there are any conflicts of interest or personal biases to be declared by a Councilor or Planning Commissioner;

3. Whether any member of the Council or Planning Commission has had any ex parte contacts.

B. Next, the Mayor or Planning Commission Chair will make a statement which:

1. Indicates the criteria which apply to the action;

2. Cautions those who wish to testify that their comments must be related to the applicable criteria or other criteria in the Comprehensive Plan or Municipal Code that the person testifying believes apply;

3. States that failure to raise an issue in a hearing, or failure to provide statements or evidence sufficient to afford the decision makers an opportunity to respond to the issue precludes appeal based on that issue;

4. Prior to the conclusion of the initial evidentiary hearing, any participant may request an opportunity to present additional evidence or testimony regarding the application. The City Council or Planning Commission shall grant such request by continuing the public hearing or leaving the record open for additional written evidence or testimony.

C. The public participation portion of the hearing will then proceed as follows:

1. Staff will summarize the staff report to the extent necessary to enable those present to understand the issues before the Council or Planning Commission.

2. The Councilors or Planning Commissioners may then ask questions of staff.

3. The Mayor or Planning Commission Chair will ask the applicant or a representative for any presentation.

4. The Mayor or Planning Commission Chair will ask for testimony from any other proponents of the proposal.

5. The Mayor or Planning Commission Chair will ask for testimony from any opponents of the proposal.

6. Staff will be given an opportunity to make concluding comments or respond to additional questions from Councilors or Planning Commissioners.

7. The Mayor or Planning Commission Chair will give the applicant and other proponents an opportunity to rebut any testimony of the opponents.

8. Unless continued, the hearing will be closed to all testimony. The Council or Planning Commission will discuss the issue among themselves. They will then either make a decision at that time or continue the public hearing until a specified time.

NOTE: Any person offering testimony must first state their name, residence, and **mailing address** for the record. If representing someone else, the speaker must state whom he represents.

Printed 10 / 6 / 2023

TAXLOTKEY	OWNER_LINE	STREET_ADD	CITY	STATE	ZIP_CODE
51030DA05600	Cook Dale Michael	229 N Lloyd Circle	Idaho Falls	ID	83402
51030DA05700	Tye Karen Y	PO Box 976	Cannon Beach	OR	97110
51030DA11400	Korinsky Pamela	2111 Hammock Pine Blvd	Clearwater	FL	33761
51030DA06902	Handel Robert B	157 Haslemere Ct	Lafayette	CA	94549
51030DA04700	Alleva Fileno A	28725 NE Tolt Hill Rd	Carnation	WA	98014
51030DA05900	Popp Daniel K	27935 NE 26th St	Redmond	WA	98053
51030DA05500	Salemann Emily	PO Box 1357	Fall City	WA	98024
51030DA04103	Henry John M	111 Reston Ln	Gilberts	IL	60136
51030DA04104	Quails Cove LLC	4955 NW 162nd Ter	Portland	OR	97229
51030DA05502	Cook Dale Michael	229 N Lloyd Circle	Idaho Falls	ID	83402
51030DA11500	Sullivan Daniel A	3201 W 32nd Ave	Anchorage	AK	99517
51030DA02400	Hay Family Limited Partnership	5 Centerpointe Dr Suite #590	Lake Oswego	OR	97035
51030DA04100	Patrick/Dave LLC	3514 NE US Grant Pl	Portland	OR	97212
51030DA04102	Cardwell Dana Lynn Hartje	171 Terrance Loop	Bozeman	MT	59718
51030DA04204	Hanna Judith K Revocable Trust	24451 SW Valley View Rd	West Linn	OR	97068
51030DA07100	Martin Joshua	1575 Edgewater Ct	West Linn	OR	97068-2772
51030DA11600	Gonzalez Patricia J	6501 113th Pl SE	Bellevue	WA	98006
51030DA02300	Hay Family Limited Partnership	5 Centerpointe Dr Suite #590	Lake Oswego	OR	97035
51030DA04600	Klonoff Robert	PO Box 902	Cannon Beach	OR	97110
51030DA08901	McDonald Mary Lisa	1427 Horseshoe Curve	Lake Oswego	OR	97034
51030DA04105	Snyder Ryan C/Stephanie	PO Box 219	Cannon Beach	OR	97110-0219
51030DA04200	Reiersgaard William L	2600 SE Ellsworth Rd	Vancouver	WA	98664
51030DA04201	Bernards Dale W/Karen L		Portland	OR	97258
51030DA04300	WJ Investments	2600 SE Ellsworth Rd	Vancouver	WA	98664-5357
51030DA08902	Fransen Larissa	252 Peakview Rd	Boulder	CO	80302
51030DA09200	Zimmers Zak F TR	1205 NE Conroy Pl	Corvallis	OR	97330-6804
51030DA04101	Snyder Ryan	PO Box 219	Cannon Beach	OR	97110
51030DA04500	Nicholson Drake	1802 SW Black Lake Blvd #301	Olympia	WA	98512
51030DA06900	Graves Judy J	6611 SE Yamhill Ct	Portland	OR	97215-2036
51030DA07400	Gray Frederick T	PO Box 1248	Cannon Beach	OR	97110
51030DA06901	Snider Martin	2219 Margaret Ct	Redondo Beach	CA	90278
51030DA09100	Sprague William B Jr Rev Trust 1/2	2915 Arbor Dr	West Linn	OR	97068-1107
51030DA04400	Riverdale Investment LLC	2600 SE Ellsworth Rd	Vancouver	WA	98664-5357

51030DA05800	Heath Diego Salvatore	PO Box 6	Cannon Beach	OR	97110
51030DA08903	Avila Juan Antonio	9810 112th Ave NE	Kirkland	WA	98033
51030DD00100	Tutmarc Michael	3857 45th Ave NE	Seattle	WA	98105-5450
51030DA09000	Wilson Scott W	3460 Kiowa Blvd N	Lake Havasu City	AZ	86404
51030DA08900	Louie Steven K	7629 122nd Pl SE	Newcastle	WA	98056
51030DA09300	Zimmers Zak F TR	1205 NE Conroy Pl	Corvallis	OR	97330-6804
51030DA07200	Kuester Stephen	230 Powderhorn Ct	Spearfish	SD	57783
51030DA11300	Mast James L	2415 SW Ivon St	Portland	OR	97202
51030DA07000	Sakai Lynn Y	6485 SW Murray Blvd	Beaverton	OR	97008-4907
51030DA07300	Gray Frederick T	PO Box 1248	Cannon Beach	OR	97110-1248

CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

Cannon Beach Planning Commission

Staff Report:

PUBLIC HEARING AND CONSIDERATION OF CU 23-03, CIDA, APPLICANT, ON BEHALF OF THE CITY OF CANNON BEACH, REQUEST FOR A CONDITIONAL USE PERMIT FOR A MUNICIPAL BUILDING IN A LIMITED COMMERICAL (C1) ZONE AT 163 E. GOWER ST. (TAXLOTS 11900 AND 12000, MAP 51030AD). THE PROPERTY IS CURRENTLY DEVELOPED WITH A MUNICIPAL BUILDING HOUSING THE CITY OF CANNON BEACH CITY HALL. THE CONDITIONAL USE REQUEST WILL BE REVIEWED AGAINST THE CRITERIA OF CANNON BEACH MUNICIPAL CODE, SECTION 17.22, LIMITED COMMERCIAL (C1) ZONE; AND 17.80, CONDITIONAL USES.

Agenda Date: December 19, 2023 **Prepared By**: Community Development Department

GENERAL INFORMATION

NOTICE

Public notice for this December 19, 2023 Public Hearing is as follows:

A. Notice was posted at area Post Offices on November 29, 2023;

B. Notice was mailed on November 29, 2023 to surrounding landowners within 250' of the exterior boundaries of the property.

DISCLOSURES

Any disclosures (i.e. conflicts of interest, site visits or ex parte communications)?

EXHIBITS

The following Exhibits are attached hereto as referenced. All application documents were received at the Cannon Beach Community Development office on November 28, 2023 unless otherwise noted.

"A" Exhibits – Application Materials

A-1 CU#23-03 Application with project narrative and schematics

A-2 Report of Geotechnical Engineering Services, Geotech Solutions Inc., dated July 31, 2023

"B" Exhibits – Agency Comments

None received as of this writing;

"C" Exhibits – Cannon Beach Supplements

C-1 CU#23-03 Completeness determination, November 29, 2023

C-2 SRG City Hall Police Station Facility Report, dated December 18, 2018

"D" Exhibits – Public Comment

None received as of this writing

SUMMARY & BACKGROUND

The applicant, CIDA, on behalf of the City of Cannon Beach, requests a conditional use permit for the construction of a government structure in the Limited Commercial (C1) zone. The proposed new structure will be a replacement of the existing City Hall building which the City is seeking to replace as the current structure has been determined to have reached the end of its economical lifespan and is no longer considered suitable for continuing use due by the City.

The proposed replacement will be a 10,609 square foot single story building that will be constructed to meet current building and design standards.

After evaluating multiple potential sites the City has determined the existing location to be the best available option for the siting of a replacement City Hall due to the availability of developable land with supporting infrastructure and ease of public accessibility.

APPLICABLE CRITERIA

Limited Commercial (C1) Zone, Chapter 17.22

17.22.030(C) – Conditional Uses Permitted

In a C1 zone the following conditional uses and their accessory uses are permitted subject to the provisions of Chapter 17.80:

C. Government structure of use other than a park, including public parking and public schools.

Staff Comment: The proposed replacement City Hall meets this definition and would functionally be a like-for-like replacement of the existing use on the property.

17.22.050 – Standards

In a C1 zone, the following standards shall apply except as they may be modified through the design review process pursuant to Chapter 17.44:

A. Lot Size. None, except that the density of multifamily dwellings shall be five thousand square feet for the first unit of the multifamily dwelling plus two thousand five hundred square feet for each additional unit, except that there is no density standard for multifamily dwellings used for long-term rental purposes (thirty days or more) and where a deed restriction is recorded preventing the multifamily dwelling from conversion to condominium use, or similar individual ownership arrangement, or use as a short-term rental pursuant to Chapter 17.77; and the maximum density of assisted living facilities shall be one residential unit per one thousand square feet of site area.

Staff Comment: Taxlot 11900 has an area of 10,011 square feet and Taxlot 12,000 has an area of 22,970 square feet. Residential development will not be part of this project.

B. Lot Dimension.

1. Lot Width and Depth. None.

2. *Yards. None, except where a lot is adjacent to an R1, R2, R3, or MP zone, the same yard as in the abutting residential zone shall apply.*

3. *Yard Abutting the Ocean Shore. For all lots abutting the ocean shore any yard abutting the ocean shore shall conform to the requirements of Section 17.42.050(A)(6), Oceanfront setback.*

Staff Comment: Properties to the south and east of the subject property are zoned Residential Medium Density (R2), the required yards for these properties are 15 feet from the front and rear and 5 feet for the sides. The site plan shows the proposed new City Hall having a 20 foot deep landscaping buffer to the south and the off-street parking area on the eastern portion of the property. The off-street parking area will have a vegetated buffer between the parking stalls and the eastern property boundary.

C. *Building Height. Maximum height of a structure is twenty-four feet, measured as the vertical distance from the average elevation of existing grade to the highest point of a roof surface of a flat roof, to the top of a mansard roof or to the mean height level between the eaves and the ridge for a pitched roof. The ridge height of a pitched roof shall not exceed twenty-eight feet. Pitched roofs are considered those with a 5-12 pitch or greater.*

Staff Comment: The proposed building is low lying in form and will not exceed 24 vertical feet above grade.

D. *Signs. As allowed by Chapter 17.56.*

Staff Comment: Signage is not proposed as part of this application. Signage for the City Hall replacement project will be evaluated during the development review process.

E. *Parking. As required by Section 17.78.020. The required off-street parking spaces can be provided anywhere within the downtown commercial district, as identified in Figure 1 (at the end of this chapter).*

Staff Comment: The proposed site plan shows 26 off-street parking spaces, an increase over the current amount of off-street parking available currently. Provisions regarding downtown parking requirements are not applicable to this application.

F. *Design Review. Design review requirements of Chapter 17.44 shall be met.*

Staff Comment: As this would be a non-residential project the plans will be reviewed by the Design Review Board at the time of application for structural development.

G. *Geologic or Soils Engineering Study. As required by Chapter 17.50.*

Staff Comment: Exhibit A-2 is a geotechnical report prepared by Geotech Solutions Inc. in July 2023 which states that redevelopment of the property for the intended use is feasible so long as specific recommendations detailed in that report are followed during design and construction. These recommendations address earthwork, seismic issues, foundation piling, hardscaping, and stormwater management.

H. *Outdoor Merchandising. As allowed by Section 17.90.150.*

Staff Comment: This criterion is not applicable to this application.

I. *A minimum landscaping border of three feet shall be provided between the sidewalk and the frontage of all buildings facing the street. The planning commission may grant exceptions to this standard for doors and entries to buildings or where a combination of seating and landscaping is provided. Such landscaping may be part of the required landscaping specified in Section 17.44.120.*

Staff Comment: The proposed site plan shows a 3 foot landscaping buffer between the northern wall of the proposed building and the sidewalk along E. Gower St. When more developed plans are submitted for design review adherence to this standard will receive additional review.

J. *Floor Area Ratio. The floor area ratio for buildings located in the downtown commercial district, as identified in Figure 1 (at the end of this chapter) shall not exceed .7, except that buildings existing as of June 1, 1995, which exceed a floor area ratio of .7, may be replaced with a building(s) with a floor area ratio equivalent to that which existed on June 1, 1995.*

Staff Comment: This criterion does not apply to this application as the subject property is not in the downtown area. However, the proposed structure measures 10,609 square feet and Taxlot 12000 measures 22,970 square feet making a floor area ratio of 0.46.

K. *Vehicular Access. In the downtown commercial district, as identified in Figure 1 (at the end of this chapter), no new vehicular access onto Hemlock Street shall be permitted. Vehicular access which existed as of July 6, 1995 may continue to be utilized, including modifications thereto.*

Staff Comment: This criterion does not apply to this application.

Conditional Uses, Chapter 17.80

17.80.110 Overall Use Standards

Before a conditional use is approved, findings will be made that the use will comply with the following standards:

A. *A demand exists for the use at the proposed location. Several factors which should be considered in determining whether or not this demand exists include: accessibility for users (such as customers and employees), availability of similar existing uses, availability of other appropriately zoned sites, particularly those not requiring conditional use approval, and the desirability of other suitably zoned sites for the use.*

Staff Comment: The current City Hall building has been determined to be at the end of its economically useful lifespan. An evaluation report prepared by SRG, Exhibit C-2, states that the building was constructed around 1948 in order to support operations in the local timber industry, it has been adapted for use as a City Hall and maintained for that purpose since approximately 1969. The report describes various challenges with the existing structure and references a March 2018 report prepared by Tolovana Architect which states "the building is simply not able to be remodeled in an economic manner as compared to constructing a new facility."

B. *The use will not create excessive traffic congestion on nearby streets or overburden the following public facilities and services: water, sewer, storm drainage, electrical service, fire protection and schools.*

Staff Comment: It is not anticipated that the construction of a replacement City Hall will result in significant changes to traffic, congestion, water use, etc. Site improvements such as off-street parking would be arranged in such a way as to increase the overall amount of parking available and bring the facility into compliance with off-street parking requirements.

C. *The site has an adequate amount of space for any yards, buildings, drives, parking, loading and unloading areas, storage facilities, utilities or other facilities which are required by city ordinances or desired by the applicant.*

Staff Comment: The project will provide for adequate buffering between the subject property and the adjacent residentially zoned properties to the east and south. Along the northern edge of the structure a 3 foot landscaped buffer will be maintained between it and the sidewalk. The site plan shows three off-street ADA accessible parking spaces, with one of those adjacent to the front entrance of the building. Refuse collection will be moved to an enclosure at the southeast corner of the parking area.

D. *The topography, soils and other physical characteristics of the site are appropriate for the use. Potential problems due to weak foundation soils will be eliminated or reduced to the extent necessary for avoiding hazardous situations.*

Staff Comment: Exhibit A-2 is a geotechnical report prepared by Geotech Solutions Inc. in July 2023 which states that redevelopment of the property for the intended use is feasible so long as specific recommendations detailed in that report are followed during design and construction. These recommendations address earthwork, seismic issues, foundation piling, hardscaping, and stormwater management.

E. *An adequate site layout will be used for transportation activities. Consideration should be given to the suitability of any access points, on-site drives, parking, loading and unloading areas, refuse collection and disposal points, sidewalks, bike paths or other transportation facilities required by city ordinances or desired by the applicant. Suitability, in part, should be determined by the potential impact of these facilities on safety, traffic flow and control and emergency vehicle movements.*

Staff Comment: The proposed site plan shows that sidewalks will be repositioned in order to create a buffer between pedestrians and automobile traffic. As stated above one off-street ADA accessible parking space will be provided in close proximity to the public entrance to the building with an additional two in the main parking lot. The redevelopment of the property will not affect the existing pedestrian walkway along the eastern perimeter.

F. *The site and building design ensure that the use will be compatible with the surrounding area.*

Staff Comment: Application materials state that the proposed building and site are designed to provide a welcoming orientation and increased public gathering space for the community and that the proposed City Hall is designed to reflect the values and priorities of the community. During the pre-development review of the project, the Design Review Board will evaluate the proposal against the criterial established in CBMC 17.44, Design Review, in order to maintain the community character.

Staff Recommendation

Staff recommends approval of the application.

Procedural Requirements

This application is subject to ORS 227.178, requiring the City to take final action within 120 days after the application is deemed complete. It was submitted November 28, 2023; and determined to be complete on November 29, 2023. Based on this, the City must make a final decision before March 28, 2024.

The Planning Commission's December 19th meeting will be the first evidentiary hearing on this request. ORS 197.763(6) allows any party to request a continuance. If such a request is made, it should be granted. The Planning Commission's next regularly scheduled hearing date is Thursday, January 25, 2024.

DECISION, CONDITIONS AND FINDINGS

Motion: Having considered the evidence in the record, based on a motion from Commissioner NAME, seconded by Commissioner NAME, the Planning Commission moves to (approve/approve with conditions/deny) the CIDA application, on behalf of the City of Cannon Beach, the conditional use request for the construction of a government structure in a commercial zone, application CU#23-03, as discussed at this public meeting (subject to the following conditions):

Site Map – 163 E. Gower Ave., Taxlots 51030AD11900 and 12000

GIS information taken from City of Cannon Beach GIS records. This map is for reference only and is not a survey product.

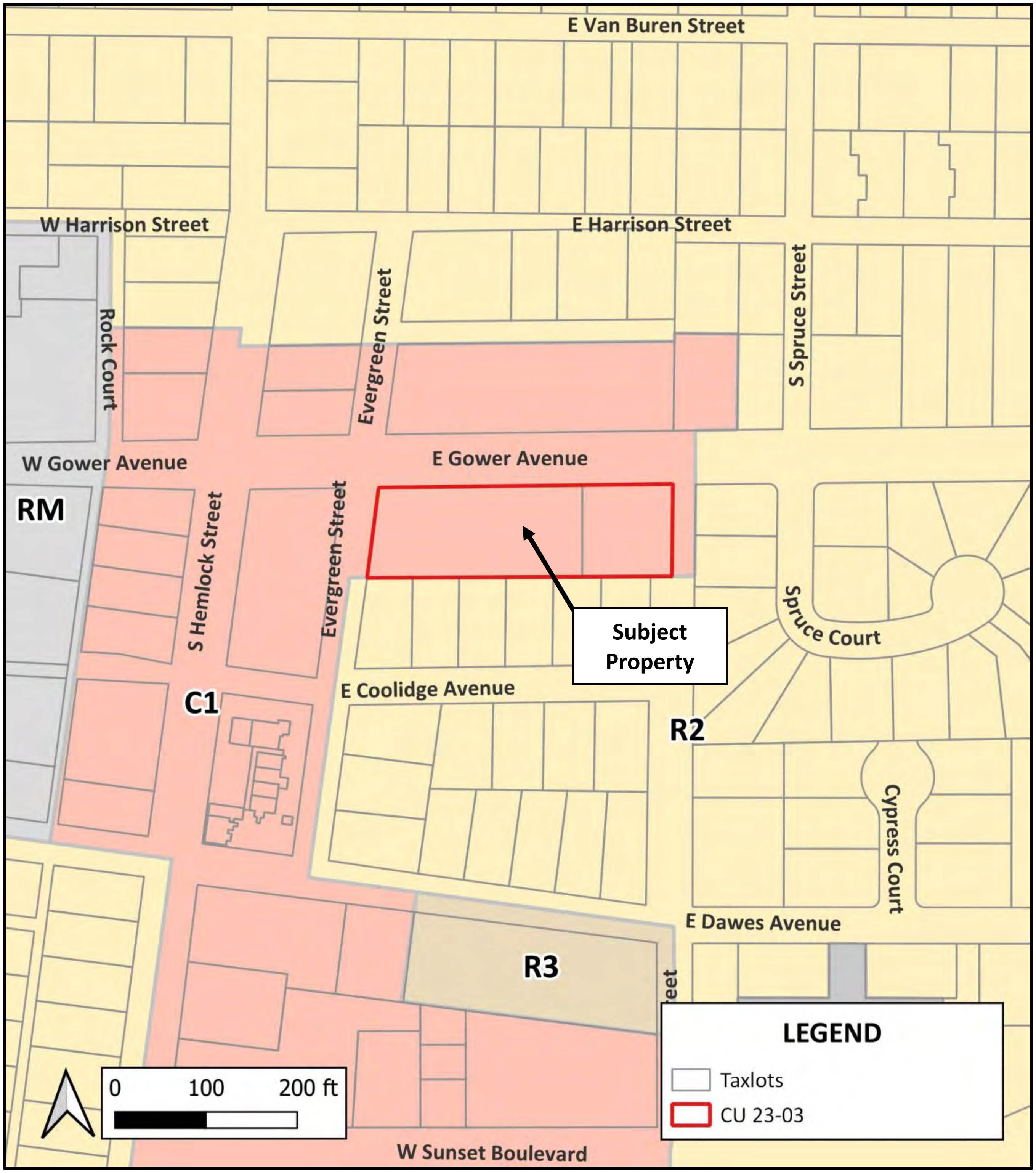


Exhibit A-1

ITY OF AN ON B ACH

CONDITIONAL USE APPLICATION

Please fill out this form completely. Please type or print.

Applicant Name: Leslie Jones, RA
Email Address: lesliej@cidainc.com
Mailing Address: 15895 SW 72nd Ave, Suite 200
Portland, OR 97224
Telephone: (503) 226-1285

Property-Owner Name: City of Cannon Beach
(if other than applicant)
Mailing Address: 163 E. Gower, Cannon Beach, OR 97110
Telephone: (503) 436-1581
Property Location: 163 E. Gower, Cannon Beach, OR 97110
(street address)
Map No.: 5.10.30AD Tax Lot No.: 12000

CONDITIONAL USE REQUEST: See attached Project Memorandum / Supplemental Information for responses to items 1 and 2 below.

1. Description of the proposal.

2. Justification of the conditional use request. Explain how the request meets each of the following criteria for granting a conditional use.

   a. Explain how a demand exists for the use at the proposed location. Several factors which should be considered include: accessibility for users (such as customers and employees); availability of similar existing uses; availability of other appropriately zoned sites, particularly those not requiring conditional use approval; and the desirability of other suitably zoned sites for the use.

   b. Explain in what way(s) the proposed use will not create traffic congestion on nearby streets or over-burden the following public facilities and services: water, sewer, storm drainage, electrical service, fire protection and schools.

c. Show that the site has an adequate amount of space for any yards, buildings, drives, parking, loading and unloading areas, storage facilities, utilities, or other facilities which are required by City Ordinances or desired by the applicant.

d. Show that the topography, soils, and other physical characteristics of the site are appropriate for the use. Potential problems due to weak foundation soils must be shown to be eliminated or reduced to the extent necessary for avoiding hazardous situations.

e. Explain in what way an adequate site layout will be used for transportation activities. Consideration should be given to the suitability of any access points, on-site drives, parking, loading and unloading areas, refuse collection and disposal points, sidewalks, bike paths or other transportation facilities required by City ordinances or desired by the applicant. Suitability, in part, should be determined by the potential impact of these facilities on safety, traffic flow and control and emergency vehicle movements.

f. Explain how the proposed site and building design will be compatible with the surrounding area.

Use extra sheets, if necessary, for answering the above questions. Attach a scale-drawing showing **t**he dimensions of the property, adjacent street(s), dimensions of existing structure, and dimensions of proposed development.

Application Fee: $750.00

Applicant Signature: ______________________________ Date: 11/28/2023
Property Owner Signature: ______________________________ Date: __________________

If the applicant is other than the owner, the owner hereby grants permission for the applicant to act on his/her behalf. Please attach the name, address, phone number, and signature of any additional property owners.

For Staff Use Only:

Date Received: ____________________________ By: ____________________________________
Fee Paid: ________________________________ Receipt No.: ____________________________
(Last revised March 2021)

CONDITIONAL USE PERMIT - GENERAL INFORMATION

What is a Conditional Use Permit?

Land use on all property in Cannon Beach is governed by zoning districts established by the City Council. Cannon Beach has two main types of zoning districts: residential and commercial. Within each of these main categories there are specific zoning districts, such as Medium Density Residential, R-2, and High Density Residential, R-3. Every zoning district has a list of permitted uses and a list of uses that are only allowed after being approved for a conditional use permit. For example, on property zoned R-2, Medium Density Residential, a single-family dwelling is allowed outright, but a church would be allowed only if approved under a conditional use permit.

The Purpose of Conditional Use Permits

Certain uses by their very nature need special consideration before they can be allowed in a particular zoning district. The reasons for requiring such special consideration involve, among other things, the size and intensity of the use, traffic generated by the use and compatibility of the use with the area. These issues are addressed through the conditional use permit process which involves a public hearing before the Planning Commission.

Application and Processing.

If the use you wish to establish on your property requires a conditional use permit, the first step is to informally discuss your proposal with the City Planner. Applications may be submitted by the property owner or an authorized agent. An application should include a detailed statement of the proposed use and a plot plan showing the development of the site. After you submit a completed application, accompanied by a fee to help defray the cost of processing, the City will begin processing your conditional use application.

Public Hearing - Planning Commission.

Conditional use permit requests are considered by the Cannon Beach Planning Commission at a public hearing. Hearings for conditional use permits will be held within 40 days after the application is submitted. Notice of the hearing is mailed to the applicant and to property owners with 250 feet of the site in question. Prior to public hearing, the City Planner will prepare a written report on the request. The report will contain the background of the request and a recommendation based on an investigation of the facts of the proposal and how they pertain to the criteria for granting a conditional use permit. A copy of the report will be mailed to the applicant. Anyone interested in the application may request a copy of the report. At the public hearing, the property owner desiring the conditional use permit has the burden of establishing that the requested conditional use meets the criteria in the Zoning Ordinance. Other people will be given the opportunity to speak in favor of the request, offer comments, ask questions, and/or speak in opposition. At the end of the hearing, the Planning Commission will approve, approve with conditions, or deny the conditional use request.

Appeals to the City Council.

Appeals of the Planning Commission action must be made within 20 days of the decision. The basis of the written appeal must be that the Planning Commission made an error in its decision. The applicant may ask for a new hearing before the City Council or request that the City Council review the Planning Commission record established in making its decision. The City Council may either uphold, reverse or place conditions upon the Planning Commission decision.

Exhibit A-1

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WWW.CIDAINC.COM

Project Memorandum

Project No:	220234.02	Date:	11.28.2023
Project Name:	Cannon Beach – City Hall		
Subject:	Conditional Use Application Response Summary		
By:	Leslie Jones		
To:	Planning Commission		

SUPPLEMENTAL INFORMATION IN SUPPORT OF THE CONDITIONAL USE APPLICATION

1. Description of the proposal.

   The proposed project is the design and construction of a new City Hall and associated site improvements on the site of the existing City Hall. Based on the 2018 Building System Analysis by Tolovana Architects, the existing City Hall - built as a building supply store and home to City Hall since 1969 - has exhausted its useful life and "the building is simply not able to be remodeled in an economic manner as compared to constructing a new facility." The existing City Hall is proposed to be demolished and a new building constructed in its place to meet current building and design standards.

2. Justification for the conditional use request. Explain how the request meets each of the following criteria for granting a conditional use.

   a. Explain how a demand exists for the use at the proposed location. Several factors which should be considered include: accessibility for users (such as customers and employees); availability of similar existing uses; availability of other appropriately zoned sites, particularly those not requiring conditional use approval; and the desirability of other suitably zoned sites for the use.

      - *The existing City Hall has been located on its current site, in the heart of Mid-town, since approximately 1969. Based on community feedback, the existing location is both familiar and convenient for residents. We propose to maintain the new building in the same location on the Gower Street site, as approved by City Council on June 13, 2023.*

        The existing Limited Commercial (C1) zone remains an appropriate zone for the proposed use as Government Structures are allowed as a conditional use. Properties zoned for allowance of government structures outright, (i.e. General Commercial – C2) are less centrally located on the east side of Highway 101 and would present increased hazard for residents, particularly pedestrians, accessing City services. Moreover, the primary office function of the City Hall is similar to, and compatible with, commercial structures in the C1 zone.

   b. Explain in what way(s) the proposed use with not create traffic congestion on nearby streets or over-burden the following public facilities and services: water, sewer, storm drainage, electrical service, fire protection and schools.

      - *Site improvements associated with the proposed new building include increasing on-site parking capacity. The proposed parking, east of the new building, will serve City Hall staff with additional flex space for volunteers and City vehicles. No change is proposed to the public parking off Hemlock. All new parking will be designed to meet current City design standards.*

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

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Additionally, while there is no substantive change in the overall building size, the Police Department, currently housed inside the City Hall, will be relocated, thereby reducing overall traffic congestion and burden on public facilities and services.

c. Show that the site has an adequate amount of space for any yards, buildings, drives, parking, loading and unloading areas, storage facilities, utilities, or other facilities which are required by City Ordinances or desired by the applicant.

- *The existing City Hall extends up to 17" into the adjacent properties south of the subject site. The proposed new building resolves the potential intrusion onto neighboring properties and provides the required twenty-foot buffer between the proposed building and adjacent residentially zoned properties. This buffer will be planted and screened per City standards with additional consideration given to providing opportunity for community involvement in enhanced landscaping efforts. At the north property line, a three-foot buffer will be maintained between the new building and the sidewalk, and area is included for an entry pedestrian plaza. See the provided site plan for additional site amenities.*

d. Show that the topography, soils, and other physical characteristics of the site are appropriate for the use. Potential problems due to weak foundation soils must be shown to be eliminated or reduced to the extent necessary for avoiding hazardous situations.

- *The conceptual foundation design is based upon the ground and soil conditions described in the attached geotechnical report and is included in current construction cost estimates. The building's structural system will be designed to the highest safety standard under current code in order to remain operational following a seismic or wind event. Note that, based on the site elevation, a tsunami event remains a potential risk.*

e. Explain in what way an adequate site layout will be used for transportation activities. Consideration should be given to the suitability of any access points, on-site drives, parking, loading and unloading areas, refuse collection and disposal points, sidewalks, bike paths or other transportation facilities required by City Ordinances or desired by the applicant. Suitability, in part, should be determined by the potential impact of these facilities on safely, traffic flow and control and emergency vehicle movements.

- *The proposed sidewalks and curb cuts alter existing traffic patterns to enhance efficiency and safety by separating public and pedestrian access on the west side of the building from parking, loading, and refuse collection on the east side of the building. Access for emergency vehicles will be maintained and no impact is proposed to the existing pedestrian path at the eastern edge of the property.*

  In addition to the required standard and accessible parking located east of the building, new accessible parallel parking access is proposed along Gower Street near the primary building entrance.

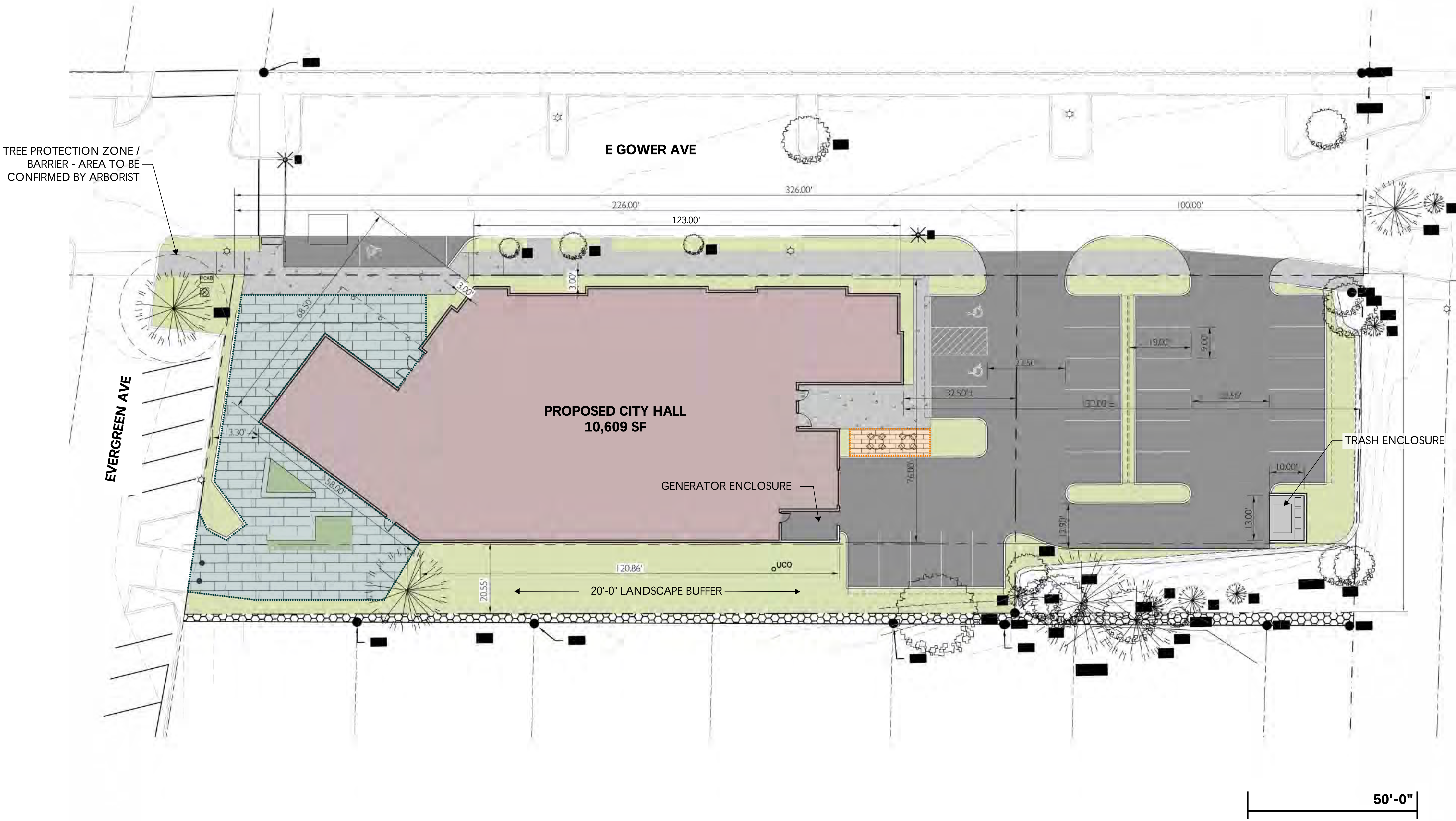
f. Explain how the proposed site and building design will be compatible with the surrounding area.

- *The proposed building and site are designed to provide a welcoming orientation and increased public gathering space for the community. Specific building elements, such as building materials, roof form, and a visual low profile, are highlighted elements of the Cannon Beach and Mid-Town vernacular. As a central feature and anchor of Mid-Town, the proposed new City Hall is designed to reflect the values and priorities of the community and to provide an efficient and attractive platform from which to offer important civic services.*

Exhibit A-1

EXISTING / DEMOLITION SITE PLAN

Exhibit A-1



PROPOSED SITE PLAN

Exhibit A-1

EXTERIOR RENDER - PUBLIC ENTRANCE

Exhibit A-1

EXTERIOR RENDER - GOWER FACADE / STAFF ENTRANCE

REPORT OF GEOTECHNICAL ENGINEERING SERVICES

Cannon Beach City Hall Improvements
163 Gower Street, Cannon Beach, Oregon

Geotech Solutions Inc.

July 31, 2023

GSI Project: cannon-22-2-gi

Geotech Solutions Inc.

July 31, 2023 *cannon-22-2-gi*

City of Cannon Beach
stdenis@ci.cannon-beach.or.us

cc: lesliej@cidainc.com; curtisg@cidainc.com

REPORT OF GEOTECHNICAL ENGINEERING SERVICES
City Hall Improvements, 163 E Gower Street
Cannon Beach, Oregon

As authorized, herein we present our report of geotechnical engineering services for the proposed improvements to City Hall at 163 East Gower Street in Cannon Beach, Oregon. We understand that the facility is to be two stories and expanded to the east and may also be used as a tsunami vertical evacuation refuge. A previous geotechnical exploration by others from 2011 was provided (attached) and also included a seismic hazard evaluation. The logs and data from that report were used as background for our analyses. In our opinion the previous report is suitable for the seismic hazard aspects other than liquefaction and site class, as those criteria and standard methods have changed since 2011. The accepted and suitably addressed issues are seismic sources, faults and rupture, and dynamic slope stability, and those seismic hazard elements were therefore not a part of our scope but are appended herein. The previous report also included detailed description of site geology by a qualified certified engineering geologist (CEG). Tsunami modeling and mapping has been updated since that report but did not change the scenario that inundation is likely even in a moderate design CSZ interface earthquake.

The purpose of our work was to conduct additional explorations to the east of the existing buildings, and analyze the conditions to provide upgraded recommendations for building foundations and related building seismic design. Specifically, our scope included the following:

- Provide principal level geotechnical project management including a site reconnaissance, review of provided information, client communications, and review of analyses, reports, and standard format invoicing.
- Explore subsurface conditions by advancing two CPT probes in the east lot gravel area to depths of up to 40 feet or refusal with ppd testing and shear wave velocity readings in each.
- Complete detailed liquefaction analyses of site soils and estimate liquefaction induced deformations and provide qualitative means to reduce or address deformations as needed.
- Provide recommendations for earthwork including suitable fill materials, seasonal material usage, compaction criteria, utility trench backfill, and need for subsurface drainage.
- Provide recommendations for asphalt concrete subgrade preparation and pavement thickness for parking and driveways.
- As appropriate, provide recommendations for deep foundation support for either deep helical piers or a drilled or drilled piles, or a qualitative approach for dual-purpose ground improvement and foundation support application (such as stone columns, deep mixing, etc.). Include vertical capacity versus embedment, allowable lateral loads and related deflection, installation criteria, and geotechnical design parameters for pile caps and grade beams.
- Provide a PE/GE stamped written report summarizing the results of our geotechnical evaluation.

20978 S Springwater Road, Estacada, OR 97023 *503.869.8679; don@geotechsolutionsinc.com*

SITE OBSERVATIONS AND CONDITIONS

Surface Conditions

The site is located at 163 E Gower Street in Cannon Beach, Oregon, and includes the single-story building in the western portion of the property with abutting planters, sidewalks, and pavement. The expansion includes going to two stories and/or two-story expansion east of the existing building. The east expansion area includes paved and gravel parking and drives and a few trees. That area has evidence of slope cuts of several feet in the east and south side of the parking area (based on visual observations and bare earth LIDAR mapping). The overall site slopes gently roughly 1% down to the west, and the existing building is roughly 750 feet east of the ocean beach and its access off Ecola Court.

Subsurface Conditions

The site was explored on July 12, 2023 with two CPT probes that are in addition to the two borings and CPT probe completed for the site in 2011. The approximate locations of our explorations are shown on the attached Site Plan, with explorations by others summarized in their attached report. According to geologic maps of the area the site is underlain by coastal terrace deposits with alluvial deposits to the west and "fingers" of alluvial deposits to the northwest and southeast. The 2011 report by others includes a detailed geological mapping description by the CEG and is appended to this report for reference and not repeated or part of the scope herein but was reviewed in a geotechnical engineering context. Soil conditions encountered are generally consistent with the marine terrace mapping, overlying older siltstone of the Astoria Formation at depth. No landslides are mapped on site, with a low risk of dynamic instability.

Subsurface conditions under gravel and pavement sections generally encountered stiff silt and fill up to 2 feet in depth, overlying soft to very soft organic silt to depths of 18 to 25 feet, in turn underlain by dense to very dense fine sand with gravel layers to depths of roughly 100 feet. Below roughly 100 feet the borings encountered massive siltstone with inferred layers of basalt intrusion in B-1 to the 121 foot depths explored.

Surface Fill - This includes the pavement and base rock and mixed fill which extended to depths of up to 2 feet in explorations. The material was generally stiff below the rock with moderate dry strength and low compressibility.

Silt with Organics - The silt unit generally transitioned from medium stiff in the top several feet to soft to very soft below that and contained organics for a discontinuous vertical extent of about 8 feet which included matted sediment/decayed material as well as intact wood at discrete layers. The total layer thickness averages about 20 feet. Organic layers were non-plastic, and inorganic portions had a moderate to high plasticity with some clay content. Moisture contents ranged from 61% to 63%. Where small dispersed organics are present, testing in this unit at the Pelican Pub 600 feet S-SW of the site ranged from 6-13% organics (a range of trace to some), and is obviously higher in actual buried wood. CPT tip resistance in this unit ranged from generally 6-20 tsf in the silt, with sand layers in P-1 ranging from 100 to 300 tsf. Blow counts from the borings (auto hammer N85) ranged from 9 to 2, generally lower with depth. Measured shear wave velocities in our CPT's ranged from 400-650 ft/sec in the silt, and up to 1100 ft/sec in some sand layers in P-1. The averaged shear wave velocity in the unit was 638 ft/sec.

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The silt has low strength and high initial and long-term compressibility. A few feet of the silts sandy layers lower in P-1 were analyzed as susceptible to liquefaction or at least strength decrease in design level seismic events at moderate to low strains, primarily at depths of 13-18 feet.

Sand - The organic silt unit was underlain by dense sand that extended below roughly 18 to 25 feet to depths to near 100 feet. CPT tip resistance in the sand was generally over 200 tsf with refusal at 500 tsf or more in gravelly sand at depths of 18 to 21 feet in the recent CPT probes. Blow counts ranged from 35 to well over 50, with the exception of one sample at 45 feet in B-1 that had a blow count of 17. Shear wave velocities in this unit measured at nearby sites and correlated from SPT blow-counts range from 1100 to 1300 ft/sec. The sand has a high static strength and low compressibility.

Siltstone - At depths of 100-101 feet in the previous borings marine siltstone was encountered that was interpreted as Astoria Formation by the CEG. Blow counts in this unit ranged from 35 to over 50 for a few inches or 30 for zero inches where inferred basalt intrusions were present below 105 feet in B-1. This material has a high strength and is not susceptible to liquefaction.

Groundwater - Pore pressure dissipation testing and free water in CPT probe holes prior to grouting indicated ground water at roughly 11 feet below the ground surface. Previous explorations noted ground water near 21 feet in depth.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on our explorations and analyses, development of the site is feasible by following recommendations provided herein. Surficial soils at the site consist of thin fills over soft silt with organics and dense to very dense sand. The silt soils are unsuitable for foundation or slab support and must be founded on piles penetrating into the very dense sand unit. Liquefaction is calculated to occur in thin layers generally near the top of the sand interface, with some near 45 feet, but at calculated low strains and low to laterally moderate deformations. Specific recommendations for site design are detailed in the following sections.

Earthwork

Preparation - Site preparation for earthwork will require removal of vegetation, existing utilities to be abandoned and existing pavements and unsuitable fill within proposed building and new pavement or hardscaping areas. Root balls from trees may extend several feet and grubbing operations can cause considerable subgrade disturbance. All disturbed material should be removed to undisturbed subgrade and backfilled with structural fill. In general, roots greater than one-inch in diameter should be removed.

Stabilization and Soft Areas - After stripping, we should be contacted to evaluate the exposed subgrade. This evaluation can be done by proof rolling or probing. Soft areas will require overexcavation and backfilling with well graded, clean angular gravel or clean sand compacted as structural fill.

Working Blankets and Haul Roads - Construction equipment should not operate directly on the subgrade when wet, as it is susceptible to disturbance and softening. Existing gravel and pavement, or new rock working blankets and haul roads placed over a the preceding geosynthetic can be used to protect subgrades. We recommend that sound, angular, pit run or crushed basalt with no more than 6 percent passing a #200 sieve be used to construct haul roads and working blankets. Working blankets should be at least 12 inches thick, and haul roads at least 18 inches thick. These can be reduced to 9 and 14 inches, respectively, with the use of the preceding geogrid.

The preceding rock thicknesses are the minimum recommended. Subgrade protection is the responsibility of the contractor and thicker sections may be required based on subgrade conditions and type and frequency of construction equipment.

Imported Granular Fill - Imported granular fill, such as clean sand or rock, should have a maximum particle size of 6-inches, be well graded, and have less than 6 percent passing the #200 sieve. This material should be compacted to 95 percent relative to ASTM D 1557.

Trenches - Utility trenches may encounter groundwater seepage and severe caving and flowing should be expected where seepage is present and in soft and/or loose soils. Shoring of utility trenches will be required for depths greater than 4 feet. We recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation.

Pipe bedding should be installed in accordance with the pipe manufacturers' recommendations. If groundwater seepage is present in the base of the utility trench excavation, we recommend over-excavating the trench by 12 to 18 inches and placing trench stabilization material in the base. Trench stabilization material should consist of well-graded, crushed rock or crushed gravel with a maximum particle size of 4 inches and be free of deleterious materials. The percent passing the U.S. Standard #200 Sieve shall be less than 6 percent by weight when tested in accordance with ASTM C 117.

Trench backfill above the pipe zone should consist of well graded, angular crushed rock or sand fill with no more than 7 percent passing a #200 sieve. Trench backfill should be compacted to 92 percent relative to ASTM D 1557, and construction of hard surfaces, such as sidewalks or pavement, should not occur within one week of backfilling.

Slopes - Temporary slopes may be inclined up to 2H:1V for slopes up to 8 feet high. Such slopes should be expected to erode somewhat, depending on weather conditions and duration of exposure, and in the winter should be covered with weighted plastic sheeting. Permanent slopes should be inclined no steeper than 2H:1V for slopes up to 6 feet high. Erosion control is critical to maintaining slopes and drainage must be routed away from slope faces.

Seismic Issues

Liquefaction - The critical liquefaction triggering event at the site is a Cascadia subduction zone earthquake with an expected Magnitude of 8.5 to 9.0 and PGA_M of 1.02g with a 2% chance of being exceeded in 50 years. Strains at that level of shaking become asymptotic, so similar liquefaction deformation is also expected with much lower and higher CSZ interface quakes and accelerations. Using the CPT and B-1 profiles, we analyzed liquefaction and deformations using several methods incorporated into the CLiq software program and SPT methods by authors Idriss, Tokimatsu, Seed, Seed and Fear, and others. We evaluated sensitivity to fines content, relative density, unit weight, slope and free face dimensions and proximity, and several other variables to estimate site deformations. An example calculation output for P1 is attached for reference. Based on this, liquefaction and strength reduction induced settlement can occur in layers at depths between 13 and 19 feet in P-1, and less in other explorations, and in a thin layer represented by one sample near 45 feet in B-1. Free field settlement is estimated at less than 1 inch (roughly 0.5 inches from the 45-foot-deep layer), with lateral spreading toward the ocean calculated to be up to 3.5 inches. Differential lateral spreading is likely half of that. Controlling lateral spreading was the "gently sloping" model versus the "free face" model of the distant ocean and low walls 750 feet west. Previous reporting used appropriate methods for that time, which are super-ceded by methods used in our analyses. Use of more detailed (with no more detailed input) finite element models of deformation are not a part of this scope and in our opinion are not justified due to the modest movement and resulting recommendations to structural systems which are not likely to be improved by such analyses.

Seismic Site Class - We used procedures from ASCE 7-22 to determine the seismic site class. Site soils technically correspond to Site Class F although liquefaction is limited. However, in accordance with the building code for short appropriate response periods the subject project soils could have structural seismic lateral forces evaluated using the parameters associated with Site Class D. Other code criteria may impact this classification.

Shear wave velocities in the upper silt unit were measured, and in the sand were obtained from nearby experience and correlation with the SPT blow counts in the borings. The weighted average of the velocities in the top 30 meters (approx. 100 feet) is used to determine the "Vs_{30}" site class, as well as other criteria to capture the site response character. As the organic vertical extent was less than 10 feet, and the soft silt less than 25 feet, other criteria for Class E were not met. The calculation sheet for Vs_{30} is attached. We calculated site class to be Class CD near the margin of Class D, and we therefore recommend using Class D as it is more conservative and would capture the variability in the profile.

Tsunamis and Coseismic Subsidence - DOGAMI 2013 tsunami mapping indicates the site will be inundated by a "medium slip" CSZ interface event or larger, and a distant Alaskan event, which is consistent with the information in the 2011 report. The structural engineer must design accordingly. The existing ground surface may drop an estimated 6 to 7 feet (ASCE 7-22) in elevation after a design level earthquake. This may impact flood elevations and tsunami inundation, as well as re-occupancy and vertical evacuation design.

Pile/Pier Foundations

General - Due to the presence of highly compressible silt soils all foundations and slabs must be supported on piles embedded into the lower dense sand unit. Based on our explorations, the top of the lower sand unit ranged from 19 to 25 feet below the ground surface. Capacities listed herein may be limited by the structural capacity of the pile and must be evaluated by a structural engineer. Piles/piers must be spaced a minimum of 3 pile diameters apart. Closer spacing will result in a reduction in pile/pier capacity resulting from group effects and we must be consulted. Fills greater than two feet above existing grades will induce down-drag on the piles and are not recommended.

Piles in a fixed condition in pile caps or within continuous grade beams are recommended. Due to the risk of long-term settlement in the silt with organics, as well as differential lateral movement from liquefaction, we recommend floors be designed as structural to free span between grade beams or be directly pile supported. Interior unsupported slabs-on-grade are not recommended.

Helical piers may be the most economical approach if they can reach suitable penetration. Grouted micropiles are more expensive but would have greater capacity and are more likely to advance through larger organics. The following sections discuss helical piers and grouted micropiles in more detail.

Helical Piers - Installation of helical piers may not be feasible to the required depths, and reaching these depths must be proven with the use of indicator piers. These depths must include both helixes being interpreted as being embedded in dense or better sand. If penetration is proven feasible, helical piers can be used to support vertical loads, and inclined piers can be used to provide greater lateral resistance. 3.5-inch diameter shafts are recommended due to penetration, efficient load use, lateral resistance, seismic motions, and related scour. Piers are generally installed in 5- to 7-foot-long sections and threaded, or sleeved and double/triple bolted pier shaft connections are required to reduce lateral deflection. A hydraulic motor mounted to an excavator is typically used for installation and observed torque during installation (with calibrated load devices) is used to confirm capacity, typically with a K factor of 7 for 3.5" shafts. Indicator piers are required prior to final design and construction to evaluate the feasibility of penetration to the required depths. Organics or the high density of the sand unit may present refusal short of the required depths, in which case predrilling or modification of the pier helixes may be required.

We recommend vertical piers with the following allowable capacities be used for design, with a minimum pier spacing (vertical and horizontal) of three helix diameters. Resistance to lateral loading of 2 kips per pile is allowed for vertical piles, and piles battered up to 30 degrees from vertical can be designed to the horizontal vector of the preceding loads in the direction of downward batter, and 90% in the opposite direction. All helical piers must be galvanized, or corrosion protected. Again, the following can only be used if the dense sand unit is penetrated to develop the needed torque. Plates larger than 12 inches are not recommended due to anticipated penetration issues, unless proved otherwise by indicator piling.

Helical Pier Type	Inclination	Est. Length (ft)	Allowable Load* (kips)
8" and 10" Double with 3-1/2" pipe with threaded or sleeved and double bolted connection	Vertical	25-30	40 (C), 36 (T)

* C – Compression T – Tension

Capacities for additional pier sizes and inclinations can be provided upon request. We recommend that we be retained to review pier support design and be called to the site to observe pier installation.

Grouted Micropiles - Grouted micro-piles are a higher capacity option for building and slab support that can often penetrate obstructions and reach suitable embedment better than helical piers. As building loads are expected to be modest for a two-story building, 6-inch diameter grouted Titan 40/16 micropiles would be a reasonable approach, although other types and sizes can be proposed and may be viable. Embedment for the 40/16 grouted piles must be at least 10 feet into the dense lower sand unit. At 10 feet into the sand unit, a downward vertical allowable load of 70 kips can be used for design, at estimated total lengths of 30-35 feet. For the preceding pile, an allowable uplift capacity of 60 kips may be used. Higher capacities of 100 kips downward and 90 kips in uplift can be obtained from penetration of 30 feet into the sand (depths of 50-55 feet), which would also be below the one thin liquefaction layer in B-1 near 45 feet (that has one-half inch of calculated settlement). Resistance to lateral loading of 3 kips per pile is allowed for vertical piles, and for piles battered up to 30 degrees from vertical the horizontal vector of the preceding loads could be used in the direction of downward batter, with 90% of that in the opposite direction.

Capacities for additional pile sizes and inclinations can be provided upon request. We must be retained to review pile support design and called to the site to observe installation of piles.

Grade Beams - Isolated pile caps are not allowed. All piles must be embedded into self-supporting grade beams (with no long-term lateral soil restraint or subgrade support except during placement) or be pile-columns properly connected with beams for lateral continuity. We recommend perimeter grade beams or a continuous pile cap around the building perimeter to help resist tsunami scour damage and aid in post tsunami egress. These beams/caps should be embedded at least 3 feet below exterior perimeter grade. To improve tsunami scour, exterior perimeter abutting grades should be paving or sidewalk a distance of at least 4 feet out from the building perimeter, or alternatively have a wire mesh gabion rock mattress installed below surface features and at least 6 feet in width. Lateral load resistance of a 200 pcf equivalent fluid can be used below the top foot of the side of grade beams for wind and seismic forces, but not tsunami forces. Grade beam base friction must be neglected due to long term settlement.

Slabs - Slabs must be structural and designed to free span between pile caps and pile supported grade beams. A vapor barrier is required on the base rock – refer to ***Ground Moisture*** herein.

Hardscaping

Exterior perimeter abutting grades should be paving or sidewalk a distance of at least 4 feet out from the building perimeter on each side to reduce tsunami scour. Abutting planters are not recommended unless an underlying gabion rock mattress is used below it out past it and to a distance of 6 feet from the building. Due to modest expected deformations, abutting hardscaping such as sidewalks and parking aprons do not need pile support. A minimum of six inches of clean, angular crushed rock with no more than 6 percent passing a #200 sieve is recommended for use under hardscaping. Prior to rock placement the subgrade will need to be evaluated by us via probing. Rock under hard scaping should be compacted to 92 percent compaction relative to ASTM D 1557. In addition, any areas contaminated with fines must be removed and replaced with clean rock. If the base rock is saturated or trapping water, this water must be removed prior to slab placement.

Ground Moisture

General - The perimeter ground surface and hard-scaping should be sloped to drain away from all structures. Gutters should be tight-lined to a suitable discharge and maintained as free-flowing. Due to shallow groundwater anticipated at the site and expected very soft conditions below a few feet, basements are not recommended. We should be consulted to evaluate moisture, drainage and stabilization impacts for finished floor embedment greater than 2 feet below existing grade.

Perimeter Foundation Drains - We recommend installing perimeter foundation drains around all exterior foundations/grade beams. The foundation drains should consist of a two-foot-wide zone of drain rock encompassing a 4-inch diameter perforated pipe, all enclosed with a non-woven filter fabric. The drain rock should have no more than 2 percent passing a #200 sieve and should extend to within one foot of the ground surface. The geosynthetic should be a Mirafi 160n or equivalent. One foot of low permeability soil prepared as structural fill should be placed over the fabric at the top of the drain to isolate the drain from surface runoff. Foundation drains must be routed to a suitable discharge.

Vapor Flow Retardant - A continuous, impervious 10-15 mil vapor barrier must be installed over the ground surface under all slabs. Barriers should be installed per the manufacturer's recommendations.

Pavement

Design - We have developed asphalt concrete pavement thickness at the site for 3 trucks per day (with a truck factor of 0.6) and a 20-year design life. These volumes can be revised if specific traffic data is available. Designs are also suitable to support a 75,000 pound fire truck. Our analyses are based on AASHTO methods and subgrade of undisturbed medium stiff silt or better native silt or fill having a resilient modulus of 3,000 psi. Construction will likely require protection and stabilization of subgrades as recommended in the ***Stabilization and Soft Areas and Working Blankets*** and ***Haul Roads*** sections of this report, and a Propex Geotex 801 (or equivalent) separation geosynthetic is required. The results of our analyses based on these parameters are provided in the following table.

Based on the results of our analyses we recommend a minimum of 3.0 inches of asphalt concrete (AC) over 9 inches of crushed rock base (CRB). Areas exposed to only car traffic can be constructed of 3 inches of AC over 8 inches of CRB.

Subgrade Preparation - The pavement subgrade should be prepared in accordance with the ***Earthwork*** recommendations presented in this report. All pavement subgrades will need to pass a proof roll prior to paving. Soft areas should be repaired by overexcavating the areas, installing a separation geosynthetic and geogrid, and brought to-grade with well graded, angular crushed rock compacted as structural fill. For a separation geosynthetic we recommend a Propex Geotex 801 or equivalent, and the geogrid a Hanes Egrid 2020 or equivalent.

Base Rock - The recommended thicknesses are intended to be the minimum acceptable. Crushed rock should conform to ODOT base rock standards and have less than 6 percent passing the #200 sieve. Asphalt concrete should be compacted in lifts no greater than 3 inches in thickness to 91 percent of a Rice Density, or to 98 percent of the maximum density from a test strip.

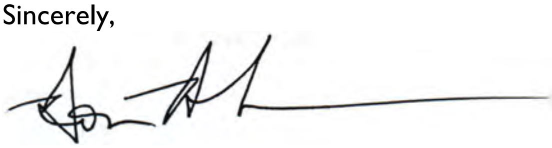
LIMITATIONS AND OBSERVATION DURING CONSTRUCTION

We have prepared this report for use by the City of Cannon Beach and members of their design and construction teams for this project only. The information herein can be used for bidding or estimating purposes but should not be construed as a warranty of subsurface conditions. We have made observations only at the surface and have drawn from adjacent personal experience and explorations reported by others, only at the stated locations and to the stated depths. These observations do not reflect soil types, strata thicknesses, water levels or seepage that may exist between observations. We should be consulted to review final design and specifications in order to see that our recommendations are suitably followed. If any changes are made to the anticipated locations, loads, configurations, or construction timing, our recommendations may not be applicable, and we should be consulted. The preceding recommendations should be considered preliminary, as actual soil conditions may vary. In order for our recommendations to be final, we must be retained to review final building plans, to observe actual subsurface conditions encountered, and to observe foundation subgrades and pile driving. Our observations will allow us to adapt to actual conditions and to update our recommendations if needed.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty, expressed or implied, is given.

We appreciate the opportunity to work with you on this project and look forward to our continued involvement. Please contact us if you have any questions.

Sincerely,



Don Rondema, MS, PE, GE
Principal

Attachments: Site Plan, CPT logs, Vs30 calculation sheet, liquefaction calculation example, ASCE 7-22 Hazard Tool, 2011 Chinook Geoservices Report

Exhibit A-2

BASE PHOTO FROM GOOGLE EARTH 2021 AERIAL

Geotech Solutions Inc.

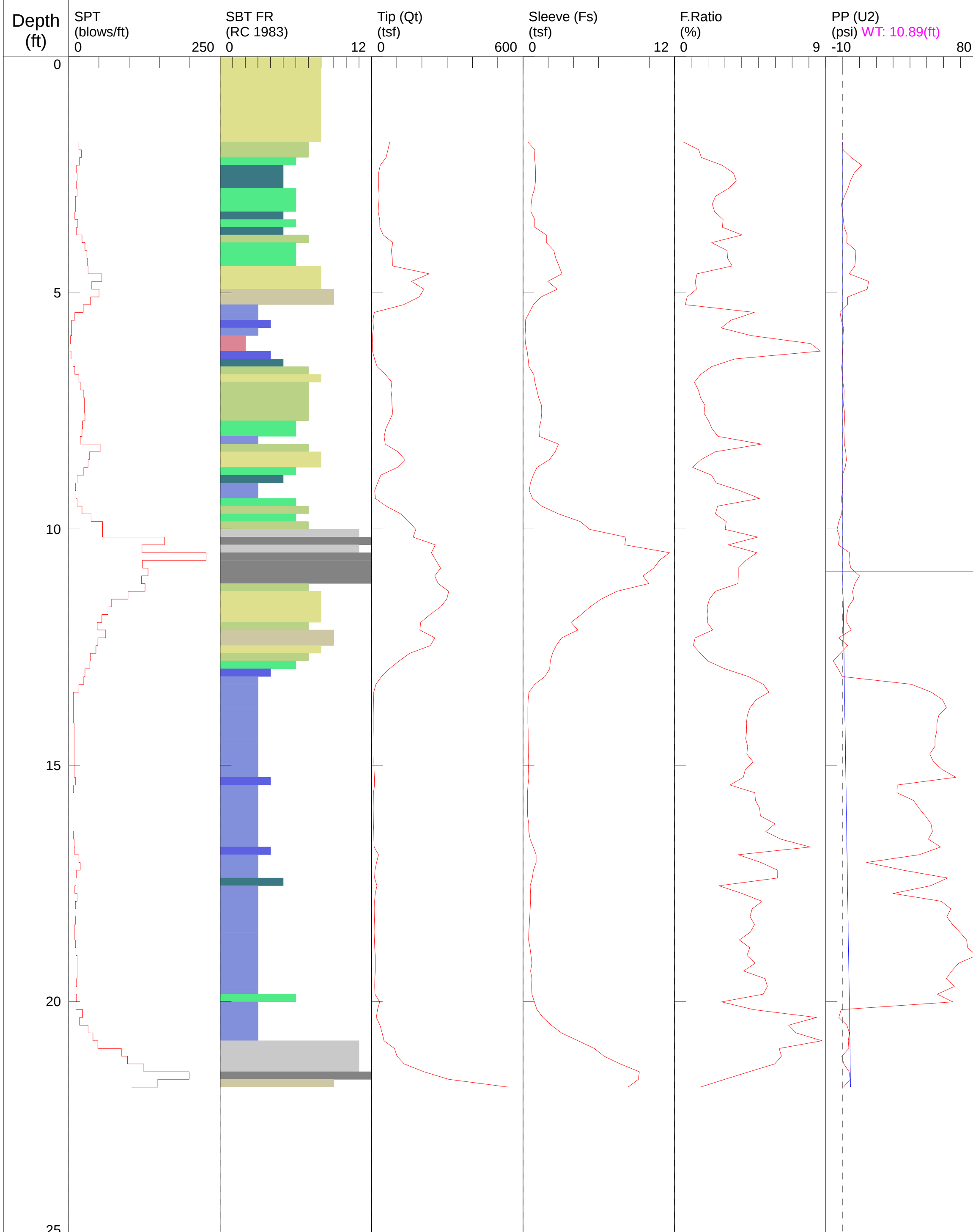
SITE PLAN

cannon-22-2-gi

Exhibit A-2

Geotech Solutions / CPT-1 / 163 E Gower Street Cannon Beach

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 7/12/2023 9:08:58 AM
TOTAL DEPTH: 21.818 ft



REMARKS

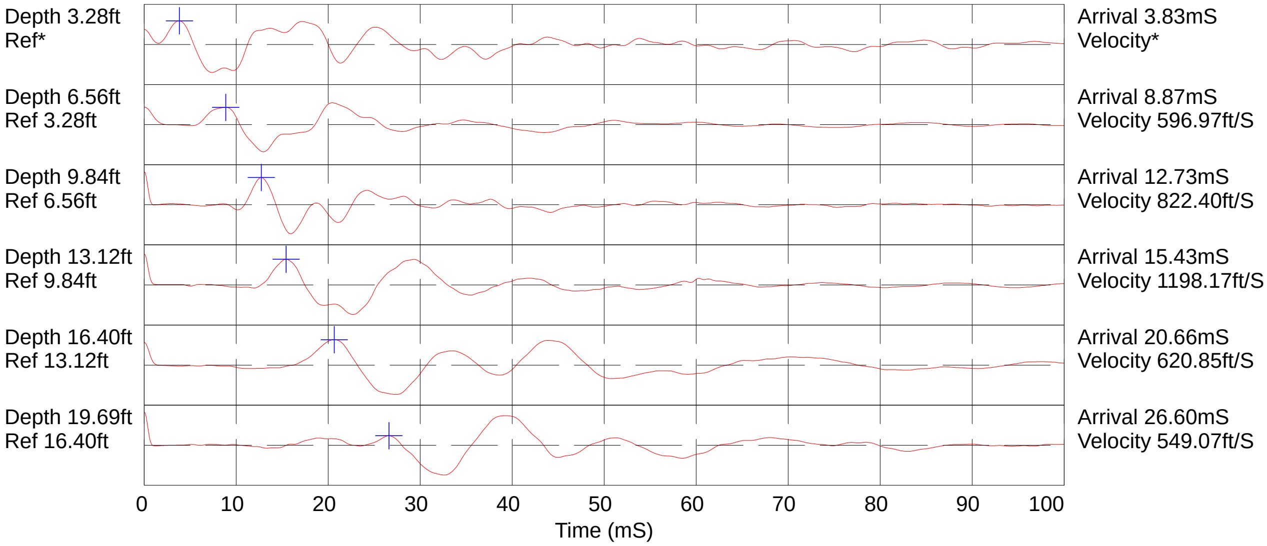
Predrill to 1.7 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

Exhibit A-2

COMMENT: Geotech Solutions / CPT-1 / 163 E Gower Street Cannon Beach



Hammer to Rod String Distance (ft): 2.04
* = Not Determined

Exhibit A-2

Geotech Solutions / CPT-1 / 163 E Gower Street Cannon Beach

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 7/12/2023 9:08:58 AM
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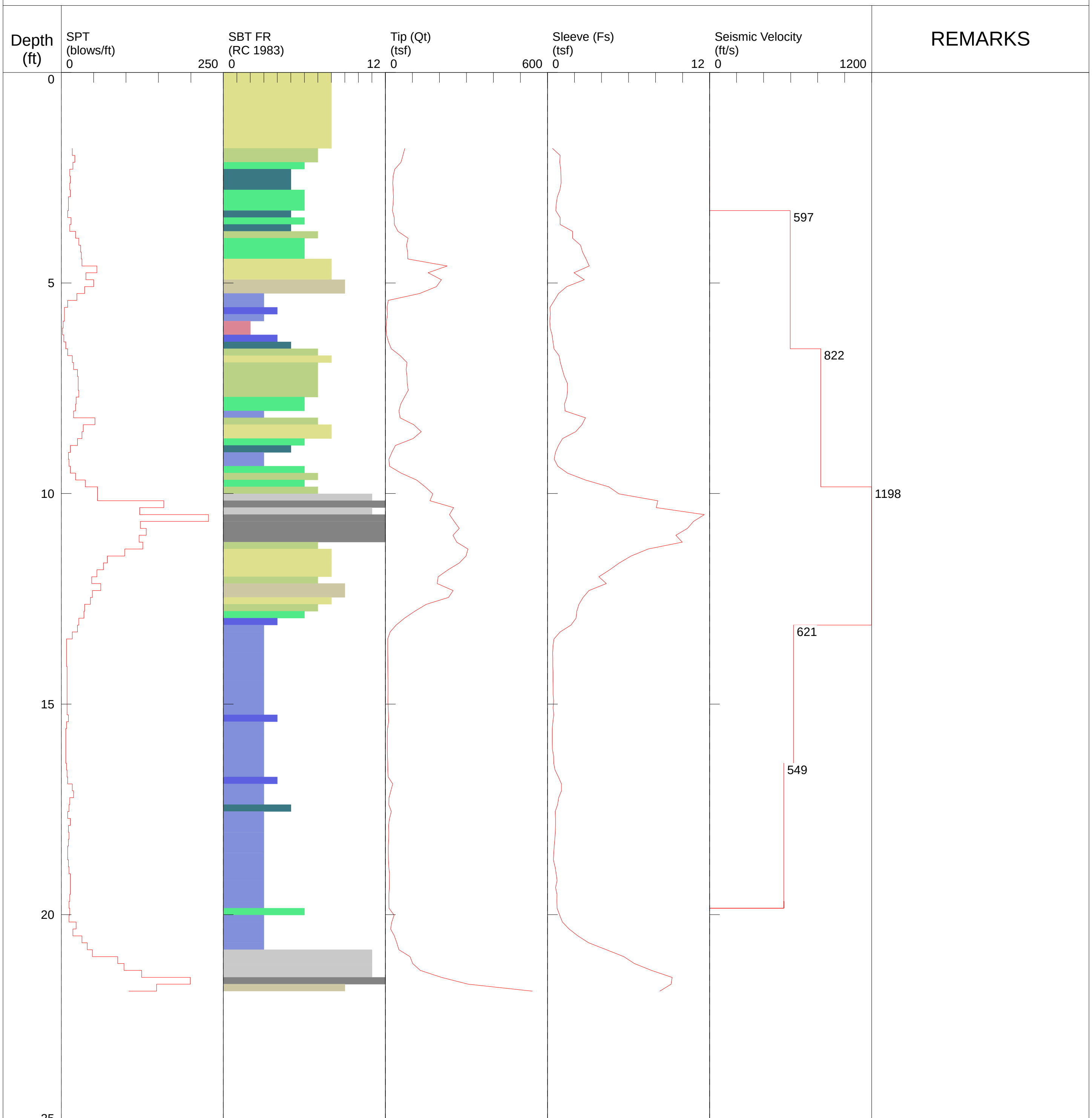

1 sensitive fine grained
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Exhibit A-2

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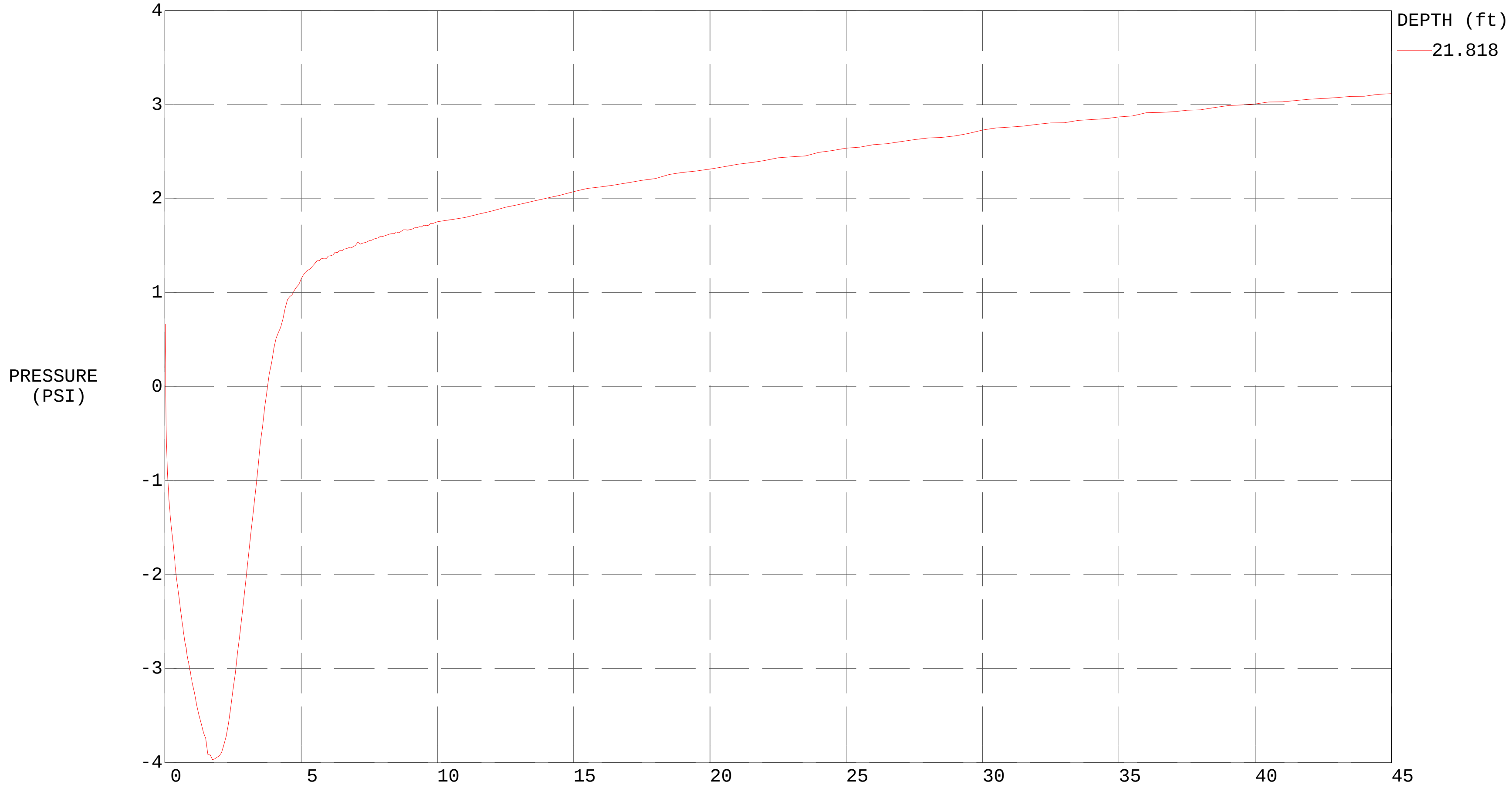


MAXIMUM PRESSURE = 3.118 (PSI)
HYDROSTATIC PRESSURE = 4.735 (PSI), WATER TABLE: 10.89 ft

Exhibit A-2

Geotech Solutions / CPT-1 / 163 E Gower Street Cannon Beach

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 7/12/2023 9:08:58 AM
TOTAL DEPTH: 21.818 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
1.804	71.87	0.3755	0.523	-0.231	17	8	sand to silty sand
1.969	64.66	0.9340	1.444	0.284	21	7	silty sand to sandy silt
2.133	57.23	0.9119	1.593	4.979	18	7	silty sand to sandy silt
2.297	34.46	0.9747	2.828	11.323	13	6	sandy silt to clayey silt
2.461	28.37	0.9946	3.506	6.831	14	5	clayey silt to silty clay
2.625	27.26	1.0014	3.673	4.639	13	5	clayey silt to silty clay
2.789	28.73	0.9185	3.197	3.084	14	5	clayey silt to silty clay
2.953	29.83	0.7287	2.442	1.031	11	6	sandy silt to clayey silt
3.117	28.67	0.6464	2.255	-0.775	11	6	sandy silt to clayey silt
3.281	25.70	0.6126	2.383	-0.036	10	6	sandy silt to clayey silt
3.445	32.22	0.9319	2.892	0.312	15	5	clayey silt to silty clay
3.609	32.81	0.9317	2.839	0.919	13	6	sandy silt to clayey silt
3.773	46.11	1.8550	4.023	2.613	22	5	clayey silt to silty clay
3.937	83.87	1.8567	2.214	2.466	27	7	silty sand to sandy silt
4.101	78.06	2.4438	3.131	7.807	30	6	sandy silt to clayey silt
4.265	82.09	2.5886	3.153	7.628	31	6	sandy silt to clayey silt
4.429	83.01	2.8487	3.432	7.188	32	6	sandy silt to clayey silt
4.593	228.46	3.0823	1.349	3.892	55	8	sand to silty sand
4.757	158.01	1.9609	1.241	15.415	38	8	sand to silty sand
4.921	207.27	2.7152	1.310	14.621	50	8	sand to silty sand
5.085	188.57	1.4247	0.756	2.920	36	9	sand
5.249	126.91	0.8205	0.646	2.942	24	9	sand
5.413	10.60	0.5035	4.750	-1.557	10	3	clay
5.577	5.45	0.1831	3.360	-0.808	5	3	clay
5.741	7.40	0.2056	2.777	0.532	5	4	silty clay to clay
5.906	3.54	0.1623	4.585	0.176	3	3	clay
6.070	2.46	0.1994	8.091	0.248	2	2	organic material
6.234	3.83	0.3323	8.684	-0.167	4	2	organic material
6.398	11.51	0.4126	3.585	0.078	7	4	silty clay to clay
6.562	21.68	0.4760	2.195	-0.596	10	5	clayey silt to silty clay
6.726	54.60	0.8528	1.562	-0.312	17	7	silty sand to sandy silt
6.890	80.11	0.9508	1.187	0.145	19	8	sand to silty sand
7.054	76.77	1.0923	1.423	0.775	25	7	silty sand to sandy silt
7.218	80.15	1.2434	1.551	0.708	26	7	silty sand to sandy silt
7.382	80.69	1.4671	1.818	0.457	26	7	silty sand to sandy silt
7.546	84.34	1.4795	1.754	1.245	27	7	silty sand to sandy silt
7.710	70.53	1.4274	2.024	1.114	23	7	silty sand to sandy silt
7.874	56.41	1.2573	2.229	0.674	22	6	sandy silt to clayey silt
8.038	50.02	1.2937	2.586	0.805	19	6	sandy silt to clayey silt
8.202	54.25	2.8047	5.170	1.036	52	3	clay
8.366	105.14	2.5466	2.422	1.808	34	7	silty sand to sandy silt
8.530	132.63	2.0874	1.574	2.223	32	8	sand to silty sand
8.694	102.42	1.1063	1.080	1.463	25	8	sand to silty sand
8.858	36.73	0.8101	2.206	-0.237	14	6	sandy silt to clayey silt
9.022	23.58	0.5863	2.487	-0.184	11	5	clayey silt to silty clay
9.186	12.71	0.4925	3.874	0.047	12	3	clay

Exhibit A-2

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
9.350	14.99	0.7581	5.056	-0.833	14	3	clay
9.514	57.98	1.4826	2.557	-0.248	22	6	sandy silt to clayey silt
9.678	115.19	2.8017	2.432	-0.649	37	7	silty sand to sandy silt
9.843	147.45	4.5385	3.078	-2.307	56	6	sandy silt to clayey silt
10.007	175.15	5.2861	3.018	-3.335	56	7	silty sand to sandy silt
10.171	164.65	8.1563	4.954	-1.886	158	11	very stiff fine grained (*)
10.335	252.45	8.0568	3.191	-2.533	121	12	sand to clayey sand (*)
10.499	237.24	11.6048	4.891	4.062	227	11	very stiff fine grained (*)
10.663	254.58	10.8200	4.250	3.744	122	12	sand to clayey sand (*)
10.827	273.25	10.3557	3.790	4.887	131	12	sand to clayey sand (*)
10.991	250.30	9.5000	3.795	9.952	120	12	sand to clayey sand (*)
11.155	263.82	9.9730	3.780	7.244	126	12	sand to clayey sand (*)
11.319	305.65	7.4451	2.436	5.867	98	7	silty sand to sandy silt
11.483	298.04	6.1876	2.076	6.458	71	8	sand to silty sand
11.647	273.43	5.3124	1.943	3.396	65	8	sand to silty sand
11.811	231.42	4.6064	1.990	2.396	55	8	sand to silty sand
11.975	194.91	3.8040	1.952	2.466	47	8	sand to silty sand
12.139	191.57	4.3514	2.271	5.104	61	7	silty sand to sandy silt
12.303	250.67	3.0684	1.224	-2.354	48	9	sand
12.467	233.40	2.6272	1.126	2.992	45	9	sand
12.631	150.95	2.3288	1.543	-1.410	36	8	sand to silty sand
12.795	109.07	2.1640	1.984	-5.575	35	7	silty sand to sandy silt
12.959	70.33	2.1131	3.005	-2.719	27	6	sandy silt to clayey silt
13.123	39.48	1.7360	4.398	-0.217	25	4	silty clay to clay
13.287	17.60	0.9289	5.279	40.886	17	3	clay
13.451	8.47	0.4762	5.622	52.593	8	3	clay
13.615	8.26	0.4010	4.858	59.285	8	3	clay
13.780	8.51	0.3824	4.496	61.609	8	3	clay
13.944	8.85	0.3836	4.333	57.170	8	3	clay
14.108	9.03	0.3861	4.277	56.011	9	3	clay
14.272	9.32	0.4001	4.294	55.947	9	3	clay
14.436	9.67	0.4092	4.232	54.877	9	3	clay
14.600	9.63	0.4189	4.347	54.897	9	3	clay
14.764	9.69	0.4169	4.304	51.707	9	3	clay
14.928	9.47	0.4431	4.678	54.011	9	3	clay
15.092	9.90	0.4164	4.206	59.001	9	3	clay
15.256	11.27	0.4603	4.086	67.250	11	3	clay
15.420	11.94	0.3945	3.303	32.424	8	4	silty clay to clay
15.584	7.40	0.3533	4.772	32.305	7	3	clay
15.748	7.19	0.3465	4.818	42.073	7	3	clay
15.912	6.91	0.3503	5.067	45.360	7	3	clay
16.076	7.12	0.3638	5.112	49.172	7	3	clay
16.240	7.52	0.4502	5.983	52.484	7	3	clay
16.404	8.48	0.4601	5.426	53.312	8	3	clay
16.568	8.89	0.5616	6.320	50.916	9	3	clay
16.732	10.06	0.8112	8.066	58.129	10	3	clay
16.896	27.21	1.0327	3.796	45.477	17	4	silty clay to clay
17.060	20.16	1.0346	5.132	14.265	19	3	clay
17.224	13.41	0.8226	6.133	35.926	13	3	clay
17.388	12.17	0.7455	6.125	62.277	12	3	clay
17.552	21.50	0.5677	2.641	52.197	10	5	clayey silt to silty clay
17.717	14.82	0.5957	4.019	29.939	14	3	clay
17.881	11.47	0.5971	5.205	58.619	11	3	clay
18.045	12.35	0.5697	4.611	64.264	12	3	clay
18.209	11.99	0.5382	4.490	61.818	11	3	clay
18.373	10.55	0.5017	4.756	65.269	10	3	clay
18.537	10.29	0.4639	4.510	69.591	10	3	clay

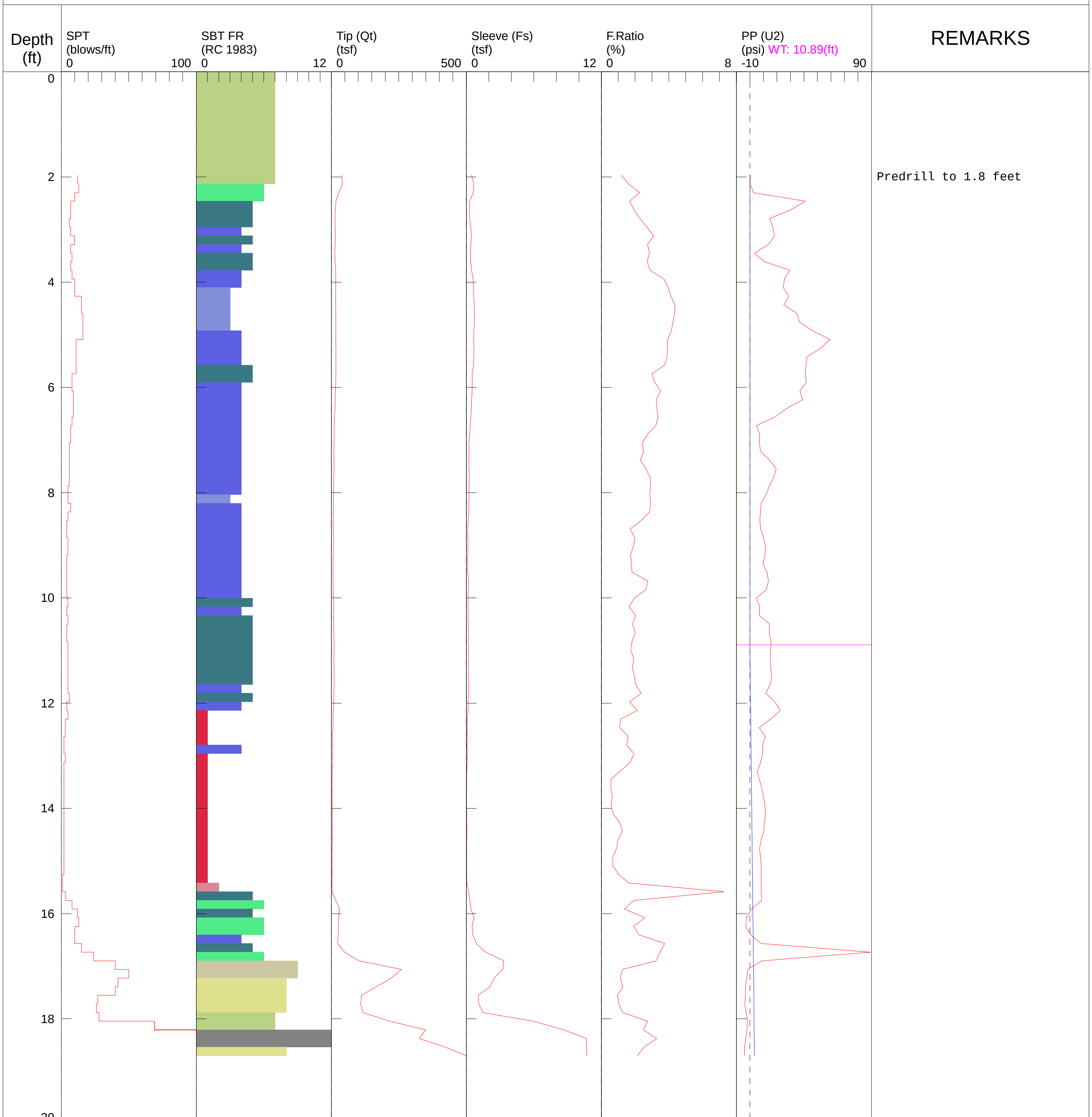
Exhibit A-2

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
18.701	11.26	0.4351	3.863	73.611	11	3	clay
18.865	12.44	0.5572	4.480	74.207	12	3	clay
19.029	14.80	0.6376	4.308	79.465	14	3	clay
19.193	14.70	0.7053	4.798	68.969	14	3	clay
19.357	14.55	0.5974	4.106	64.774	14	3	clay
19.521	13.05	0.7035	5.388	61.475	13	3	clay
19.685	12.49	0.6895	5.522	66.378	12	3	clay
19.849	13.37	0.7056	5.276	56.226	13	3	clay
20.013	32.03	0.8997	2.809	65.364	12	6	sandy silt to clayey silt
20.177	23.55	1.1050	4.691	-0.983	23	3	clay
20.341	18.85	1.5922	8.446	-2.312	18	3	clay
20.505	33.08	2.2454	6.787	2.535	32	3	clay
20.669	42.13	3.0459	7.230	3.953	40	3	clay
20.833	49.73	4.3588	8.765	3.318	48	3	clay
20.997	90.81	5.6496	6.221	3.594	87	11	very stiff fine grained (*)
21.161	100.99	6.4220	6.359	-0.571	97	11	very stiff fine grained (*)
21.325	129.13	7.6998	5.963	0.680	124	11	very stiff fine grained (*)
21.490	207.82	9.2211	4.437	3.772	199	11	very stiff fine grained (*)
21.654	306.01	9.1524	2.991	4.388	147	12	sand to clayey sand (*)
21.818	543.94	8.3122	1.528	0.390	104	9	sand

Exhibit A-2

Geotech Solutions / CPT-2 / 163 E Gower Street Cannon Beach

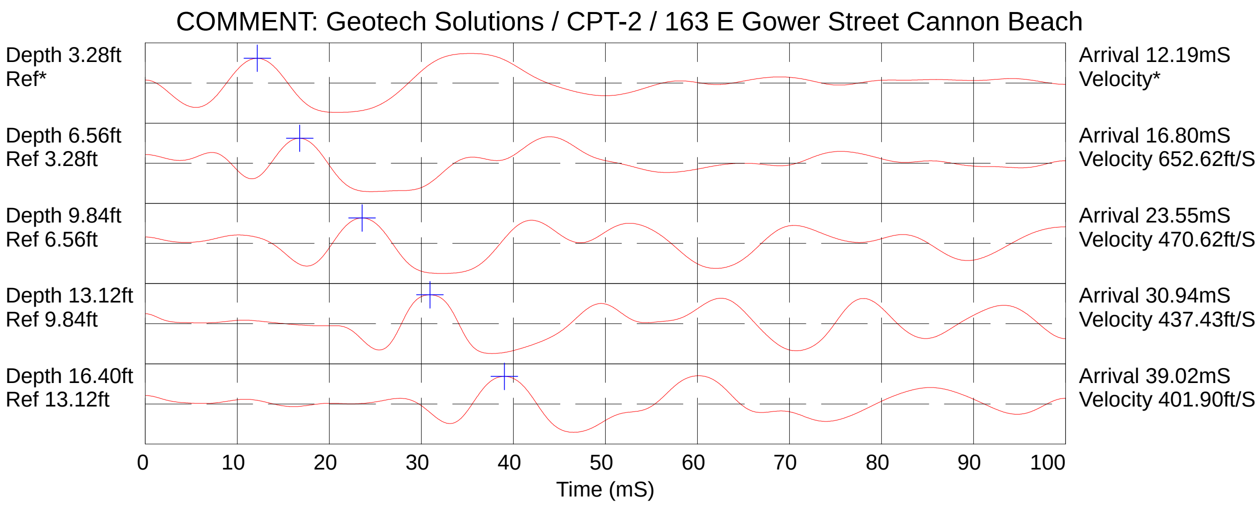
OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 7/12/2023 10:44:55 AM
TOTAL DEPTH: 18.701 ft



1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

Exhibit A-2



Hammer to Rod String Distance (ft): 2.04
* = Not Determined

Geotech Solutions / CPT-2 / 163 E Gower Street Cannon Beach

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 7/12/2023 10:44:55 AM
TOTAL DEPTH: 18.701 ft

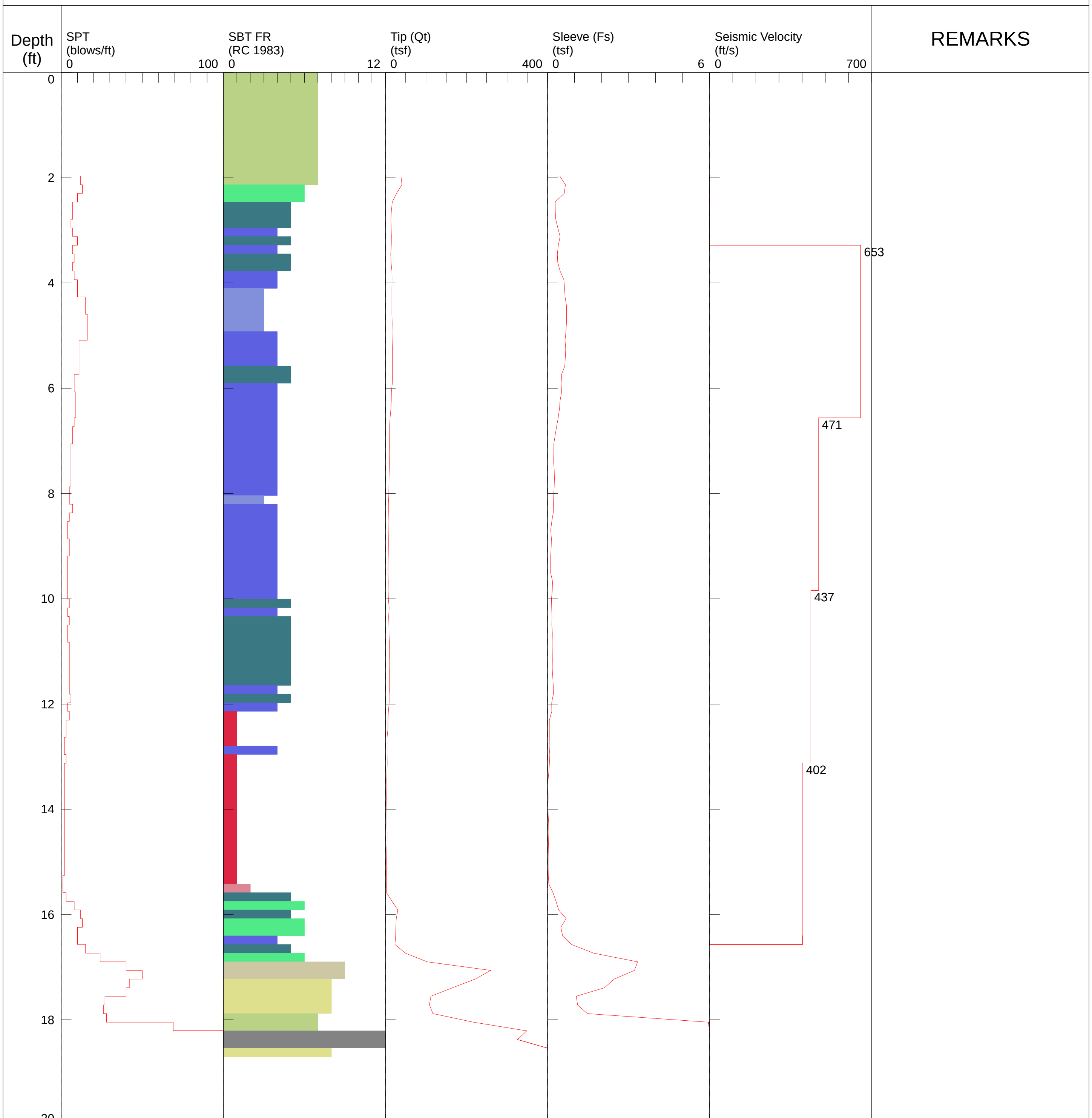


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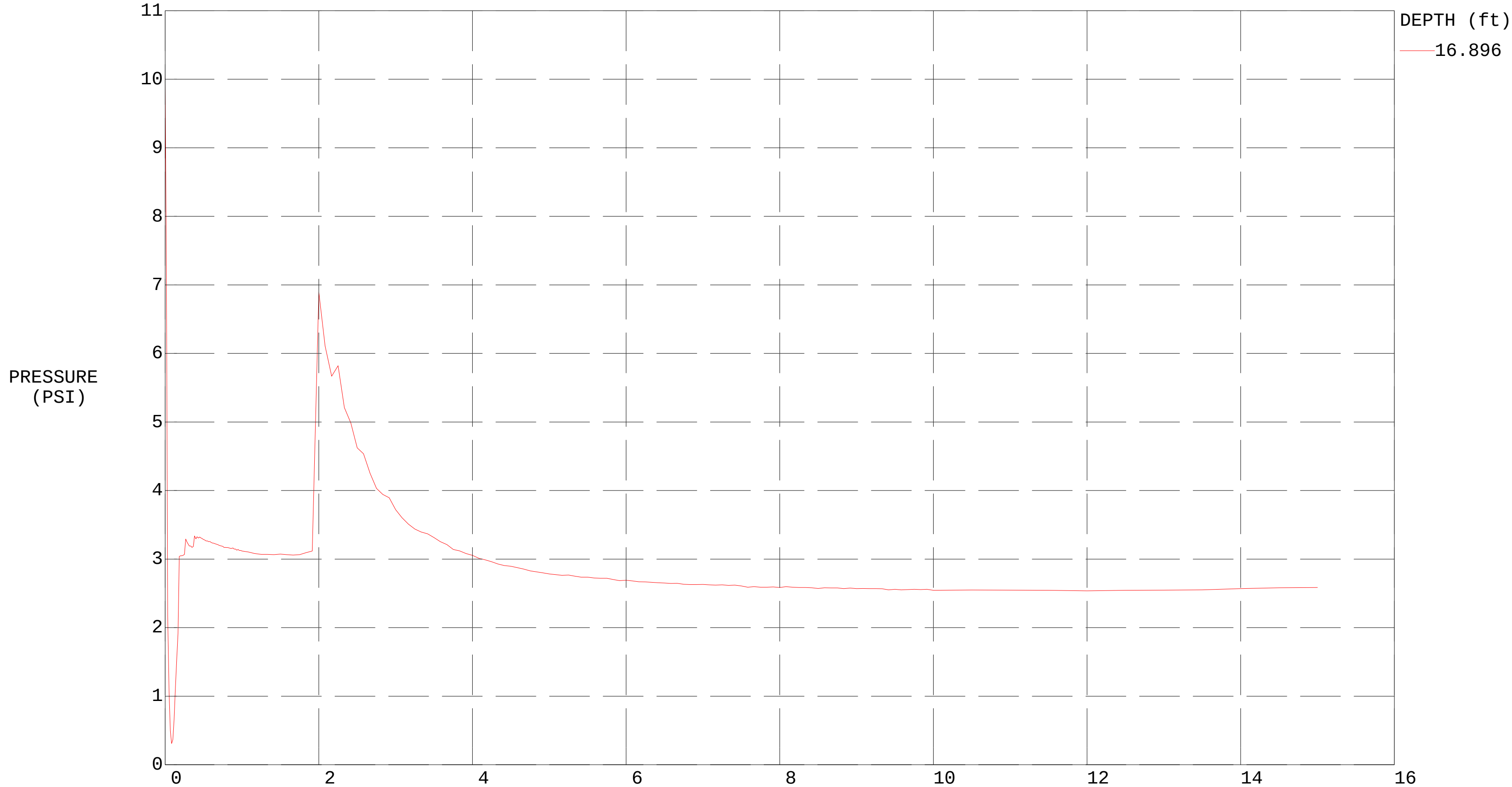
Exhibit A-2

COMMENT: Geotech Solutions / CPT-2 / 163 E Gower Street Cannon Beach

CONE ID: DDG1296
TEST DATE: 7/12/2023 10:44:55 AM



MAXIMUM PRESSURE = 10.038 (PSI)
HYDROSTATIC PRESSURE = 2.602 (PSI), WATER TABLE: 10.89 ft

Exhibit A-2

Geotech Solutions / CPT-2 / 163 E Gower Street Cannon Beach

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 7/12/2023 10:44:55 AM
TOTAL DEPTH: 18.701 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
1.969	38.24	0.4536	1.186	0.192	12	7	silty sand to sandy silt
2.133	40.81	0.6616	1.621	0.293	13	7	silty sand to sandy silt
2.297	27.23	0.6167	2.265	2.552	10	6	sandy silt to clayey silt
2.461	16.97	0.2840	1.673	40.986	7	6	sandy silt to clayey silt
2.625	14.78	0.2858	1.934	30.379	7	5	clayey silt to silty clay
2.789	13.30	0.3046	2.290	14.660	6	5	clayey silt to silty clay
2.953	14.19	0.3814	2.688	16.917	7	5	clayey silt to silty clay
3.117	15.01	0.4647	3.096	18.263	10	4	silty clay to clay
3.281	14.53	0.3970	2.732	13.799	7	5	clayey silt to silty clay
3.445	12.85	0.3660	2.848	3.421	8	4	silty clay to clay
3.609	13.91	0.3765	2.708	10.487	7	5	clayey silt to silty clay
3.773	16.18	0.4667	2.885	29.546	8	5	clayey silt to silty clay
3.937	16.28	0.6020	3.698	25.543	10	4	silty clay to clay
4.101	15.93	0.6310	3.960	24.637	10	4	silty clay to clay
4.265	15.83	0.6509	4.112	28.786	15	3	clay
4.429	16.14	0.7032	4.357	25.036	15	3	clay
4.593	16.23	0.7043	4.338	34.859	16	3	clay
4.757	16.59	0.7030	4.238	36.620	16	3	clay
4.921	16.40	0.6795	4.144	46.241	16	3	clay
5.085	16.63	0.6532	3.928	59.196	11	4	silty clay to clay
5.249	17.17	0.6708	3.907	52.752	11	4	silty clay to clay
5.413	17.02	0.6606	3.882	42.326	11	4	silty clay to clay
5.577	17.11	0.6415	3.749	41.499	11	4	silty clay to clay
5.741	17.12	0.5140	3.003	40.880	8	5	clayey silt to silty clay
5.906	16.78	0.5308	3.163	41.755	8	5	clayey silt to silty clay
6.070	14.85	0.5209	3.509	36.968	9	4	silty clay to clay
6.234	14.36	0.4663	3.248	39.000	9	4	silty clay to clay
6.398	13.34	0.4384	3.286	27.265	9	4	silty clay to clay
6.562	11.78	0.3951	3.353	18.458	8	4	silty clay to clay
6.726	10.46	0.3371	3.221	4.739	7	4	silty clay to clay
6.890	10.41	0.2846	2.733	7.294	7	4	silty clay to clay
7.054	9.68	0.2350	2.429	6.987	6	4	silty clay to clay
7.218	9.38	0.2343	2.499	7.912	6	4	silty clay to clay
7.382	9.72	0.2247	2.312	14.524	6	4	silty clay to clay
7.546	9.52	0.2506	2.632	19.514	6	4	silty clay to clay
7.710	8.96	0.2584	2.884	17.586	6	4	silty clay to clay
7.874	8.61	0.2509	2.913	14.365	5	4	silty clay to clay
8.038	8.10	0.2322	2.866	11.802	5	4	silty clay to clay
8.202	7.40	0.2156	2.913	8.258	7	3	clay
8.366	7.44	0.2127	2.858	7.784	5	4	silty clay to clay
8.530	6.74	0.1583	2.349	7.252	4	4	silty clay to clay
8.694	6.95	0.1178	1.694	8.010	4	4	silty clay to clay
8.858	7.36	0.1464	1.989	10.013	5	4	silty clay to clay
9.022	7.32	0.1388	1.896	11.615	5	4	silty clay to clay
9.186	7.00	0.1208	1.726	11.064	4	4	silty clay to clay
9.350	6.43	0.1150	1.788	9.609	4	4	silty clay to clay

Exhibit A-2

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
9.514	6.57	0.1190	1.812	12.549	4	4	silty clay to clay
9.678	6.84	0.1887	2.760	13.786	4	4	silty clay to clay
9.843	6.73	0.1766	2.625	12.186	4	4	silty clay to clay
10.007	7.49	0.1455	1.943	4.575	5	4	silty clay to clay
10.171	9.19	0.1512	1.645	7.252	4	5	clayey silt to silty clay
10.335	8.02	0.1621	2.021	6.965	5	4	silty clay to clay
10.499	8.55	0.1577	1.844	14.602	4	5	clayey silt to silty clay
10.663	8.93	0.1784	1.999	14.226	4	5	clayey silt to silty clay
10.827	9.56	0.1730	1.809	15.591	5	5	clayey silt to silty clay
10.991	10.08	0.1745	1.732	15.312	5	5	clayey silt to silty clay
11.155	9.42	0.1805	1.916	15.020	5	5	clayey silt to silty clay
11.319	9.55	0.1752	1.835	15.215	5	5	clayey silt to silty clay
11.483	10.01	0.1941	1.940	16.123	5	5	clayey silt to silty clay
11.647	10.47	0.2122	2.026	14.945	5	5	clayey silt to silty clay
11.811	9.19	0.2172	2.364	11.777	6	4	silty clay to clay
11.975	9.08	0.1508	1.662	18.430	4	5	clayey silt to silty clay
12.139	7.33	0.1565	2.136	22.484	5	4	silty clay to clay
12.303	6.20	0.0704	1.136	15.312	3	1	sensitive fine grained
12.467	6.26	0.0677	1.082	6.840	3	1	sensitive fine grained
12.631	4.27	0.0680	1.593	11.370	2	1	sensitive fine grained
12.795	4.30	0.0643	1.496	9.445	2	1	sensitive fine grained
12.959	4.32	0.0834	1.929	9.414	3	4	silty clay to clay
13.123	4.38	0.0747	1.704	7.915	2	1	sensitive fine grained
13.287	3.84	0.0432	1.127	5.413	2	1	sensitive fine grained
13.451	3.53	0.0197	0.558	6.854	2	1	sensitive fine grained
13.615	3.38	0.0188	0.556	8.854	2	1	sensitive fine grained
13.780	3.35	0.0218	0.651	10.133	2	1	sensitive fine grained
13.944	3.45	0.0202	0.584	11.108	2	1	sensitive fine grained
14.108	3.61	0.0256	0.710	11.610	2	1	sensitive fine grained
14.272	3.64	0.0397	1.092	10.618	2	1	sensitive fine grained
14.436	4.01	0.0495	1.235	10.222	2	1	sensitive fine grained
14.600	3.99	0.0390	0.976	8.289	2	1	sensitive fine grained
14.764	3.52	0.0315	0.895	7.160	2	1	sensitive fine grained
14.928	3.33	0.0224	0.673	7.899	2	1	sensitive fine grained
15.092	3.14	0.0216	0.687	8.266	2	1	sensitive fine grained
15.256	2.91	0.0300	1.032	8.238	1	1	sensitive fine grained
15.420	2.79	0.0457	1.638	8.180	1	1	sensitive fine grained
15.584	2.75	0.1996	7.264	8.269	3	2	organic material
15.748	16.41	0.3153	1.922	8.798	8	5	clayey silt to silty clay
15.912	30.44	0.4148	1.363	1.215	12	6	sandy silt to clayey silt
16.076	26.74	0.6875	2.571	-2.574	13	5	clayey silt to silty clay
16.240	25.91	0.4962	1.915	-3.159	10	6	sandy silt to clayey silt
16.404	25.19	0.5623	2.232	0.607	10	6	sandy silt to clayey silt
16.568	23.56	0.8840	3.752	8.049	15	4	silty clay to clay
16.732	49.09	1.7038	3.471	89.166	24	5	clayey silt to silty clay
16.896	103.17	3.3367	3.234	8.746	40	6	sandy silt to clayey silt
17.060	259.68	3.2177	1.239	-1.557	50	9	sand
17.224	221.48	2.4684	1.114	-2.374	42	9	sand
17.388	165.54	2.1064	1.272	-3.388	40	8	sand to silty sand
17.552	112.06	1.0629	0.948	-3.343	27	8	sand to silty sand
17.717	108.72	1.1122	1.023	-3.761	26	8	sand to silty sand
17.881	117.15	1.4765	1.260	-2.797	28	8	sand to silty sand
18.045	217.08	5.9547	2.743	-1.895	69	7	silty sand to sandy silt
18.209	348.96	8.6677	2.484	-2.215	111	7	silty sand to sandy silt
18.373	326.04	10.6558	3.268	-3.143	156	12	sand to clayey sand (*)
18.537	422.63	10.6728	2.525	-3.917	202	12	sand to clayey sand (*)
18.701	499.60	10.6928	2.140	-4.257	120	8	sand to silty sand

Exhibit A-2

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983

Exhibit A-2

SITE CLASS

Project	**cannon-22-2-gi**
Location	gower city hall

profile from site measurements and vicinty info

Soil Type	Thick (ft)	Vs-ave	Vs-low	N
silt - ave of measured in CPT	21	638	500	5
dense sand	79	1200	1100	50
siltstone	0	1900	1900	100

total depth	100	ave	low
weighted Vs 100 =		**1082.0**	974

ASCE 7-22 Site Class Table

Table 20.2-1. Site Classification.

Site Class	$\bar{v}_s$ Calculated Using Measured or Estimated Shear Wave Velocity Profile (ft/s)
A. Hard rock	>5,000
B. Medium hard rock	>3,000 to 5,000
BC. Soft rock	>2,100 to 3,000
C. Very dense sand or hard clay	>1,450 to 2,100
CD. Dense sand or very stiff clay	>1,000 to 1,450
D. Medium dense sand or stiff clay	>700 to 1,000
DE. Loose sand or medium stiff clay	>500 to 700
E. Very loose sand or soft clay	≥500
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.2.1

Note: For SI: 1 ft = 0.3048 m; 1 ft/s = 0.3048 m/s.

Geotech Solutions Inc.

Exhibit A-2

TABLE OF CONTENTS

23092 CPT-1 Text File results

Exhibit A-2

Geotech Solutions, Inc.

Geotech Solutions Inc.

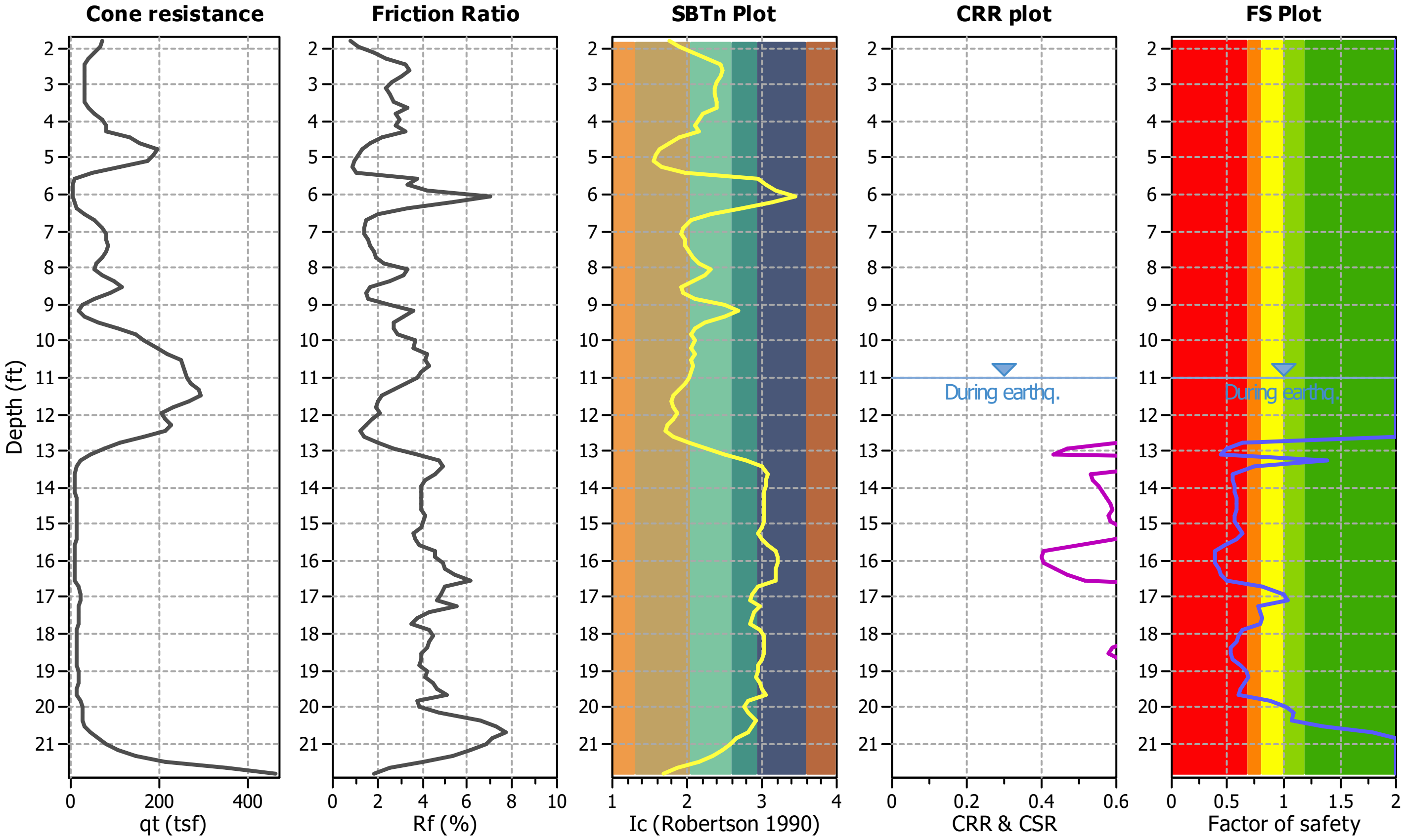
LIQUEFACTION ANALYSIS REPORT

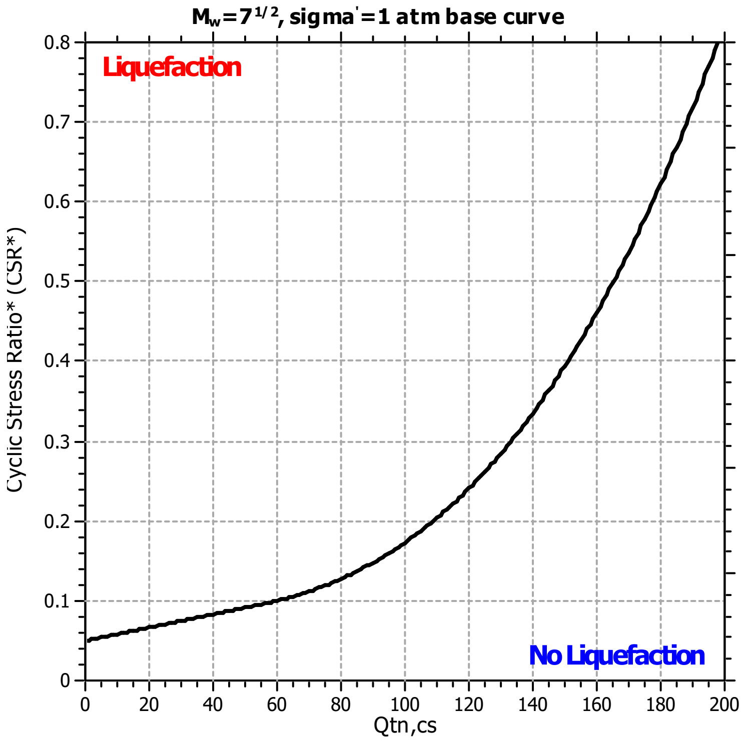
Project title : cannon beach gower city hall **Location :**

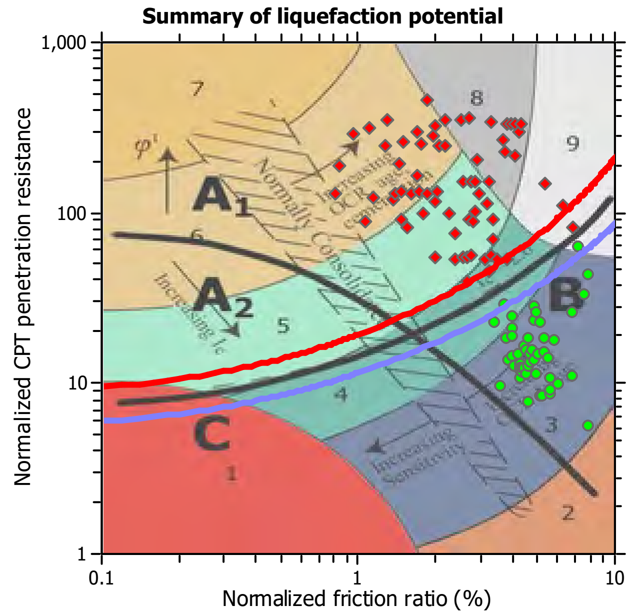
CPT file : 23092 CPT-1 Text File

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	11.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	11.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	8.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	1.02	Unit weight calculation:	Based on SBT	K_σ applied:	No		

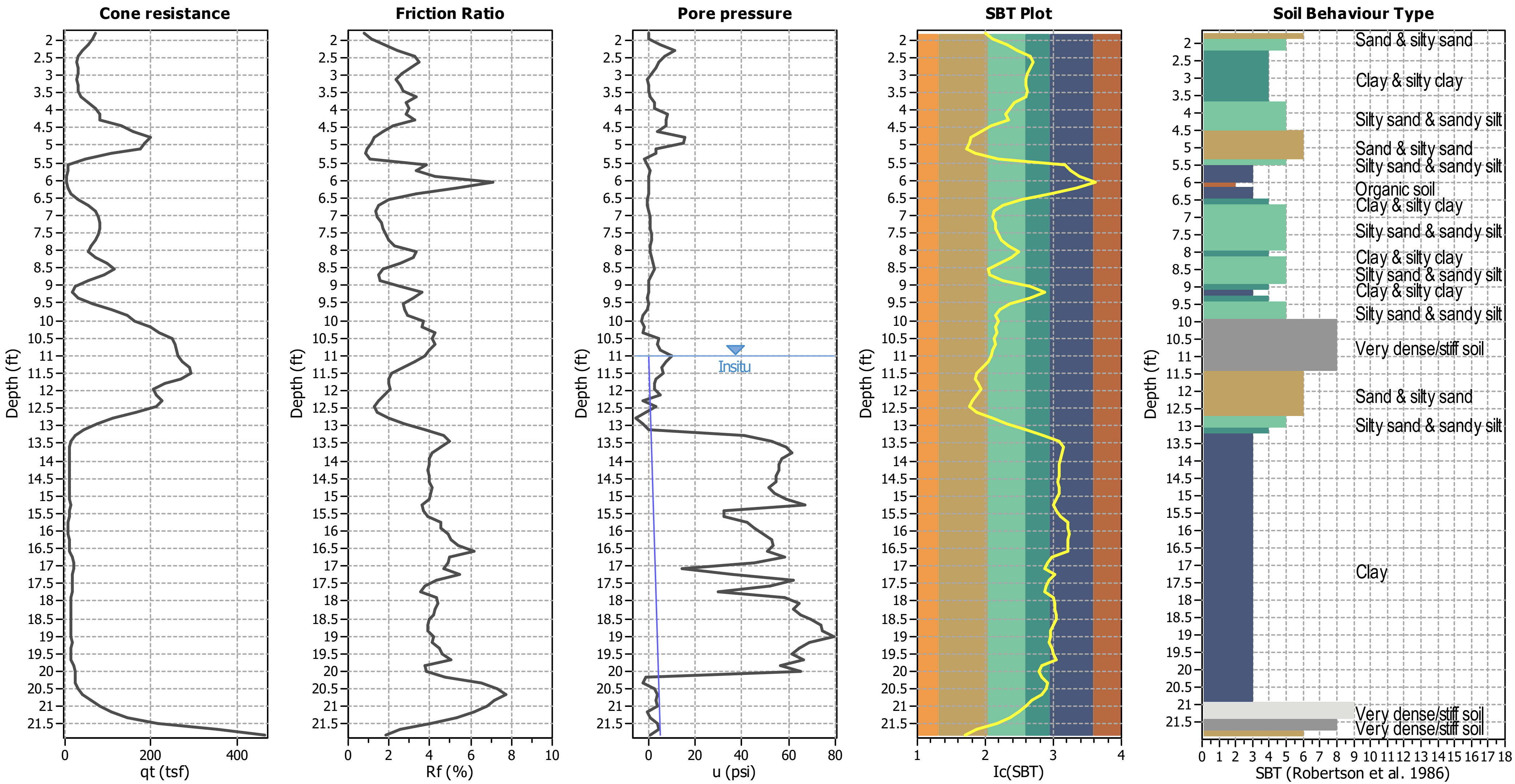






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



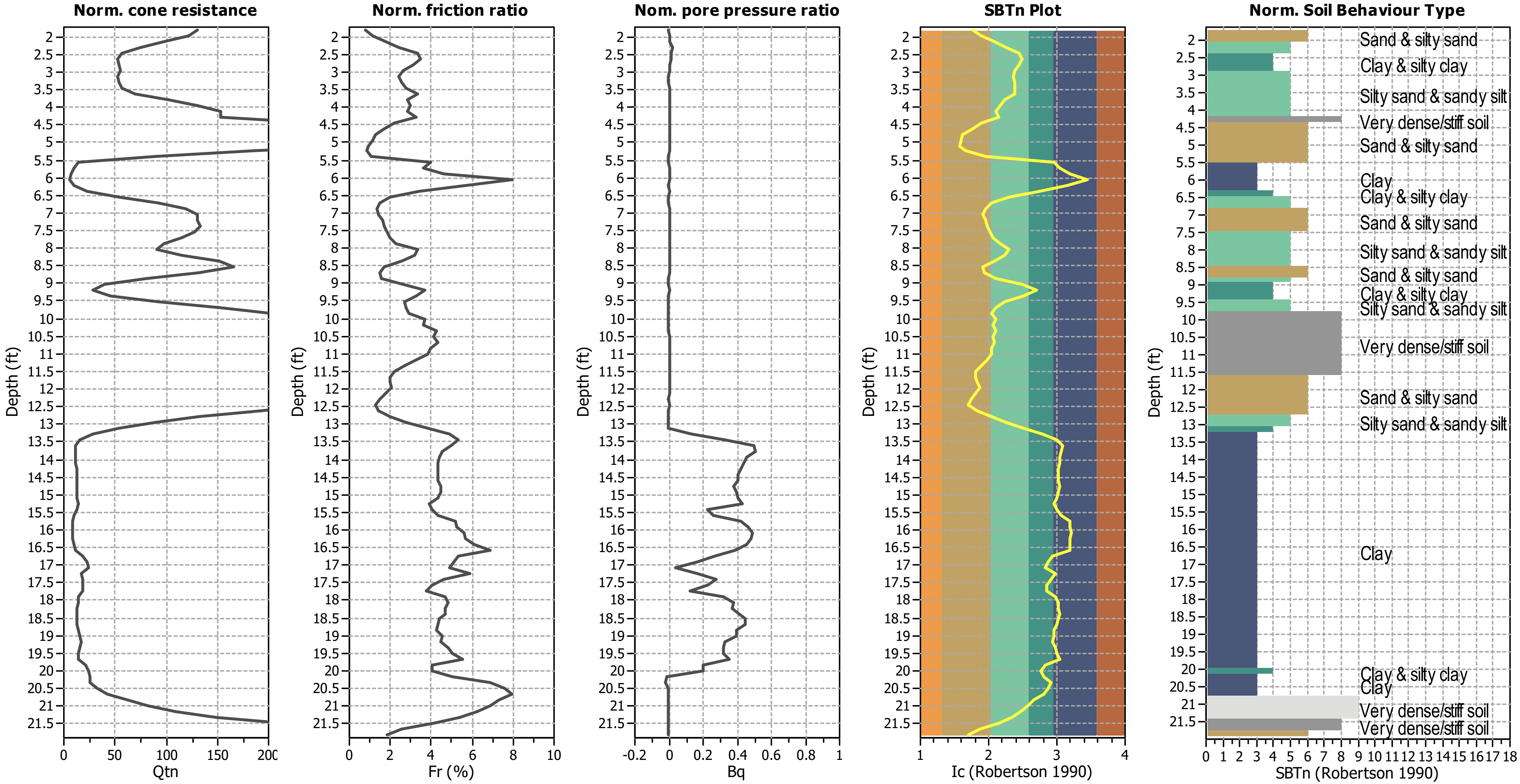
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	11.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	8.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	1.02	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

CPT basic interpretation plots (normalized)



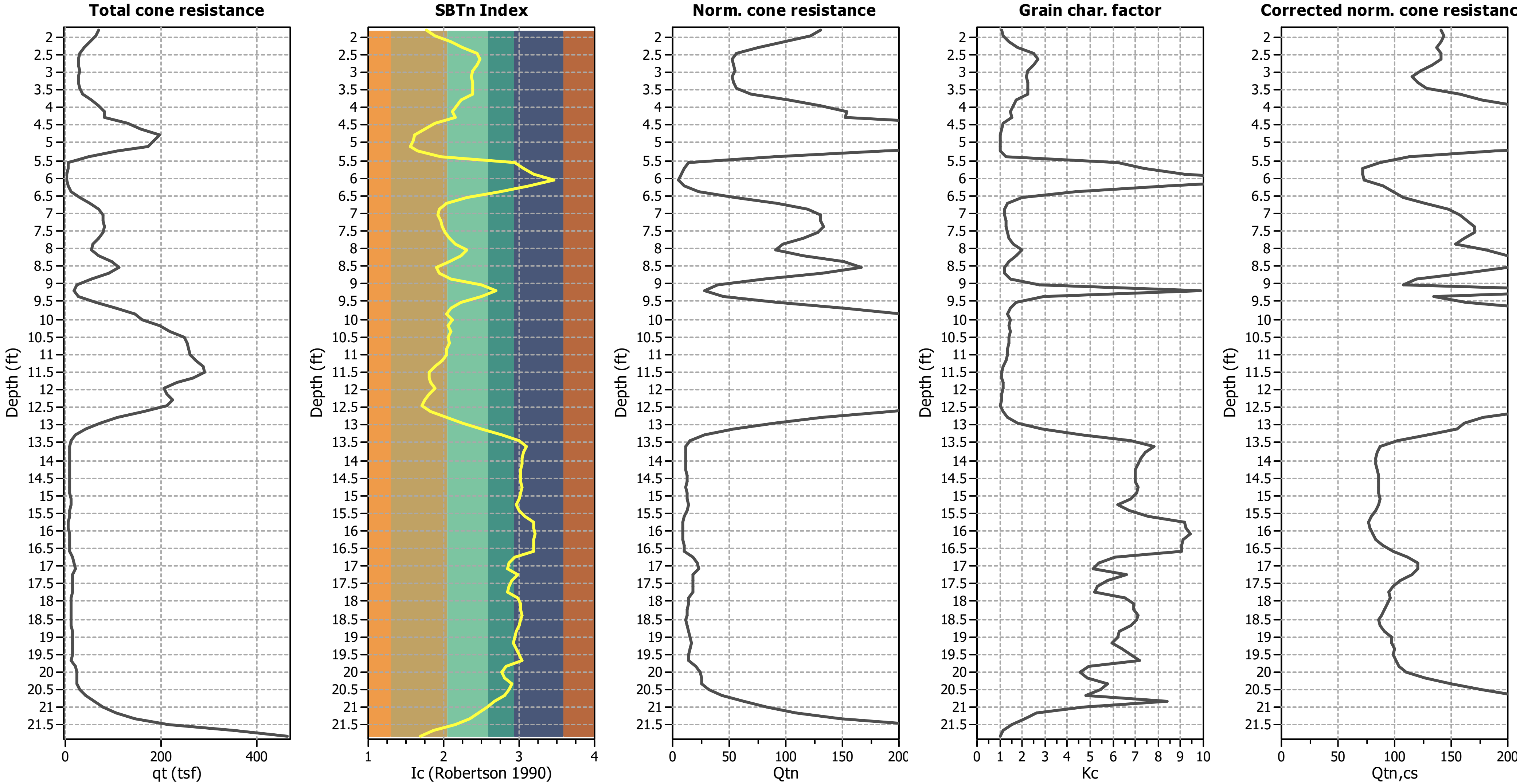
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	11.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	8.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	1.02	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

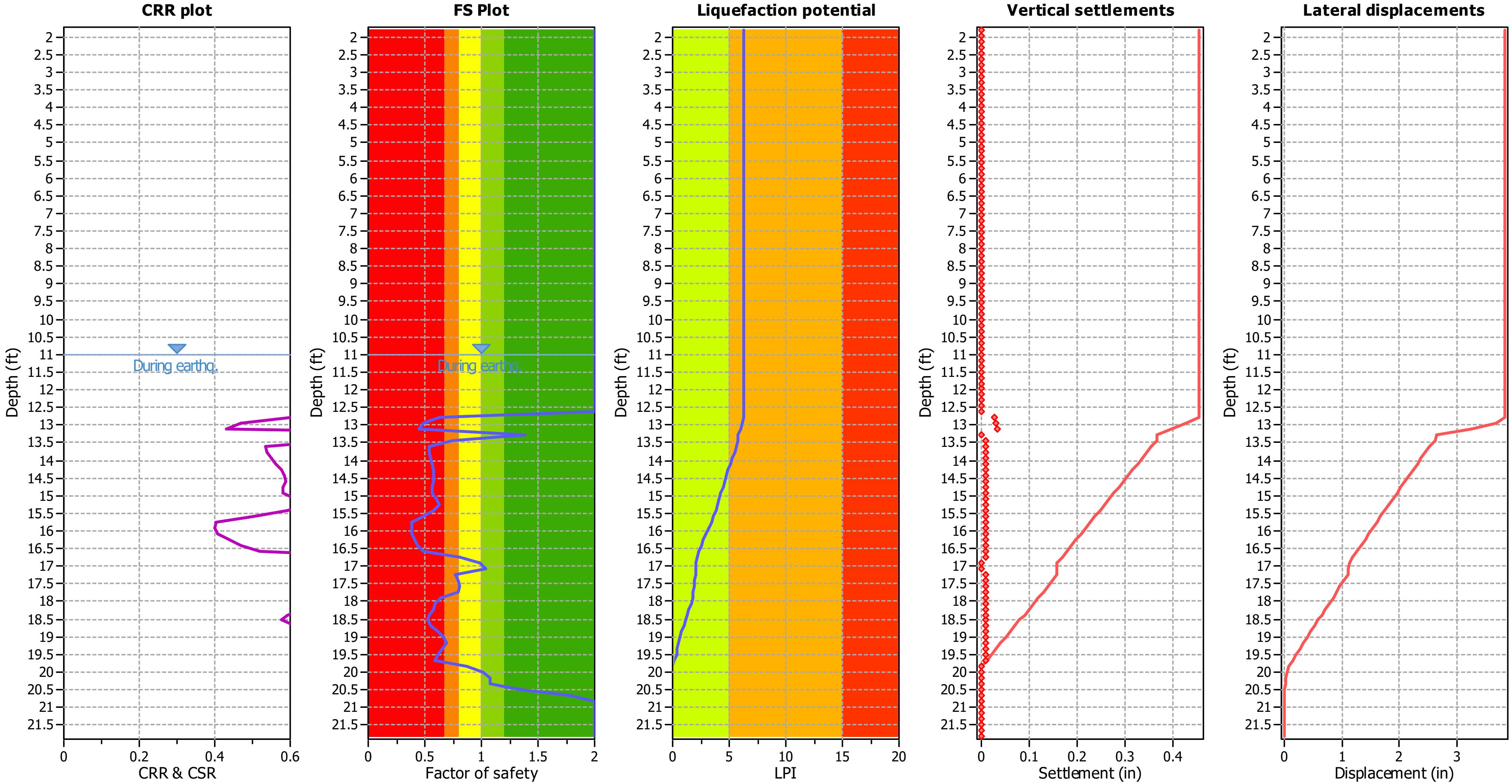
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	11.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	8.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	1.02	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	11.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	8.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	1.02	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

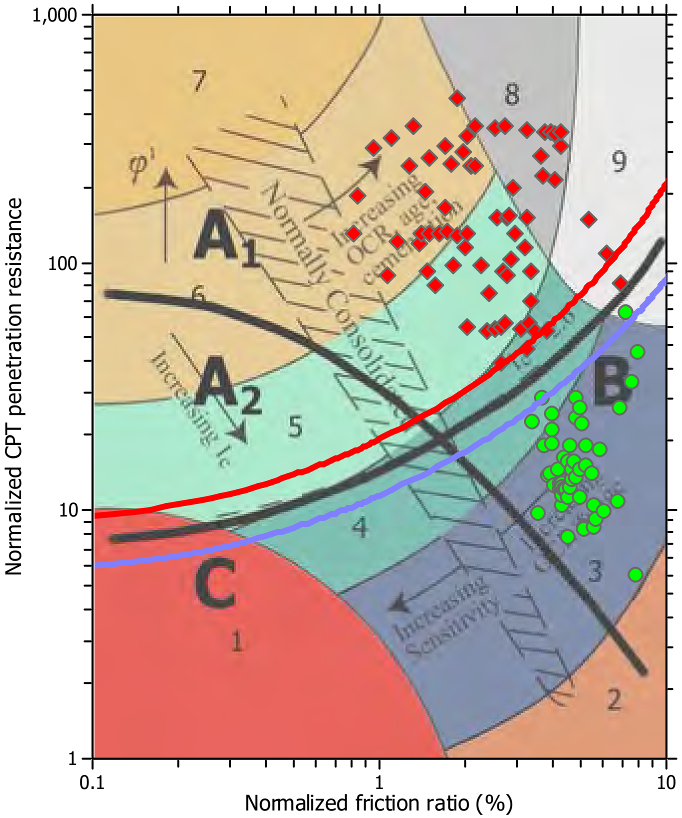
F.S. color scheme

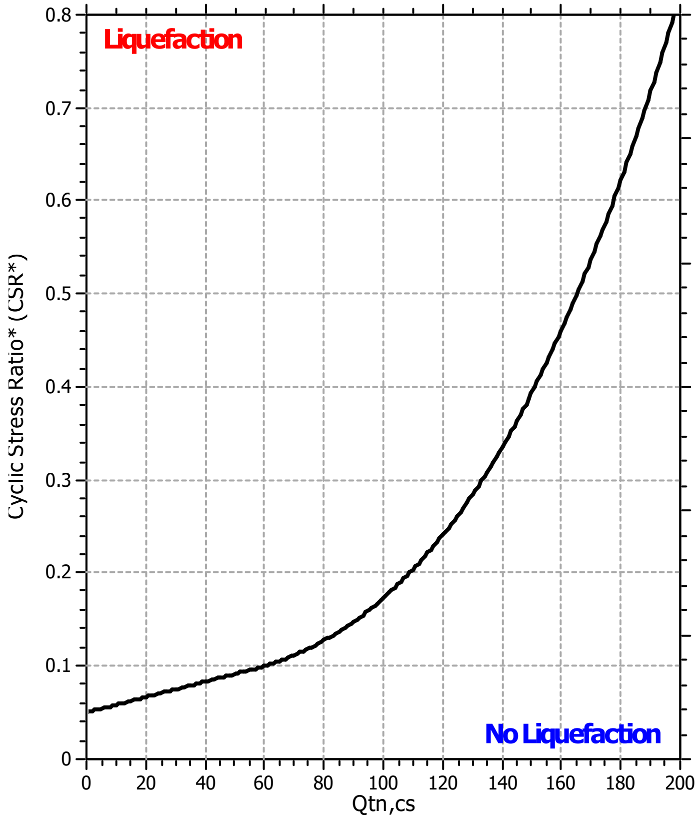
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

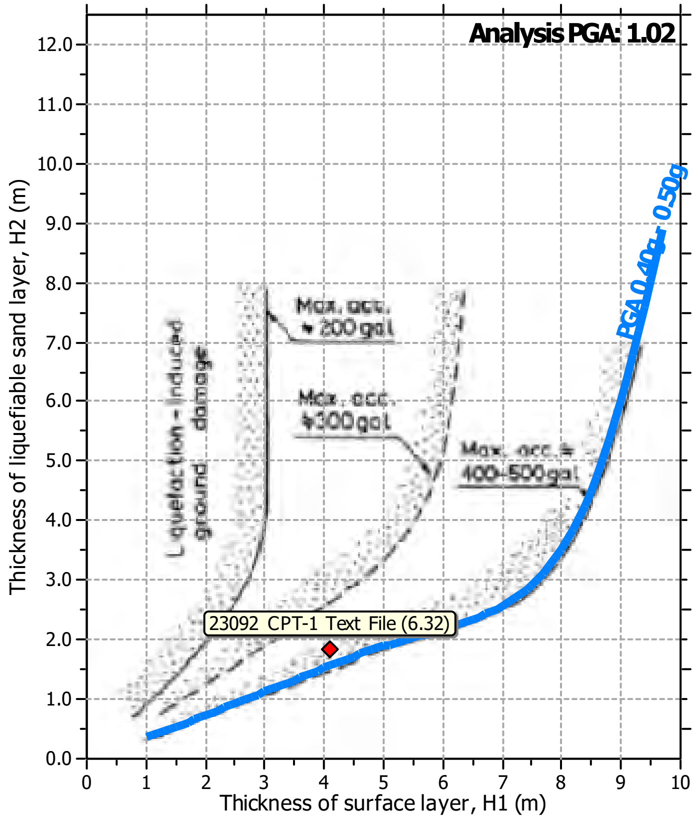
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



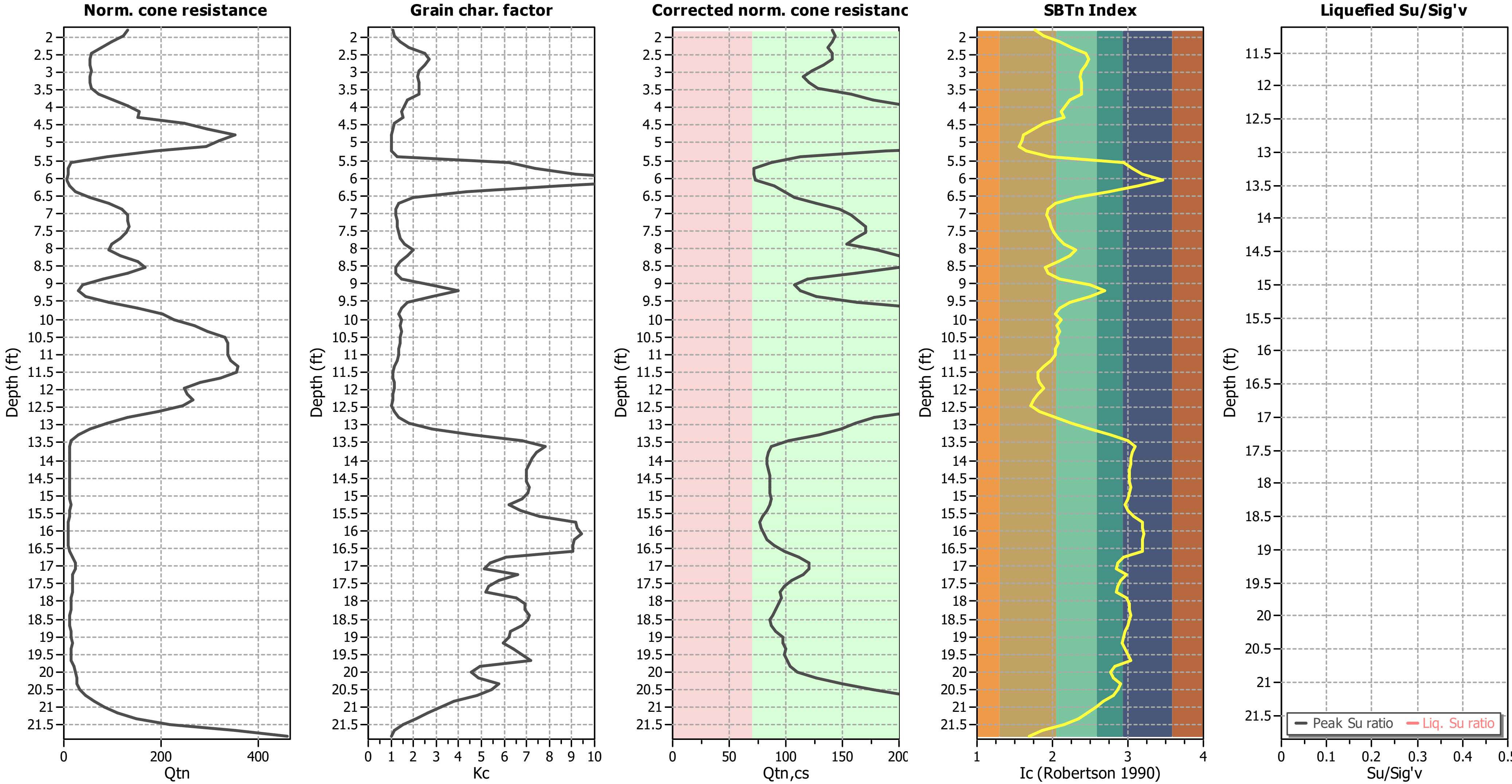




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	11.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	8.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	1.02	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	11.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	8.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	1.02	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	11.00 ft	Fill height:	N/A	Limit depth:	N/A

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	1.80	71.87	0.38	-0.23	7.32	116.39
2	1.97	64.66	0.93	0.28	10.04	118.24
3	2.13	57.23	0.91	4.98	15.46	119.47
4	2.30	34.46	0.97	11.32	20.96	118.98
5	2.46	28.37	0.99	6.83	28.21	118.51
6	2.63	27.26	1.00	4.64	29.74	118.20
7	2.79	28.73	0.92	3.08	28.06	117.54
8	2.95	29.83	0.73	1.03	25.88	116.53
9	3.12	28.67	0.65	-0.78	25.09	115.39
10	3.28	25.70	0.61	-0.04	25.55	116.17
11	3.44	32.22	0.93	0.31	25.86	117.18
12	3.61	32.81	0.93	0.92	25.89	120.65
13	3.77	46.11	1.85	2.61	19.80	123.21
14	3.94	83.87	1.86	2.47	17.90	125.87
15	4.10	78.06	2.44	7.81	16.05	127.09
16	4.26	82.09	2.59	7.63	17.57	128.06
17	4.43	83.01	2.85	7.19	10.20	129.80
18	4.59	228.46	3.08	3.89	7.24	129.67
19	4.76	158.01	1.96	15.41	4.76	130.12
20	4.92	207.27	2.72	14.62	4.21	128.19
21	5.08	188.57	1.42	2.92	3.79	126.54
22	5.25	126.91	0.82	2.94	5.37	121.07
23	5.41	10.60	0.50	-1.56	12.00	114.66
24	5.58	5.45	0.18	-0.81	55.08	106.41
25	5.74	7.40	0.21	0.53	62.12	102.01
26	5.91	3.54	0.16	0.18	72.38	101.74
27	6.07	2.46	0.20	0.25	94.65	102.46
28	6.23	3.83	0.33	-0.17	68.69	106.16
29	6.40	11.51	0.41	0.08	42.99	109.82
30	6.56	21.68	0.48	-0.60	22.79	114.53
31	6.73	54.60	0.85	-0.31	14.21	117.91
32	6.89	80.11	0.95	0.14	11.56	120.39
33	7.05	76.77	1.09	0.78	10.94	121.60
34	7.22	80.15	1.24	0.71	12.05	122.67
35	7.38	80.69	1.47	0.46	12.42	123.46
36	7.55	84.34	1.48	1.25	13.48	123.67
37	7.71	70.53	1.43	1.11	14.92	123.05
38	7.87	56.41	1.26	0.67	17.71	122.28
39	8.04	50.02	1.29	0.81	22.82	124.22
40	8.20	54.25	2.80	1.04	19.93	126.45
41	8.37	105.14	2.55	1.81	15.13	128.08
42	8.53	132.63	2.09	2.22	10.71	126.56
43	8.69	102.42	1.11	1.46	11.32	123.37
44	8.86	36.73	0.81	-0.24	15.91	118.69
45	9.02	23.58	0.59	-0.18	30.34	114.67
46	9.19	12.71	0.49	0.05	40.19	113.61
47	9.35	14.99	0.76	-0.83	31.08	117.76
48	9.51	57.98	1.48	-0.25	20.14	124.16

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	9.68	115.19	2.80	-0.65	15.91	129.56
50	9.84	147.45	4.54	-2.31	14.21	132.94
51	10.01	175.15	5.29	-3.33	16.08	135.79
52	10.17	164.65	8.16	-1.89	14.73	137.28
53	10.34	252.45	8.06	-2.53	15.89	137.28
54	10.50	237.24	11.60	4.06	14.79	137.28
55	10.66	254.58	10.82	3.74	15.19	137.28
56	10.83	273.25	10.36	4.89	14.26	137.28
57	10.99	250.30	9.50	9.95	13.84	137.28
58	11.15	263.82	9.97	7.24	12.22	137.28
59	11.32	305.65	7.45	5.87	10.23	137.28
60	11.48	298.04	6.19	6.46	8.29	137.28
61	11.65	273.43	5.31	3.40	8.17	136.20
62	11.81	231.42	4.61	2.40	8.71	134.69
63	11.97	194.91	3.80	2.47	9.81	133.86
64	12.14	191.57	4.35	5.10	8.45	132.99
65	12.30	250.67	3.07	-2.35	6.98	132.33
66	12.47	233.40	2.63	2.99	6.28	130.53
67	12.63	150.95	2.33	-1.41	8.56	129.04
68	12.79	109.07	2.16	-5.58	13.94	127.51
69	12.96	70.33	2.11	-2.72	20.82	125.82
70	13.12	39.48	1.74	-0.22	30.94	122.83
71	13.29	17.60	0.93	40.89	44.72	118.18
72	13.45	8.47	0.48	52.59	58.75	112.65
73	13.62	8.26	0.40	59.28	64.73	109.35
74	13.78	8.51	0.38	61.61	62.68	108.83
75	13.94	8.85	0.38	57.17	61.42	108.79
76	14.11	9.03	0.39	56.01	60.71	108.97
77	14.27	9.32	0.40	55.95	60.06	109.19
78	14.44	9.67	0.41	54.88	59.84	109.43
79	14.60	9.63	0.42	54.90	59.80	109.56
80	14.76	9.69	0.42	51.71	60.76	109.74
81	14.93	9.47	0.44	54.01	60.40	109.75
82	15.09	9.90	0.42	59.00	58.63	110.13
83	15.26	11.27	0.46	67.25	55.35	110.01
84	15.42	11.94	0.39	32.42	58.33	109.43
85	15.58	7.40	0.35	32.30	63.50	108.35
86	15.75	7.19	0.35	42.07	72.50	107.58
87	15.91	6.91	0.35	45.36	72.98	107.65
88	16.08	7.12	0.36	49.17	73.98	108.38
89	16.24	7.52	0.45	52.48	72.34	109.21
90	16.40	8.48	0.46	53.31	71.91	110.43
91	16.57	8.89	0.56	50.92	71.91	112.26
92	16.73	10.06	0.81	58.13	54.66	115.44
93	16.90	27.21	1.03	45.48	49.97	117.24
94	17.06	20.16	1.03	14.27	48.27	117.39
95	17.22	13.41	0.82	35.93	57.48	115.96
96	17.39	12.17	0.75	62.28	52.33	114.61

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
97	17.55	21.50	0.57	52.20	49.53	113.85
98	17.72	14.82	0.60	29.94	48.91	113.22
99	17.88	11.47	0.60	58.62	57.21	112.75
100	18.05	12.35	0.57	64.26	59.41	112.36
101	18.21	11.99	0.54	61.82	59.46	111.89
102	18.37	10.55	0.50	65.27	60.83	111.26
103	18.54	10.29	0.46	69.59	60.39	110.70
104	18.70	11.26	0.44	73.61	58.68	111.12
105	18.86	12.44	0.56	74.21	55.61	112.23
106	19.03	14.80	0.64	79.47	55.12	113.54
107	19.19	14.70	0.71	68.97	53.81	113.80
108	19.36	14.55	0.60	64.77	56.40	113.94
109	19.52	13.05	0.70	61.48	58.65	113.76
110	19.68	12.49	0.69	66.38	61.21	114.07
111	19.85	13.37	0.71	56.23	47.17	115.64
112	20.01	32.03	0.90	65.36	44.31	117.23
113	20.18	23.55	1.10	-0.98	46.74	119.46
114	20.34	18.85	1.59	-2.31	52.50	121.79
115	20.50	33.08	2.25	2.54	50.28	124.75
116	20.67	42.13	3.05	3.95	46.20	127.92
117	20.83	49.73	4.36	3.32	38.87	131.06
118	21.00	90.81	5.65	3.59	34.31	133.42
119	21.16	100.99	6.42	-0.57	29.40	135.47
120	21.32	129.13	7.70	0.68	24.16	137.28
121	21.49	207.82	9.22	3.77	17.50	137.28
122	21.65	306.01	9.15	4.39	9.65	137.28
123	21.82	543.94	8.31	0.39	6.00	137.28

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_c: Measured cone resistance (tsf)
f_s: Sleeve friction resistance (tsf)
u: Pore pressure (tsf)
Fines content: Percentage of fines in soil (%)
Unit weight: Bulk soil unit weight (pcf)

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
1	1.80	0.10	0.00	0.10	1.00	0.662	0.73	0.912	1.00	1.00	2.000	No
2	1.97	0.11	0.00	0.11	1.00	0.661	0.73	0.911	1.00	1.00	2.000	No
3	2.13	0.12	0.00	0.12	1.00	0.661	0.73	0.911	1.00	1.00	2.000	No
4	2.30	0.13	0.00	0.13	1.00	0.661	0.73	0.911	1.00	1.00	2.000	No
5	2.46	0.14	0.00	0.14	1.00	0.661	0.73	0.910	1.00	1.00	2.000	No
6	2.63	0.15	0.00	0.15	1.00	0.660	0.73	0.910	1.00	1.00	2.000	No
7	2.79	0.16	0.00	0.16	1.00	0.660	0.73	0.910	1.00	1.00	2.000	No
8	2.95	0.17	0.00	0.17	1.00	0.660	0.73	0.909	1.00	1.00	2.000	No
9	3.12	0.18	0.00	0.18	0.99	0.659	0.73	0.909	1.00	1.00	2.000	No
10	3.28	0.19	0.00	0.19	0.99	0.659	0.73	0.909	1.00	1.00	2.000	No
11	3.44	0.20	0.00	0.20	0.99	0.659	0.73	0.908	1.00	1.00	2.000	No
12	3.61	0.21	0.00	0.21	0.99	0.659	0.73	0.908	1.00	1.00	2.000	No
13	3.77	0.22	0.00	0.22	0.99	0.658	0.73	0.907	1.00	1.00	2.000	No
14	3.94	0.23	0.00	0.23	0.99	0.658	0.73	0.907	1.00	1.00	2.000	No
15	4.10	0.24	0.00	0.24	0.99	0.658	0.73	0.907	1.00	1.00	2.000	No
16	4.26	0.25	0.00	0.25	0.99	0.658	0.73	0.906	1.00	1.00	2.000	No
17	4.43	0.26	0.00	0.26	0.99	0.657	0.73	0.906	1.00	1.00	2.000	No
18	4.59	0.27	0.00	0.27	0.99	0.657	0.73	0.906	1.00	1.00	2.000	No
19	4.76	0.28	0.00	0.28	0.99	0.657	0.73	0.905	1.00	1.00	2.000	No
20	4.92	0.30	0.00	0.30	0.99	0.657	0.73	0.905	1.00	1.00	2.000	No
21	5.08	0.31	0.00	0.31	0.99	0.656	0.73	0.905	1.00	1.00	2.000	No
22	5.25	0.32	0.00	0.32	0.99	0.656	0.73	0.904	1.00	1.00	2.000	No
23	5.41	0.32	0.00	0.32	0.99	0.656	0.73	0.904	1.00	1.00	2.000	No
24	5.58	0.33	0.00	0.33	0.99	0.656	0.73	0.904	1.00	1.00	2.000	No
25	5.74	0.34	0.00	0.34	0.99	0.655	0.73	0.903	1.00	1.00	2.000	No
26	5.91	0.35	0.00	0.35	0.99	0.655	0.73	0.903	1.00	1.00	2.000	No
27	6.07	0.36	0.00	0.36	0.99	0.655	0.73	0.903	1.00	1.00	2.000	No
28	6.23	0.37	0.00	0.37	0.99	0.655	0.73	0.902	1.00	1.00	2.000	No
29	6.40	0.38	0.00	0.38	0.99	0.654	0.73	0.902	1.00	1.00	2.000	No
30	6.56	0.39	0.00	0.39	0.99	0.654	0.73	0.902	1.00	1.00	2.000	No
31	6.73	0.40	0.00	0.40	0.99	0.654	0.73	0.901	1.00	1.00	2.000	No
32	6.89	0.41	0.00	0.41	0.99	0.654	0.73	0.901	1.00	1.00	2.000	No
33	7.05	0.42	0.00	0.42	0.99	0.653	0.73	0.901	1.00	1.00	2.000	No
34	7.22	0.43	0.00	0.43	0.99	0.653	0.73	0.900	1.00	1.00	2.000	No
35	7.38	0.44	0.00	0.44	0.98	0.653	0.73	0.900	1.00	1.00	2.000	No
36	7.55	0.45	0.00	0.45	0.98	0.653	0.73	0.900	1.00	1.00	2.000	No
37	7.71	0.46	0.00	0.46	0.98	0.652	0.73	0.899	1.00	1.00	2.000	No
38	7.87	0.47	0.00	0.47	0.98	0.652	0.73	0.899	1.00	1.00	2.000	No
39	8.04	0.48	0.00	0.48	0.98	0.652	0.73	0.899	1.00	1.00	2.000	No
40	8.20	0.49	0.00	0.49	0.98	0.652	0.73	0.898	1.00	1.00	2.000	No
41	8.37	0.50	0.00	0.50	0.98	0.652	0.73	0.898	1.00	1.00	2.000	No
42	8.53	0.51	0.00	0.51	0.98	0.651	0.73	0.898	1.00	1.00	2.000	No
43	8.69	0.52	0.00	0.52	0.98	0.651	0.73	0.897	1.00	1.00	2.000	No
44	8.86	0.53	0.00	0.53	0.98	0.651	0.73	0.897	1.00	1.00	2.000	No
45	9.02	0.54	0.00	0.54	0.98	0.651	0.73	0.897	1.00	1.00	2.000	No
46	9.19	0.55	0.00	0.55	0.98	0.650	0.73	0.896	1.00	1.00	2.000	No
47	9.35	0.56	0.00	0.56	0.98	0.650	0.73	0.896	1.00	1.00	2.000	No
48	9.51	0.57	0.00	0.57	0.98	0.650	0.73	0.896	1.00	1.00	2.000	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	9.68	0.58	0.00	0.58	0.98	0.650	0.73	0.895	1.00	1.00	2.000	No
50	9.84	0.59	0.00	0.59	0.98	0.649	0.73	0.895	1.00	1.00	2.000	No
51	10.01	0.60	0.00	0.60	0.98	0.649	0.73	0.895	1.00	1.00	2.000	No
52	10.17	0.61	0.00	0.61	0.98	0.649	0.73	0.894	1.00	1.00	2.000	No
53	10.34	0.62	0.00	0.62	0.98	0.649	0.73	0.894	1.00	1.00	2.000	No
54	10.50	0.63	0.00	0.63	0.98	0.648	0.73	0.894	1.00	1.00	2.000	No
55	10.66	0.64	0.00	0.64	0.98	0.648	0.73	0.893	1.00	1.00	2.000	No
56	10.83	0.65	0.00	0.65	0.98	0.648	0.73	0.893	1.00	1.00	2.000	No
57	10.99	0.67	0.00	0.67	0.98	0.648	0.73	0.893	1.00	1.00	2.000	No
58	11.15	0.68	0.00	0.67	0.98	0.652	0.73	0.899	1.00	1.00	0.899	No
59	11.32	0.69	0.01	0.68	0.98	0.657	0.73	0.905	1.00	1.00	0.905	No
60	11.48	0.70	0.02	0.68	0.98	0.661	0.73	0.911	1.00	1.00	0.911	No
61	11.65	0.71	0.02	0.69	0.98	0.666	0.73	0.918	1.00	1.00	0.918	No
62	11.81	0.72	0.03	0.70	0.98	0.670	0.73	0.924	1.00	1.00	0.924	No
63	11.97	0.73	0.03	0.70	0.97	0.674	0.73	0.929	1.00	1.00	0.929	No
64	12.14	0.74	0.04	0.71	0.97	0.679	0.73	0.935	1.00	1.00	0.935	No
65	12.30	0.75	0.04	0.71	0.97	0.683	0.73	0.941	1.00	1.00	0.941	No
66	12.47	0.77	0.05	0.72	0.97	0.687	0.73	0.947	1.00	1.00	0.947	No
67	12.63	0.78	0.05	0.73	0.97	0.691	0.73	0.952	1.00	1.00	0.952	No
68	12.79	0.79	0.06	0.73	0.97	0.695	0.73	0.957	1.00	1.00	0.957	No
69	12.96	0.80	0.06	0.74	0.97	0.699	0.73	0.963	1.00	1.00	0.963	No
70	13.12	0.81	0.07	0.74	0.97	0.702	0.73	0.968	1.00	1.00	0.968	No
71	13.29	0.82	0.07	0.75	0.97	0.706	0.73	0.973	1.00	1.00	0.973	No
72	13.45	0.83	0.08	0.75	0.97	0.710	0.73	0.979	1.00	1.00	0.979	No
73	13.62	0.83	0.08	0.75	0.97	0.714	0.73	0.984	1.00	1.00	0.984	No
74	13.78	0.84	0.09	0.76	0.97	0.718	0.73	0.989	1.00	1.00	0.989	No
75	13.94	0.85	0.09	0.76	0.97	0.721	0.73	0.994	1.00	1.00	0.994	No
76	14.11	0.86	0.10	0.76	0.97	0.725	0.73	0.999	1.00	1.00	0.999	No
77	14.27	0.87	0.10	0.77	0.97	0.729	0.73	1.004	1.00	1.00	1.004	No
78	14.44	0.88	0.11	0.77	0.97	0.732	0.73	1.009	1.00	1.00	1.009	No
79	14.60	0.89	0.11	0.78	0.97	0.736	0.73	1.014	1.00	1.00	1.014	No
80	14.76	0.90	0.12	0.78	0.97	0.739	0.73	1.019	1.00	1.00	1.019	No
81	14.93	0.91	0.12	0.78	0.97	0.743	0.73	1.024	1.00	1.00	1.024	No
82	15.09	0.92	0.13	0.79	0.97	0.746	0.73	1.028	1.00	1.00	1.028	No
83	15.26	0.92	0.13	0.79	0.97	0.749	0.73	1.033	1.00	1.00	1.033	No
84	15.42	0.93	0.14	0.80	0.97	0.753	0.73	1.037	1.00	1.00	1.037	No
85	15.58	0.94	0.14	0.80	0.97	0.756	0.73	1.042	1.00	1.00	1.042	No
86	15.75	0.95	0.15	0.80	0.97	0.759	0.73	1.047	1.00	1.00	1.047	No
87	15.91	0.96	0.15	0.81	0.97	0.763	0.73	1.051	1.00	1.00	1.051	No
88	16.08	0.97	0.16	0.81	0.97	0.766	0.73	1.055	1.00	1.00	1.055	No
89	16.24	0.98	0.16	0.81	0.97	0.769	0.73	1.060	1.00	1.00	1.060	No
90	16.40	0.99	0.17	0.82	0.97	0.772	0.73	1.064	1.00	1.00	1.064	No
91	16.57	1.00	0.17	0.82	0.97	0.775	0.73	1.068	1.00	1.00	1.068	No
92	16.73	1.01	0.18	0.83	0.96	0.778	0.73	1.072	1.00	1.00	1.072	No
93	16.90	1.02	0.18	0.83	0.96	0.781	0.73	1.076	1.00	1.00	1.076	No
94	17.06	1.02	0.19	0.84	0.96	0.784	0.73	1.080	1.00	1.00	1.080	No
95	17.22	1.03	0.19	0.84	0.96	0.787	0.73	1.084	1.00	1.00	1.084	No
96	17.39	1.04	0.20	0.84	0.96	0.789	0.73	1.088	1.00	1.00	1.088	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
97	17.55	1.05	0.20	0.85	0.96	0.792	0.73	1.092	1.00	1.00	1.092	No
98	17.72	1.06	0.21	0.85	0.96	0.795	0.73	1.096	1.00	1.00	1.096	No
99	17.88	1.07	0.21	0.86	0.96	0.798	0.73	1.099	1.00	1.00	1.099	No
100	18.05	1.08	0.22	0.86	0.96	0.800	0.73	1.103	1.00	1.00	1.103	No
101	18.21	1.09	0.22	0.87	0.96	0.803	0.73	1.107	1.00	1.00	1.107	No
102	18.37	1.10	0.23	0.87	0.96	0.806	0.73	1.110	1.00	1.00	1.110	No
103	18.54	1.11	0.24	0.87	0.96	0.808	0.73	1.114	1.00	1.00	1.114	No
104	18.70	1.12	0.24	0.88	0.96	0.811	0.73	1.118	1.00	1.00	1.118	No
105	18.86	1.13	0.25	0.88	0.96	0.814	0.73	1.121	1.00	1.00	1.121	No
106	19.03	1.14	0.25	0.89	0.96	0.816	0.73	1.125	1.00	1.00	1.125	No
107	19.19	1.15	0.26	0.89	0.96	0.818	0.73	1.128	1.00	1.00	1.128	No
108	19.36	1.15	0.26	0.89	0.96	0.821	0.73	1.131	1.00	1.00	1.131	No
109	19.52	1.16	0.27	0.90	0.96	0.823	0.73	1.135	1.00	1.00	1.135	No
110	19.68	1.17	0.27	0.90	0.96	0.826	0.73	1.138	1.00	1.00	1.138	No
111	19.85	1.18	0.28	0.91	0.96	0.828	0.73	1.141	1.00	1.00	1.141	No
112	20.01	1.19	0.28	0.91	0.96	0.830	0.73	1.144	1.00	1.00	1.144	No
113	20.18	1.20	0.29	0.92	0.96	0.832	0.73	1.147	1.00	1.00	1.147	No
114	20.34	1.21	0.29	0.92	0.96	0.834	0.73	1.150	1.00	1.00	1.150	No
115	20.50	1.22	0.30	0.93	0.96	0.836	0.73	1.153	1.00	1.00	1.153	No
116	20.67	1.23	0.30	0.93	0.96	0.838	0.73	1.156	1.00	1.00	1.156	No
117	20.83	1.24	0.31	0.94	0.95	0.840	0.73	1.158	1.00	1.00	1.158	No
118	21.00	1.25	0.31	0.94	0.95	0.842	0.73	1.160	1.00	1.00	1.160	No
119	21.16	1.27	0.32	0.95	0.95	0.844	0.73	1.163	1.00	1.00	1.163	No
120	21.32	1.28	0.32	0.95	0.95	0.845	0.73	1.165	1.00	1.00	1.165	No
121	21.49	1.29	0.33	0.96	0.95	0.847	0.73	1.167	1.00	1.00	1.167	No
122	21.65	1.30	0.33	0.97	0.95	0.849	0.73	1.169	1.00	1.00	1.169	No
123	21.82	1.31	0.34	0.97	0.95	0.850	0.73	1.172	1.00	1.00	1.172	No

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
σ_v: Total overburden pressure at test point (tsf)
u_0: Water pressure at test point (tsf)
σ_v': Effective overburden pressure based on GWT during earthquake (tsf)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
CSR_{eq}: CSR adjusted for M=7.5
K_σ: Effective overburden stress factor
CSR^*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) calculation data ::

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	1.80	69.47	1.76	0.81	0.53	131.10	1.08	141.50	4.000	No	No	2.00
2	1.97	64.61	1.89	1.15	0.57	121.91	1.18	143.26	4.000	No	No	2.00
3	2.13	52.20	2.09	1.81	0.65	98.42	1.43	141.16	4.000	No	No	2.00
4	2.30	40.13	2.26	2.40	0.72	75.60	1.82	137.46	4.000	No	No	2.00
5	2.46	30.14	2.44	3.30	0.79	56.70	2.50	141.60	4.000	No	No	2.00
6	2.63	28.19	2.48	3.47	0.80	52.99	2.66	141.14	4.000	No	No	2.00
7	2.79	28.65	2.44	3.10	0.79	53.84	2.48	133.63	4.000	No	No	2.00
8	2.95	29.09	2.39	2.64	0.77	54.66	2.26	123.54	4.000	No	No	2.00
9	3.12	28.07	2.37	2.38	0.76	52.71	2.18	115.04	4.000	No	No	2.00
10	3.28	28.86	2.38	2.55	0.77	54.19	2.23	120.71	4.000	No	No	2.00
11	3.44	30.25	2.39	2.75	0.77	56.79	2.26	128.25	4.000	No	No	2.00
12	3.61	37.07	2.39	3.36	0.77	69.66	2.26	157.47	4.000	No	No	2.00
13	3.77	54.29	2.22	2.86	0.71	102.20	1.73	176.48	4.000	No	No	2.00
14	3.94	69.41	2.17	2.97	0.69	130.76	1.59	207.84	4.000	No	No	2.00
15	4.10	81.43	2.11	2.83	0.66	153.45	1.47	225.43	4.000	No	No	2.00
16	4.26	81.16	2.16	3.25	0.68	152.93	1.57	239.59	4.000	No	No	2.00
17	4.43	131.28	1.89	2.17	0.58	247.64	1.18	292.53	4.000	No	No	2.00
18	4.59	156.62	1.76	1.68	0.53	295.52	1.08	318.24	4.000	No	No	2.00
19	4.76	198.08	1.62	1.31	0.48	352.44	1.00	352.44	4.000	No	No	2.00
20	4.92	184.77	1.59	1.10	0.47	317.63	1.00	317.63	4.000	No	No	2.00
21	5.08	174.35	1.56	0.95	0.46	291.27	1.00	291.27	4.000	No	No	2.00
22	5.25	108.71	1.66	0.85	0.50	186.86	1.01	188.66	4.000	No	No	2.00
23	5.41	47.66	1.96	1.06	0.61	89.46	1.26	112.35	4.000	No	No	2.00
24	5.58	7.81	2.95	3.98	0.99	14.13	6.19	87.43	4.000	No	Yes	2.00
25	5.74	5.46	3.05	3.59	1.00	9.68	7.35	71.17	4.000	No	Yes	2.00
26	5.91	4.47	3.19	4.59	1.00	7.79	9.14	71.19	4.000	No	Yes	2.00
27	6.07	3.28	3.45	7.92	1.00	5.52	13.27	73.21	4.000	No	Yes	2.00
28	6.23	5.93	3.14	5.65	1.00	10.52	8.49	89.29	4.000	No	Yes	2.00
29	6.40	12.34	2.75	3.40	0.91	22.61	4.35	98.35	4.000	No	Yes	2.00
30	6.56	29.26	2.31	2.01	0.75	54.58	1.97	107.65	4.000	No	No	2.00
31	6.73	52.13	2.05	1.47	0.65	92.58	1.36	126.30	4.000	No	No	2.00
32	6.89	70.50	1.95	1.38	0.61	119.02	1.24	147.19	4.000	No	No	2.00
33	7.05	79.02	1.92	1.39	0.60	130.41	1.21	157.91	4.000	No	No	2.00
34	7.22	79.21	1.97	1.61	0.62	130.88	1.26	164.68	4.000	No	No	2.00
35	7.38	81.74	1.98	1.72	0.62	133.80	1.28	170.63	4.000	No	No	2.00
36	7.55	78.53	2.02	1.87	0.64	128.36	1.33	170.21	4.000	No	No	2.00
37	7.71	70.44	2.07	1.98	0.66	115.32	1.40	161.80	4.000	No	No	2.00
38	7.87	59.00	2.16	2.27	0.70	97.85	1.58	154.26	4.000	No	No	2.00
39	8.04	53.57	2.31	3.36	0.75	91.48	1.97	180.64	4.000	No	No	2.00
40	8.20	69.82	2.23	3.19	0.72	114.81	1.74	199.41	4.000	No	No	2.00
41	8.37	97.36	2.08	2.56	0.66	151.32	1.42	214.14	4.000	No	No	2.00
42	8.53	113.42	1.91	1.69	0.60	166.22	1.20	199.72	4.000	No	No	2.00
43	8.69	90.61	1.94	1.48	0.61	131.97	1.23	161.89	4.000	No	No	2.00
44	8.86	54.25	2.10	1.55	0.68	81.32	1.46	118.81	4.000	No	No	2.00
45	9.02	24.34	2.49	2.65	0.82	39.39	2.73	107.54	4.000	No	No	2.00
46	9.19	17.09	2.70	3.70	0.90	28.43	9.88	280.73	4.000	No	No	2.00
47	9.35	28.56	2.51	3.25	0.83	45.23	2.97	134.43	4.000	No	No	2.00
48	9.51	62.71	2.23	2.70	0.73	92.63	1.75	162.41	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	9.68	106.86	2.10	2.77	0.68	151.70	1.46	221.60	4.000	No	No	2.00
50	9.84	145.90	2.05	2.90	0.66	202.19	1.36	275.83	4.000	No	No	2.00
51	10.01	162.38	2.11	3.70	0.68	225.50	1.47	331.69	4.000	No	No	2.00
52	10.17	197.38	2.06	3.64	0.66	268.31	1.39	373.54	4.000	No	No	2.00
53	10.34	218.11	2.10	4.26	0.68	295.40	1.46	431.12	4.000	No	No	2.00
54	10.50	248.12	2.07	4.11	0.67	329.76	1.40	460.31	4.000	No	No	2.00
55	10.66	255.08	2.08	4.29	0.67	336.02	1.42	476.66	4.000	No	No	2.00
56	10.83	259.47	2.05	3.95	0.66	335.93	1.37	459.13	4.000	No	No	2.00
57	10.99	262.56	2.03	3.80	0.66	335.32	1.34	450.82	4.000	No	No	2.00
58	11.15	273.37	1.97	3.29	0.63	343.43	1.27	434.68	4.000	No	No	2.00
59	11.32	289.26	1.89	2.73	0.60	356.57	1.18	421.60	4.000	No	No	2.00
60	11.48	292.45	1.81	2.16	0.57	353.56	1.11	393.31	4.000	No	No	2.00
61	11.65	267.69	1.80	2.01	0.57	321.65	1.11	356.44	4.000	No	No	2.00
62	11.81	233.29	1.83	1.97	0.58	279.98	1.13	315.49	4.000	No	No	2.00
63	11.97	206.01	1.88	2.07	0.60	247.83	1.17	289.16	4.000	No	No	2.00
64	12.14	212.41	1.82	1.77	0.58	251.98	1.12	281.70	4.000	No	No	2.00
65	12.30	225.24	1.74	1.49	0.55	263.24	1.07	281.15	4.000	No	No	2.00
66	12.47	211.67	1.71	1.27	0.53	244.98	1.04	255.66	4.000	No	No	2.00
67	12.63	164.45	1.82	1.45	0.58	192.45	1.12	215.90	4.000	No	No	2.00
68	12.79	110.07	2.04	2.01	0.66	131.91	1.35	178.07	0.605	No	No	0.63
69	12.96	72.92	2.25	2.78	0.74	89.30	1.81	161.37	0.471	No	No	0.49
70	13.12	42.65	2.51	3.81	0.84	53.37	2.91	155.46	0.429	No	No	0.44
71	13.29	22.30	2.78	4.87	0.94	28.26	4.60	129.95	1.348	No	Yes	1.39
72	13.45	12.18	3.00	5.30	1.00	15.15	6.79	102.84	0.723	No	Yes	0.74
73	13.62	9.25	3.09	4.99	1.00	11.17	7.80	87.08	0.533	No	Yes	0.54
74	13.78	9.39	3.06	4.55	1.00	11.30	7.45	84.13	0.539	No	Yes	0.54
75	13.94	9.64	3.04	4.37	1.00	11.55	7.23	83.51	0.551	No	Yes	0.55
76	14.11	9.88	3.03	4.32	1.00	11.79	7.11	83.90	0.563	No	Yes	0.56
77	14.27	10.14	3.02	4.30	1.00	12.06	7.01	84.52	0.575	No	Yes	0.57
78	14.44	10.34	3.02	4.33	1.00	12.24	6.97	85.34	0.584	No	Yes	0.58
79	14.60	10.44	3.02	4.35	1.00	12.30	6.96	85.66	0.587	No	Yes	0.58
80	14.76	10.37	3.03	4.50	1.00	12.14	7.12	86.48	0.579	No	Yes	0.57
81	14.93	10.48	3.03	4.45	1.00	12.21	7.06	86.22	0.582	No	Yes	0.57
82	15.09	11.08	3.00	4.33	1.00	12.90	6.77	87.31	0.615	No	Yes	0.60
83	15.26	11.80	2.95	3.90	1.00	13.73	6.23	85.59	0.655	No	Yes	0.63
84	15.42	10.84	3.00	4.07	1.00	12.45	6.72	83.63	0.594	No	Yes	0.57
85	15.58	9.36	3.07	4.34	1.00	10.53	7.59	79.86	0.502	No	Yes	0.48
86	15.75	7.74	3.19	5.15	1.00	8.46	9.16	77.47	0.403	No	Yes	0.39
87	15.91	7.73	3.20	5.22	1.00	8.39	9.25	77.58	0.400	No	Yes	0.38
88	16.08	7.89	3.21	5.61	1.00	8.54	9.43	80.49	0.407	No	Yes	0.39
89	16.24	8.45	3.19	5.68	1.00	9.18	9.13	83.79	0.438	No	Yes	0.41
90	16.40	9.05	3.19	6.09	1.00	9.85	9.05	89.21	0.470	No	Yes	0.44
91	16.57	9.92	3.19	6.84	1.00	10.85	9.06	98.30	0.518	No	Yes	0.48
92	16.73	16.13	2.94	5.30	1.00	18.29	6.12	111.96	0.873	No	Yes	0.81
93	16.90	19.71	2.87	5.13	0.98	22.39	5.38	120.54	1.068	No	Yes	0.99
94	17.06	20.72	2.84	4.89	0.97	23.41	5.12	119.92	1.116	No	Yes	1.03
95	17.22	15.79	2.99	5.88	1.00	17.56	6.58	115.53	0.838	No	Yes	0.77
96	17.39	16.42	2.91	4.63	1.00	18.19	5.75	104.60	0.868	No	Yes	0.80

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
97	17.55	16.86	2.86	4.03	0.98	18.54	5.32	98.55	0.884	No	Yes	0.81
98	17.72	16.61	2.85	3.78	0.98	18.13	5.22	94.67	0.865	No	Yes	0.79
99	17.88	13.61	2.98	4.68	1.00	14.64	6.53	95.62	0.698	No	Yes	0.64
100	18.05	12.82	3.01	4.84	1.00	13.64	6.90	94.06	0.651	No	Yes	0.59
101	18.21	12.55	3.01	4.68	1.00	13.25	6.91	91.47	0.632	No	Yes	0.57
102	18.37	11.89	3.03	4.65	1.00	12.41	7.13	88.56	0.592	No	Yes	0.53
103	18.54	11.70	3.03	4.41	1.00	12.13	7.06	85.66	0.579	No	Yes	0.52
104	18.70	12.37	3.00	4.31	1.00	12.83	6.78	86.96	0.612	No	Yes	0.55
105	18.86	13.92	2.96	4.25	1.00	14.52	6.27	91.11	0.693	No	Yes	0.62
106	19.03	15.05	2.95	4.55	1.00	15.71	6.20	97.36	0.750	No	Yes	0.67
107	19.19	15.71	2.93	4.44	1.00	16.37	5.98	97.96	0.781	No	Yes	0.69
108	19.36	15.04	2.97	4.82	1.00	15.53	6.40	99.45	0.741	No	Yes	0.65
109	19.52	14.29	3.00	5.06	1.00	14.61	6.77	98.96	0.697	No	Yes	0.61
110	19.68	13.85	3.04	5.52	1.00	14.05	7.20	101.17	0.670	No	Yes	0.59
111	19.85	20.20	2.82	4.02	0.97	20.87	4.96	103.48	0.995	No	Yes	0.87
112	20.01	23.56	2.77	4.04	0.95	24.36	4.54	110.57	1.162	No	Yes	1.02
113	20.18	25.11	2.81	5.02	0.97	25.97	4.90	127.14	1.239	No	Yes	1.08
114	20.34	25.16	2.91	6.88	1.00	26.01	5.78	150.25	1.241	No	Yes	1.08
115	20.50	31.37	2.87	7.61	0.99	32.52	5.43	176.59	1.551	No	Yes	1.35
116	20.67	41.69	2.80	7.95	0.96	43.24	4.81	208.19	2.063	No	Yes	1.79
117	20.83	60.94	2.67	7.29	0.91	63.05	8.43	531.44	4.000	No	No	2.00
118	21.00	80.54	2.58	6.91	0.88	82.93	4.70	389.64	4.000	No	No	2.00
119	21.16	106.99	2.47	6.23	0.84	109.49	2.63	287.52	4.000	No	No	2.00
120	21.32	146.00	2.34	5.38	0.79	148.32	2.10	310.83	4.000	No	No	2.00
121	21.49	214.36	2.15	4.08	0.72	215.77	1.56	337.06	4.000	No	No	2.00
122	21.65	352.63	1.87	2.53	0.61	350.70	1.16	407.01	4.000	No	No	2.00
123	21.82	464.65	1.69	1.85	0.54	458.19	1.03	473.63	4.000	No	No	2.00

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_t: Total cone resistance
I_c: Soil behavior type index
Fr: Normalized friction ratio (%)
n: Stress exponent
Q_{tn}: Normalized cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for M_w=7.5
FS: Factor of safety against soil liquefaction

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
1.80	2.00	0.00	9.73	0.17	0.00	1.97	2.00	0.00	9.70	0.17	0.00
2.13	2.00	0.00	9.67	0.16	0.00	2.30	2.00	0.00	9.65	0.16	0.00
2.46	2.00	0.00	9.62	0.16	0.00	2.63	2.00	0.00	9.60	0.16	0.00
2.79	2.00	0.00	9.57	0.16	0.00	2.95	2.00	0.00	9.55	0.16	0.00
3.12	2.00	0.00	9.52	0.16	0.00	3.28	2.00	0.00	9.50	0.16	0.00
3.44	2.00	0.00	9.47	0.16	0.00	3.61	2.00	0.00	9.45	0.16	0.00
3.77	2.00	0.00	9.42	0.16	0.00	3.94	2.00	0.00	9.40	0.16	0.00
4.10	2.00	0.00	9.38	0.16	0.00	4.26	2.00	0.00	9.35	0.16	0.00
4.43	2.00	0.00	9.33	0.16	0.00	4.59	2.00	0.00	9.30	0.16	0.00
4.76	2.00	0.00	9.28	0.16	0.00	4.92	2.00	0.00	9.25	0.16	0.00
5.08	2.00	0.00	9.23	0.16	0.00	5.25	2.00	0.00	9.20	0.16	0.00
5.41	2.00	0.00	9.18	0.16	0.00	5.58	2.00	0.00	9.15	0.16	0.00
5.74	2.00	0.00	9.13	0.16	0.00	5.91	2.00	0.00	9.10	0.17	0.00
6.07	2.00	0.00	9.07	0.16	0.00	6.23	2.00	0.00	9.05	0.16	0.00
6.40	2.00	0.00	9.02	0.16	0.00	6.56	2.00	0.00	9.00	0.16	0.00
6.73	2.00	0.00	8.97	0.16	0.00	6.89	2.00	0.00	8.95	0.16	0.00
7.05	2.00	0.00	8.92	0.16	0.00	7.22	2.00	0.00	8.90	0.16	0.00
7.38	2.00	0.00	8.87	0.16	0.00	7.55	2.00	0.00	8.85	0.16	0.00
7.71	2.00	0.00	8.82	0.16	0.00	7.87	2.00	0.00	8.80	0.16	0.00
8.04	2.00	0.00	8.78	0.16	0.00	8.20	2.00	0.00	8.75	0.16	0.00
8.37	2.00	0.00	8.73	0.16	0.00	8.53	2.00	0.00	8.70	0.16	0.00
8.69	2.00	0.00	8.68	0.16	0.00	8.86	2.00	0.00	8.65	0.16	0.00
9.02	2.00	0.00	8.63	0.16	0.00	9.19	2.00	0.00	8.60	0.16	0.00
9.35	2.00	0.00	8.58	0.16	0.00	9.51	2.00	0.00	8.55	0.16	0.00
9.68	2.00	0.00	8.53	0.16	0.00	9.84	2.00	0.00	8.50	0.16	0.00
10.01	2.00	0.00	8.47	0.16	0.00	10.17	2.00	0.00	8.45	0.16	0.00
10.34	2.00	0.00	8.42	0.16	0.00	10.50	2.00	0.00	8.40	0.16	0.00
10.66	2.00	0.00	8.37	0.16	0.00	10.83	2.00	0.00	8.35	0.16	0.00
10.99	2.00	0.00	8.32	0.16	0.00	11.15	2.00	0.00	8.30	0.16	0.00
11.32	2.00	0.00	8.27	0.16	0.00	11.48	2.00	0.00	8.25	0.16	0.00
11.65	2.00	0.00	8.22	0.16	0.00	11.81	2.00	0.00	8.20	0.16	0.00
11.97	2.00	0.00	8.18	0.16	0.00	12.14	2.00	0.00	8.15	0.16	0.00
12.30	2.00	0.00	8.13	0.16	0.00	12.47	2.00	0.00	8.10	0.16	0.00
12.63	2.00	0.00	8.08	0.16	0.00	12.79	0.63	0.37	8.05	0.16	0.15
12.96	0.49	0.51	8.03	0.16	0.21	13.12	0.44	0.56	8.00	0.16	0.22
13.29	1.39	0.00	7.98	0.16	0.00	13.45	0.74	0.26	7.95	0.16	0.10
13.62	0.54	0.46	7.93	0.16	0.18	13.78	0.54	0.46	7.90	0.16	0.18
13.94	0.55	0.45	7.87	0.16	0.18	14.11	0.56	0.44	7.85	0.16	0.17
14.27	0.57	0.43	7.82	0.16	0.17	14.44	0.58	0.42	7.80	0.16	0.16
14.60	0.58	0.42	7.77	0.16	0.16	14.76	0.57	0.43	7.75	0.16	0.17
14.93	0.57	0.43	7.72	0.16	0.17	15.09	0.60	0.40	7.70	0.16	0.15
15.26	0.63	0.37	7.67	0.16	0.14	15.42	0.57	0.43	7.65	0.16	0.16
15.58	0.48	0.52	7.62	0.16	0.20	15.75	0.39	0.61	7.60	0.16	0.23
15.91	0.38	0.62	7.58	0.16	0.23	16.08	0.39	0.61	7.55	0.16	0.23
16.24	0.41	0.59	7.53	0.16	0.22	16.40	0.44	0.56	7.50	0.16	0.21
16.57	0.48	0.52	7.48	0.16	0.19	16.73	0.81	0.19	7.45	0.16	0.07
16.90	0.99	0.01	7.43	0.16	0.00	17.06	1.03	0.00	7.40	0.16	0.00
17.22	0.77	0.23	7.38	0.16	0.08	17.39	0.80	0.20	7.35	0.16	0.07

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI
17.55	0.81	0.19	7.33	0.16	0.07
17.72	0.79	0.21	7.30	0.16	0.08
17.88	0.64	0.36	7.27	0.16	0.13
18.05	0.59	0.41	7.25	0.16	0.15
18.21	0.57	0.43	7.22	0.16	0.15
18.37	0.53	0.47	7.20	0.16	0.17
18.54	0.52	0.48	7.17	0.16	0.17
18.70	0.55	0.45	7.15	0.16	0.16
18.86	0.62	0.38	7.12	0.16	0.14
19.03	0.67	0.33	7.10	0.16	0.12
19.19	0.69	0.31	7.07	0.16	0.11
19.36	0.65	0.35	7.05	0.16	0.12
19.52	0.61	0.39	7.02	0.16	0.14
19.68	0.59	0.41	7.00	0.16	0.14
19.85	0.87	0.13	6.98	0.16	0.04
20.01	1.02	0.00	6.95	0.16	0.00
20.18	1.08	0.00	6.93	0.16	0.00
20.34	1.08	0.00	6.90	0.16	0.00
20.50	1.35	0.00	6.88	0.16	0.00
20.67	1.79	0.00	6.85	0.16	0.00
20.83	2.00	0.00	6.83	0.16	0.00
21.00	2.00	0.00	6.80	0.16	0.00
21.16	2.00	0.00	6.78	0.16	0.00
21.32	2.00	0.00	6.75	0.16	0.00
21.49	2.00	0.00	6.72	0.16	0.00
21.65	2.00	0.00	6.70	0.16	0.00
21.82	2.00	0.00	6.67	0.16	0.00

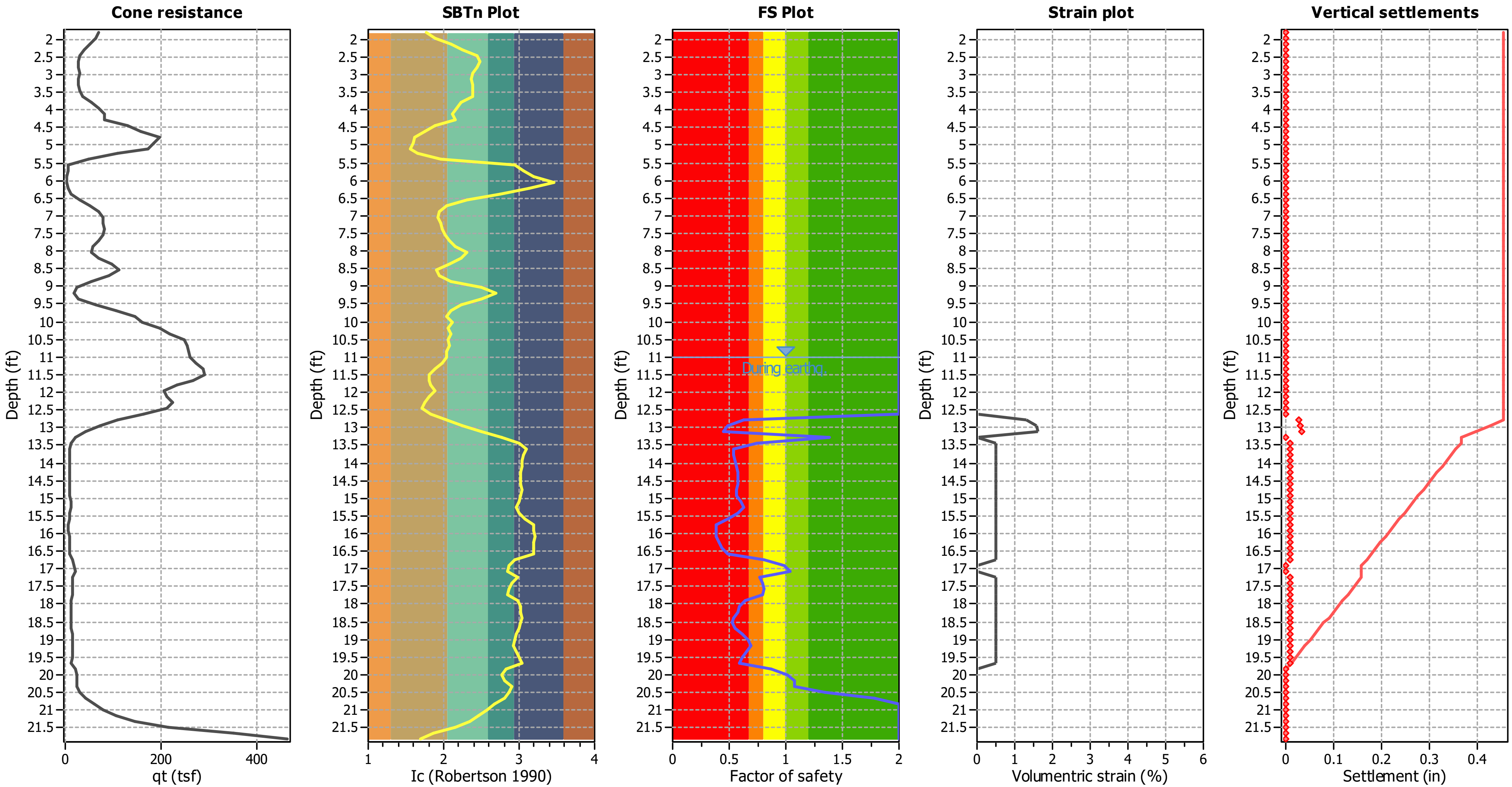
Overall liquefaction potential: 6.32

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
F_L: 1 - FS
w_z: Function value of the extend of soil liquefaction according to depth
d_z: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
11.15	434.68	2.00	0.00	1.00	0.00	11.32	421.60	2.00	0.00	1.00	0.00
11.48	393.31	2.00	0.00	1.00	0.00	11.65	356.44	2.00	0.00	1.00	0.00
11.81	315.49	2.00	0.00	1.00	0.00	11.97	289.16	2.00	0.00	1.00	0.00
12.14	281.70	2.00	0.00	1.00	0.00	12.30	281.15	2.00	0.00	1.00	0.00
12.47	255.66	2.00	0.00	1.00	0.00	12.63	215.90	2.00	0.00	1.00	0.00
12.79	178.07	0.63	1.31	1.00	0.03	12.96	161.37	0.49	1.58	1.00	0.03
13.12	155.46	0.44	1.63	1.00	0.03	13.29	129.95	1.39	0.00	1.00	0.00
13.45	102.84	0.74	0.50	1.00	0.01	13.62	87.08	0.54	0.50	1.00	0.01
13.78	84.13	0.54	0.50	1.00	0.01	13.94	83.51	0.55	0.50	1.00	0.01
14.11	83.90	0.56	0.50	1.00	0.01	14.27	84.52	0.57	0.50	1.00	0.01
14.44	85.34	0.58	0.50	1.00	0.01	14.60	85.66	0.58	0.50	1.00	0.01
14.76	86.48	0.57	0.50	1.00	0.01	14.93	86.22	0.57	0.50	1.00	0.01
15.09	87.31	0.60	0.50	1.00	0.01	15.26	85.59	0.63	0.50	1.00	0.01
15.42	83.63	0.57	0.50	1.00	0.01	15.58	79.86	0.48	0.50	1.00	0.01
15.75	77.47	0.39	0.50	1.00	0.01	15.91	77.58	0.38	0.50	1.00	0.01
16.08	80.49	0.39	0.50	1.00	0.01	16.24	83.79	0.41	0.50	1.00	0.01
16.40	89.21	0.44	0.50	1.00	0.01	16.57	98.30	0.48	0.50	1.00	0.01
16.73	111.96	0.81	0.50	1.00	0.01	16.90	120.54	0.99	0.01	1.00	0.00
17.06	119.92	1.03	0.01	1.00	0.00	17.22	115.53	0.77	0.50	1.00	0.01
17.39	104.60	0.80	0.50	1.00	0.01	17.55	98.55	0.81	0.50	1.00	0.01
17.72	94.67	0.79	0.50	1.00	0.01	17.88	95.62	0.64	0.50	1.00	0.01
18.05	94.06	0.59	0.50	1.00	0.01	18.21	91.47	0.57	0.50	1.00	0.01
18.37	88.56	0.53	0.50	1.00	0.01	18.54	85.66	0.52	0.50	1.00	0.01
18.70	86.96	0.55	0.50	1.00	0.01	18.86	91.11	0.62	0.50	1.00	0.01
19.03	97.36	0.67	0.50	1.00	0.01	19.19	97.96	0.69	0.50	1.00	0.01
19.36	99.45	0.65	0.50	1.00	0.01	19.52	98.96	0.61	0.50	1.00	0.01
19.68	101.17	0.59	0.50	1.00	0.01	19.85	103.48	0.87	0.01	1.00	0.00
20.01	110.57	1.02	0.01	1.00	0.00	20.18	127.14	1.08	0.01	1.00	0.00
20.34	150.25	1.08	0.01	1.00	0.00	20.50	176.59	1.35	0.01	1.00	0.00
20.67	208.19	1.79	0.00	1.00	0.00	20.83	531.44	2.00	0.00	1.00	0.00
21.00	389.64	2.00	0.00	1.00	0.00	21.16	287.52	2.00	0.00	1.00	0.00
21.32	310.83	2.00	0.00	1.00	0.00	21.49	337.06	2.00	0.00	1.00	0.00
21.65	407.01	2.00	0.00	1.00	0.00	21.82	473.63	2.00	0.00	1.00	0.00

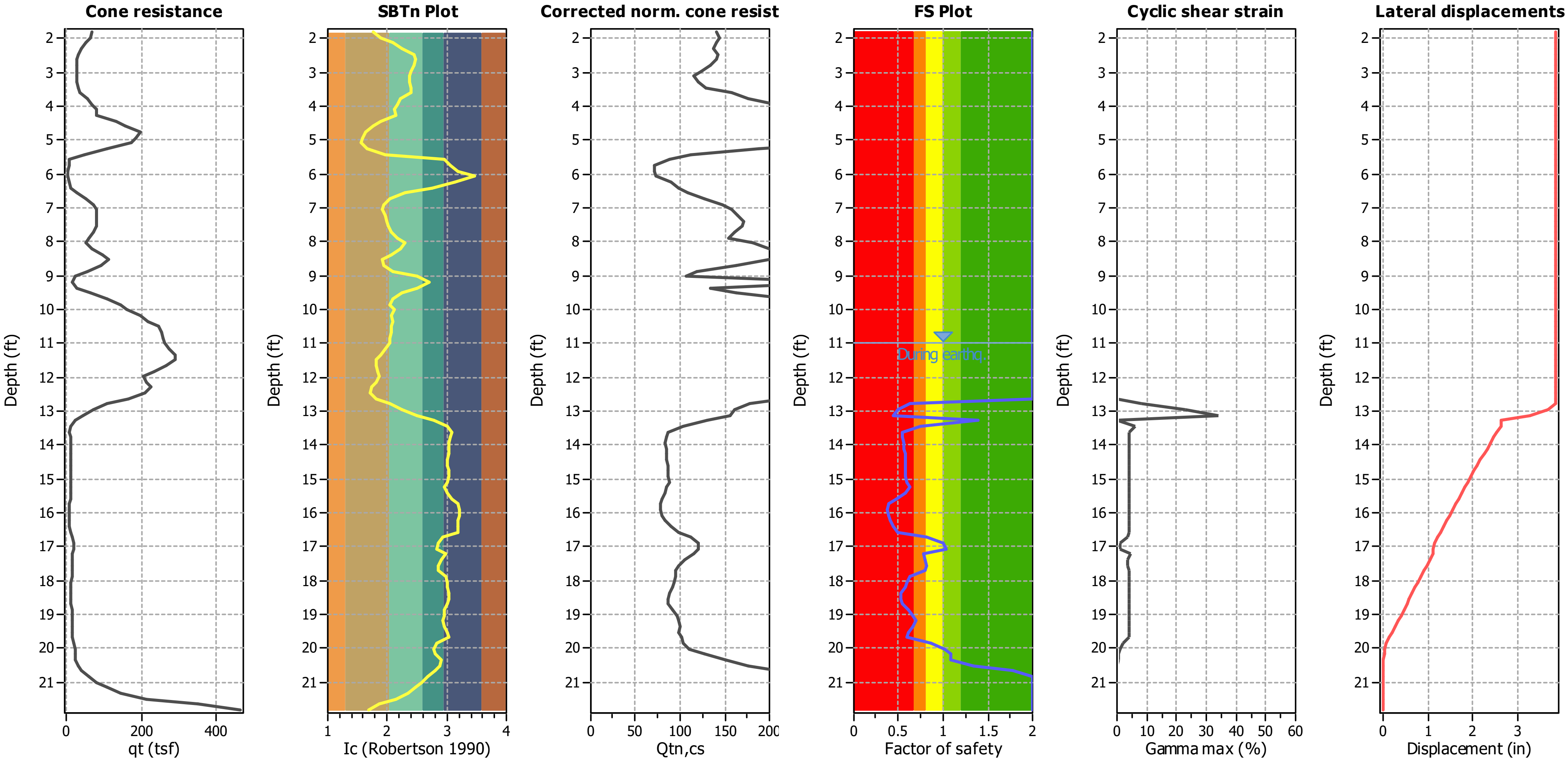
Total estimated settlement: 0.45

Abbreviations

$Q_{tn,cs}$: Equivalent clean sand normalized cone resistance
FS: Factor of safety against liquefaction
e_v (%): Post-liquefaction volumentric strain
DF: e_v depth weighting factor
Settlement: Calculated settlement

Estimation of post-earthquake lateral Displacements

Geometric parameters: Gently sloping ground without free face (Slope 1.00 %)

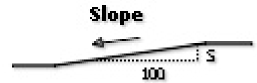


Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent clean sand normalized CPT total cone resistance

F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
11.15	273.37	343.43	3.28	434.68	2.00	100.00	0.00	0.00
11.32	289.26	356.57	2.72	421.60	2.00	100.00	0.00	0.00
11.48	292.45	353.56	2.16	393.31	2.00	100.00	0.00	0.00
11.65	267.69	321.65	2.01	356.44	2.00	100.00	0.00	0.00
11.81	233.29	279.98	1.96	315.49	2.00	100.00	0.00	0.00
11.97	206.01	247.83	2.06	289.16	2.00	96.96	0.00	0.00
12.14	212.41	251.98	1.76	281.70	2.00	97.50	0.00	0.00
12.30	225.24	263.24	1.49	281.15	2.00	98.95	0.00	0.00
12.47	211.67	244.98	1.26	255.66	2.00	96.57	0.00	0.00
12.63	164.45	192.45	1.44	215.90	2.00	88.61	0.00	0.00
12.79	110.07	131.91	2.00	178.07	0.63	76.14	8.36	0.15
12.96	72.92	89.30	2.75	161.37	0.49	63.27	22.70	0.42
13.12	42.65	53.37	3.73	155.46	0.44	46.27	34.10	0.63
13.29	22.30	28.26	4.70	129.95	1.39	25.29	0.22	0.00
13.45	12.18	15.15	4.94	102.84	0.74	4.71	5.90	0.11
13.62	9.25	11.17	4.54	87.08	0.54	0.00	4.00	0.07
13.78	9.39	11.30	4.14	84.13	0.54	0.00	4.00	0.07
13.94	9.64	11.55	3.99	83.51	0.55	0.00	4.00	0.07
14.11	9.88	11.79	3.95	83.90	0.56	0.00	4.00	0.07
14.27	10.14	12.06	3.93	84.52	0.57	0.00	4.00	0.07
14.44	10.34	12.24	3.96	85.34	0.58	0.00	4.00	0.07
14.60	10.44	12.30	3.98	85.66	0.58	0.00	4.00	0.07
14.76	10.37	12.14	4.11	86.48	0.57	0.00	4.00	0.07
14.93	10.48	12.21	4.06	86.22	0.57	0.00	4.00	0.07
15.09	11.08	12.90	3.97	87.31	0.60	0.00	4.00	0.07
15.26	11.80	13.73	3.59	85.59	0.63	1.47	4.00	0.07
15.42	10.84	12.45	3.72	83.63	0.57	0.00	4.00	0.07
15.58	9.36	10.53	3.90	79.86	0.48	0.00	4.00	0.07
15.75	7.74	8.46	4.52	77.47	0.39	0.00	4.00	0.07
15.91	7.73	8.39	4.57	77.58	0.38	0.00	4.00	0.07
16.08	7.89	8.54	4.92	80.49	0.39	0.00	4.00	0.07
16.24	8.45	9.18	5.03	83.79	0.41	0.00	4.00	0.07
16.40	9.05	9.85	5.42	89.21	0.44	0.00	4.00	0.07
16.57	9.92	10.85	6.16	98.30	0.48	0.00	4.00	0.07
16.73	16.13	18.29	4.97	111.96	0.81	10.93	3.38	0.06
16.90	19.71	22.39	4.87	120.54	0.99	17.60	1.20	0.02
17.06	20.72	23.41	4.65	119.92	1.03	19.07	0.97	0.02
17.22	15.79	17.56	5.50	115.53	0.77	9.58	4.38	0.07
17.39	16.42	18.19	4.34	104.60	0.80	10.75	3.71	0.06
17.55	16.86	18.54	3.77	98.55	0.81	11.38	3.42	0.06
17.72	16.61	18.13	3.53	94.67	0.79	10.64	3.89	0.06
17.88	13.61	14.64	4.32	95.62	0.64	3.57	4.00	0.07
18.05	12.82	13.64	4.43	94.06	0.59	1.24	4.00	0.07
18.21	12.55	13.25	4.28	91.47	0.57	0.28	4.00	0.07
18.37	11.89	12.41	4.22	88.56	0.53	0.00	4.00	0.07
18.54	11.70	12.13	3.99	85.66	0.52	0.00	4.00	0.06
18.70	12.37	12.83	3.92	86.96	0.55	0.00	4.00	0.06
18.86	13.92	14.52	3.90	91.11	0.62	3.32	4.00	0.06

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
19.03	15.05	15.71	4.21	97.36	0.67	5.92	4.00	0.06
19.19	15.71	16.37	4.12	97.96	0.69	7.27	4.00	0.06
19.36	15.04	15.53	4.45	99.45	0.65	5.53	4.00	0.06
19.52	14.29	14.61	4.64	98.96	0.61	3.52	4.00	0.06
19.68	13.85	14.05	5.05	101.17	0.59	2.23	4.00	0.06
19.85	20.20	20.87	3.79	103.48	0.87	15.28	2.25	0.04
20.01	23.56	24.36	3.83	110.57	1.02	20.39	1.01	0.02
20.18	25.11	25.97	4.78	127.14	1.08	22.50	0.72	0.01
20.34	25.16	26.01	6.55	150.25	1.08	22.55	0.73	0.01
20.50	31.37	32.52	7.31	176.59	1.35	29.92	0.21	0.00
20.67	41.69	43.24	7.72	208.19	1.79	39.33	0.04	0.00
20.83	60.94	63.05	7.14	531.44	2.00	51.77	0.00	0.00
21.00	80.54	82.93	6.80	389.64	2.00	60.82	0.00	0.00
21.16	106.99	109.49	6.16	287.52	2.00	69.99	0.00	0.00
21.32	146.00	148.32	5.33	310.83	2.00	80.01	0.00	0.00
21.49	214.36	215.77	4.05	337.06	2.00	92.38	0.00	0.00
21.65	352.63	350.70	2.52	407.01	2.00	100.00	0.00	0.00
21.82	464.65	458.19	1.85	473.63	2.00	100.00	0.00	0.00

Total estimated displacement: 3.85

Abbreviations

q_t:	Total cone resistance
Q_{tn}:	Adjusted cone resistance to an effective overburden stress of 1 atm
R_f:	Friction ration
$Q_{tn,cs}$:	Adjusted and corrected cone resistance due to fines
FS:	Calculated factor of safety against liquefaction
D_r:	Calculated relative density
$Gamma_{max}$:	Calculated maximum cyclic shear strain
Lat. disp.:	Lateral displacement

:: Strength loss calculation (Robertson (2009) ::

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
1.80	69.47	131.10	1.08	141.50	1.76	N/A	N/A
1.97	64.61	121.91	1.18	143.26	1.89	N/A	N/A
2.13	52.20	98.42	1.43	141.16	2.09	N/A	N/A
2.30	40.13	75.60	1.82	137.46	2.26	N/A	N/A
2.46	30.14	56.70	2.50	141.60	2.44	N/A	N/A
2.63	28.19	52.99	2.66	141.14	2.48	N/A	N/A
2.79	28.65	53.84	2.48	133.63	2.44	N/A	N/A
2.95	29.09	54.66	2.26	123.54	2.39	N/A	N/A
3.12	28.07	52.71	2.18	115.04	2.37	N/A	N/A
3.28	28.86	54.19	2.23	120.71	2.38	N/A	N/A
3.44	30.25	56.79	2.26	128.25	2.39	N/A	N/A
3.61	37.07	69.66	2.26	157.47	2.39	N/A	N/A
3.77	54.29	102.20	1.73	176.48	2.22	N/A	N/A
3.94	69.41	130.76	1.59	207.84	2.17	N/A	N/A
4.10	81.43	153.45	1.47	225.43	2.11	N/A	N/A
4.26	81.16	152.93	1.57	239.59	2.16	N/A	N/A
4.43	131.28	247.64	1.18	292.53	1.89	N/A	N/A
4.59	156.62	295.52	1.08	318.24	1.76	N/A	N/A
4.76	198.08	352.44	1.00	352.44	1.62	N/A	N/A
4.92	184.77	317.63	1.00	317.63	1.59	N/A	N/A
5.08	174.35	291.27	1.00	291.27	1.56	N/A	N/A
5.25	108.71	186.86	1.01	188.66	1.66	N/A	N/A
5.41	47.66	89.46	1.26	112.35	1.96	N/A	N/A
5.58	7.81	14.13	6.19	87.43	2.95	N/A	N/A
5.74	5.46	9.68	7.35	71.17	3.05	N/A	N/A
5.91	4.47	7.79	9.14	71.19	3.19	N/A	N/A
6.07	3.28	5.52	13.27	73.21	3.45	N/A	N/A
6.23	5.93	10.52	8.49	89.29	3.14	N/A	N/A
6.40	12.34	22.61	4.35	98.35	2.75	N/A	N/A
6.56	29.26	54.58	1.97	107.65	2.31	N/A	N/A
6.73	52.13	92.58	1.36	126.30	2.05	N/A	N/A
6.89	70.50	119.02	1.24	147.19	1.95	N/A	N/A
7.05	79.02	130.41	1.21	157.91	1.92	N/A	N/A
7.22	79.21	130.88	1.26	164.68	1.97	N/A	N/A
7.38	81.74	133.80	1.28	170.63	1.98	N/A	N/A
7.55	78.53	128.36	1.33	170.21	2.02	N/A	N/A
7.71	70.44	115.32	1.40	161.80	2.07	N/A	N/A
7.87	59.00	97.85	1.58	154.26	2.16	N/A	N/A
8.04	53.57	91.48	1.97	180.64	2.31	N/A	N/A
8.20	69.82	114.81	1.74	199.41	2.23	N/A	N/A
8.37	97.36	151.32	1.42	214.14	2.08	N/A	N/A
8.53	113.42	166.22	1.20	199.72	1.91	N/A	N/A
8.69	90.61	131.97	1.23	161.89	1.94	N/A	N/A
8.86	54.25	81.32	1.46	118.81	2.10	N/A	N/A
9.02	24.34	39.39	2.73	107.54	2.49	N/A	N/A
9.19	17.09	28.43	3.96	112.59	2.70	N/A	N/A
9.35	28.56	45.23	2.81	127.24	2.51	N/A	N/A
9.51	62.71	92.63	1.75	162.41	2.23	N/A	N/A

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
9.68	106.86	151.70	1.46	221.60	2.10	N/A	N/A
9.84	145.90	202.19	1.36	275.83	2.05	N/A	N/A
10.01	162.38	225.50	1.47	331.69	2.11	N/A	N/A
10.17	197.38	268.31	1.39	373.54	2.06	N/A	N/A
10.34	218.11	295.40	1.46	431.12	2.10	N/A	N/A
10.50	248.12	329.76	1.40	460.31	2.07	N/A	N/A
10.66	255.08	336.02	1.42	476.66	2.08	N/A	N/A
10.83	259.47	335.93	1.37	459.13	2.05	N/A	N/A
10.99	262.56	335.32	1.34	450.82	2.03	N/A	N/A
11.15	273.37	343.43	1.27	434.68	1.97	1.02	1.02
11.32	289.26	356.57	1.18	421.60	1.89	1.02	1.02
11.48	292.45	353.56	1.11	393.31	1.81	1.02	1.02
11.65	267.69	321.65	1.11	356.44	1.80	1.01	1.01
11.81	233.29	279.98	1.13	315.49	1.83	0.98	0.98
11.97	206.01	247.83	1.17	289.16	1.88	0.96	0.96
12.14	212.41	251.98	1.12	281.70	1.82	0.97	0.97
12.30	225.24	263.24	1.07	281.15	1.74	0.97	0.97
12.47	211.67	244.98	1.04	255.66	1.71	0.96	0.96
12.63	164.45	192.45	1.12	215.90	1.82	0.92	0.92
12.79	110.07	131.91	1.35	178.07	2.04	0.87	0.87
12.96	72.92	89.30	1.81	161.37	2.25	0.81	0.81
13.12	42.65	53.37	2.80	149.31	2.51	0.74	0.74
13.29	22.30	28.26	4.60	129.95	2.78	2.06	2.06
13.45	12.18	15.15	6.79	102.84	3.00	1.08	1.08
13.62	9.25	11.17	7.80	87.08	3.09	0.80	0.80
13.78	9.39	11.30	7.45	84.13	3.06	0.81	0.81
13.94	9.64	11.55	7.23	83.51	3.04	0.82	0.82
14.11	9.88	11.79	7.11	83.90	3.03	0.84	0.84
14.27	10.14	12.06	7.01	84.52	3.02	0.86	0.86
14.44	10.34	12.24	6.97	85.34	3.02	0.87	0.87
14.60	10.44	12.30	6.96	85.66	3.02	0.88	0.88
14.76	10.37	12.14	7.12	86.48	3.03	0.87	0.87
14.93	10.48	12.21	7.06	86.22	3.03	0.87	0.87
15.09	11.08	12.90	6.77	87.31	3.00	0.92	0.92
15.26	11.80	13.73	6.23	85.59	2.95	0.98	0.98
15.42	10.84	12.45	6.72	83.63	3.00	0.89	0.89
15.58	9.36	10.53	7.59	79.86	3.07	0.75	0.75
15.75	7.74	8.46	9.16	77.47	3.19	0.60	0.60
15.91	7.73	8.39	9.25	77.58	3.20	0.60	0.60
16.08	7.89	8.54	9.43	80.49	3.21	0.61	0.61
16.24	8.45	9.18	9.13	83.79	3.19	0.66	0.66
16.40	9.05	9.85	9.05	89.21	3.19	0.70	0.70
16.57	9.92	10.85	9.06	98.30	3.19	0.78	0.78
16.73	16.13	18.29	6.12	111.96	2.94	1.31	1.31
16.90	19.71	22.39	5.38	120.54	2.87	1.61	1.61
17.06	20.72	23.41	5.12	119.92	2.84	1.68	1.68
17.22	15.79	17.56	6.58	115.53	2.99	1.25	1.25
17.39	16.42	18.19	5.75	104.60	2.91	1.30	1.30

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
17.55	16.86	18.54	5.32	98.55	2.86	1.33	1.33
17.72	16.61	18.13	5.22	94.67	2.85	1.30	1.30
17.88	13.61	14.64	6.53	95.62	2.98	1.05	1.05
18.05	12.82	13.64	6.90	94.06	3.01	0.97	0.97
18.21	12.55	13.25	6.91	91.47	3.01	0.95	0.95
18.37	11.89	12.41	7.13	88.56	3.03	0.89	0.89
18.54	11.70	12.13	7.06	85.66	3.03	0.87	0.87
18.70	12.37	12.83	6.78	86.96	3.00	0.92	0.92
18.86	13.92	14.52	6.27	91.11	2.96	1.04	1.04
19.03	15.05	15.71	6.20	97.36	2.95	1.12	1.12
19.19	15.71	16.37	5.98	97.96	2.93	1.17	1.17
19.36	15.04	15.53	6.40	99.45	2.97	1.11	1.11
19.52	14.29	14.61	6.77	98.96	3.00	1.04	1.04
19.68	13.85	14.05	7.20	101.17	3.04	1.00	1.00
19.85	20.20	20.87	4.96	103.48	2.82	1.50	1.50
20.01	23.56	24.36	4.54	110.57	2.77	1.75	1.75
20.18	25.11	25.97	4.90	127.14	2.81	1.86	1.86
20.34	25.16	26.01	5.78	150.25	2.91	1.86	1.86
20.50	31.37	32.52	5.43	176.59	2.87	2.33	2.33
20.67	41.69	43.24	4.81	208.19	2.80	3.10	3.10
20.83	60.94	63.05	3.78	238.40	2.67	4.55	4.55
21.00	80.54	82.93	3.20	265.05	2.58	0.80	0.80
21.16	106.99	109.49	2.63	287.52	2.47	0.84	0.84
21.32	146.00	148.32	2.10	310.83	2.34	0.88	0.88
21.49	214.36	215.77	1.56	337.06	2.15	0.94	0.94
21.65	352.63	350.70	1.16	407.01	1.87	1.02	1.02
21.82	464.65	458.19	1.03	473.63	1.69	1.07	1.07

Abbreviations

q_t:	Total cone resistance
K_c:	Cone resistance correction factor due to fines
$Q_{tn,cs}$:	Adjusted and corrected cone resistance due to fines
I_c:	Soil behavior type index
$S_{u(liq)}/\sigma'_v$:	Calculated liquefied undrained strength ratio
$S_{u(peak)}/\sigma'_v$:	Calculated peak undrained strength ratio

Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:

q_c : tip resistance, f_s : sleeve friction
σ_{vo}, σ_{vo}' : in-situ vertical total and effective stress
units : all in kPa

initial stress exponent[a] : n = 1.0 and calculate Q, F, and I_c
if $I_c \le 1.64$, $n = 0.5$
if $1.64 < I_c < 3.30$, $n = (I_c - 1.64)0.3 + 0.5$
if $I_c \ge 3.30$, $n = 1.0$
iterate until the change in n, $\Delta n < 0.01$
if $\sigma_{vo}' > 300$ kPa, let n = 1.0 for all soils

[a]updated from Robertson and Wride (1998)

$$C_n = \left(\frac{100}{\sigma_{vo}'}\right)^n$$

$$Q = \frac{(q_c - \sigma_{vo})}{100} \cdot C_n \qquad F = \frac{f_s}{(q_c - \sigma_{vo})} \cdot 100$$

$$I_c = \sqrt{\left[(3.47 - \log Q)^2 + (1.22 + \log F)^2\right]}$$

if $I_c \le 1.64$, $K_c = 1.0$
if $1.64 < I_c < 2.60$, $K_c = -0.403\, I_c^4 + 5.581\, I_c^3 - 21.63\, I_c^2 + 33.75\, I_c - 17.88$
if $I_c \ge 2.60$, evaluate using other criteria; likely nonliquefiable if $F > 1\%$
BUT, if $1.64 < I_c < 2.36$ and $F < 0.5\%$, set $K_c = 1.0$

$$(q_{c1N})_{cs} = K_c Q$$

$$CRR_{7.5} = 93 \cdot \left[\frac{(q_{c1N})_{cs}}{1000}\right]^3 + 0.08, \text{ if } 50 \le (q_{c1N})_{cs} < 160$$

$$CRR_{7.5} = 0.833 \cdot \left[\frac{(q_{c1N})_{cs}}{1000}\right] + 0.05, \text{ if } (q_{c1N})_{cs} < 50$$

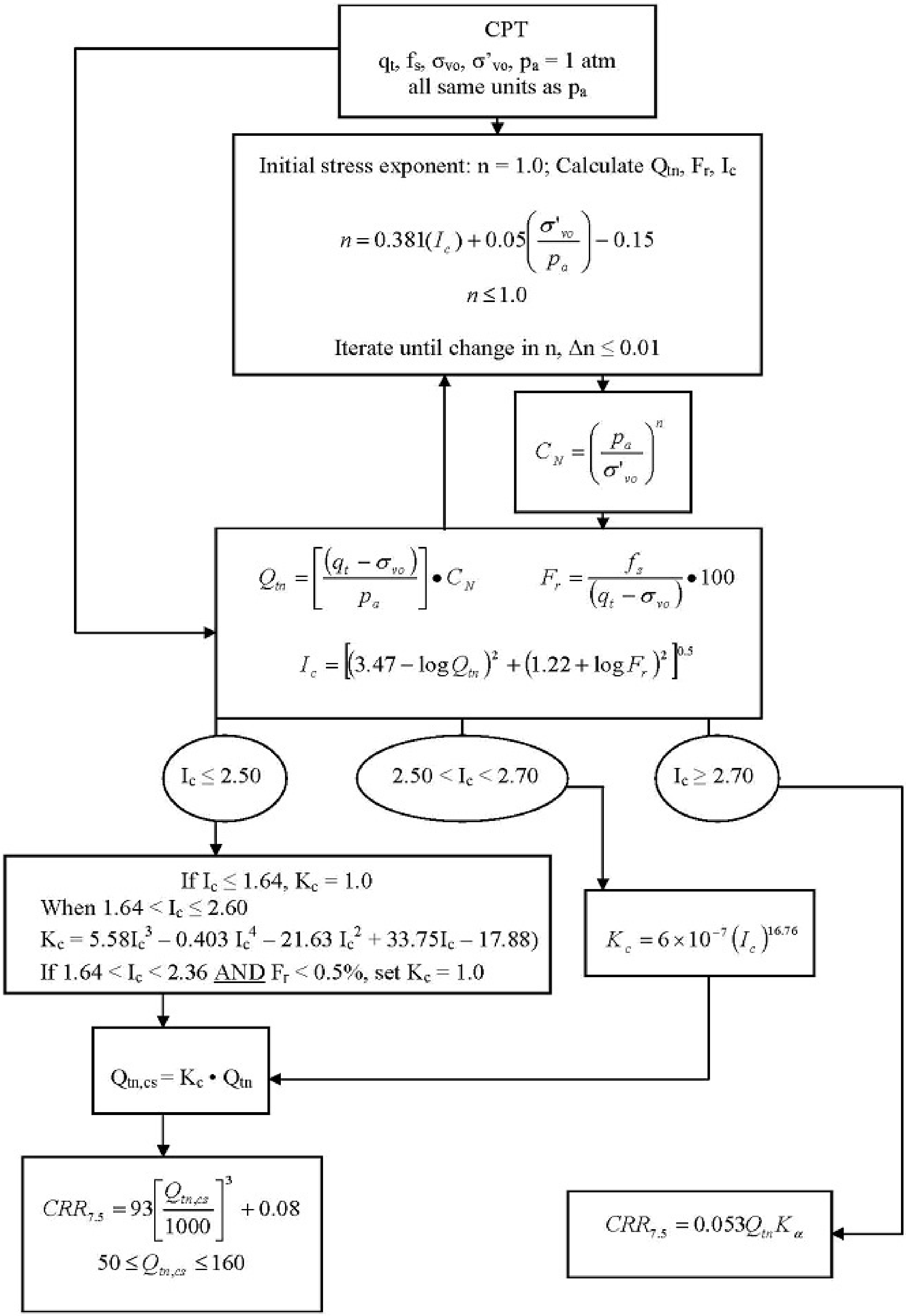
if $I_c \ge 2.60$, evaluate using other criteria; likely nonliquifiable if $F > 1\%$

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

Exhibit A-2

Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

Exhibit A-2

Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)

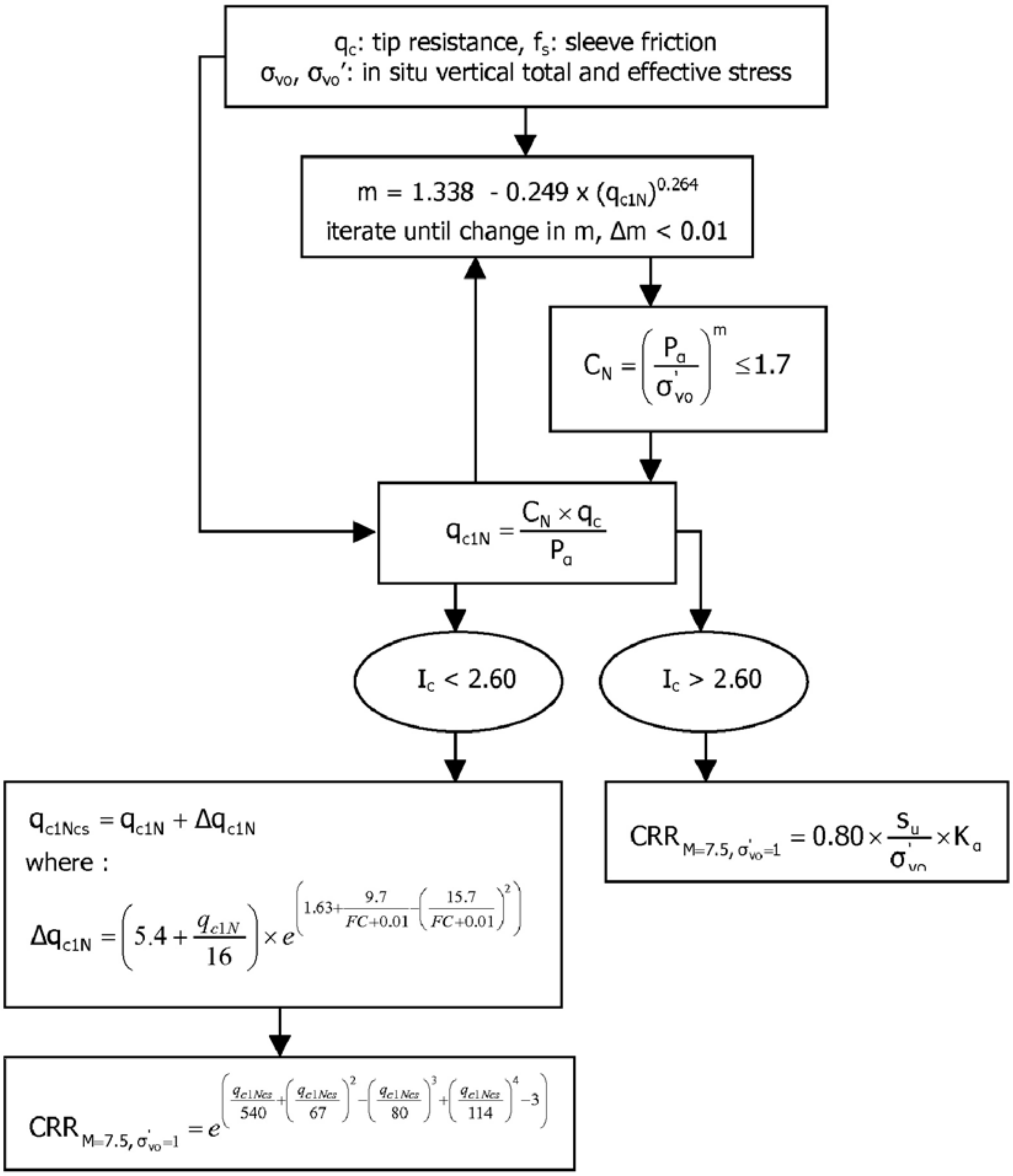


Exhibit A-2

Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)

CPT

q_t, f_s, I_c

$I_c < I_c$ cut-off

Initial estimate using raw tip measurements, friction ratio. Calculate $q_{t,1}$. Repeat until an acceptable convergence tolerance is achieved.

$$c = f_1 \cdot \left(\frac{R_f}{f_3} \right)^{f_2}$$

$$C_q = \left(\frac{P_a}{\sigma'_v} \right)^{c}$$

$$q_{t,1} = C_q \cdot q_t$$

$$CRR = \exp\left[\frac{q_{t,1}^{1.045} + q_{t,1} \cdot (0.110 \cdot R_f) + (0.001 \cdot R_f) + c \cdot (1 + 0.850 \cdot R_f) - 0.848 \cdot \ln(M_w) - 0.002 \cdot \ln(\sigma'_v) - 20.923 + 1.632 \cdot \Phi^{-1}(P_L)}{7.177} \right]$$

Exhibit A-2

Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)

$$FS_{liq} = \frac{CRR_{M=7.5,\sigma'_v=1atm}}{CSR_{M=7.5,\sigma'_v=1atm}}$$

$$CSR_{M=7.5,\sigma'_v=1atm} = 0.65 \frac{\sigma_v}{\sigma'_v} \frac{a_{\max}}{g} r_d \frac{1}{MSF} \frac{1}{K_\sigma}$$

$$r_d = \exp\left[\alpha(z) + \beta(z) \cdot M\right]$$

$$\alpha(z) = -1.012 - 1.126 \sin\left(\frac{z}{11.73} + 5.133\right)$$

$$\beta(z) = 0.106 + 0.118 \sin\left(\frac{z}{11.28} + 5.142\right)$$

$$K_\sigma = 1 - C_\sigma \ln\left(\frac{\sigma'_v}{P_a}\right) \le 1.1$$

$$C_\sigma = \frac{1}{37.3 - 8.27\left(q_{c1Ncs}\right)^{0.264}} \le 0.3$$

$$MSF = 1 + \left(MSF_{max} - 1\right)\left(8.64 \exp\left(\frac{-M}{4}\right) - 1.325\right)$$

$$MSF_{max} = 1.09 + \left(\frac{q_{c1Ncs}}{180}\right)^3 \le 2.2$$

σ'_v *and* σ_v *at start of earthquake shaking*

$$CRR_{M=7.5,\sigma'_v=1atm} = \exp\left(\frac{q_{c1Ncs}}{113} + \left(\frac{q_{c1Ncs}}{1000}\right)^2 - \left(\frac{q_{c1Ncs}}{140}\right)^3 + \left(\frac{q_{c1Ncs}}{137}\right)^4 - 2.80\right)$$

$$q_{c1Ncs} = q_{c1N} + \Delta q_{c1N}$$

$$\Delta q_{c1N} = \left(11.9 + \frac{q_{c1N}}{14.6}\right) \exp\left(1.63 - \frac{9.7}{FC+2} - \left(\frac{15.7}{FC+2}\right)^2\right)$$

$$q_{c1N} = C_{N} \frac{q_c}{P_a}$$

$$C_{N} = \left(\frac{P_a}{\sigma'_v}\right)^m \le 1.7$$

$$m = 1.338 - 0.249\left(q_{c1Ncs}\right)^{0.264} \quad with \quad 0.264 \le m \le 0.782$$

$$FC = 80\left(I_C + C_{FC}\right) - 137 \quad with \quad 0\% \le FC \le 100\%$$

$$I_c = \left[\left(3.47 - \log(Q)\right)^2 + \left(1.22 + \log(F)\right)^2\right]^{0.5}$$

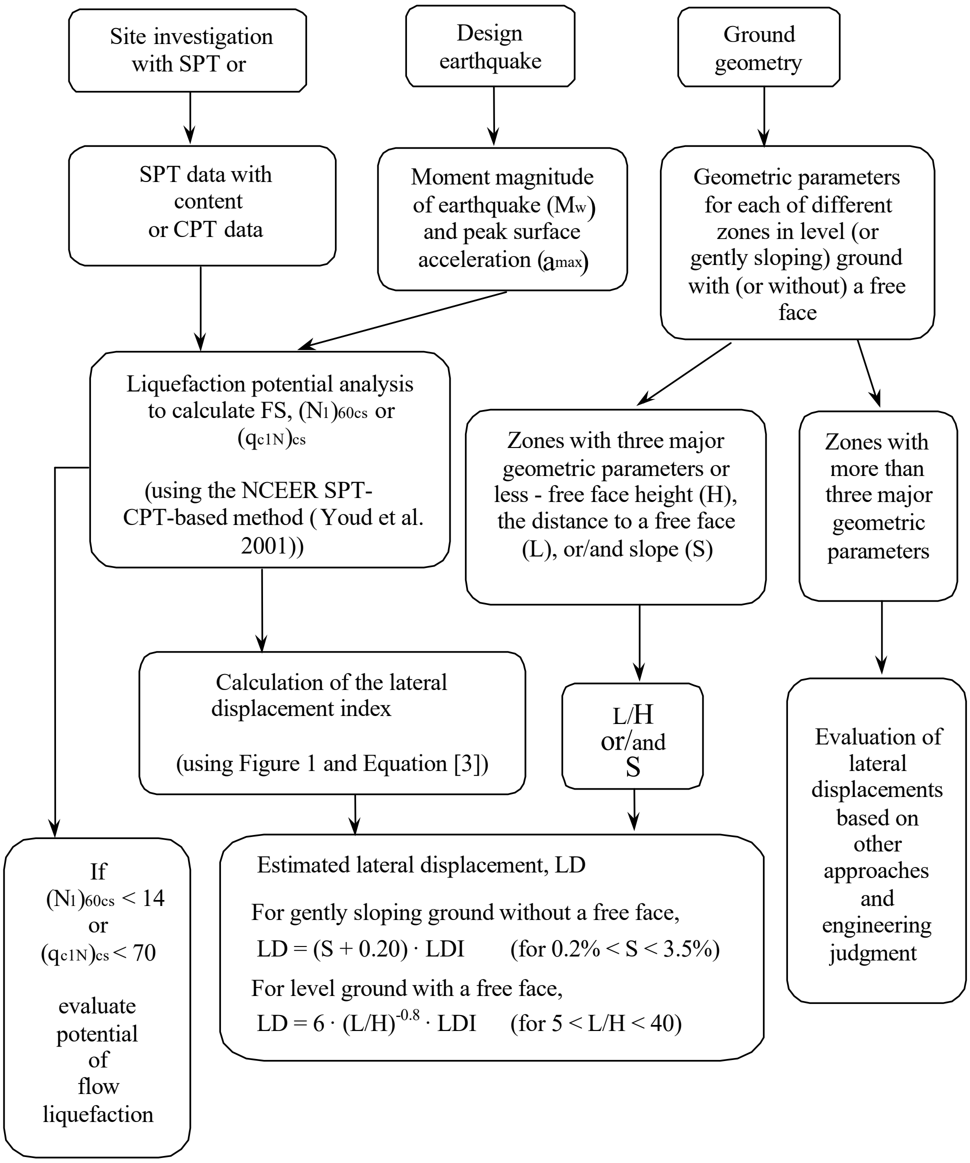
$$Q = \left(\frac{q_c - \sigma_{vc}}{P_a}\right)\left(\frac{P_a}{\sigma'_{vc}}\right)^n \quad with\ 0.5 \le n \le 1.0\ per\ Robertson\ \&\ Wride\ (1998)$$

$$F = \left(\frac{f_s}{q_c - \sigma_{vc}}\right) \cdot 100\%$$

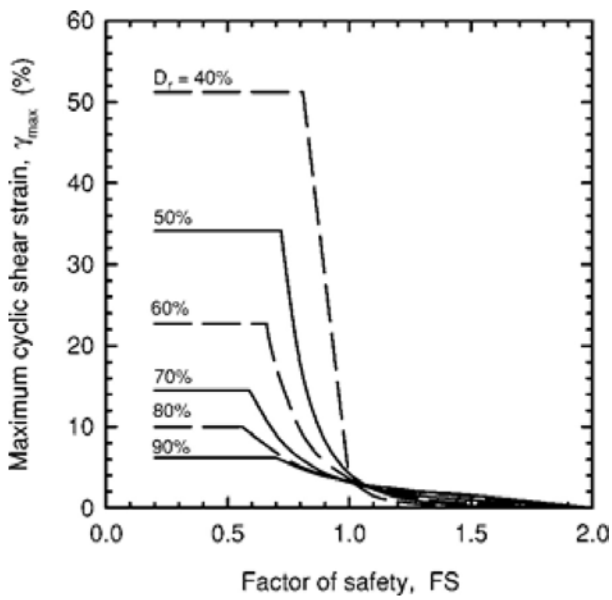
σ'_v *at time of CPT sounding*

Exhibit A-2

Procedure for the evaluation of liquefaction-induced lateral spreading displacements



[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



[1] **Figure 1**

$$LDI = \int_0^{Z_{max}} \gamma_{max} \, dz$$

[1] **Equation [3]**

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

Procedure for the estimation of seismic induced settlements in dry sands

Average shear stress, τ_{av}

$$\tau_{av} = CSR^{*} \cdot \sigma_{v0}' = 0.65 \cdot \frac{\alpha_{max}}{g} \cdot \sigma_{v0} \cdot r_d$$

↓

Estimate small shear strain modulus, G_0

$$G_0 = 0.0188 \cdot \left[10^{(0.55 I_c + 1.68)}\right] \cdot (q_t - \sigma_v)$$

↓

Estimate shear strain amplitude, γ (based on Pradel (1998))

$$\gamma = \left[\frac{1 + \alpha \cdot e^{bR}}{1 + \alpha}\right] \cdot R \cdot 100\ (\%)$$

$$R = \frac{\tau_{av}}{G_0} \text{ (Note } \tau_{av} \text{ and } G_0 \text{ same units)}$$

$$\alpha = 0.0389 \cdot \left(\frac{\sigma_v}{p_a}\right) + 0.124$$

$$b = 6400 \cdot \left(\frac{\sigma_v}{p_a}\right)$$

↓

Estimate volumetric strain in 15 cycles

$$\varepsilon_{vol(15)} = \gamma \cdot \left[\frac{(N_1)_{60cs}}{20}\right]^{-1.20}$$

$$(N_1)_{60,cs} = \frac{Q_{tn,cs}}{8.5 \cdot \left[1 - \frac{I_c}{4.6}\right]}$$

↓

Volumetric strain in design earthquake

$$\Sigma_{vol} = \varepsilon_{vol(15)} \cdot \left[\frac{N_c}{15}\right]^{0.45}$$

$$N_c = (M - 4)^{2.17}$$

↓

Seismic settlement, s

$$s = 2 \cdot \int_0^{GWT} \Sigma_{vol} \cdot dz$$

Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Exhibit A-2

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\textbf{LPI} = \int_0^{20} (10 - 0{,}5_z) \times F_L \times d_z$$

where:

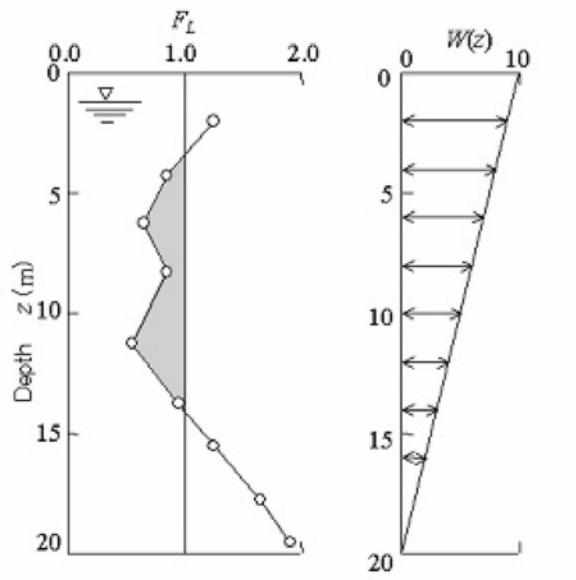
F_L = 1 - F.S. when F.S. less than 1

F_L = 0 when F.S. greater than 1

z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$Ln(Ds) = c1 + c2 * LBS + 0.58 * Ln\left(Tanh\left(\frac{HL}{6}\right)\right) +$$
$$4.59 * Ln(Q) - 0.42 * Ln(Q)^2 - 0.02 * B +$$
$$0.84 * Ln(CAVdp) + 0.41 * Ln(Sa1) + \varepsilon$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

$$LBS = \sum W * \frac{\varepsilon_{shear}}{z} dz$$

where z (m) is the depth measured from the ground surface > 0, W is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_shear) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

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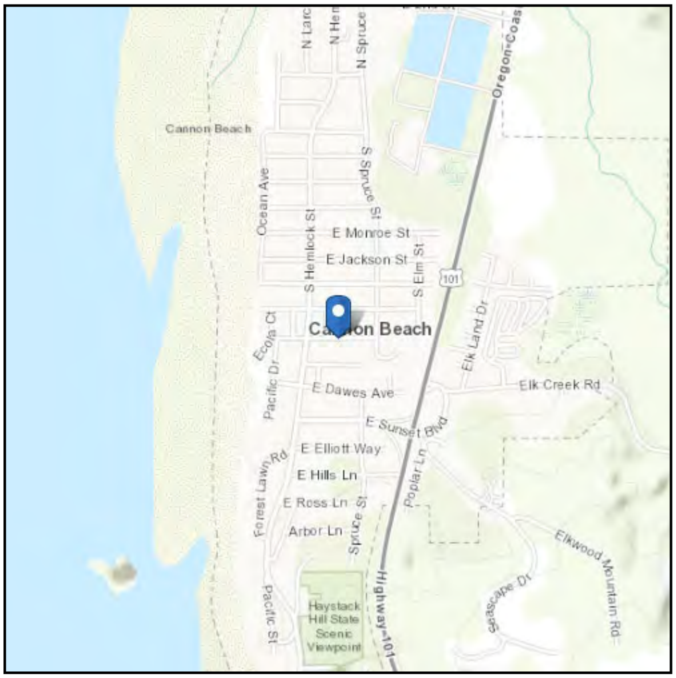
Exhibit A-2

ASCE 7 Hazards Report

Address:
Cannon Beach Police Department - 163 E Gower St
Cannon Beach,

Standard: ASCE/SEI 7-22
Risk Category: IV
Soil Class: D - Stiff Soil

Latitude: 45.88997
Longitude: -123.96076
Elevation: 33.006202949243075 ft (NAVD 88)



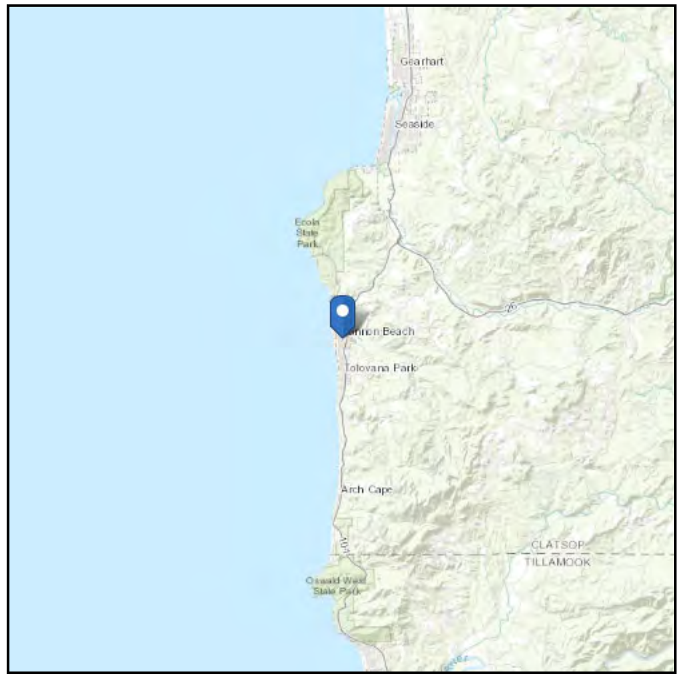


Exhibit A-2

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

D - Stiff Soil

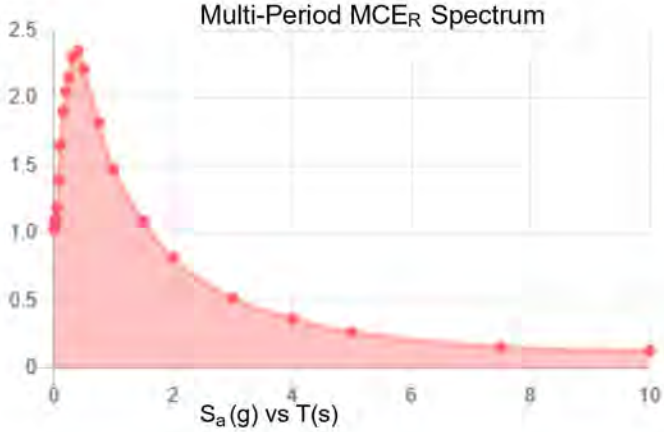
Site Soil Class:

Results:

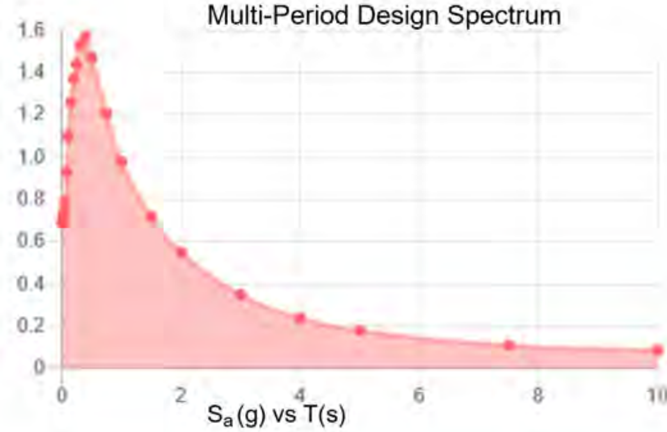
PGA_M :	1.02	T_L :	16
S_{MS} :	2.12	S_S :	1.71
S_{M1} :	1.48	S_1 :	0.72
S_{DS} :	1.41	V_{S30} :	260
S_{D1} :	0.99		

Seismic Design Category: D

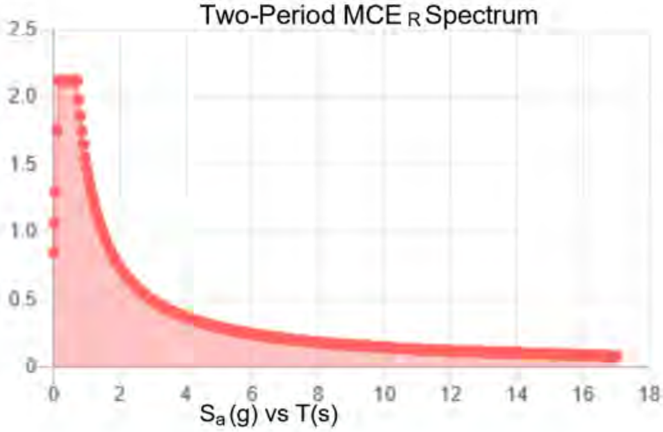
Multi-Period MCE_R Spectrum



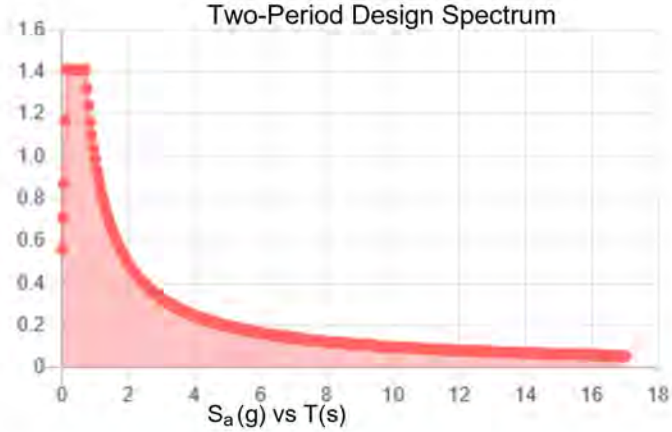
Multi-Period Design Spectrum



Two-Period MCE $_R$ Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Exhibit A-2

Data Accessed: **Sun Jul 30 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Exhibit A-2

Geotechnical Engineering Report and Site Specific Seismic Hazard Investigation

For the

Proposed New City Hall/Tsunami Evacuation Building
163 East Gower Street
Cannon Beach, Oregon

Prepared for

Mr. Mark See
Public Works Director
City of Cannon Beach
163 East Gower Street
P.O. Box 368
Cannon Beach, Oregon 97110

Prepared by

Chinook GeoServices, Inc.
1701 Broadway #105
Vancouver, Washington 98663
Telephone (360) 695-8500
Fax (360) 695-8510

CGI Report No. 11-022-1

May 4, 2011

Chinook GeoServices, Inc.

REGISTERED PROFESSIONAL ENGINEER
16,590
OREGON
JULY 20, 1996
MARCELLA M. BOYER
5/4/11
EXPIRES 12/31/11

Marcella Boyer, P.E., G.E.
Principal Geotechnical Engineer

R. Warren Krager, R.G., C.E.G.
Principal Engineering Geologist

CERTIFIED
OREGON
R. WARREN KRAGER
E 957
ENGINEERING GEOLOGIST
Exp 12-31-2011

Exhibit A-2

Chinook GeoServices Inc.

May 4, 2011

Mr. Mark See
Public Works Director
City of Cannon Beach
163 East Gower Street
P.O. Box 368
Cannon Beach, Oregon 97110
see@ci.cannon-beach.or.us

Subject: **Geotechnical Engineering Report and Site-Specific Seismic Hazard Evaluation Proposed New City Hall/Tsunami Evacuation Building 163 East Gower Street Cannon Beach, Oregon CGI Report No. 11-022-1**

Dear Mr. See:

Chinook GeoServices, Inc. (CGI) is pleased to submit our Geotechnical Engineering Report and Site-Specific Seismic Hazard Evaluation for the proposed new City Hall/Tsunami Evacuation Building (TEB) located at 163 East Gower Street in Cannon Beach, Oregon. This report includes the results of our field and laboratory testing, geotechnical engineering analysis, recommendations for site development, and results of our site-specific seismic hazard evaluation.

We appreciate the opportunity to perform this evaluation and look forward to continued participation during the remaining design and construction phases of this project. Please contact Marcy Boyer at (360) 695-8500 if you have any questions or if we may be of further service.

Respectfully submitted,

CHINOOK GEOSERVICES, INC.

Marcella Boyer, P.E., G.E.
Principal Geotechnical Engineer

R. Warren Krager, R.G., C.E.G.
Principal Engineering Geologist

Distribution: Addressee
Oregon Department of Geology and Mineral Industries

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

CGI has completed a geotechnical engineering study and seismic site hazard investigation to evaluate the feasibility of the proposed City of Cannon Beach, City Hall/Tsunami Evacuation Building (TEB) that is proposed at 163 East Gower Street in Cannon Beach, Oregon. The seismic site hazard investigation was conducted in general accordance with the Oregon Structural Specialty Code (OSSC) Chapter 1802.4.2.

The geotechnical subsurface exploration consisted of one 28-foot deep cone penetrometer test (CPT-1) and two mud rotary soil borings (B-1 and B-2) to depths of 115.5 feet and 121 feet using a subcontracted truck mounted drill rig. In general, the subsurface conditions consisted of medium stiff to soft silt and clay in the approximately upper 25 feet, which included abundant organic material below 15 feet. Below 25 feet, we encountered medium dense to dense gray sand. Multiple thin gravel layers were observed in the two borings at various depths. At an approximate depth of 100 feet below the ground surface we encountered siltstone bedrock. Static groundwater was encountered at about 21 feet below the ground surface based on interpretation of the pore-water pressure dissipation test conducted in CPT-1.

Based on the results of the field exploration and engineering analyses, it is our opinion that the proposed project is geotechnically feasible, based on the assumptions stated in this report.

In our opinion, the greatest geotechnical constraints at this site include the dynamic response of the subsurface conditions to earthquakes and the significant depth required for the foundations. Deep foundations that are embedded into the underlying siltstone bedrock are recommended for the proposed Tsunami Evacuation Building (TEB).

The owner and/or designer should not rely solely on this Executive Summary and must read and evaluate the entire contents of this report prior to using our engineering recommendations to prepare the design/construction documents.

2.0 PROJECT INFORMATION

2.1 Project Authorization

Chinook GeoServices, (CGI) has completed a geotechnical engineering evaluation and a site specific seismic hazard study to evaluate the feasibility of the proposed City Hall/Tsunami Evacuation Building (TEB) that may be located at 163 East Gower Street in Cannon Beach, Oregon. The site specific seismic hazard evaluation is included as Appendix A of this report. Our work was completed in general accordance with the March 7, 2011 Personal Services Contract with the City of Cannon Beach.

2.2 Project Description

Our understanding of the project is based on a September 2010 site visit with Mark See, our review of the RFP and our participation in the Ad-Hoc Committee for the Tsunami Evacuation Building at City Hall during 2009 and 2010. The proposed City Hall/TEB is proposed to be in the same location as the existing City Hall. The current conceptual design consists of the main city hall offices on the main floor with a flat roof for evacuation during a tsunami. The main offices would be elevated on robust concrete posts above the anticipated tsunami inundation elevation established by computer modeling. Stairs and a flat roof will be constructed for public access if a tsunami occurs. We anticipate that the new structure will be supported on concrete piers founded below the anticipated liquefaction depth and scour depth.

The geotechnical recommendations presented in this report are based on the available project information, and the subsurface conditions described in this report. If any of the project information is known to be incorrect, the client or authorized representatives should advise CGI in writing so that we may amend the recommendations as appropriate based on the corrected information. CGI will not be responsible for the applicability of its recommendations when not notified of changes in the project.

2.3 Purpose and Scope of Services

The purpose of our services was to provide geotechnical engineering design recommendations and conduct a site-specific seismic hazard study to evaluate the feasibility of development for the proposed new City Hall/TEB. Our general scope of work for this project was outlined in Exhibit A of the March 7, 2011 Personal Services Contract between the City of Cannon Beach and CGI.

Our scope of services included two mud rotary soil borings, one cone penetration test, soil laboratory testing, and engineering analyses to evaluate the soil properties for deep foundation support, seismic characteristics and hazards and other geotechnical engineering concerns for subsurface materials underlying the site. This geotechnical engineering report provides our recommendations for site earthwork, deep foundation design, subsurface drainage, slab support, pavement design, and other geotechnical engineering design and construction considerations. Appendix A includes the results of our Site-Specific Seismic Hazard Evaluation, which was prepared in general conformance with Exhibit A and the 2010 Oregon Structural Specialty Code (OSSC).

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Location and Description

The site location is shown on Figure 1, Site Location Plan, attached to the back of this report. The site address is 163 East Gower Street, Cannon Beach, Oregon. The site is comprised of Tax Lots 11100, 12000, and 11900, of T5N R10W Section 30-AD in Clatsop County. Lots 12000 and 11900 are adjacent and are bordered on the north by East Gower Street, on the west by Evergreen Avenue, on the east by the undeveloped Harding Avenue right-of-way, and on the south by developed residential properties. The combined lot dimensions are approximately 325 feet east to west and 100 feet north to south. Lot 11100 across the street to the west of the other lots is bordered on the north by East Gower Street, on the west by South Hemlock Avenue, on the east by Evergreen Avenue, and on the south by Coolidge Avenue. The approximate lot dimensions are 100 feet east to west and 200 feet north to south.

Lot 12000 is currently developed with a single story structure housing the City of Cannon Beach municipal offices. Lot 12000 also includes paved parking areas east and west of the developed structure. Lot 11900 is currently undeveloped. Lot 11100 is developed with a paved municipal parking lot. It is our understanding that the proposed structure will be located on Lot 12000, which is referred to in this report as the project site.

Based on an aerial topographic survey of The City of Cannon Beach dated December 28, 2004, the project site elevation is roughly 30 feet above mean sea level (MSL). The area of the project site is relatively level, with a minor descending slope toward the west. Site specific topographic mapping was not available at the time of this report.

3.2 Soil and Geologic Setting

Soils mapped in the project area by the United States Department of Agriculture (USDA), Natural Resource Conservation Service Web Soil Survey (http://websoilsurvey.nrcs.usda.gov) consist of Walluski silt loam, 0 to 7 percent slopes. This mapped unit consists of very deep, moderately well drained soils found on fluviomarine and stream terraces. The soil formed from mixed alluvium and/or fluviomarine deposits derived from sedimentary rock. A typical soil profile consists of medial silt loam to a depth of 13 inches, underlain by silty clay loam to a depth of 60 inches.

Geologic mapping for the project area is included in the 2009 Oregon Department of Geology and Mineral Industries (DOGAMI) open file report O-09-06 "Coastal Erosion Hazard Zones in Southern Clatsop County, Oregon: Seaside to Cape Falcon". This publication maps the geology in the project area as late Pleistocene age (126,000 years to 10,000 years ago) coastal terrace deposits (unit Qpt). This unit is described as unconsolidated to moderately consolidated gravel, beach, and dune sand; locally containing minor consolidated clay-rich paleosol, colluvium, debris flows, and alluvial sand, silt, and gravel deposited in channel and point bar environments. The 1985 Geologic Map of the Astoria Basin, Clatsop and Northernmost Tillamook Counties, Northwest Oregon, Oil and Gas Investigation 14 prepared by DOGAMI similarly maps the site as Pleistocene age (1.8 million years to 10,000 years ago) coastal marine-terrace deposits (Qmt). This unit is described as predominantly laminated to cross-bedded beach sand and crudely stratified rounded basalt gravels with some discontinuous paleosols, mud beds, and layers of partially carbonized tree trunks and limbs. The 1972 Environmental Geology of the Coastal Region of Tillamook and Clatsop Counties, Oregon, Bulletin 74 prepared by DOGAMI also maps the geology at the site as Pleistocene age Marine Terraces (Qmt).

The DOGAMI O-09-06 geologic map also shows undifferentiated Holocene age (10,000 years ago to present) alluvial deposits (Qha) directly west of the site. This unit is described as unconsolidated sand, silt, and gravel deposited in alluvial fan, stream terrace, or basin environments. The mapped geologic unit may represent an old stream channel in the vicinity of the project.

The uplands to the south of the subject site are mapped by Bulletin 81 as Oligocene to Miocene Sedimentary Rocks (unit Toms) and by Oil and Gas Investigation 14 as middle to lower Miocene Cannon Beach member of the Astoria Formation (unit Tac). The Toms unit consists of thin bedded to massive, medium to dark gray (orange to white where weathered), tuffaceous siltstone, with lesser amounts of sandstone and claystone. Unit Tac is described as well bedded, laminated to massive micaceous mudstone with subordinate rhythmically thin bedded feldspathic sandstone and mudstone in the lower part of the unit. Numerous outcrops of Intrusive Grande Ronde Basalt (unit Tgri) are mapped within unit Tac south of the site. Unit Tgri is described as a Tertiary middle

Miocene age, invasive sills, dikes, and irregular bodies of massive to columnar-jointed, aphyric to rarely phyric basalt and peperite or intrusive bodies related to Grande Ronde Basalt.

3.3 Subsurface Soil Conditions

Subsurface soil conditions were explored by CGI Geologic Associate Chuck Bolduc, G.I.T., who visited the site on March 29 and March 30, 2011. We observed advancement of two mud rotary soil borings (B-1 and B-2) to depths of 115.5 feet and 121 feet using a subcontracted truck mounted drill rig and one cone penetrometer test (CPT-1) to a depth of 28 feet using a subcontracted rig. The borings and CPT were located in the general vicinity of the proposed structure and were selected in the field by Mark See, the Public Works Director with the City of Cannon Beach, Oregon. The approximate boring and CPT locations are shown on Figure 2. Detailed boring and CPT logs are included in the attached Appendix B.

Boring B-1 was drilled on March 29, 2011 and with sample intervals between 0 feet and 5 feet and took more than 1 day to drill. Because we observed primarily sand that was similar in gradation between 25 feet and 100 feet and bedrock at 100 feet, we recommended to Mr. See that we expand the sample intervals to between 10 feet and 25 feet so that we could get better information for foundation design in the bedrock. Mr. See agreed with the recommendation and boring B-2 was drilled on March 30, 2011 using the expanded sample intervals.

In general, the subsurface conditions consisted of medium stiff to soft silt and clay in the approximately upper 25 feet, which included abundant organic material below 15 feet. Below 25 feet, we encountered medium dense to very dense gray sand. Multiple thin gravel layers were observed in the two borings at various depths. At approximately 100 feet below the ground surface, we encountered siltstone bedrock. A more detailed description of the soils encountered in the borings is included below:

Clay and Organic Debris - The clay was stiff in the near surface becoming softer with depth. Clay was tan with rust mottling with minor inclusions of rust concretions. Some sandy texture was observed but sand particles were not present. In boring B-2, the drill cuttings were observed to be significantly more orange in color than in boring B-1. Wood fiber was observed in the cuttings from boring B-2 at a depth of 10 feet and again at 15 feet. A sample in boring B-2 encountered a log or stump oriented vertically based on the vertical wood grain, which was relatively fresh to minimally decomposed. Other samples encountered gray clay with decomposed wood debris and gray clayey sand with decomposed wood debris. We interpret this sequence of sediments were deposited in an alluvial environment. Based on the CPT data, the shear wave velocity was between 402 feet per second and 582 feet per second in this soil layer.

Beach and Dune Sand - Dense, wet, gray sand was encountered at a depth of 25 feet in boring B-1 and dense sand to silty sand was found in CPT-1 below 26 feet. The sand was fine-grained, poorly-sorted sand with abundant micaceous flakes at selected depths. The micaceous material may have been derived from weathering of local mica-bearing sandstones of the Astoria Formation and deposited as alluvial sands. Very dense basaltic gravel and sand was encountered in boring B-1 at 55 feet below the ground surface, and ended at 57.5 feet below the ground surface based on drilling characteristics. Thin layers of gravel were also interpreted at 61.5 feet in boring B-1 and 65 feet in boring B-2 based on drilling characteristics. Based on the limited thickness and variable depth, we interpret the gravel to be discontinuous. We interpret the sands and gravel deposits to be consistent with the geologic mapping of marine terrace deposits. The CPT met refusal near the top of the contact of the upper dense sand layer at 26 feet and shear wave velocities were not obtained below 25 feet. However, based on our blow count data, we estimate that the beach and dune sand has a shear wave velocity between 650 feet per second and 1,300 feet per second.

Siltstone Bedrock - Hard siltstone bedrock was encountered in boring B-1 at 100 feet below the ground surface and in boring B-2 at 101 feet below the ground surface. The siltstone observed in each boring differed in blow counts, drilling characteristics, and cutting return. The siltstone in boring B-1 had very high blow counts, variably hard and easy drilling and black fragments of basaltic rock returned in the drill cuttings. The siltstone in boring B-2 had relatively lower blow counts, consistent drilling characteristics, and no basaltic cuttings were observed. We interpret that the siltstone in boring B-1 also included a minor basalt intrusion, which is consistent with the abundantly mapped basaltic intrusives within the Astoria Formation in the area. In boring B-1, we drilled 15 feet into the formation and in boring B-2,we drilled 20 feet into the formation. According to a Madin and Wang 1999 paper, the shear wave velocity of the siltstone bedrock was estimated to be 1,870 feet per second.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in Appendix B should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, and test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. The samples that were not altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

3.4 Groundwater Information

The static groundwater elevation in the project area was interpreted to be approximately 25 feet to 30 feet below the ground surface based on our observation of soil samples recorded during mud rotary drilling. The cone penetrometer test conducted a pore-water dissipation test within the dense gray sand at a depth of approximately 27.5 feet. Results of the pore-water dissipation test indicated a static water level of approximately 21 feet below the ground surface. We have assumed a groundwater depth of 21 feet below the ground surface for the purpose of this report.

4.0 GEOTECHNICAL ENGINEERING EVALUATION

4.1 Geotechnical Engineering Discussion

Based on the results of the field exploration and engineering analyses, it is our opinion that the proposed project is geotechnically feasible based on assumptions and preliminary design criteria discussed below. However, this report may not include geotechnical analyses and design recommendations sufficient for final design.

In our opinion, the greatest geotechnical constraints at this site include the dynamic response of the subsurface conditions to earthquakes and the significant depth required for the foundations. Deep foundations that are embedded into the underlying siltstone bedrock are recommended for this development.

4.2 Site Preparation and Earthwork Recommendations

We anticipate that the proposed building footprint and related parking areas, sidewalks, and other site improvements will be located in areas that are currently developed with the existing city building and paved parking areas. We recommend that the existing pavement and foundations be completely removed from the site in areas that will be developed with structures or pavement. The existing base rock could remain in-place if it is below finished subgrade elevation. Based on our subsurface explorations, the thickness of the asphalt pavement was 1.5 inches in boring B-1. The depths of the existing foundations for the city building are unknown; therefore, the depth of removal in this area is unknown. In areas where there are trees, soft disturbed soil, or manmade fill, additional stripping may be necessary. A representative of the geotechnical engineer should determine the depth of removal at the time of construction.

The existing asphaltic pavement and stripped soils may not be suitable for re-use as structural fill and should be exported from the site. The base rock gravel could re-used as structural fill. Additionally, the removed concrete foundations could potentially be crushed for re-use as structural fill. A representative of the geotechnical engineer should be contacted to review and approve the onsite materials for re-use as structural fill at the time of construction. Our recommendations for structural fill and compaction are included below in section 4.6.

Wet weather and construction equipment could severely disturb the upper several feet of the clayey subgrade during initial phases of site clearing. We recommend dry weather construction to protect the subgrade from disturbance. If the subgrade becomes wet or is exposed to significant construction traffic, the subgrade may soften and require additional stripping prior to construction. After stripping, a granular working pad consisting of crushed rock should be placed over the subgrade to protect it from disturbance and provide access for construction equipment. The thickness of the working pad would depend on the use of the stripped area (haul road, material storage, etc.) We can provide thickness recommendations prior to construction when construction sequencing and staging is known.

Alternately, the site could be stripped in phases. The proposed building area could be prepared for placement of foundations and the existing pavement could be used for construction access and staging during construction. The paved areas could then be stripped for construction of the new parking areas and other related improvements outside the building area. We are providing these considerations solely for your use in developing a plan for your project. It is the ultimate responsibility of the contractor to determine the construction methods that are most appropriate for the site.

Following subgrade preparation, and prior to placement of structural fill or base course, we recommend that the site be proof rolled with a fully loaded 10 yard to 12 yard dump truck or other suitably loaded rubber-tired construction vehicle. Any areas that pump, weave, or appear exceptionally soft or muddy should be overexcavated to a depth determined by the geotechnical engineer and backfilled with compacted granular fill. If significant time passes between completion of subgrade preparation and commencement of other construction activities, or if significant traffic has been routed across the site, we recommend that the site be similarly proof rolled before placement of base rock or paving. A representative of our firm should observe this operation.

4.3 Temporary Excavations

Stability of temporary excavations is the responsibility of the contractor, who must maintain safe excavation slopes and/or shoring. Excavations must comply with the current requirements of OSHA and the State of Oregon. We are providing the information below solely as a service to our client. Under no circumstances should the information provided be interpreted to mean that CGI is assuming responsibility for construction site safety or the contractor's compliance with local, state, and federal safety or other regulations.

The contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

We recommend that the temporary excavations not encroach below a 2H:1V line extended downward from the existing utilities to reduce the risk of settlement and/or collapse of existing features, such as the sidewalk and street pavement. If this setback cannot be maintained, we recommend installing temporary shoring. We should be contracted to review the final documents for construction.

The near surface soils generally consist of medium stiff fine-grained cohesive soils, which are considered a Type B soil when applying the OSHA regulations. For Type B soils, the maximum recommended temporary slope inclination is 1 Horizontal to 1 Vertical (1H:1V). Flatter slopes and/or trench shields may be required if loose soils, debris, voids, and/or water are encountered along the slope face. The recommended maximum inclination for temporary slopes is based on the assumption that the ground surface behind the cut slope is level, that surface loads from equipment and materials are kept a sufficient distance away from the top of the slope (typically at least half the slope height), and that utility trench excavations are completed and backfilled prior to the construction of structures adjacent to the excavations. If these assumptions are not valid, we should be contacted for additional recommendations.

4.4 Construction Dewatering

Groundwater was estimated to be approximately 21 feet below the ground surface during our explorations, which were conducted in March, when groundwater is typically at higher levels in response to the wet season. However, it is possible that shallow perched water within the fine-grained soils may be encountered during construction. If shallow water is encountered during construction, for most excavations, pumping from a sump inside or outside the limits of the excavation should adequately control seepage and surface water ponding. As an alternative, dewatering wells may be installed outside of the excavation is water seepage is significant. During wet weather, earthen berms or other methods should be used to prevent runoff water from entering excavations. All runoff water and groundwater encountered within the excavation(s) should be collected and disposed of outside the construction limits.

4.5 Permanent Cut and Fill Slopes

We do not expect significant cut or fill slopes will be associated with this project based on the relatively level topography in the area. If any are planned, we recommend that permanent slopes in native soils or engineered fill be graded no steeper than 2H:1V and be protected from erosion by civil engineer designed and approved methods.

4.6 Structural Fill Materials

Imported structural fill should only be installed on a subgrade that has been prepared in accordance with the preceding recommendations. Fill materials should be free of organic or other deleterious materials have a maximum particle size less than 3 inches, be relatively well graded, and have a liquid limit less than 45 and plasticity index less than 25. The suitability of soil for use as compacted structural fill will depend on the gradation and moisture content of the soil when it is placed. As the amount of fines (that portion finer than the US Standard No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and compaction becomes more difficult to achieve. Soils containing more than about 5 percent fines cannot consistently be compacted to a dense, non-yielding condition when the water content is significantly greater (or significantly less) than optimum. The onsite clay soil will not be acceptable for re-use as structural fill. The existing base rock will likely be acceptable for re-use as structural fill provided it meets the specifications above, is free of organic material, and is separated from the asphalt pavement. The demolished concrete foundations can potentially be processed to create a crushed rock product meeting the above specifications for use as structural fill.

On-site base rock and imported granular material that are used for engineered fill should be uniformly moisture conditioned to within ±2 percent of the optimum moisture content and compacted in thin lifts using suitable mechanical compaction equipment. We recommend that fill intended to support foundations, slabs or pavements be placed in horizontal lifts in thickness from 8 inches to 12 inches, and be compacted to at least 95 percent of the maximum dry density as determined by the modified Proctor compaction test method (AASHTO T-180 or ASTM D1557).

4.7 Deep Foundation Recommendations

Deep foundations and a structural slab are recommended for this development. At this time, 2-foot diameter concrete auger cast-in-place piles would be generally compatible with the site subsurface conditions and earthquake performance criteria for this project. No structural load information was available at the time of this evaluation and our foundation analysis is intended for a feasibility evaluation only.

The results of our liquefaction analysis (included in Appendix A) indicate the presence of up to 75 feet of unconsolidated clayey silt, sand and gravel that may liquefy and/or strain soften during the modeled earthquakes. Based on the thickness of liquefiable soils we anticipate that deep foundations will need to be embedded in the bedrock. For feasibility evaluation purposes we have calculated the axial capacity of 2-foot diameter concrete auger cast-in-place piles embedded 10 feet into the underlying siltstone bedrock at an approximate depth of 100 feet below the ground surface. Other pile sizes and types could be used, subject to structural design and constructability criteria.

We assumed a cohesion value of 2,500 pounds per square foot (psf) for the blue-gray siltstone. A friction angle is not appropriate for the siltstone bedrock material.

Estimated Axial Pile Capacity – We expect that the static and transient compressive loads on the piles will be achieved through a combination of end bearing and skin friction. Our estimated allowable compressive capacities are based on a static factor of safety of 3.0 for end bearing, side friction and uplift. The capacities can be increased by 1/3 for transient loads. Axial pile capacities were determined using the computer program AllPile 7. The pile has an axial downward capacity of approximately 975 kips and an allowable uplift capacity of 230 kips under static conditions. The results of the analysis are included in Appendix D.

Estimated Downdrag – Downdrag is the additional load caused by adhesion or friction between the pile and the surrounding settling soil. Downdrag loads are caused by negative skin friction. Some negative skin friction would occur during settlement of the clay with organics layer between 15 feet and 25 feet below the ground surface. In addition, we expect that the pile will be subjected to negative skin friction from liquefaction during the modeled earthquakes. The earthquake ground motions will strain soften the clayey soils and liquefy the saturated sand. The structural capacity of piles is affected by downdrag loads. Downdrag increases the stresses in the pile and pile cap and has the potential for creating settlement. For a single pile, the downward load transferred to a pile is equal to the shearing resistance along the pile. This may be calculated using the formula on the following page.

$Q_{nf} = s * L * P^1$ Where Q_{nf} = Average downward load transferred to the pile
s = Shear resistance of the soil
L = Length of embedment above the bottom of the compressible layer
P^1 = Perimeter of the Pile

Then, the average downward load, Q_{nf} is then added to the total live load and dead load, Q, applied to the pile, according to the following equation:

$Q_T = Q + Q_{nf}$ Where Q_T = Total applied load
Q = Live load plus dead load
Q_{nf} = Average downward load transferred to the pile

For this site, we estimate that the load transferred to the pile (Q_{nf}) for consolidating organics would be approximately 46 kips. The downward load transferred to the pile (Q_{nf}) from liquefaction during the modeled earthquake is estimated to be 450 kips, assuming the upper 75 feet contributes to the downdrag load.

Estimated Lateral Pile Capacities – Lateral loads on piles could be imposed by wind and seismic events and by liquefied soil. These loads are resisted primarily by horizontal bearing support of the soils adjacent to the pile shafts. The lateral capacity of a pile depends on its length, stiffness in the direction of loading, proximity to other piles and degree of zero moment, as well as the engineering properties of the soil. Lateral pile capacities were estimated using the computer program LPILE Plus V5.0. The results are included in Appendix D.

Our model included liquefied sand that could be present during the modeled earthquakes.

We have presented our estimated lateral pile top capacities for free and fixed head conditions in Table 1 on the following page. These include a factor of safety of 3 applied to the lateral load.

Table 1 – Lateral Load Information

Lateral Load Information for ½-inch Deflection				
Pile Length (feet)	Pile Head Condition	Allowable Lateral Load (kips)	Maximum Bending Moment (feet-kips)	Depth of Zero Moment (feet)
110	Free	12.0	253	0, 50
	Fixed	21.2	663	17
Lateral Load Information for 1-inch Deflection				
110	Free	16.4	408	0, 54
	Fixed	31.2	1,153	18

Pile Spacing and Group Effects – The above mentioned values for compressive, uplift and lateral capacity refer to single piles unaffected by group interactions. To reduce or eliminate group effects, we recommend that the pile spacing not be less than three pile diameters measured center to center. If piles are at least three diameters apart, group effects can be neglected for compressive, uplift and perpendicularly applied lateral loads. For in-line lateral loads, however, group effects reduce the lateral load capacity of the pile at a pile spacing less than eight diameters. The following reduction factors should be applied to in-line laterally loaded piles with a center-to-center spacing between three and eight diameters as shown in the following table.

Table 2 – Reduction Factors for In-Line Laterally Loaded Piles

Pile Spacing Center to Center	In-line Load Reduction Factor
3 pile widths	.25
4 pile widths	.4
6 pile widths	.7
8 pile widths	1.0

Estimated Settlements – We estimate that total post-construction static settlements of pile-supported elements will not exceed 1 inch. Differential settlements could approach ½ of the actual total settlement amount.

Installation Monitoring – CGI should be retained to continuously monitor installation of the piles. CGI will verify that the suitable tip depths are reached. The monitoring program would include observation and documentation of installation procedures, construction equipment, pile materials, drilling conditions and sequencing and load testing.

4.8 Seismic Design

The seismic analysis for the feasibility study was conducted using historic earthquakes with shorter duration than the 5 minutes to 6 minutes of shaking that the scientific community believes may be possible. In our opinion, the selected ground motions were adequate for this feasibility study and showed that seismic hazards do exist at the site. Longer duration ground motions may need to be considered during the final design phase of this project.

According to the site specific seismic hazard feasibility summary, we recommend using the site specific values of S_{DS} and S_{D1}, which are recommended to be 0.52g and 1.41g, respectively. Both values exceed the IBC response spectrum. The analysis was conducted for shorter duration earthquakes and these values could change.

4.9 Drainage

All roof, landscape, and other upland surface water should be directed to approved discharge points away from foundations and retaining walls. In our opinion, underslab and perimeter drains are not needed for this project. We do not expect that infiltration of stormwater into the underlying clay soils will be feasible for this site. A professional civil engineer should be consulted to provide grading plans for drainage, stormwater management options, and utility design.

4.10 Floor Slabs

Because of the intended function of the proposed building as an essential facility, we do not recommend conventional floor slab on grade. We have concern that a conventional floor slab would provide performance liabilities during an earthquake and/or subsequent tsunami event. Liquefaction under a concrete floor slab may cause it to heave or tilt and become more susceptible to tsunami shear forces or scour. A non structural slab could potentially damage foundation components during an earthquake and tsunami.

We recommend that any required floor slabs be designed as structural slabs that would not rely on near surface soil for support and would be engineered to remain intact during the design seismic event.

4.11 Pavement Design

Our scope of services did not include extensive sampling and CBR testing for the existing subgrade, or testing of potential sources of imported fill, for the specific purpose of detailed pavement analysis. Instead, we have assumed pavement related design parameters that are considered to be typical for the area soil types. The pavement recommendations presented in this report are limited to the on-site parking areas and driveways. A more detailed analysis of the subgrade and traffic conditions should be made for street improvements to the existing right-of-way or where pavements are subject to significant traffic loading conditions. The results of such a study would provide information necessary to design an economical and serviceable pavement.

We anticipate that stiff to medium stiff clay will remain underlying proposed driveway and parking areas. We recommend that the subgrade be prepared in accordance with Section 4.2, Site Preparation and Earthwork Recommendations, of this report. Pavement may be placed after the subgrade has been properly prepared, fine-graded and proof rolled.

The thickness recommendations presented below are considered minimum for the assumed parameters. We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the project team should be aware that thinner pavement sections might result in increased maintenance costs and lower than anticipated pavement life.

We have estimated the near surface subgrade soils will be have a CBR of at least 4. Our recommended pavement sections are outlined in Table 3. The pavement materials and installation procedures should be completed in accordance with Oregon Department of Transportation guidelines.

Table 3 – Pavement Section Recommendations

	Car Parking and Driveways
Asphalt Surface Course	2.5
Granular Base Course	8

Rigid concrete pavements are not recommended for this site because of potentially poor performance during an earthquake event.

5.0 REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by CGI and project information provided by Mark See of the City of Cannon Beach, Oregon for the feasibility study for the proposed City Hall/Tsunami Evacuation Building. We will be available to provide further geotechnical analysis and design services as the project progresses.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed. This report has been prepared for the exclusive use of the client or their authorized agents for the specific application to the proposed project.

APPENDIX A:

SITE-SPECIFIC SEISMIC HAZARD EVALUATION

APPENDIX A

SITE-SPECIFIC SEISMIC HAZARD EVALUATION

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FIGURES

SITE-SPECIFIC SEISMIC HAZARD EVALUATION

Chinook GeoServices, (CGI) has completed this site specific seismic hazard evaluation for the proposed City Hall/Tsunami Evacuation Building (TEB) located at 163 East Gower Street in Cannon Beach, Oregon to determine the feasibility of the project. This study is an attachment to our geotechnical engineering report titled "Proposed New City Hall/Tsunami Evacuation Building, 163 East Gower Street, Cannon Beach, Oregon", CGI Report No. 11-022-1 dated May 4, 2011. Our work was completed in general accordance with the March 7, 2011 Personal Services Contract with the City of Cannon Beach.

Site Location and Description

The site location is shown on Figure A-1, Site Location Plan, attached to the back of this report. The site address is 163 East Gower Street, Cannon Beach, Oregon. The site is comprised of Tax Lots 11100, 12000, and 11900, of T5N R10W Section 30-AD in Clatsop County. Lots 12000 and 11900 are adjacent and are bordered on the north by East Gower Street, on the west by Evergreen Avenue, on the east by the undeveloped Harding Avenue right-of-way, and on the south by developed residential properties. The combined lot dimensions are approximately 325 feet east to west and 100 feet north to south. Lot 11100 lies across the street to the west of the other lots is bordered on the north by East Gower Street, on the west by South Hemlock Avenue, on the east by Evergreen Avenue, and on the south by Coolidge Avenue. The approximate lot dimensions are 100 feet east to west and 200 feet north to south. The approximate site layout is included in Figure A-2.

Lot 12000 is currently developed with a single story structure housing the City of Cannon Beach municipal offices. Lot 12000 also includes paved parking areas east and west of the developed structure. Lot 11900 is currently undeveloped. Lot 11100 is developed with a paved municipal parking lot. It is our understanding that the proposed structure will be located on Lot 12000, which is referred to in this report as the project site.

Based on an aerial topographic survey of The City of Cannon Beach dated December 28, 2004, the project site elevation is roughly 30 feet above mean sea level (MSL). The area of the project site is relatively level, with a minor descending slope toward the west. Site specific topographic mapping was not available at the time of this report.

Regional Geology

Much of Oregon's geologic history is defined by its location on a convergent plate tectonic boundary (subduction zone). The oceanic crust west of Oregon has collided with and subducted beneath the continental crust, a process which continues to the present day. As the oceanic crust moved toward the continent, material that could not be subducted was accreted onto the continent. The subducting oceanic plate melted as it plunged deeper into the earth and magma migrated to the surface, creating a volcanic arc; known today as the Cascade Range. Other local and massive volcanic episodes, large earthquakes, tectonic shifting, continued erosion and sedimentation, catastrophic flooding and other geologic processes further defined Oregon's landscape. Oregon can be generally divided into geologic provinces, which share similar geologic histories, landforms, and composition. The subject site is generally located in the geologic province known as the Coast Range.

Marine sedimentary formations make up the primary bedrock in the Coast Range, which began forming approximately 65 million years ago (early Paleocene) when forearc sedimentation built a thick wedge of marine sediments off the coast. Silt, sand, and mud were deposited on the Pacific Ocean floor off the coast of Oregon and were compressed into thick layers of sedimentary rocks. As the ocean sediments were steadily accumulating, the two tectonic plates continued to collide. Uplift, folding, and faulting associated with the plate convergence continued to push the marine sedimentary rock upward to form much of the Coast Range. Accumulation of marine sediments and convergence of the plates continues to the present day.

Approximately 45 million years to 36 million years ago (middle Eocene age), the North American continental plate drifted west over a hot spot. The hot spot fed magma through the submarine Coast Range sediments and erupted lava that built up along the coast. These volcanic and intrusive rocks make up the Tillamook Highlands. Hot spot volcanism again influenced the Coast Range province between 17 million years and 15 million years ago (middle Miocene age). This period of highly active volcanism produced a series of gigantic lava floods originating from great fissures near the current Oregon-Idaho-Washington border. The thick and widespread deposits are collectively known as the Columbia River Basalts. Some basalt flows travelled all the way to the Oregon coast.

Marine sediment accumulation, lithification, and uplift were taking place before, during, and after the intermittent volcanic episodes. Where the marine sedimentary formations are older, intrusive sills and dykes, and flows of younger volcanics are sometimes present within and overlying the sedimentary rock. Basalt flows were also deposited along with the marine sediments in shallow marine environments, creating intermittent layers of marine sedimentary rock and submarine basalt formations. Large flows of basalt, such as the Columbia River Basalt, also created injection sills and dikes in the underlying sedimentary formations, which are abundant in the northwest Coast Range.

Soil and Geologic Setting

Soils mapped in the project area by the United States Department of Agriculture (USDA), Natural Resource Conservation Service Web Soil Survey (http://websoilsurvey.nrcs.usda.gov) consist of

Walluski silt loam, 0 to 7 percent slopes. This mapped unit consists of very deep, moderately well drained soils found on fluviomarine and stream terraces. The soil formed from mixed alluvium and/or fluviomarine deposits derived from sedimentary rock. A typical soil profile consists of medial silt loam to a depth of 13 inches, underlain by silty clay loam to a depth of 60 inches.

Geologic mapping for the project area is included in the 2009 Oregon Department of Geology and Mineral Industries (DOGAMI) open file report O-09-06 "Coastal Erosion Hazard Zones in Southern Clatsop County, Oregon: Seaside to Cape Falcon". This publication maps the geology in the project area as late Pleistocene age (126,000 years to 10,000 years ago) coastal terrace deposits (unit Qpt). This unit is described as unconsolidated to moderately consolidated gravel, beach, and dune sand; locally containing minor consolidated clay-rich paleosol, colluvium, debris flows, and alluvial sand, silt, and gravel deposited in channel and point bar environments. The 1985 Geologic Map of the Astoria Basin, Clatsop and Northernmost Tillamook Counties, Northwest Oregon, Oil and Gas Investigation 14 prepared by DOGAMI similarly maps the site as Pleistocene age (1.8 million years to 10,000 years ago) coastal marine-terrace deposits (Qmt). This unit is described as predominantly laminated to cross-bedded beach sand and crudely stratified rounded basalt gravels with some discontinuous paleosols, mud beds, and layers of partially carbonized tree trunks and limbs. The 1972 Environmental Geology of the Coastal Region of Tillamook and Clatsop Counties, Oregon, Bulletin 74 prepared by DOGAMI also maps the geology at the site as Pleistocene age Marine Terraces (Qmt).

The DOGAMI O-09-06 geologic map also shows undifferentiated Holocene age (10,000 years ago to present) alluvial deposits (Qha) directly west of the site. This unit is described as unconsolidated sand, silt, and gravel deposited in alluvial fan, stream terrace, or basin environments. The mapped geologic unit may represent an old stream channel in the vicinity of the project.

The uplands to the south of the subject site are mapped by Bulletin 81 as Oligocene to Miocene Sedimentary Rocks (unit Toms) and by Oil and Gas Investigation 14 as middle to lower Miocene Cannon Beach member of the Astoria Formation (unit Tac). The Toms unit consists of thin bedded to massive, medium to dark gray (orange to white where weathered), tuffaceous siltstone, with lesser amounts of sandstone and claystone. Unit Tac is described as well bedded, laminated to massive micaceous mudstone with subordinate rhythmically thin bedded feldspathic sandstone and mudstone in the lower part of the unit. Numerous outcrops of Intrusive Grande Ronde Basalt (unit Tgri) are mapped within unit Tac south of the site. Unit Tgri is described as a Tertiary middle Miocene age, invasive sills, dikes, and irregular bodies of massive to columnar-jointed, aphyric to rarely phyric basalt and peperite or intrusive bodies related to Grande Ronde Basalt. A figure illustrating the geologic maps is included in Figure A-3.

Subsurface Soil Conditions

Subsurface soil conditions were explored by CGI Geologic Associate Chuck Bolduc, G.I.T., who visited the site on March 29 and March 30, 2011. We observed advancement of two mud rotary soil borings (B-1 and B-2) to depths of 115.5 feet and 121 feet using a subcontracted truck mounted drill rig and one cone penetrometer test (CPT-1) to a depth of 28 feet using a subcontracted rig. The borings and CPT were located in the general vicinity of the proposed structure and were selected in the field by Mark See, the Public Works Director with the City of Cannon Beach, Oregon. The approximate boring and CPT locations are shown on Figure A-2. Detailed boring and CPT logs are included in the attached Appendix B.

Boring B-1 was drilled on March 29, 2011 and with sample intervals between 0 feet and 5 feet and took more than 1 day to drill. Because we observed primarily sand that was similar in gradation between 25 feet and 100 feet and bedrock at 100 feet, we recommended to Mr. See that we extend the sample intervals to between 10 feet and 25 feet so that we could get better information for foundation design in the bedrock. Mr. See agreed with the recommendation and boring B-2 was drilled on March 30, 2011 using the extended sample intervals.

In general, the subsurface conditions consisted of medium stiff to soft silt and clay in the approximately upper 25 feet, which included abundant organic material below 15 feet. Below 25 feet, we encountered medium dense to very dense gray sand. Multiple thin gravel layers were observed in the two borings at various depths. At approximately 100 feet below the ground surface, we encountered siltstone bedrock. A more detailed description of the soils encountered in the borings is included below:

Clay and Organic Debris

The clay was stiff in the near surface becoming softer with depth. Clay was tan with rust mottling with minor inclusions of rust concretions. Some sandy texture was observed but sand particles were not present. In boring B-2, the drill cuttings were observed to be significantly more orange in color than in boring B-1. Wood fiber was observed in the cuttings from boring B-2 at a depth of 10 feet and again at 15 feet. A sample in boring B-2 encountered a relatively fresh to minimally decomposed log or stump oriented vertically based on the vertical wood grain recovered in the sampler. Other samples encountered gray clay with decomposed wood debris and gray clayey sand with decomposed wood debris. We interpret this sequence of sediments were deposited in an alluvial environment. Based on the CPT data, the shear wave velocity was between 402 feet per second and 582 feet per second in this soil layer.

Beach and Dune Sand

Dense, wet, gray sand was encountered at a depth of 25 feet in boring B-1 and dense sand to silty sand was interpreted in CPT-1 below 26 feet. The sand was generally fine-grained poorly-sorted with abundant micaceous flakes in select samples. The micaceous material may have been derived from weathering of local mica-bearing sandstones of the Astoria Formation and deposited as alluvial sands. Very dense basaltic gravel and sand was encountered in boring B-1 at 55 feet below the ground surface, and ended at 57.5 feet below the ground surface based on drilling characteristics. Thin layers of gravel were also interpreted at 61.5 feet in boring B-1 and 65 feet in boring B-2 based on drilling characteristics. Based on the limited thickness and variable depth, we interpret the gravel to be discontinuous. We interpret the sands and gravel deposits to be consistent with the geologic mapping of marine terrace deposits. The CPT met refusal near the top of the contact of the upper dense sand layer at 26 feet and shear wave velocities were not obtained below 25 feet. However, based on our blow count data, we estimate that the beach and dune sand has a shear wave velocity between 650 feet per second and 1,300 feet per second.

Siltstone Bedrock

Hard siltstone bedrock was encountered in boring B-1 at 100 feet below the ground surface and in boring B-2 at 101 feet below the ground surface. The siltstone observed in each boring differed in blow counts, drilling characteristics, and cutting return. The siltstone in boring B-1 had very high blow counts, variably hard and easy drilling and black fragments of basaltic rock returned in the drill cuttings. The siltstone in boring B-2 had relatively lower blow counts, consistent drilling characteristics, and no basaltic cuttings were observed. We interpret that the siltstone in boring B-1 also included a minor basalt intrusion, which is consistent with the abundantly mapped basaltic intrusives within the Astoria Formation in the area. In boring B-1, we drilled 15 feet into the formation and in boring B-2, we drilled 20 feet into the formation. According to a Madin and Wang 1999 paper, the shear wave velocity of the siltstone bedrock was estimated to be 1,870 feet per second.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in Appendix B should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, and test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. The samples that were not altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

Groundwater Information

The static groundwater elevation in the project area was interpreted to be approximately 25 feet to 30 feet below the ground surface based on our observation of soil samples recorded during mud rotary drilling. The cone penetrometer test conducted a pore-water dissipation test within the dense gray sand at a depth of approximately 27.5 feet. Results of the pore-water dissipation test indicated a static water level of approximately 21 feet below the ground surface. We have assumed a groundwater depth of 21 feet below the ground surface for the purpose of this report.

Seismic Setting

The Oregon Coast is located near the western margin of the North American tectonic plate. The Pacific and Juan de Fuca tectonic plates that form the ocean floor are converging upon, and being subducted beneath, the North American Plate off the Oregon coastline. This zone of tectonic plate convergence, called the Cascadia Subduction Zone, has created a complex set of stress regimes that influence the tectonic and volcanic activity of the Pacific Northwest.

The moment magnitude (M_w) scale, rather than the Richter magnitude (M_L) scale, is now being used by seismologists to provide more accurate information. Moment magnitude measures an earthquake in terms of energy released and takes into account the rigidity of the earth, the average amount of slip on the fault and the size of the area that slipped. Richter magnitude is a base-10 logarithmic scale where the magnitude is calculated based on the combined shaking amplitude and the largest displacement from zero on a particular type of seismometer. The effective limit of measurement on the Richter scale is about M_L equal to 6.8. The size of an earthquake measured by moment magnitude and Richter magnitude are similar up to about 6.8.

The following paragraphs describe the distinct seismic sources that could potentially generate earthquakes affecting the subject site.

Cascadia Subduction Zone

The Cascadia Subduction Zone, located approximately 50 miles to 60 miles off the Oregon and Washington coastlines, is an immense thrust fault and a potential source of earthquakes large enough to cause significant ground shaking at the subject site and potentially throughout western Oregon and Washington. Research over the last several years has shown that this offshore fault zone has repeatedly produced large earthquakes every 300 years to 700 years. Geologic research of ancient Japanese tsunami records along with dendrochronology (tree ring dating techniques) has established that the last large Cascadia Subduction Zone earthquake occurred in January of 1700 AD. Although researchers do not fully agree on the likely magnitude of the next Cascadia Subduction Zone thrust fault earthquake, it is widely believed that earthquakes of moment magnitude (M_w) 8.0 to 9.0 are possible. The scientific community believes that the duration of strong ground shaking may be as long as 5 minutes to 6 minutes, with minor shaking lasting on the order of several minutes longer. Subduction zone earthquake aftershocks could continue to occur for hours or days after the initial rupture.

Intra-Slab Seismic Sources

Additional earthquake sources in this region include fault ruptures within the subducting oceanic plates. Earthquakes occurring within the subducting oceanic plates are called intraplate earthquakes. Originating at depths on the order of 20 miles to 30 miles within the remains of the subducting Juan de Fuca Plate, these large earthquakes have occurred with historical frequency in western Washington and to a lesser extent in western Oregon. These earthquakes range up to about Mw 7.5 and have caused widespread damage in the southern Puget Sound and northwest Oregon region in 1949, 1965, and 2001.

Crustal Seismic Sources

Crustal earthquakes are relatively shallow, occurring within approximately 6 miles to 12 miles of the earth's surface as a result of localized tectonic stresses. Oregon has experienced at least two significant crustal earthquakes in the past 18 years—the Scotts Mills (Mt. Angel) earthquake (Mw 5.6) on March 25, 1993 and the Klamath Falls earthquake (Mw 6.0) on September 21, 1993. Although there are no mapped crustal faults in the immediate vicinity of the project site that pose a surface rupture hazard, there may be yet undiscovered faults capable of generating significant ground motion and capable of influencing local relative seismic hazards. Based on limited data available in Oregon, it would be reasonable to assume Mw 6.0 to 6.6 crustal earthquakes may occur in Oregon.

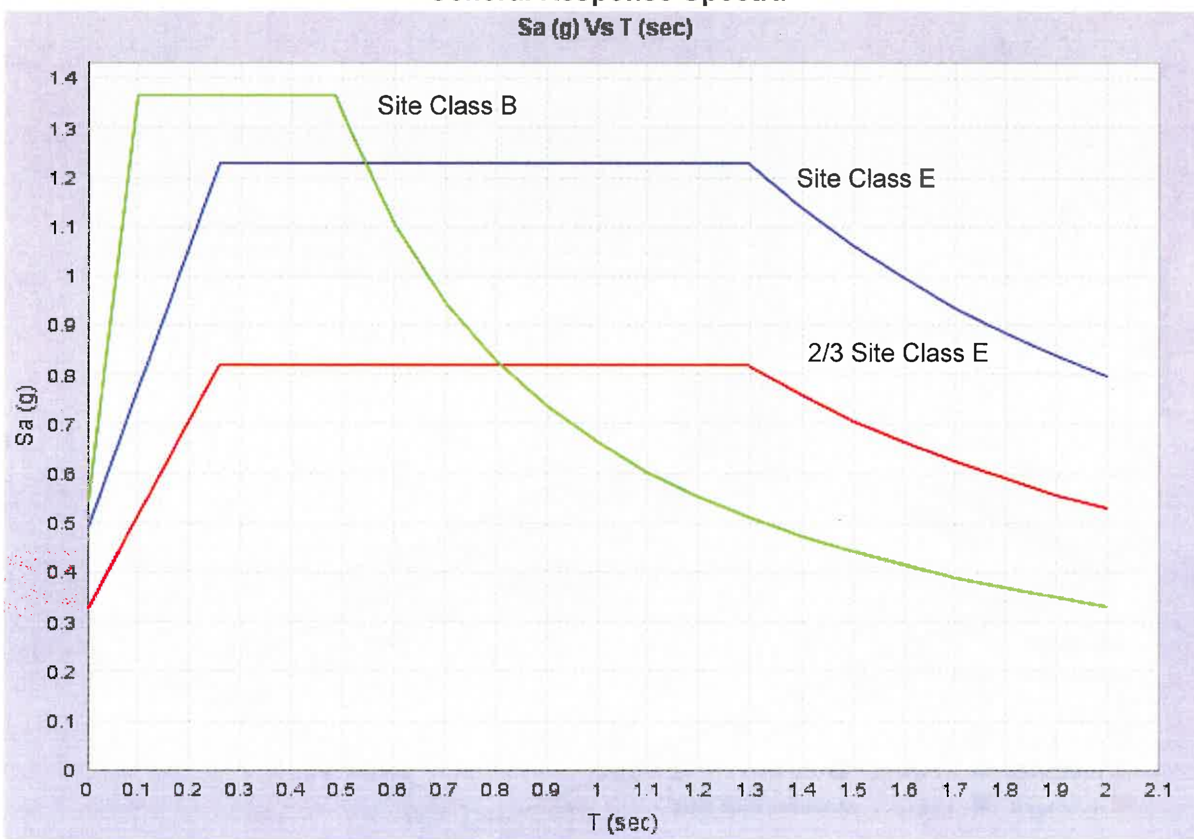
Ground Shaking

The peak horizontal ground acceleration (PGA) is the standard quantitative method of describing ground motion associated with propagating seismic waves in bedrock. The PGA is based on empirical attenuation relationships of seismic wave energy with distance from the seismic source. PGA's are expressed as a fraction of the acceleration due to gravity (g). Both Probabilistic Seismic Site Hazard (PSHA) and Deterministic Seismic Site Hazard (DSHA) were used to determine the PGA's for the site. The results are summarized in the following sections.

Probabilistic Seismic Hazard Analysis (PSHA)

The PSHA uses a response spectrum that is based on the chance that a particular ground motion will be exceeded in a defined recurrence interval (typically the lifetime of the planned development) due to earthquakes on numerous nearby and distant sources. We used the USGS National Seismic Hazard Mapping Program to obtain the ground motions evaluated for this study. Based on the exploration logs, we classified this site as a Site Class E in accordance with the 2010 Oregon Structural Specialty Code (OSSC) Table 1613.5.6(1) and (2). The probabilistic response is based on a return interval of 2 percent probability of exceedance within 50 years as described by ASCE 7-10 Section 21.2.1. The values determined in the PSHA assessment are shown and discussed on the below.

General Response Spectra



In accordance with Table 1613.5.2 of the 2010 OSSC, which is an amendment to the 2009 International Building Code (IBC), we recommend a Site Class E (stiff soil profile) for this site. According to the USGS Java Ground Motion Parameter Calculator using the ASCE 7-05, the maximum considered earthquake (MCE) ground motions for the site are S_S=1.379g and S_1=0.676g (for Site Class B and 5 percent critical damping). The USGS values are a more accurate interpolation of the values presented in Figure 1613.5(1) and 1613.5(2) of the OSSC. Site Coefficients F_a and F_v are 0.9 and 2.4, respectively for Site Class E. Therefore the adjusted MCE ground motions are S_{MS}=1.241g and S_{M1}=1.623g (for Site Class E). The return interval for these ground motions is 2 percent probability of exceedance in 50 years.

In addition, we performed a seismic deaggregation for the site. The estimated ground surface PGA is approximately 0.5778g for a Site Class B based on that evaluation. The seismic deaggragation is included on the following page.

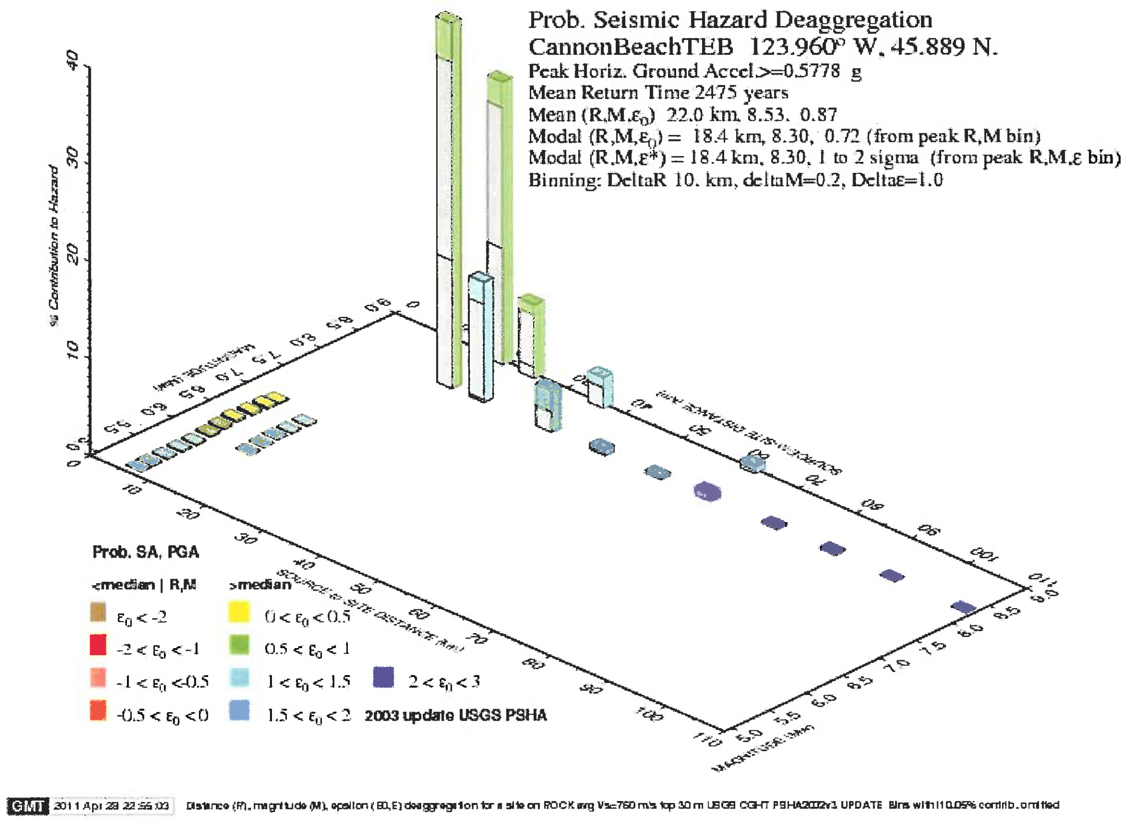


Table A-1: Principal Seismic Sources with Greater than 10 Percent Contribution to the Probabilistic Hazard at the Site

Earthquake Source	Percent Contribution	Probabilistic Magnitude
Cascadia M8.3	57 percent	8.3
Cascadia Megathrust	41 percent	9.0

Deterministic Seismic Hazard Analysis (DSHA)

A DSHA calculates the ground motions due to a specific maximum characteristic earthquake magnitude that is defined as the largest earthquake that could be expected to occur for a particular seismic source, regardless of the frequency of occurrence. The maximum characteristic earthquake is defined as the maximum earthquake that appears capable of occurring under the known tectonic framework (Kramer 1996). The size of the maximum characteristic earthquakes are discussed above in the Seismic Setting section of this appendix and are M_W 6.0 to 6.6 for shallow crustal earthquakes, M_W 7.5 for intraplate earthquakes and M_W 8.0 to 9.0 for the interface (subduction) zone earthquakes. These magnitudes are also reflected in the probabilistic analysis used by the USGS.

For the DSHA, we only conducted seismic analysis for the interface zone earthquake because that is the controlling earthquake at this site. The results of the DSHA are summarized in the following paragraphs.

Historical Seismicity

For historical seismicity within a 20 kilometer (12 mile) radius of the site, we reviewed the DOGAMI 2002 open-file report O-03-02, Map of Selected Earthquakes for Oregon, 1841 through 2002. The publication shows the location of earthquakes greater than magnitude 2.0 between 1841 and 2002. Based on our review, no earthquakes have been recorded within a 12 mile radius. No earthquakes greater than 5.9 were shown on the map. A copy of the pertinent section of the DOGAMI O-03-02 map is included in Figure A-4.

Local and Regional Potentially Active Faults

Based on review of the USGS 2006 (updated November 3, 2010) Quaternary Fault and Fold Database of the United States website, there are both on-shore and off-shore potentially active fault zones present in northwestern Oregon. The nearest potentially active fault, Fault "H", is mapped by the USGS offshore of Cannon Beach. Fault "H" consists of multiple fault strands, the eastern most of which is approximately 5.6 kilometers (3.5 miles) east of the site, although the reliability of the location is poor. The USGS describes Fault "H" as a 30 mile long northwest-striking, normal and/or left-lateral fault, which offsets accretionary wedge sediment of unknown age that underlies the continental shelf in the forearc of the Cascadia Subduction Zone. Similarities with other faults suggest most recent movement in the late Pleistocene and Holocene (<15,000 years ago). As with other folds and faults located in the Cascadia forearc, it is unknown if coseismic displacements on these faults are always related to great megathrust earthquakes on the subduction zone, or whether some displacements are related to smaller earthquakes in the North American Plate.

The known faults within 100 kilometers (62 miles) of the site have been listed in Table A-2 on the following page.

Table A-2: Class A Seismic Sources within 100-km (62 mile) Radius of the Site

Fault Name or Zone	USGS ID No.	Approximate Distance from Site (km)	Slip Rate (mm/yr)	Fault Length (km)	Most Recent Deformation
Fault "H" (offshore)	790	5.6	>5.0	49	<15Ka
Nehalem Bank Fault	789	19.0	1.0 to 5.0	101	<15Ka
Unnamed Offshore Faults	785	20.7	1.0 to 5.0	300	<15Ka
Gales Creek Fault Zone	718	22.5	<0.2	73	<1.6Ma
Tillamook Bay Fault Zone	881	35.0	<0.2	32	<1.6Ma
Cascadia Fold and Fault Belt	784	46.0	1.0 to 5.0	484	<15Ka
Fault "G" (offshore)	791	46.0	>5.0	56	<15Ka
Fault "J" (offshore)	788	48.6	1.0 to 5.0	8	<15Ka
Happy Camp Fault	882	49.5	<0.2	3	<1.6Ma
Willapa Bay fault zone	592	57.5	0.2 to 1.0	37	<15Ka
Portland Hills Fault	877	82.1	<0.2	49	<1.6Ma
Helvetia Fault	714	84.0	<0.2	7	<1.6Ma
Beaverton Fault Zone	715	88.9	<0.2	15	<750Ka
Unnamed fault set offshore of mouth of Willapa Bay	590	92.1	<0.2	26	<130Ka
Stonewall Anticline	786	92.3	1.0 to 5.0	80	<15Ka
East Bank Fault	876	94.9	<0.2	29	<15Ka
Oatfield Fault	875	95.1	<0.2	29	<1.6Ma
Unnamed fault zone offshore of Cape Shoalwater	591	95.8	<0.2	6	<1.6Ma
Newberg Fault	717	98.0	<0.2	5	<1.6Ma

USGS 2006 (updated November 3, 2010) Quaternary Fault and Fold Database of the United States.

Site Response Model

CGI used the computer program SHAKE2000 version 8.1.0 to perform dynamic analysis of a model soil profile created from subsurface information obtained in our field exploration and sol laboratory testing. Troy Hull, P.E., G.E. of Earth Engineers, Inc. provided technical expertise with the SHAKE2000 modeling. We modeled subsurface conditions represented by boring B-1 with 5 foot thick layers that extended to the bedrock. The dynamic model consisted of five different types of soil.

The following dynamic properties were selected for the model; shear modulus/maximum shear modulus (G/Gmax) and damping curves. We used soil with PI=15 (Vucetic and Dobry, JGE, 1/91) for the upper clay layer; soil with PI=50 (Vucetic and Dobry, JGE, 1/91) for the clay with organics; average sand (Seed and Idriss, 1970) for the dense to very dense sand; G/Gmax curves for sand CP>3.0ksc 3/11 1988 and damping curves for deep cohesionless soil 21 to 50 feet for the medium dense sand; G/Gmax curves for sand CP>3.0ksc 3/11 1988 and damping curves for deep cohesionless soil 21 to 50 feet for the lower dense sand layer between 60 feet and 65 feet below the ground surface; and EPRI, 1993 for rock 51 to 120 feet for the siltstone bedrock. Shear wave velocities were determined in the field in the CPT or correlated with the N_{60} value calculated from the corrected blow counts in the boring log for B-1. The shear wave velocity of the bedrock was estimated to be 1,870 feet per second (Madin and Wang 1999).

The horizontal PGAs were calculated using three attenuation relationships for a M_W of either 8.5 or 9 because the some of the models are reliable only to that magnitude. The source to site distance was 80 kilometers (50 miles) and a depth of 20 kilometers (13 miles) was assumed for this site. The calculated PGAs are summarized in Table A-3 below.

Table A-3: Calculated PGA at Bedrock, g

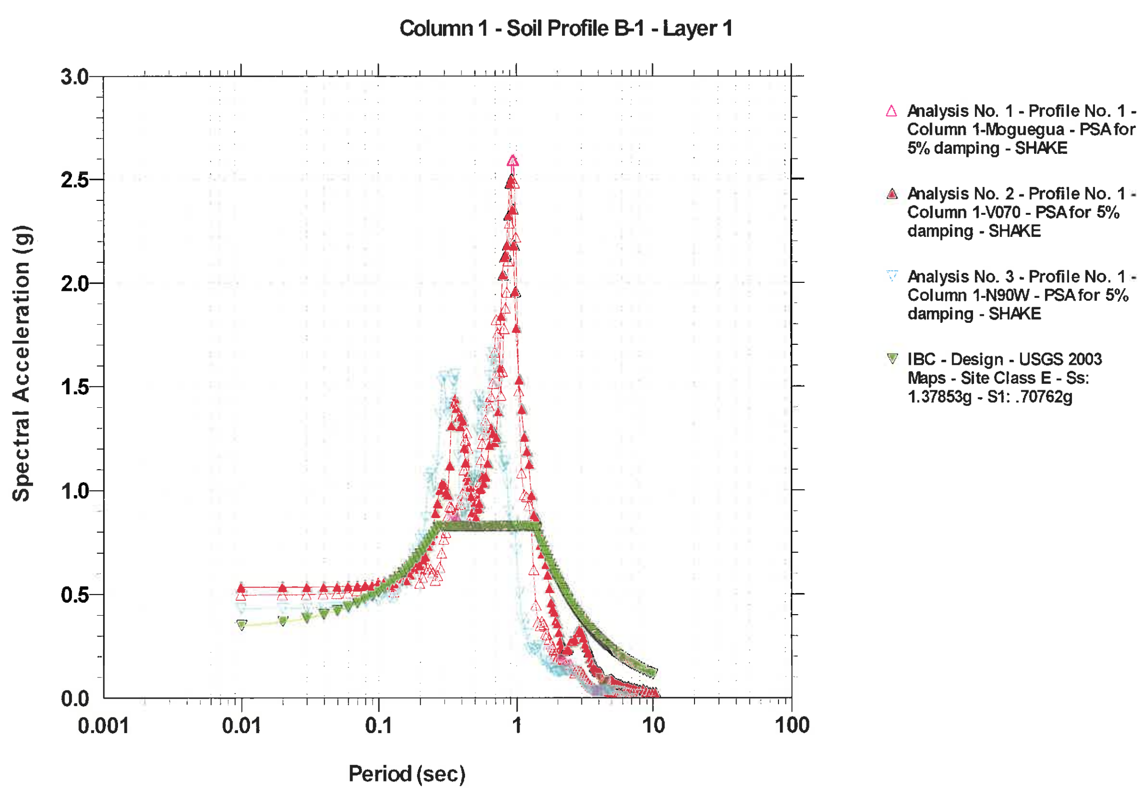
Relationship	Calculated PGA
Gregor, et.al (2002)	0.349
Youngs, et.al (1997)	0.437
Atkinson and Boore (2003)	0.165

We modeled only the interface or subduction zone earthquake because that is the principal seismic source for this site based on the research obtained during the PSHA analysis. We selected three historic earthquakes to complete the analysis. The length of recorded shaking for these earthquakes varied from 1 minute to over 3 minutes. Longer records were not available to us. However, the analysis showed that liquefaction and lateral spreading would occur at the site during the shorter duration ground motions. In our opinion, the selected ground motions were adequate for this feasibility study. Longer duration ground motions may need to be considered during the final design phase of this project. The earthquakes were scaled so that their response spectrum is, on average, approximately at the level of the targeted base spectrum over the anticipated range of significance to the structure. The details of the earthquake records are listed in Table A-4 on the next page.

Table A-4: Earthquake Motions Used In Analysis

Earthquake	Earthquake Type	Station	Magnitude	Source to Site Distance	Recorded PGA	Scaling Factor
2001 Peru	Subduction Zone, Interface	Moquegua	8.4	--	0.30	1.2
1985 Valparaiso (Chili)	Subduction Zone, Interface	Valparaiso (VALU) 70	7.8	109 km (80 miles)	0.23	1.4
1985 Michoacan (Mexico)	Subduction Zone, Interface	Caleta de Campos, N90W	8.1	38 km (23 miles)	0.14	1.6

The response spectrum for the earthquake motions and the IBC code values for reference are provided in the figure included below.



Site Specific Acceleration Parameters for Design

As specified in ASCE 7-10, the design spectral response acceleration parameter at short periods (S_{DS}) obtained from a site specific procedure should be taken at the 0.2 second spectral acceleration, but should not be less than 80 percent of the peak spectral acceleration at any period larger than 0.2 seconds. ASCE 7-10 requires that the parameter S_{D1}, the design spectral response acceleration at a period of 1 second, shall be taken as the greater of the spectral acceleration values at 1 second or two times the spectral acceleration value at 2 seconds. Based on these procedures, the site specific values of S_{DS} and S_{D1} are recommended to be 0.52g and 1.41g, respectively. These values were obtained from the average of the three earthquake response spectrums shown above. Both values exceed the IBC response spectrum. The analysis was conducted for 1 to 3 minute duration earthquakes and these values could change under longer duration earthquakes.

Site Specific Seismic Hazard Summary

The following section of this report presents out evaluation of the site-specific seismic hazards including:

- Liquefaction and Lateral Spread
- Fault Rupture Hazard
- Tsunami Hazard
- Co-Seismic Ground Subsidence
- Earthquake-Induced Landslide Hazard
- Settlement Mitigation and Scour Protection

Liquefaction and Lateral Spread Hazard
Liquefaction occurs when saturated deposits of loose to medium dense, cohesionless, fine-grained soils, generally sands and sand-silt mixtures, are subjected to strong earthquake shaking. If these deposits are saturated and cannot drain rapidly, there will be an increase in pore water pressure. With increasing seismic shaking, the pore water pressure can increase to the value of the overburden pressure. The shear strength of a cohesionless soil is directly proportional to the effective stress, which is equal to the difference between the overburden pressure and the pore water pressure. Therefore, when the pore water pressure increases to the value of the overburden pressure, the shear strength of the soil reduces to zero, and the soil deposits turn to a liquefied state. Liquefaction typically occurs when very loose to loose, saturated sediments are subjected to large earthquake motions. Ground surface response to seismic liquefaction could include softening or settlement of soil grades, loss of foundation support, tipping or tilting of taller structures founded on shallow footings, and a form of slope stability failure called lateral spreading.

Simplified empirical field methods were used to assess liquefaction. These methods are effective to depths of 75 feet. Cyclic laboratory testing and additional ground response analysis would need to be completed to assess the liquefaction potential below depths of 75 feet.

For our liquefaction analysis, we assumed that groundwater would be at a depth of 21 feet below the ground surface. We found that the clay layer will strain soften in the upper 25 feet of boring B-1 and underlying sand could liquefy at all depths except for the between 35 feet and 40 feet and below 75 feet. Based on our soil explorations, laboratory testing and analysis, we estimated that 9 to 15 inches of liquefaction induced settlement in the sand layers and strain softening in the upper clay layers could occur within the upper 75 feet of the site soil profile during the earthquakes modeled. Liquefaction could result in softening or deformation of surface grades or expulsion of water and sediment from the subsurface. Liquefaction can also reduce soil support and pile foundation capacity during an earthquake. Between 1 foot and 4 feet of lateral spreading could occur at the site during the earthquakes modeled with the anticipated direction of movement toward the Pacific Ocean beaches.

Fault Rupture Hazard

There are no mapped crustal faults in the immediate vicinity of the project site. We also reviewed available LIDAR imagery and bathymetry for the project area and did not observe significant signs or trends of any unmapped fault traces, such as lineaments, off-set topographic features, or off-set drainages. However, there may be yet undiscovered faults capable of generating significant ground motion and capable of influencing local relative seismic hazards.

Tsunami Hazards

Due to the relatively low elevation of the site above sea level, tsunami inundation and scour are considered likely seismic hazards at this site. A tsunami, or seismic sea wave, is produced when a fault under the ocean floor shifts vertically, displacing the seawater above it. Based on the DOGAMI Special Paper 41, 2009, the City Hall site lies within in a zone predicted to be inundated by between 50 percent and 70 percent of possible Cascadia Tsunami scenarios as shown on Figure A-5. The site is also subject to inundation by the maximum distant tsunami scenario modeled from Gulf of Alaska seismic source. Lines of 50 percent, 70 percent, 90 percent, and 99 percent lines on Figure A-5 correspond to inundation depths of 9 meters (29 feet), 11meters (36 feet), 16 meters (52 meters), and 30 meters (100 feet), where tsunamis were amplified by local topography. Scour from a tsunami could remove several feet of surface soil from the site, potentially eroding parking and street grades, damaging shallow underground utilities and undermining shallow foundations.

Co-Seismic Ground Subsidence

Co-seismic ground subsidence occurs when large areas of the coastline release built up strain during a large earthquake. The historical and geologic evidence suggest that 2 meters (6 feet) or more of rapid co-seismic subsidence could occur in this area during a strong Cascadia Suduction zone earthquake. Site affects could include immediate flooding of low lying or coastal areas and relatively higher tsunami inundation levels.

Earthquake Induced Landslide Hazard
The risk of earthquake induced landslides on the site is negligible because the site slopes are mild to level.

Settlement Mitigation and Scour Protection
A building supported on concrete piles with a structural slab would not be affected by dynamic settlement and lateral spreading. However, the ground surface, surrounding structures and utilities will be affected by the dynamic settlement and lateral spreading. Ground improvement techniques, such as deep soil mixing and installation of vertical drains could reduce the risk of liquefaction and lateral spreading.

Foundation elements should be constructed of cast-in-place concrete to resist tsunami scour. Placing the rectangular building with the long axis parallel to the tsunami surge could reduce forces. Bearing walls or structural walls should be placed perpendicular to the water flow. Tsunami forces could be reduced by allowing non-structural elements at lower levels to break away

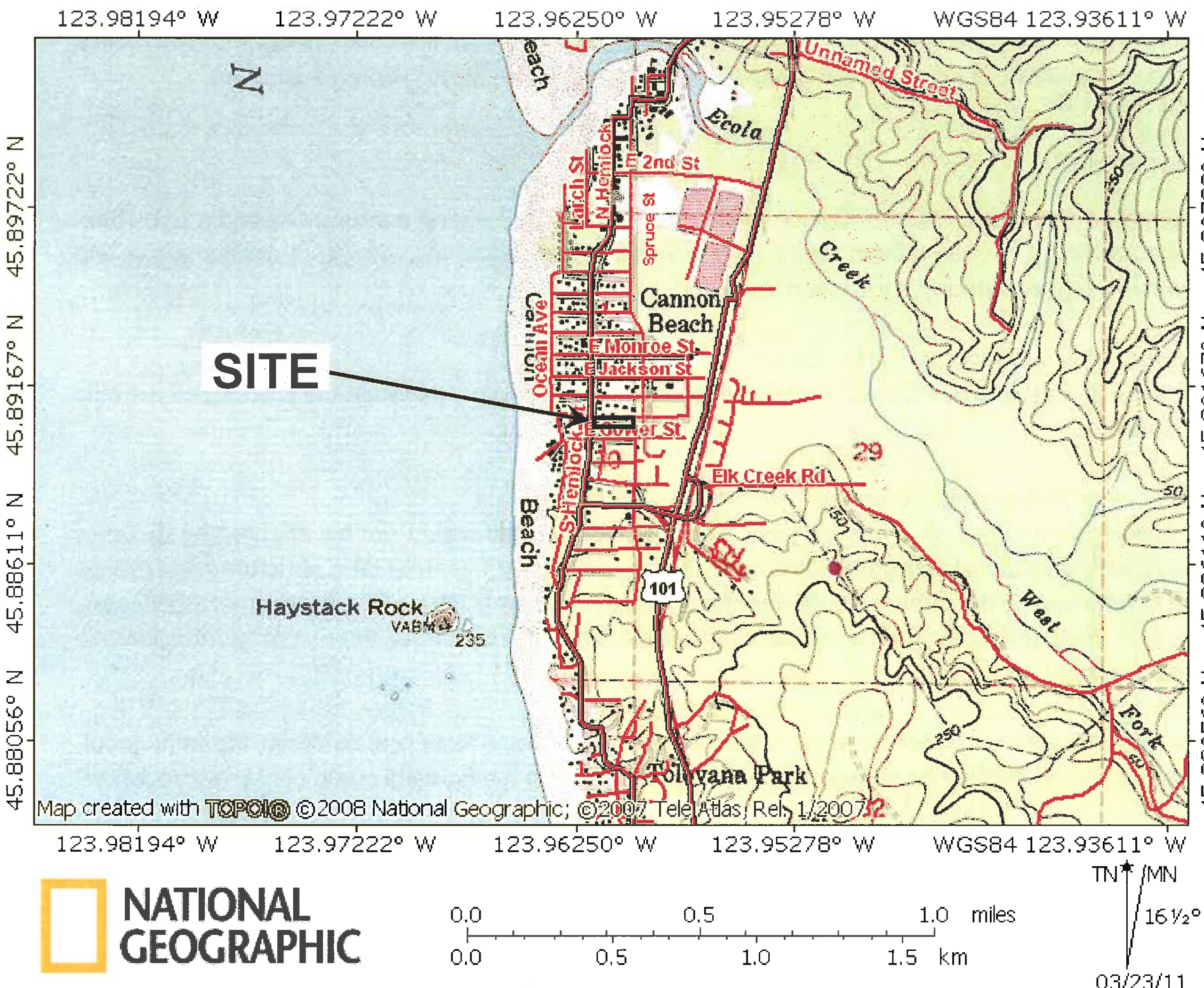
Limitations

This feasibility study showed that seismic hazards do exist at the site. Final design may need to consider different earthquake scenarios for longer duration ground motions than were considered for this analysis.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed. This report has been prepared for the exclusive use of the client or their authorized agents for the specific application to the proposed project.

Exhibit A-2

FIGURE A-1: SITE LOCATION PLAN



Scale: 1 inch = 2,000 feet

Approximate Scale: 1 inch = 2,000 feet

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Exhibit A-2

FIGURE A-2: SITE PLAN WITH EXPLORATION LOCATIONS

Approximate Scale: 1 inch = 80 feet
Source: City of Cannon Beach GIS Website (http://www.ci.cannon-beach.or.us/docs/Planning/GIS_2010/MASTER/index4.htm)

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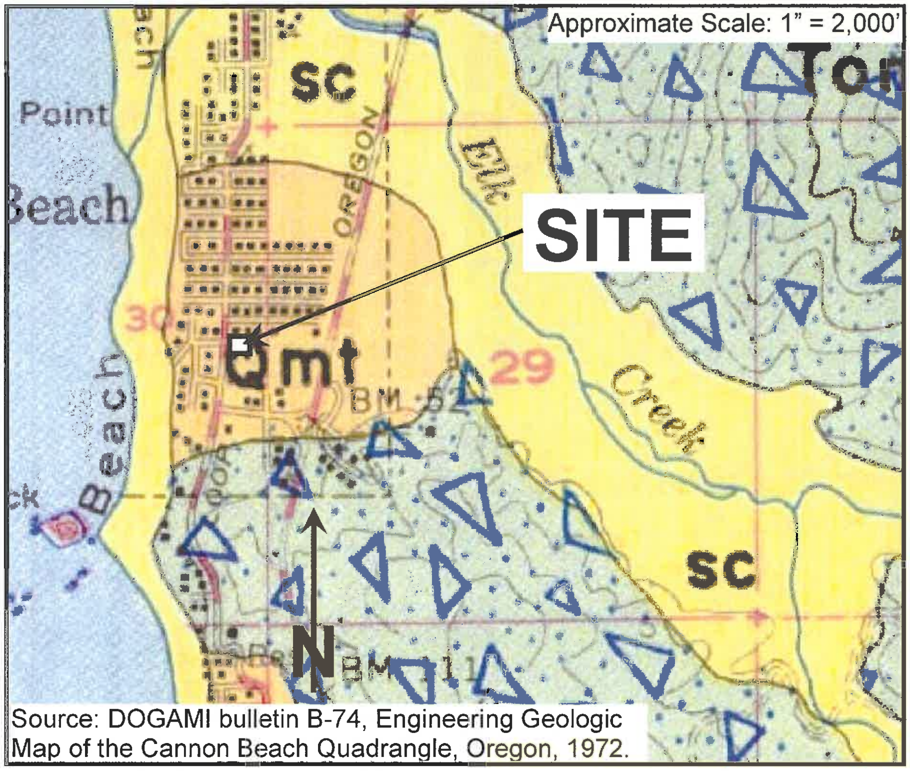
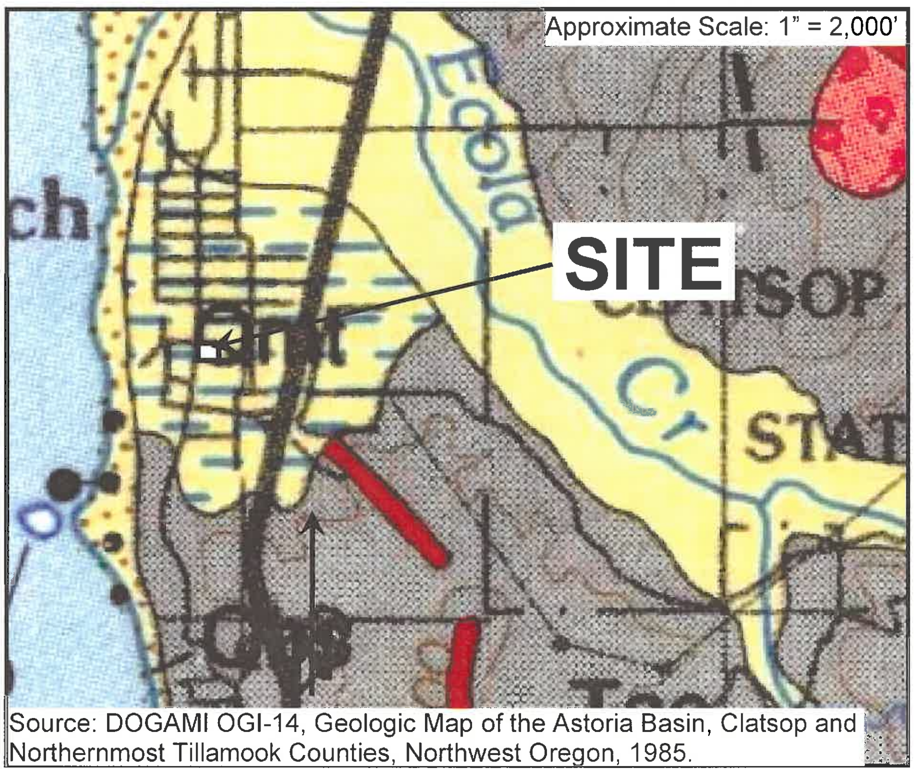
Exhibit A-2

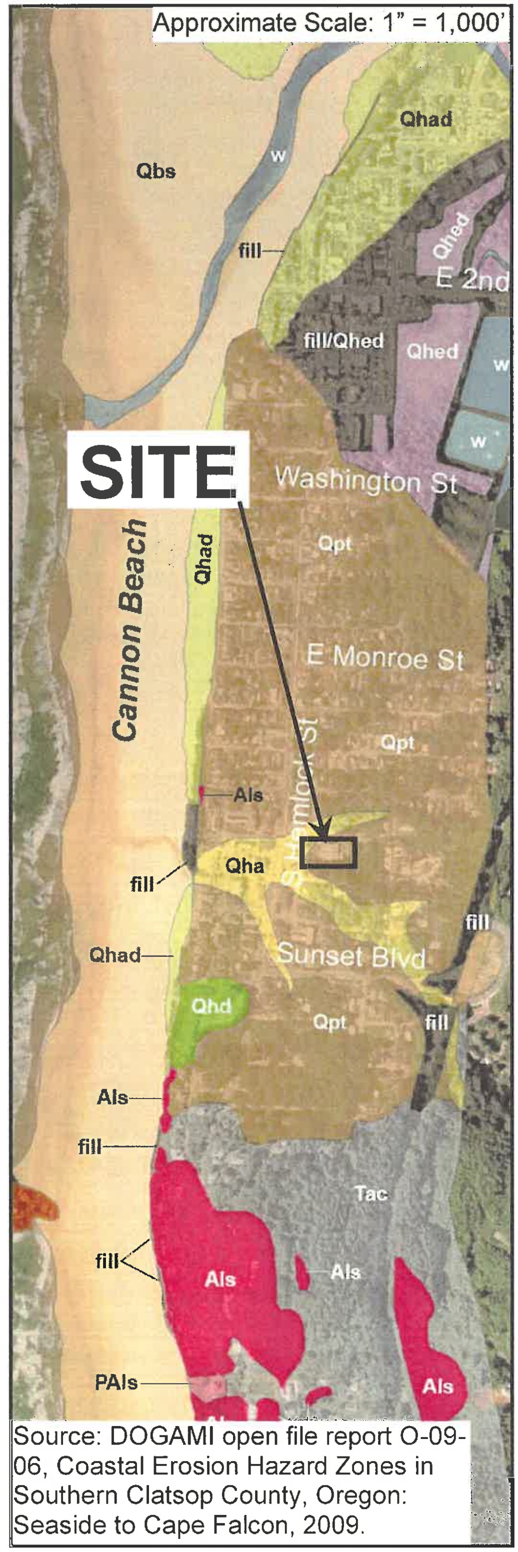
FIGURE A-3: GEOLOGIC MAPS



Source: DOGAMI bulletin B-74, Engineering Geologic Map of the Cannon Beach Quadrangle, Oregon, 1972.



Source: DOGAMI OGI-14, Geologic Map of the Astoria Basin, Clatsop and Northernmost Tillamook Counties, Northwest Oregon, 1985.



Source: DOGAMI open file report O-09-06, Coastal Erosion Hazard Zones in Southern Clatsop County, Oregon: Seaside to Cape Falcon, 2009.

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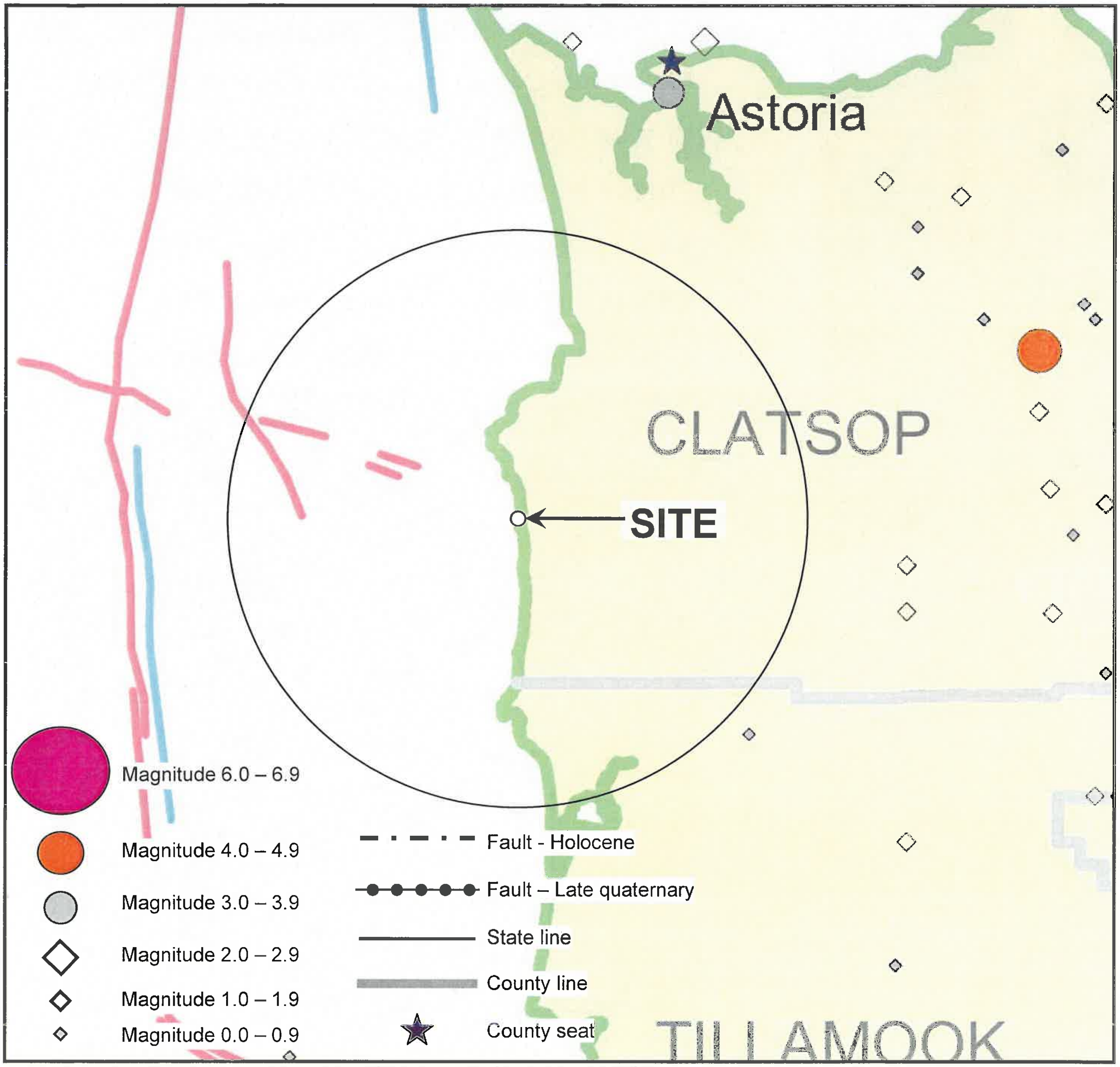
FIGURE A-4: HISTORIC EARTHQUAKES AND FAULT MAP



Approximate Scale: 1 inch = 10 kilometers

Source: DOGAMI 0-03-02 Map of Selected Earthquakes for Oregon 1841 through 2002

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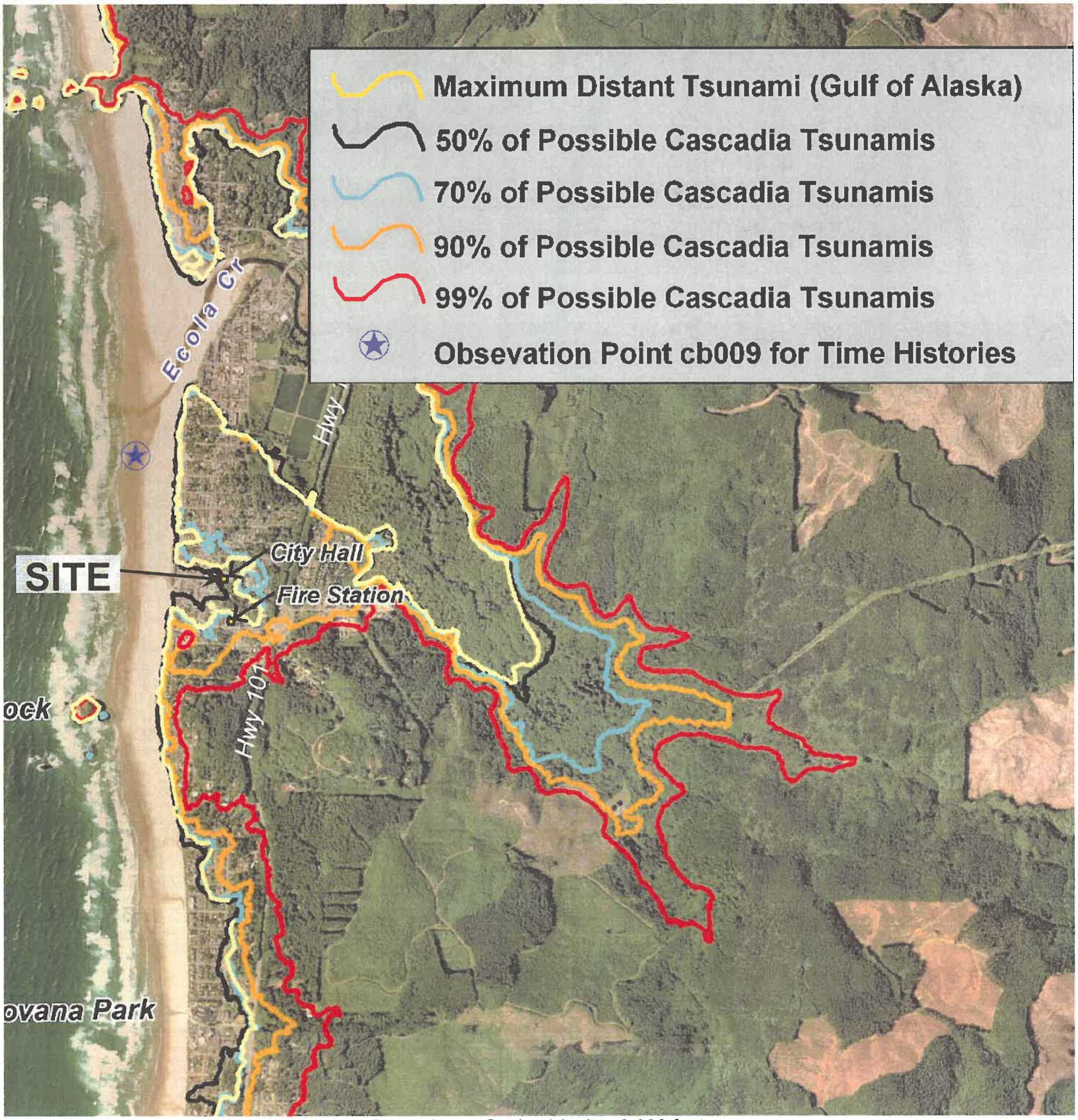
Exhibit A-2

FIGURE A-5: TSUNAMI INUNDATION MAP



Approximate Scale: 1 inch = 2,000 feet

Source: DOGAMI SP-41, Tsunami hazard assessment of the northern Oregon coast: a multi-deterministic approach tested at Cannon Beach, Clatsop County, Oregon, Figure 50 page 73.

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APPENDIX B:

FIELD EXPLORATION PROCEDURES AND LOGS

APPENDIX B

FIELD EXPLORATION PROCEDURES AND LOGS

Chinook GeoServices, Inc. (CGI) explored subsurface conditions on March 29 and 30, 2011, during which time two soil borings (B-1 and B-2) were drilled and one cone penetrometer (CPT-1) was advanced.

Drilled Borings

Our two soil borings (B-1 and B-2) were drilled and sampled using mud rotary drilling equipment. The drill rig was operated by Subsurface Technologies of North Plains, Oregon under contract to CGI. Boring locations were selected in the field by the Client in the general vicinity of proposed structure. Field measurements from site features were used to locate the borings on the site plan. A qualified representative from CGI continuously observed the borings, logged the subsurface conditions and collected representative soil samples. All samples were stored in watertight containers and later transported to a subcontracted laboratory for further testing. After each boring was completed, the borehole was backfilled with bentonite chips and patched with asphalt cold patch.

Throughout the drilling operation, soil samples were generally obtained at 5-foot intervals in boring B-1 and 25-foot to 10-foot intervals in boring B-2 using a Standard Penetration Test (SPT) in accordance with ASTM D1586 using an automatic hammer. The testing and sampling procedure consists of driving a 2-inch diameter steel split spoon sampler 18 inches into the soil with a 140 pound hammer free-falling a distance of 30 inches. The number of blows required to drive the sampler through each 6-inch interval are counted, and the total number of blows struck during the final 12 inches is recorded as the SPT blow count (N-value). If the total blow count of 50 blows is recorded for any 6-inch interval, the driving is stopped and the blow count is recorded as 50 blows for the actual penetration distance. The resulting SPT resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

The automatic hammer produces lower blow counts and SPT N-values than the traditional safety hammer. Studies have generally shown that penetration resistances may vary by a factor of 1.5 to 2 between the two methods. We have not adjusted the numbers recorded on the boring logs, and therefore the SPT values should be considered conservative.

The enclosed Boring Logs describe the vertical sequence of soils and materials encountered in each boring, based primarily on field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Where the soil type changed between sample intervals, we inferred the contact depth. Our logs graphically present the blow count per 6-inch interval, the sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these samples. If any ground water was encountered in a boring, the approximate ground water depth is shown in the boring log. Ground water depth estimates were determined by visual examination of the samples.

Cone Penetrometer Test Probe

One cone penetrometer test probe (CPT) (CPT-1) was advanced using electronic cone equipment. The CPT rig was a Hogentogler Seismic/Pore Pressure 10 ton Subtraction Electronic Cone Penetrometer operated by Subsurface Technologies of North Plains, Oregon under contract to CGI. The exploration location was selected in the field by the Client in the general vicinity of proposed structure. Field measurements from site features were used to locate the CPT probe on the site plan. The exploration was advanced in general conformance with ASTM D3441. The test method consists of pushing an instrumented cone, with the tip facing down, into the ground at a controlled rate.

Seismic shear wave velocity testing was obtained at 2 meter intervals. The seismic shear wave testing equipment consists of hammer, a static load and a field computer all connected with a trigger that serves as the seismic source. The time for the shear wave to arrive at the seismic cone is measured. The shear wave velocity is calculated based on the information obtained in the field.

Pore pressure dissipation was also measured within the sand material present at a depth of 27.5 feet. The testing is conducted by allowing the excess pore water pressure to dissipate from the test depth. Pore pressure dissipation testing allows for calculation of the static water table. Results of the pore-water dissipation test indicated a static water level of approximately 21 feet below the ground surface.

Boring Log B-1

Chinook GeoServices Inc.

CLIENT: Mark See, Public Works Director, City of Cannon Beach	CGI PROJECT NO.: 11-022
PROJECT: Proposed New City Hall / Tsunami Evacuation Building	BORING TYPE: Mud rotary using truck mounted rig equipped with automatic SPT hammer
LOCATION: 163 East Gower Street, Cannon Beach, Oregon	ELEVATION: Approximately 30 feet above mean sea level
DATE DRILLED: March 29, 2011	LOGGED BY: Chuck Bolduc, G.I.T.

DEPTH (ft)	SAMPLE NO.	SAMPLE	SOIL DESCRIPTION	BLOWS PER 6 INCHES	SPT "N" Value	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT (%)	UNIT DRY WT. (p.c.f.)	REMARKS
			1.5 inches asphalt underlain by approximately 7.5 inches base rock							
	S-1		Stiff, moist, gray-brown with rust mottling, clay with sand texture	3 4 5	9					
	S-2		Becomes medium stiff.	2 3 4	7	53	35	61.5		
5	S-3		Becomes light tan.	2 2 3	5					
10	S-4		Becomes soft.	1 1 1	2	62	36	63.1		
15	S-5		Tree or stump in upright position. Wood core had grains orientec vertically. Fresh to partially decomposed.	3 5 6	11					
20	S-6		Soft, moist to wet, gray clay with sand texture and decomposec wood debris and organics.	0 2 1	3					
25	S-7		Dense, wet, gray fine-grained sand.	10 15 20	35					▼ Estimated Static Groundwater
30	S-8		Becomes tan.	16 20 19	39					
35	S-9			18 22 27	49					
40	S-10			14 18 17	35					
45	S-11		Becomes medium dense, wet, gray and tan sand with abundan micaceous grains.	7 8 9	17					
50										

Exhibit A-2

Boring Log B-1 Continued

Chinook GeoServices Inc.

CLIENT: Mark See, Public Works Director, City of Cannon Beach	CGI PROJECT NO.: 11-022
PROJECT: Proposed New City Hall / Tsunami Evacuation Building	BORING TYPE: Mud rotary using truck mounted rig equipped with automatic SPT hammer
LOCATION: 163 East Gower Street, Cannon Beach, Oregon	ELEVATION: Approximately 30 feet above mean sea level
DATE DRILLED: March 29, 2011	LOGGED BY: Chuck Bolduc, G.I.T.

DEPTH (ft)	SAMPLE NO.	SOIL DESCRIPTION	BLOWS PER 6 INCHES	SPT "N" Value	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT (%)	UNIT DRY WT. (p.c.f.)	REMARKS
	S-12	Becomes dense.	10 14 20	34					
55	S-13	Very dense, wet, gray sand and basaltic gravel.	45 50 for 3"	>50					
		Base of gravel layer, based on driling characteristics.							
60	S-14	Dense, wet, gray fine-grained sand with micaceous flakes and trace rounded black gravel.	8 20 15	35					
		Layer of gravel infered from drilling characteristics.							
65	S-15	Very dense, wet, gray fine-grained sand with no micaceous flakes	16 47 42	89					
70	S-16		20 31 31	62					
75	S-17		20 26 33	59					
80	S-18	Becomes dense with some micaceous flakes.	15 17 25	42					
85	S-19	More abundant micaceous flakes.	22 24 18	42					
90	S-20		16 23 25	48					
95	S-21	Becomes very dense.	22 27 26	53					
100									

Boring Log B-1 Continued

Chinook GeoServices Inc.

CLIENT: Mark See, Public Works Director, City of Cannon Beach	CGI PROJECT NO.: 11-022
PROJECT: Proposed New City Hall / Tsunami Evacuation Building	BORING TYPE: Mud rotary using truck mounted rig equipped with automatic SPT hammer
LOCATION: 163 East Gower Street, Cannon Beach, Oregon	ELEVATION: Approximately 30 feet above mean sea level
DATE DRILLED: March 29, 2011	LOGGED BY: Chuck Bolduc, G.I.T.

DEPTH (ft)	SAMPLE NO.	SOIL DESCRIPTION	BLOWS PER 6 INCHES	SPT "N" Value	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT (%)	UNIT DRY WT. (p.c.f.)	REMARKS
	S-22	Hard, moist, purplish-brown siltstone.	36 50 for 3"	>50					
	S-23	No sample recovery.	30 for 0"	>50					
		Fragments of black basalt observed in the drill cuttings.							
105	S-24	No sample recovery.	30 for 0"	>50					
		Drilling indicated contact between harder and softer material							
110	S-25	Hard, moist, purplish-brown siltstone.	50 for 4"	>50					
		Drill cuttings continue to bring up black basalt fragments							
115	S-26		50 for 6"	>50					
		Boring terminated at 115.5 feet below the ground surface and backfilled with bentonite/cement grout and bentonite chip hole-plug							
120									
125									
130									
135									
140									
145									
150									

Boring Log B-2

Chinook GeoServices Inc.

CLIENT: Mark See, Public Works Director, City of Cannon Beach	CGI PROJECT NO.: 11-022
PROJECT: Proposed New City Hall / Tsunami Evacuation Building	BORING TYPE: Mud rotary using truck mounted rig equipped with automatic SPT hammer
LOCATION: 163 East Gower Street, Cannon Beach, Oregon	ELEVATION: Approximately 30 feet above mean sea level
DATE DRILLED: March 30, 2011	LOGGED BY: Chuck Bolduc, G.I.T.

DEPTH (ft)	SAMPLE NO.	SAMPLE	SOIL DESCRIPTION	BLOWS PER 6 INCHES	SPT "N" Value	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT (%)	UNIT DRY WT. (p.c.f.)	REMARKS
5										
10			Woody debris observed in cuttings.							
15			Woddy debris observed in cuttings.							
20										
25	S-1		Stiff, moist, gray clayey sand with wood and organic debris	4 6 8	14					
30										
35										
40										
45										
50										

Exhibit A-2

Boring Log B-2 Continued

Chinook GeoServices Inc.

CLIENT: Mark See, Public Works Director, City of Cannon Beach	CGI PROJECT NO.: 11-022
PROJECT: Proposed New City Hall / Tsunami Evacuation Building	BORING TYPE: Mud rotary using truck mounted rig equipped with automatic SPT hammer
LOCATION: 163 East Gower Street, Cannon Beach, Oregon	ELEVATION: Approximately 30 feet above mean sea level
DATE DRILLED: March 30, 2011	LOGGED BY: Chuck Bolduc, G.I.T.

DEPTH (ft)	SAMPLE NO.	SOIL DESCRIPTION	BLOWS PER 6 INCHES	SPT "N" Value	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT (%)	UNIT DRY WT. (p.c.f.)	REMARKS
	S-2	Medium dense, wet gray sand with layers of mica and micaceous sand.	4 8 15	23					
55									
60									
65		Layer of gravelly material based on drilling characteristics							
70									
75	S-3	Medium dense, wet, tan and gray fine-grained sand with no mica	8 12 15	27					
80									
85	S-4	Becomes dense with layers of concetrated micaceious flakes.	12 16 20	36					
90		Alternately hard and easier drilling between 90 and 95 feet							
95	S-5		13 19 24	43					
100									

Boring Log B-2 Continued

Chinook GeoServices Inc.

CLIENT: Mark See, Public Works Director, City of Cannon Beach	CGI PROJECT NO.: 11-022
PROJECT: Proposed New City Hall / Tsunami Evacuation Building	BORING TYPE: Mud rotary using truck mounted rig equipped with automatic SPT hammer
LOCATION: 163 East Gower Street, Cannon Beach, Oregon	ELEVATION: Approximately 30 feet above mean sea level
DATE DRILLED: March 30, 2011	LOGGED BY: Chuck Bolduc, G.I.T.

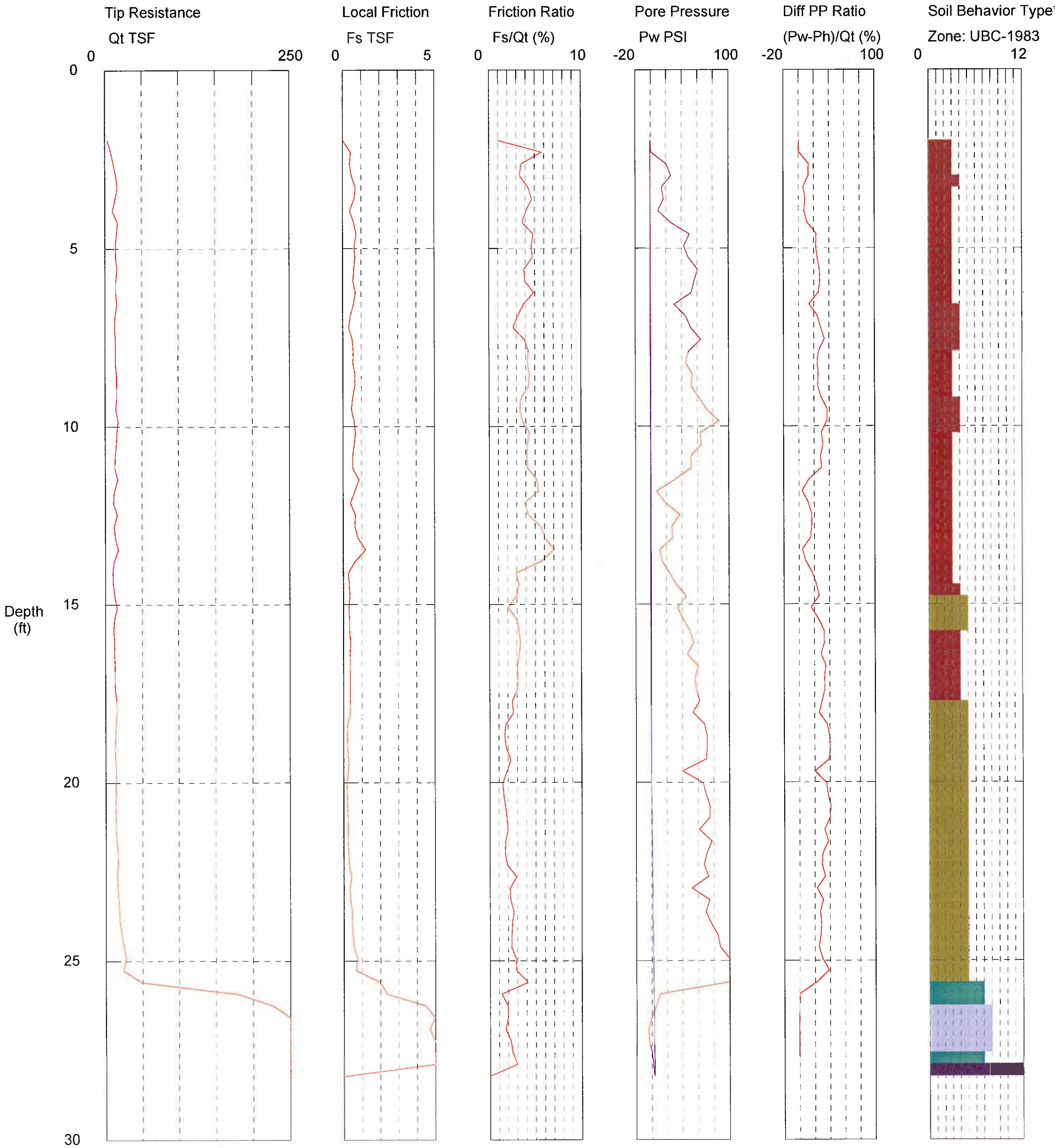
DEPTH (ft)	SAMPLE NO.	SAMPLE	SOIL DESCRIPTION	BLOWS PER 6 INCHES	SPT "N" Value	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE CONTENT (%)	UNIT DRY WT. (p.c.f.)	REMARKS
			Contact with bedrock based on drilling characteristics.							
	S-6		Hard, moist, grayish brown siltstone.	50 for 4"	>50					
105										
110	S-7			32 43 50 for 5"	>50					
115										
120	S-8			48 50 for 5"						
			Boring terminated at 121 feet below the ground surface anc backfilled with bentonite/cement grout and bentonite chip hole-plug							
125										
130										
135										
140										
145										
150										

Exhibit A-2

Subsurface Technologies

Operator: SAM
Sounding: P-1
Cone Used: DSG1021

CPT Date/Time: 3/29/2011 9:24:20 AM
Location: CANNON-CITY HALL
Job Number: 11-022



Maximum Depth = 28.22 feet

Depth Increment = 0.328 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

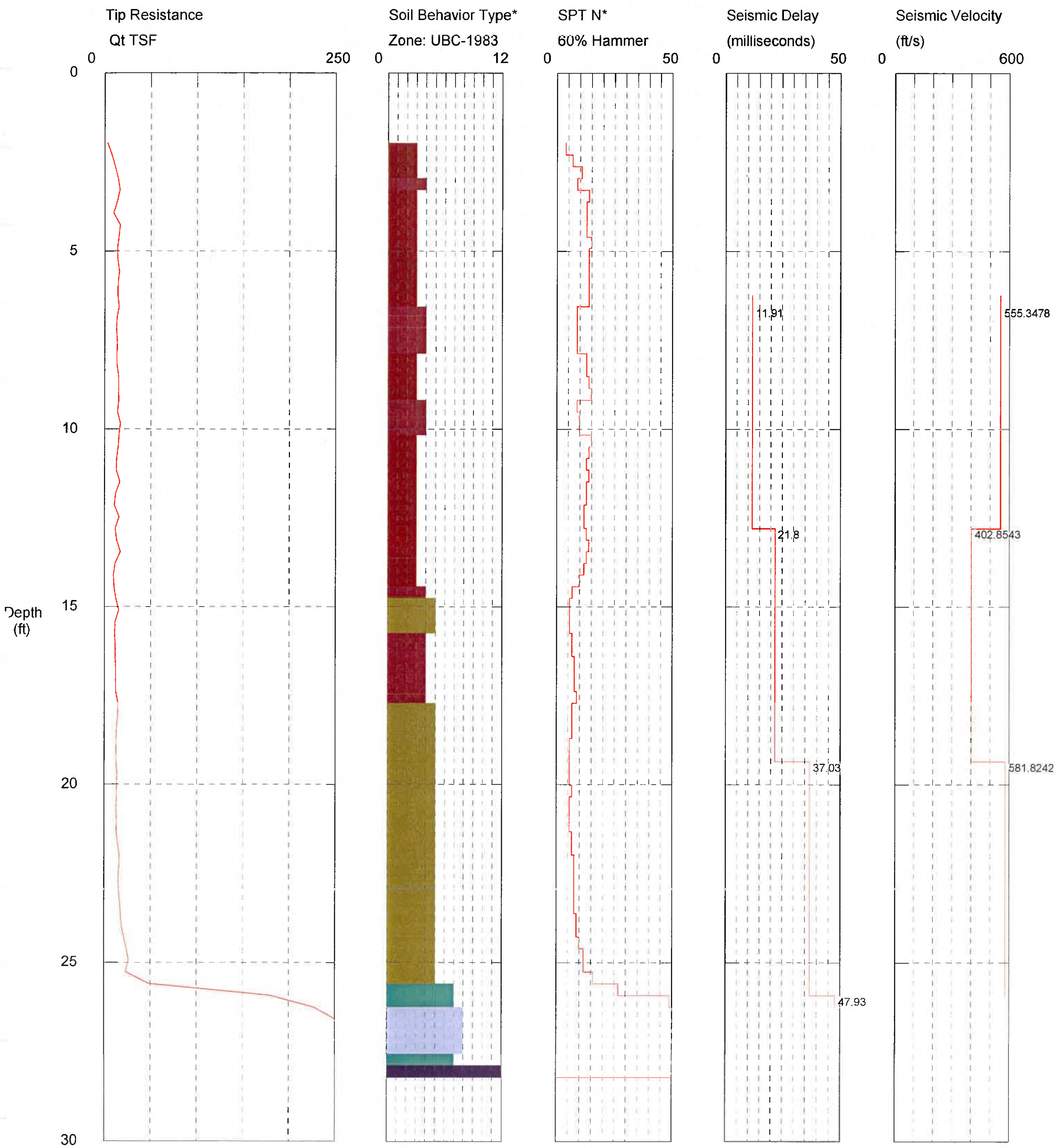
Soil behavior type and SPT based on data from UBC-1983

Exhibit A-2

Subsurface Technologies

Operator: SAM
Sounding: P-1
Cone Used: DSG1021

CPT Date/Time: 3/29/2011 9:24:20 AM
Location: CANNON-CITY HALL
Job Number: 11-022



Maximum Depth = 28.22 feet

Depth Increment = 0.328 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

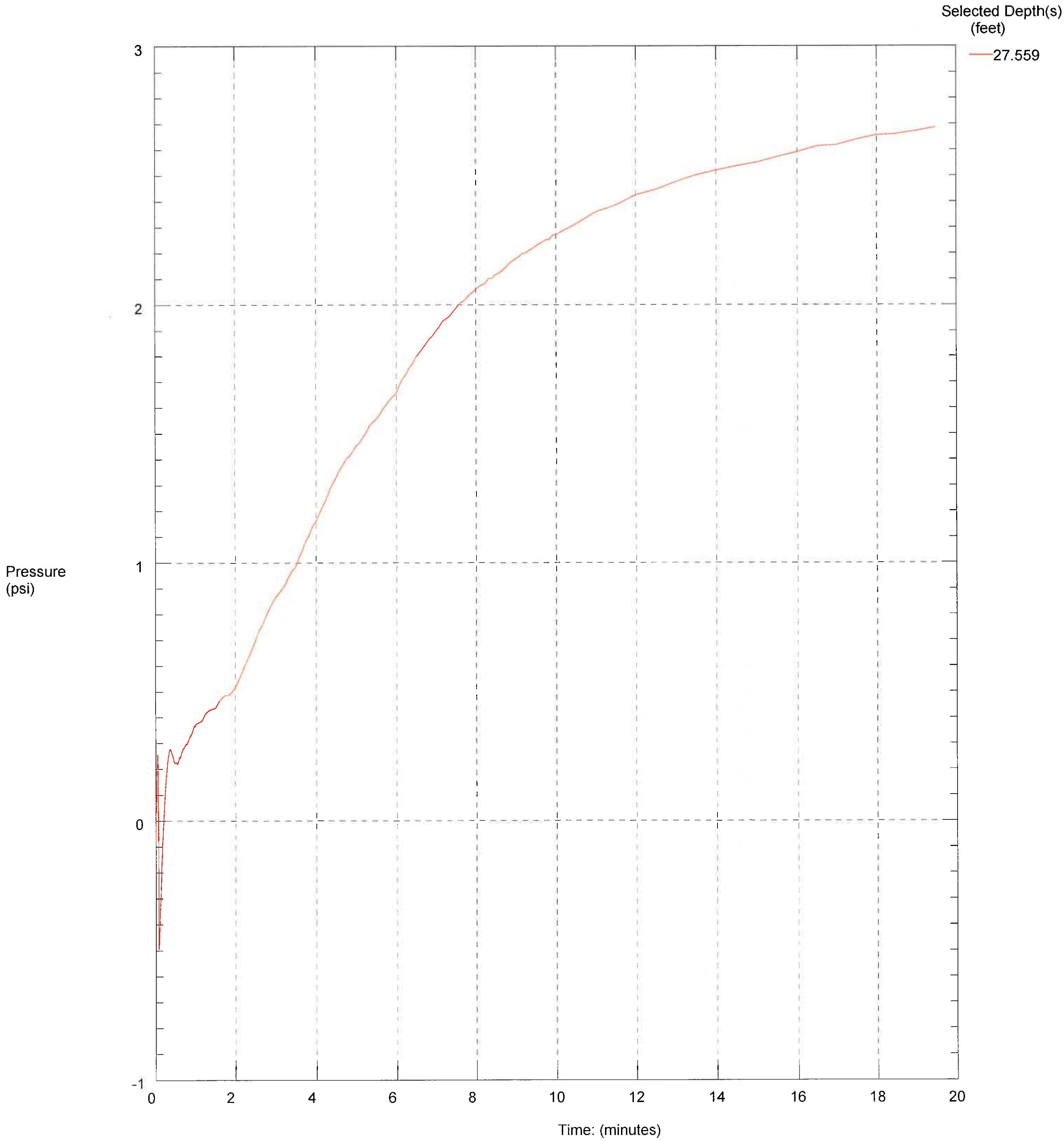
*Soil behavior type and SPT based on data from UBC-1983

Exhibit A-2

Subsurface Technologies

Operator SAM
Sounding: P-1
Cone Used: DSG1021

CPT Date/Time: 3/29/2011 9:24:20 AM
Location: CANNON-CITY HALL
Job Number: 11-022



Maximum Pressure = 2.686 psi
Hydrostatic Pressure = 3.417 psi

APPENDIX C:

LABORATORY TEST PROCEDURES AND RESULTS

APPENDIX C

LABORATORY TEST PROCEDURES AND RESULTS

The following paragraphs describe the procedures associated with the laboratory testing that we conducted for this project. Graphic results of certain laboratory tests are enclosed with this appendix.

Visual Classification Procedures

Visual soil classifications were conducted on all samples in the field and on selected samples in the laboratory. All soils were classified in general accordance with ASTM D2488 and the Unified Soil Classification System. The resulting classifications are included in our boring logs included in Appendix B.

Moisture Content Determination Procedures

Moisture content determinations were performed on representative samples to aid in identification and correlation with soil types. All determinations were made in general accordance with ASTM D2216. The results of these tests are shown on the boring logs included in Appendix B.

Atterberg Limits Testing

The plastic limit, liquid limit and plasticity index were determined on selected soil samples in general accordance with ASTM D4318. The results are shown on the boring logs included in Appendix B.

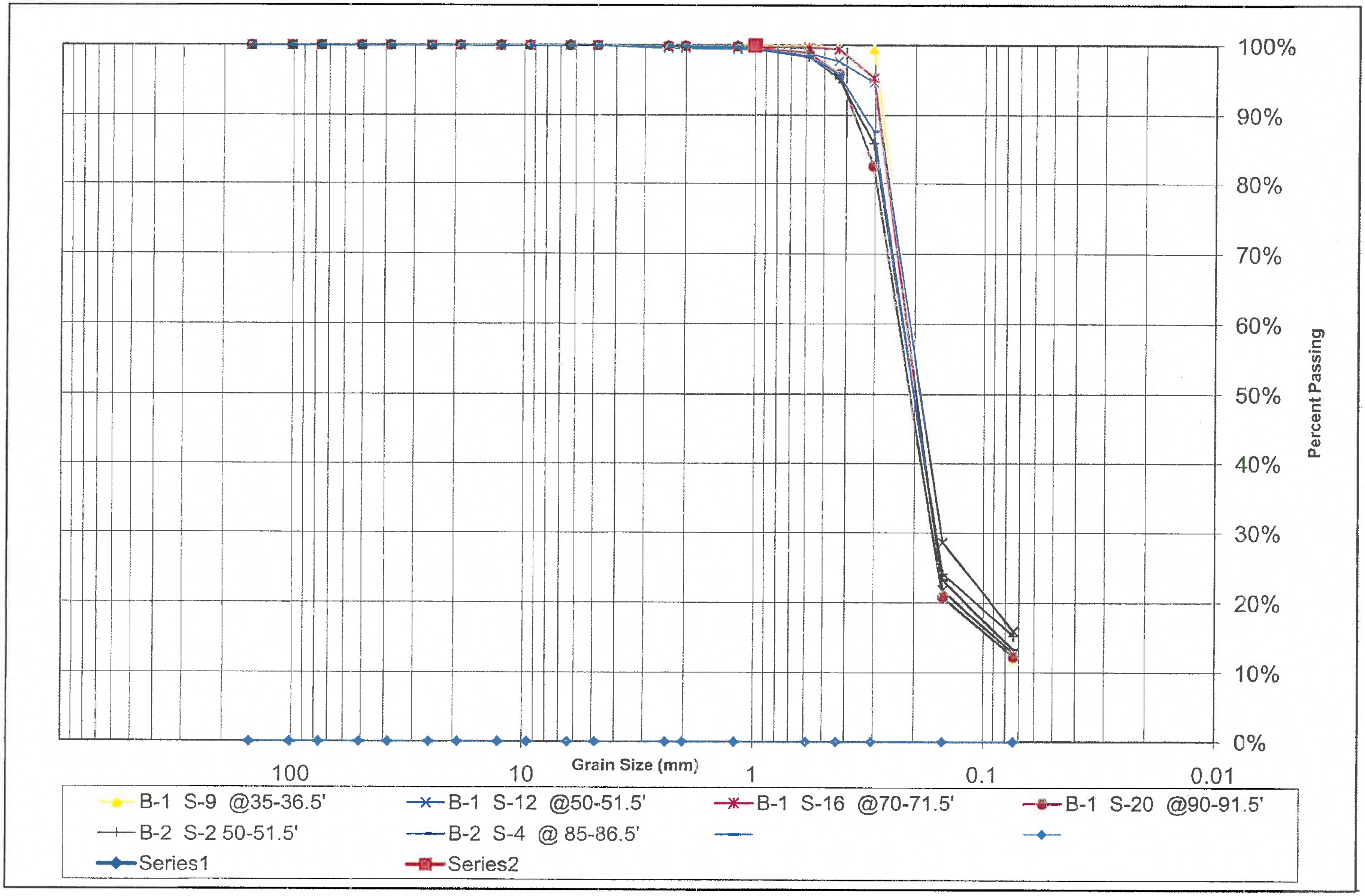
Grain Size Analysis Procedure

A grain size analysis indicates the range of soil particle diameters included in a particular sample. Grain size analyses were performed on representative samples in general accordance with ASTM D422. The results are included with this appendix and were used to classify the soils described in the boring logs.

Exhibit A-2

PROJECT:	CANNON BEACH TEB		JOB NO:	11-3303-000
LOCATION:	CANNON BEACH		WORK ORDER NO:	
SAMPLE SOURCE:	SEE BELOW	REVISED CHART TO ADD IN SERIES	DATE SAMPLED:	3/29/11 & 3/30/11

MECHANICAL SIEVE ANALYSIS

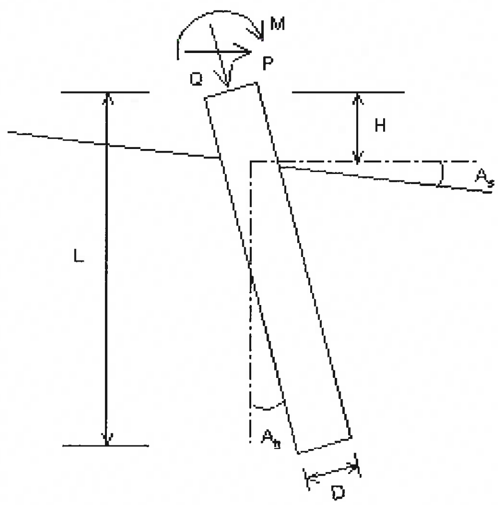


APPENDIX D:

PILE DESIGN COMPUTER OUTPUT

Exhibit A-2

VERTICAL ANALYSIS



Drilled Pile (dia <=24 in. or 61 cm)

Loads:

Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

Vertical Load, Q= 975.0 -kp
Shear Load, P= 0.0 -kp
Moment, M= 0.0 -kp-f

Profile:

Pile Length, L= 110.0 -ft
Top Height, H= 0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	105	0	1.0	0	0	
7.5	105	0	1.00	0	0	
15	100	0	0.25	0	0	
21	37.6	0	.25	0	0	
25	42.6	38	0.00	0	0	
45	42.6	35	0.00	0	0	
50	42.6	38	0.00	0	0	
100	77.6	0	2.5	0	0	
150	77.6	0	2.5	0	0	

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	24	452.4	75.4	16286.0	3000	0.471
110.0	24	452.4	75.4	16286.0	3000	0.471

Vertical capacity:

Weight above Ground= 0.00 Total Weight= 34.39-kp *Soil Weight is not included
Side Resistance (Down)= 908.260-kp Side Resistance (Up)= 587.619-kp
Tip Resistance (Down)= 70.688-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down)= 978.948-kp Total Ultimate Capacity (Up)= 622.013-kp
Total Allowable Capacity (Down)= 326.316-kp Total Allowable Capacity (Up)= 230.267-kp
N/G! Qallow < Q

Settlement Calculation:

At Q= 975.00-kp Settlement= 0.83467-in
At Xallow= 1.00-in Qallow= 976.87335-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

TEB/City Hall Cannon Beach, OR
2 ft diameter piles

```
***************************************************************
              ALLPILE 7
      VERTICAL ANALYSIS DETAILED OUTPUT
       Copyright by CivilTech Software
         www.civiltechsoftware.com
***************************************************************
Licensed to   Marcella M Boyer     Chinook GeoServices, Inc.
Date: 4/29/2011  File: P:\2011 Projects\11-022 (Cannon Beach TEB)\Pile
Analysis\Allpile\TEB24.alp                  1.0

Title 1: TEB/City Hall Cannon Beach, OR
Title 2: 2 ft diameter piles


Pile Profile and Loading:
        Piletype: Drilled Pile (dia <=24 in. or 61 cm)
        Pile Length, L= 110.0 -ft
        Top Height, H= 0 -ft
        Slope Angle, As= 0
        Batter Angle, Ab= 0.00

Single Pile, Vertical Analysis:
        Vertical Load, Q: 975.0 -kp
          Load Factor for Vertical Loads: 1.0

Bearing stratum from pile tip extending to 10 Diameter of pile, which
is=20.0-ft Starting from Pile Tip= 110.0-ft
From Ztip=110.0 to 130.0-ft  Average Properties: Es= 937.50-kp/f2
C=2.50-kp/f2  Friction=0.00 Cp=0.14  Ksand=1.00
Limits of Max. tip resistance, q_lim= N/A
Batter Angle, Ab= 0.00    Batter Factor, Kbat= 1.00
Qtip_dw=70.7-kp  based on qult=22.5-kp/f2  and Base Area=3.1-ft2
Qtip_up=0.0-kp  and Base Area=0.0-ft2


TIP RESISTANCE (Down) CALCULATION:
Tip Depth= 110.0-ft Critical Depth Ratio Z/D= 20 Critical Depth= 40.0-ft
Effective Width of Tip= 2.00-ft,   Tip Area= 3.14-ft2
Bearing stratum from pile tip extending to 10 Diameter of pile. Bearing
stratum= 20.00-ft
Btip: width at pile tip= 2.00-ft
Phi & C are average value in bearing stratum
Batter Angle= 0.00,    Batter Factor for Tip and Side= 1.00

Ztip    Z/D     Z_lim   q_lim   Width   Area    Phi     C       Nq      Nc
Sv      qult    Qtip_dw
-ft             -ft     -kp/f2  -ft     -ft2    - o     -kp/f2
-kp/f2  -kp/f2  -kp
------------------------------------------------------------------------------
--------------------------
110.0   20.0    40.0    N/A     2.0     3.14    0.0     2.50    0.0     9.0
3.0     22.5    70.7

 Ztip - Depth of pile tip from ground surface
 D - Pile average diameter (below ground) for calculation of critical depth.
D=2.00-ft
 Z/D - Critical depth (for tip resistances) as ratio of depth/diameter.
Vertical stress will be constant below critical depth
 Z_lim - Critical depth (for tip resistances)
 q_lim -  Limit of Max. tip resistance
 Btip: width or diameter at pile tip
 Bearing stratum: A stratum from pile tip extending to some depth. Average
soil properties in the stratum are used for bearing calclation


SIDE RESISTANCE (Up & Down) CALCULATION:
```

D	Z/D	Z_lim	Sf_lim	K_dw	K_up	dz
-ft		-ft	-kp/f2			-ft
2.00	20.0	40.00	N/A	0.8	0.4	0.220

D - Pile average diameter for calculation of critical depth
Z/D - Critical depth (for side resistances) as ratio of depth/diameter.
Vertical stress will be constant below critical depth
Z_lim - Critical depth (for side resistances)
Sf_lim - Limit of Max. side resistance

Users Setting: Ka=1, which is constant. Ca=KcKaC=KcC

SIDE RESISTANCE (Up & Down) CALCULATION vs DEPTH:
Calculation is based on segment dZ= 0.22

Zs	Prem	Sv	Phi	Kf(<2)	Delta	f_dw	f_up	C	Ka
Kc(<2)	Ca_dw	Ca_up	Sf_dw	Sf_up	Weight	Qneg	Q_dw	Q_up	
-ft	-ft	-kp/f2	- o	Delta	- o	-kp/f2	-kp/f2	-kp/f2	
Ca	-kp/f2	-kp/f2	-kp/f2	-kp/f2	-kp	-kp	-kp	-kp	
110.00	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	0.00	0.00	0.00	0.00	70.7	0.0	
109.78	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.06	0.00	74.2	3.5	
109.56	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.12	0.00	77.6	7.0	
109.34	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.18	0.00	81.1	10.6	
109.12	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.24	0.00	84.5	14.1	
108.90	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.30	0.00	88.0	17.6	
108.68	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.36	0.00	91.5	21.1	
108.46	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.42	0.00	94.9	24.7	
108.24	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.48	0.00	98.4	28.2	
108.02	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.55	0.00	101.9	31.7	
107.80	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.61	0.00	105.3	35.2	
107.58	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.67	0.00	108.8	38.8	
107.35	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.73	0.00	112.2	42.3	
107.13	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.79	0.00	115.7	45.8	
106.91	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.85	0.00	119.2	49.3	
106.69	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.91	0.00	122.6	52.9	
106.47	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	0.97	0.00	126.1	56.4	
106.25	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.03	0.00	129.6	59.9	
106.03	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.09	0.00	133.0	63.4	
105.81	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.15	0.00	136.5	66.9	
105.59	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.21	0.00	139.9	70.5	
105.37	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.27	0.00	143.4	74.0	

105.15	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.33	0.00	146.9	77.5	
104.93	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.39	0.00	150.3	81.0	
104.71	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.45	0.00	153.8	84.6	
104.49	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.52	0.00	157.3	88.1	
104.27	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.58	0.00	160.7	91.6	
104.05	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.64	0.00	164.2	95.1	
103.83	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.70	0.00	167.6	98.7	
103.61	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.76	0.00	171.1	102.2	
103.39	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.82	0.00	174.6	105.7	
103.17	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.88	0.00	178.0	109.2	
102.95	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	1.94	0.00	181.5	112.7	
102.73	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.00	0.00	185.0	116.3	
102.51	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.06	0.00	188.4	119.8	
102.28	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.12	0.00	191.9	123.3	
102.06	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.18	0.00	195.3	126.8	
101.84	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.24	0.00	198.8	130.4	
101.62	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.30	0.00	202.3	133.9	
101.40	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.36	0.00	205.7	137.4	
101.18	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.42	0.00	209.2	140.9	
100.96	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.49	0.00	212.7	144.5	
100.74	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.55	0.00	216.1	148.0	
100.52	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.61	0.00	219.6	151.5	
100.30	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.67	0.00	223.0	155.0	
100.08	6.28	2.98	0.0	0.80	0.00	0.00	0.00	2.5	1.00
1.0	2.50	2.50	2.50	2.50	2.73	0.00	226.5	158.6	
99.86	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	2.79	0.00	228.5	159.6	
99.64	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	2.85	0.00	230.4	160.6	
99.42	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	2.91	0.00	232.3	161.6	
99.20	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	2.97	0.00	234.3	162.7	
98.98	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.03	0.00	236.2	163.7	
98.76	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.09	0.00	238.1	164.7	
98.54	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.15	0.00	240.1	165.8	
98.32	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.21	0.00	242.0	166.8	
98.10	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.27	0.00	244.0	167.8	

97.88	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.33	0.00	245.9	168.9	
97.66	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.39	0.00	247.8	169.9	
97.43	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.45	0.00	249.8	170.9	
97.21	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.52	0.00	251.7	171.9	
96.99	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.58	0.00	253.7	173.0	
96.77	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.64	0.00	255.6	174.0	
96.55	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.70	0.00	257.5	175.0	
96.33	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.76	0.00	259.5	176.1	
96.11	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.82	0.00	261.4	177.1	
95.89	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.88	0.00	263.3	178.1	
95.67	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	3.94	0.00	265.3	179.2	
95.45	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.00	0.00	267.2	180.2	
95.23	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.06	0.00	269.2	181.2	
95.01	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.12	0.00	271.1	182.2	
94.79	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.18	0.00	273.0	183.3	
94.57	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.24	0.00	275.0	184.3	
94.35	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.30	0.00	276.9	185.3	
94.13	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.36	0.00	278.9	186.4	
93.91	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.42	0.00	280.8	187.4	
93.69	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.49	0.00	282.7	188.4	
93.47	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.55	0.00	284.7	189.5	
93.25	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.61	0.00	286.6	190.5	
93.03	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.67	0.00	288.6	191.5	
92.81	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.73	0.00	290.5	192.5	
92.59	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.79	0.00	292.4	193.6	
92.36	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.85	0.00	294.4	194.6	
92.14	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.91	0.00	296.3	195.6	
91.92	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	4.97	0.00	298.2	196.7	
91.70	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.03	0.00	300.2	197.7	
91.48	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.09	0.00	302.1	198.7	
91.26	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.15	0.00	304.1	199.8	
91.04	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.21	0.00	306.0	200.8	
90.82	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.27	0.00	307.9	201.8	

90.60	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.33	0.00	309.9	202.8	
90.38	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.39	0.00	311.8	203.9	
90.16	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.46	0.00	313.8	204.9	
89.94	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.52	0.00	315.7	205.9	
89.72	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.58	0.00	317.6	207.0	
89.50	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.64	0.00	319.6	208.0	
89.28	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.70	0.00	321.5	209.0	
89.06	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.76	0.00	323.5	210.1	
88.84	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.82	0.00	325.4	211.1	
88.62	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.88	0.00	327.3	212.1	
88.40	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	5.94	0.00	329.3	213.1	
88.18	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.00	0.00	331.2	214.2	
87.96	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.06	0.00	333.1	215.2	
87.74	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.12	0.00	335.1	216.2	
87.52	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.18	0.00	337.0	217.3	
87.29	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.24	0.00	339.0	218.3	
87.07	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.30	0.00	340.9	219.3	
86.85	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.36	0.00	342.8	220.4	
86.63	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.42	0.00	344.8	221.4	
86.41	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.49	0.00	346.7	222.4	
86.19	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.55	0.00	348.7	223.4	
85.97	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.61	0.00	350.6	224.5	
85.75	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.67	0.00	352.5	225.5	
85.53	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.73	0.00	354.5	226.5	
85.31	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.79	0.00	356.4	227.6	
85.09	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.85	0.00	358.3	228.6	
84.87	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.91	0.00	360.3	229.6	
84.65	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	6.97	0.00	362.2	230.7	
84.43	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.03	0.00	364.2	231.7	
84.21	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.09	0.00	366.1	232.7	
83.99	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.15	0.00	368.0	233.7	
83.77	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.21	0.00	370.0	234.8	
83.55	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.27	0.00	371.9	235.8	

83.33	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.33	0.00	373.9	236.8	
83.11	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.39	0.00	375.8	237.9	
82.89	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.46	0.00	377.7	238.9	
82.67	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.52	0.00	379.7	239.9	
82.44	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.58	0.00	381.6	241.0	
82.22	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.64	0.00	383.6	242.0	
82.00	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.70	0.00	385.5	243.0	
81.78	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.76	0.00	387.4	244.0	
81.56	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.82	0.00	389.4	245.1	
81.34	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.88	0.00	391.3	246.1	
81.12	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	7.94	0.00	393.2	247.1	
80.90	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.00	0.00	395.2	248.2	
80.68	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.06	0.00	397.1	249.2	
80.46	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.12	0.00	399.1	250.2	
80.24	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.18	0.00	401.0	251.3	
80.02	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.24	0.00	402.9	252.3	
79.80	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.30	0.00	404.9	253.3	
79.58	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.36	0.00	406.8	254.3	
79.36	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.43	0.00	408.8	255.4	
79.14	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.49	0.00	410.7	256.4	
78.92	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.55	0.00	412.6	257.4	
78.70	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.61	0.00	414.6	258.5	
78.48	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.67	0.00	416.5	259.5	
78.26	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.73	0.00	418.5	260.5	
78.04	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.79	0.00	420.4	261.6	
77.82	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.85	0.00	422.3	262.6	
77.60	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.91	0.00	424.3	263.6	
77.37	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	8.97	0.00	426.2	264.6	
77.15	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.03	0.00	428.1	265.7	
76.93	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.09	0.00	430.1	266.7	
76.71	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.15	0.00	432.0	267.7	
76.49	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.21	0.00	434.0	268.8	
76.27	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.27	0.00	435.9	269.8	

76.05	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.33	0.00	437.8	270.8	
75.83	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.39	0.00	439.8	271.9	
75.61	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.46	0.00	441.7	272.9	
75.39	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.52	0.00	443.7	273.9	
75.17	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.58	0.00	445.6	274.9	
74.95	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.64	0.00	447.5	276.0	
74.73	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.70	0.00	449.5	277.0	
74.51	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.76	0.00	451.4	278.0	
74.29	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.82	0.00	453.3	279.1	
74.07	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.88	0.00	455.3	280.1	
73.85	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	9.94	0.00	457.2	281.1	
73.63	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.00	0.00	459.2	282.2	
73.41	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.06	0.00	461.1	283.2	
73.19	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.12	0.00	463.0	284.2	
72.97	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.18	0.00	465.0	285.2	
72.75	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.24	0.00	466.9	286.3	
72.53	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.30	0.00	468.9	287.3	
72.30	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.36	0.00	470.8	288.3	
72.08	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.43	0.00	472.7	289.4	
71.86	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.49	0.00	474.7	290.4	
71.64	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.55	0.00	476.6	291.4	
71.42	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.61	0.00	478.6	292.5	
71.20	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.67	0.00	480.5	293.5	
70.98	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.73	0.00	482.4	294.5	
70.76	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.79	0.00	484.4	295.5	
70.54	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.85	0.00	486.3	296.6	
70.32	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.91	0.00	488.2	297.6	
70.10	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	10.97	0.00	490.2	298.6	
69.88	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.03	0.00	492.1	299.7	
69.66	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.09	0.00	494.1	300.7	
69.44	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.15	0.00	496.0	301.7	
69.22	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.21	0.00	497.9	302.8	
69.00	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.27	0.00	499.9	303.8	

68.78	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.33	0.00	501.8	304.8	
68.56	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.40	0.00	503.8	305.8	
68.34	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.46	0.00	505.7	306.9	
68.12	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.52	0.00	507.6	307.9	
67.90	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.58	0.00	509.6	308.9	
67.68	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.64	0.00	511.5	310.0	
67.45	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.70	0.00	513.5	311.0	
67.23	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.76	0.00	515.4	312.0	
67.01	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.82	0.00	517.3	313.1	
66.79	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.88	0.00	519.3	314.1	
66.57	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	11.94	0.00	521.2	315.1	
66.35	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.00	0.00	523.1	316.1	
66.13	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.06	0.00	525.1	317.2	
65.91	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.12	0.00	527.0	318.2	
65.69	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.18	0.00	529.0	319.2	
65.47	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.24	0.00	530.9	320.3	
65.25	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.30	0.00	532.8	321.3	
65.03	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.36	0.00	534.8	322.3	
64.81	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.43	0.00	536.7	323.4	
64.59	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.49	0.00	538.7	324.4	
64.37	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.55	0.00	540.6	325.4	
64.15	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.61	0.00	542.5	326.4	
63.93	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.67	0.00	544.5	327.5	
63.71	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.73	0.00	546.4	328.5	
63.49	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.79	0.00	548.3	329.5	
63.27	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.85	0.00	550.3	330.6	
63.05	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.91	0.00	552.2	331.6	
62.83	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	12.97	0.00	554.2	332.6	
62.61	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.03	0.00	556.1	333.7	
62.38	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.09	0.00	558.0	334.7	
62.16	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.15	0.00	560.0	335.7	
61.94	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.21	0.00	561.9	336.7	
61.72	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.27	0.00	563.9	337.8	

61.50	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.33	0.00	565.8	338.8	
61.28	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.40	0.00	567.7	339.8	
61.06	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.46	0.00	569.7	340.9	
60.84	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.52	0.00	571.6	341.9	
60.62	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.58	0.00	573.6	342.9	
60.40	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.64	0.00	575.5	344.0	
60.18	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.70	0.00	577.4	345.0	
59.96	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.76	0.00	579.4	346.0	
59.74	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.82	0.00	581.3	347.0	
59.52	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.88	0.00	583.2	348.1	
59.30	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	13.94	0.00	585.2	349.1	
59.08	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.00	0.00	587.1	350.1	
58.86	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.06	0.00	589.1	351.2	
58.64	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.12	0.00	591.0	352.2	
58.42	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.18	0.00	592.9	353.2	
58.20	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.24	0.00	594.9	354.3	
57.98	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.30	0.00	596.8	355.3	
57.76	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.37	0.00	598.8	356.3	
57.54	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.43	0.00	600.7	357.3	
57.31	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.49	0.00	602.6	358.4	
57.09	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.55	0.00	604.6	359.4	
56.87	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.61	0.00	606.5	360.4	
56.65	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.67	0.00	608.5	361.5	
56.43	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.73	0.00	610.4	362.5	
56.21	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.79	0.00	612.3	363.5	
55.99	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.85	0.00	614.3	364.6	
55.77	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.91	0.00	616.2	365.6	
55.55	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	14.97	0.00	618.1	366.6	
55.33	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.03	0.00	620.1	367.6	
55.11	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.09	0.00	622.0	368.7	
54.89	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.15	0.00	624.0	369.7	
54.67	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.21	0.00	625.9	370.7	
54.45	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.27	0.00	627.8	371.8	

54.23	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.33	0.00	629.8	372.8	
54.01	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.40	0.00	631.7	373.8	
53.79	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.46	0.00	633.7	374.9	
53.57	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.52	0.00	635.6	375.9	
53.35	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.58	0.00	637.5	376.9	
53.13	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.64	0.00	639.5	377.9	
52.91	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.70	0.00	641.4	379.0	
52.69	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.76	0.00	643.3	380.0	
52.46	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.82	0.00	645.3	381.0	
52.24	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.88	0.00	647.2	382.1	
52.02	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	15.94	0.00	649.2	383.1	
51.80	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.00	0.00	651.1	384.1	
51.58	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.06	0.00	653.0	385.2	
51.36	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.12	0.00	655.0	386.2	
51.14	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.18	0.00	656.9	387.2	
50.92	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.24	0.00	658.9	388.2	
50.70	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.30	0.00	660.8	389.3	
50.48	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.37	0.00	662.7	390.3	
50.26	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.43	0.00	664.7	391.3	
50.04	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	16.49	0.00	666.6	392.4	
49.82	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.55	0.00	668.4	393.3	
49.60	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.61	0.00	670.1	394.2	
49.38	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.67	0.00	671.9	395.2	
49.16	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.73	0.00	673.6	396.1	
48.94	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.79	0.00	675.4	397.1	
48.72	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.85	0.00	677.2	398.0	
48.50	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.91	0.00	678.9	398.9	
48.28	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	16.97	0.00	680.7	399.9	
48.06	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.03	0.00	682.4	400.8	
47.84	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.09	0.00	684.2	401.8	
47.62	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.15	0.00	685.9	402.7	
47.39	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.21	0.00	687.7	403.6	
47.17	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.27	0.00	689.5	404.6	

46.95	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.34	0.00	691.2	405.5	
46.73	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.40	0.00	693.0	406.4	
46.51	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.46	0.00	694.7	407.4	
46.29	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.52	0.00	696.5	408.3	
46.07	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.58	0.00	698.2	409.3	
45.85	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.64	0.00	700.0	410.2	
45.63	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.70	0.00	701.8	411.1	
45.41	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.76	0.00	703.5	412.1	
45.19	6.28	2.98	35.0	0.80	28.00	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	17.82	0.00	705.3	413.0	
44.97	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	17.88	0.00	707.2	414.1	
44.75	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	17.94	0.00	709.1	415.1	
44.53	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.00	0.00	711.1	416.1	
44.31	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.06	0.00	713.0	417.1	
44.09	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.12	0.00	715.0	418.2	
43.87	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.18	0.00	716.9	419.2	
43.65	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.24	0.00	718.8	420.2	
43.43	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.30	0.00	720.8	421.3	
43.21	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.37	0.00	722.7	422.3	
42.99	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.43	0.00	724.7	423.3	
42.77	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.49	0.00	726.6	424.4	
42.55	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.55	0.00	728.5	425.4	
42.32	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.61	0.00	730.5	426.4	
42.10	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.67	0.00	732.4	427.4	
41.88	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.73	0.00	734.4	428.5	
41.66	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.79	0.00	736.3	429.5	
41.44	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.85	0.00	738.2	430.5	
41.22	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.91	0.00	740.2	431.6	
41.00	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	18.97	0.00	742.1	432.6	
40.78	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	19.03	0.00	744.0	433.6	
40.56	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	19.09	0.00	746.0	434.7	
40.34	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	19.15	0.00	747.9	435.7	
40.12	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	19.21	0.00	749.9	436.7	
39.90	6.28	2.98	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	19.27	0.00	751.8	437.7	

39.68	6.28	2.97	38.0	0.80	30.40	1.40	0.70	0.0	1.00
1.0	0.00	0.00	1.40	0.70	19.34	0.00	753.7	438.8	
39.46	6.28	2.96	38.0	0.80	30.40	1.39	0.70	0.0	1.00
1.0	0.00	0.00	1.39	0.70	19.40	0.00	755.7	439.8	
39.24	6.28	2.95	38.0	0.80	30.40	1.39	0.69	0.0	1.00
1.0	0.00	0.00	1.39	0.69	19.46	0.00	757.6	440.8	
39.02	6.28	2.94	38.0	0.80	30.40	1.38	0.69	0.0	1.00
1.0	0.00	0.00	1.38	0.69	19.52	0.00	759.5	441.8	
38.80	6.28	2.94	38.0	0.80	30.40	1.38	0.69	0.0	1.00
1.0	0.00	0.00	1.38	0.69	19.58	0.00	761.4	442.8	
38.58	6.28	2.93	38.0	0.80	30.40	1.37	0.69	0.0	1.00
1.0	0.00	0.00	1.37	0.69	19.64	0.00	763.3	443.9	
38.36	6.28	2.92	38.0	0.80	30.40	1.37	0.68	0.0	1.00
1.0	0.00	0.00	1.37	0.68	19.70	0.00	765.2	444.9	
38.14	6.28	2.91	38.0	0.80	30.40	1.36	0.68	0.0	1.00
1.0	0.00	0.00	1.36	0.68	19.76	0.00	767.1	445.9	
37.92	6.28	2.90	38.0	0.80	30.40	1.36	0.68	0.0	1.00
1.0	0.00	0.00	1.36	0.68	19.82	0.00	769.0	446.9	
37.70	6.28	2.89	38.0	0.80	30.40	1.36	0.68	0.0	1.00
1.0	0.00	0.00	1.36	0.68	19.88	0.00	770.9	447.9	
37.47	6.28	2.88	38.0	0.80	30.40	1.35	0.68	0.0	1.00
1.0	0.00	0.00	1.35	0.68	19.94	0.00	772.7	448.9	
37.25	6.28	2.87	38.0	0.80	30.40	1.35	0.67	0.0	1.00
1.0	0.00	0.00	1.35	0.67	20.00	0.00	774.6	449.9	
37.03	6.28	2.86	38.0	0.80	30.40	1.34	0.67	0.0	1.00
1.0	0.00	0.00	1.34	0.67	20.06	0.00	776.5	450.9	
36.81	6.28	2.85	38.0	0.80	30.40	1.34	0.67	0.0	1.00
1.0	0.00	0.00	1.34	0.67	20.12	0.00	778.3	451.8	
36.59	6.28	2.84	38.0	0.80	30.40	1.33	0.67	0.0	1.00
1.0	0.00	0.00	1.33	0.67	20.18	0.00	780.2	452.8	
36.37	6.28	2.83	38.0	0.80	30.40	1.33	0.66	0.0	1.00
1.0	0.00	0.00	1.33	0.66	20.24	0.00	782.0	453.8	
36.15	6.28	2.82	38.0	0.80	30.40	1.32	0.66	0.0	1.00
1.0	0.00	0.00	1.32	0.66	20.31	0.00	783.8	454.8	
35.93	6.28	2.81	38.0	0.80	30.40	1.32	0.66	0.0	1.00
1.0	0.00	0.00	1.32	0.66	20.37	0.00	785.7	455.8	
35.71	6.28	2.80	38.0	0.80	30.40	1.32	0.66	0.0	1.00
1.0	0.00	0.00	1.32	0.66	20.43	0.00	787.5	456.7	
35.49	6.28	2.79	38.0	0.80	30.40	1.31	0.66	0.0	1.00
1.0	0.00	0.00	1.31	0.66	20.49	0.00	789.3	457.7	
35.27	6.28	2.79	38.0	0.80	30.40	1.31	0.65	0.0	1.00
1.0	0.00	0.00	1.31	0.65	20.55	0.00	791.1	458.7	
35.05	6.28	2.78	38.0	0.80	30.40	1.30	0.65	0.0	1.00
1.0	0.00	0.00	1.30	0.65	20.61	0.00	792.9	459.6	
34.83	6.28	2.77	38.0	0.80	30.40	1.30	0.65	0.0	1.00
1.0	0.00	0.00	1.30	0.65	20.67	0.00	794.7	460.6	
34.61	6.28	2.76	38.0	0.80	30.40	1.29	0.65	0.0	1.00
1.0	0.00	0.00	1.29	0.65	20.73	0.00	796.5	461.5	
34.39	6.28	2.75	38.0	0.80	30.40	1.29	0.64	0.0	1.00
1.0	0.00	0.00	1.29	0.64	20.79	0.00	798.3	462.5	
34.17	6.28	2.74	38.0	0.80	30.40	1.29	0.64	0.0	1.00
1.0	0.00	0.00	1.29	0.64	20.85	0.00	800.1	463.5	
33.95	6.28	2.73	38.0	0.80	30.40	1.28	0.64	0.0	1.00
1.0	0.00	0.00	1.28	0.64	20.91	0.00	801.8	464.4	
33.73	6.28	2.72	38.0	0.80	30.40	1.28	0.64	0.0	1.00
1.0	0.00	0.00	1.28	0.64	20.97	0.00	803.6	465.3	
33.51	6.28	2.71	38.0	0.80	30.40	1.27	0.64	0.0	1.00
1.0	0.00	0.00	1.27	0.64	21.03	0.00	805.4	466.3	
33.29	6.28	2.70	38.0	0.80	30.40	1.27	0.63	0.0	1.00
1.0	0.00	0.00	1.27	0.63	21.09	0.00	807.1	467.2	
33.07	6.28	2.69	38.0	0.80	30.40	1.26	0.63	0.0	1.00
1.0	0.00	0.00	1.26	0.63	21.15	0.00	808.9	468.2	
32.85	6.28	2.68	38.0	0.80	30.40	1.26	0.63	0.0	1.00
1.0	0.00	0.00	1.26	0.63	21.21	0.00	810.6	469.1	
32.63	6.28	2.67	38.0	0.80	30.40	1.25	0.63	0.0	1.00
1.0	0.00	0.00	1.25	0.63	21.27	0.00	812.4	470.0	

32.40	6.28	2.66	38.0	0.80	30.40	1.25	0.62	0.0	1.00
1.0	0.00	0.00	1.25	0.62	21.34	0.00	814.1	470.9	
32.18	6.28	2.65	38.0	0.80	30.40	1.25	0.62	0.0	1.00
1.0	0.00	0.00	1.25	0.62	21.40	0.00	815.8	471.9	
31.96	6.28	2.64	38.0	0.80	30.40	1.24	0.62	0.0	1.00
1.0	0.00	0.00	1.24	0.62	21.46	0.00	817.5	472.8	
31.74	6.28	2.63	38.0	0.80	30.40	1.24	0.62	0.0	1.00
1.0	0.00	0.00	1.24	0.62	21.52	0.00	819.2	473.7	
31.52	6.28	2.63	38.0	0.80	30.40	1.23	0.62	0.0	1.00
1.0	0.00	0.00	1.23	0.62	21.58	0.00	821.0	474.6	
31.30	6.28	2.62	38.0	0.80	30.40	1.23	0.61	0.0	1.00
1.0	0.00	0.00	1.23	0.61	21.64	0.00	822.7	475.5	
31.08	6.28	2.61	38.0	0.80	30.40	1.22	0.61	0.0	1.00
1.0	0.00	0.00	1.22	0.61	21.70	0.00	824.3	476.4	
30.86	6.28	2.60	38.0	0.80	30.40	1.22	0.61	0.0	1.00
1.0	0.00	0.00	1.22	0.61	21.76	0.00	826.0	477.3	
30.64	6.28	2.59	38.0	0.80	30.40	1.21	0.61	0.0	1.00
1.0	0.00	0.00	1.21	0.61	21.82	0.00	827.7	478.2	
30.42	6.28	2.58	38.0	0.80	30.40	1.21	0.61	0.0	1.00
1.0	0.00	0.00	1.21	0.61	21.88	0.00	829.4	479.1	
30.20	6.28	2.57	38.0	0.80	30.40	1.21	0.60	0.0	1.00
1.0	0.00	0.00	1.21	0.60	21.94	0.00	831.1	480.0	
29.98	6.28	2.56	38.0	0.80	30.40	1.20	0.60	0.0	1.00
1.0	0.00	0.00	1.20	0.60	22.00	0.00	832.7	480.9	
29.76	6.28	2.55	38.0	0.80	30.40	1.20	0.60	0.0	1.00
1.0	0.00	0.00	1.20	0.60	22.06	0.00	834.4	481.8	
29.54	6.28	2.54	38.0	0.80	30.40	1.19	0.60	0.0	1.00
1.0	0.00	0.00	1.19	0.60	22.12	0.00	836.0	482.7	
29.32	6.28	2.53	38.0	0.80	30.40	1.19	0.59	0.0	1.00
1.0	0.00	0.00	1.19	0.59	22.18	0.00	837.7	483.6	
29.10	6.28	2.52	38.0	0.80	30.40	1.18	0.59	0.0	1.00
1.0	0.00	0.00	1.18	0.59	22.24	0.00	839.3	484.5	
28.88	6.28	2.51	38.0	0.80	30.40	1.18	0.59	0.0	1.00
1.0	0.00	0.00	1.18	0.59	22.31	0.00	841.0	485.4	
28.66	6.28	2.50	38.0	0.80	30.40	1.17	0.59	0.0	1.00
1.0	0.00	0.00	1.17	0.59	22.37	0.00	842.6	486.2	
28.44	6.28	2.49	38.0	0.80	30.40	1.17	0.59	0.0	1.00
1.0	0.00	0.00	1.17	0.59	22.43	0.00	844.2	487.1	
28.22	6.28	2.48	38.0	0.80	30.40	1.17	0.58	0.0	1.00
1.0	0.00	0.00	1.17	0.58	22.49	0.00	845.8	488.0	
28.00	6.28	2.48	38.0	0.80	30.40	1.16	0.58	0.0	1.00
1.0	0.00	0.00	1.16	0.58	22.55	0.00	847.4	488.8	
27.78	6.28	2.47	38.0	0.80	30.40	1.16	0.58	0.0	1.00
1.0	0.00	0.00	1.16	0.58	22.61	0.00	849.0	489.7	
27.56	6.28	2.46	38.0	0.80	30.40	1.15	0.58	0.0	1.00
1.0	0.00	0.00	1.15	0.58	22.67	0.00	850.6	490.6	
27.33	6.28	2.45	38.0	0.80	30.40	1.15	0.57	0.0	1.00
1.0	0.00	0.00	1.15	0.57	22.73	0.00	852.2	491.4	
27.11	6.28	2.44	38.0	0.80	30.40	1.14	0.57	0.0	1.00
1.0	0.00	0.00	1.14	0.57	22.79	0.00	853.8	492.3	
26.89	6.28	2.43	38.0	0.80	30.40	1.14	0.57	0.0	1.00
1.0	0.00	0.00	1.14	0.57	22.85	0.00	855.4	493.1	
26.67	6.28	2.42	38.0	0.80	30.40	1.14	0.57	0.0	1.00
1.0	0.00	0.00	1.14	0.57	22.91	0.00	857.0	494.0	
26.45	6.28	2.41	38.0	0.80	30.40	1.13	0.57	0.0	1.00
1.0	0.00	0.00	1.13	0.57	22.97	0.00	858.5	494.8	
26.23	6.28	2.40	38.0	0.80	30.40	1.13	0.56	0.0	1.00
1.0	0.00	0.00	1.13	0.56	23.03	0.00	860.1	495.6	
26.01	6.28	2.39	38.0	0.80	30.40	1.12	0.56	0.0	1.00
1.0	0.00	0.00	1.12	0.56	23.09	0.00	861.6	496.5	
25.79	6.28	2.38	38.0	0.80	30.40	1.12	0.56	0.0	1.00
1.0	0.00	0.00	1.12	0.56	23.15	0.00	863.2	497.3	
25.57	6.28	2.37	38.0	0.80	30.40	1.11	0.56	0.0	1.00
1.0	0.00	0.00	1.11	0.56	23.21	0.00	864.7	498.1	
25.35	6.28	2.36	38.0	0.80	30.40	1.11	0.55	0.0	1.00
1.0	0.00	0.00	1.11	0.55	23.28	0.00	866.3	499.0	

25.13	6.28	2.35	38.0	0.80	30.40	1.10	0.55	0.0	1.00
1.0	0.00	0.00	1.10	0.55	23.34	0.00	867.8	499.8	
24.91	6.28	2.34	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.40	0.00	868.1	500.2	
24.69	6.28	2.34	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.46	0.00	868.5	500.6	
24.47	6.28	2.33	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.52	0.00	868.8	501.0	
24.25	6.28	2.32	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.58	0.00	869.2	501.4	
24.03	6.28	2.31	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.64	0.00	869.5	501.8	
23.81	6.28	2.30	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.70	0.00	869.9	502.2	
23.59	6.28	2.30	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.76	0.00	870.2	502.6	
23.37	6.28	2.29	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.82	0.00	870.6	503.1	
23.15	6.28	2.28	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.88	0.00	870.9	503.5	
22.93	6.28	2.27	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	23.94	0.00	871.3	503.9	
22.71	6.28	2.26	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.00	0.00	871.6	504.3	
22.48	6.28	2.25	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.06	0.00	871.9	504.7	
22.26	6.28	2.25	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.12	0.00	872.3	505.1	
22.04	6.28	2.24	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.18	0.00	872.6	505.5	
21.82	6.28	2.23	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.24	0.00	873.0	505.9	
21.60	6.28	2.22	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.31	0.00	873.3	506.3	
21.38	6.28	2.21	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.37	0.00	873.7	506.7	
21.16	6.28	2.20	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.43	0.00	874.0	507.1	
20.94	6.28	2.18	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.53	0.00	874.4	507.6	
20.72	6.28	2.16	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.63	0.00	874.7	508.0	
20.50	6.28	2.14	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.74	0.00	875.1	508.5	
20.28	6.28	2.12	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.84	0.00	875.4	508.9	
20.06	6.28	2.09	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	24.95	0.00	875.8	509.4	
19.84	6.28	2.07	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.05	0.00	876.1	509.8	
19.62	6.28	2.05	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.15	0.00	876.4	510.3	
19.40	6.28	2.03	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.26	0.00	876.8	510.7	
19.18	6.28	2.01	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.36	0.00	877.1	511.2	
18.96	6.28	1.98	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.47	0.00	877.5	511.6	
18.74	6.28	1.96	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.57	0.00	877.8	512.1	
18.52	6.28	1.94	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.67	0.00	878.2	512.5	
18.30	6.28	1.92	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.78	0.00	878.5	513.0	
18.08	6.28	1.90	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.88	0.00	878.9	513.4	

17.86	6.28	1.87	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	25.98	0.00	879.2	513.9	
17.64	6.28	1.85	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.09	0.00	879.6	514.3	
17.41	6.28	1.83	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.19	0.00	879.9	514.8	
17.19	6.28	1.81	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.30	0.00	880.3	515.2	
16.97	6.28	1.79	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.40	0.00	880.6	515.7	
16.75	6.28	1.76	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.50	0.00	880.9	516.1	
16.53	6.28	1.74	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.61	0.00	881.3	516.6	
16.31	6.28	1.72	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.71	0.00	881.6	517.0	
16.09	6.28	1.70	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.81	0.00	882.0	517.5	
15.87	6.28	1.67	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	26.92	0.00	882.3	517.9	
15.65	6.28	1.65	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	27.02	0.00	882.7	518.4	
15.43	6.28	1.63	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	27.13	0.00	883.0	518.8	
15.21	6.28	1.61	0.0	0.80	0.00	0.00	0.00	0.3	1.00
1.0	0.25	0.25	0.25	0.25	27.23	0.00	883.4	519.3	
14.99	6.28	1.59	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	27.33	0.00	884.8	520.8	
14.77	6.28	1.56	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	27.44	0.00	886.1	522.3	
14.55	6.28	1.54	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	27.54	0.00	887.5	523.7	
14.33	6.28	1.52	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	27.65	0.00	888.9	525.2	
14.11	6.28	1.49	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	27.75	0.00	890.3	526.7	
13.89	6.28	1.47	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	27.85	0.00	891.7	528.2	
13.67	6.28	1.45	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	27.96	0.00	893.1	529.7	
13.45	6.28	1.42	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.06	0.00	894.5	531.2	
13.23	6.28	1.40	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.16	0.00	895.8	532.7	
13.01	6.28	1.38	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.27	0.00	897.2	534.2	
12.79	6.28	1.35	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.37	0.00	898.6	535.7	
12.57	6.28	1.33	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.48	0.00	900.0	537.1	
12.34	6.28	1.31	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.58	0.00	901.4	538.6	
12.12	6.28	1.28	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.68	0.00	902.8	540.1	
11.90	6.28	1.26	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.79	0.00	904.2	541.6	
11.68	6.28	1.24	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	28.89	0.00	905.5	543.1	
11.46	6.28	1.22	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.00	0.00	906.9	544.6	
11.24	6.28	1.19	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.10	0.00	908.3	546.1	
11.02	6.28	1.17	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.20	0.00	909.7	547.6	
10.80	6.28	1.15	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.31	0.00	911.1	549.1	

10.58	6.28	1.12	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.41	0.00	912.5	550.5	
10.36	6.28	1.10	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.51	0.00	913.8	552.0	
10.14	6.28	1.08	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.62	0.00	915.2	553.5	
9.92	6.28	1.05	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.72	0.00	916.6	555.0	
9.70	6.28	1.03	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.83	0.00	918.0	556.5	
9.48	6.28	1.01	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	29.93	0.00	919.4	558.0	
9.26	6.28	0.98	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.03	0.00	920.8	559.5	
9.04	6.28	0.96	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.14	0.00	922.2	561.0	
8.82	6.28	0.94	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.24	0.00	923.5	562.5	
8.60	6.28	0.91	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.34	0.00	924.9	563.9	
8.38	6.28	0.89	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.45	0.00	926.3	565.4	
8.16	6.28	0.87	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.55	0.00	927.7	566.9	
7.94	6.28	0.84	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.66	0.00	929.1	568.4	
7.72	6.28	0.82	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.76	0.00	930.5	569.9	
7.49	6.28	0.80	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.86	0.00	931.9	571.4	
7.27	6.28	0.78	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	30.97	0.00	933.2	572.9	
7.05	6.28	0.75	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.07	0.00	934.6	574.4	
6.83	6.28	0.73	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.18	0.00	936.0	575.9	
6.61	6.28	0.71	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.28	0.00	937.4	577.3	
6.39	6.28	0.68	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.38	0.00	938.8	578.8	
6.17	6.28	0.66	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.49	0.00	940.2	580.3	
5.95	6.28	0.64	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.59	0.00	941.5	581.8	
5.73	6.28	0.61	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.69	0.00	942.9	583.3	
5.51	6.28	0.59	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.80	0.00	944.3	584.8	
5.29	6.28	0.57	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	31.90	0.00	945.7	586.3	
5.07	6.28	0.54	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.01	0.00	947.1	587.8	
4.85	6.28	0.52	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.11	0.00	948.5	589.3	
4.63	6.28	0.50	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.21	0.00	949.9	590.7	
4.41	6.28	0.47	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.32	0.00	951.2	592.2	
4.19	6.28	0.45	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.42	0.00	952.6	593.7	
3.97	6.28	0.43	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.53	0.00	954.0	595.2	
3.75	6.28	0.41	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.63	0.00	955.4	596.7	
3.53	6.28	0.38	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.73	0.00	956.8	598.2	

3.31	6.28	0.36	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.84	0.00	958.2	599.7	
3.09	6.28	0.34	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	32.94	0.00	959.6	601.2	
2.87	6.28	0.31	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.04	0.00	960.9	602.7	
2.65	6.28	0.29	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.15	0.00	962.3	604.1	
2.42	6.28	0.27	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.25	0.00	963.7	605.6	
2.20	6.28	0.24	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.36	0.00	965.1	607.1	
1.98	6.28	0.22	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.46	0.00	966.5	608.6	
1.76	6.28	0.20	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.56	0.00	967.9	610.1	
1.54	6.28	0.17	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.67	0.00	969.3	611.6	
1.32	6.28	0.15	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.77	0.00	970.6	613.1	
1.10	6.28	0.13	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.88	0.00	972.0	614.6	
0.88	6.28	0.10	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	33.98	0.00	973.4	616.1	
0.66	6.28	0.08	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	34.08	0.00	974.8	617.5	
0.44	6.28	0.06	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	34.19	0.00	976.2	619.0	
0.22	6.28	0.03	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	34.29	0.00	977.6	620.5	
0.00	6.28	0.01	0.0	0.80	0.00	0.00	0.00	1.0	1.00
1.0	1.00	1.00	1.00	1.00	34.39	0.00	978.9	622.0	

DEPTH - SETTLEMENT RELATION by Vesic Method (1977):
Ztip=110.00 Btip= 2.00 Cp= 0.135 Cs= 0.286
Xpp=2.545 Xps= 1.258
Cp & Cs are average value at bearing stratum from pile tip extend to 10 Btip

Zs -ft	Qdw -kp	Area' -ft2	E -kp/i2	dXs -in	Xall -in
110.00	70.7	3.142	3000.0	0.0000	3.803
109.78	74.2	3.142	3000.0	0.0001	3.803
109.56	77.6	3.142	3000.0	0.0002	3.803
109.34	81.1	3.142	3000.0	0.0002	3.804
109.12	84.5	3.142	3000.0	0.0002	3.804
108.90	88.0	3.142	3000.0	0.0002	3.804
108.68	91.5	3.142	3000.0	0.0002	3.804
108.46	94.9	3.142	3000.0	0.0002	3.804
108.24	98.4	3.142	3000.0	0.0002	3.804
108.02	101.9	3.142	3000.0	0.0002	3.805
107.80	105.3	3.142	3000.0	0.0002	3.805
107.58	108.8	3.142	3000.0	0.0002	3.805
107.35	112.2	3.142	3000.0	0.0002	3.805
107.13	115.7	3.142	3000.0	0.0002	3.805
106.91	119.2	3.142	3000.0	0.0002	3.806
106.69	122.6	3.142	3000.0	0.0002	3.806
106.47	126.1	3.142	3000.0	0.0002	3.806
106.25	129.6	3.142	3000.0	0.0003	3.806
106.03	133.0	3.142	3000.0	0.0003	3.807
105.81	136.5	3.142	3000.0	0.0003	3.807
105.59	139.9	3.142	3000.0	0.0003	3.807
105.37	143.4	3.142	3000.0	0.0003	3.808
105.15	146.9	3.142	3000.0	0.0003	3.808
104.93	150.3	3.142	3000.0	0.0003	3.808
104.71	153.8	3.142	3000.0	0.0003	3.808

104.49	157.3	3.142	3000.0	0.0003	3.809
104.27	160.7	3.142	3000.0	0.0003	3.809
104.05	164.2	3.142	3000.0	0.0003	3.809
103.83	167.6	3.142	3000.0	0.0003	3.810
103.61	171.1	3.142	3000.0	0.0003	3.810
103.39	174.6	3.142	3000.0	0.0003	3.810
103.17	178.0	3.142	3000.0	0.0003	3.811
102.95	181.5	3.142	3000.0	0.0004	3.811
102.73	185.0	3.142	3000.0	0.0004	3.811
102.51	188.4	3.142	3000.0	0.0004	3.812
102.28	191.9	3.142	3000.0	0.0004	3.812
102.06	195.3	3.142	3000.0	0.0004	3.813
101.84	198.8	3.142	3000.0	0.0004	3.813
101.62	202.3	3.142	3000.0	0.0004	3.813
101.40	205.7	3.142	3000.0	0.0004	3.814
101.18	209.2	3.142	3000.0	0.0004	3.814
100.96	212.7	3.142	3000.0	0.0004	3.815
100.74	216.1	3.142	3000.0	0.0004	3.815
100.52	219.6	3.142	3000.0	0.0004	3.815
100.30	223.0	3.142	3000.0	0.0004	3.816
100.08	226.5	3.142	3000.0	0.0004	3.816
99.86	228.5	3.142	3000.0	0.0004	3.817
99.64	230.4	3.142	3000.0	0.0004	3.817
99.42	232.3	3.142	3000.0	0.0005	3.818
99.20	234.3	3.142	3000.0	0.0005	3.818
98.98	236.2	3.142	3000.0	0.0005	3.819
98.76	238.1	3.142	3000.0	0.0005	3.819
98.54	240.1	3.142	3000.0	0.0005	3.819
98.32	242.0	3.142	3000.0	0.0005	3.820
98.10	244.0	3.142	3000.0	0.0005	3.820
97.88	245.9	3.142	3000.0	0.0005	3.821
97.66	247.8	3.142	3000.0	0.0005	3.821
97.43	249.8	3.142	3000.0	0.0005	3.822
97.21	251.7	3.142	3000.0	0.0005	3.822
96.99	253.7	3.142	3000.0	0.0005	3.823
96.77	255.6	3.142	3000.0	0.0005	3.823
96.55	257.5	3.142	3000.0	0.0005	3.824
96.33	259.5	3.142	3000.0	0.0005	3.824
96.11	261.4	3.142	3000.0	0.0005	3.825
95.89	263.3	3.142	3000.0	0.0005	3.825
95.67	265.3	3.142	3000.0	0.0005	3.826
95.45	267.2	3.142	3000.0	0.0005	3.826
95.23	269.2	3.142	3000.0	0.0005	3.827
95.01	271.1	3.142	3000.0	0.0005	3.827
94.79	273.0	3.142	3000.0	0.0005	3.828
94.57	275.0	3.142	3000.0	0.0005	3.829
94.35	276.9	3.142	3000.0	0.0005	3.829
94.13	278.9	3.142	3000.0	0.0005	3.830
93.91	280.8	3.142	3000.0	0.0005	3.830
93.69	282.7	3.142	3000.0	0.0006	3.831
93.47	284.7	3.142	3000.0	0.0006	3.831
93.25	286.6	3.142	3000.0	0.0006	3.832
93.03	288.6	3.142	3000.0	0.0006	3.832
92.81	290.5	3.142	3000.0	0.0006	3.833
92.59	292.4	3.142	3000.0	0.0006	3.834
92.36	294.4	3.142	3000.0	0.0006	3.834
92.14	296.3	3.142	3000.0	0.0006	3.835
91.92	298.2	3.142	3000.0	0.0006	3.835
91.70	300.2	3.142	3000.0	0.0006	3.836
91.48	302.1	3.142	3000.0	0.0006	3.836
91.26	304.1	3.142	3000.0	0.0006	3.837
91.04	306.0	3.142	3000.0	0.0006	3.838
90.82	307.9	3.142	3000.0	0.0006	3.838
90.60	309.9	3.142	3000.0	0.0006	3.839
90.38	311.8	3.142	3000.0	0.0006	3.839
90.16	313.8	3.142	3000.0	0.0006	3.840

89. 94	315. 7	3. 142	3000. 0	0. 0006	3. 841
89. 72	317. 6	3. 142	3000. 0	0. 0006	3. 841
89. 50	319. 6	3. 142	3000. 0	0. 0006	3. 842
89. 28	321. 5	3. 142	3000. 0	0. 0006	3. 843
89. 06	323. 5	3. 142	3000. 0	0. 0006	3. 843
88. 84	325. 4	3. 142	3000. 0	0. 0006	3. 844
88. 62	327. 3	3. 142	3000. 0	0. 0006	3. 844
88. 40	329. 3	3. 142	3000. 0	0. 0006	3. 845
88. 18	331. 2	3. 142	3000. 0	0. 0006	3. 846
87. 96	333. 1	3. 142	3000. 0	0. 0006	3. 846
87. 74	335. 1	3. 142	3000. 0	0. 0007	3. 847
87. 52	337. 0	3. 142	3000. 0	0. 0007	3. 848
87. 29	339. 0	3. 142	3000. 0	0. 0007	3. 848
87. 07	340. 9	3. 142	3000. 0	0. 0007	3. 849
86. 85	342. 8	3. 142	3000. 0	0. 0007	3. 850
86. 63	344. 8	3. 142	3000. 0	0. 0007	3. 850
86. 41	346. 7	3. 142	3000. 0	0. 0007	3. 851
86. 19	348. 7	3. 142	3000. 0	0. 0007	3. 852
85. 97	350. 6	3. 142	3000. 0	0. 0007	3. 852
85. 75	352. 5	3. 142	3000. 0	0. 0007	3. 853
85. 53	354. 5	3. 142	3000. 0	0. 0007	3. 854
85. 31	356. 4	3. 142	3000. 0	0. 0007	3. 854
85. 09	358. 3	3. 142	3000. 0	0. 0007	3. 855
84. 87	360. 3	3. 142	3000. 0	0. 0007	3. 856
84. 65	362. 2	3. 142	3000. 0	0. 0007	3. 857
84. 43	364. 2	3. 142	3000. 0	0. 0007	3. 857
84. 21	366. 1	3. 142	3000. 0	0. 0007	3. 858
83. 99	368. 0	3. 142	3000. 0	0. 0007	3. 859
83. 77	370. 0	3. 142	3000. 0	0. 0007	3. 859
83. 55	371. 9	3. 142	3000. 0	0. 0007	3. 860
83. 33	373. 9	3. 142	3000. 0	0. 0007	3. 861
83. 11	375. 8	3. 142	3000. 0	0. 0007	3. 862
82. 89	377. 7	3. 142	3000. 0	0. 0007	3. 862
82. 67	379. 7	3. 142	3000. 0	0. 0007	3. 863
82. 44	381. 6	3. 142	3000. 0	0. 0007	3. 864
82. 22	383. 6	3. 142	3000. 0	0. 0007	3. 865
82. 00	385. 5	3. 142	3000. 0	0. 0008	3. 865
81. 78	387. 4	3. 142	3000. 0	0. 0008	3. 866
81. 56	389. 4	3. 142	3000. 0	0. 0008	3. 867
81. 34	391. 3	3. 142	3000. 0	0. 0008	3. 868
81. 12	393. 2	3. 142	3000. 0	0. 0008	3. 868
80. 90	395. 2	3. 142	3000. 0	0. 0008	3. 869
80. 68	397. 1	3. 142	3000. 0	0. 0008	3. 870
80. 46	399. 1	3. 142	3000. 0	0. 0008	3. 871
80. 24	401. 0	3. 142	3000. 0	0. 0008	3. 871
80. 02	402. 9	3. 142	3000. 0	0. 0008	3. 872
79. 80	404. 9	3. 142	3000. 0	0. 0008	3. 873
79. 58	406. 8	3. 142	3000. 0	0. 0008	3. 874
79. 36	408. 8	3. 142	3000. 0	0. 0008	3. 875
79. 14	410. 7	3. 142	3000. 0	0. 0008	3. 875
78. 92	412. 6	3. 142	3000. 0	0. 0008	3. 876
78. 70	414. 6	3. 142	3000. 0	0. 0008	3. 877
78. 48	416. 5	3. 142	3000. 0	0. 0008	3. 878
78. 26	418. 5	3. 142	3000. 0	0. 0008	3. 879
78. 04	420. 4	3. 142	3000. 0	0. 0008	3. 879
77. 82	422. 3	3. 142	3000. 0	0. 0008	3. 880
77. 60	424. 3	3. 142	3000. 0	0. 0008	3. 881
77. 37	426. 2	3. 142	3000. 0	0. 0008	3. 882
77. 15	428. 1	3. 142	3000. 0	0. 0008	3. 883
76. 93	430. 1	3. 142	3000. 0	0. 0008	3. 884
76. 71	432. 0	3. 142	3000. 0	0. 0008	3. 884
76. 49	434. 0	3. 142	3000. 0	0. 0008	3. 885
76. 27	435. 9	3. 142	3000. 0	0. 0008	3. 886
76. 05	437. 8	3. 142	3000. 0	0. 0009	3. 887
75. 83	439. 8	3. 142	3000. 0	0. 0009	3. 888
75. 61	441. 7	3. 142	3000. 0	0. 0009	3. 889

75.39	443.7	3.142	3000.0	0.0009	3.890
75.17	445.6	3.142	3000.0	0.0009	3.890
74.95	447.5	3.142	3000.0	0.0009	3.891
74.73	449.5	3.142	3000.0	0.0009	3.892
74.51	451.4	3.142	3000.0	0.0009	3.893
74.29	453.3	3.142	3000.0	0.0009	3.894
74.07	455.3	3.142	3000.0	0.0009	3.895
73.85	457.2	3.142	3000.0	0.0009	3.896
73.63	459.2	3.142	3000.0	0.0009	3.897
73.41	461.1	3.142	3000.0	0.0009	3.898
73.19	463.0	3.142	3000.0	0.0009	3.898
72.97	465.0	3.142	3000.0	0.0009	3.899
72.75	466.9	3.142	3000.0	0.0009	3.900
72.53	468.9	3.142	3000.0	0.0009	3.901
72.30	470.8	3.142	3000.0	0.0009	3.902
72.08	472.7	3.142	3000.0	0.0009	3.903
71.86	474.7	3.142	3000.0	0.0009	3.904
71.64	476.6	3.142	3000.0	0.0009	3.905
71.42	478.6	3.142	3000.0	0.0009	3.906
71.20	480.5	3.142	3000.0	0.0009	3.907
70.98	482.4	3.142	3000.0	0.0009	3.908
70.76	484.4	3.142	3000.0	0.0009	3.909
70.54	486.3	3.142	3000.0	0.0009	3.910
70.32	488.2	3.142	3000.0	0.0010	3.911
70.10	490.2	3.142	3000.0	0.0010	3.911
69.88	492.1	3.142	3000.0	0.0010	3.912
69.66	494.1	3.142	3000.0	0.0010	3.913
69.44	496.0	3.142	3000.0	0.0010	3.914
69.22	497.9	3.142	3000.0	0.0010	3.915
69.00	499.9	3.142	3000.0	0.0010	3.916
68.78	501.8	3.142	3000.0	0.0010	3.917
68.56	503.8	3.142	3000.0	0.0010	3.918
68.34	505.7	3.142	3000.0	0.0010	3.919
68.12	507.6	3.142	3000.0	0.0010	3.920
67.90	509.6	3.142	3000.0	0.0010	3.921
67.68	511.5	3.142	3000.0	0.0010	3.922
67.45	513.5	3.142	3000.0	0.0010	3.923
67.23	515.4	3.142	3000.0	0.0010	3.924
67.01	517.3	3.142	3000.0	0.0010	3.925
66.79	519.3	3.142	3000.0	0.0010	3.926
66.57	521.2	3.142	3000.0	0.0010	3.927
66.35	523.1	3.142	3000.0	0.0010	3.928
66.13	525.1	3.142	3000.0	0.0010	3.929
65.91	527.0	3.142	3000.0	0.0010	3.930
65.69	529.0	3.142	3000.0	0.0010	3.931
65.47	530.9	3.142	3000.0	0.0010	3.932
65.25	532.8	3.142	3000.0	0.0010	3.933
65.03	534.8	3.142	3000.0	0.0010	3.935
64.81	536.7	3.142	3000.0	0.0010	3.936
64.59	538.7	3.142	3000.0	0.0010	3.937
64.37	540.6	3.142	3000.0	0.0011	3.938
64.15	542.5	3.142	3000.0	0.0011	3.939
63.93	544.5	3.142	3000.0	0.0011	3.940
63.71	546.4	3.142	3000.0	0.0011	3.941
63.49	548.3	3.142	3000.0	0.0011	3.942
63.27	550.3	3.142	3000.0	0.0011	3.943
63.05	552.2	3.142	3000.0	0.0011	3.944
62.83	554.2	3.142	3000.0	0.0011	3.945
62.61	556.1	3.142	3000.0	0.0011	3.946
62.38	558.0	3.142	3000.0	0.0011	3.947
62.16	560.0	3.142	3000.0	0.0011	3.948
61.94	561.9	3.142	3000.0	0.0011	3.949
61.72	563.9	3.142	3000.0	0.0011	3.951
61.50	565.8	3.142	3000.0	0.0011	3.952
61.28	567.7	3.142	3000.0	0.0011	3.953
61.06	569.7	3.142	3000.0	0.0011	3.954

60.84	571.6	3.142	3000.0	0.0011	3.955
60.62	573.6	3.142	3000.0	0.0011	3.956
60.40	575.5	3.142	3000.0	0.0011	3.957
60.18	577.4	3.142	3000.0	0.0011	3.958
59.96	579.4	3.142	3000.0	0.0011	3.960
59.74	581.3	3.142	3000.0	0.0011	3.961
59.52	583.2	3.142	3000.0	0.0011	3.962
59.30	585.2	3.142	3000.0	0.0011	3.963
59.08	587.1	3.142	3000.0	0.0011	3.964
58.86	589.1	3.142	3000.0	0.0011	3.965
58.64	591.0	3.142	3000.0	0.0012	3.966
58.42	592.9	3.142	3000.0	0.0012	3.968
58.20	594.9	3.142	3000.0	0.0012	3.969
57.98	596.8	3.142	3000.0	0.0012	3.970
57.76	598.8	3.142	3000.0	0.0012	3.971
57.54	600.7	3.142	3000.0	0.0012	3.972
57.31	602.6	3.142	3000.0	0.0012	3.973
57.09	604.6	3.142	3000.0	0.0012	3.975
56.87	606.5	3.142	3000.0	0.0012	3.976
56.65	608.5	3.142	3000.0	0.0012	3.977
56.43	610.4	3.142	3000.0	0.0012	3.978
56.21	612.3	3.142	3000.0	0.0012	3.979
55.99	614.3	3.142	3000.0	0.0012	3.980
55.77	616.2	3.142	3000.0	0.0012	3.982
55.55	618.1	3.142	3000.0	0.0012	3.983
55.33	620.1	3.142	3000.0	0.0012	3.984
55.11	622.0	3.142	3000.0	0.0012	3.985
54.89	624.0	3.142	3000.0	0.0012	3.987
54.67	625.9	3.142	3000.0	0.0012	3.988
54.45	627.8	3.142	3000.0	0.0012	3.989
54.23	629.8	3.142	3000.0	0.0012	3.990
54.01	631.7	3.142	3000.0	0.0012	3.991
53.79	633.7	3.142	3000.0	0.0012	3.993
53.57	635.6	3.142	3000.0	0.0012	3.994
53.35	637.5	3.142	3000.0	0.0012	3.995
53.13	639.5	3.142	3000.0	0.0012	3.996
52.91	641.4	3.142	3000.0	0.0013	3.998
52.69	643.3	3.142	3000.0	0.0013	3.999
52.46	645.3	3.142	3000.0	0.0013	4.000
52.24	647.2	3.142	3000.0	0.0013	4.001
52.02	649.2	3.142	3000.0	0.0013	4.003
51.80	651.1	3.142	3000.0	0.0013	4.004
51.58	653.0	3.142	3000.0	0.0013	4.005
51.36	655.0	3.142	3000.0	0.0013	4.007
51.14	656.9	3.142	3000.0	0.0013	4.008
50.92	658.9	3.142	3000.0	0.0013	4.009
50.70	660.8	3.142	3000.0	0.0013	4.010
50.48	662.7	3.142	3000.0	0.0013	4.012
50.26	664.7	3.142	3000.0	0.0013	4.013
50.04	666.6	3.142	3000.0	0.0013	4.014
49.82	668.4	3.142	3000.0	0.0013	4.016
49.60	670.1	3.142	3000.0	0.0013	4.017
49.38	671.9	3.142	3000.0	0.0013	4.018
49.16	673.6	3.142	3000.0	0.0013	4.019
48.94	675.4	3.142	3000.0	0.0013	4.021
48.72	677.2	3.142	3000.0	0.0013	4.022
48.50	678.9	3.142	3000.0	0.0013	4.023
48.28	680.7	3.142	3000.0	0.0013	4.025
48.06	682.4	3.142	3000.0	0.0013	4.026
47.84	684.2	3.142	3000.0	0.0013	4.027
47.62	685.9	3.142	3000.0	0.0013	4.029
47.39	687.7	3.142	3000.0	0.0013	4.030
47.17	689.5	3.142	3000.0	0.0013	4.031
46.95	691.2	3.142	3000.0	0.0013	4.033
46.73	693.0	3.142	3000.0	0.0014	4.034
46.51	694.7	3.142	3000.0	0.0014	4.036

46.29	696.5	3.142	3000.0	0.0014	4.037
46.07	698.2	3.142	3000.0	0.0014	4.038
45.85	700.0	3.142	3000.0	0.0014	4.040
45.63	701.8	3.142	3000.0	0.0014	4.041
45.41	703.5	3.142	3000.0	0.0014	4.042
45.19	705.3	3.142	3000.0	0.0014	4.044
44.97	707.2	3.142	3000.0	0.0014	4.045
44.75	709.1	3.142	3000.0	0.0014	4.046
44.53	711.1	3.142	3000.0	0.0014	4.048
44.31	713.0	3.142	3000.0	0.0014	4.049
44.09	715.0	3.142	3000.0	0.0014	4.051
43.87	716.9	3.142	3000.0	0.0014	4.052
43.65	718.8	3.142	3000.0	0.0014	4.053
43.43	720.8	3.142	3000.0	0.0014	4.055
43.21	722.7	3.142	3000.0	0.0014	4.056
42.99	724.7	3.142	3000.0	0.0014	4.058
42.77	726.6	3.142	3000.0	0.0014	4.059
42.55	728.5	3.142	3000.0	0.0014	4.060
42.32	730.5	3.142	3000.0	0.0014	4.062
42.10	732.4	3.142	3000.0	0.0014	4.063
41.88	734.4	3.142	3000.0	0.0014	4.065
41.66	736.3	3.142	3000.0	0.0014	4.066
41.44	738.2	3.142	3000.0	0.0014	4.068
41.22	740.2	3.142	3000.0	0.0014	4.069
41.00	742.1	3.142	3000.0	0.0014	4.071
40.78	744.0	3.142	3000.0	0.0015	4.072
40.56	746.0	3.142	3000.0	0.0015	4.073
40.34	747.9	3.142	3000.0	0.0015	4.075
40.12	749.9	3.142	3000.0	0.0015	4.076
39.90	751.8	3.142	3000.0	0.0015	4.078
39.68	753.7	3.142	3000.0	0.0015	4.079
39.46	755.7	3.142	3000.0	0.0015	4.081
39.24	757.6	3.142	3000.0	0.0015	4.082
39.02	759.5	3.142	3000.0	0.0015	4.084
38.80	761.4	3.142	3000.0	0.0015	4.085
38.58	763.3	3.142	3000.0	0.0015	4.087
38.36	765.2	3.142	3000.0	0.0015	4.088
38.14	767.1	3.142	3000.0	0.0015	4.090
37.92	769.0	3.142	3000.0	0.0015	4.091
37.70	770.9	3.142	3000.0	0.0015	4.093
37.47	772.7	3.142	3000.0	0.0015	4.094
37.25	774.6	3.142	3000.0	0.0015	4.096
37.03	776.5	3.142	3000.0	0.0015	4.097
36.81	778.3	3.142	3000.0	0.0015	4.099
36.59	780.2	3.142	3000.0	0.0015	4.100
36.37	782.0	3.142	3000.0	0.0015	4.102
36.15	783.8	3.142	3000.0	0.0015	4.103
35.93	785.7	3.142	3000.0	0.0015	4.105
35.71	787.5	3.142	3000.0	0.0015	4.106
35.49	789.3	3.142	3000.0	0.0015	4.108
35.27	791.1	3.142	3000.0	0.0015	4.109
35.05	792.9	3.142	3000.0	0.0015	4.111
34.83	794.7	3.142	3000.0	0.0015	4.113
34.61	796.5	3.142	3000.0	0.0016	4.114
34.39	798.3	3.142	3000.0	0.0016	4.116
34.17	800.1	3.142	3000.0	0.0016	4.117
33.95	801.8	3.142	3000.0	0.0016	4.119
33.73	803.6	3.142	3000.0	0.0016	4.120
33.51	805.4	3.142	3000.0	0.0016	4.122
33.29	807.1	3.142	3000.0	0.0016	4.123
33.07	808.9	3.142	3000.0	0.0016	4.125
32.85	810.6	3.142	3000.0	0.0016	4.127
32.63	812.4	3.142	3000.0	0.0016	4.128
32.40	814.1	3.142	3000.0	0.0016	4.130
32.18	815.8	3.142	3000.0	0.0016	4.131
31.96	817.5	3.142	3000.0	0.0016	4.133

31.74	819.2	3.142	3000.0	0.0016	4.135
31.52	821.0	3.142	3000.0	0.0016	4.136
31.30	822.7	3.142	3000.0	0.0016	4.138
31.08	824.3	3.142	3000.0	0.0016	4.139
30.86	826.0	3.142	3000.0	0.0016	4.141
30.64	827.7	3.142	3000.0	0.0016	4.143
30.42	829.4	3.142	3000.0	0.0016	4.144
30.20	831.1	3.142	3000.0	0.0016	4.146
29.98	832.7	3.142	3000.0	0.0016	4.147
29.76	834.4	3.142	3000.0	0.0016	4.149
29.54	836.0	3.142	3000.0	0.0016	4.151
29.32	837.7	3.142	3000.0	0.0016	4.152
29.10	839.3	3.142	3000.0	0.0016	4.154
28.88	841.0	3.142	3000.0	0.0016	4.156
28.66	842.6	3.142	3000.0	0.0016	4.157
28.44	844.2	3.142	3000.0	0.0016	4.159
28.22	845.8	3.142	3000.0	0.0016	4.161
28.00	847.4	3.142	3000.0	0.0017	4.162
27.78	849.0	3.142	3000.0	0.0017	4.164
27.56	850.6	3.142	3000.0	0.0017	4.166
27.33	852.2	3.142	3000.0	0.0017	4.167
27.11	853.8	3.142	3000.0	0.0017	4.169
26.89	855.4	3.142	3000.0	0.0017	4.171
26.67	857.0	3.142	3000.0	0.0017	4.172
26.45	858.5	3.142	3000.0	0.0017	4.174
26.23	860.1	3.142	3000.0	0.0017	4.176
26.01	861.6	3.142	3000.0	0.0017	4.177
25.79	863.2	3.142	3000.0	0.0017	4.179
25.57	864.7	3.142	3000.0	0.0017	4.181
25.35	866.3	3.142	3000.0	0.0017	4.182
25.13	867.8	3.142	3000.0	0.0017	4.184
24.91	868.1	3.142	3000.0	0.0017	4.186
24.69	868.5	3.142	3000.0	0.0017	4.187
24.47	868.8	3.142	3000.0	0.0017	4.189
24.25	869.2	3.142	3000.0	0.0017	4.191
24.03	869.5	3.142	3000.0	0.0017	4.192
23.81	869.9	3.142	3000.0	0.0017	4.194
23.59	870.2	3.142	3000.0	0.0017	4.196
23.37	870.6	3.142	3000.0	0.0017	4.198
23.15	870.9	3.142	3000.0	0.0017	4.199
22.93	871.3	3.142	3000.0	0.0017	4.201
22.71	871.6	3.142	3000.0	0.0017	4.203
22.48	871.9	3.142	3000.0	0.0017	4.204
22.26	872.3	3.142	3000.0	0.0017	4.206
22.04	872.6	3.142	3000.0	0.0017	4.208
21.82	873.0	3.142	3000.0	0.0017	4.209
21.60	873.3	3.142	3000.0	0.0017	4.211
21.38	873.7	3.142	3000.0	0.0017	4.213
21.16	874.0	3.142	3000.0	0.0017	4.215
20.94	874.4	3.142	3000.0	0.0017	4.216
20.72	874.7	3.142	3000.0	0.0017	4.218
20.50	875.1	3.142	3000.0	0.0017	4.220
20.28	875.4	3.142	3000.0	0.0017	4.221
20.06	875.8	3.142	3000.0	0.0017	4.223
19.84	876.1	3.142	3000.0	0.0017	4.225
19.62	876.4	3.142	3000.0	0.0017	4.226
19.40	876.8	3.142	3000.0	0.0017	4.228
19.18	877.1	3.142	3000.0	0.0017	4.230
18.96	877.5	3.142	3000.0	0.0017	4.232
18.74	877.8	3.142	3000.0	0.0017	4.233
18.52	878.2	3.142	3000.0	0.0017	4.235
18.30	878.5	3.142	3000.0	0.0017	4.237
18.08	878.9	3.142	3000.0	0.0017	4.238
17.86	879.2	3.142	3000.0	0.0017	4.240
17.64	879.6	3.142	3000.0	0.0017	4.242
17.41	879.9	3.142	3000.0	0.0017	4.244

17.19	880.3	3.142	3000.0	0.0017	4.245
16.97	880.6	3.142	3000.0	0.0017	4.247
16.75	880.9	3.142	3000.0	0.0017	4.249
16.53	881.3	3.142	3000.0	0.0017	4.250
16.31	881.6	3.142	3000.0	0.0017	4.252
16.09	882.0	3.142	3000.0	0.0017	4.254
15.87	882.3	3.142	3000.0	0.0017	4.256
15.65	882.7	3.142	3000.0	0.0017	4.257
15.43	883.0	3.142	3000.0	0.0017	4.259
15.21	883.4	3.142	3000.0	0.0017	4.261
14.99	884.8	3.142	3000.0	0.0017	4.263
14.77	886.1	3.142	3000.0	0.0017	4.264
14.55	887.5	3.142	3000.0	0.0017	4.266
14.33	888.9	3.142	3000.0	0.0017	4.268
14.11	890.3	3.142	3000.0	0.0017	4.269
13.89	891.7	3.142	3000.0	0.0017	4.271
13.67	893.1	3.142	3000.0	0.0017	4.273
13.45	894.5	3.142	3000.0	0.0017	4.275
13.23	895.8	3.142	3000.0	0.0017	4.276
13.01	897.2	3.142	3000.0	0.0017	4.278
12.79	898.6	3.142	3000.0	0.0018	4.280
12.57	900.0	3.142	3000.0	0.0018	4.282
12.34	901.4	3.142	3000.0	0.0018	4.283
12.12	902.8	3.142	3000.0	0.0018	4.285
11.90	904.2	3.142	3000.0	0.0018	4.287
11.68	905.5	3.142	3000.0	0.0018	4.289
11.46	906.9	3.142	3000.0	0.0018	4.290
11.24	908.3	3.142	3000.0	0.0018	4.292
11.02	909.7	3.142	3000.0	0.0018	4.294
10.80	911.1	3.142	3000.0	0.0018	4.296
10.58	912.5	3.142	3000.0	0.0018	4.298
10.36	913.8	3.142	3000.0	0.0018	4.299
10.14	915.2	3.142	3000.0	0.0018	4.301
9.92	916.6	3.142	3000.0	0.0018	4.303
9.70	918.0	3.142	3000.0	0.0018	4.305
9.48	919.4	3.142	3000.0	0.0018	4.307
9.26	920.8	3.142	3000.0	0.0018	4.308
9.04	922.2	3.142	3000.0	0.0018	4.310
8.82	923.5	3.142	3000.0	0.0018	4.312
8.60	924.9	3.142	3000.0	0.0018	4.314
8.38	926.3	3.142	3000.0	0.0018	4.316
8.16	927.7	3.142	3000.0	0.0018	4.317
7.94	929.1	3.142	3000.0	0.0018	4.319
7.72	930.5	3.142	3000.0	0.0018	4.321
7.49	931.9	3.142	3000.0	0.0018	4.323
7.27	933.2	3.142	3000.0	0.0018	4.325
7.05	934.6	3.142	3000.0	0.0018	4.326
6.83	936.0	3.142	3000.0	0.0018	4.328
6.61	937.4	3.142	3000.0	0.0018	4.330
6.39	938.8	3.142	3000.0	0.0018	4.332
6.17	940.2	3.142	3000.0	0.0018	4.334
5.95	941.5	3.142	3000.0	0.0018	4.336
5.73	942.9	3.142	3000.0	0.0018	4.337
5.51	944.3	3.142	3000.0	0.0018	4.339
5.29	945.7	3.142	3000.0	0.0018	4.341
5.07	947.1	3.142	3000.0	0.0018	4.343
4.85	948.5	3.142	3000.0	0.0018	4.345
4.63	949.9	3.142	3000.0	0.0019	4.347
4.41	951.2	3.142	3000.0	0.0019	4.348
4.19	952.6	3.142	3000.0	0.0019	4.350
3.97	954.0	3.142	3000.0	0.0019	4.352
3.75	955.4	3.142	3000.0	0.0019	4.354
3.53	956.8	3.142	3000.0	0.0019	4.356
3.31	958.2	3.142	3000.0	0.0019	4.358
3.09	959.6	3.142	3000.0	0.0019	4.360
2.87	960.9	3.142	3000.0	0.0019	4.362

2.65	962.3	3.142	3000.0	0.0019	4.363
2.42	963.7	3.142	3000.0	0.0019	4.365
2.20	965.1	3.142	3000.0	0.0019	4.367
1.98	966.5	3.142	3000.0	0.0019	4.369
1.76	967.9	3.142	3000.0	0.0019	4.371
1.54	969.3	3.142	3000.0	0.0019	4.373
1.32	970.6	3.142	3000.0	0.0019	4.375
1.10	972.0	3.142	3000.0	0.0019	4.377
0.88	973.4	3.142	3000.0	0.0019	4.379
0.66	974.8	3.142	3000.0	0.0019	4.380
0.44	976.2	3.142	3000.0	0.0019	4.382
0.22	977.6	3.142	3000.0	0.0019	4.384
0.00	978.9	3.142	3000.0	0.0019	4.386

LOAD - SETTLEMENT RELATION (from t-z, and q-w curves):
Based on Vesic Method (1977)

Xall -in	Qtip -kp	Qside -kp	Qtotal -kp
0.006099	0.1	16.2	16.4
0.293557	2.5	566.8	569.3
0.383112	3.6	685.1	688.7
0.454502	4.8	764.0	768.8
0.513476	6.0	819.3	825.3
0.563530	7.2	859.1	866.3
0.606961	8.3	888.2	896.6
0.645368	9.5	909.6	919.1
0.679915	10.7	925.3	936.0
0.711477	11.8	936.8	948.6
0.740729	13.0	945.0	958.0
0.768197	14.2	950.7	964.9
0.794294	15.3	954.6	969.9
0.819346	16.4	957.0	973.4
0.843609	17.6	958.3	975.9
0.867278	18.7	958.8	977.5
0.890503	19.8	958.7	978.5
0.913391	20.9	958.0	978.9
0.936017	22.0	956.9	978.9
0.958429	23.1	955.5	978.6
0.980657	24.2	953.6	977.8
1.002710	25.2	951.5	976.7
1.024592	26.3	949.1	975.4
1.046300	27.3	946.4	973.7
1.067839	28.4	943.4	971.8
1.089218	29.4	940.4	969.7
1.110424	30.4	937.1	967.5
1.131452	31.4	933.7	965.1
1.152316	32.4	930.2	962.6
1.173033	33.3	926.6	959.9
1.193618	34.3	922.8	957.1
1.214123	35.2	919.1	954.3
1.234598	36.2	915.4	951.6
1.255109	37.1	911.8	948.9
1.275730	38.0	908.5	946.5
1.296541	38.9	905.5	944.4
1.317638	39.8	902.9	942.7
1.339099	40.7	900.8	941.5
1.361022	41.5	899.3	940.8
1.383932	42.3	898.9	941.3
1.406152	43.2	897.8	940.9
1.428362	44.0	896.6	940.6
1.450562	44.8	895.5	940.3
1.472752	45.6	894.4	940.0
1.494934	46.4	893.4	939.7
1.517105	47.1	892.4	939.5
1.539268	47.9	891.4	939.2

Exhibit A-2

1.561422	48.6	890.4	939.0
1.583568	49.3	889.5	938.8
1.605704	50.1	888.5	938.6
1.627829	50.8	887.6	938.4
1.649945	51.5	886.7	938.2
1.672052	52.1	885.8	937.9
1.694145	52.8	884.8	937.6
1.716225	53.5	883.7	937.2
1.738290	54.1	882.5	936.6
1.760338	54.7	881.3	936.0
1.782370	55.3	880.2	935.6
1.804396	56.0	879.2	935.1
1.826415	56.6	878.2	934.7
1.848434	57.1	877.3	934.4
1.870454	57.7	876.5	934.2
1.892463	58.3	875.6	933.9
1.914466	58.8	874.8	933.6
1.936466	59.4	874.0	933.4
1.958451	59.9	873.2	933.1
1.980430	60.5	872.3	932.8
2.002402	61.0	871.5	932.5
2.024363	61.5	870.7	932.2
2.046318	62.0	869.9	931.9
2.068265	62.5	869.0	931.5
2.090204	63.0	868.2	931.2
2.112136	63.4	867.4	930.8
2.134058	63.9	866.6	930.5
2.155979	64.4	865.7	930.1
2.177890	64.8	864.9	929.7
2.199789	65.3	864.1	929.4
2.221689	65.7	863.3	929.0
2.243581	66.1	862.4	928.6
2.265468	66.6	861.6	928.2
2.287346	67.0	860.8	927.8
2.309220	67.4	860.0	927.4
2.331088	67.8	859.1	926.9
2.352950	68.2	858.3	926.5
2.374807	68.6	857.5	926.1
2.396659	69.0	856.7	925.7
2.418506	69.4	855.8	925.2
2.440348	69.7	855.0	924.8
2.462187	70.1	854.2	924.3
2.484020	70.5	853.4	923.9
2.505852	70.8	852.5	923.4
2.527674	71.2	851.7	922.9
2.549495	71.5	850.9	922.5
2.571310	71.9	850.1	922.0
2.702132	73.9	845.1	919.0
3.137424	79.7	828.7	908.4
3.571583	84.2	812.3	896.5
4.004045	86.8	795.9	882.7
4.433840	86.5	779.5	866.0
4.860473	82.6	763.2	845.7

At Qwork= 975.00-kp Settlement= 0.83467-in
At Qwork= 975.00-kp Secant Stiffness Kqx= 1168.13-kp/-in
At Xallow= 1.00-in Qallow= 976.87-kp
Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

SUMMARY:
Total Ultimate Capacity (Down)= 978.948-kp Total Ultimate Capacity (Up)= 622.013-kp
Total Allowable Capacity (Down)= 326.316-kp Total Allowable Capacity (Up)= 230.267-kp

Weight above Ground= 0.00 Total Pile Weight= 34.39-kp
*Soil Weight is not included
Side Resistance (Down)= 908.260-kp Side Resistance (Up)= 587.619-kp
Tip Resistance (Down)= 70.688-kp Tip Resistance (Up)= 0.000-kp
Negative Friction, Qneg= 0.000-kp, which has been subtracted from
Total Ultimate Capacity (Down)
Negative friction does not affect Total Uplift Ultimate Capacity (Up)

N/G! Qallow < Q * Vertical Load, Q= 975.0 -kp

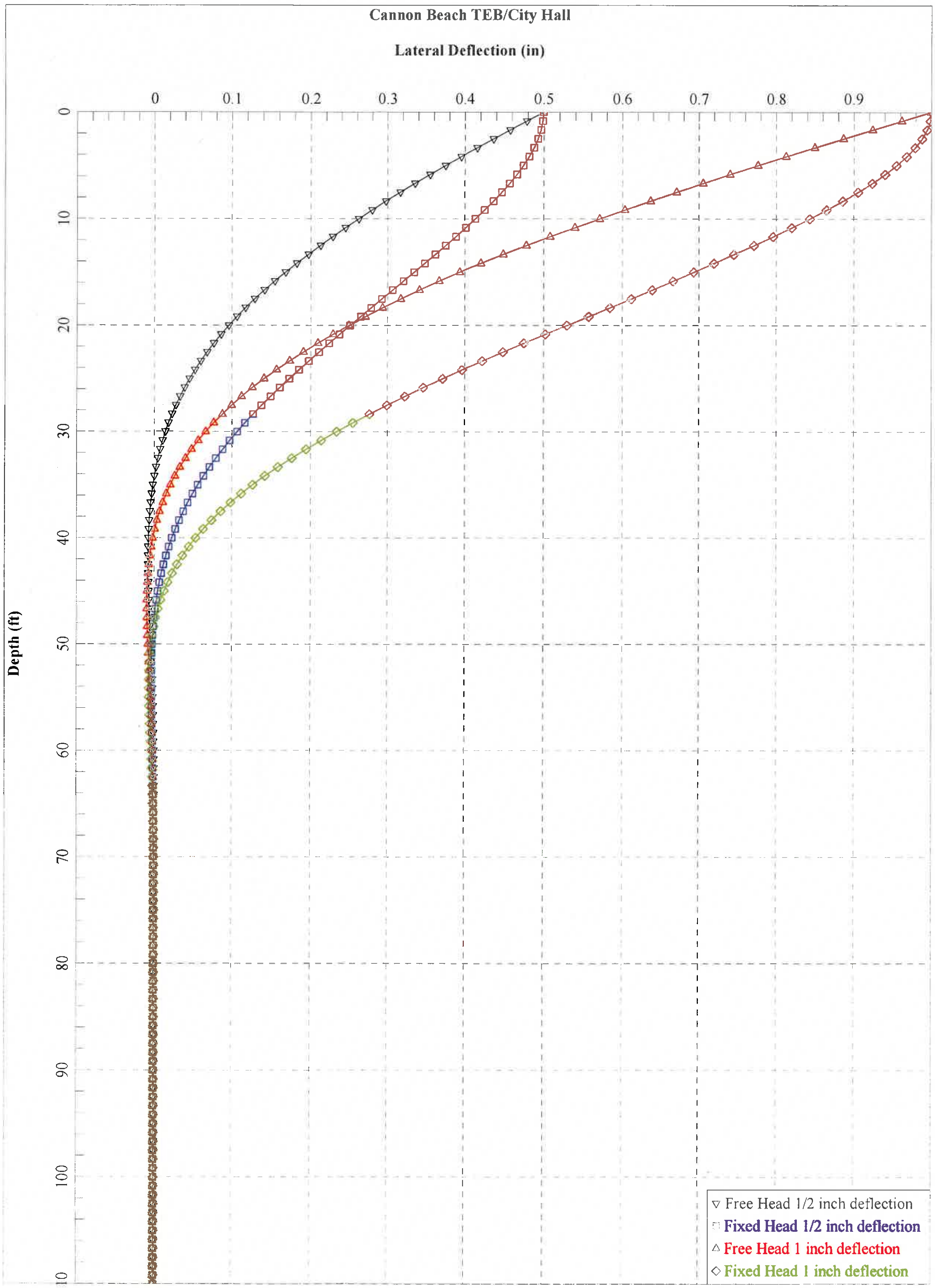
FACTOR OF SAFETY:

FSside	FStip	FSup	FSweight
3.0	3.0	3.0	1.0

Notes:
* Settlement in the program is Elastic Settlement only. Consolidation Settlement is not calculated!
Length - Pile length, distance from pile top to tip (not from ground surface)

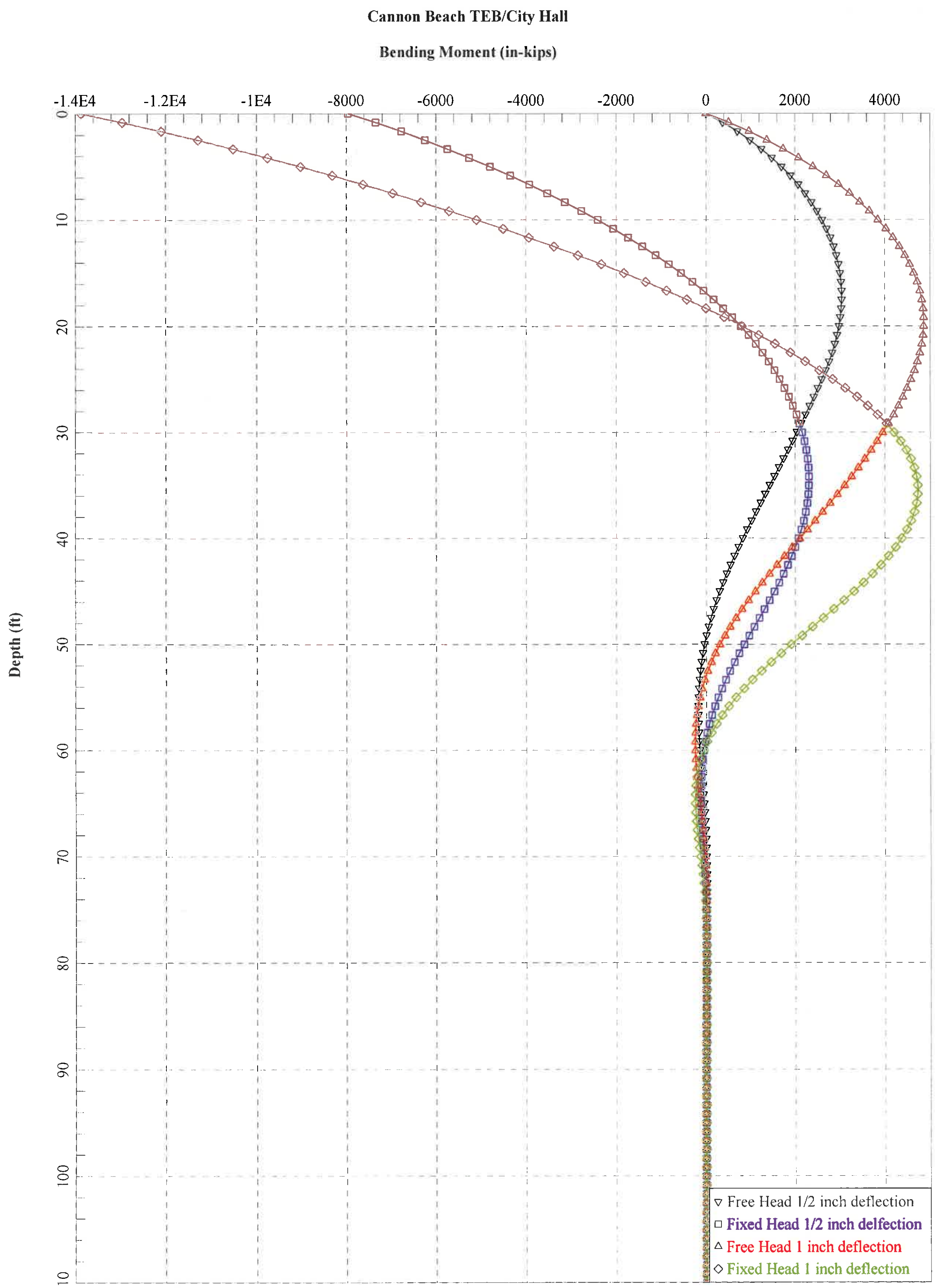
Width or D - Width of pile shaft (pile diameter)
Ds and Dl - Short Side and Long Side of Footing
Area - Section area of pile shaft or tip area of pile
Sv - Vertical stress in soils (It may be limited based on critical depth, Z_lim or Z/D
qult - Ultimate tip resistance (pressure)
Qtip_dw - Ultimate downward tip resistance (Force or Capacity)
Qtip_up - Ultimate uplift tip resistance for belled pile or uplift plate (Force or Capacity)
dz - Small Segment of Depth for Calculation
Zs - Soil Depth, Depth from ground surface
Zp - Pile Depth, Depth from pile top
Prem - Primer of pile shaft
Phi - Soil internal friction angle (between soils)
Kf - Friction factor to convert Phi to Delta
Delta - Ski friction between soil and pile (function of Phi. It is different from Phi)
f_dw - Resistance between soil and pile from Delta
f_up - Resistance between soil and pile from Delta
C - Soil cohesion (between soils)
Ca - Adhesion between soil and pile (function of C. It is different from C) Ca=KaKcC
Ka - Adhesion ratio, C/Ca
Kc - Adhesion factor defended by users
Ca_dw - Downward adhesion between pile and soil
Ca_up - Uplift adhesion between pile and soil
Sf_dw - Downward side resistance (sum of friction and adhesion, f_dw + Ca_dw)
Sf_up - Uplift side resistance (sum of friction and adhesion, f_up + Ca_up)
Weight - Weight of Pile shaft
Qneg - negative friction Resistance
Qside - Ultimate side resistance (Qside_dw or Qside_up)
Qtip - Ultimate tip resistance (Qtip_dw or Qtip_up for uplift plate)
Q_dw - Ultimate downward capacity (Qtip + Qside_dw)
Q_up - Ultimate uplift capacity (Weight + Qside_up)
E - Elastic modules
dXs - Axial deformation of pile shaft in each segment, dz
Xs - Settlement due to axial deformation of pile shaft
Xpp - Settlement due to point load from pile tip
Xps- Settlement due to load from pile shaft
Xall - Total Settlement, Xs + Xpp + Xps
Xallow - Allowable settlement specified by users
Qwork - Vertical working load applied to pile
Qallow - Vertical allowable load, Qult/F.S.

Exhibit A-2

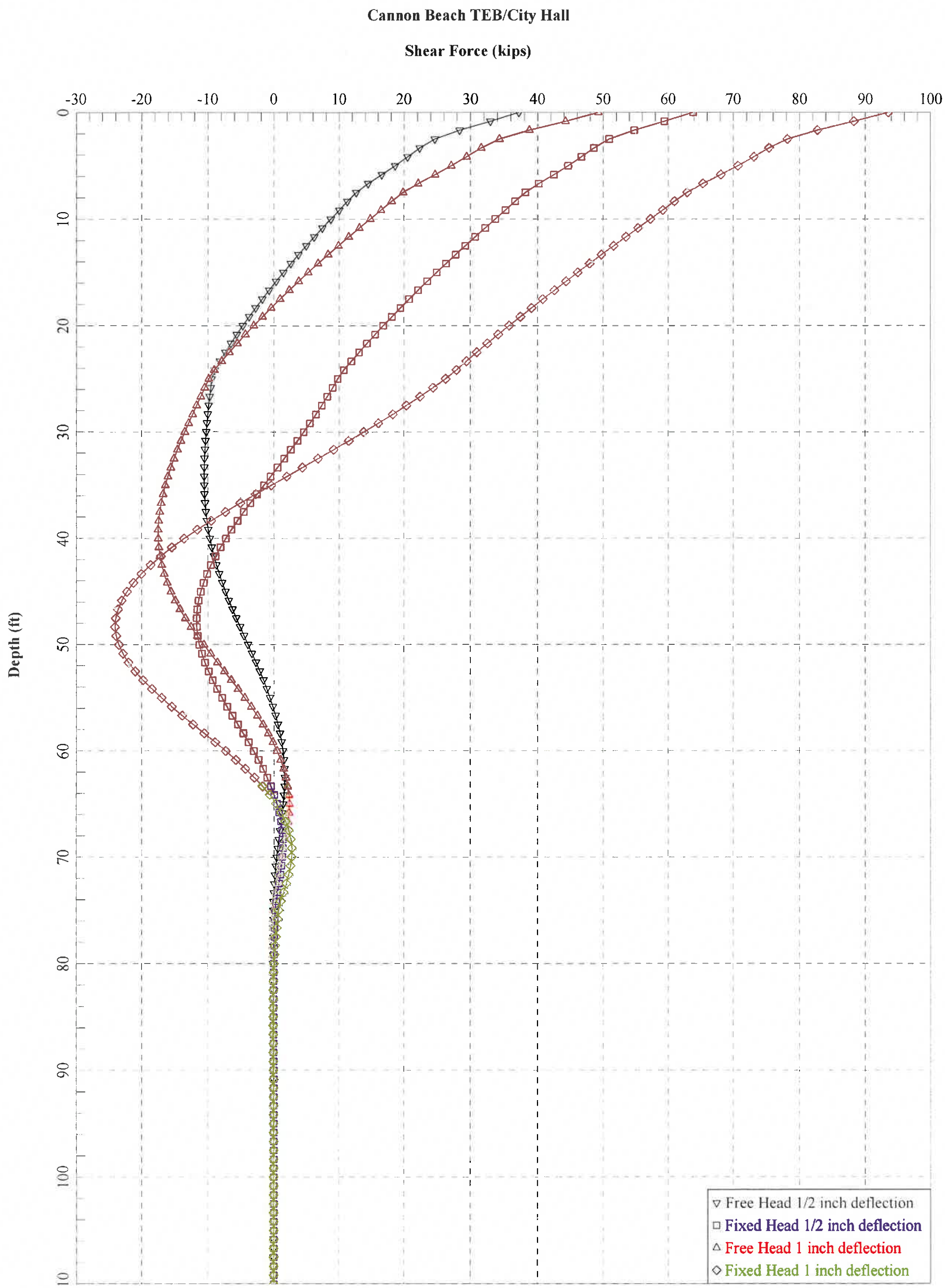


Cannon Beach TEB/City Hall
Lateral Deflection (in)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
Free Head 1/2 inch deflection
Fixed Head 1/2 inch deflection
Free Head 1 inch deflection
Fixed Head 1 inch deflection

Exhibit A-2



Cannon Beach TEB/City Hall
Bending Moment (in-kips)
-1.4E4
-1.2E4
-1E4
-8000
-6000
-4000
-2000
0
2000
4000
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
Free Head 1/2 inch deflection
Fixed Head 1/2 inch delfection
Free Head 1 inch deflection
Fixed Head 1 inch deflection


Cannon Beach TEB/City Hall
Shear Force (kips)
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
Depth (ft)
0
10
20
30
40
50
60
70
80
90
100
110
Free Head 1/2 inch deflection
Fixed Head 1/2 inch deflection
Free Head 1 inch deflection
Fixed Head 1 inch deflection

```
==============================================================================
==

              LPILE Plus for Windows, Version 5.0 (5.0.46)

                 Analysis of Individual Piles and Drilled Shafts
               Subjected to Lateral Loading Using the p-y Method

                       (c) 1985-2010 by Ensoft, Inc.
                           All Rights Reserved

==============================================================================
==

This program is licensed to:

Marcella Boyer
Chinook GeoServices, Inc.

------------------------------------------------------------------------------
--
                        Files Used for Analysis
------------------------------------------------------------------------------
--

Path to file locations:        P:\2011 Projects\11-022 (Cannon Beach TEB)\Pile
Analysis\Lpile\
Name of input data file:       Conc24.lpd
Name of output file:           Conc24.lpo
Name of plot output file:      Conc24.lpp
Name of runtime file:          Conc24.lpr


------------------------------------------------------------------------------
                       Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  April 28, 2011      Time:  15:47:47


------------------------------------------------------------------------------
                            Problem Title
------------------------------------------------------------------------------

TEB/City Hall, Cannon Beach 2 ft dia concrete



------------------------------------------------------------------------------
                            Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units: Inches, Pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
```

- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 132
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 1320.00 in

Depth of ground surface below top of pile = 0.00 in

Slope angle of ground surface = 0.00 deg.

Structural properties of pile defined using 2 points

Point No.	Point Depth in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	24.00000000	16286.0000	452.0000	30000000.
2	1320.0000	24.00000000	16286.0000	452.0000	30000000.

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = 0.000 in
Distance from top of pile to bottom of layer = 30.000 in

Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 30.000 in
Distance from top of pile to bottom of layer = 90.000 in

Layer 3 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = 90.000 in
Distance from top of pile to bottom of layer = 180.000 in

Layer 4 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = 180.000 in
Distance from top of pile to bottom of layer = 252.000 in

Layer 5 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = 252.000 in
Distance from top of pile to bottom of layer = 300.000 in

Layer 6 is liquefiable sand, by Rollins et al, 2004
Distance from top of pile to top of layer = 300.000 in
Distance from top of pile to bottom of layer = 900.000 in

Warning : The depth of this layer is deeper than the recommended depth limit

for using the p-y criteria for liquefied sand.
Please consult the LPile Technical Manual for additional background information regarding limitations on the use of the liquefied sand criteria.

Layer 7 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 900.000 in
Distance from top of pile to bottom of layer = 1200.000 in
p-y subgrade modulus k for top of soil layer = 125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 125.000 lbs/in**3

Layer 8 is stiff clay without free water
Distance from top of pile to top of layer = 1200.000 in
Distance from top of pile to bottom of layer = 1440.000 in

(Depth of lowest layer extends 120.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 16 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	0.00	0.06076
2	30.00	0.06076
3	30.00	0.06076
4	90.00	0.06076
5	90.00	0.06076
6	180.00	0.06076
7	180.00	0.05787
8	252.00	0.05787
9	252.00	0.02176
10	300.00	0.02176
11	300.00	0.02465
12	900.00	0.02465
13	900.00	0.02465
14	1200.00	0.02465
15	1200.00	0.04491
16	1440.00	0.04491

Shear Strength of Soils

Shear strength parameters with depth defined using 16 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	0.000	10.00000	0.00	0.00500	0.0
2	30.000	10.00000	0.00	0.00500	0.0
3	30.000	5.00000	0.00	0.04000	0.0
4	90.000	5.00000	0.00	0.04000	0.0
5	90.000	2.00000	0.00	0.02000	0.0
6	180.000	2.00000	0.00	0.02000	0.0
7	180.000	2.00000	0.00	0.02000	0.0
8	252.000	2.00000	0.00	0.02000	0.0
9	252.000	2.00000	0.00	0.02000	0.0
10	300.000	2.00000	0.00	0.02000	0.0
11	300.000	0.00000	0.00	------	------

12	900.000	0.00000	0.00	------	------
13	900.000	0.00000	38.00	------	------
14	1200.000	0.00000	38.00	------	------
15	1200.000	15.00000	0.00	0.00500	0.0
16	1440.000	15.00000	0.00	0.00500	0.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 0.500 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 1100000.000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 0.500 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 1100000.000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = 0.000 in-lbs
Axial load at pile head = 1100000.000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = 0.000 in/in
Axial load at pile head = 1100000.000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (Pile-head Condition

Type 4)
Specified deflection at pile head = 0.500000 in
Specified moment at pile head = 0.000 in-lbs
Specified axial load at pile head = 1100000.000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.500000	0.0000	37185.2215	-0.0021226	2433.6283	-409.0390	4090.3897
10.000	0.478774	374749.	32935.4190	-0.0021187	2709.7540	-440.9215	9209.3825
20.000	0.457625	705321.	28371.5292	-0.0021077	2953.3292	-471.8564	10310.9802
30.000	0.436621	988548.	24622.3410	-0.0020904	3162.0195	-277.9812	6366.6548
40.000	0.415818	1243755.	22346.1725	-0.0020675	3350.0635	-177.2525	4262.7403
50.000	0.395270	1480957.	20521.7645	-0.0020396	3524.8406	-187.6291	4746.8549
60.000	0.375026	1699062.	18595.5057	-0.0020071	3685.5469	-197.6226	5269.5761
70.000	0.355129	1897023.	16571.2785	-0.0019703	3831.4100	-207.2228	5835.1451
80.000	0.335620	2073834.	14453.0676	-0.0019296	3961.6897	-216.4194	6448.3436
90.000	0.316536	2228536.	12613.5847	-0.0018856	4075.6788	-151.4772	4785.4659
100.000	0.297908	2367589.	11243.6883	-0.0018386	4178.1370	-122.5021	4112.0789
110.000	0.279764	2493859.	9993.5380	-0.0017888	4271.1762	-127.5280	4558.4064
120.000	0.262131	2606814.	8705.4553	-0.0017366	4354.4049	-130.0885	4962.7235
130.000	0.245032	2706174.	7419.0312	-0.0016823	4427.6160	-127.1963	5191.0097
140.000	0.228486	2792204.	6161.7167	-0.0016260	4491.0059	-124.2666	5438.6910
150.000	0.212512	2865180.	4933.8801	-0.0015681	4544.7763	-121.3007	5707.9424
160.000	0.197124	2925380.	3735.8785	-0.0015088	4589.1335	-118.2996	6001.2648
170.000	0.182336	2973091.	2568.0592	-0.0014485	4624.2889	-115.2643	6321.5476
180.000	0.168155	3008607.	1430.7602	-0.0013873	4650.4580	-112.1955	6672.1451
190.000	0.154590	3032226.	324.3123	-0.0013254	4667.8611	-109.0941	7056.9719
200.000	0.141646	3044253.	-750.9600	-0.0012632	4676.7228	-105.9604	7480.6248
210.000	0.129326	3044998.	-1794.7362	-0.0012009	4677.2720	-102.7949	7948.5358
220.000	0.117628	3034779.	-2806.6980	-0.0011387	4669.7419	-99.5975	8467.1717
230.000	0.106551	3013916.	-3786.5260	-0.0010768	4654.3697	-96.3681	9044.2928
240.000	0.096092	2982738.	-4733.8965	-0.0010154	4631.3968	-93.1060	9689.2975
250.000	0.086242	2941578.	-5648.4771	-0.0009548	4601.0688	-89.8101	10413.6841
260.000	0.076995	2890775.	-6529.9211	-0.0008951	4563.6354	-86.4787	

```
11231.6854
270.000   0.068340    2830672.   -7377.8601  -0.0008366    4519.3504    -83.1091
12161.1542
280.000   0.060264    2761622.   -8191.8946  -0.0007793    4468.4720    -79.6978
13224.8304
290.000   0.052753    2683980.   -8971.5811  -0.0007236    4411.2632    -76.2395
14452.2001
300.000   0.045791    2598110.   -9430.0334  -0.0006696    4347.9916    -15.4509
 3374.1990
310.000   0.039362    2510110.   -9583.2752  -0.0006173    4283.1505    -15.1974
 3860.9742
320.000   0.033446    2420025.   -9732.9913  -0.0005668    4216.7732    -14.7458
 4408.8856
330.000   0.028025    2327920.   -9877.1301  -0.0005182    4148.9080    -14.0820
 5024.7852
340.000   0.023081    2233884.  -10013.5061  -0.0004716    4079.6189    -13.1932
 5716.1147
350.000   0.018594    2138025.  -10139.8164  -0.0004268    4008.9872    -12.0688
 6490.7802
360.000   0.014544    2040477.  -10253.6606  -0.0003841    3937.1115    -10.7000
 7356.7785
370.000   0.010913    1941401.  -10352.5639  -0.0003433    3864.1089     -9.0806
 8321.1880
380.000   0.007678    1840979.  -10434.0062  -0.0003046    3790.1152     -7.2078
 9387.3084
390.000   0.004821    1739422.  -10495.4629  -0.0002680    3715.2849     -5.0835
10545.1442
400.000   0.002319    1636965.  -10534.4774  -0.0002334    3639.7916     -2.7194
11726.0968
410.000   0.000153    1533867.  -10548.9834  -0.0002010    3563.8263   -0.1817719
11912.6095
420.000  -0.001700    1430406.  -10536.5534  -0.0001706    3487.5931      2.6678
15692.7726
430.000  -0.003260    1326890.  -10492.8923  -0.0001424    3411.3193      6.0644
18603.6458
440.000  -0.004548    1223681.  -10413.5145  -0.0001163    3335.2721      9.8111
21572.1538
450.000  -0.005586    1121178.  -10295.3304  -9.2304E-05   3259.7449     13.8257
24751.3651
460.000  -0.006394    1019805.  -10136.0115  -7.0394E-05   3185.0504     18.0381
28210.3809
470.000  -0.006994     920006.   -9933.9202  -5.0542E-05   3111.5158     22.3802
32000.4314
480.000  -0.007405     822239.   -9688.1042  -3.2713E-05   3039.4777     26.7830
36168.9707
490.000  -0.007648     726964.   -9398.3057  -1.6859E-05   2969.2766     31.1767
40764.6603
500.000  -0.007742     634643.   -9064.9728  -2.9242E-06   2901.2520     35.4899
45839.8845
510.000  -0.007706     545729.   -8689.2653   9.1554E-06   2835.7372     39.6516
51452.4796
520.000  -0.007559     460657.   -8273.0529   1.9455E-05   2773.0535     43.5909
57667.2481
530.000  -0.007317     379840.   -7818.9033   2.8056E-05   2713.5053     47.2390
64557.5094
540.000  -0.006998     303661.   -7330.0593   3.5051E-05   2657.3748     50.5298
72206.8300
550.000  -0.006616     232467.   -6810.4046   4.0537E-05   2604.9171     53.4012
80711.0500
560.000  -0.006187     166561.   -6264.4167   4.4621E-05   2556.3556     55.7964
90180.7234
570.000  -0.005724     106197.   -5697.1089   4.7412E-05   2511.8777     57.6651
   100744.
580.000  -0.005239  51576.1302   -5113.9599   4.9027E-05   2471.6311     58.9647
   112551.
590.000  -0.004743   2839.6628   -4520.8325   4.9584E-05   2435.7207     59.6608
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125777.

600.000	-0.004247	-39931.3604	-3923.8822	4.9204E-05	2463.0509	59.7292	140630.
610.000	-0.003759	-76720.4717	-3329.4574	4.8010E-05	2490.1582	59.1557	157358.
620.000	-0.003287	-107577.	-2743.9916	4.6124E-05	2512.8940	57.9374	176260.
630.000	-0.002837	-132615.	-2173.8905	4.3666E-05	2531.3429	56.0828	197696.
640.000	-0.002414	-152015.	-1625.4162	4.0753E-05	2545.6376	53.6121	222113.
650.000	-0.002022	-166020.	-1104.5698	3.7499E-05	2555.9567	50.5572	250066.
660.000	-0.001664	-174932.	-616.9780	3.4009E-05	2562.5230	46.9612	282260.
670.000	-0.001342	-179108.	-167.7839	3.0386E-05	2565.6001	42.8776	319610.
680.000	-0.001056	-178956.	238.4507	2.6722E-05	2565.4881	38.3693	363336.
690.000	-0.000807	-174927.	597.8268	2.3100E-05	2562.5193	33.5060	415129.
700.000	-0.000594	-167507.	907.1659	1.9596E-05	2557.0527	28.3619	477458.
710.000	-0.000415	-157214.	1164.0285	1.6273E-05	2549.4685	23.0106	554208.
720.000	-0.000269	-144585.	1366.6649	1.3184E-05	2540.1627	17.5166	652248.
730.000	-0.000152	-130171.	1513.8222	1.0373E-05	2529.5422	11.9148	786404.
740.000	-6.11E-05	-114537.	1604.1009	7.8684E-06	2518.0222	6.1409	1004985.
750.000	5.86E-06	-98262.2175	1630.0099	5.6907E-06	2506.0308	-0.9591394	1637411.
760.000	5.27E-05	-82061.6110	1592.0588	3.8453E-06	2494.0937	-6.6311	1258070.
770.000	8.28E-05	-66505.6372	1505.8067	2.3249E-06	2482.6316	-10.6193	1283102.
780.000	9.92E-05	-51996.6245	1384.9328	1.1122E-06	2471.9409	-13.5554	1366396.
790.000	0.000105	-38831.4494	1239.2139	1.8264E-07	2462.2405	-15.5883	1484516.
800.000	0.000103	-27216.3640	1077.2550	-4.9328E-07	2453.6821	-16.8035	1633646.
810.000	9.51E-05	-17275.4965	906.8649	-9.4859E-07	2446.3574	-17.2746	1815690.
820.000	8.39E-05	-9058.1976	735.1032	-1.2181E-06	2440.3027	-17.0777	2035810.
830.000	7.08E-05	-2546.6343	568.2386	-1.3368E-06	2435.5048	-16.2952	2302263.
840.000	5.71E-05	2335.9860	411.6883	-1.3390E-06	2435.3495	-15.0149	2627290.
850.000	4.40E-05	5716.5889	269.9722	-1.2566E-06	2437.8405	-13.3283	3029236.
860.000	3.20E-05	7763.0753	146.7056	-1.1186E-06	2439.3484	-11.3250	3537090.
870.000	2.16E-05	8675.3106	44.6517	-9.5042E-07	2440.0205	-9.0857	4201320.
880.000	1.30E-05	8677.0185	-34.1197	-7.7284E-07	2440.0218	-6.6685	5125890.
890.000	6.17E-06	8009.9187	-87.8413	-6.0207E-07	2439.5303	-4.0758	6606752.
900.000	9.68E-07	6933.4386	-108.8849	-4.4915E-07	2438.7371	-0.1329555	1373373.
910.000	-2.81E-06	5842.1020	-107.5999	-3.1840E-07	2437.9329	0.3899579	1385873.
920.000	-5.40E-06	4788.4458	-101.8745	-2.0961E-07	2437.1566	0.7551183	

Exhibit A-2

1398373.							
	930.000	-7.01E-06	3809.2234	-93.1566	-1.2163E-07	2436.4351	0.9884681
1410873.							
	940.000	-7.83E-06	2927.9901	-82.6399	-5.2680E-08	2435.7857	1.1149
1423373.							
	950.000	-8.06E-06	2157.5837	-71.2793	-6.3579E-10	2435.2181	1.1573
1435873.							
	960.000	-7.85E-06	1502.4182	-59.8115	3.6820E-08	2434.7353	1.1363
1448373.							
	970.000	-7.32E-06	960.5427	-48.7809	6.2025E-08	2434.3361	1.0698
1460873.							
	980.000	-6.60E-06	525.4348	-38.5661	7.7232E-08	2434.0155	0.9731238
1473373.							
	990.000	-5.78E-06	187.5211	-29.4073	8.4528E-08	2433.7665	0.8586329
1485873.							
	1000.	-4.91E-06	-64.5716	-21.4325	8.5787E-08	2433.6759	0.7363258
1498373.							
	1010.	-4.06E-06	-243.0172	-14.6816	8.2639E-08	2433.8074	0.6138543
1510873.							
	1020.	-3.26E-06	-360.0226	-9.1282	7.6467E-08	2433.8936	0.4968319
1523373.							
	1030.	-2.53E-06	-427.2638	-4.6984	6.8411E-08	2433.9431	0.3891231
1535873.							
	1040.	-1.89E-06	-455.4965	-1.2871	5.9377E-08	2433.9639	0.2931353
1548373.							
	1050.	-1.35E-06	-454.3131	1.2290	5.0066E-08	2433.9631	0.2100984
1560873.							
	1060.	-8.92E-07	-432.0175	2.9811	4.0995E-08	2433.9466	0.1403238
1573373.							
	1070.	-5.26E-07	-395.5924	4.0999	3.2526E-08	2433.9198	0.0834366
1585873.							
	1080.	-2.41E-07	-350.7344	4.7100	2.4888E-08	2433.8867	0.0385767
1598373.							
	1090.	-2.84E-08	-301.9399	4.9257	1.8209E-08	2433.8508	0.0045687
1610873.							
	1100.	1.23E-07	-252.6205	4.8489	1.2534E-08	2433.8145	-0.0199393
1623373.							
	1110.	2.22E-07	-205.2382	4.5673	7.8480E-09	2433.7795	-0.0363671
1635873.							
	1120.	2.80E-07	-161.4463	4.1549	4.0954E-09	2433.7473	-0.0461192
1648373.							
	1130.	3.04E-07	-122.2301	3.6717	1.1924E-09	2433.7184	-0.0505268
1660873.							
	1140.	3.04E-07	-88.0390	3.1650	-9.5948E-10	2433.6932	-0.0508092
1673373.							
	1150.	2.85E-07	-58.9089	2.6707	-2.4633E-09	2433.6717	-0.0480522
1685873.							
	1160.	2.54E-07	-34.5709	2.2144	-3.4200E-09	2433.6538	-0.0432010
1698373.							
	1170.	2.17E-07	-14.5452	1.8131	-3.9226E-09	2433.6390	-0.0370626
1710873.							
	1180.	1.76E-07	1.7776	1.4762	-4.0533E-09	2433.6296	-0.0303167
1723373.							
	1190.	1.36E-07	15.0683	1.2070	-3.8809E-09	2433.6394	-0.0235323
1735873.							
	1200.	9.83E-08	26.0023	0.7575505	-3.4606E-09	2433.6475	-0.0663511
6750000.							
	1210.	6.64E-08	30.2954	0.2018522	-2.8844E-09	2433.6506	-0.0447886
6750000.							
	1220.	4.06E-08	30.1028	-0.1591479	-2.2663E-09	2433.6505	-0.0274115
6750000.							
	1230.	2.10E-08	27.1623	-0.3671713	-1.6803E-09	2433.6483	-0.0141932
6750000.							
	1240.	7.00E-09	22.7964	-0.4617756	-1.1690E-09	2433.6451	-0.0047276
6750000.							
	1250.	-2.35E-09	17.9525	-0.4774710	-7.5201E-10	2433.6415	0.0015885

1260.	-8.04E-09	13.2635	-0.4424060	-4.3255E-10	2433.6381	0.0054245	6750000.
1270.	-1.10E-08	9.1139	-0.3781438	-2.0355E-10	2433.6350	0.0074280	6750000.
1280.	-1.21E-08	5.7051	-0.3001423	-5.1893E-11	2433.6325	0.0081723	6750000.
1290.	-1.20E-08	3.1122	-0.2186380	3.8341E-11	2433.6306	0.0081285	6750000.
1300.	-1.13E-08	1.3315	-0.1397217	8.3817E-11	2433.6293	0.0076547	6750000.
1310.	-1.04E-08	0.3159236	-0.0664630	1.0068E-10	2433.6286	0.0069970	6750000.
1320.	-9.33E-09	0.0000	0.0000	1.0391E-10	2433.6283	0.0062956	3375000.

(Preceding value at top of page: 6750000.)

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.50000000 in
Computed slope at pile head	=	-0.00212257
Maximum bending moment	=	3044998. lbs-in
Maximum shear force	=	37185.22152 lbs
Depth of maximum bending moment	=	210.00000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	10
Number of zero deflection points	=	5

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Slope (Pile-head Condition Type 5)

Specified deflection at pile head	=	0.500000 in
Specified slope at pile head	=	0.000E+00 in/in
Specified axial load at pile head	=	1100000.000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	0.500000	-7961505.	63879.8610	0.0000	8299.8972	-409.0390	4090.3897
10.000	0.499185	-7344087.	59424.3892	-0.0001566	7844.9660	-445.5472	8925.4878
20.000	0.496867	-6769571.	54788.3465	-0.0003011	7421.6457	-481.6614	9693.9635
30.000	0.493164	-6241697.	50947.1717	-0.0004342	7032.6926	-286.5736	5810.9202
40.000	0.488183	-5741075.	48591.7734	-0.0005569	6663.8196	-184.5061	3779.4457
50.000	0.482027	-5257610.	46683.3891	-0.0006694	6307.5891	-197.1708	4090.4527

60. 000	0. 474795	- 4792680.	44649. 4041	- 0. 0007723	5965. 0146	- 209. 6262	4415. 0919
70. 000	0. 466582	- 4347633.	42491. 9955	- 0. 0008658	5637. 0909	- 221. 8555	4754. 9129
80. 000	0. 457479	- 3923792.	40213. 5051	- 0. 0009504	5324. 7929	- 233. 8426	5111. 5515
90. 000	0. 447573	- 3522453.	38194. 2104	- 0. 0010267	5029. 0743	- 170. 0164	3798. 6314
100. 000	0. 436946	- 3137322.	36648. 2108	- 0. 0010948	4745. 2985	- 139. 1836	3185. 3749
110. 000	0. 425677	- 2765403.	35218. 9055	- 0. 0011552	4471. 2578	- 146. 6775	3445. 7496
120. 000	0. 413841	- 2407529.	33728. 1467	- 0. 0012082	4207. 5659	- 151. 4743	3660. 2015
130. 000	0. 401514	- 2064261.	32220. 9999	- 0. 0012539	3954. 6357	- 149. 9551	3734. 7453
140. 000	0. 388763	- 1735523.	30729. 4710	- 0. 0012928	3712. 4122	- 148. 3507	3815. 9664
150. 000	0. 375658	- 1421229.	29254. 3943	- 0. 0013251	3480. 8317	- 146. 6646	3904. 2117
160. 000	0. 362261	- 1121283.	27796. 5704	- 0. 0013511	3259. 8221	- 144. 9001	3999. 8820
170. 000	0. 348635	- 835573.	26356. 7688	- 0. 0013712	3049. 3031	- 143. 0602	4103. 4369
180. 000	0. 334838	- 563982.	24935. 7299	- 0. 0013855	2849. 1867	- 141. 1476	4215. 3999
190. 000	0. 320926	- 306378.	23534. 1665	- 0. 0013944	2659. 3768	- 139. 1651	4336. 3660
200. 000	0. 306950	- 62622. 2391	22152. 7660	- 0. 0013982	2479. 7702	- 137. 1150	4467. 0094
210. 000	0. 292962	167436.	20792. 1918	- 0. 0013971	2557. 0004	- 134. 9998	4608. 0931
220. 000	0. 279009	383957.	19453. 0849	- 0. 0013914	2716. 5394	- 132. 8216	4760. 4815
230. 000	0. 265134	587110.	18136. 0652	- 0. 0013815	2866. 2280	- 130. 5824	4925. 1533
240. 000	0. 251379	777072.	16841. 7333	- 0. 0013675	3006. 1975	- 128. 2840	5103. 2191
250. 000	0. 237783	954030.	15570. 6715	- 0. 0013498	3136. 5858	- 125. 9283	5295. 9408
260. 000	0. 224382	1118181.	14323. 4456	- 0. 0013286	3257. 5370	- 123. 5169	5504. 7560
270. 000	0. 211210	1269729.	13100. 6057	- 0. 0013042	3369. 2017	- 121. 0511	5731. 3068
280. 000	0. 198298	1408886.	11902. 6883	- 0. 0012768	3471. 7364	- 118. 5324	5977. 4750
290. 000	0. 185675	1535872.	10730. 2170	- 0. 0012466	3565. 3035	- 115. 9619	6245. 4254
300. 000	0. 173366	1650916.	9779. 5116	- 0. 0012140	3650. 0714	- 74. 1792	4278. 7705
310. 000	0. 161394	1758170.	9015. 6672	- 0. 0011791	3729. 0996	- 78. 5897	4869. 4175
320. 000	0. 149783	1857170.	8208. 6056	- 0. 0011421	3802. 0456	- 82. 8226	5529. 5080
330. 000	0. 138552	1947470.	7360. 3779	- 0. 0011032	3868. 5808	- 86. 8229	6266. 4626
340. 000	0. 127719	2028648.	6473. 5929	- 0. 0010625	3928. 3955	- 90. 5341	7088. 5376
350. 000	0. 117301	2100317.	5551. 4268	- 0. 0010203	3981. 2029	- 93. 8991	8004. 9398
360. 000	0. 107314	2162122.	4597. 6256	- 0. 0009766	4026. 7432	- 96. 8611	9025. 9631
370. 000	0. 097769	2213755.	3616. 5006	- 0. 0009319	4064. 7877	- 99. 3639	10163. 1479
380. 000	0. 088677	2254953.	2612. 9167	- 0. 0008861	4095. 1436	- 101. 3529	11429. 4721

390.000	0.080046	2285508.	1592.2713	-0.0008397	4117.6574	-102.7762	12839.5800
400.000	0.071884	2305271.	560.4664	-0.0007927	4132.2193	-103.5848	14410.0573
410.000	0.064193	2314156.	-476.1286	-0.0007454	4138.7663	-103.7342	16159.7683
420.000	0.056976	2312147.	-1510.7219	-0.0006981	4137.2859	-103.1845	18110.2707
430.000	0.050232	2299299.	-2536.1531	-0.0006509	4127.8190	-101.9018	20286.3331
440.000	0.043958	2275743.	-3544.9543	-0.0006040	4110.4623	-99.8585	22716.5917
450.000	0.038151	2241689.	-4529.4185	-0.0005578	4085.3702	-97.0344	25434.3960
460.000	0.032802	2197427.	-5481.6746	-0.0005124	4052.7565	-93.4169	28478.9232
470.000	0.027903	2143328.	-6393.7676	-0.0004680	4012.8950	-89.0017	31896.6823
480.000	0.023443	2079847.	-7257.7420	-0.0004247	3966.1200	-83.7932	35743.6079
490.000	0.019408	2007518.	-8065.7274	-0.0003829	3912.8259	-77.8039	40088.0879
500.000	0.015785	1926956.	-8810.0217	-0.0003427	3853.4659	-71.0549	45015.5481
510.000	0.012555	1838855.	-9483.1682	-0.0003041	3788.5507	-63.5744	50635.8183
520.000	0.009702	1743983.	-10078.0200	-0.0002674	3718.6461	-55.3960	57095.8958
530.000	0.007206	1643179.	-10587.7787	-0.0002328	3644.3705	-46.5557	64604.3765
540.000	0.005047	1537349.	-11005.9823	-0.0002002	3566.3919	-37.0850	73485.0843
550.000	0.003202	1427464.	-11326.3879	-0.0001699	3485.4258	-26.9961	84321.2013
560.000	0.001649	1314559.	-11542.5694	-0.0001418	3402.2337	-16.2402	98501.4007
570.000	0.000365	1199733.	-11646.2461	-0.0001161	3317.6269	-4.4951	123179.
580.000	-0.000673	1084188.	-11624.1441	-9.2729E-05	3232.4898	8.9155	132413.
590.000	-0.001490	969291.	-11476.1631	-7.1714E-05	3147.8299	20.6806	138829.
600.000	-0.002108	856243.	-11214.7900	-5.3032E-05	3064.5329	31.5940	149905.
610.000	-0.002550	746161.	-10848.4744	-3.6634E-05	2983.4218	41.6692	163390.
620.000	-0.002840	640079.	-10386.0340	-2.2447E-05	2905.2573	50.8189	178923.
630.000	-0.002999	538935.	-9837.2430	-1.0381E-05	2830.7311	58.9393	196514.
640.000	-0.003048	443563.	-9212.8918	-3.2681E-07	2760.4582	65.9310	216316.
650.000	-0.003006	354684.	-8524.6961	7.8422E-06	2694.9698	71.7082	238568.
660.000	-0.002891	272896.	-7785.1375	1.4265E-05	2634.7062	76.2035	263584.
670.000	-0.002720	198667.	-7007.2644	1.9091E-05	2580.0122	79.3711	291754.
680.000	-0.002509	132331.	-6204.4670	2.2478E-05	2531.1336	81.1884	323558.
690.000	-0.002271	74083.5156	-5390.2360	2.4590E-05	2488.2152	81.6578	359580.
700.000	-0.002017	23985.2138	-4577.9110	2.5594E-05	2451.3013	80.8072	400544.
710.000	-0.001759	-18037.7703	-3780.4271	2.5655E-05	2446.9191	78.6896	447344.

720.000	-0.001504	-52187.7335	-3010.0647	2.4936E-05	2472.0818	75.3829	501103.
730.000	-0.001260	-78787.6598	-2278.2102	2.3596E-05	2491.6814	70.9880	563255.
740.000	-0.001032	-98271.0450	-1595.1344	2.1784E-05	2506.0373	65.6271	635661.
750.000	-0.000825	-111170.	-969.7970	1.9640E-05	2515.5413	59.4403	720801.
760.000	-0.000640	-118099.	-409.6870	1.7294E-05	2520.6472	52.5817	822084.
770.000	-0.000479	-119744.	79.2909	1.4860E-05	2521.8590	45.2139	944397.
780.000	-0.000342	-116840.	492.8643	1.2439E-05	2519.7196	37.5008	1095194.
790.000	-0.000230	-110160.	828.3484	1.0116E-05	2514.7975	29.5960	1286899.
800.000	-0.000140	-100496.	1084.4411	7.9601E-06	2507.6765	21.6225	1543434.
810.000	-7.08E-05	-88646.4743	1260.6640	6.0245E-06	2498.9456	13.6220	1924648.
820.000	-1.96E-05	-75415.0228	1355.4163	4.3455E-06	2489.1963	5.3284	2718074.
830.000	1.61E-05	-61633.7502	1357.2879	2.9430E-06	2479.0419	-4.9541	3070612.
840.000	3.93E-05	-48334.0115	1276.9887	1.8176E-06	2469.2422	-11.1057	2829009.
850.000	5.25E-05	-36133.9646	1144.8998	9.5321E-07	2460.2529	-15.3120	2917323.
860.000	5.83E-05	-25456.9863	977.4729	3.2290E-07	2452.3858	-18.1733	3116096.
870.000	5.89E-05	-16591.6102	786.7020	-1.0741E-07	2445.8535	-19.9808	3389761.
880.000	5.62E-05	-9720.5828	582.0233	-3.7668E-07	2440.7907	-20.9549	3730444.
890.000	5.14E-05	-4942.8565	370.8491	-5.2674E-07	2437.2704	-21.2800	4139178.
900.000	4.56E-05	-2292.0128	233.1105	-6.0078E-07	2435.3171	-6.2678	1373373.
910.000	3.94E-05	-267.4302	174.4731	-6.2698E-07	2433.8254	-5.4597	1385873.
920.000	3.31E-05	1211.2423	124.0327	-6.1732E-07	2434.5208	-4.6284	1398373.
930.000	2.70E-05	2226.8048	81.8094	-5.8213E-07	2435.2691	-3.8163	1410873.
940.000	2.15E-05	2860.2381	47.4584	-5.3007E-07	2435.7358	-3.0539	1423373.
950.000	1.64E-05	3187.6339	20.3804	-4.6818E-07	2435.9771	-2.3617	1435873.
960.000	1.21E-05	3278.1456	-0.1848069	-4.0201E-07	2436.0438	-1.7514	1448373.
970.000	8.41E-06	3192.7821	-15.0827	-3.3579E-07	2435.9809	-1.2282	1460873.
980.000	5.38E-06	2983.8790	-25.1843	-2.7258E-07	2435.8269	-0.7921128	1473373.
990.000	2.96E-06	2695.0929	-31.3408	-2.1446E-07	2435.6141	-0.4391868	1485873.
1000.	1.09E-06	2361.7813	-34.3510	-1.6271E-07	2435.3685	-0.1628625	1498373.
1010.	-2.98E-07	2011.6517	-34.9399	-1.1796E-07	2435.1106	0.0450987	1510873.
1020.	-1.27E-06	1665.5791	-33.7454	-8.0324E-08	2434.8556	0.1938009	1523373.
1030.	-1.90E-06	1338.5116	-31.3135	-4.9581E-08	2434.6146	0.2925791	1535873.
1040.	-2.26E-06	1040.4006	-28.0980	-2.5236E-08	2434.3949	0.3505202	1548373.

1050.	-2.41E-06	777.1074	-24.4648	-6.6356E-09	2434.2009	0.3761205	1560873.
1060.	-2.40E-06	551.2513	-20.6989	6.9584E-09	2434.0345	0.3770603	1573373.
1070.	-2.27E-06	362.9772	-17.0132	1.6314E-08	2433.8958	0.3600742	1585873.
1080.	-2.07E-06	210.6287	-13.5583	2.2185E-08	2433.7835	0.3308985	1598373.
1090.	-1.83E-06	91.3227	-10.4324	2.5275E-08	2433.6956	0.2942775	1610873.
1100.	-1.56E-06	1.4238	-7.6910	2.6224E-08	2433.6294	0.2540137	1623373.
1110.	-1.30E-06	-63.0740	-5.3557	2.5593E-08	2433.6748	0.2130470	1635873.
1120.	-1.05E-06	-106.2529	-3.4227	2.3860E-08	2433.7066	0.1735523	1648373.
1130.	-8.25E-07	-132.0526	-1.8697	2.1421E-08	2433.7256	0.1370459	1660873.
1140.	-6.24E-07	-144.1180	-0.6619995	1.8595E-08	2433.7345	0.1044930	1673373.
1150.	-4.53E-07	-145.7017	0.2425209	1.5629E-08	2433.7357	0.0764111	1685873.
1160.	-3.12E-07	-139.6115	0.8894070	1.2709E-08	2433.7312	0.0529661	1698373.
1170.	-1.99E-07	-128.1932	1.3245	9.9686E-09	2433.7228	0.0340564	1710873.
1180.	-1.12E-07	-113.3404	1.5917	7.4968E-09	2433.7118	0.0193865	1723373.
1190.	-4.91E-08	-96.5234	1.7313	5.3491E-09	2433.6994	0.0085270	1735873.
1200.	-5.51E-09	-78.8320	1.7925	3.5546E-09	2433.6864	0.0037185	6750000.
1210.	2.20E-08	-60.7510	1.7370	2.1261E-09	2433.6731	-0.0148295	6750000.
1220.	3.70E-08	-44.1393	1.5379	1.0527E-09	2433.6608	-0.0249843	6750000.
1230.	4.30E-08	-30.0161	1.2678	2.9382E-10	2433.6504	-0.0290411	6750000.
1240.	4.29E-08	-18.7902	0.9778178	-2.0565E-10	2433.6422	-0.0289509	6750000.
1250.	3.89E-08	-10.4552	0.7017391	-5.0494E-10	2433.6360	-0.0262648	6750000.
1260.	3.28E-08	-4.7444	0.4597438	-6.6049E-10	2433.6318	-0.0221343	6750000.
1270.	2.57E-08	-1.2458	0.2623314	-7.2179E-10	2433.6292	-0.0173482	6750000.
1280.	1.84E-08	0.5181501	0.1136398	-7.2924E-10	2433.6287	-0.0123901	6750000.
1290.	1.11E-08	1.0430	0.0141716	-7.1326E-10	2433.6291	-0.0075035	6750000.
1300.	4.09E-09	0.8172739	-0.0371515	-6.9422E-10	2433.6289	-0.0027611	6750000.
1310.	-2.77E-09	0.3152493	-0.0416146	-6.8263E-10	2433.6286	0.0018685	6750000.
1320.	-9.56E-09	0.0000	0.0000	-6.7941E-10	2433.6283	0.0064545	3375000.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.50000000 in
Computed slope at pile head = -0.00000632

```
Maximum bending moment              =      -7961505. lbs-in
Maximum shear force                 =     63879.86102 lbs
Depth of maximum bending moment     =         0.00000 in
Depth of maximum shear force        =         0.00000 in
Number of iterations                =               7
Number of zero deflection points    =               5
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (Pile-head Condition Type 4)

```
Specified deflection at pile head   =        1.000000 in
Specified moment at pile head       =           0.000 in-lbs
Specified axial load at pile head   =     1100000.000 lbs
```

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res. p lbs/in	Es*h F/L lbs/in
0.000	1.000000	0.0000	49286.3543	-0.0037684	2433.6283	-486.4321	2432.1603
10.000	0.962316	509994.	44229.2033	-0.0037631	2809.4067	-524.9981	5455.5667
20.000	0.924737	967373.	38791.2992	-0.0037480	3146.4170	-562.5827	6083.7029
30.000	0.887356	1368276.	34318.8645	-0.0037241	3441.8142	-331.9043	3740.3733
40.000	0.850255	1735681.	31599.5468	-0.0036924	3712.5287	-211.9592	2492.8904
50.000	0.813509	2081499.	29416.0894	-0.0036533	3967.3375	-224.7322	2762.5046
60.000	0.777189	2404375.	27106.8756	-0.0036074	4205.2420	-237.1105	3050.8726
70.000	0.741361	2702999.	24675.9034	-0.0035551	4425.2767	-249.0839	3359.8179
80.000	0.706087	2976106.	22127.2709	-0.0034970	4626.5098	-260.6426	3691.3664
90.000	0.671422	3222478.	19850.9275	-0.0034336	4808.0442	-194.6261	2898.7172
100.000	0.637416	3448662.	18088.5317	-0.0033653	4974.7034	-157.8530	2476.4532
110.000	0.604116	3658285.	16475.1032	-0.0032926	5129.1595	-164.8327	2728.4949
120.000	0.571565	3850601.	14807.5033	-0.0032157	5270.8633	-168.6873	2951.3254
130.000	0.539802	4025181.	13136.5526	-0.0031351	5399.4990	-165.5028	3065.9941
140.000	0.508862	4182304.	11497.6462	-0.0030511	5515.2722	-162.2785	3189.0448
150.000	0.478779	4322258.	9891.1768	-0.0029641	5618.3945	-159.0154	3321.2694
160.000	0.449581	4445338.	8317.5253	-0.0028744	5709.0830	-155.7149	3463.5595
170.000	0.421292	4551845.	6777.0612	-0.0027823	5787.5605	-152.3779	3616.9213
180.000	0.393935	4642089.	5270.1436	-0.0026882	5854.0553	-149.0056	

							3782.4946
190.000	0.367528	4716388.	3797.1213	-0.0025924	5908.8008	-145.5989	3961.5744
200.000	0.342086	4775065.	2358.3338	-0.0024953	5952.0357	-142.1586	4155.6379
210.000	0.317622	4818451.	954.1122	-0.0023971	5984.0039	-138.6857	4366.3769
220.000	0.294144	4846884.	-415.2201	-0.0022982	6004.9539	-135.1808	4595.7367
230.000	0.271658	4860707.	-1749.3460	-0.0021989	6015.1394	-131.6444	4845.9655
240.000	0.250167	4860272.	-3047.9540	-0.0020994	6014.8186	-128.0772	5119.6742
250.000	0.229670	4845935.	-4310.7361	-0.0020000	6004.2544	-124.4793	5419.9121
260.000	0.210166	4818058.	-5537.3864	-0.0019011	5983.7143	-120.8508	5750.2626
270.000	0.191647	4777012.	-6727.5985	-0.0018030	5953.4703	-117.1916	6114.9648
280.000	0.174107	4723171.	-7881.0634	-0.0017057	5913.7988	-113.5013	6519.0719
290.000	0.157533	4656917.	-8997.4655	-0.0016097	5864.9807	-109.7791	6968.6572
300.000	0.141912	4578636.	-9839.3142	-0.0015152	5807.3012	-58.5907	4128.6665
310.000	0.127228	4493466.	-10430.1489	-0.0014224	5744.5450	-59.5763	4682.6331
320.000	0.113464	4401326.	-11028.8450	-0.0013314	5676.6536	-60.1630	5302.3773
330.000	0.100601	4302179.	-11631.2307	-0.0012423	5603.5991	-60.3142	5995.3838
340.000	0.088618	4196032.	-12232.7787	-0.0011553	5525.3868	-59.9954	6770.0864
350.000	0.077495	4082940.	-12828.6312	-0.0010706	5442.0577	-59.1751	7636.0242
360.000	0.067207	3963012.	-13413.6304	-0.0009883	5353.6912	-57.8247	8604.0346
370.000	0.057730	3836409.	-13982.3526	-0.0009084	5260.4065	-55.9197	9686.4960
380.000	0.049038	3703351.	-14529.1493	-0.0008313	5162.3650	-53.4396	10897.6365
390.000	0.041104	3564114.	-15048.1906	-0.0007569	5059.7717	-50.3686	12253.9413
400.000	0.033900	3419039.	-15533.5133	-0.0006854	4952.8757	-46.6959	13774.7032
410.000	0.027395	3268524.	-15979.0705	-0.0006170	4841.9719	-42.4155	15482.8041
420.000	0.021560	3113031.	-16378.7813	-0.0005517	4727.4005	-37.5266	17405.8866
430.000	0.016361	2953085.	-16726.5782	-0.0004896	4609.5477	-32.0327	19578.2549
440.000	0.011767	2789271.	-17016.4446	-0.0004308	4488.8447	-25.9406	22044.3273
450.000	0.007744	2622235.	-17242.4339	-0.0003755	4365.7676	-19.2573	24866.0441
460.000	0.004258	2452683.	-17398.6399	-0.0003235	4240.8365	-11.9839	28143.9022
470.000	0.001274	2281380.	-17479.0214	-0.0002751	4114.6156	-4.0924	32128.6709
480.000	-0.001244	2109154.	-17476.5770	-0.0002302	3987.7147	4.5813	36837.6606
490.000	-0.003329	1936912.	-17384.7886	-0.0001887	3860.8014	13.7764	41378.7978
500.000	-0.005019	1765611.	-17199.6024	-0.0001509	3734.5820	23.2608	46349.2819
510.000	-0.006346	1596239.	-16918.9833	-0.0001165	3609.7835	32.8630	

51781.3792						
520.000	-0.007348	1429793.	-16542.5676	-8.5485E-05	3487.1417	42.4202
57732.8805						
530.000	-0.008056	1267268.	-16071.5912	-5.7884E-05	3367.3883	51.7751
64267.4525						
540.000	-0.008505	1109635.	-15508.8388	-3.3560E-05	3251.2397	60.7754
71455.4411						
550.000	-0.008727	957829.	-14858.5907	-1.2402E-05	3139.3850	69.2743
79375.6607						
560.000	-0.008753	812736.	-14126.5565	5.7175E-06	3032.4758	77.1326
88117.3548						
570.000	-0.008613	675173.	-13319.7918	2.0944E-05	2931.1152	84.2204
97782.3909						
580.000	-0.008335	545879.	-12446.5937	3.3440E-05	2835.8481	90.4192
108488.						
590.000	-0.007944	425505.	-11516.3778	4.3381E-05	2747.1528	95.6240
120369.						
600.000	-0.007467	314597.	-10539.5328	5.0955E-05	2665.4328	99.7450
133583.						
610.000	-0.006925	213593.	-9527.2575	5.6361E-05	2591.0101	102.7100
148315.						
620.000	-0.006340	122812.	-8491.3797	5.9803E-05	2524.1200	104.4655
164781.						
630.000	-0.005729	42450.0593	-7444.1596	6.1495E-05	2464.9068	104.9785
183238.						
640.000	-0.005110	-27423.8308	-6398.0816	6.1648E-05	2453.8350	104.2371
203995.						
650.000	-0.004496	-86867.8353	-5365.6368	6.0479E-05	2497.6351	102.2518
227423.						
660.000	-0.003900	-136067.	-4359.1002	5.8197E-05	2533.8865	99.0555
253975.						
670.000	-0.003332	-175330.	-3390.3073	5.5010E-05	2562.8167	94.7031
284210.						
680.000	-0.002800	-205083.	-2470.4358	5.1117E-05	2584.7398	89.2712
318826.						
690.000	-0.002310	-225863.	-1609.7954	4.6707E-05	2600.0511	82.8568
358717.						
700.000	-0.001866	-238307.	-817.6361	4.1957E-05	2609.2198	75.5750
405043.						
710.000	-0.001471	-243139.	-101.9781	3.7030E-05	2612.7804	67.5565
459359.						
720.000	-0.001125	-241161.	530.5222	3.2074E-05	2611.3229	58.9435
523825.						
730.000	-0.000829	-233234.	1074.6611	2.7219E-05	2605.4823	49.8842
601600.						
740.000	-0.000581	-220267.	1526.7039	2.2578E-05	2595.9273	40.5243
697646.						
750.000	-0.000378	-203197.	1884.2859	1.8244E-05	2583.3498	30.9921
820690.						
760.000	-0.000216	-182982.	2146.0763	1.4292E-05	2568.4551	21.3660
989231.						
770.000	-9.18E-05	-160590.	2310.7513	1.0776E-05	2551.9557	11.5690
1260388.						
780.000	-4.61E-07	-137004.	2369.4366	7.7307E-06	2534.5772	0.1680595
3643296.						
790.000	6.28E-05	-113371.	2319.0476	5.1684E-06	2517.1636	-10.2459
1630849.						
800.000	0.000103	-90737.2222	2183.7674	3.0797E-06	2500.4862	-16.8102
1633520.						
810.000	0.000124	-69763.7196	1992.4044	1.4371E-06	2485.0323	-21.4624
1725018.						
820.000	0.000132	-50920.7511	1762.3502	2.0208E-07	2471.1482	-24.5484
1864670.						
830.000	0.000128	-34521.1622	1508.2468	-6.7231E-07	2459.0645	-26.2722
2045168.						
840.000	0.000118	-20741.0246	1242.8487	-1.2379E-06	2448.9109	-26.8074

2267889.						
850.000	0.000104	-9636.9559	977.1835	-1.5487E-06	2440.7291	-26.3257
2538562.						
860.000	8.72E-05	-1163.2832	720.5342	-1.6593E-06	2434.4855	-25.0042
2866484.						
870.000	7.05E-05	4810.2314	480.3935	-1.6219E-06	2437.1726	-23.0239
3264978.						
880.000	5.48E-05	8480.2702	262.4639	-1.4859E-06	2439.8768	-20.5620
3752821.						
890.000	4.08E-05	10092.1997	70.7640	-1.2959E-06	2441.0645	-17.7780
4357414.						
900.000	2.89E-05	9924.0589	-37.9530	-1.0910E-06	2440.9407	-3.9654
1373373.						
910.000	1.90E-05	9357.1415	-70.9314	-8.9370E-07	2440.5229	-2.6303
1385873.						
920.000	1.10E-05	8525.0920	-91.7735	-7.1070E-07	2439.9099	-1.5382
1398373.						
930.000	4.77E-06	7537.3071	-102.8258	-5.4632E-07	2439.1820	-0.6722967
1410873.						
940.000	7.33E-08	6480.5956	-106.2394	-4.0286E-07	2438.4034	-0.0104305
1423373.						
950.000	-3.29E-06	5421.3820	-103.9280	-2.8106E-07	2437.6230	0.4727091
1435873.						
960.000	-5.55E-06	4408.2188	-97.5467	-1.8047E-07	2436.8764	0.8035478
1448373.						
970.000	-6.90E-06	3474.4178	-88.4879	-9.9798E-08	2436.1884	1.0082
1460873.						
980.000	-7.54E-06	2640.6564	-77.8893	-3.7218E-08	2435.5740	1.1115
1473373.						
990.000	-7.65E-06	1917.4504	-66.6514	9.4282E-09	2435.0412	1.1361
1485873.						
1000.	-7.36E-06	1307.4202	-55.4605	4.2431E-08	2434.5917	1.1021
1498373.						
1010.	-6.80E-06	807.3060	-44.8152	6.4072E-08	2434.2232	1.0270
1510873.						
1020.	-6.07E-06	409.7076	-35.0539	7.6527E-08	2433.9302	0.9252803
1523373.						
1030.	-5.27E-06	104.5450	-26.3830	8.1790E-08	2433.7054	0.8088975
1535873.						
1040.	-4.44E-06	-119.7515	-18.9026	8.1634E-08	2433.7166	0.6871835
1548373.						
1050.	-3.63E-06	-275.3025	-12.6305	7.7591E-08	2433.8312	0.5672238
1560873.						
1060.	-2.89E-06	-374.0693	-7.5238	7.0946E-08	2433.9039	0.4541194
1573373.						
1070.	-2.22E-06	-427.3398	-3.4968	6.2744E-08	2433.9432	0.3512875
1585873.						
1080.	-1.63E-06	-445.3854	-0.4365619	5.3813E-08	2433.9565	0.2607580
1598373.						
1090.	-1.14E-06	-437.2550	1.7845	4.4780E-08	2433.9505	0.1834538
1610873.						
1100.	-7.36E-07	-410.6807	3.2990	3.6103E-08	2433.9309	0.1194466
1623373.						
1110.	-4.17E-07	-372.0692	4.2371	2.8092E-08	2433.9025	0.0681822
1635873.						
1120.	-1.74E-07	-326.5558	4.7214	2.0943E-08	2433.8689	0.0286732
1648373.						
1130.	2.06E-09	-278.1016	4.8631	1.4755E-08	2433.8332	-0.0003420
1660873.						
1140.	1.21E-07	-229.6189	4.7600	9.5589E-09	2433.7975	-0.0202723
1673373.						
1150.	1.93E-07	-183.1118	4.4958	5.3351E-09	2433.7632	-0.0325772
1685873.						
1160.	2.28E-07	-139.8212	4.1394	2.0303E-09	2433.7313	-0.0386971
1698373.						
1170.	2.34E-07	-100.3688	3.7459	-4.2777E-10	2433.7023	-0.0400074

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1710873.
1180.   2.19E-07      -64.8945       3.3569  -2.1190E-09    2433.6761   -0.0377923
1723373.
1190.   1.91E-07      -33.1849       3.0017  -3.1227E-09    2433.6528   -0.0332352
1735873.
1200.   1.57E-07       -4.7913       2.3062  -3.5114E-09    2433.6318   -0.1058654
6750000.
1210.   1.21E-07       13.0169       1.3677  -3.4272E-09    2433.6379   -0.0818326
6750000.
1220.   8.83E-08       22.6388    0.6605795  -3.0623E-09    2433.6450   -0.0595981
6750000.
1230.   6.00E-08       26.2958    0.1601320  -2.5615E-09    2433.6477   -0.0404913
6750000.
1240.   3.71E-08       25.8978   -0.1674120  -2.0274E-09    2433.6474   -0.0250175
6750000.
1250.   1.94E-08       22.9922   -0.3581068  -1.5271E-09    2433.6453   -0.0131215
6750000.
1260.   6.52E-09       18.7693   -0.4457244  -1.0997E-09    2433.6421   -0.0044020
6750000.
1270.  -2.55E-09       14.1019   -0.4591127  -7.6330E-10    2433.6387    0.0017244
6750000.
1280.  -8.74E-09        9.6038   -0.4209784  -5.2070E-10    2433.6354    0.0059025
6750000.
1290.  -1.30E-08        5.6938   -0.3476967  -3.6415E-10    2433.6325    0.0087538
6750000.
1300.  -1.60E-08        2.6579   -0.2498349  -2.7868E-10    2433.6303    0.0108185
6750000.
1310.  -1.85E-08     0.7032109   -0.1331620  -2.4428E-10    2433.6288    0.0125160
6750000.
1320.  -2.09E-08        0.0000       0.0000  -2.3709E-10    2433.6283    0.0141164
3375000.

Output Verification:

Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No.  3:

Pile-head deflection                =      1.00000000 in
Computed slope at pile head         =     -0.00376836
Maximum bending moment              =        4860707. lbs-in
Maximum shear force                 =     49286.35427 lbs
Depth of maximum bending moment     =       230.00000 in
Depth of maximum shear force        =         0.00000 in
Number of iterations                =               9
Number of zero deflection points    =               5



------------------------------------------------------------------------------
                 Computed Values of Load Distribution and Deflection
                     for Lateral Loading for Load Case Number  4
------------------------------------------------------------------------------

Pile-head boundary conditions are Displacement and Slope (Pile-head Condition
Type 5)
Specified deflection at pile head     =        1.000000 in
Specified slope at pile head          =       0.000E+00 in/in
Specified axial load at pile head     =     1100000.000 lbs

  Depth     Deflect.     Moment      Shear      Slope      Total      Soil Res.
    Es*h
    X          y           M           V          S        Stress         p
     F/L
```

in	in	lbs-in	lbs	Rad.	lbs/in**2	lbs/in	lbs/in
0.000	1.000000	-1.3866E+07	93591.8876	0.0000	12650.3251	-486.4321	2432.1603
10.000	0.998581	-1.2955E+07	88293.1297	-0.0002745	11979.0841	-529.8758	5306.2875
20.000	0.994511	-1.2094E+07	82779.2164	-0.0005308	11344.7367	-572.9069	5760.6918
30.000	0.987965	-1.1288E+07	78209.9991	-0.0007701	10750.5966	-340.9366	3450.8986
40.000	0.979109	-1.0513E+07	75407.4671	-0.0009932	10179.7051	-219.5698	2242.5479
50.000	0.968101	-9757513.	73136.0055	-0.0012006	9623.2482	-234.7225	2424.5667
60.000	0.955096	-9023583.	70714.1457	-0.0013928	9082.4677	-249.6495	2613.8677
70.000	0.940244	-8312587.	68144.2435	-0.0015702	8558.5852	-264.3310	2811.3015
80.000	0.923691	-7626153.	65428.8474	-0.0017334	8052.8003	-278.7482	3017.7647
90.000	0.905577	-6965876.	62959.9273	-0.0018827	7566.2893	-215.0358	2374.5724
100.000	0.886037	-6325535.	61003.9044	-0.0020187	7094.4672	-176.1688	1988.2771
110.000	0.865203	-5701387.	59194.0684	-0.0021418	6634.5764	-185.7984	2147.4556
120.000	0.843201	-5094534.	57304.9230	-0.0022523	6187.4299	-192.0306	2277.3995
130.000	0.820157	-4505738.	55393.4443	-0.0023505	5753.5876	-190.2651	2319.8613
140.000	0.796191	-3934954.	53500.1514	-0.0024369	5333.0172	-188.3935	2366.1846
150.000	0.771419	-3382123.	51626.0888	-0.0025118	4925.6754	-186.4190	2416.5725
160.000	0.745955	-2847173.	49772.2692	-0.0025755	4531.5085	-184.3449	2471.2591
170.000	0.719909	-2330016.	47939.6757	-0.0026285	4150.4522	-182.1738	2530.5131
180.000	0.693385	-1830552.	46129.2642	-0.0026711	3782.4326	-179.9085	2594.6406
190.000	0.666487	-1348667.	44341.9648	-0.0027036	3427.3654	-177.5514	2663.9895
200.000	0.639312	-884233.	42578.6842	-0.0027265	3085.1571	-175.1048	2738.9541
210.000	0.611957	-437111.	40840.3066	-0.0027400	2755.7042	-172.5708	2819.9810
220.000	0.584512	-7146.9715	39127.6955	-0.0027445	2438.8944	-169.9514	2907.5758
230.000	0.557066	405823.	37441.6952	-0.0027405	2732.6507	-167.2486	3002.3110
240.000	0.529703	801977.	35783.1315	-0.0027281	3024.5485	-164.4641	3104.8353
250.000	0.502504	1181504.	34152.8132	-0.0027078	3304.1951	-161.5996	3215.8851
260.000	0.475547	1544605.	32551.5324	-0.0026799	3571.7385	-158.6566	3336.2968
270.000	0.448906	1891493.	30980.0657	-0.0026447	3827.3354	-155.6367	3467.0231
280.000	0.422652	2222391.	29439.1745	-0.0026026	4071.1508	-152.5415	3609.1506
290.000	0.396853	2537535.	27929.6051	-0.0025539	4303.3578	-149.3724	3763.9213
300.000	0.371573	2837170.	26272.0033	-0.0024989	4524.1376	-182.1480	4902.0723

310.000	0.346874	3117951.	24403.4961	-0.0024380	4731.0256	-191.5535	5522.2706
320.000	0.322814	3378875.	22443.4695	-0.0023715	4923.2822	-200.4518	6209.5208
330.000	0.299444	3618993.	20397.5652	-0.0022999	5100.2083	-208.7290	6970.5415
340.000	0.276816	3837424.	18272.5680	-0.0022236	5261.1543	-216.2704	7812.7870
350.000	0.254973	4033364.	16076.4043	-0.0021430	5405.5283	-222.9623	8744.5483
360.000	0.233955	4206099.	13818.1277	-0.0020587	5532.8046	-228.6930	9775.0708
370.000	0.213799	4355018.	11507.8889	-0.0019711	5642.5324	-233.3547	10914.6936
380.000	0.194533	4479621.	9156.8916	-0.0018807	5734.3436	-236.8447	12175.0151
390.000	0.176185	4579531.	6777.3332	-0.0017880	5807.9601	-239.0670	13569.0899
400.000	0.158774	4654503.	4382.3296	-0.0016935	5863.2018	-239.9338	15111.6668
410.000	0.142315	4704434.	1985.8256	-0.0015977	5899.9924	-239.3671	16819.4779
420.000	0.126820	4729369.	-397.5100	-0.0015012	5918.3653	-237.3001	18711.5936
430.000	0.112292	4729509.	-2752.4031	-0.0014044	5918.4686	-233.6786	20809.8638
440.000	0.098733	4705217.	-5063.1062	-0.0013078	5900.5693	-228.4621	23139.4740
450.000	0.086136	4657019.	-7313.5424	-0.0012120	5865.0556	-221.6252	25729.6585
460.000	0.074493	4585610.	-9487.4587	-0.0011174	5812.4394	-213.1581	28614.6312
470.000	0.063788	4491853.	-11568.5873	-0.0010245	5743.3563	-203.0676	31834.8311
480.000	0.054002	4376777.	-13540.8116	-0.0009338	5658.5655	-191.3772	35438.6348
490.000	0.045113	4241579.	-15388.3324	-0.0008456	5558.9474	-178.1269	39484.7925
500.000	0.037091	4087613.	-17095.8298	-0.0007603	5445.5008	-163.3725	44046.0417
510.000	0.029906	3916389.	-18648.6117	-0.0006784	5319.3382	-147.1839	49214.7544
520.000	0.023523	3729566.	-20032.7401	-0.0006002	5181.6811	-129.6418	55112.3600
530.000	0.017903	3528938.	-21235.1129	-0.0005259	5033.8528	-110.8327	61906.4671
540.000	0.013006	3316433.	-22243.4701	-0.0004558	4877.2727	-90.8387	69845.7188
550.000	0.008787	3094097.	-23046.2485	-0.0003902	4713.4491	-69.7170	79343.1078
560.000	0.005201	2864093.	-23632.0905	-0.0003292	4543.9753	-47.4514	91231.5093
570.000	0.002202	2628698.	-23988.2738	-0.0002730	4370.5300	-23.7852	108024.
580.000	-0.000259	2390334.	-24088.6704	-0.0002217	4194.8960	3.7059	142823.
590.000	-0.002232	2151802.	-23920.4812	-0.0001752	4019.1386	29.9319	134130.
600.000	-0.003763	1915778.	-23503.2703	-0.0001336	3845.2297	53.5103	142192.
610.000	-0.004903	1684675.	-22859.7635	-9.6715E-05	3674.9457	75.1911	153364.
620.000	-0.005698	1460711.	-22009.2106	-6.4526E-05	3509.9226	94.9195	166597.
630.000	-0.006193	1245910.	-20971.9356	-3.6827E-05	3351.6512	112.5355	181705.

640.000	-0.006434	1042082.	-19769.9227	-1.3413E-05	3201.4649	127.8671	198734.
650.000	-0.006462	850807.	-18426.7916	5.9588E-06	3060.5275	140.7592	217841.
660.000	-0.006315	673415.	-16967.5586	2.1557E-05	2929.8204	151.0874	239255.
670.000	-0.006030	510981.	-15418.2941	3.3678E-05	2810.1342	158.7655	263275.
680.000	-0.005641	364309.	-13805.7215	4.2636E-05	2702.0615	163.7491	290266.
690.000	-0.005178	233929.	-12156.7804	4.8758E-05	2605.9939	166.0392	320681.
700.000	-0.004666	120100.	-10498.1707	5.2381E-05	2522.1217	165.6828	355071.
710.000	-0.004130	22812.9678	-8855.8907	5.3843E-05	2450.4376	162.7732	394116.
720.000	-0.003589	-58202.1234	-7254.7807	5.3481E-05	2476.5133	157.4488	438660.
730.000	-0.003060	-123459.	-5718.0843	5.1622E-05	2524.5967	149.8905	489764.
740.000	-0.002557	-173699.	-4267.0399	4.8581E-05	2561.6152	140.3184	548789.
750.000	-0.002089	-209869.	-2920.5138	4.4656E-05	2588.2658	128.9868	617505.
760.000	-0.001664	-233092.	-1694.6916	4.0123E-05	2605.3775	116.1776	698284.
770.000	-0.001286	-244645.	-602.8431	3.5234E-05	2613.8901	102.1921	794412.
780.000	-0.000959	-245924.	344.8144	3.0213E-05	2614.8324	87.3394	910652.
790.000	-0.000682	-238414.	1141.1202	2.5257E-05	2609.2985	71.9217	1054382.
800.000	-0.000454	-223657.	1781.7739	2.0528E-05	2598.4256	56.2090	1238208.
810.000	-0.000272	-203230.	2264.7830	1.6159E-05	2583.3740	40.3928	1487411.
820.000	-0.000131	-178717.	2589.0385	1.2251E-05	2565.3124	24.4583	1870338.
830.000	-2.66E-05	-151719.	2748.7665	8.8689E-06	2545.4190	7.4873	2819627.
840.000	4.66E-05	-123937.	2722.6428	6.0479E-06	2524.9488	-12.7120	2727397.
850.000	9.44E-05	-97398.8211	2537.1238	3.7828E-06	2505.3946	-24.3918	2583757.
860.000	0.000122	-73277.8188	2252.1003	2.0362E-06	2487.6216	-32.6129	2667394.
870.000	0.000135	-52401.6105	1897.1908	7.5000E-07	2472.2394	-38.3690	2839460.
880.000	0.000137	-35350.5022	1494.4462	-1.4803E-07	2459.6756	-42.1799	3072883.
890.000	0.000132	-22509.4294	1061.4268	-7.4016E-07	2450.2139	-44.4239	3361198.
900.000	0.000122	-14105.6834	755.2141	-1.1149E-06	2444.0218	-16.8186	1373373.
910.000	0.000110	-7380.6197	594.9885	-1.3348E-06	2439.0666	-15.2265	1385873.
920.000	9.58E-05	-2176.5481	451.8970	-1.4326E-06	2435.2321	-13.3918	1398373.
930.000	8.12E-05	1688.8364	327.6437	-1.4375E-06	2434.8727	-11.4589	1410873.
940.000	6.70E-05	4407.9511	222.6549	-1.3752E-06	2436.8762	-9.5388	1423373.
950.000	5.37E-05	6172.1885	136.3965	-1.2669E-06	2438.1762	-7.7128	1435873.
960.000	4.17E-05	7163.7520	67.6495	-1.1304E-06	2438.9068	-6.0366	1448373.

970. 000	3. 11E- 05	7550. 0474	14. 7449	- 9. 7983E- 07	2439. 1914	- 4. 5444	1460873.
980. 000	2. 21E- 05	7480. 2058	- 24. 2442	- 8. 2601E- 07	2439. 1400	- 3. 2534	1473373.
990. 000	1. 46E- 05	7083. 3359	- 51. 3486	- 6. 7697E- 07	2438. 8475	- 2. 1674	1485873.
1000.	8. 54E- 06	6468. 1273	- 68. 5854	- 5. 3829E- 07	2438. 3942	- 1. 2799	1498373.
1010.	3. 82E- 06	5723. 4696	- 77. 8717	- 4. 1353E- 07	2437. 8455	- 0. 5773265	1510873.
1020.	2. 72E- 07	4919. 7906	- 80. 9652	- 3. 0461E- 07	2437. 2534	- 0. 0413767	1523373.
1030.	- 2. 27E- 06	4110. 8662	- 79. 4282	- 2. 1219E- 07	2436. 6573	0. 3487911	1535873.
1040.	- 3. 97E- 06	3335. 8955	- 74. 6090	- 1. 3598E- 07	2436. 0863	0. 6150366	1548373.
1050.	- 4. 99E- 06	2621. 6774	- 67. 6390	- 7. 5012E- 08	2435. 5600	0. 7789629	1560873.
1060.	- 5. 47E- 06	1984. 7653	- 59. 4392	- 2. 7870E- 08	2435. 0908	0. 8610094	1573373.
1070.	- 5. 55E- 06	1433. 5073	- 50. 7349	7. 1113E- 09	2434. 6846	0. 8798373	1585873.
1080.	- 5. 33E- 06	969. 9102	- 42. 0760	3. 1707E- 08	2434. 3430	0. 8519574	1598373.
1090.	- 4. 91E- 06	591. 2906	- 33. 8584	4. 7684E- 08	2434. 0640	0. 7915546	1610873.
1100.	- 4. 38E- 06	291. 6933	- 26. 3483	5. 6720E- 08	2433. 8432	0. 7104646	1623373.
1110.	- 3. 78E- 06	63. 0768	- 19. 7047	6. 0351E- 08	2433. 6748	0. 6182646	1635873.
1120.	- 3. 17E- 06	- 103. 7275	- 14. 0011	5. 9935E- 08	2433. 7047	0. 5224439	1648373.
1130.	- 2. 58E- 06	- 218. 2640	- 9. 2458	5. 6640E- 08	2433. 7891	0. 4286244	1660873.
1140.	- 2. 04E- 06	- 289. 8890	- 5. 3986	5. 1439E- 08	2433. 8419	0. 3408085	1673373.
1150.	- 1. 55E- 06	- 327. 3678	- 2. 3864	4. 5123E- 08	2433. 8695	0. 2616353	1685873.
1160.	- 1. 13E- 06	- 338. 6094	- 0. 1150591	3. 8307E- 08	2433. 8778	0. 1926300	1698373.
1170.	- 7. 86E- 07	- 330. 5118	1. 5203	3. 1460E- 08	2433. 8718	0. 1344376	1710873.
1180.	- 5. 05E- 07	- 308. 8959	2. 6276	2. 4916E- 08	2433. 8559	0. 0870323	1723373.
1190.	- 2. 87E- 07	- 278. 5073	3. 3123	1. 8905E- 08	2433. 8335	0. 0498998	1735873.
1200.	- 1. 27E- 07	- 243. 0660	3. 9901	1. 3567E- 08	2433. 8074	0. 0856689	6750000.
1210.	- 1. 61E- 08	- 199. 0031	4. 4729	9. 0431E- 09	2433. 7749	0. 0108815	6750000.
1220.	5. 39E- 08	- 153. 8073	4. 3452	5. 4325E- 09	2433. 7416	- 0. 0364125	6750000.
1230.	9. 25E- 08	- 112. 2180	3. 8509	2. 7101E- 09	2433. 7110	- 0. 0624571	6750000.
1240.	1. 08E- 07	- 76. 8492	3. 1736	7. 7520E- 10	2433. 6849	- 0. 0729983	6750000.
1250.	1. 08E- 07	- 48. 7630	2. 4440	- 5. 1028E- 10	2433. 6642	- 0. 0729223	6750000.
1260.	9. 79E- 08	- 27. 9579	1. 7488	- 1. 2954E- 09	2433. 6489	- 0. 0661095	6750000.
1270.	8. 21E- 08	- 13. 7576	1. 1411	- 1. 7223E- 09	2433. 6385	- 0. 0554341	6750000.
1280.	6. 35E- 08	- 5. 0975	0. 6496662	- 1. 9153E- 09	2433. 6321	- 0. 0428580	6750000.
1290.	4. 38E- 08	- 0. 7221200	0. 2874881	- 1. 9748E- 09	2433. 6289	- 0. 0295776	6750000.

```
1300.   2.40E-08    0.6956832    0.0586121 -1.9751E-09    2433.6288   -0.0161975
6750000.
1310.   4.32E-09    0.4935751   -0.0369434 -1.9629E-09    2433.6287   -0.0029136
6750000.
1320.  -1.53E-08       0.0000       0.0000 -1.9579E-09    2433.6283    0.0103022
3375000.
```

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection              =     1.00000000 in
Computed slope at pile head       =    -0.00000932
Maximum bending moment            =     -13865760. lbs-in
Maximum shear force               =    93591.88759 lbs
Depth of maximum bending moment   =        0.00000 in
Depth of maximum shear force      =        0.00000 in
Number of iterations              =              7
Number of zero deflection points  =              5
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,         y = pile-head displacment in
Type 2 = Shear and Slope,          M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,    S = Pile-head Slope, radians
Type 5 = Deflection and Slope,     R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= 0.500000	M= 0.000	1100000.	0.5000000	3044998.	37185.2215
5	y= 0.500000	S= 0.000	1100000.	0.5000000	-7961505.	63879.8610
4	y= 1.000000	M= 0.000	1100000.	1.0000000	4860707.	49286.3543
5	y= 1.000000	S= 0.000	1100000.	1.0000000	-1.3866E+07	93591.8876

The analysis ended normally.

Summary of Warning Messages

APPENDIX E:

REFERENCES

APPENDIX E

REFERENCES

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CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

November 29, 2023

Leslie Jones
CIDA
15895 SW 72nd Ave, Ste. 200
Portland, OR 97224

RE: Completeness Determination for Conditional Use Application at 163 E. Gower St., Taxlots 51030AD12000 and 51030AD11900 (File: CU 23-03)

Dear Ms. Jones:

Your application for a Conditional Use Permit for a municipal building in a (C1) Limited Commercial zone at 163 E. Gower St. was received on November 28, 2023 and determined to be complete on November 29th. The City has 120 days from this date of determination to exhaust all local review, that period ends on Thursday, March 28, 2024. The first evidentiary hearing for this application will be held on Tuesday, December 19, 2023 at 6:00pm, you may participate in person or by Zoom.

The materials received with this application include:

- Conditional Use application with supplemental Project Memorandum
- Geotech Solutions Inc. Report of Geotechnical Engineering Services dated July 31, 2023

Please be aware that the determination of a complete application is not a decision or a guarantee of outcome for the application.

Please feel free to contact my office at (503) 436-8053, or by email at stclair@ci.cannon-beach.or.us if you have questions regarding this information.

Sincerely,

Robert St. Clair
Planner

Exhibit C-2

CITY OF CANNON BEACH

CITY HALL / POLICE STATION FACILITY REPORT

Volume One
SUMMARY

12.18.2018

SRG

Exhibit C-2

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VOLUME TWO

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INTRODUCTION

The building in which the current City Hall/Police Station is located was built around 1948 and has been maintained as a City Hall for over 40 years. The building was originally constructed to support operations in the local lumber industry.

The facility has many challenges including uneven floors due to settling (sawdust was mixed with dirt to support the slab), walls constructed from hollow block which are very poor at withstanding seismic events, past renovations that seem to have occurred without the expected level of engineering and inadequate (or non-existent) air circulation in occupied areas.

For several years people have talked about building a new City Hall/Police Station facility that would be of adequate size, be constructed in a manner that would improve survivability so that emergency operations could be supported immediately after a disaster, would meet all code requirements for an Emergency Operations facility as well as being better suited to support and enhance community events.

In March of 2018 the City commissioned a local Architectural firm to put together a team to analyze the feasibility of renovating the current City Hall/Police Station.

This was their conclusion:
"It is the opinion of the Tolovana Architect and our consultants that the useful life of the current City Hall building has been realized. Since it was constructed for the storage and sale of building materials, the construction techniques employed were not meant for a higher occupant load or increased structural capacities of a public building. When considering the many phases of expansion over its history, the building is simply not able to be remodeled in an economic manner as compared to constructing a new facility."

In August of 2018 the City Council directed staff to initiate the process to determine the necessary elements and estimated costs for a modern City Hall/Police Station in Cannon Beach. The City hired the Portland firm of the SRG Partnership to put together a team to do the initial studies for a new facility.

The product of the project team is this City Hall/Police Station Facility Report that defines all work spaces in terms of size, unique characteristics and adjacency requirements, advanced study of the foundation considerations, project budget including the building cost per square foot and the allowance for site work.

This study shows that the costs of a new City Hall/Police Station is higher than most people would suspect. The reason is that the two building sites available both have significant foundation challenges and the facility will be built to higher structural standards than a residence or a commercial building.

The following report should help the reader understand these considerations as the decision process for a new City Hall/Police Station progresses.

EXECUTIVE SUMMARY

The purpose of this study was to determine the costs to develop a new City Hall / Police Station on two different sites in order to provide the project cost information needed for development of a referral which asks voters to approve general obligation bonds to build the facility.

The first step in the process was to develop a program for the new facility. In order to determine the size and quantity of spaces needed, the design team interviewed existing facility staff and users and surveyed the existing building. The discussion included projecting future growth for each department.

After developing a conceptual space adjacency diagram - which illustrates the important relationships between the various spaces, both sites were evaluated and options for where to place the building on each site were tested.

Criteria for development of the Gower Street Site included the need to maintain as much parking as possible for the City Hall / Police Station site in the redevelopment and the need for the facility to remain operational during construction.

For the South Wind site, consideration for future site amenities, including a school, an emergency preparedness center and additional residential development was given when developing the potential site location for the center. South Wind Option A includes only the costs for the utility infrastructure needed for the City Hall / Police, while Site Option B includes the costs for utility infrastructure sized to include the future school, emergency preparedness center and / or residential development. The costs for developing those facilities and associated parking for the future buildings is not included in this project cost. The costs for widening Highway 101 per ODOT requirements to allow for proper ingress and egress from the site are also included, as are the costs for development a roadway from Highway 101 to the existing gravel road in order to allow the Police to have a second way out of the site in case of emergency. A geotechnical investigation is currently underway which will determine the foundation and site measures needed to mitigate the site's know landslide risk.

Exhibit C-2

PROJECT COST COMPARISON CHART

Option	Size	Direct Construction	Cost per SF	Soft Costs	Other Costs	Project Cost
GOWER STREET SITE OPTION A	16,000 sf	$10,121,398	$632.59	$4,391,880	NA	$14,513,278
- one story non-tsunami resistant building						
- includes site work and parking lot						
GOWER STREET SITE OPTION B	16,400 sf	$11,333,471	$691.07	$4,834,241	NA	$16,167,712
- two story tsunami resistant building to M level						
- includes site work and both a parking lot to the south and to the east of the site						
Additional Cost for Tsunami Resistant Building	**$1,654,435**					
SOUTH WIND SITE OPTION A	16,600 sf	$19,883,943	$1,197.83	$6,956,551	$388,994	$27,229,488
- 1 1/2 story tsunami resistant building above XXL line						
- includes required highway improvements						
- includes utilities for Police / City Hall / Police Station Only						
SOUTH WIND OPTION B	16,600 sf	$20,285,088	$1,221.99	$7,055,517	$388,994	$27,729,599
- 1 1/2 story tsunami resistant building above XXL line						
- includes required highway improvements						
- includes utilities for full build out of site						
Additional Cost for Building Out Site Utilities	**$500,111**					

DRAFT - ADDITIONAL INVESTIGATION ONGOING TO DETERMINE
COSTS RELATED TO SLIDE RISK ON THE SOUTH WIND SITE AND
COSTS TO PURCHASE RIGHT OF WAY TO ACCESS SITE FROM 101

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PROGRAM DEVELOPMENT

Project programming is the phase where what you need to know before beginning the design of the building is developed. It is a process that the architect leads a client through to identify and articulate what the project's objectives and constraints are now and in the future.

Detailed programming is imperative to a successful project. It is the crucial process of gathering, organizing, and assessing a client's building-use information. This process includes program objectives, staff and employee projections, current and future space requirements, adjacencies and relationships, equipment and utility requirements, and developing an estimated project cost. Programming precedes the design process and does not include the development of the design or floor plans.

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Exhibit C-2

PROGRAM SUMMARY

The program summary below was developed in conjunction with the City Hall and Police Department Heads, with input from their staff during two day-long workshops held at the current City Hall / Police Station. The proposed program is intended to account for growth in each department for the next 15 to 20 years. Additional growth can easily be accommodated in all options, except for the Gower Street Option A scheme.

A detailed program with both current and proposed square footage for each room is in included in Volume 2 of this report.

FUNCTION	SPACE ID		Existing	Proposed	% Increase
Public Works	**1**		**373**	**457**	**123%**
Community Development	**2**		**346**	**407**	**147%**
Executive	**3**		**263**	**286**	**109%**
Farmer's Market	**4**		**63**	**170**	**270%**
Finance	**5**		**487**	**561**	**115%**
HRAP	**6**		**1,158**	**1,258**	**109%**
IT	**7**		**144**	**243**	**169%**
Community Spaces	**8**		**1,369**	**1,776**	**130%**
Public Safety / Police Department	**9**		**1,338**	**2,869**	**214%**
Shared	**10**		**2,163**	**1,469**	**68%**
Garage	10.1			600	
Additional Bay for Farmers Market / Wheel chairs				200	
			Sub-total SF	**800**	
			NET AREA (approx.) SF	**12,008**	**135%**
			GROSS AREA (approx.) SF	**16,000**	**174%**

not including Garage

Exhibit C-2

SPATIAL RELATIONSHIP DIAGRAM

A spatial relationship diagram graphically depicts the proposed program adjacencies based on the interviews performed as part of the programming phase. This diagram is not intended to represent the building floor plan.

The diagram is intended to show relationships of the various program elements to each other and is independent of site factors.

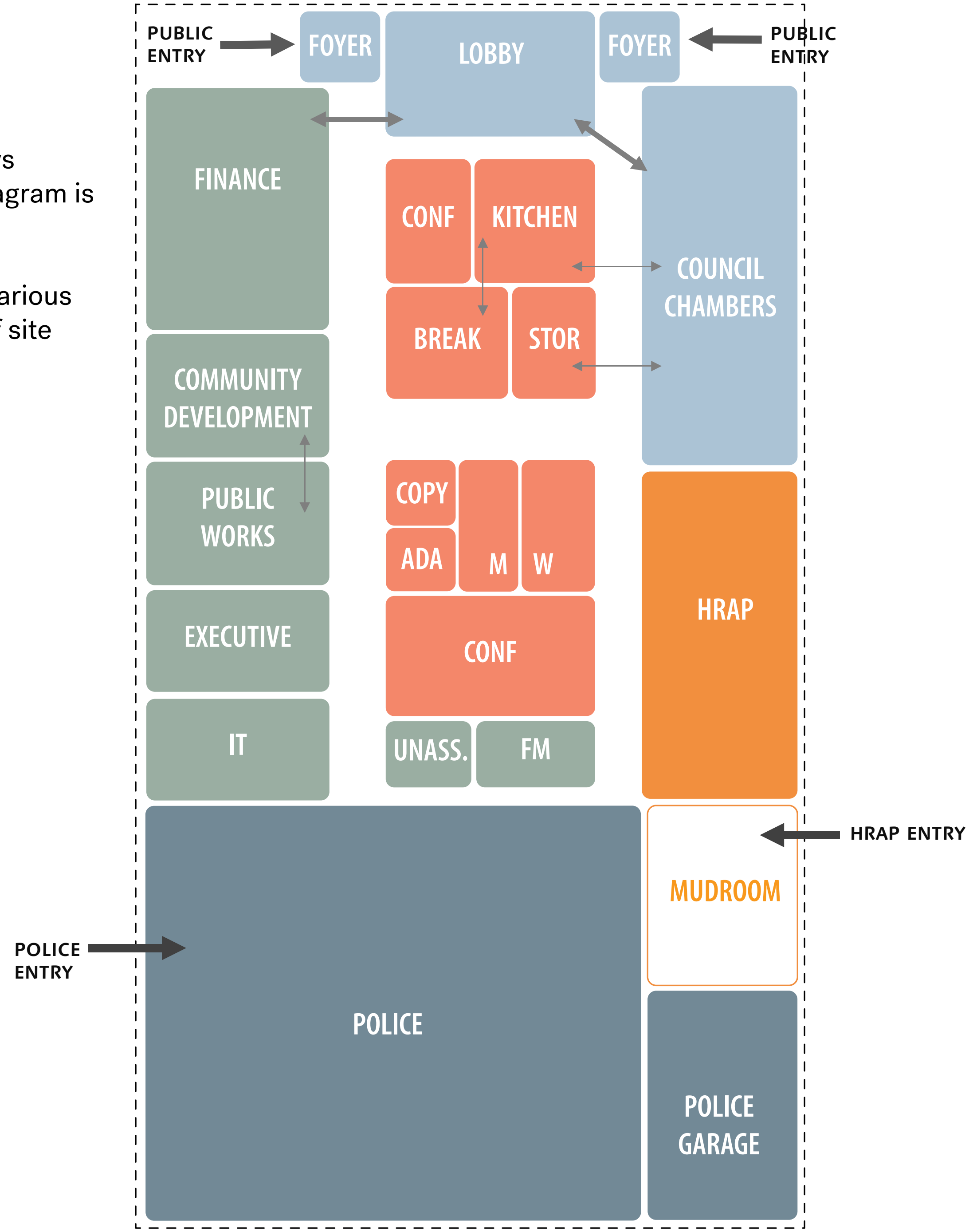

Exhibit C-2

SITE OPTIONS

This study evaluated the potential development of two possible sites for the new City Hall / Police Station.

The first site analyzed, called the Gower Street site includes 3 parcels, the parcel between Hemlock and Evergreen that is currently used for parking, the parcel that the current City Hall / Police Station is located on and the parcel that contains the gravel parking lot immediately to the east of the current facility. This site is within the Tsunami Inundation zone. The study determined it could be possible to build a structure that would resist a medium tsunami event, allowing a second floor to be occupied after that event.

The second site analyzed, called the South Wind site, is a 55 acre parcel approximately 1.5 miles south of the current City Hall / Police Station. The parcel is accessed from Highway 101 and is currently undeveloped. A gravel / dirt access road from the south exists on the site. This site is above the XXL Tsunami inundation zone.

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Exhibit C-2

GOWER STREET SITE

1.22 Acres

Site has the potential to provide additional parking for tourists near Haystack Rock.

Site is immediately adjacent to current site in the heart of the City of Cannon Beach

Site can be accessed directly from Hemlock / Evergreen Streets.

No additional site infrastructure modifications are required.

Site is below the XXL Tsunami Inundation zone, but the second floor of a building could be designed to be tsunami resistant for a medium size event

Site has a required setback of 15’ from residential areas to the south and east.

SOUTH WIND SITE

55 Acres

Site is large enough for other facilities in addition to the City Hall / Police Station to be included on the site.

Site is located approximately 1.5 miles south of current site.

Site can be accessed directly from Highway 101, however modifications will be required in order to meet the ODOT requirements for ingress and egress from Highway 101.

Additional utility infrastructure is required to develop this site.

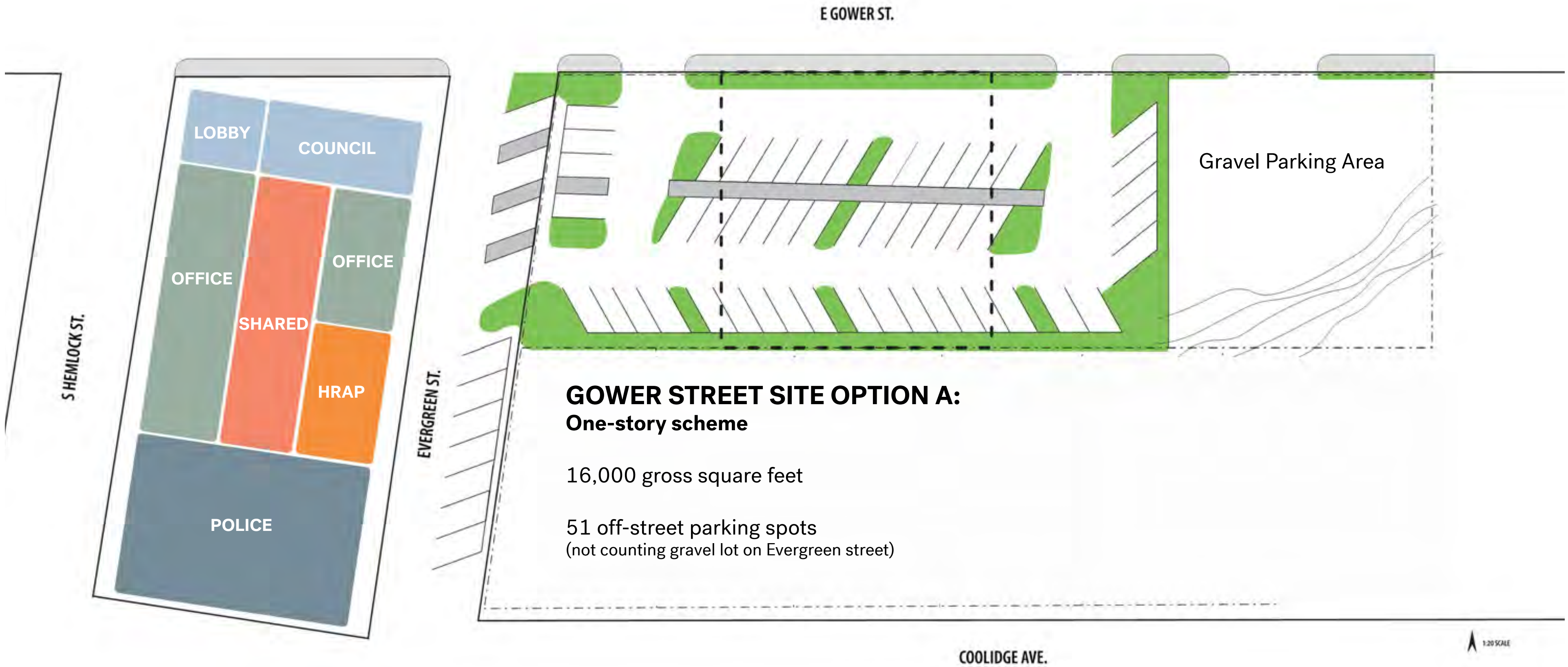
Site is above the XXL Tsunami Inundation zone, but has had slides in the past.

Site has a 100’ setback from Highway 101 and a 280’ setback from the residential area to the north.

After initially developing 5 options for the Gower Street site and 2 options for the South Wind site, the development team with input from staff decided to proceed with cost estimating for two options on the City Hall / Police Station site and two options for the South Wind site. The options are intended to provide a range of costs for the various options. They are not intended to be design solutions or specific recommendations about an approach to proceed with.

GOWER STREET Site - Option A:	This option depicts a generic layout for a one story building located on the portion of the site between Hemlock and Evergreen streets. Parking is located on the eastern portion of the site.
GOWER STREET Site - Option B:	This option depicts a generic layout for a two story building located on the northern portion of the site between Hemlock and Evergreen streets. Parking is located on the both the eastern and southern parts of the site. The foundation system proposed for this option is proposed to be robust enough to withstand a medium size tsunami event, which would then allow the upper floor of the building to serve as an emergency command center.
SOUTH WIND Site - Option A:	This option depicts a generic layout for a one and half story building located on the southern portion of the center build-able site identified by the Horning Geosciences Report. This placement allows for future development of the site but only the costs for infrastructure needed for the City Hall / Police Station are included in the cost estimate. Improvements to Highway 101 required to ingress to and egress from the site are included. Parking for the building is also included in the cost estimate. Foundations for this option are currently under review. A foundation contingency has been included, but it will need to be revised after the geotechnical investigation is finalized and a strategy for mitigating the slide risk is developed. The site itself is above the XXL Tsunami Inundation line.
SOUTH WIND Site - Option B:	In addition to all of the items noted for South Wind Site Option A, this option also includes the costs to build the utility infrastructure needed for the future school, emergency preparedness center and residential development.

Exhibit C-2



GOWER STREET SITE OPTION A:
One-story scheme

16,000 gross square feet

51 off-street parking spots
(not counting gravel lot on Evergreen street)

FIRST FLOOR PLAN

PROS:

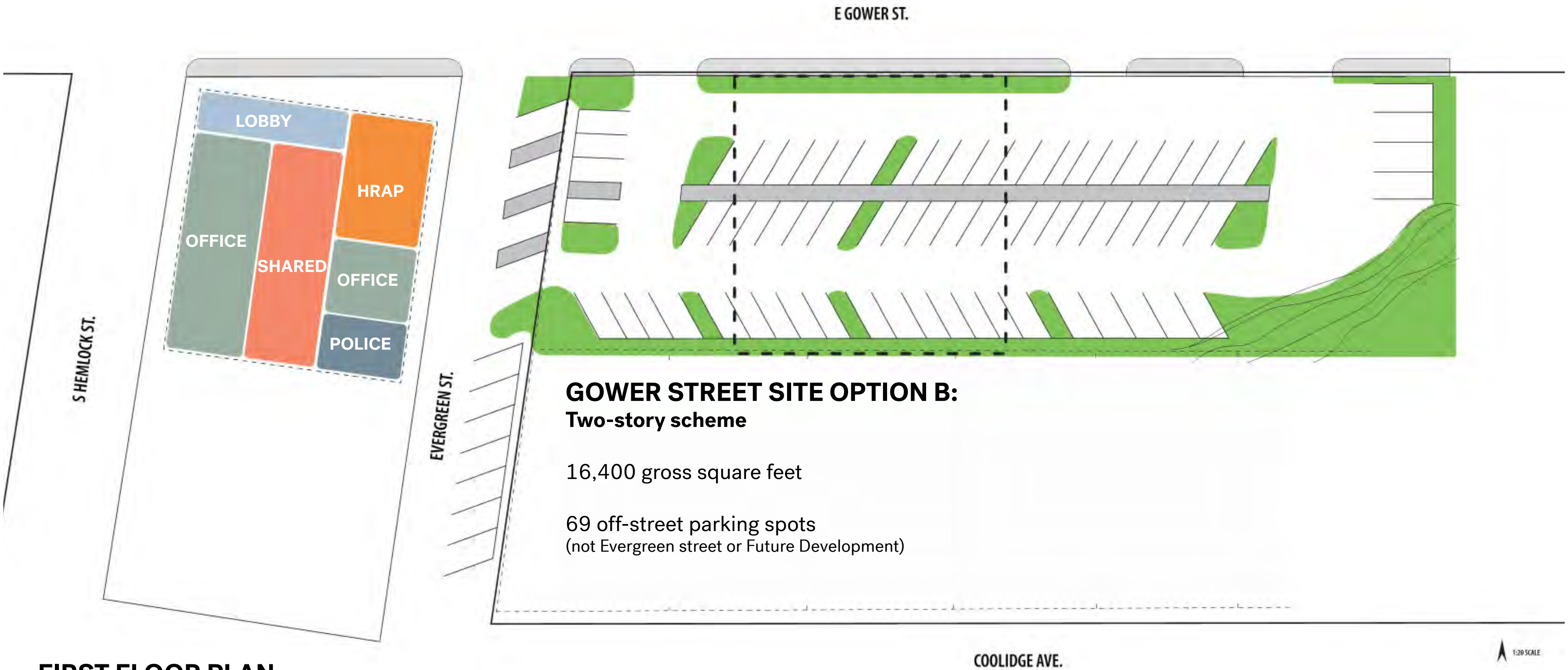
Smallest Structure
City Hall / Police Station is prominent
Parking Consolidated
Police have easy access and 2 ways in and out of site
HRAP has separate Entry

CONS:

Entire structure is below Medium T shirt DOGAMI line
One story structure does allow future development opportunities for the site

UNKNOWNS:
Cost for Soil Remediation

Exhibit C-2



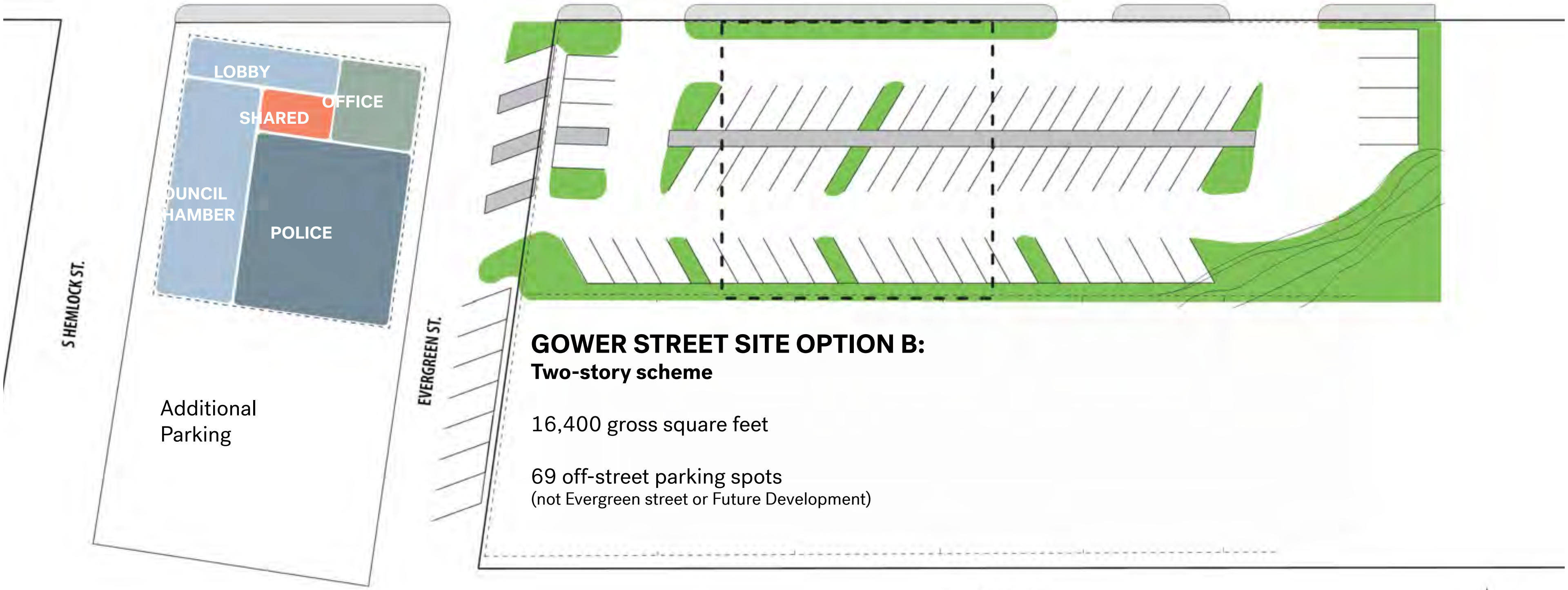
GOWER STREET SITE OPTION B:
Two-story scheme

16,400 gross square feet

69 off-street parking spots
(not Evergreen street or Future Development)

FIRST FLOOR PLAN

Exhibit C-2



GOWER STREET SITE OPTION B:
Two-story scheme

16,400 gross square feet

69 off-street parking spots
(not Evergreen street or Future Development)

SECOND FLOOR PLAN

PROS:

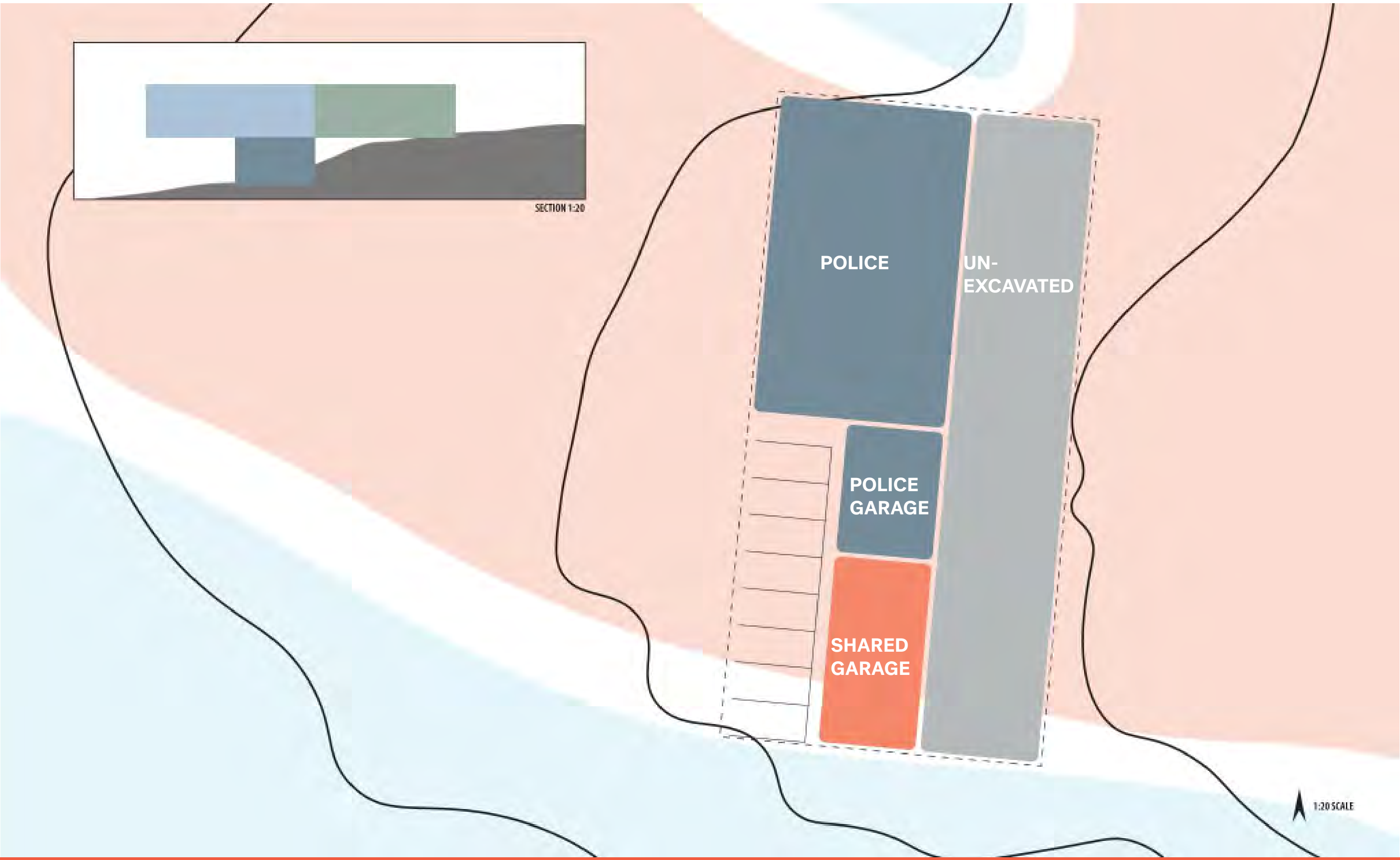
Smallest Footprint = less Foundation
City Hall / Police Station is prominent
Parking Consolidated
Police have easy access and 2 ways in and out of site
HRAP has separate Entry
Police garage is in structure
Upper Level is above Medium T shirt line

CONS:

Added Elevator, stairs and toilet room due to 2 floors
Offices are split between 2 levels

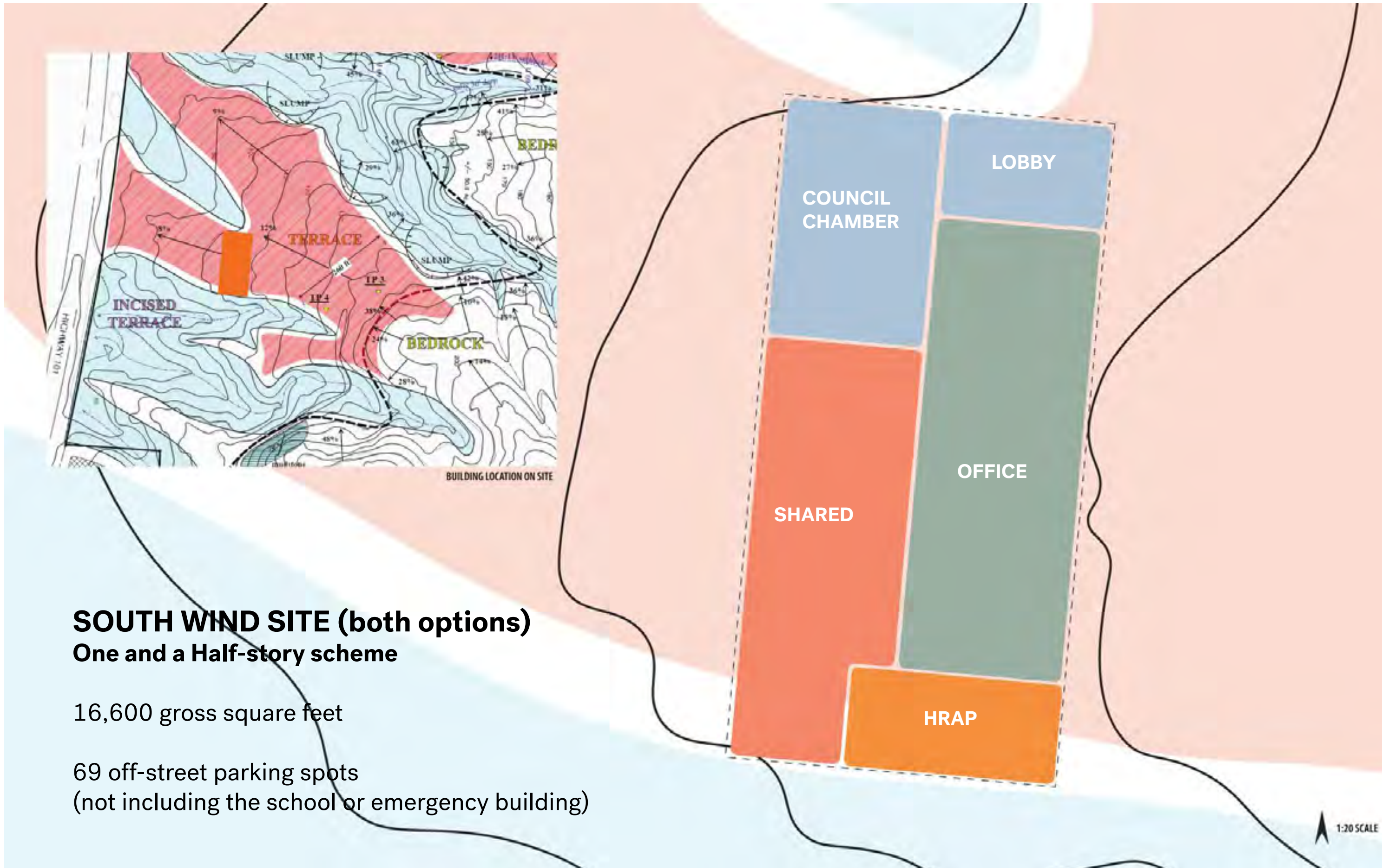
UNKNOWNS:
Cost for Soil Remediation

Exhibit C-2



FIRST FLOOR PLAN

Exhibit C-2



SOUTH WIND SITE (both options)
One and a Half-story scheme

16,600 gross square feet

69 off-street parking spots
(not including the school or emergency building)

SECOND FLOOR PLAN

PROS:

Above the XXL DOGAMI T shirt line

CONS:

More expensive infrastructure
Site slope makes parking difficult to access for ADA
Added highway access costs
Added costs due to site slope and distance from roadway

UNKNOWNS:
Cost for Mitigating Landslide

TOTAL PROJECT COSTS INCLUDES THE FOLLOWING ITEMS:

Net Construction Cost:
Net construction cost includes all the costs associated with building the building, including all subcontractor labor, material and markups.

Direct Construction Cost:
Direct Construction Cost includes Net Construction plus the general contractors overhead and profit, general conditions, bonds and insurance, contingencies, and escalation. Contingencies and Escalation factors are defined on page 1.17.

Soft Costs:
Soft Costs are a construction industry term used to account for expense items that are not considered part of the direct construction cost. Soft costs include architectural, engineering, financing, and legal fees, and other pre- and post-construction expenses. They also include costs for furniture, fixture and equipment needed in order for the Owner to occupy the building, costs for building permits, plan review fees, testing and inspection fees, surveys, and moving costs. An Owner's contingency is also included for unforeseen things in soft costs.

Other Costs:
Other costs are costs associated with the project that are not either direct construction costs or soft costs. Examples include the cost to acquire the Highway 101 right of way. For the South wind Site options, we are including the cost to demolish the existing City Hall / Police Station and replace it with a parking lot in the other costs category.

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Exhibit C-2

		City Hall Option A	City Hall Option B	South Wind Site A	South Wind Site B
		One Story	Two Story	One 1/2 Story	One 1/2 Story
			Tsunami Resistant	Police /City Hall Only	Utilities for Full Build
	square footage	16000	16400	16600	16600
	Estimate Net Construction Costs				
A1010	Standard Foundations	$ 268,475	$ 88,400	$ 207,000	$ 207,000
A1020	Special Foundations		$ 828,000	$ 498,000	$ 498,000
A1030	Slab on Grade	$ 192,000	$ 98,400	$ 50,400	$ 50,400
B1010	Floor Construction		$ 229,600	$ 347,200	$ 347,200
B1020	Roof Construction	$ 436,800	$ 243,860	$ 338,520	$ 338,520
B2010	Exterior Walls	$ 507,580	$ 676,360	$ 656,500	$ 656,500
B2020	Exterior Windows	$ 124,425	$ 166,650	$ 161,625	$ 161,625
B2030	Exterior Doors	$ 48,000	$ 49,200	$ 49,800	$ 49,800
B3010	Roof Coverings	$ 537,600	$ 275,520	$ 416,640	$ 416,640
C1010	Partitions	$ 288,000	$ 295,200	$ 298,800	$ 298,800
C1020	Interior Doors	$ 128,000	$ 131,200	$ 132,800	$ 132,800
C1030	Specialties	$ 147,540	$ 149,340	$ 150,240	$ 150,240
C2010	Stair Construction		$ 40,000	$ 40,000	$ 40,000
C3010	Wall Finishes	$ 142,576	$ 144,976	$ 146,176	$ 146,176
C3020	Floor Finishes	$ 144,000	$ 147,600	$ 149,400	$ 149,400
C3030	Ceiling Finishes	$ 215,680	$ 220,480	$ 222,880	$ 222,880
D10	Conveying		$ 90,000	$ 180,000	$ 180,000
D2010	Plumbing Fixtures	$ 224,000	$ 229,600	$ 232,400	$ 232,400
D2040	Rain Water Drainage	$ 29,600	$ 30,340	$ 30,710	$ 30,710
D3060	Controls and Instrumentation	$ 64,000	$ 65,600	$ 66,400	$ 66,400
D3090	Other HVAC Systems and Equipment	$ 608,000	$ 623,200	$ 630,800	$ 630,800
D4040	Sprinklers	$ 80,000	$ 82,000	$ 83,000	$ 83,000
D5010	Electrical Service and Distribution	$ 197,600	$ 202,540	$ 205,010	$ 205,010
D5020	Lighting and Branch Wiring	$ 256,000	$ 262,400	$ 265,600	$ 265,600
D5030	Communications & Security	$ 201,600	$ 206,640	$ 209,160	$ 209,160
E1090	Other Equipment	$ 10,000	$ 10,000	$ 10,000	$ 10,000
E2010	Fixed Furnishings	$ 201,680	$ 204,880	$ 206,480	$ 206,480
E2020	Movable Furnishings				

Costs for the Yellow highlighted line item are still being developed.

Exhibit C-2

		City Hall Option A One Story	City Hall Option B Two Story Tsunami Resistant	South Wind Site A One 1/2 Story Police /City Hall Only	South Wind Site B One 1/2 Story Utilities for Full Build
G1010	Site Clearing	$ 13,098	$ 10,523	$ 52,189	$ 52,189
G1020	Site Demolition	$ 136,539	$ 104,061		
G1030	Site Earthwork	$ 192,242	$ 147,190	$ 166,768	$ 166,768
G2010	Roadways	$ 45,018	$ 45,018	$ 3,916,385	$ 3,916,385
G2020	Parking Lots	$ 252,455	$ 314,886	$ 233,425	$ 233,425
G2030	Pedestrian Paving	$ 90,840	$ 90,840	$ 377,590	$ 377,590
G2040	Site Development	$ 35,505	$ 35,505	$ 150,000	$ 150,000
G2050	Landscaping	$ 27,188	$ 44,215	$ 72,514	$ 72,514
G3010	Water Supply	$ 6,800	$ 6,800	$ 79,740	$ 319,880
G3020	Sanitary Sewer	$ 3,000	$ 3,000	$ 77,030	$ 77,940
G3030	Storm Sewer	$ 11,500	$ 11,500	$ 165,515	$ 165,515
G3090	Other Site Mechanical Utilities			$ 450,000	$ 450,000
G4020	Site Lighting	$ 104,784	$ 84,180	$ 201,680	$ 201,680
G4090	Other Site Utilities	$ 20,000	$ 20,000	$ 20,000	$ 20,000
	Estimated Net Construction Cost	**$ 5,992,125**	**$ 6,709,704**	**$ 11,948,377**	**$ 12,189,427**
0.9%	PreConstruction Fee	$ 53,930	$ 60,387	$ 107,535	$ 109,704
4.0%	Location Factor	$ 241,843	$ 270,803	$ 482,237	$ 491,965
1.5%	Phasing and Temporary Work	$ 94,318	$ 105,614		
10.0%	General Conditions	$ 638,221	$ 714,651	$ 1,253,815	$ 1,279,110
3.0%	Bonds and Insurance	$ 210,613	$ 235,834	$ 413,759	$ 422,107
4.0%	Overhead and Profit	$ 289,242	$ 323,880	568229	$ 579,693
15.0%	Design Contingency	$ 1,128,044	$ 1,263,131	$ 2,216,093	$ 2,260,801
3.0%	CMGC Contingency	$ 259,450	$ 290,520	$ 509,701	$ 519,985
2.0%	Market Volatility Contingency	$ 178,156	$ 199,491	$ 349,995	$ 357,055
9.75%	Escalation to 3Q2020	$ 899,167	$ 1,006,846	$ 1,766,455	$ 1,802,093
1.5%	Solar / Green Energy	$ 136,289	$ 152,610	$ 267,747	$ 273,148
	Total Direct Construction	**$ 10,121,398**	**$ 11,333,471**	**$ 19,883,943**	**$ 20,285,088**
	Cost per square Foot	$ 632.59	$ 691.07	$ 1,197.83	$ 1,221.99

Exhibit C-2

		City Hall Option A One Story	City Hall Option B Two Story Tsunami Resistant	South Wind Site A One 1/2 Story Police /City Hall Only	South Wind Site B One 1/2 Story Utilities for Full Build
	Soft Costs				
8.5%	Design Fees	$ 860,319	$ 963,345	$ 1,690,135	$ 1,724,232
varies	Additional Site Contingency	$ 253,035	$ 283,337	$ -	$ -
	Site Engineering Fees		$ 100,000.00	$ 250,000.00	$ 250,000.00
	Building Permit Costs	$ 33,171	$ 37,110	$ 64,899	$ 66,203
	Mechanical Permit Cost	$ 5,000	$ 5,000	$ 5,000	$ 5,000
	Plumbing Permit Cost	$ 4,000	$ 4,000	$ 4,000	$ 4,000
	Structural Plan Review	$ 21,561	$ 24,122	$ 42,185	$ 43,032
	Fire and Life Safety Fee	$ 21,561	$ 24,122	$ 42,185	$ 43,032
	Mechanical Plan Review Fee	$ 3,250	$ 3,250	$ 3,250	$ 3,250
	Plumbing Plan Review Fee	$ 2,600	$ 2,600	$ 2,600	$ 2,600
	State Surcharge	$ 10,937	$ 12,024	$ 19,694	$ 20,054
	Inspection Fees	$ 25,000	$ 25,000	$ 100,000	$ 100,000
	Surveys	$ 50,000	$ 50,000	$ 150,000	$ 150,000
	Geotechnical studies	$ 30,000	$ 30,000	completed	completed
	Environmental Studies	$ 25,000	$ 25,000	$ 25,000	$ 25,000
	Furniture Fixture and Equipment	$ 352,000	$ 352,000	$ 352,000	$ 352,000
	Fee for FFE Design / Specifications	$ 35,200	$ 35,200	$ 35,200	$ 35,200
	IT Budget	$ 400,000	$ 400,000	$ 400,000	$ 400,000
	City Project Management Fees	$ 85,000	$ 85,000	$ 85,000	$ 85,000
	Legal Fees	$ 300,000	$ 300,000	$ 300,000	$ 300,000
	Move in Costs	$ 150,000	$ 150,000	$ 150,000	$ 150,000
4%	Construction Contingency	$ 404,856	$ 453,339	$ 795,358	$ 811,404
10%	Owners Contingency	$ 1,319,389	$ 1,469,792	$ 2,440,045	$ 2,485,510
	TOTAL Soft Costs	**$ 4,391,880**	**$ 4,834,241**	**$ 6,956,551**	**$ 7,055,517**

Costs for the Yellow highlighted line item are still being developed.

Exhibit C-2

	City Hall Option A One Story		City Hall Option B Two Story Tsunami Resistant		South Wind Site A One 1/2 Story Police /City Hall Only		South Wind Site B One 1/2 Story Utilities for Full Build	
Cost to Aquire Right of Way								
Cost for Demolition of Existing City Hall	included above		included above			$136,539		$136,539
Cost for Converting site to parking lot	included above		included above		$	252,455	$	252,455
Total Other Costs					**$**	**388,994**	**$**	**388,994**
TOTAL PROJECT COST	**$**	**14,513,278**	**$**	**16,167,712**	**$**	**27,229,488**	**$**	**27,729,599**
Direct construction + Soft Costs + Other Costs								

Costs for the Yellow highlighted line item are still being developed.

Definitions:

Design Contingency – This is an allocation of funds to cover anticipated but as yet undefined costs related to incomplete design. Ideally as the design progresses the Design Contingency is reduced to reflect more defined scope, but the cost of work above the line increases proportionally as more detailed line items are added. It is not meant to cover added scope or costs related to unforeseen site conditions.

CMGC (or Construction) Contingency – This is a CMGC's contingency primarily to cover costs to mitigate impacts due to unforeseen site conditions/constraints. It is only carried when CMGC is the chosen procurement model. It is not carried in estimates for projects using traditional (Design-Bid-Build) procurement. It is not meant to cover design development or added scope.

Owner Contingency – This is typically NOT carried in construction estimates but rather in the Owner's soft cost budget and it is an allocation of funds to cover added scope or "wish list" items.

Market Volatility Contingency – This is an allocation of funds to account for cost increases related to local market forces. It is also sometimes referred to as a "bidding contingency". In a hot market such as Portland, general contractors sometimes struggle to get subcontractors to bid on work in certain trades and the lack of competition causes the bids they do get to be inflated. This contingency tries to address that risk.

Location Factor – This is an allocation of funds to account for the fact that this project is located far enough from any urban centers that travel costs (vehicles, fuel, drive time, per diem, lodging in some cases, etc.) will likely be incurred by multiple subcontractors that will increase their prices.

Escalation – This is an allocation of funds to account for normal cost increases related to the passage of time from the estimating phase until the buyout/construction phase. Estimates are typically done in today's dollars and then escalation is added to account for material cost increases, labor rate increases, equipment cost increases, etc. In large jobs where design can take years, escalation can be a substantial cost to the project.

FINANCING:

Staff and our consultants are looking at various ways to fund the City Hall / Police Station Project.

One option is to fund 100% of the project through the issuance of General Obligation bonds.

Our financial consultant has indicated that in today's market a General Obligation Bond would be $0.75 (seventy-five cents) per $1,000 in assessed value. This would raise bond proceeds of approximately $16,000,000 and is slightly higher than the estimate of the lowest cost option. In this scenario the rough annual cost to a homeowner whose property has an appraised value of $300,000 would see an assessment of $225 per year or $18.75 per month for a period of 30 years.

The City could also add an additional 1% TRT levy. 30% of those funds could be available for general purposes such as making the bond payments. In 2018-19 we anticipate the 30% (+ $150,000) would generate enough funds to make bond payments that would reduce the amount to be funded out of property taxes by $2.4 million. This has the potential of reducing the annual assessment to property owners to $0.64 per $1,000 of assessed value to an annual levy of $192 or $16.00 per month.

The City is meeting with multiple state agencies at the end of January in order to discuss grant opportunities. We will be seeking grants Public Safety Facilities as well as for Community spaces. There may be other grant opportunities that will be pursued also. Another factor to consider is that the estimated construction costs that have been generated at this time include significant contingencies for various items. We have been conservative in these estimates, so we anticipate the projected costs of the City Hall / Police Station will likely go down from what you see now.

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CITY OF CANNON BEACH

November 29, 2023

Dear Property Owner,

Cannon Beach Zoning Ordinance requires notification to property owners within 250 feet, measured from the exterior boundary, of any property which is the subject of the proposed applications. Your property is located within 250 feet of the above-referenced property or you are being notified as a party of record.

Please note that you may submit a statement either in writing or orally at the hearing, supporting or opposing the proposed action. Your statement should address the pertinent criteria, as stated in the hearing notice. Statements in writing must be received by the date of the hearing.

Enclosed are copies of the public hearing notice, a description of how public hearings are conducted and a map of the subject area. Should you need further information regarding the relevant Zoning Ordinance, Subdivision Ordinance or Comprehensive Plan criteria, please contact Cannon Beach City Hall at the address below, or call Emily Bare at (503) 436-8054 or email bare@ci.cannon-beach.or.us.

Sincerely,

EBare

Emily Bare
Administrative Assistant
Community Development

Enclosures: Notice of Hearing
Conduct of Public Hearings
Map of Subject Area

NOTICE OF PUBLIC HEARING
CANNON BEACH PLANNING COMMISSION

The Cannon Beach Planning Commission will hold a public hearing on **Tuesday, December 19, 2023,** at **6:00 p.m.** at City Hall, 163 E Gower Street, Cannon Beach, regarding the following:

ZO #23-03 CIDA proposed Comprehensive Plan Amendment & Zone Change for Taxlot 41006B000200, an undeveloped property located at 81389 N HWY 101. The property is currently zoned (IR) Institutional Reserve, and the request is to change the zoning classification to (IN) Institutional. The request will be reviewed under Municipal Code section 17.86, Amendments, provisions established.

CU #23-03 CIDA application for a Conditional Use Permit for a municipal building in a commercial zone at 163 E. Gower St., Taxlots 51030AD120000 and 51030AD11900. The property is a developed parcel with an existing municipal building that is zoned (C1) Limited Commercial. The request will be reviewed under Municipal Code Section 17.80, Conditional Uses.

CU #23-04 Red Crow LLC/Jamie Lerma application on behalf of Patrick/Dave LLC for a Conditional Use Permit for the purpose of creating a private use boardwalk spanning a delineated wetland and its buffer area. The property is located on Forest Lawn Road, Taxlot 51030DA04100 and is zoned (R2) Residential Medium Density. The request will be reviewed under Municipal Code Section 17.80, Conditional Uses.

All interested parties are invited to attend the hearings and express their views. Statements will be accepted in writing or orally at the hearing. Failure to raise an issue at the public hearing, in person or by letter, or failure to provide statements or evidence sufficient to afford the decision maker an opportunity to respond to the issue precludes appeal to the Land Use Board of Appeals based on that issue.

Correspondence should be mailed to the Cannon Beach Planning Commission, Attn. Community Development, PO Box 368, Cannon Beach, OR 97110 or via email at planning@ci.cannon-beach.or.us. Written testimony received one week prior to the hearing will be included in the Planning Commissioner's meeting materials and allow adequate time for review. Materials and relevant criteria are available for review at Cannon Beach City Hall, 163 East Gower Street, Cannon Beach, or may be obtained at a reasonable cost. Staff reports are available for inspection at no cost or may be obtained at a reasonable cost seven days prior to the hearing. Questions regarding the applications may be directed to Robert St. Clair, 503-436-8053, or at stclair@ci.cannon-beach.or.us.

The Planning Commission reserves the right to continue the hearing to another date and time. If the hearing is continued, no further public notice will be provided. The hearings are accessible to the disabled. Contact City Manager, the ADA Compliance Coordinator, at (503) 436-8050, if you need any special accommodations to attend or to participate in the meeting. TTY (503) 436-8097. Publications may be available in alternate formats and the meeting is accessible to the disabled.

NOTICE TO MORTGAGEE, LIEN-HOLDER, VENDOR OR SELLER:
PLEASE PROMPTLY FORWARD THIS NOTICE TO THE PURCHASER

Robert St. Clair
City Planner

Posted/Mailed: 11/29/23

CONDUCT OF PUBLIC HEARINGS BEFORE CANNON BEACH CITY COUNCIL and PLANNING COMMISSION

A. At the start of the public hearing, the Mayor or Planning Commission Chair will ask the following questions to ensure that the public hearing is held in an impartial manner:

1. Whether there is a challenge to the jurisdiction of the City Council or Planning Commission to hear the matter;

2. Whether there are any conflicts of interest or personal biases to be declared by a Councilor or Planning Commissioner;

3. Whether any member of the Council or Planning Commission has had any ex parte contacts.

B. Next, the Mayor or Planning Commission Chair will make a statement which:

1. Indicates the criteria which apply to the action;

2. Cautions those who wish to testify that their comments must be related to the applicable criteria or other criteria in the Comprehensive Plan or Municipal Code that the person testifying believes apply;

3. States that failure to raise an issue in a hearing, or failure to provide statements or evidence sufficient to afford the decision makers an opportunity to respond to the issue precludes appeal based on that issue;

4. Prior to the conclusion of the initial evidentiary hearing, any participant may request an opportunity to present additional evidence or testimony regarding the application. The City Council or Planning Commission shall grant such request by continuing the public hearing or leaving the record open for additional written evidence or testimony.

C. The public participation portion of the hearing will then proceed as follows:

1. Staff will summarize the staff report to the extent necessary to enable those present to understand the issues before the Council or Planning Commission.

2. The Councilors or Planning Commissioners may then ask questions of staff.

3. The Mayor or Planning Commission Chair will ask the applicant or a representative for any presentation.

4. The Mayor or Planning Commission Chair will ask for testimony from any other proponents of the proposal.

5. The Mayor or Planning Commission Chair will ask for testimony from any opponents of the proposal.

6. Staff will be given an opportunity to make concluding comments or respond to additional questions from Councilors or Planning Commissioners.

7. The Mayor or Planning Commission Chair will give the applicant and other proponents an opportunity to rebut any testimony of the opponents.

8. Unless continued, the hearing will be closed to all testimony. The Council or Planning Commission will discuss the issue among themselves. They will then either make a decision at that time or continue the public hearing until a specified time.

NOTE: Any person offering testimony must first state their name, residence, and **mailing address** for the record. If representing someone else, the speaker must state whom he represents.

CU23-05 Notice Area

Disclaimer: The information contained in this GIS application is NOT AUTHORITATIVE and has NO WARRANTY OR GUARANTEE assuring the information presented to you is correct. GIS applications are intended for a visual display of data and do not carry legal authority to determine a boundary or the location of fixed works, including parcels of land. They are intended as a location reference for planning, infrastructure management and general information only. The City of Cannon Beach assumes no liability for any decisions made or actions taken or not taken by the user of the GIS application. The City of Cannon Beach provides this GIS map on an "as is" basis without warranty of any kind, expressed or implied, including but not limited to warranties of merchantability or fitness for a particular purpose, and assumes no liability for any errors, omissions, or inaccuracies in the information provided.

Printed 11 / 29 / 2023

CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

Cannon Beach Planning Commission

Staff Report:

PUBLIC HEARING AND CONSIDERATION OF ZO 23-03, CIDA INC, APPLICANT, ON BEHALF OF THE CITY OF CANNON BEACH, REQUEST FOR A COMPREHENSIVE PLAN AMENDMENT & ZONE CHANGE FOR TAXLOT 41006B000200, A PARTIALLY DEVELOPED PROPERTY ADJACENT TO THE INTERSECTION OF U.S. HIGHWAY 101 AND TOLOVANA MAINLINE RD. THE PROPERTY IS CURRENTLY ZONED INSTITUTIONAL RESERVE (IR) AND THE REQUEST IS TO CHANGE THE ZONING CLASSIFICATION TO INSTITUTIONAL (IN).

Agenda Date: December 19, 2023 **Prepared By**: Community Development Department

General Information

Notice

Public notice for this December 19, 2023 Public Hearing is as follows:

A. Notice was posted at area Post Offices on November 29, 2023;

B. Notice was mailed on November 29, 2023 to surrounding landowners within 250' of the exterior boundaries of the property.

Disclosures

Any disclosures (i.e. conflicts of interest, site visits or ex parte communications)?

Exhibits

The following Exhibits are attached hereto as referenced. All application documents were received at the Cannon Beach Community Development office on October 25, 2023 unless otherwise noted.

"A" Exhibits – Application Materials

A-1 Comprehensive Plan Amendment and Zone Change Application;

"B" Exhibits – Agency Comments

None received as of this writing;

"C" Exhibits – Cannon Beach Supplements

C-1 ZO#23-03 Completeness determination, October 27, 2023;

C-2 Oregon DLCD Post Adoption Plan Amendment (PAPA) memo, October 27, 2023

C-3 South Wind Master Plan, December 17, 2014

C-4 Preliminary Police Department Schematics, November 6, 2023

"D" Exhibits – Public Comment

None received as of this writing;

Summary & Background

CIDA, on behalf of the City of Cannon Beach, is requesting a comprehensive plan amendment and zone change for Taxlot 41006B000200 (subject property) adjacent to the intersection of U.S. Highway 101 and Tolovana Mainline Rd. The parcel was acquired by the City as part of the purchase of the larger South Wind site in 2013 and its zoning classification is Instititonal Reserve (IR). Adjacent properties on the east side of Highway 101 include the two other City owned taxlots that comprise the Southwind site and one approximately 0.5 acre taxlot owned by L&C Tree Farms LLC. The City owned properties are within city limits and are undeveloped with the exception of an emergency services cache site located on the subject property.

After acquiring the proeprty the South Wind Master Plan was finalized in December 2014. This plan detailed current conidtions and outlined potential development as well as roads and utility access. This plan states that the City intends to use the site for critical and essential facilities and services because the property is largely above the reach of the largest predicted tsunami. Potential uses detailed in the plan include a police station, fire station, emergency operations center, day care facilities, a medical clinic, food bank, and any replacement for the former Cannon Beach Elementary School. The plan shows these uses being clustered on a portion of Taxlot 41006B000100 that was cleared through timber harvest in 2013.

The purpose of this application is to change the zoning classification of the subject property from Institutional Reserve (IR) to Institutional (IN) for the purpose of constructing a new police station and emeregency operations center on that site. The current zoning classification allows for a range of forestry operations and miscelaneous activities as permitted or conditional uses, but it does not allow for any significant level of developent. The proposed zoning classification allows for community buidings as a use permitted outright. A police station is consdiered a community building and would be a permitted use in this zone.

As this application is for a single property that will not affect a broad area or number of property owners it is considered a quasi-judicial ammendment action as defined by CMBC 17.86.050.

Applicable Criteria

The peritent criteria to be considered are found in CMBC 17.86.070(B) – Ammendments, Criteria.

B. Before an amendment to a zone boundary is approved, findings will be made that the following criteria are satisfied:

1. The amendment is consistent with the comprehensive plan;

Staff Comment: The subject property's land use planning framework is detailed in the South Wind Master Plan which was developed in response to the unique nature of the site and its intended purposes at the time of acquisition and annexation into the City. This plan mandates that the property be used by the City for municipal or other community buildings that serve a public purpose, a requirement which the intended development is consistent with.

The Tolovana Park Policies of the Comprehensive Plan mandate that the Tolovana Park neighborhood remain primarily residential in nature. This neighborhood is separated from the subject property by U.S. Highway 101 which provides a barrier between it and the subject property. The proposed police station has no apparent inconsistencies with the primarily residential nature of the neighborhood and no significant level of additional development is planned or anticipated in conjunction with the new police station project.

Due to current and anticipated future levels of tourism, there is a significant pressure placed on the City's police department. The new station will increase the ability of the department to provide more efficient and effective services to residents and visitors.

2. *The amendment will either:*

   a. *Satisfy land and water use needs, or*

   b. *Meet transportation demands, or*

   c. *Provide community facilities and services;*

Staff Comment: The amendment will allow for the provision of community facilities and services through the construction of a new police station and retention of and possible future improvements to the existing cache site managed by the City's Emergency Services program.

The City has long considered this property for development new essential facilities above the tsunami inundation line. The City's goal for the Police Station project is to develop a structure that will facilitate the department's ability to provide day to day services, while being constructed to remain operational following a seismic or tsunami event. The proposed Emergency Operations Center will be designed to function as an epicenter during all phases of resiliency efforts. The requested zone change will allow the development of the Police Station and Emergency Operation Center to be constructed out of the tsunami inundation zone.

During the site selection process the City evaluated the current Gower St. location and determined it to be unsuitable for the placement of emergency infrastructure as it does not comply with new statutory requirements regarding identified tsunami inundation potential.

There is an adequate level of sewer and water system capacity available to accommodate the projected development of the area and such capacity can be made available in a timely manner. Some infrastructure improvements such as roads and electrical services currently exist at the site and can be easily upgraded; other infrastructure such as water, sewer, and stormwater services can readily be extended to the site.

3. *The land is physically suitable for the uses to be allowed, in terms of slope, geologic stability, flood hazard and other relevant considerations;*

Staff Comment: Oregon House Bill 2605, which became effective on January 1, 2022, requires newly constructed structures that are designated as "essential facilities," which includes police stations, emergency vehicle garages, and designated emergency preparedness and operation facilities required for emergency response to be located outside of delineated tsunami inundation zones. Due to the nature of the topography in the Cannon Beach area, there are limited opportunities for such development that avoids tsunami inundation areas, the subject property being one of them. Figure 2, included below, shows the subject property in relation to a "Statewide XXL" inundation scenario modeled by Oregon Department of Geology and Mineral Industries.

4. *Resource lands, such as wetlands are protected;*

   Staff Comment: The subject property generally and site proposed for the new police station specifically do not have any identified wetlands or stream corridors present on them and there are no trees that would need to be removed in order to accommodate the planned development. The South Wind Master Plan does call for development to be placed in an area on Taxlot 41006B000100 that was cleared through timber harvest approximately 10 years ago, however placement in this location would require development of new infrastructure, access roads, vegetative clearing, and likely the placement of fill or other terrain altering activities prior to the start of work. Additionally, placement of the new police station on the subject property increases its visibility and accessibility compared to the location on the Master Plan.

5. *The amendment is compatible with the land use development pattern in the vicinity of the request.*

   Staff Comment: The proposed police station has no apparent inconsistencies with the primarily residential nature of the Tolovana Park neighborhood on the opposite side of U.S. Highway 101 and no significant level of additional development is planned or anticipated in conjunction with the new police station project. The general types of development conceived by the South Wind Master Plan are relatively low intensity and unlikely to have any significant impact on adjacent property users.

Recommendation

Staff reccomends that the Planning Commission find the proposed zone change consistent with applicable comprehensive plan policies, criteria in the City's zoning ordinance, and statewide planning goads and recommend City Council approval of the proposed zone change.

Motion

Based on a motion by Commissioner (NAME), seconded by Commissioner (NAME), the Cannon Beach Planning Commission moves to (recommend/not recommend) the proposed Comprehensive Plan map amdendment and zone change, ZO 23-03, to the City Council.

Figure 1: Site Map – Current Zoning

Taxlot and zoning information taken from City of Cannon Beach GIS records. This map is for reference only and is not a survey product.

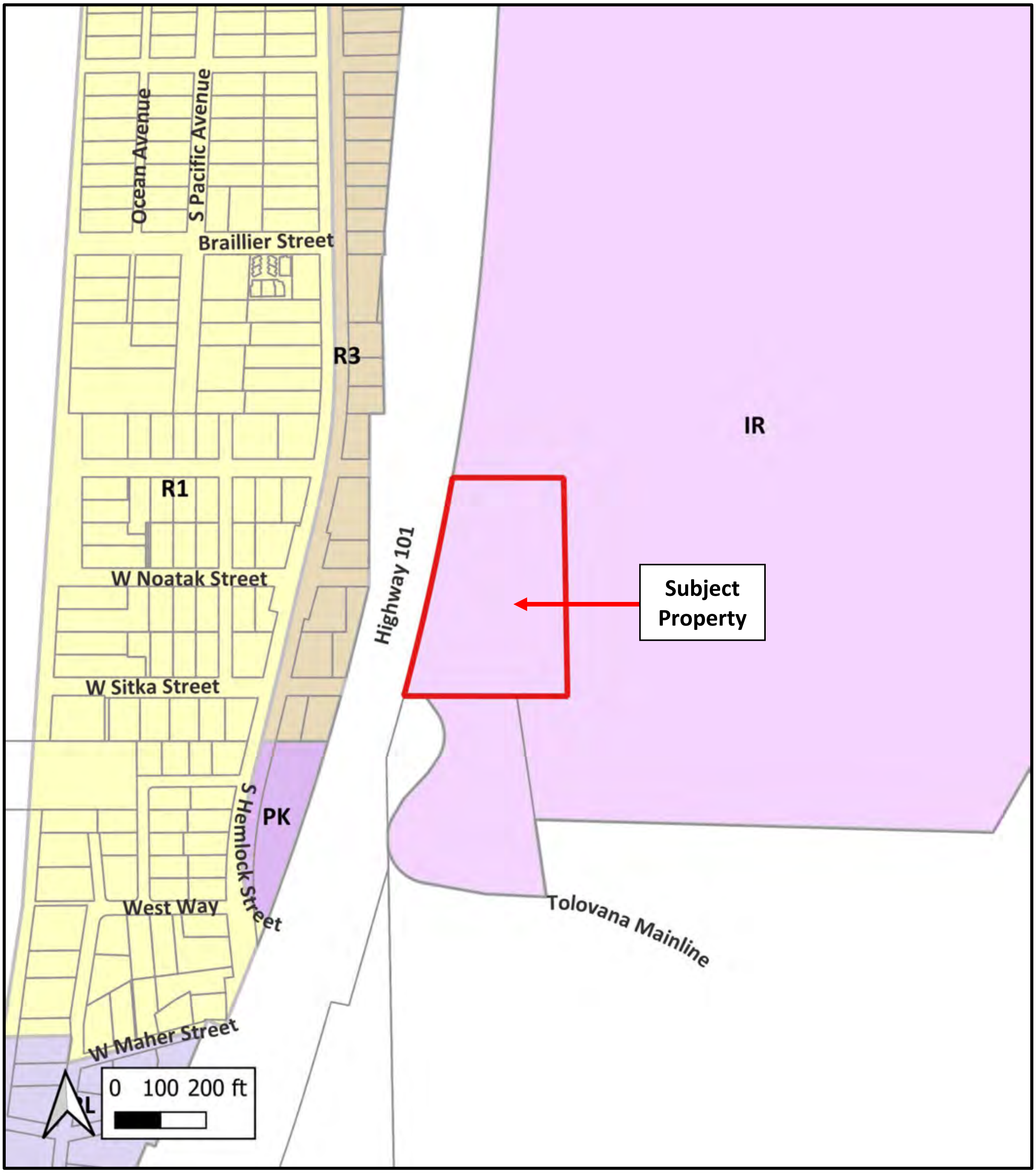

Figure 2: DOGAMI Tsunami Inundation Modeling

Mapping information taken from City of Cannon Beach GIS records. This map is for reference only and is not a survey product.

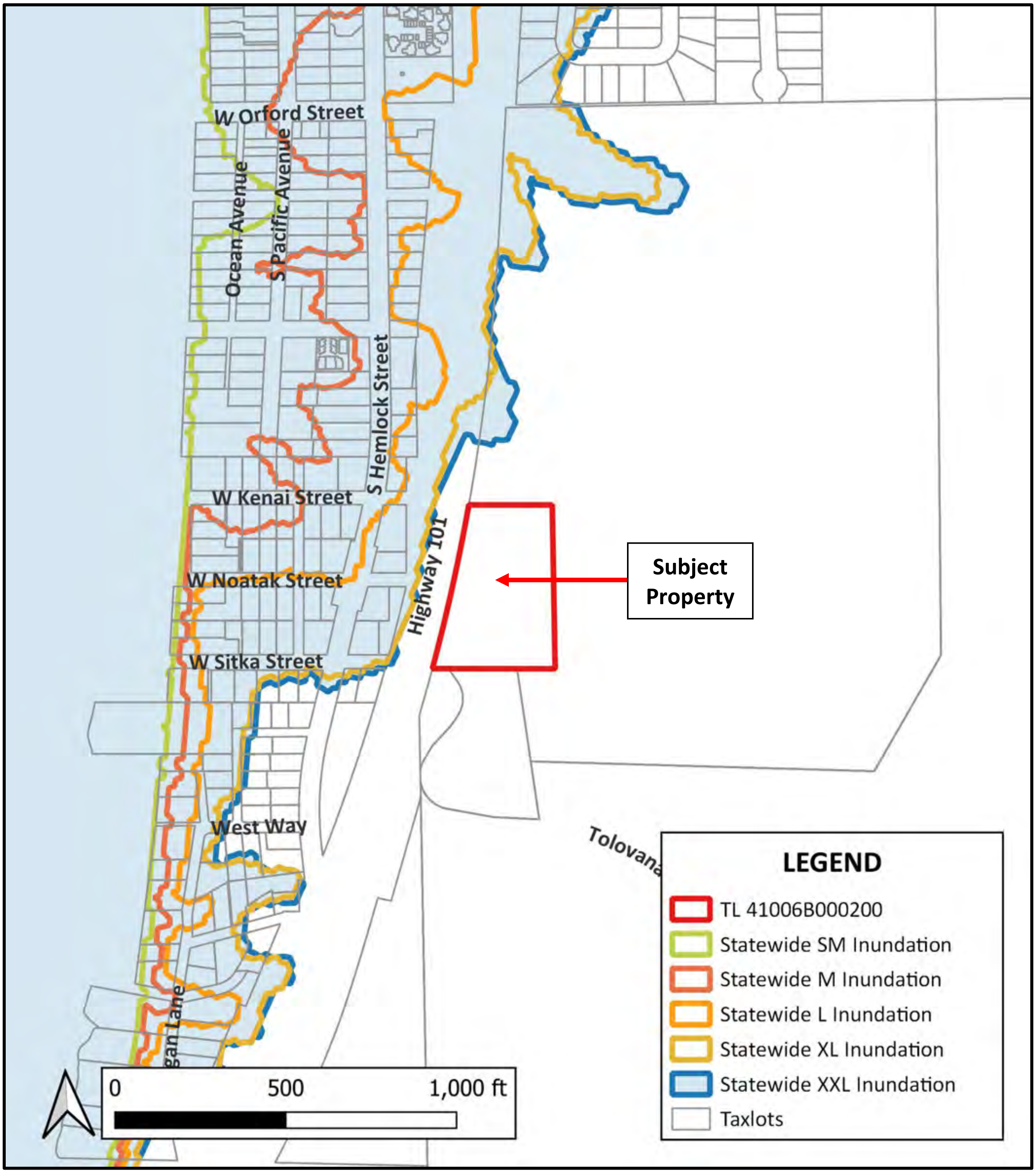

Exhibit A-1

15895 SW 72ND AVE
SUITE 200
PORTLAND, OR 97224
PHONE: 503.226.1285
FAX: 503.226.1670
INFO@CIDAINC.COM
WWW.CIDAINC.COM

AMENDMENT TO THE ZONING ORDINANCE / COMPREHENSIVE PLAN MAP FOR:

CANNON BEACH POLICE STATION

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

October 2023

Exhibit A-1

15895 SW 72ND AVE
SUITE 200
PORTLAND, OR 97224
PHONE: 503.226.1285
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TABLE OF CONTENTS

CANNON BEACH POLICE STATION ZONE
AMENDMENT REQUEST APPLICATION PACKAGE

APPENDIX

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

Exhibit A-1

CITY OF CANNON BEACH

AMENDMENT TO THE ZONING ORDINANCE/COMPREHENSIVE PLAN MAP

Please fill out this form completely. Please type or print.

Applicant Name: Leslie Jones

Email Address: lesliej@cidainc.com

Mailing Address: 15895 SW 72nd Avenue, Suite 200
Portland, Oregon 97224

Telephone: (503) 226-1285

Property-Owner Name: City of Cannon Beach
(if other than applicant)

Mailing Address: 163 E. Gower Street
Cannon Beach, Oregon 97110

Telephone: (503) 436-1581

Property Location: 81389 N Hwy 101
(street address)

Map No.: 4.10.6B Tax Lot No.: 200

AMENDMENT TO THE ZONING ORDINANCE/COMPREHENSIVE PLAN MAP REQUEST:

See responses below and attachment for additional information.

1. Description of the proposal.
The City of Cannon Beach is seeking a zone change in support of the City Council decision on June 13, 2023 to locate the new Police Station on the current Tolovana Cache Site. The site is currently zoned as (IR) Institutional Reserve. We are proposing a rezone to (IN) Institutional Zone.

2. Justification for the map change. Explain how the request meets each of the following criteria.

   a. The amendment is consistent with the Comprehensive Plan.
   The proposed amendment is **consistent with the Comprehensive Plan** including its general development policies and alignment with the social values and physical form that is outlined in the plan.

   b. The amendment will either: (1) satisfy land and water use needs, (2) meet transportation demands, or (3) provide community facilities and services.
   As the proposed location for the the new Police Station and Emergency Operations Center, this amendment to the comprehensive plan map **will provide community facilities and services**.

c. The land is physically suitable for the uses to be allowed, in terms of slope, geologic stability, flood hazard and other relevant considerations.

The proposed site is **outside of the tsunami inundation zone** and has been evaluated by a geotechnical engineer to confirm it **suitability in terms of geological stability**.

d. Resource lands, such as wetlands are protected.

The proposed site is **not an affected tax lot per the City of Cannon Beach Local Wetland Inventory Map**.

e. The amendment is compatible with the land use development pattern in the vicinity of the request.

The proposed site has a current land use classification of **CG (Civic Governmental)**. This is compatible with the proposed use of a Police Station and Emergency Operations Center.

Use extra sheets, if necessary, for answering the above questions.
Fee: $1,500.00

Applicant Signature: ______________________ Date: 10/25/2023

Property Owner Signature: ______________________ Date: ______________________

If the applicant is other than the owner, the owner hereby grants permission for the applicant to act on his/her behalf. Please attach the name, address, phone number, and signature of any additional property owners. As Property Owner, my signature or an authorized applicant's signature, allows any duly authorized employee of the City to enter upon all properties affected by this permit for the purpose of follow-up inspection, observation, or measurement.

For Staff Use Only:

Received on: ______________________ By: ______________________
Fee Paid: ______________________ Receipt No.: ______________________
(Last revised March 2021)

Exhibit A-1

15895 SW 72ND AVE
SUITE 200
PORTLAND, OR 97224
PHONE: 503.226.1285
FAX: 503.226.1670
INFO@CIDAINC.COM
WWW.CIDAINC.COM

APPENDIX

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

SUPPLEMENTAL INFORMATION IN SUPPORT OF THE APPLICATION FOR AMENDMENT TO THE ZONING ORDINANCE / COMPREHENSIVE PLAN MAP

1. **Description of the proposal.**

   The City is seeking a zone change in support of the City Council decision on June 13, 2023 to locate the new Police Station on the Tolovana Cache Site. The site is currently zoned as (IR) Institutional Reserve. We are proposing a rezone to (IN) Institutional Zone.

2. **Justification for the map change. Explain how the request meets each of the following criteria.**

   a. **The amendment is consistent with the Comprehensive Plan.**

   - *The proposed amendment is* ***consistent with the Comprehensive Plan*** *including its general development policies and alignment with the social values and physical form that is outlined in the plan.*

   The comprehensive Plan states that due to the increasing number of tourists that visit the Cannon Beach area, there is an increasing pressure placed on the City police force. The new Police Station will increase the ability of the Police Department to provide more efficient and effective services to citizens and visitors.

   The subject Tolovana Cache Site is included in the area known as SouthWind and its proposed uses are addressed in the SouthWind Master Plan, dated December 17, 2014. From the Master Plan:

   > *"SouthWind consists of about 58.3 acres located east of Highway 101 and south of the Haystack Heights neighborhood. SouthWind is made up of two parcels. A 55-acre tract was acquired by the City from Campbell Global in 2013. A 3.3-acre parcel was acquired by the City from Clatsop County in 1990".*

   The proposed zone change is limited to the 3.3-acre parcel. No changes or development are currently proposed for the larger 55-acre tract.

   According to the Master Plan, the City should facilitate the location of new essential facilities above the tsunami inundation line. The Plan states the City's intent to use the SouthWind site for critical and essential facilities and services because the property includes developable areas above the reach of the largest predicted tsunami. The police station, fire station, day care facilities, a medical clinic, and the now closed Cannon Beach Elementary School are all within the tsunami inundation zone at their current locations. At the time of the Master Plan, the City wished to facilitate the relocation of the following buildings/facilities on the SouthWind site: Police station, Fire station, School, Child care/pre-school, Food bank, and Emergency shelter/emergency operations center. The City estimated that space needs for the Police Department, including site development, would be slightly less than one-half acre.

   The requested zone change will allow the development of the Police Station and Emergency Operation Center – currently operating out of the City Hall – to be constructed out of the tsunami inundation zone as proposed in the Master Plan.

b. The amendment will either: (1) satisfy land and water use needs, (2) meet transportation demands, or (3) provide community facilities and services.

- *As the proposed location for the new Police Station and Emergency Operations Center, this amendment to the comprehensive plan map will **provide community facilities and services**.*

The City's goal for the Police Station project is to develop a structure that will facilitate the department's ability to provide exceptional day to day municipal services, while being constructed to remain operational following a seismic or tsunami event. The proposed Emergency Operations Center will be designed to function as an epicenter during all phases of resiliency efforts.

While the City had previously planned to rebuild the Police Department at the current location, recent legislative changes mandate that essential facilities, such as police stations, be located above the inundation elevation of the Maximum Considered Tsunami (roughly equivalent to a Cascadia 9.0 tsunami event). In order to meet current requirements and provide additional safety and emergency resources, the Police Station is currently proposed on the Tolovana Cache site – a City owned property that meets state mandated elevation criteria.

At this site, there is an adequate level of sewer and water system capacity available to accommodate the proposed development and capacity can be made available in a timely manner.

City utilities and roads either serve or can be extended to serve the area. Transportation demands are currently being coordinated with ODOT in conjunction with a Traffic Impact Analysis by Red Plains, Engineering. The project team is working with ODOT and Nuveen (formerly Greenwood Timber) to coordinate shared access from Hwy 101. Preliminary information indicates that access may be feasible without widening the existing highway. The final design will be developed in conjunction with ODOT permitting and safety considerations.

c. The land is physically suitable for the uses to be allowed, in terms of slope, geologic stability, flood hazard and other relevant considerations.

- *The proposed site is outside of the tsunami inundation zone and has been evaluated by a geotechnical engineer to confirm it suitability in terms of geological stability.*

When the Master Plan for the larger SouthWind site was prepared, The Horning Geoscience report evaluated three potential development sites on the property which are referred to as the North, Central, and South sites. The Police Station is planned to be constructed adjacent to the "South" site on the site often referred to as the Cache site.

The report concludes that these three (3) areas are potentially developable, assuming appropriate geotechnical engineering measures are taken. The report did not rule out development on other parts of the site given appropriate engineering solutions to the site's geological limitations. According to the report, the City will require a site-specific geologic hazard study for each building, for road construction, and for any grading or filling on the SouthWind site.

The Police Station development on the Cache site has been reviewed for the potential landslide risk that was described in the Horning report. As part of that study, inclinometers were installed in December of 2018. A recent reading of the equipment indicated "no horizontal movement of the ground surface has occurred." According to the recent findings, "the Cache Site may not be an 'active' landslide subject to continuous creep-like static movements." The memo, dated 05/18/2023, is attached to this application for reference.

The City has additionally commissioned a new geotechnical report, specific to the Cache Site, to coordinate the foundation design with soil conditions and site-specific risk factors. The current report, dated 10/09/2023, is also attached to this application for reference.

d. Resource lands, such as wetlands are protected.

- *The proposed site is not an affected tax lot per the City of Cannon Beach Local Wetland Inventory map, and the location preserves forested resource areas.*

The SouthWind Master Plan, dated December 17, 2014, states:

> *"Developed facilities on the SouthWind site should be clustered in the area shown in the master plan to preserve the largest possible forested area, and to avoid conflicts with adjoining land uses".*

By developing on the Cache site, forested resource areas are preserved.

e. The amendment is compatible with the land use development pattern in the vicinity of the request.

- *The proposed site has a current land use classification of CG (Civic Governmental). This is compatible with the proposed use of a Police Station and Emergency Operations Center.*

The selected site is appropriate for the proposed use. The location allows quick access via Hwy 101 to all areas of the City and maintains distance from residential development. Additional history and benefits as an Emergency Operations Center follow:

The current City Hall/Police Station facility started its life 70 years ago as a lumber yard and has been modified over the years to house a City Hall and Police Station. During initial construction or in subsequent modifications there has been no obvious attempt to incorporate any structural elements that would make it even minimally resistant to a small to medium earthquake or tsunami event.

After a significant natural event, residents will expect, even demand, enhanced performance from staff to manage search and rescue, street clearing, debris removal, and utility restoration to improve conditions to the point that our residents and businesses will be able to start to rebuild their homes and businesses.

Given the structural condition of the current building, the existing facility may offer little to no support in such efforts. Equipment located in the current City Hall/Police Station building, such as emergency response equipment, communications technology or communications gear may become inaccessible or unusable at the time of the event.

Most modern buildings of which we are all familiar (commercial, schools) are constructed to withstand the effects of an earthquake long enough to allow occupants to be able to exit safely. They are not required to be designed to be usable after the event.

The Police Station will be an emergency facility designed and constructed to provide both protection for occupants within the structure during an event and to be functional immediately afterwards to provide and coordinate emergency operations and recovery operations. A well-constructed City Police Station will be an investment for and by the residents and businesses to have the City Staff in the best positions to assist, protect, and help them rebuild their lives in the event of a disaster.

Additional Background & Summary:

In 2018, the City commissioned an Architectural and Engineering firm to do a study to review the conditions of the existing building. They found that many of the bearing walls were made from hollow block (possibly Terra Cotta). These walls have a very low likelihood of withstanding even a moderate earthquake or tsunami. The following is a quote from that report. - "It is the opinion of the Tolovana Architect and our consultants that the useful life of the current City Hall building has been realized. Since it was constructed for the storage and sale of building materials, the construction techniques employed were not meant for a higher occupant load or increased structural capacities of a public building. When considering the many phases of expansion over its history, the building is simply not able to be remodeled in an economic manner as compared to constructing a new facility."

Based on evaluation of existing conditions, the Police Department needs a new home. The following are benefits of locating the building as proposed on the Tolovana Cache site:

- The structure will be constructed to facilitate a quick transition from offices to an emergency management facility.
- Back-up power and communication systems will be built in and protected within the facility - PD will be able to coordinate and assist in search and rescue as well as other public safety issues as they arise.
- The Police Department portion of the facility will also be hosting at least 50 police officers from numerous jurisdictions and will be the City agency that will be getting most of the inquiries in the first few days after an event.

Here are some of the risks that we accept if we do not build a new, relocated Police Station:

- Information or equipment such as computers, police gear, PW equipment, paper copies of utility system plans, or equipment meant for, or that would be used in responding or managing the crisis, may be lost.
- There will be limited redundancy in the overall City emergency management plan.
- Citizens will lose the opportunity to have a reliable location outside of the tsunami inundation zone to seek help or information.
- City staff will have more limited options for safe locations from which to work and coordinate outside resources as they respond to an event.
- City staff's ability to effectively manage the influx and efforts of heavy equipment companies, search and rescue personnel, first responders, utility contractors, debris management companies, mass care providers, and volunteers could be significantly hampered.

A well-constructed Police Station will be an investment for and by the residents and businesses to have the City Staff in the best positions to assist, protect and help them rebuild their lives in the event of a disaster.

Exhibit A-1

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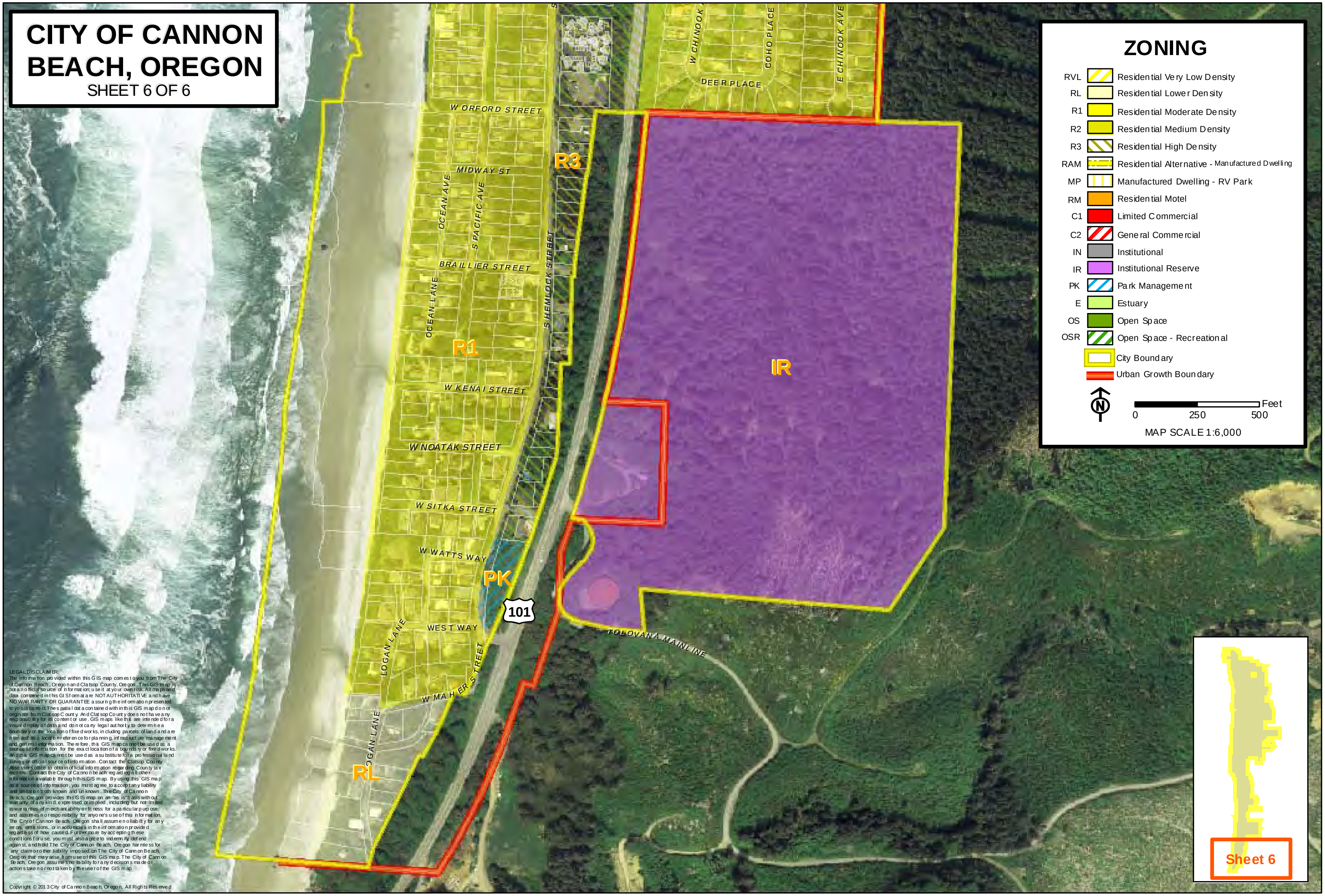
APPENDIX

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

Exhibit A-1



CITY OF CANNON BEACH, OREGON
SHEET 6 OF 6
ZONING
RVL Residential Very Low Density
RL Residential Lower Density
R1 Residential Moderate Density
R2 Residential Medium Density
R3 Residential High Density
RAM Residential Alternative - Manufactured Dwelling
MP Manufactured Dwelling - RV Park
RM Residential Motel
C1 Limited Commercial
C2 General Commercial
IN Institutional
IR Institutional Reserve
PK Park Management
E Estuary
OS Open Space
OSR Open Space - Recreational
City Boundary
Urban Growth Boundary
Feet
0 250 500
MAP SCALE 1:6,000
W ORFORD STREET
MIDWAY ST
OCEAN AVE
S PACIFIC AVE
BRAILLIER STREET
OCEAN LANE
S HEMLOCK STREET
W KENAI STREET
W NOATAK STREET
W SITKA STREET
W WATTS WAY
WEST WAY
LOGAN LANE
W MAHER STREET
W CHINOOK
COHO PLACE
E CHINOOK AVE
DEER PLACE
TOLOVANA MAINLINE
101
R3
R1
IR
PK
RL
Sheet 6

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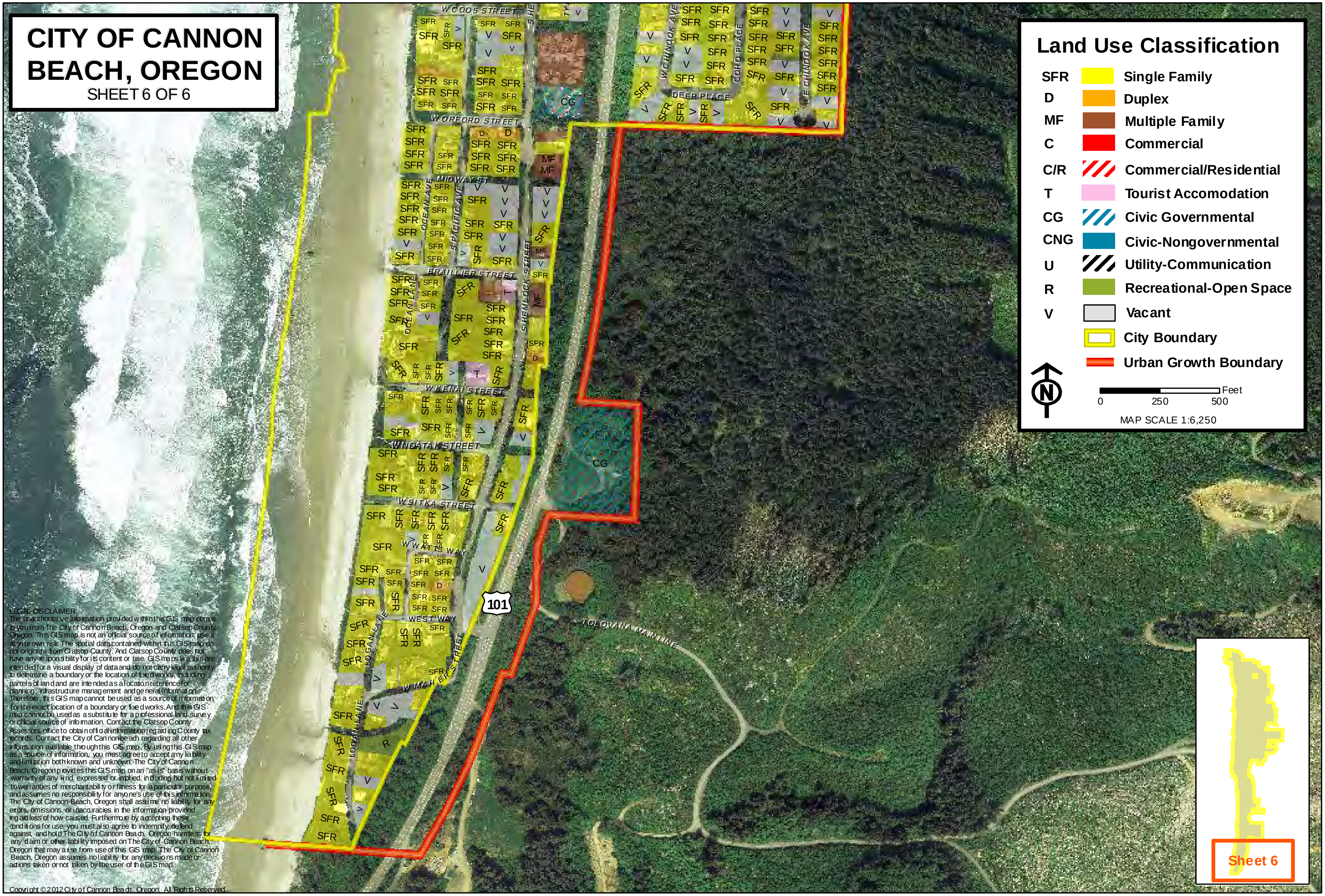

CITY OF CANNON BEACH, OREGON
SHEET 6 OF 6
Land Use Classification
SFR Single Family
D Duplex
MF Multiple Family
C Commercial
C/R Commercial/Residential
T Tourist Accomodation
CG Civic Governmental
CNG Civic-Nongovernmental
U Utility-Communication
R Recreational-Open Space
V Vacant
City Boundary
Urban Growth Boundary
N
Feet
0 250 500
MAP SCALE 1:6,250
W COOS STREET
WORFORD STREET
MIDWAY ST
OCEAN AVE
PACIFIC AVE
BRAILLIER STREET
HEMLOCK STREET
OCEAN LANE
W KENAI STREET
W NOATAK STREET
W SITKA STREET
W WATTS WAY
WEST WAY
LOGAN LANE
W MAHER STREET
CHINOOK AVE
COHO PLACE
DEER PLACE
101
TOLOVANA MAINLINE
Sheet 6
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Exhibit A-1

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APPENDIX

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

REPORT OF GEOTECHNICAL ENGINEERING SERVICES

Cannon Beach Cache Site Police Project
Cannon Beach, Oregon

Geotech Solutions Inc.

October 9, 2023

GSI Project: cannon-22-4-gi

October 9, 2023 *cannon-22-4-gi*

City of Cannon Beach
stdenis@ci.cannon-beach.or.us; rbarrett@ci.cannon-beach.or.us

cc: lesliej@cidainc.com; curtisg@cidainc.com

REPORT OF GEOTECHNICAL ENGINEERING SERVICES
Cache Site Police Station
Cannon Beach, Oregon

As authorized, herein we present our report of geotechnical engineering services for the proposed Cache Site Police Facility in Cannon Beach, Oregon. A roughly 5,300 square foot single story wood framed structure is planned, with associated pavements and utilities. We previously provided consultation on this site for storage projects in 2013. Recently we were provided preliminary geotechnical and geological reports by others that included the "Southwind" project abutting this site, as well as instrumentation monitoring of ground water and subsurface movement, and have used this as background for our work. From that previous work, seismic landslide induced deformations were expected, and geotechnical analyses and recommendations were needed for building design performance by others. That performance is expected to include having the building life safe and functional after a CSZ design level earthquake, albeit with some level of damage. The overall purpose of our work was to complete project specific site explorations and analyses to provide recommendations for building design. As an essential facility, our work also included site specific evaluation of seismic hazards including seismic stability for the proposed building support design compatible with the complexity of the project. Specifically, our scope included the following:

- Provide principal level geotechnical project management including a site reconnaissance, review of provided information, client communications, and review of analyses, reports, and standard format invoicing.
- Review previous reports, geologic maps, and vicinity geotechnical information as indicators of subsurface conditions.
- Complete a site reconnaissance and mark the exploration locations.
- Complete one-call utility locates and subcontract a private locator. Utilities that cannot be located (i.e., plastic, non-ferric, no tracer wire, etc.) are the responsibility of the owner and may be damaged if not marked. Damage to these and exploration locations, and surface repair of any kind, other than backfilling and any asphalt patching of explorations, is not a part of this scope.
- Explore subsurface conditions by advancing two mud rotary drilled borings to depths of up to 100 feet or refusal or 20 feet into basalt, and 3 test pits with an excavator to depths of up to 10 feet or refusal.
- Maintain a detailed log of the explorations and obtain samples at intervals and make observations for evidence of ground water.
- Complete laboratory testing to aid in soil classification.
- Evaluate site specific seismic hazards: including tsunami, fault rupture, and complete detailed liquefaction analyses of site soils, and estimate liquefaction induced deformations and provide qualitative means to reduce deformations as needed.
- Complete static and dynamic slope stability analyses in a 2D cross section of the site from the borings and previous adjacent work, including the overall site and means to reduce hazards.
- If feasible, provide recommendations for new shallow reinforced mat foundation or grade beam

support, including possible reinforced subgrade, and criteria and forces for resistance to lateral loads and movement, as well as settlement from static loads, site preparation and base rock, and foundation drainage.

- Provide shear pile analyses for one pile type to reduce deformations, including pile size, type and spacing, estimated embedment and possible use outside the building footprint.
- Provide recommendations for site grading, including earthwork vertical extent limitations regarding stability, wet season grading criteria, surface soil stabilization for pavements, and utility backfill materials and compaction.
- Provide recommendations for site pavement thicknesses and materials.
- Provide a PE/GE stamped written report summarizing the results of our geotechnical evaluation.

SITE OBSERVATIONS AND CONDITIONS

Surface Conditions

The site consists of gently- to moderately sloping terrain, with extensive past filling and earthwork associated with the gravel loop road and levelling/site grading in the proposed building area. A buried, culverted drainage is present under the fills presumed running east-west across the center-north of the parcel with the culvert outlet near the north drive at the Highway. A storage building and containers are present in the east central portion of the parcel northwest of the drainage ravine and culvert inlet. The drainage ravine may have been created from filling west of it, and now routes to the west-southwest toward the Tolovana Mainline Road intersection. No significant foundation cracking or distortion of the storage building was noted during our site work. Mike McEwan of McEwan Excavating recalled historical filling and described mixed fill materials with predominantly organic soils and topsoil fill to the north side of the loop road, and inorganic soils within the loop including some concrete rubble.

Aerial photos of the site were obtained from the Corps of Engineers, City of Cannon Beach archives, and Google Earth historical photos. Photos were reviewed for grading and surface changes to the degree possible by the generally low resolution and are attached to this report. Features included the following:

1939 - The site is forested with what appear to be mature conifers, and the central drainage is unfilled. Highway 101 is not present, and Hemlock Street is present but appears unpaved.

1962 - The site area has been cleared and the central drainage is present and appears to be culverted under Highway 101 which is also present. The Loop road is present further north than the 2013 alignment.

1977 - Some regrowth of brush is present on the site, with additional filling near Highway 101 and over the west end of the ravine.

1994 - Extensive additional fill is evident over the ravine area, and the ravine is not evident in the cleared area. The northernmost loop road is overgrown with brush and a new northern loop road is evident further south. Possible fill tiers are present.

2001 - The site fills have low vegetation present over them, with some active filling of the lower south loop road near the highway.

2012 - The storage shed is present, and new fills are evident in the center of the loop road.

Subsurface Conditions

Geologic maps indicate the site is within marine terrace deposits of silt and clay (City of Cannon Beach Geological mapping, DOGAMI Bulletin 74, DOGAMI ODGC-7). These maps indicate this unit is underlain at depth by sedimentary rock of the Astoria Formation with Columbia River basalt present to the southeast. Bulletin 74 indicates that the Astoria Formation mapped to the east northeast is part of landslide terrain and this parcel appears to be within that or at the southern margin. The city mapping does not indicate that the site is in active landslide terrain, nor does Oregon SLIDO. Inclinometer readings over a period of 3 years in B-3 by others just east of the site boundary indicated no movement from 2020-2023, and the Southwind preliminary report states that the slide is not considered active. Personal communications and mapping with/by Tom Horning of Horning Geosciences (excerpt attached) from work on the Southwind site indicate the site as marine terrace south of an incised drainage, with bedrock Astoria Formation contact generally at elevations higher than 120 feet east and south of the site, and outcropping basalt in ridges further southeast. The isolated "mound" feature above the site on the City access road may be a slide feature as a test pit by Horning in that area described conditions as possible basaltic colluvium. We observed a basalt outcrop at elevations below roughly 200 feet east-southeast of the site east of the incised drainage that appeared massive and may represent a slide block or a thick intrusive body/sill.

To evaluate site specific soil conditions, we advancing three test pits to depths of up to 15 feet with an excavator, and 2 borings to depths of up to 100 feet at the approximate locations shown on the attached ***Site Plan***. A previous boring by others in work for the Southwind site was advanced to a depth of 150 feet at the "B-3 by others" location just off site to the east as shown on the ***Site Plan,*** and a well log from the T-Mobile site uphill to the southeast that encountered siltstone was also reviewed. 5 test pits were also reviewed from our 2013 report on the site for storage.

The subsurface consisted of several units of soil and rock. These generally included from the surface down; fill, younger terrace landslide deposits, older non-landslide terrace deposits, siltstone (where present), and basalt. These units are described in the following sections, with strength and other parameters of each unit used in our stability analyses summarized in the attached stability sections.

Fill - Fill content varied widely in both the current and previous 2013 test pits. Materials in previous test pits north of the loop road included very soft organic silt with debris to depths of 7 to 9 feet overlying a 2-foot-thick layer of crushed rock fill in one test pit, with a layer of buried original rooty organic topsoil beneath both. Fill in our current explorations extended to depths of roughly 10-11 feet, and consisted of variable fine sand, silt, gravel, occasional concrete, asphalt, and boulders and scattered trace organics. Blow counts (N_{85} autohammer) in the fill ranged from 5-24, with moisture contents of 13-37% in current test pits, and up to 94% where organic in previous northern test pits. Minor to moderate caving was common the test pits. Despite the medium stiff or better condition, this fill is inconsistent and undocumented and not have the reliable properties of structural fill. Previous explorations north of the loop road encountered that fill as including organics, and Mike McEwan stated after topsoil loads were routed to fill in that location.

Upper Terrace Silt/Ancient Slide Deposit - Beneath the fill and topsoil, soils consisted of very soft to stiff generally gray silt with variable sand and clay content and variable wood debris that extended to depths of 43 to 48 feet in our borings, and 33 feet in the B-3 boring by others to the east. The blow counts ranged from 0-22 with most below 10 and many of 5 or less, and generally softer more variable structure in the lower 10-20 feet. Plasticity ranged from non-plastic to moderately plastic where clay content was higher. Moisture contents ranged from 29-197%, the higher readings correlating to organics. Previous strength testing in the soil by others and in our experience indicate a static phi angle of 10-15 degrees in the softer zones of this unit. The strength is considered higher in cyclic loading related to the number of loading cycles which are high for CSZ interface earthquakes. Carbon dating by others of the wood debris in the upper terrace indicated the wood was growing roughly 20-40 thousand years ago. Much of the wood observed in this unit was still relatively fresh and undecayed in our samples.

Lower Terrace - This unit was present under the upper terrace in both of our borings and extended to a depth of 58 feet in B-1 to the east and 82 feet in B-1 to the west. The unit includes an undisturbed sedimentary structure of silt to sandy silt with variable fine organic content and is inferred as not landslide deposited. The unit was generally stiff with blow counts of 8-15 with two exceptions. The upper few feet in B-1 was very soft with trace fine sand and organics (which could represent old topsoil). The lower 7 feet of this unit in B-2 consisted of very dense fine poorly graded sand with blow counts of 86 to 50/5", consistent with our vicinity downslope borings and inferred as wave densified (and/or seismically densified) ancient beach sand common lower in this unit.

Siltstone - Siltstone was encountered at a depth of 48 feet in B-1. The top roughly 5 feet of the unit was severely weathered into silt with siltstone clasts retrieved as gravel in size with a blow count of 6. Below this extending to a depth of 58 feet the siltstone was soft to moderately hard rock and little weathered, with a blow count of 53. This unit was also encountered beneath the landslide terrace in B-3 upslope and extended to the 150-foot depth explored in that boring. Siltstone was not encountered in our boring B-2.

Basalt – Hard, little weathered, fractured, dark gray to black basalt was encountered at depths of 58 to 82 feet from east to west, in B-1 and B-2, respectively, but was not encountered in B-3 by others. Attempted coring of the basalt was very difficult due to fracturing with little retrieved, and a tricone bit was then used with the CME 75 drill rig with advance rates of 6 to 8 feet an hour. Basalt was observed outcropping (or in a large slide block) at about 200 feet in elevation east-northeast of the site and is mapped in the hillside to the southeast. The basalt is generally intrusive and displaces the siltstone and is interpreted as massive below the building site or a very thick sill or body and was not present in B-3 by others nearby. This basalt would preclude deeper slide surfaces perhaps corroborated by overlying older marine terrace deposits remaining undisturbed.

Groundwater - Wet soil conditions were noted at depths near 20 feet in our borings and were not encountered at depths of 15 feet in our test pits, done near the end of the dry season. Instrumentation and monitoring in B-3 by others showed wet season groundwater levels near 15 feet in depth in an inferred perched condition. The B-3 boring included instrumentation in sealed zones at depths of 100 to 150 feet but did not observe excess confined pressures.

Slope Stability Analyses

As discussed previously, the site area is considered to be blanketed in ancient landslide deposits that are not active but can be destabilized in earthquake motions. To evaluate stability we used several sources of information to develop stability models. This includes City GIS 2-ft topographic information, site reconnaissance of outcropping units, geological mapping, site explorations, and testing of encountered units in both our site sampling and experience in the vicinity and on the Southwind site by others. Based on our local experience in these units we also considered the likely presence of a weak shear zone in the lower portions of the landslide terrace unit. Morgenstern-Price limit equilibrium methods were used, and sensitivity analyses were conducted on each of these parameters along with ground water levels to refine the inputs and evaluate their impact.

From the preceding information and approach we used the stability software SLIDE2 and embedded seismic deformation program SLAMMER's Newmark analyses to evaluate the probable stability of each model, seismic yield accelerations, and expected seismic deformations. Two primary 2D profiles were evaluated based on the most probable instability cross sections, as shown on the attached Sections. The more east-west line in Section A-A was found to have the lower stability, with a static factor of safety of 2.6 and a yield acceleration of 0.26g. As the site is near the margin of more stable conditions to the south and southeast, these are likely somewhat conservative if 3D influences are considered. To estimate deformations during the design level 0.73 accelerations (for a magnitude 9.0 CSZ interface quake) we used the SLAMMER Newmark analyses in both scaled earthquake time histories and empirical estimates (Jibson'07, Saygili Rathje '08) as well as independent empirical subduction zone modeling estimates (Macedo '17). For the most applicable scenarios, this resulted in estimated site deformations along A-A ranging from 3 to 8 inches laterally parallel to the shear surface (inclined slightly down of horizontal to the west). Typical estimates of vertical deformation are half the lateral, which would be about 2 to 4 inches. Half of that in differential settlement would also be typical, at 1-2 inches.

Southeaster Hillside Stability - No significant slumps or indications of large-scale instability were noted in our reconnaissance of the southeast hillside and review of LIDAR imagery. The hillside is generally sloped at 1.8H:1V to 2.5H:1V. Old logging road/skid road cuts generally have localized raveling exacerbated by game trails, but no significant or fresh slumping was observed. Some of the large spruce trees show slight overcorrected growth, likely due to surface soil creep. This slope has an age subjected to many CSZ interface earthquakes and does not show features of past global instability. It is possible that shallow or "veneer" slides could occur in wet season seismic conditions. Thin flow slide runout is possible but unlikely to impact the location of the building footprint due to site topography and typical inviscid behavior following site topography. To reduce this risk and divert possible flows, the eastern site berm could be enhanced to route flow toward the southwest entrance drive away from the building. If flow materials reach the lower drive area, such materials can typically be excavated/removed with conventional equipment.

Stabilization – If needed, one option to reduce deformations may be shear piles that could double for building support. This type of pile essentially increases the resisting forces along the shear surface of the slide and can also carry vertical building loads. Our stability analyses indicated that 200 kips in shear per pile, with piles at 8 ft centers under the building pad, would increase the yield acceleration to 0.35g and lateral deflection estimates to about 3 inches. This has been done on other sites with a drilled reinforced concrete piles, but typically in a scenario where the slide zone overlies a much stronger more rigid unit. As expected, due to the depth of the shear surface of 43 to 48 feet and the thickness of the underlying lower marine terrace over basalt, bending moments for piles at the interface were very high. For example, for a 200-kip pile shear capacity a 4-ft diameter drilled reinforced concrete pile with 14 #14 bars properly seated 10 feet into basalt (a total depth of 68 feet in B-1 and 92 feet in B-2) would develop a plastic hinge at only roughly 4 inches of movement on the shear surface. In conclusion this method would only reduce total estimated deformation from 8 to 4 inches, and at a very high pile cost.

Other methods of increasing resistance across the shear zone could be used for the stabilization at an equivalent shear load across the building, such as jet grouting or ground anchors. These likely have an even greater cost than the preceding pile approach. Reducing groundwater levels was considered but is likely impractical due to the low permeability of the terrace soils and slide dimensions. Loading and unloading of the site area was also considered impractical due to the small size of the site to the overall slide, as well as possible downslope localized stability impacts.

CONCLUSIONS AND RECOMMENDATIONS

The preceding estimated deformations are generally moderate for low-rise structures in this situation but would likely cause structural damage for conventional spread and continuous footing construction. In conference with the structural engineer at CIDA, we discussed the preceding shear pile to increase performance, albeit at a high cost and moderate gain (3-4 inches of total deflection versus 8 inches). The moderate differential seismic slide deformations and light building may also allow for a reinforced mat or grade beam system, supported by lighter piles to reduce settlement risk for gravity (non-landslide) loads. The mat/grade beams would serve to reduce differential movement of the structure in an earthquake condition, and the piles would be used to reduce static settlement from the uncontrolled fill and underlying upper terrace deposit in non-earthquake conditions. The structural engineer may be able to design this system to reduce building damage to an acceptable performance level, and geotechnical parameters for design of such a system are included in the following ***Foundations*** section.

The deformations in an earthquake may damage utilities, especially less ductile conduit or conduit with little tension capacity at the joints. The preceding differential movement in the ***Stability Analyses*** section can be used to evaluate utility performance, and consideration of flexible connections, alignment, materials, and allowance for deformation should be made. It would likely be prudent to include emergency power and communication systems contiguous with the reinforced mat or grade beam system of the building to reduce risk to emergency systems.

It should be noted that the total lateral slide deformation estimated at 8 inches is only an estimate based on the described analyses. More or less deformation may occur as the analyses is complex with many variables. Based on the references used, the deformation estimate presented was the highest of those calculated, and for the subduction zone empirical model estimate (Macedo '17) generally has an 84% level of not being exceeded for the motions used.

Seismic Design

The response of the project site soil profile in proposed building areas is consistent with site class D. Ground motion parameters for this site at a code level of 2% chance of being exceeded in 50 years are included in the attached ASCE 7-16 hazard tool output and include a PGA of 0.73g. In addition to these parameters the project design team should understand that repeated cycles of horizontal ground accelerations from the relatively near field Cascadia Subduction Zone (CSZ) interface earthquakes are expected to be in the 0.3-0.5g range, with duration of strong motion of several minutes. Refer to the ***Seismic Hazard Investigation*** herein for more detail on the level of seismic hazards.

Foundations

Based on our analyses and discussions with the structural engineer, in our opinion the most cost effective foundation system for building support to a functional performance may be a reinforced mat or grade beam system with a structural slab. To reduce settlement from static/gravity loading, helical piers could be used. The following sections provide parameters for this system.

Mat or Grade Beams - A reinforced mat foundation or grade beam system can be designed for tensional forces during lateral movement that would be acting to pull the mat or beam system apart. These forces would consist of frictional forces on the north and south sides and the base of all grade beams or mats. An ultimate base friction coefficient of 0.39 should be used on the base (this assumes the existing fill is under the grade beams). A side friction coefficient of 0.22 can be applied to the sides with a normal force from the lateral pressure of a 30 pcf equivalent fluid. As helical piers are expected to fail laterally given their low moment resistance, the grade beams should also be sized for a width that accommodates an allowable bearing pressure of 1,500 psf for post-earthquake movement support. This pressure is not expected to result in more than 2 inches of settlement post-earthquake from the gravity loads, and the strength of the grade beams would likely allow for levelling pier applications if needed.

A minimum of 12 inches of clean, angular crushed rock with no more than 5% passing a #200 sieve is recommended for base rock under slabs or a mat. This can be substituted for the recommended working pad in the ***Earthwork*** section of this report only if it remains clean and uncontaminated with fines. Prior to slab placement the rock will need to pass a wheel roll with a fully loaded truck or meet 92% compaction relative to ASTM D-1557, or approval via probing by the geotechnical engineer. In addition, any areas contaminated with fines must be removed and replaced with clean rock. If the base rock is saturated or trapping water, this water must be removed prior to slab placement. Two inches of crushed rock is recommended under grade beams to keep an undisturbed condition.

We recommend slabs be designed to free span between grade beams. We recommend a vapor barrier be used under the slab or mat. Typically, a reinforced product or thicker product (such as a 10-15 mil STEGO wrap) can be used. Experienced contractors using special concrete mix design and placement have been successful placing concrete directly over the vapor barrier which overlies the rock. This avoids the issue of water trapped in the rock between the slab and vapor barrier, which otherwise requires removal. In either case, slab moisture must be tested/monitored until it meets floor covering manufacturer's recommendations.

Drilled Shafts for Slide Shear Improvement

To reduce seismic deformations to roughly 3 inches laterally and less than 2 inches vertically, the preceding stabilization piles (drilled shaft 4 feet in diameter with 14 #14 bars) could be used and support over 200 kips per pile vertically, and 15 kips per pile laterally in static loads, if embedded at least 6 feet into basalt, or 10 feet into siltstone. Piles would need to be installed at 8-foot centers north to south, and 12 feet east to west to accumulate enough total shear to reduce deformations to the preceding 3 inches laterally. Downdrag loads from organic decay are included in the preceding but are not expected to be large as primary organics were relatively undecayed ancient debris not expected to induce enough settlement for full mobilization. Pile sequencing would likely require drilling of every other pile during construction sequencing to reduce potential caving or grout loss, and casing is expected to be required above the siltstone or basalt. The cost of the preceding piles may not justify the modest deformation reduction if the alternative grade beam or mat system can be suitably designed.

Helical Pier Foundations

Provided the preceding mat or grade beam foundation system is used, helical piers can be designed to support static/gravity loads and reduce settlement from underlying uncontrolled fill and the soft portions of the upper terrace soils. Installation of helical piers may not be feasible to the required depths, and reaching these depths must be proven with the use of indicator piers. Occasional boulders and debris were present in the upper fill. For moderate loading up to 40 kips, pier embedment of at least 10 feet into the underlying lower stiff terrace and correlated capacity torques can be used. Based on our explorations, the top of the lower terrace unit ranged from 43 to 48 feet below the ground surface, so resulting pier lengths would be 53 to 58 feet below the existing ground surface, although this is expected to vary widely. A tensional load test is required prior to production pile installation, tested at 50% intervals to 200% of design pullout capacity with creep measurements at the design load.

Capacities listed herein may be limited by the structural capacity of the pile and must be evaluated by a structural engineer. Piers must be spaced a minimum of 3 pile diameters apart. Closer spacing will result in reduction in pier capacity and we must be consulted. Fills greater than three feet above existing grades in the building pad will induce down-drag on the piles and are not recommended unless they are installed at least 6 months prior to construction, are adequately monitored for settlement with at least 3 settlement plates, and if such monitoring indicates settlement is complete prior to pile installation. Settlement could take longer.

Piers in a fixed condition in grade beams are recommended. Due to the risk of long-term settlement we recommend floors be designed as structural to free span between grade beams or be directly pile supported. Interior unsupported slabs-on-grade are not recommended.

We recommend vertical piers with the following allowable capacities be used for design, with a minimum pier spacing (vertical and horizontal) of three helix diameters. Resistance to non-seismic lateral loading of 1.5 kips per pile is allowed for vertical piles, and piles battered up to 30 degrees from vertical can be designed to the horizontal vector of the preceding loads in the horizontal direction of downward batter, and 90% of that in the opposite horizontal direction. All helical piers must be galvanized, or corrosion protected. Again, the following can only be used if the lower terrace soils are suitably penetrated and develop the needed torque. Plates larger than 12 inches are not recommended due to anticipated penetration issues, unless proved otherwise by indicator piling.

Helical Pier Type	Inclination	Est. Length (ft)	Allowable Load* (kips)
10" and 12" Double with 3-1/2" pipe with threaded or sleeved and double bolted connection	Vertical	53-58+	40 (C), 36 (T)

* C – Compression T – Tension + - installation depth will vary and must fully penetrate the upper terrace soils

Capacities for additional pier sizes and inclinations can be provided upon request. We recommend that we be retained to review pier support design and be called to the site to observe and document pier installation.

Drainage
The ground surface must be sloped to drain away from the building on all sides. A perimeter drain is required around all exterior foundations. The drain must consist of a two-foot width of drain rock encompassing a 4-inch diameter perforated pipe, all enclosed with a nonwoven filter fabric. The drain rock must have no more than 2% passing a #200 sieve and must extend to within one foot of the ground surface. The geosynthetic should be a Mirafi 160n or equivalent. One foot of low permeability soil (such as on-site silt) must be placed over the fabric at the top of the drain to isolate the drain from surface runoff. The drain must be tight-lined to a suitable discharge as determined by the civil engineer. Gutters must be maintained as free flowing.

Earthwork
Preparation - Prior to earthwork the site must be prepared by removal of any existing structures and utilities that conflict with new infrastructure. If utilities are encountered during site excavation, they must be rerouted away from the building area, or properly abandoned. Abandonment requires removal and backfill with granular structural fill, or full grouting with confirmation of grout at both ends of the conduit and a volume check for continuity.

Site preparation for earthwork may also require removal of existing fill to reach building or pavement subgrades. Fill north of the loop road is not expected to be suitable for fill as it was organic to depths of 7 to 9 feet in the 2013 test pits. Fill within the loop may be possible to reuse in dry summer conditions if properly moisture conditioned/dried to near optimum for compaction.

In the helipad pavement area and in other areas where cuts expose organic soils, it may be possible to stabilize the subgrade with the placement of fabric over geogrid capped with two feet of clean well graded crushed rock.

Removal of the fills must be done carefully to prevent disturbance of the underlying soils. We recommend using a smooth bucket excavator working on top of the material to be removed and loading into trucks supported on haul roads.

Stabilization and Soft Areas - After cuts are made and topsoil removed, the exposed soils must be evaluated. This can be done by the geotechnical engineer observing wheel rolling in dry conditions or probing in wet conditions. Soft areas will require over excavation and stabilization with a nonwoven separation geosynthetic and overlying grid, and backfill with well graded, angular crushed rock compacted as structural fill. The separation geosynthetic must consist of a Mirafi 801 or approved equivalent, and the grid a Hanes EGrid 2020 or equivalent.

Working Blankets and Haul Roads - Construction equipment must not directly traffic soils with more than trace silt as they are susceptible to disturbance when wet. Rock working blankets and haul roads placed over a stabilization geosynthetic in a thickened advancing pad can provide this protection.

For working blanket and haul road rock, we recommend sound, angular, pit run or crushed basalt with no more than 6% passing a # 200 sieve. Working blankets must be at least 12 inches thick, and haul roads at least 18 inches thick, and can be placed in one lift over a Mirafi 801 separation fabric. Some repair of these elements must be expected.

Fill - Structural fill must consist of pit run rock less than 6 inches in nominal size compacted to 92% relative to ASTM D-1557 or to a dense state as observed by our geotechnical engineer, and must also pass a wheel roll. In wet conditions, this criteria can typically only be met by rock with less than 6% or less fines. The on-site silty angular gravel and sand fills may be for fill in dry conditions of late summer if properly moisture conditioned. Such fills must be placed in lifts no greater than 12 inches in loose thickness.

Cut Slopes - Cut slopes should not be made steeper than 3H:1V, and no closer than 25 feet from the planned buildings, and only after proposed cuts are submitted to us for stability evaluation.

It should be noted that the fill slope immediately east of the existing storage shed may deform and slump down in an earthquake, and may impact the shed. This may preclude the use of the shed for mechanical support equipment or other settlement sensitive contents.

Trenches – Utility trenches may encounter ground water seepage and severe caving at depth as encountered in the culvert installation excavations reported by Mike McEwan. Seepage was not encountered in our test pits but is expected to be perched at shallow depths in the wet season. Even above seepage levels, caving in the fill is expected and likely will be worse than the temporary short length cuts in the test pits. Proper shoring is required, with dewatering required if excavations encounter seepage. Increased backfill volumes are expected and must be included in the project budget and schedule. Trench base stabilization will likely be required for inverts where seepage is present. Stabilization with at least 12 inches of clean, well graded, angular pit run rock must be expected. Pipe bedding must be in accordance with the pipe manufacturers' recommendations. Trench backfill above the pipe zone must consist of well graded, angular crushed rock with no more than 7% passing a # 200 sieve. Trench backfill must be compacted to 92% relative to ASTM D-1557, with paving not occurring within one week of backfilling.

Utilities - The deformations in an earthquake may damage utilities, especially less ductile conduit or conduit with little tension capacity at the joints. The preceding differential movement in the ***Stability Analyses*** section can be used to evaluate utility performance, and consideration of flexible connections, alignment, materials, and allowance for deformation should be made. It would be prudent to include emergency power and communication systems contiguous with the reinforced mat or grade beam system of the building to reduce risk to emergency systems.

Pavement

Design - We have developed asphalt concrete pavement thickness at the site for 3 trucks per day (with a truck factor of 0.6) and a 20-year design life. These volumes can be revised if specific traffic data is available. Designs are also suitable to support a 75,000-pound fire truck. Our analyses are based on AASHTO methods and subgrade of undisturbed medium stiff silt or better native silt or fill having a resilient modulus of 3,000 psi. Construction will likely require protection and stabilization of subgrades as recommended in the ***Stabilization and Soft Areas and Working Blankets*** and ***Haul Roads*** sections of this report, and a Propex Geotex 801 (or equivalent) separation geosynthetic is required. Stabilization is expected to be needed particularly under the northern pavement areas where organic fill is expected. The results of our analyses based on these parameters are provided in the following table.

The main entry drive and any helicopter pad area should be underlain by a non-woven geosynthetic and two layers of geogrid, one located on top of the non-woven and one six inches up from it. This grid is intended to reduce the size of individual pavement cracks and vertical offsets to improve access after earthquake movement (the total cracking is expected to be the same).

Based on the results of our analyses we recommend a minimum of 3.0 inches of asphalt concrete (AC) over 12 inches of crushed rock base (CRB) in the main drive, helicopter landing, and any truck areas. Areas exposed to only car traffic can be constructed of 3 inches of AC over 8 inches of CRB. The rock sections will need to conform to haul roads and working blankets in the wet season.

Subgrade Preparation - The pavement subgrade should be prepared in accordance with the ***Earthwork*** recommendations presented in this report. All pavement subgrades will need to pass a proof roll prior to paving. Soft areas should be repaired by over excavating the areas, installing a separation geosynthetic and geogrid, and be brought to grade with well graded, angular crushed rock compacted as structural fill. For a separation geosynthetic we recommend a Propex Geotex 801 or equivalent, and the geogrid a Hanes Egrid 2020 or equivalent.

Base Rock and Asphalt Concrete - The recommended thicknesses are intended to be the minimum acceptable in dry conditions. Greater thicknesses are expected to be needed in wet conditions per the ***Earthwork, Stabilization*** sections in this report. Crushed rock should conform to ODOT base rock standards and have less than 6 percent passing the #200 sieve. Asphalt concrete should be compacted in lifts no greater than 3 inches in thickness to 91 percent of a Rice Density, or to 98 percent of the maximum density from a test strip.

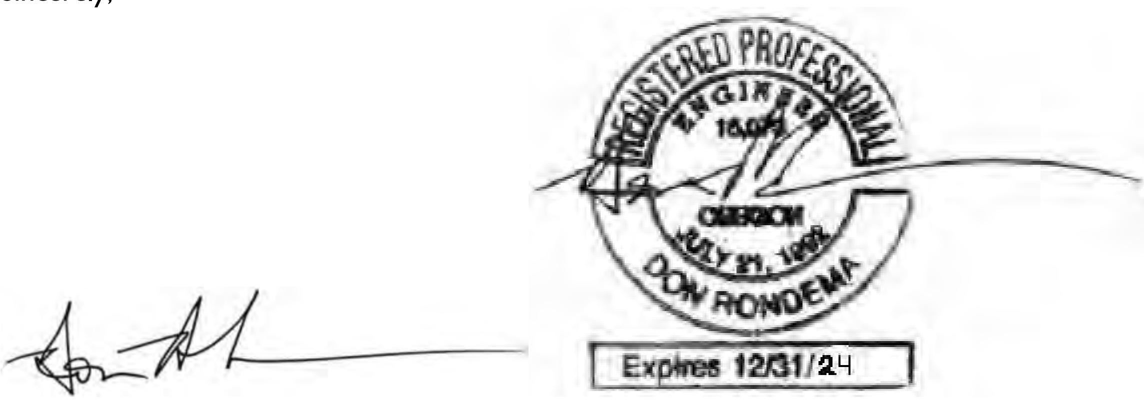
LIMITATIONS AND OBSERVATION DURING CONSTRUCTION

We have prepared this report for use by the City of Cannon Beach and members of their design and construction team for this project only. The information herein could be used for bidding or estimating purposes but must not be construed as a warranty of subsurface conditions. We have made observations only at the aforementioned locations and only at the stated depths. These observations do not reflect soil types, strata thicknesses, water levels or seepage that may exist between observations. We must be consulted to observe all foundation bearing surfaces, helical piers, proof rolling of slab and pavement subgrades, installation of structural fill, and any cut slopes. We must be consulted to review final design and specifications to see that our recommendations are suitably followed. If any changes are made to the anticipated locations, loads, configurations, or construction timing, our recommendations may not be applicable, and we must be consulted. The preceding recommendations must be considered preliminary, as actual soil conditions may vary. For our recommendations to be final, we must be retained to observe actual subsurface conditions encountered. Our observations will allow us to interpret actual conditions and adapt our recommendations if needed.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty, express or implied, is given.

We appreciate the opportunity to work with you on this project and look forward to our continued involvement. If you have any questions, please contact us.

Sincerely,



Don Rondema, MS, PE, GE
Principal

Attachments:

Site Plan
Guidelines for Classification of Soil and Rock
Test Pit Logs
Boring Logs
Moisture Content
Stability Sections
A-A Stability Model
A-A Static Stability
A-A yield acceleration
A-A example displacement
B-B static stability
B-B yield acceleration
Horning Geologic Map Excerpt
City Geological Map Excerpt
DOGAMI Bulletin 74 Excerpt
SLIDO landslide susceptibility
DOGAMI Tsunami Map Excerpt
ASCE 7-16 hazard tool output
Seismic Hazard Investigation

Exhibit A-1

BASE PHOTO FROM 2022 AERIAL

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SITE PLAN

cannon-22-4-gi

GUIDELINES FOR CLASSIFICATION OF SOIL

Description of Relative Density for Granular Soil	
Relative Density	**Standard Penetration Resistance (N-values) blows per foot**
very loose	0 - 4
loose	4 - 10
medium dense	10 - 30
dense	30 - 50
very dense	over 50

Description of Consistency for Fine-Grained (Cohesive) Soils		
Consistency	**Standard Penetration Resistance (N-values) blows per foot**	**Torvane Undrained Shear Strength, tsf**
very soft	0 - 2	less than 0.125
soft	2 - 4	0.125 - 0.25
medium stiff	4 - 8	0.25 - 0.50
stiff	8 - 15	0.50 - 1.0
very stiff	15 - 30	1.0 - 2.0
hard	over 30	over 2.0

Grain-Size Classification	
Description	**Size**
Boulders	12 - 36 in.
Cobbles	3 - 12 in.
Gravel	¼ - ¾ in. (fine)
	¾ - 3 in. (coarse)
Sand	No. 200 - No. 40 Sieve (fine)
	No. 40 - No. 10 sieve (medium)
	No. 10 - No. 4 sieve (coarse)
Silt/Clay	Pass No. 200 sieve

Modifier for Subclassification	
Adjective	**Percentage of Other Material In Total Sample**
Clean/Occasional	0 - 2
Trace	2 - 10
Some	10 - 30
Sandy, Silty, Clayey, etc.	30 - 50

GUIDELINES FOR CLASSIFICATION OF ROCK

Scale of Rock Hardness

Hardness	Description	Definition
RH-0	Very Soft	For plastic material only
RH-1	Soft	Carved or gouged with a knife
RH-2	Moderately Hard	Scratched with a knife
RH-3	Hard	Difficult to scratch with a knife
RH-4	Very Hard	Rock scratches metal; rock cannot be scratched with a knife

Terms used to Describe the Degree of Weathering

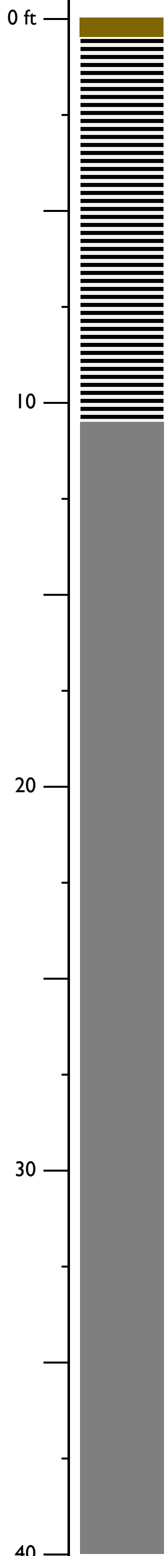
Description	Definition
Severely Weathered	Rock decomposed; thorough discoloration; all fractures extensively coated with clay, oxides, or carbonates
Moderately Weathered	Intense localized discoloration of rock; fracture surfaces coated with weathering minerals
Little Weathered	Slight and intermittent discoloration of rock; few stains on fracture surfaces
Fresh	Rock unaffected by weathering

Relation of RQD and Rock Quality

Rock Quality Designation (RQD), %	Description of Rock Quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

Descriptive Terminology for Joint Spacing

Spacing of Joints	Description
< 2 in	Very Close
2 in - 1 ft	Close
1 ft - 3 ft	Moderately Close
3 ft - 10 ft	Wide
> 10 ft	Very Wide



Soil and Rock Description

Medium stiff, dark gray SILT FILL, with trace gravel; moist.

Becomes with trace to some clay

Very soft to stiff, gray SILT, with trace to some clay; moist. (marine terrace inferred as ancient slide debris from inconsistent structure).

very stiff; wet.

very soft, sandy SILT; wet.

soft to medium stiff with some wood debris.

Cont.

Samples and Data

N_{85}	Data
6	w = 34%
5	w = 37%
5	w =31%
9	w = 37%
22	w = 32%
0	w = 45%
5	w = 157%
3	w = 148%

N_{85} = SPT blowcount
w = moisture content
f = percent fines
γ_d = dry unit weight

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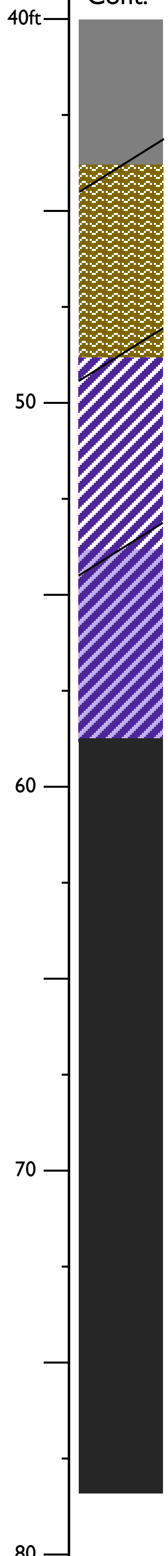
BORING B-1

Cannon 22-4-gi

Exhibit A-1

Cont.



Soil and Rock Description

stiff SILT with some fine sand and fine organics. Sedimentary structure -not slide debris. (inferred as older marine terrace).

Medium stiff, gray/blue gravelly SILT (severely weathered siltstone with gravel sized clasts)

Soft to moderately hard (RH1-2) little weathered gray SILTSTONE

Hard, RH-3, little weathered, closely fractured dark gray/black BASALT.

Coring attempt unsuccessful due to fracturing. Tricone bit advanced roughly 8 feet an hour.

NOTES: Boring completed to 78 feet on Sep 7, 2023. Backfilled with bentonite chips.

Samples and Data

Sample	Data
5	w = 156%
16	w = 130%
6	w = 45%
53	w = 15%
50/ 6"	

N_{85} = SPT blowcount
w = moisture content
f = percent fines
γ_d = dry unit weight

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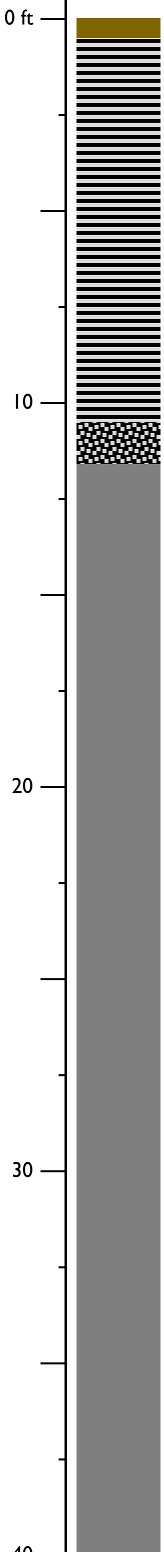
BORING B-1 (cont.)

Cannon 22-4-gi

Exhibit A-1



Soil and Rock Description

Medium dense, fine gray SAND FILL, with trace silt and some gravels and

becomes silty

Medium dense, angular black GRAVEL FILL; moist.

Medium stiff to stiff, gray SILT, with trace sand and trace to some clay; moist (marine terrace inferred as ancient slide debris from inconsistent structure).

Becomes medium stiff to stiff with occasional wood debris.; wet

Cont.

Samples and Data

14	w = 17%
24	w = 13%
12	w =17%
12	w = 29%
19	NR
11	w = 29%
8	w = 39%
7	w = 75%

N_{85} = SPT blowcount
w = moisture content
f = percent fines
γ_d = dry unit weight

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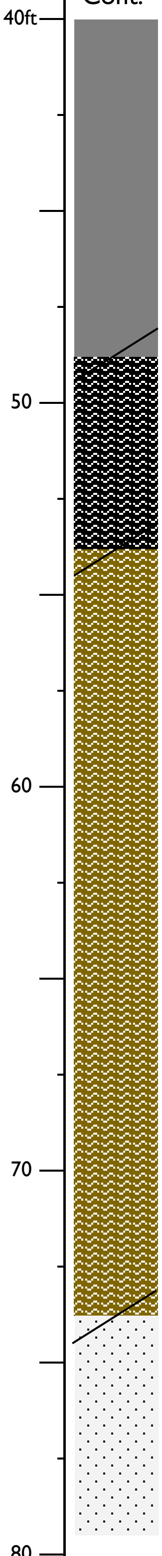
BORING B-2

Cannon 22-4-gi

Cont.



Soil and Rock Description

very soft to soft with some wood debris.

medium stiff with some wood debris.

Very soft gray SILT with trace fine sand and organics; moist. (undisturbed sedimentary structure, non-landslide, inferred as top of older marine terrace).

Stiff, brown, sandy SILT, with some organics; moist. (Older marine terrace - non landslide).

Very dense fine gray SAND; wet. (Older marine terrace).

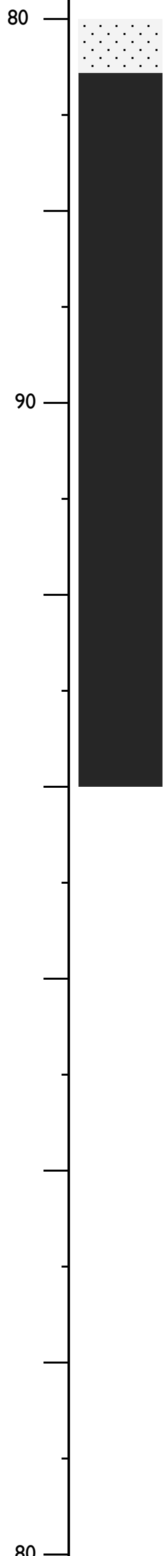
Cont.

Samples and Data

N85	w
0	w = 54%
5	w =197%
0	w = 48%
11	w = 177%
8	w = 100%
15	w = 81%
9	w = 86%
86	w = 17%

N_{85} = SPT blowcount
w = moisture content
f = percent fines
γ_d = dry unit weight

Cont.



Soil and Rock Description

Hard, RH-3, little weathered, moderately fractured dark gray/black BASALT

Tricone bit advanced roughly 6 feet per hour.

NOTES: Boring completed to 100 feet on Sep 8, 2023. Backfilled with bentonite chips.

Samples and Data

50/ 5" w = 18%

50/ 0"

N_{85} = SPT blowcount
w = moisture content
f = percent fines
γ_d = dry unit weight

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BORING B-2 (cont.)

Cannon 22-4-gi

Explorations completed on September 6, 2023 with a track mounted excavator.

TP-1		**Location:** NE portion of site.
		Surface conditions: Short grass, weeds.
	0 – 5	Loose, light brown gravelly SAND FILL, with trace silt and asphalt debris; dry
	5 - 9	Medium dense, light brown gravelly SAND FILL, with occasional boulders; dry.
	9 – 11	Medium stiff, brown sandy SILT FILL, with some gravels and cobbles and trace organics; moist.
	11 – 15	Stiff, brown SILT, with some sand and siltstone gravels and cobbles; moist.
		Minor caving beneath 5'. No seepage.

TP-2		**Location:** NW portion of site.
		Surface conditions: Short grass, weeds.
	0 – 5	Loose, light brown gravelly SAND FILL, with trace silt and asphalt debris; dry
	5 – 11	Medium stiff, brown sandy SILT FILL, with some gravels and cobbles and trace clay; moist.
	11 – 15	Stiff, brown SILT, with some sand and siltstone gravels and cobbles; moist.
		Minor caving beneath 5'. No seepage.

TP-3		**Location:** SW portion of site.
		Surface conditions: Short grass, weeds.
	0 – 5	Loose, light brown gravelly SAND FILL, with trace silt and asphalt debris; dry
	5 – 11	Medium stiff, brown sandy SILT FILL, with some gravels and cobbles and trace organics; moist.
	11 – 15	Stiff, brown SILT, with some sand and siltstone gravels and cobbles; moist.
		Minor caving beneath 5'. No seepage.

Exploration	Depth, ft	Moisture Content
TP-1	5.0	34%
TP-1	8.0	41%
TP-2	4.0	21%
TP-2	7.0	9%
TP-2	9.0	28%
TP-2	14.0	24%
TP-3	8.0	94%
TP-3	13.0	15%
B-1	2.5	34%
B-1	5.0	37%
B-1	10.0	31%
B-1	15.0	37%
B-1	20.0	32%
B-1	25.0	45%
B-1	30.0	157%
B-1	35.0	148%
B-1	40.0	156%
B-1	45.0	130%
B-1	50.0	45%
B-1	55.0	15%
B-2	2.5	17%
B-2	5.0	13%
B-2	10.0	17%
B-2	15.0	29%
B-2	25.0	29%
B-2	30.0	39%
B-2	35.0	75%
B-2	40.0	54%
B-2	45.0	197%
B-2	50.0	48%
B-2	55.0	177%
B-2	60.0	100%
B-2	65.0	81%
B-2	70.0	86%
B-2	75.0	17%
B-2	80.0	18%

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MOISTURE CONTENTS
cannon 22-4-gi

Exhibit A-1

N
NOT TO SCALE

BASE PHOTO FROM 2022 AERIAL

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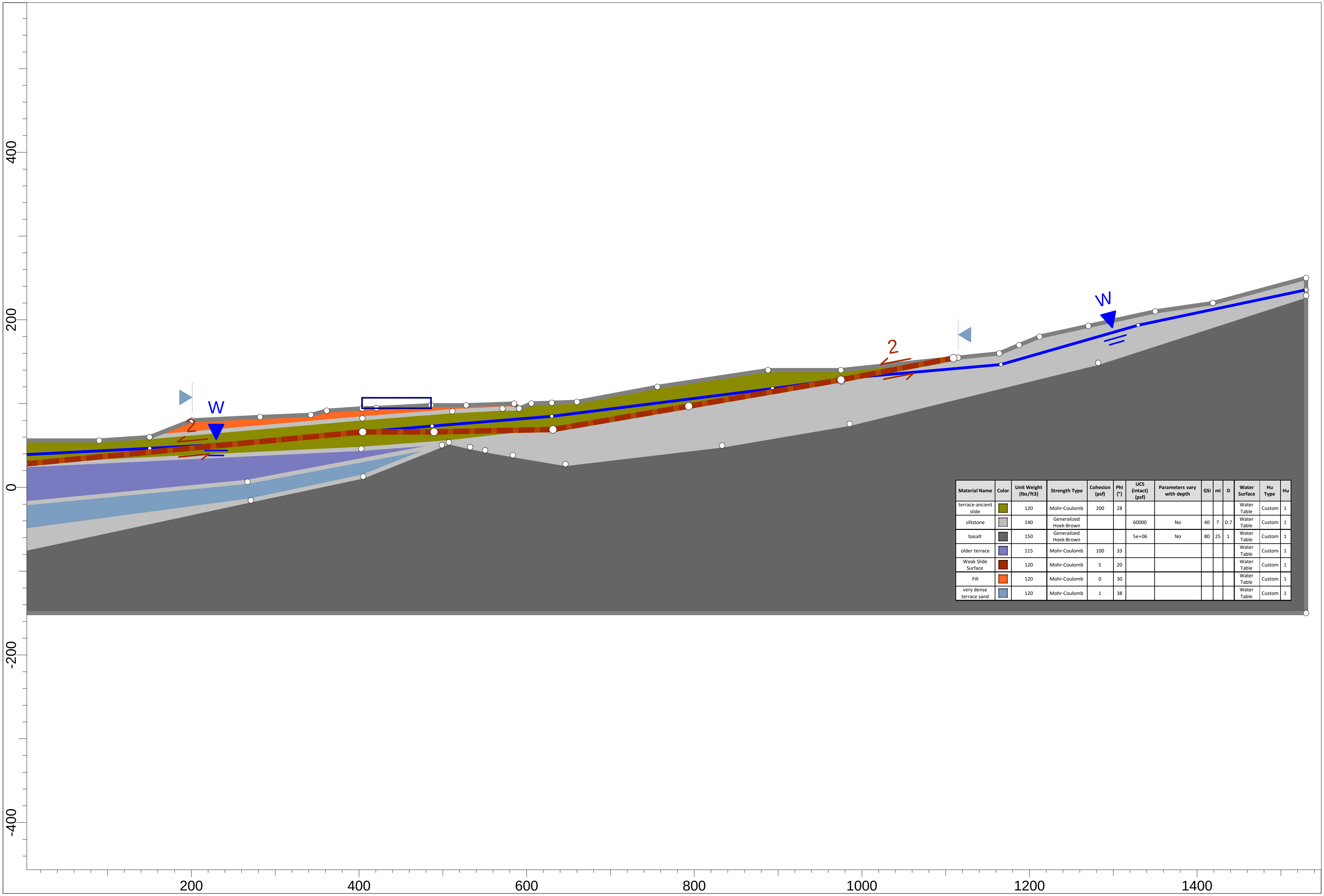
STABILITY SECTIONS

cannon-22-4-gi

Exhibit A-1

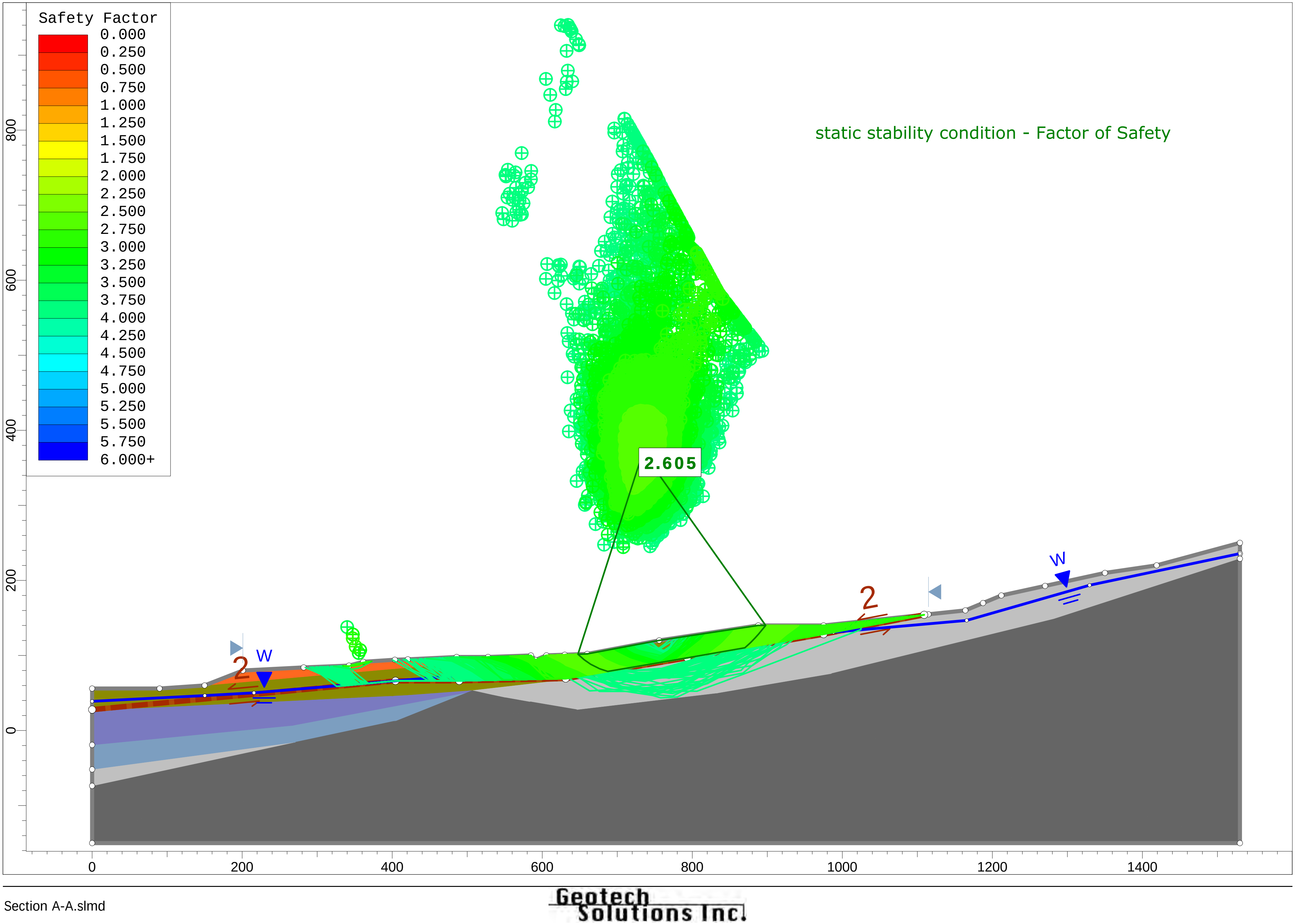


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)	UCS (intact) (psf)	Parameters vary with depth	GSI	mi	D	Water Surface	Hu Type	Hu
terrace-ancient slide		120	Mohr-Coulomb	200	28						Water Table	Custom	1
siltstone		140	Generalized Hoek-Brown			60000	No	40	7	0.7	Water Table	Custom	1
basalt		150	Generalized Hoek-Brown			5e+06	No	80	25	1	Water Table	Custom	1
older terrace		115	Mohr-Coulomb	100	33						Water Table	Custom	1
Weak Slide Surface		120	Mohr-Coulomb	5	20						Water Table	Custom	1
Fill		120	Mohr-Coulomb	0	30						Water Table	Custom	1
very dense terrace sand		120	Mohr-Coulomb	1	38						Water Table	Custom	1

Section A-A.slmd

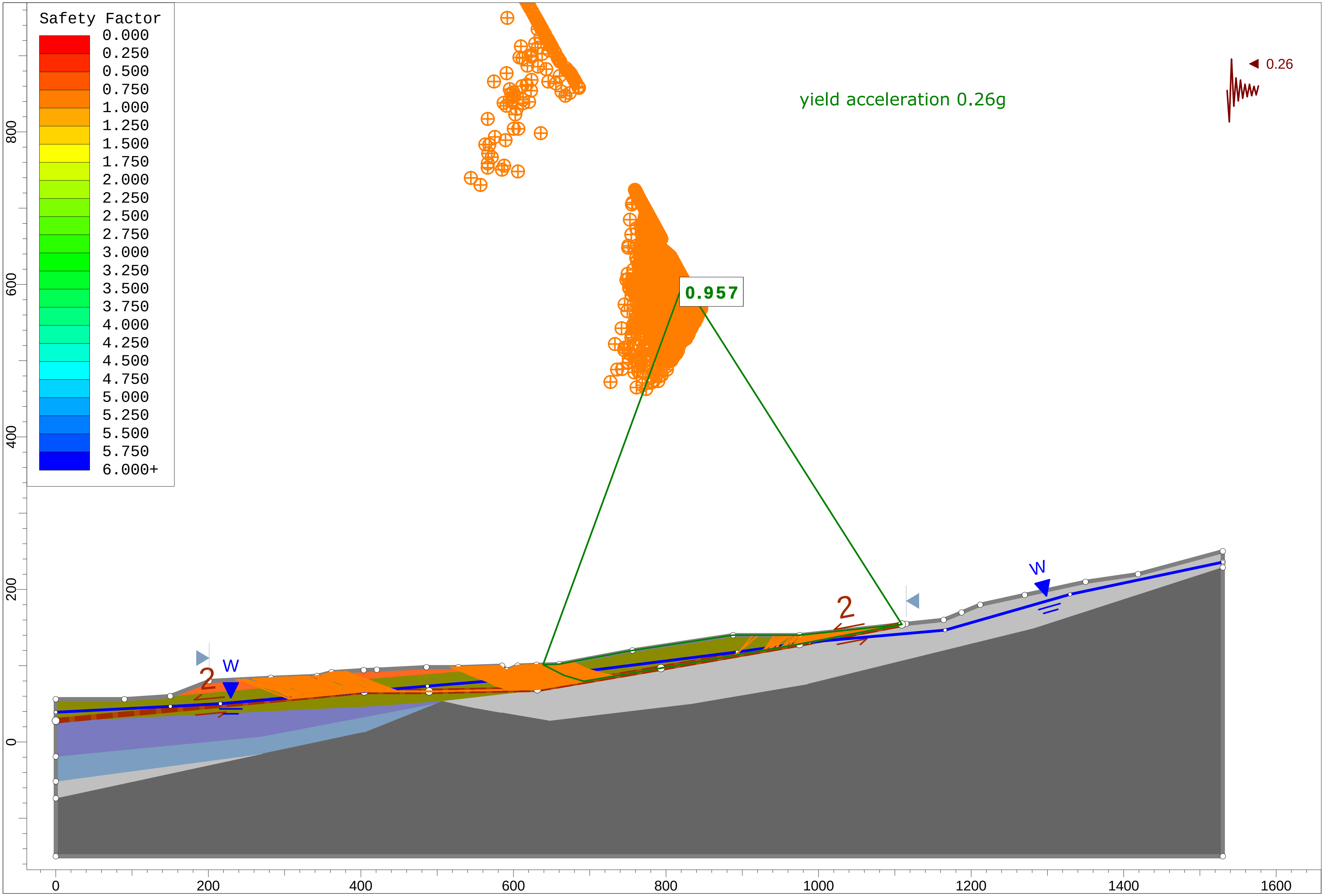
Geotech Solutions Inc.

Exhibit A-1



Section A-A.slmd

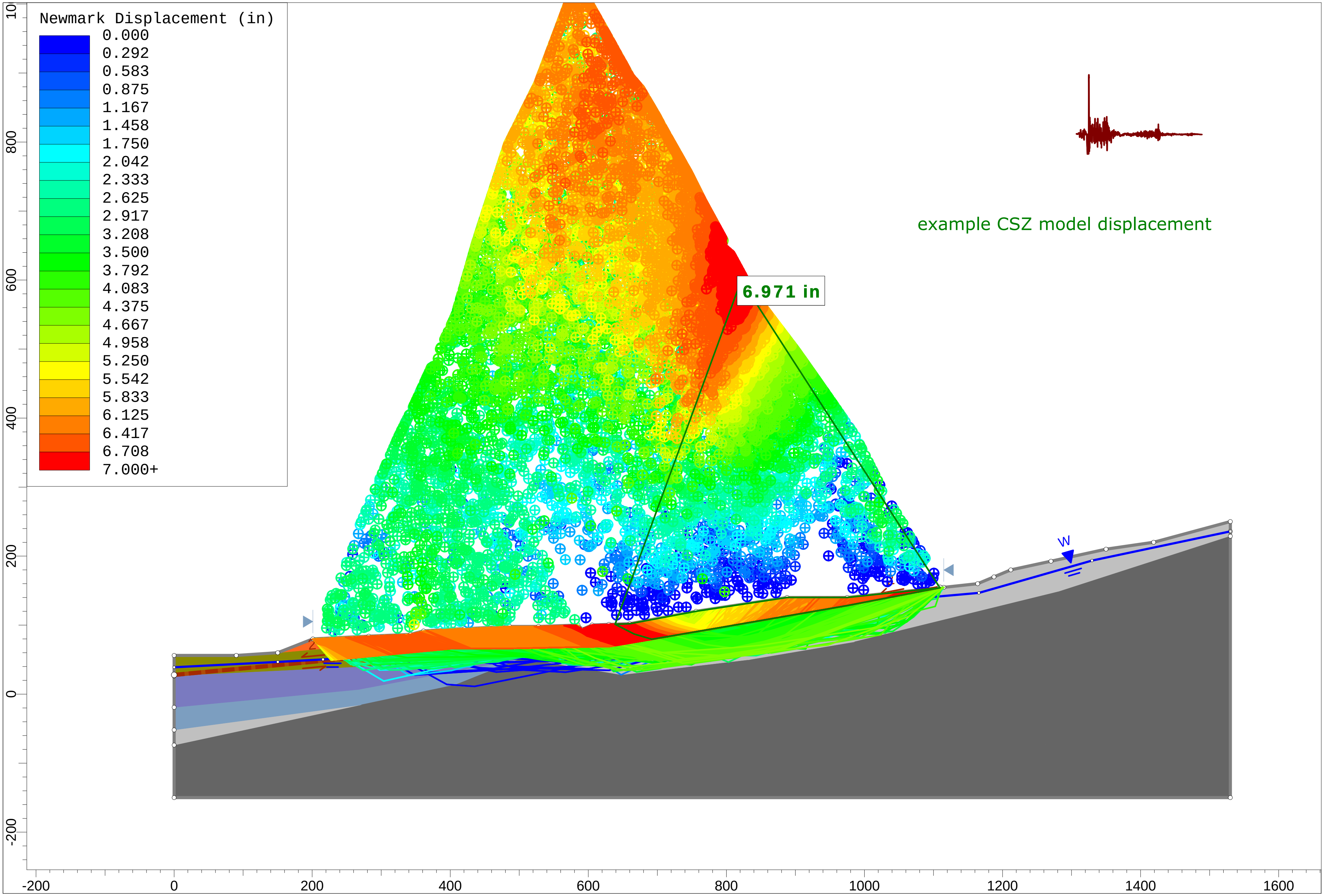
Exhibit A-1



Section A-A 0p26g weak surface at spt0.slmd

Geotech Solutions Inc.

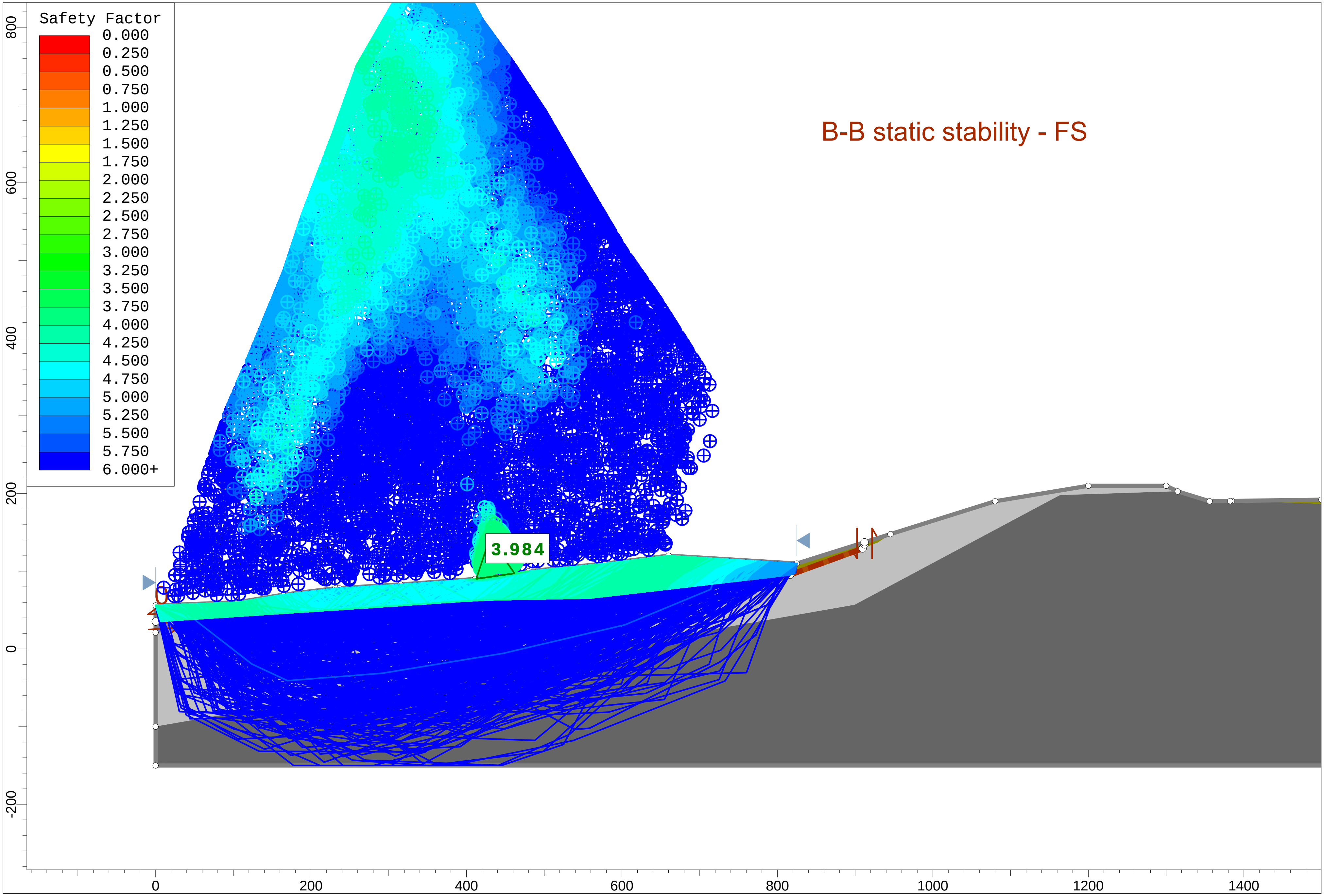
Exhibit A-1



Section A-A Ky newmark displacement - CSZ model

Geotech Solutions Inc.

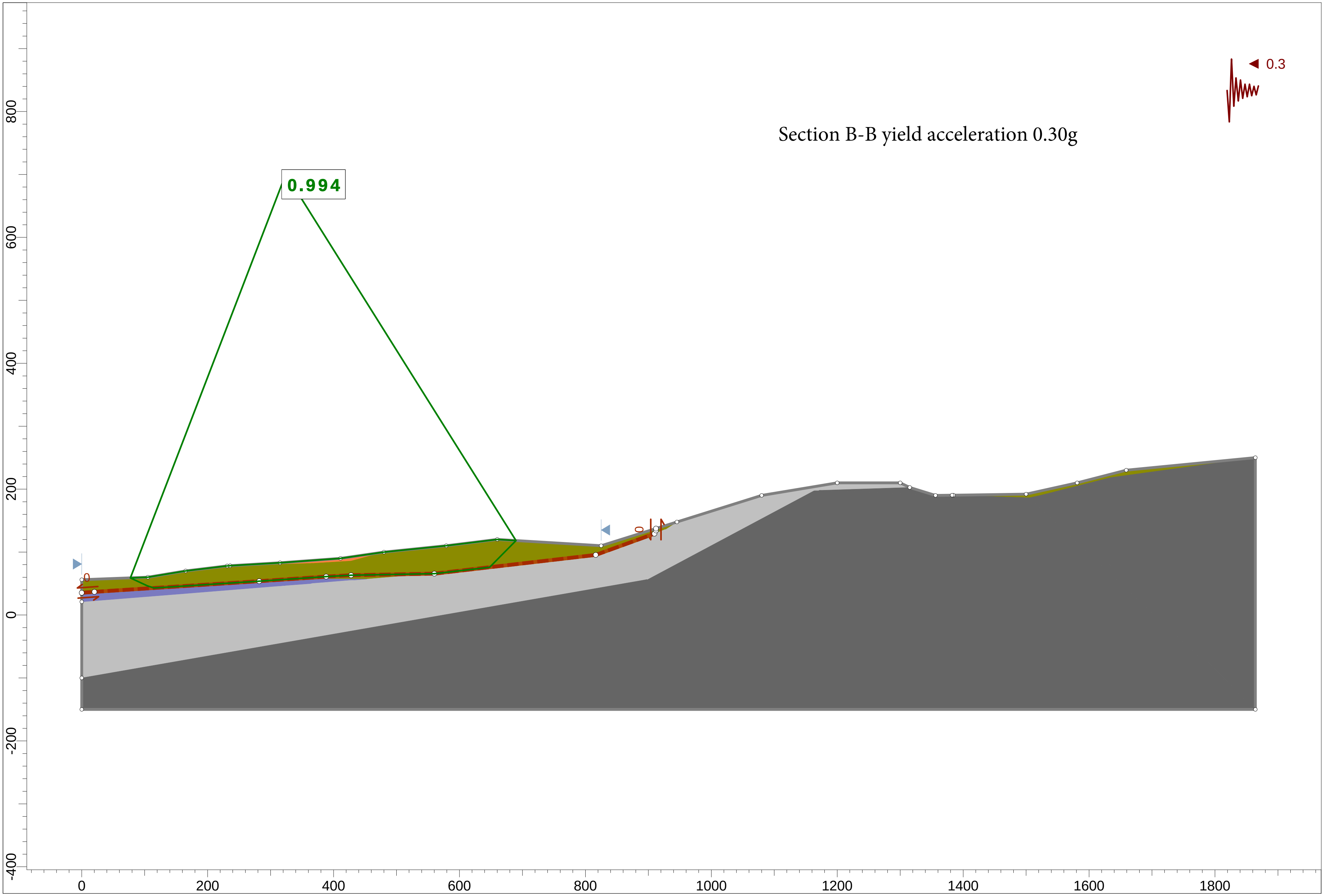
Exhibit A-1



Section B-B.slmd

Geotech Solutions Inc.

Exhibit A-1

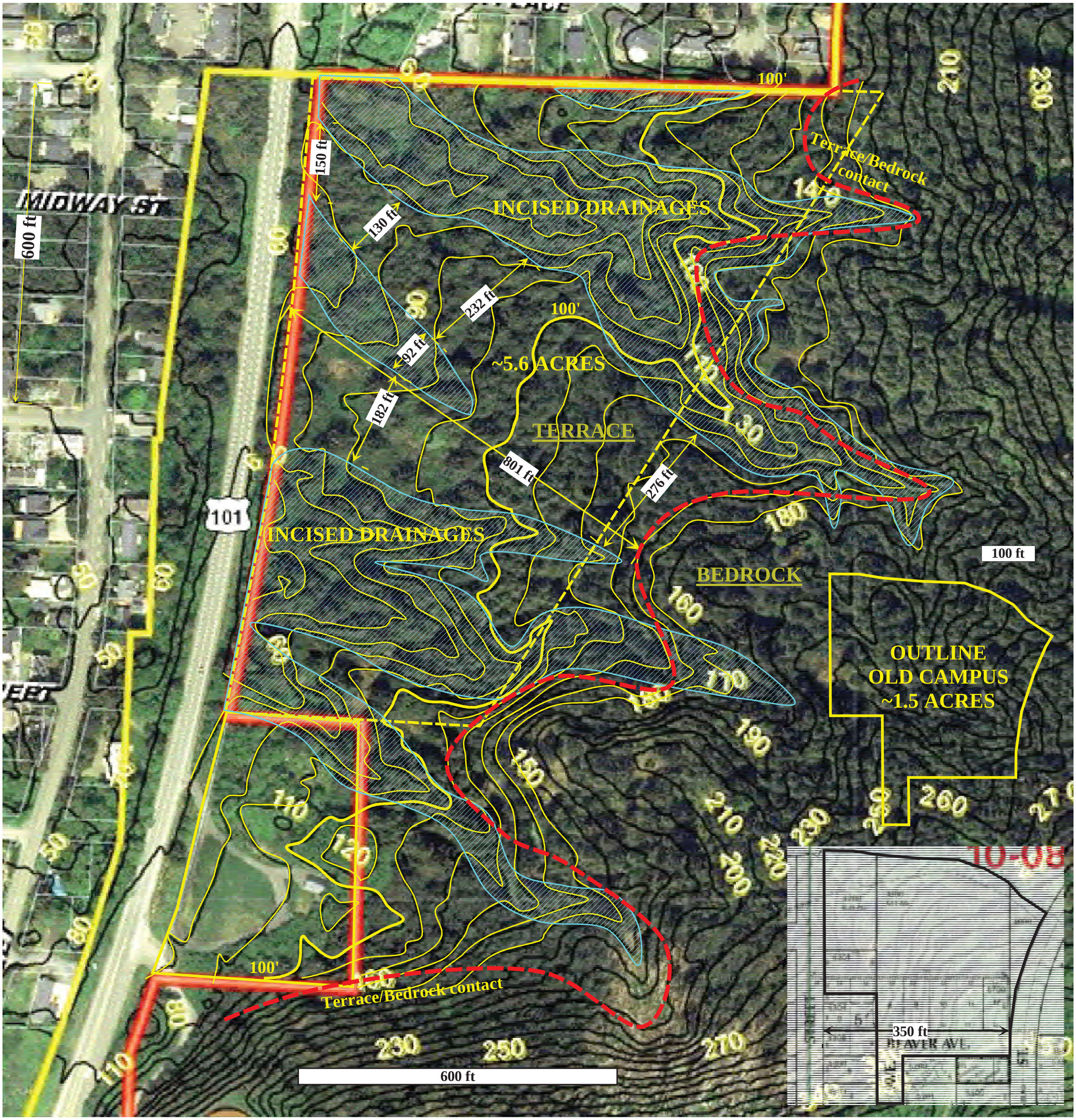


Section B-B.slmd

Geotech Solutions Inc.

Exhibit A-1

Horning GeoSciences



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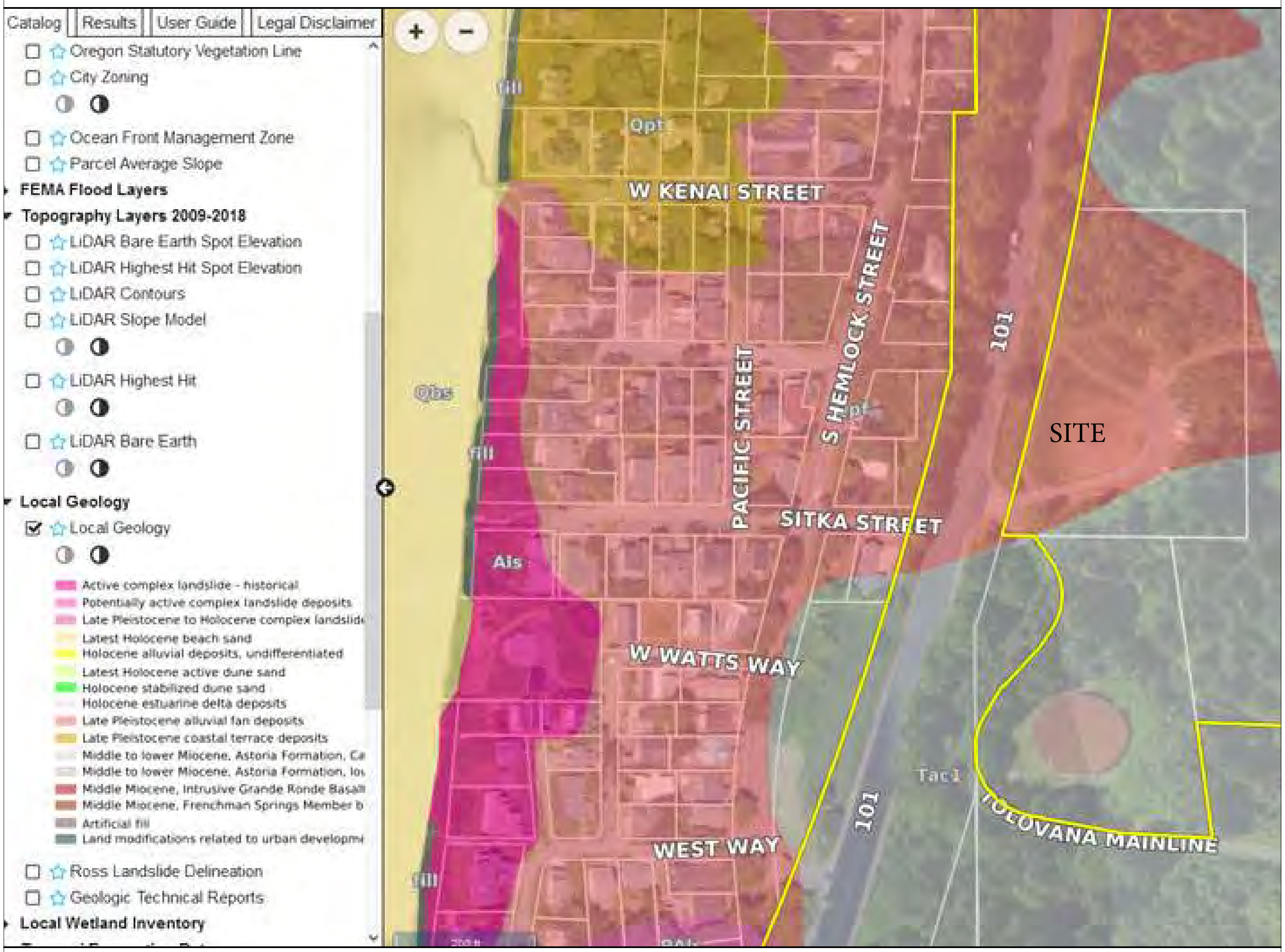


N
NOT TO SCALE

BASE PHOTO FROM 2022 AERIAL

Geotech Solutions Inc.

CITY GIS GEOOGICAL MAPPING

cannon-22-4-gi

Exhibit A-1

Geotech Solutions Inc.

DOGAMI Bulletin 74

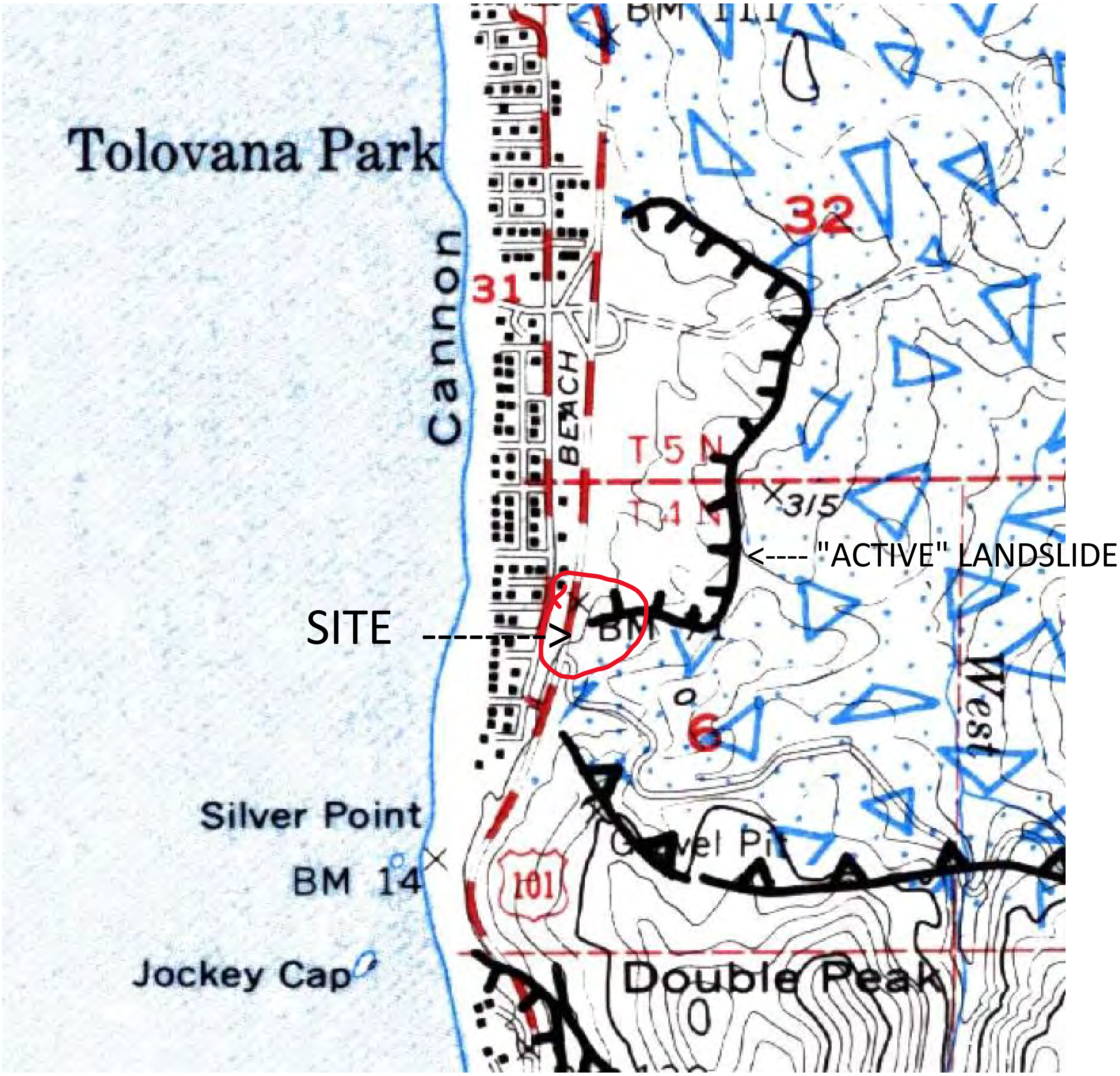


Exhibit A-1

Geotech Solutions Inc.

Oregon SLIDO Landslide Susceptibility

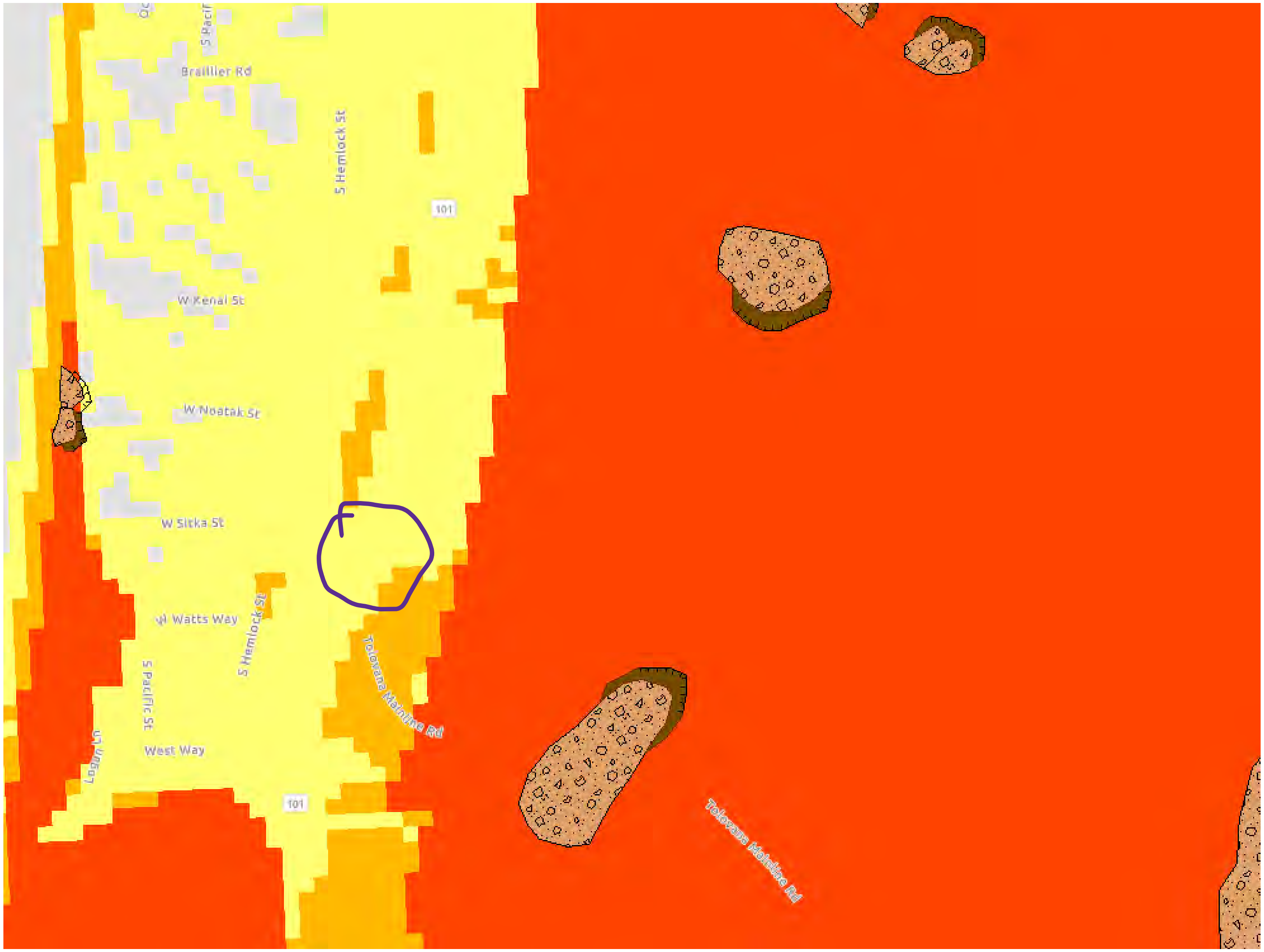


Exhibit A-1

N
NOT TO SCALE

BASE PHOTO FROM 2022 AERIAL

Geotech Solutions Inc.

DOGAMI TSUNAMI MAPPING

cannon-22-4-gi

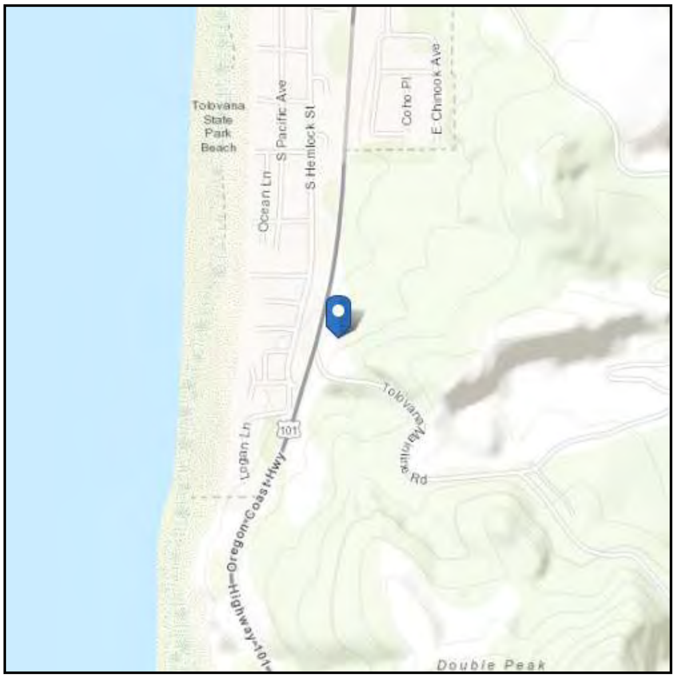
Exhibit A-1

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: IV
Soil Class: D - Stiff Soil

Latitude: 45.86268
Longitude: -123.958819
Elevation: 103.74040760446984 ft (NAVD 88)



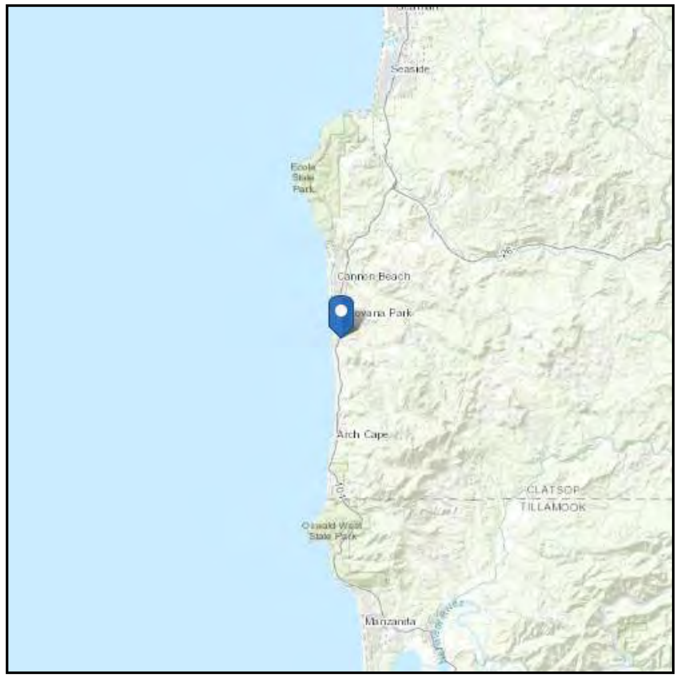


Exhibit A-1

Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.312	S_{D1} :	N/A
S_1 :	0.688	T_L :	16
F_a :	1	PGA :	0.661
F_v :	N/A	PGA_M :	0.727
S_{MS} :	1.312	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1.5
S_{DS} :	0.875	C_v :	1.362

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Thu Sep 21 2023

Date Source: USGS Seismic Design Maps

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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SEISMIC HAZARD INVESTIGATION

General

We have evaluated earthquake hazards in accordance with the degree of complexity of the proposed project and the site per SOSSC guidelines. This included literature and map review, as well as site specific subsurface investigations and analyses described in detail in the preceding report. Based on this evaluation, tsunami inundation hazards are low. Overall ground motion and amplification hazards are moderate and can be accommodated with code based design and the recommendations in our report. Liquefaction hazards are low due to the stiff and cohesive nature of the native site soils. Risk of on-site fault rupture is low. The risk of dynamic slope instability for the east-west terrace deposit sections across the site is high, with moderate deformations, as discussed in detail in the report text. The risk of instability for the southeast slope is moderate. A summary of the basis for these opinions is included herein.

Seismic Sources and Design Earthquake

Three earthquake types can induce ground motions at the site. These include local crustal earthquakes, and both CSZ intraplate and interface earthquakes. Local crustal earthquakes may occur from northwest trending faults in the region, most possibly from the Gales Creek or Tillamook Bay fault zones over 20 miles from the site, or possibly from small faults that are as close as 3.5 miles that are present in the accretionary wedge. These are shown on the attached fault map (USGS Quaternary fault database). However, these local crustal faults are considered a low hazard. CSZ intraplate earthquakes are presumed possible within the subducted Juan de Fuca plate, with estimated magnitudes of 7.0 to 7.5. These earthquakes are analogous to the 2001 Nisqually earthquake near Olympia as well as other large earthquakes historically beneath southern Puget Sound and inferred beneath the southern Oregon coast. The expected depth of these presumed earthquakes of 40 to 60 km, and when coupled with low seismicity in western Oregon they present a moderate hazard. A CSZ interface earthquake presents a high hazard for the site area and is the controlling design earthquake, as evidenced by USGS hazard de-aggregations (USGS OFR 2008-1128). Such an event has an expected magnitude of 8.7 to 9.1 and recurrence intervals roughly from 100 to 1100 years. A magnitude $M_w = 8.7$ is expected to correspond to an average 10% chance of being exceeded in 50 years, with $M_w = 9.0$ corresponding to 2% in 50 years. It is possible that such earthquakes could occur with hypo-central distances of 20 to 40 kilometers. Duration of strong ground motion is expected to be several minutes, and repeated cycles of horizontal ground acceleration are expected in the 0.35 to 0.50g range, with PHGA listed as 0.73 g by the USGS.

Tsunami Inundation

Based on a review of tsunami inundation elevations on maps (DOGAMI TIM-Clat-09, 2013 – excerpt attached) the proposed facilities will be located above tsunami inundation elevations of roughly 80 feet which is west of Highway 101 in this location. The risk of tsunami inundation is low.

Amplification

Amplification hazards at the site are moderate based on the fundamental period of the soil column as derived from its stiffness and depth. Based on the site-specific conditions encountered, the mapped units, and the low-rise building planned, the amplification hazard at the site is accommodated by code level design consistent with our preceding report recommendations.

Liquefaction
The liquefaction hazard for the site is low primarily due to the cohesive nature of the native site soils. Although non-cohesive sand was present in the west boring B-2 at depths of 73-82 feet, this sand is very dense and not susceptible to liquefaction.

Fault Rupture
No faults are mapped as crossing the site (USGS Quaternary fault database), with the nearest Quaternary fault mapped as within 4 miles to the west-northwest within/below accretionary wedge sediment. The Gales Creek fault zone is the next nearest fault located roughly 16 miles to the east-southeast. Interface earthquakes from the CSZ are offshore and buried nearer shore, and intraplate CSZ earthquakes are deep within the subducted plate. Therefore, the hazard from potential fault rupture on-site is low.

Earthquake Induced Slope Instability
The site is mapped at the margin of a mapped landslide noted as "active" in DOGAMI Bulletin 74 which includes a broad scale perspective (excerpt attached). Site inclinometer readings from 2020-2023 indicate no site movement during that time, and no site indications of active instability have been noted in our site reconnaissance in 2013 and in 2023 for this report. Previous reports for the Southwind site also indicate that the area is not undergoing active movement.

The site subsurface below depths of roughly 43-48 feet includes marine terrace with variable structure, intact organic debris, and characteristics of landslide deposition. This deposit is susceptible to landslide movements at yield accelerations calculated to be above 0.26g, well below the design earthquake threshold. This would categorize the general earthquake instability risk as high, although deformations were analyzed to be moderate. Based on our interaction with the structural engineer, this risk can be accommodated for functional design by proper structural engineering that addresses the quantified deformations and foundation approaches and parameters detailed in the text of this report's ***Foundations*** section.

Exhibit A-1

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APPENDIX

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

MEMORANDUM

To: Tim Scott, PE / Red Plains Professional, Inc.

Date: May 18, 2023
(REVISED: May 26, 2023)

GRI Project No.: 6803-A

From: George A. Freitag, CEG; and Nicholas M. Hatch, PE

Re: Instrumentation Data Collection Summary
New Cannon Beach City Hall
South Wind Site
Cannon Beach, Oregon

This memorandum summarizes data recently collected from instrumentation installed by GRI to monitor ground movement and groundwater levels at the South Wind Site as part of our 2019 Geotechnical Feasibility Study for the New Cannon Beach City Hall (GRI, 2019). The general location of the South Wind Site is shown on the Vicinity Map, Figure 1. The South Wind site was one location being considered for the proposed new city hall in Cannon Beach, Oregon. However, based on information provided by you, we understand the City is now considering building the new city hall on the Cache site, which borders the southwest corner of the South Wind site. This recent data collection effort was completed to assist with estimating an adequate level of effort to complete a geotechnical investigation for the Cache site.

INSTRUMENTATION

General

For our 2019 study, a total of three borings, designated B-1 through B-3, were advanced to depths of 100 feet to 151.5 feet at the South Wind Site, and instrumentation consisting of two inclinometer casings and six vibrating-wire piezometers was installed in the completed boreholes. The approximate locations of the explorations are shown on the Site Plan, Figure 2. The instrumentation data were last collected on February 8, 2019, and were limited to about two months of monitoring. No obvious inclinometer readings indicative of active landslide movement were noted in 2019. New data was recently collected on May 5, 2023, and this memorandum provides our interpretation of the recent data.

Inclinometers

Inclinometer casings 140 feet and 150 feet long were installed in the completed boreholes of borings B-2 and B-3, respectively. An inclinometer is a device that allows measurements to be made of subsurface lateral movements. An inclinometer casing consists of a 2.75-inch O.D., acrylonitrile butadiene styrene (ABS)-plastic casing with orthogonal grooves or slots that permit a calibrated instrument to be lowered to the bottom of the casing in a fixed orientation. When the ground surrounding the casing moves, the casing distorts above the zone of movement, and the orientation of the casing changes. The inclination, or vertical orientation, of the casing is monitored by lowering an electronic measuring device to the bottom of the grooved casing and obtaining readings at 2-foot intervals as the instrument is withdrawn. An initial set of readings serves as a “benchmark” and is commonly portrayed as the vertical axis on a plot of casing deflection versus depth. All subsequent readings are then referenced to the initial readings. By comparing relative movements at fixed depths over the length of the casing, zones of horizontal movement can be identified. The total, or cumulative, displacement with respect to the base of the casing is obtained by summing the relative displacements from the bottom to the top.

A benchmark reading of each inclinometer was taken on December 12, 2018, with subsequent readings taken on February 8, 2019, and May 5, 2023. The inclinometer benchmark and subsequent readings are provided on Inclinometer Summary B-2 and Inclinometer Summary B-3, Figures 3 and 4. In general, the readings overlap and indicate that horizontal movement of the ground surface at these boring locations has not occurred since the inclinometers were installed in December 2018.

VIbrating-WIre Piezometers

Vibrating-wire piezometers were installed at depths of 50 feet and 90 feet in borings B-1 and B-2 and at depths of 100 feet and 150 feet in boring B-3. A vibrating-wire piezometer is a device that allows measurements to be made of subsurface fluid pressures. The piezometer consists of a sensitive steel diaphragm to which a vibrating-wire element is connected. A filter is used to keep out solid particles and prevent damage to the sensitive diaphragm. Changing pressures cause the diaphragm to deflect, and this deflection is measured as a change in tension and frequency of vibration of the vibrating-wire element. The square of the vibration frequency is directly proportional to the pressure applied to the diaphragm. To read the piezometer, a pulse of varying frequency is applied to the piezometer and causes the wire to vibrate at is resonant frequency. After excitation ends, the wire continues to vibrate, and a signal is transmitted to a readout box, where it is conditioned and displayed. The data on the readout box can then be converted to a fluid pressure based on the calibration data supplied by the manufacturer.

An initial reading of each piezometer was taken on December 12, 2018, and data loggers were attached to the piezometers to allow for continuous measurement of water pressures. During our recent site visit on May 5, 2023, the boring B-1 location could not be found due to overgrowth of brush and trees, and the data logger equipped to the boring B-3 piezometers was damaged. Therefore, the only data logger information collected was from boring B-2 piezometers, and the batteries in this data logger died on September 22, 2020. The water pressures recorded in the boring B-2 piezometers between December 12, 2018, and September 22, 2020, are provided on

Piezometer Summary B-2, Figure 5. GRI also collected groundwater data from the Boring B-2 and B-3 piezometers using a handheld readout device, and this data is summarized in Table 1 below.

TABLE 1: GROUNDWATER DEPTH AND PRESSURE MEASUREMENTS

Boring	Piezometer Depth, ft	Water Pressure, ft
B-2	50	42.3
	90	59.6
B-3	100	83.1
	150	130.6

The vibrating-wire piezometer readings indicate the perched groundwater level at borings B-2 and B-3 will typically occur at depths of 5 feet to 10 feet and 15 feet to 20 feet, respectively, throughout the year.

CONCLUSIONS

Current inclinometer data from borings B-2 and B-3 generally show that horizontal movement of the ground surface at these boring locations has not occurred at the South Wind Site since the inclinometers were installed in December 2018. The recent readings are consistent with observations documented in our 2019 report, notably that the previous proposed building area shown on Figure 2 is not underlain by an “active” landslide. In our opinion, the geotechnical and geologic findings of our 2019 report remain valid and should be used to evaluate future development of the South Wind Site.

The Cache Site is located at the base of a forested hillside that generally defines the southwestern property boundary of the South Wind Site. Boring B-3 was installed in the southwestern corner of the South Wind Site near the eastern side of the Cache Site, as shown on Figure 2. The recent inclinometer data from boring B-3 suggests the overall hillside bordering the Cache Site may not be an “active” landslide subject to continuous creep-like static movements. However, a more detailed geologic reconnaissance of that hillside is required to identify the presence of smaller, localized landslide topography. In addition, as discussed in our 2019 report for the South Wind Site, we anticipate seismic movement of the hillside towards Highway 101 could occur during a code-based seismic event. This is an important consideration as it relates to selecting the location of the new city hall building on the Cache Site. We recommend completing a geotechnical investigation that includes geologic reconnaissance to further evaluate the impacts of the hillside bordering the eastern side of the Cache Site.

LIMITATIONS

This memorandum should be considered an addendum to our March 14, 2019, feasibility study for the South Wind Site and is subject to the limitations stated therein.

Please contact the undersigned if you have any questions.

Submitted for GRI,

RENEWS: 02/2024

George A. Freitag, CEG
Principal

Nicholas M. Hatch, PE
Senior Engineer

This document has been submitted electronically.

6803-A INSTRUMENTATION DATA COLLECTION SUMMARY MEMORANDUM

Enclosures: Figure 1, Vicinity Map
Figure 2, Site Plan
Figure 3, Inclinometer Summary B-2
Figure 4, Inclinometer Summary B-3
Figure 5, Piezometer Summary B-2

BORINGS COMPLETED BY GRI (DECEMBER 3-10, 2018)

A A' CROSS SECTION USED IN SLOPE STABILITY ANALYSIS

SITE PLAN FROM FILE BY SRG PARTNERSHIP, 2018

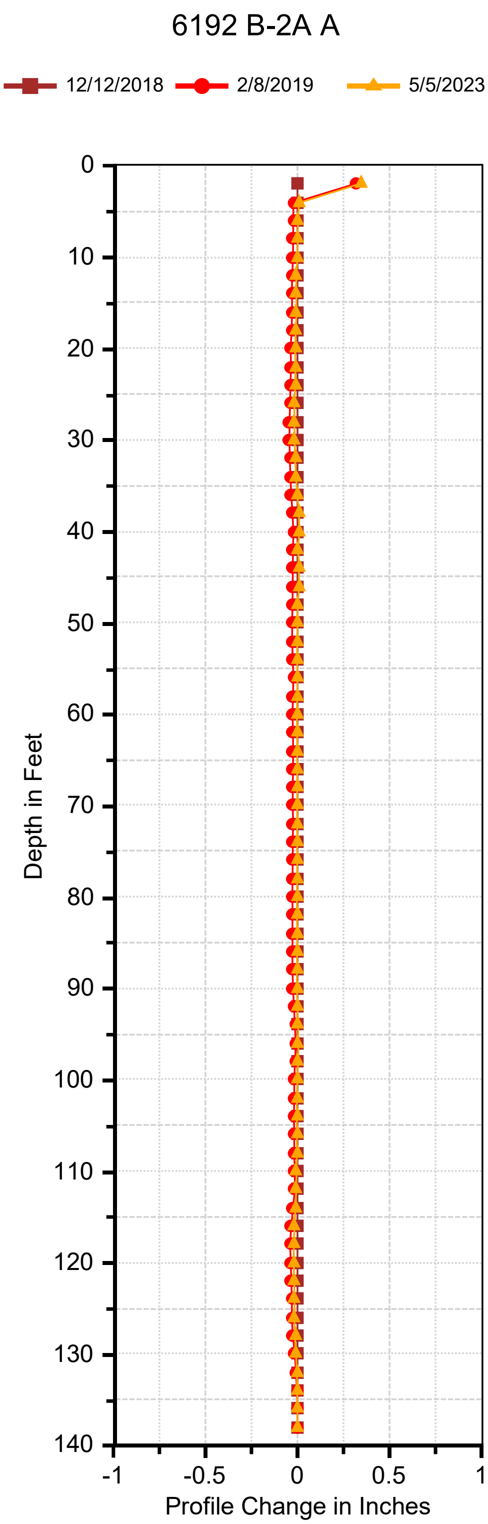
0 180 360 FT

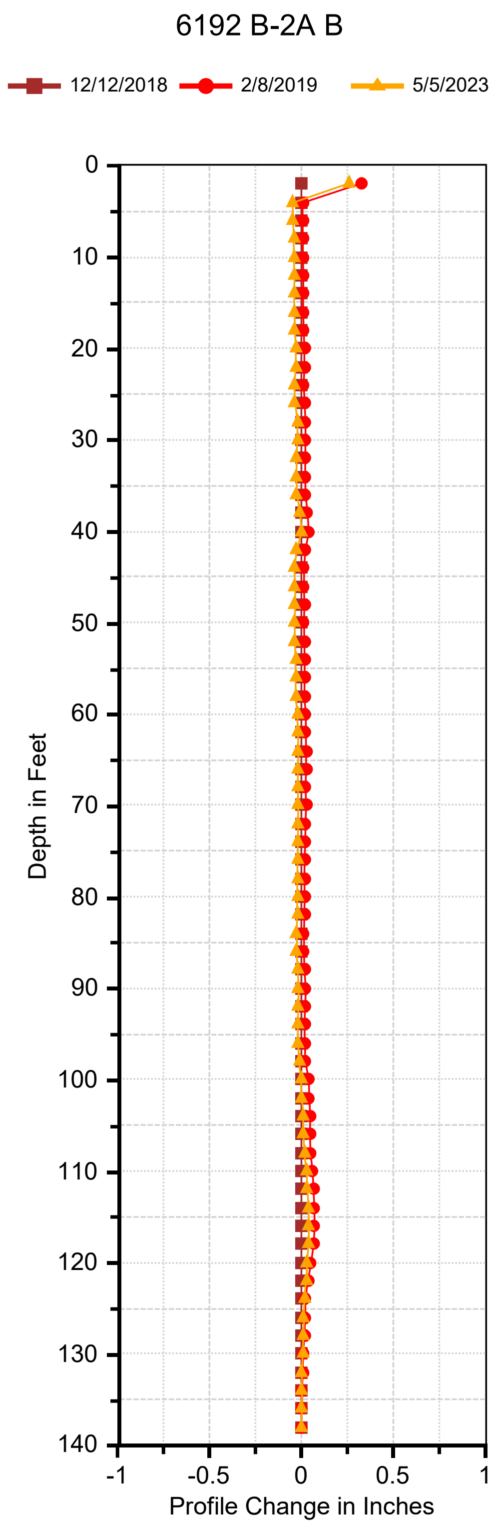
GRI RED PLAINS PROFESSIONAL, INC.
NEW CANNON BEACH CITY HALL - SOUTH WIND SITE

SITE PLAN

MAY 2023 JOB NO. 6803-A FIG. 2

Exhibit A-1





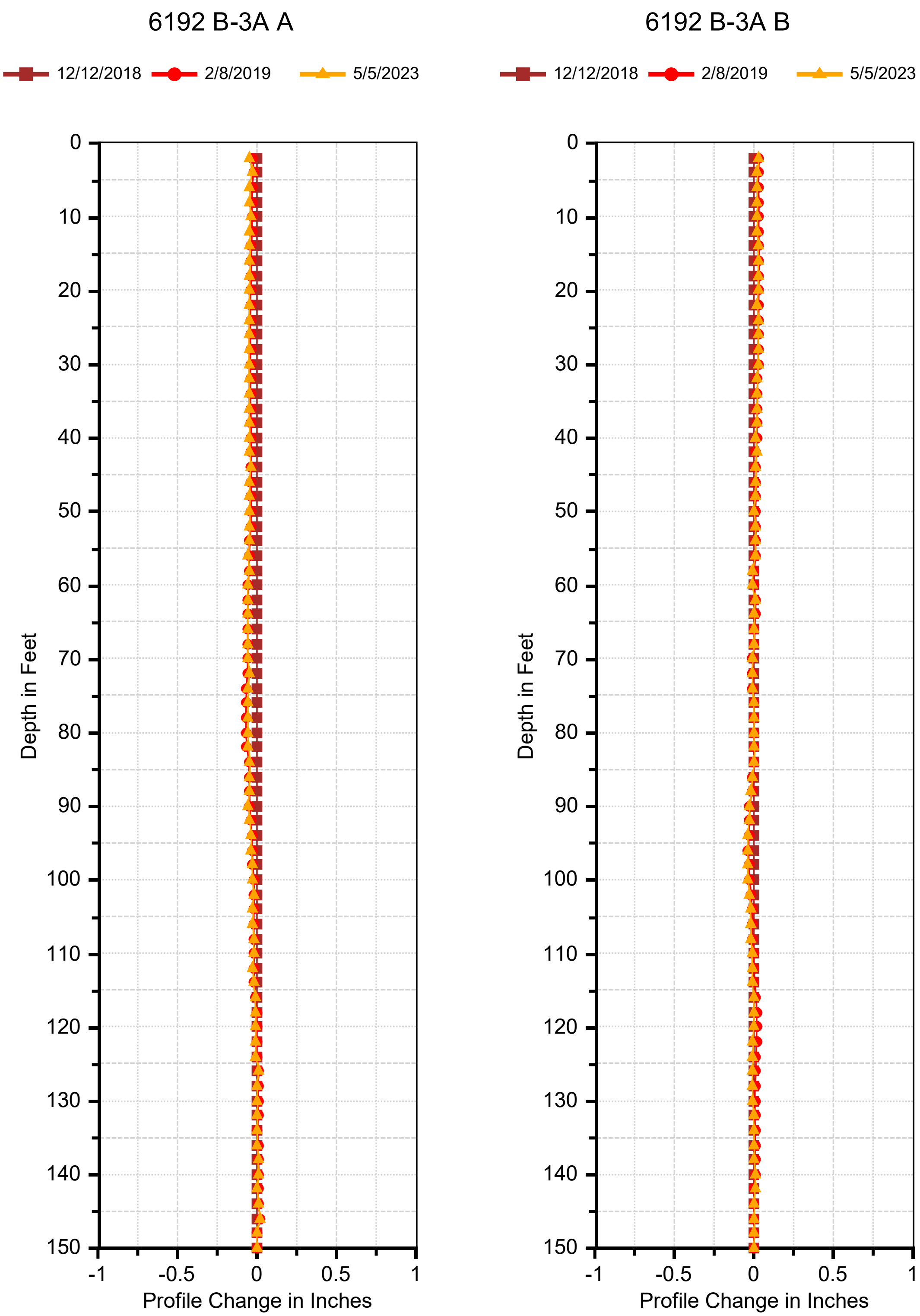
GRI

RED PLAINS PROFESSIONAL, INC.
NEW CANNON BEACH CITY HALL - SOUTH WIND SITE

INCLINOMETER SUMMARY
B-2

MAY 2023 | JOB NO. 6803-A | FIG. 3

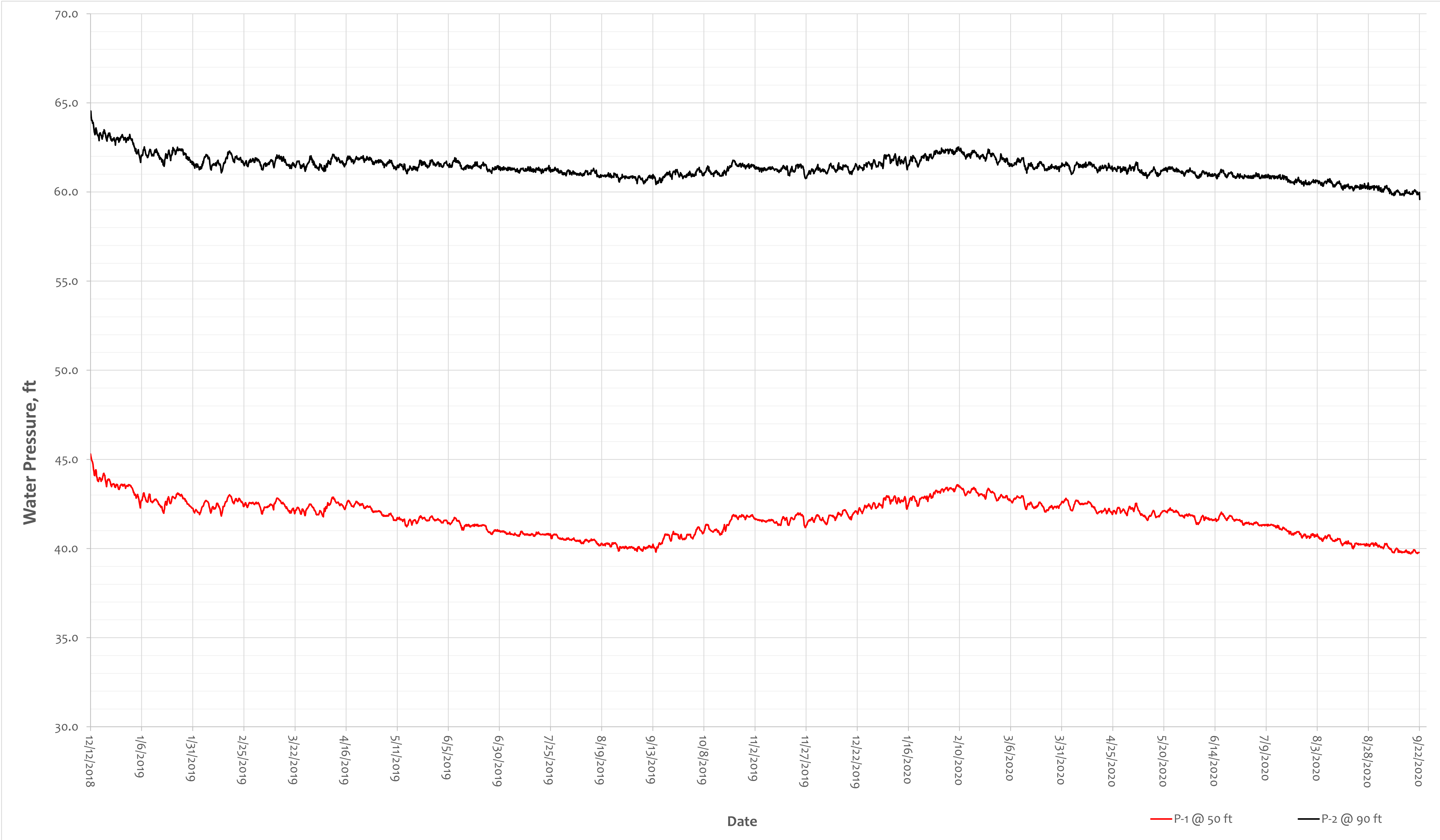
Exhibit A-1



RED PLAINS PROFESSIONAL, INC.
NEW CANNON BEACH CITY HALL - SOUTH WIND SITE

INCLINOMETER SUMMARY
B-3

MAY 2023 | JOB NO. 6803-A | FIG. 4



GRI RED PLAINS PROFESSIONAL, INC.
NEW CANNON BEACH CITY HALL - SOUTH WIND SITE

PIEZOMETER SUMMARY B-2

MAY 2023 JOB NO. 6803-A FIG. 5

Exhibit A-1

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APPENDIX

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

SOUTH WIND MASTER PLAN

December 17, 2014

Prepared by the Master Plan Advisory Committee:

Liz Beckman
Wendy Higgens (City Council Liaison)
Beth Holland
Jim Litherland
Bob Lundy
Mark Morgans
John Nelson

Mark Barnes (City Planning Director)
Dan Grassick (City Public Works Director)

SOUTHWIND MASTER PLAN

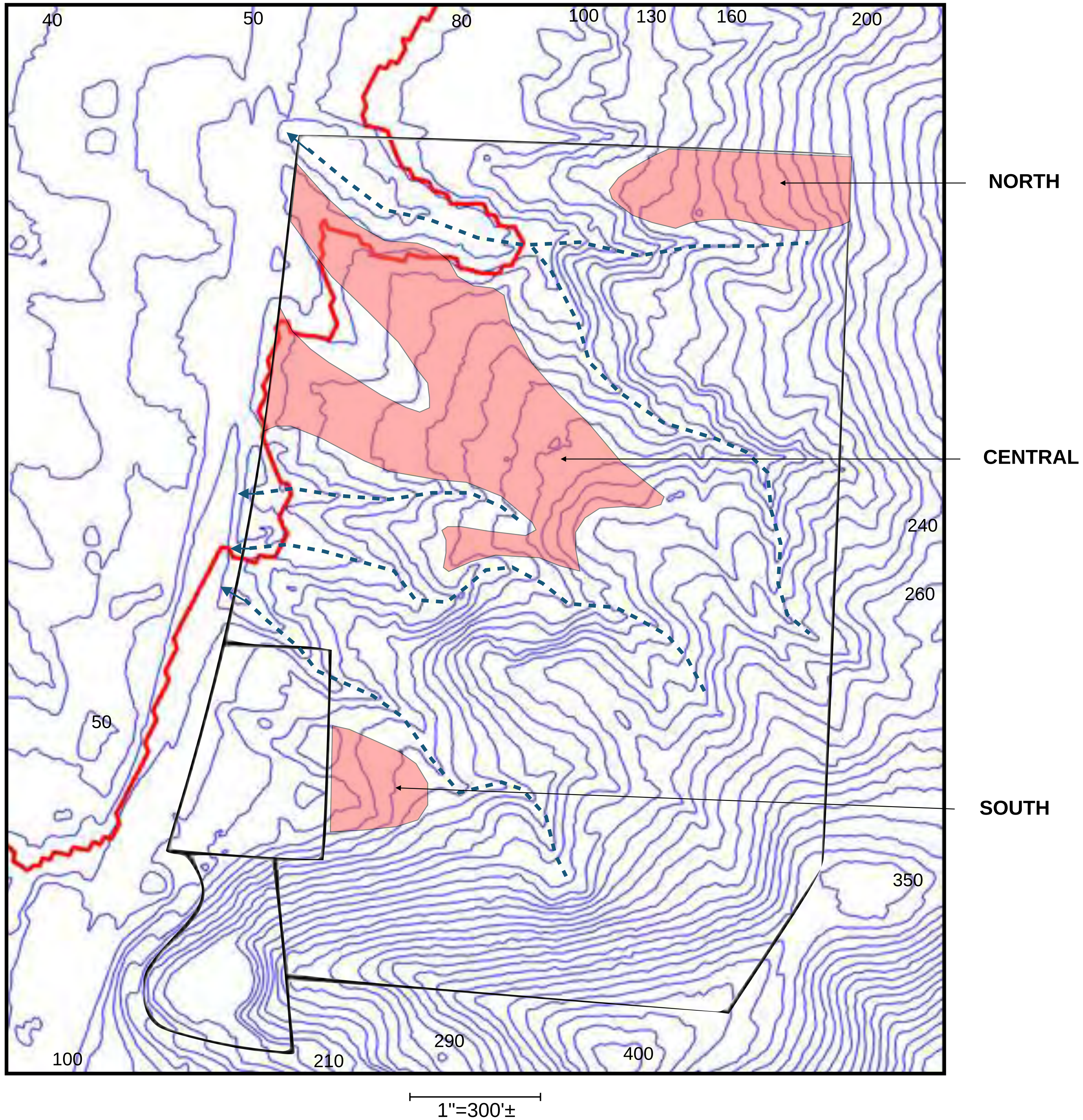
1"=300'±

CURRENT CONDITIONS

SouthWind consists of about 58.3 acres located east of Highway 101 and south of the Haystack Heights neighborhood. SouthWind is made up of two parcels. A 55-acre tract was acquired by the City from Campbell Global in 2013. A 3.3 acre parcel was acquired by the City from Clatsop County in 1990.

The site is vacant except for an existing 450 square foot garage used to store emergency supplies, visible near the southwest corner of the site.

The aerial photograph to the left was taken in 2013. Logging on the site was conducted in 2011 and 2013.



Topography, Hydrology, Geology, and Tsunami Risk

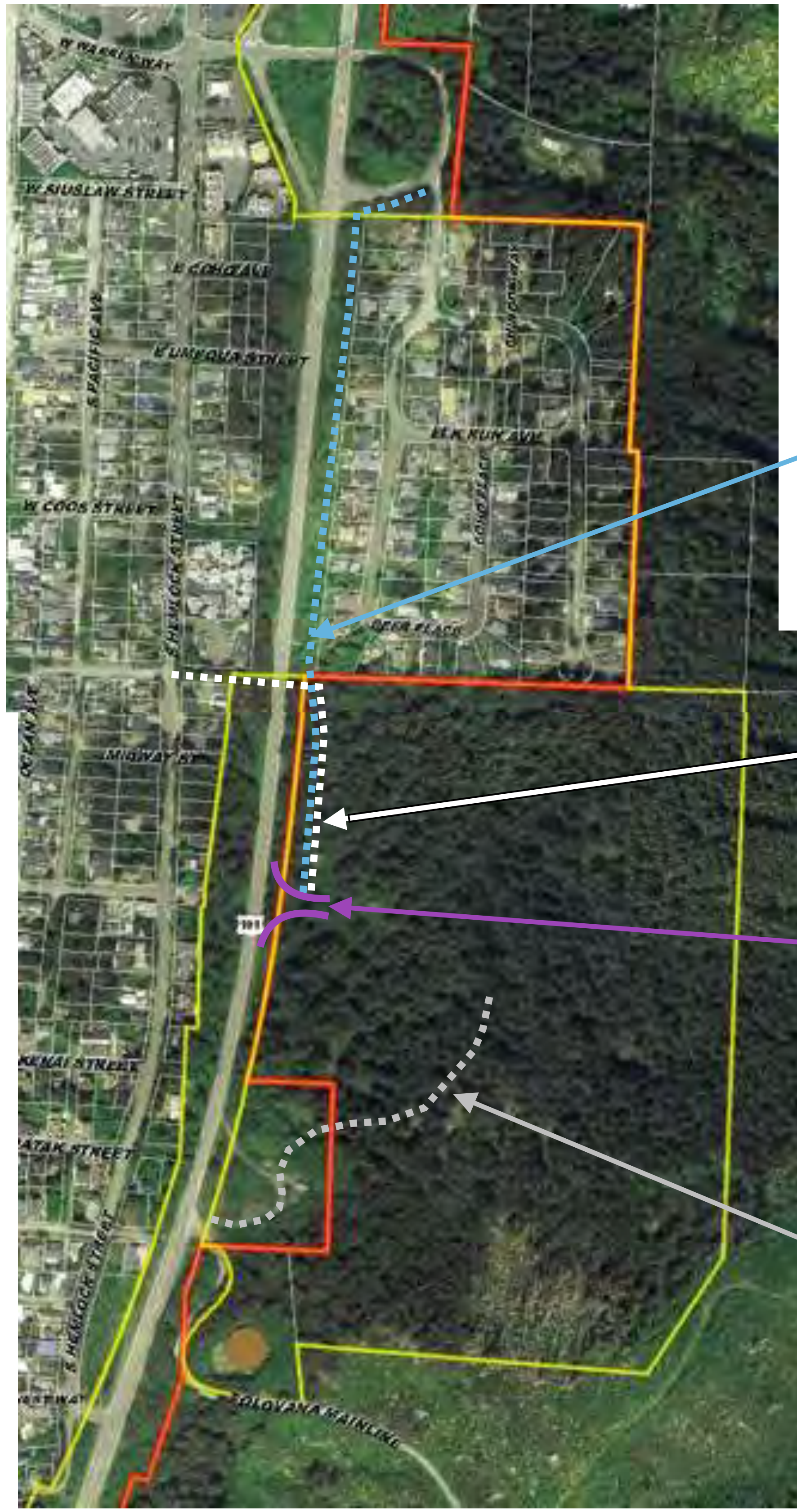
This topographic map is based on 2011 LIDAR data. Ten-foot contour intervals are shown. Elevations on the site range from about fifty feet above sea level near the site's northwest corner, to almost 400 feet near the site's southern boundary.

The Tsunami Inundation Line is shown as a solid red line on this map. It is based on data developed by the Oregon Department of Geology and Mineral Industries (DOGAMI) in 2013. Several different risk levels were considered; shown is the inundation line for a tsunami generated by the largest predicted Cascadia subduction zone earthquake. Lands to the west of this line (that is, toward the left side of the map) would be inundated by this tsunami; lands to the east are above the estimated inundation line. The earthquake in this model releases fault slip built up over about 1,200 years; earthquakes of this magnitude are infrequent, and roughly equivalent to the 2011 Tōhoku tsunami. ***The City will restrict construction of essential facilities on the SouthWind site to areas above the DOGAMI XXL inundation line.***

A report prepared by Horning Geoscience in 2013 addressed geological hazards on the site. A copy of this report is included as an addendum to this master plan. The Horning Geoscience report evaluated three potential development sites on the property, shown on the map to the left. These areas are referred to as the North, Central, and South sites in the Horning Geoscience report, and are so labeled on the map to the left. The South site covers about one acre; the Central site about eight acres; and the North site about two acres. The report concludes that these three areas are potentially developable, assuming appropriate geotechnical engineering measures are taken. The report does not rule-out development on other parts of the site given appropriate engineering solutions to the site's geological limitations. ***The City will require a site-specific geologic hazard study for each building, for road construction, and for any grading or filling on the SouthWind site.***

The site drains to the west via several drainage basins. These are shown as dark blue dotted lines on the map to the left. Culverts beneath Highway 101 convey site runoff to the west. ***The City will maintain existing drainages and stream corridors on the SouthWind site. A ten-foot wide buffer is established on each side of each stream corridor. Where it is necessary to cross a stream corridor, the crossing will be designed to maintain stream corridor hydrology, and will comply with all applicable state or federal permit requirements.***

Exhibit A-1



1"=500'±

ROAD AND UTILITY ACCESS

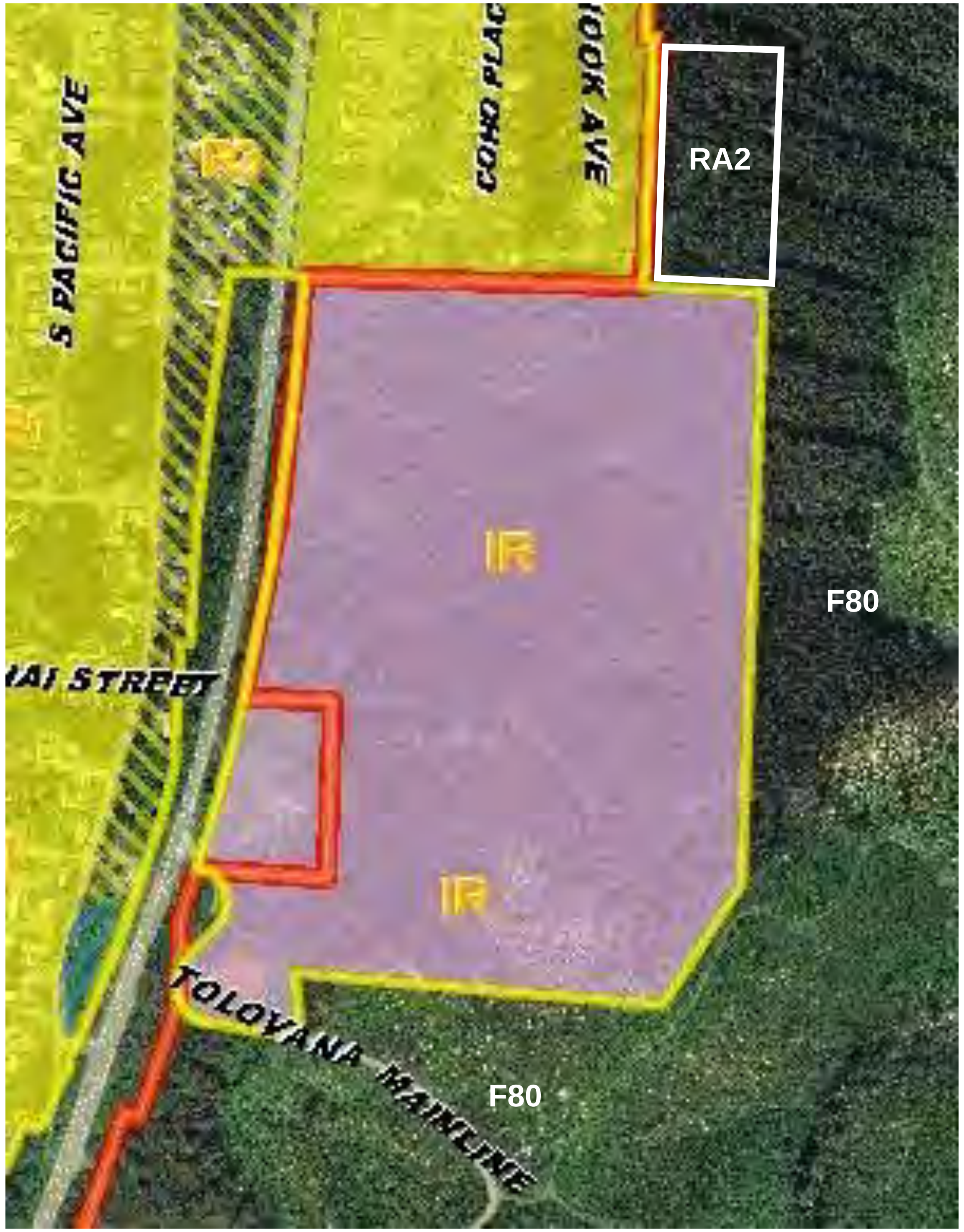
The SouthWind site has about 1,600 feet of frontage on Highway 101. East Chinook Street, a city street, ends at the site's north property line. The Tolovana Mainline, a privately-owned gated logging road, enters Highway 101 at the southwest corner of the site. Utilities (water, power, sewer) are in the Hemlock Street corridor, west of Highway 101.

Pedestrian access to the SouthWind site could be (a) via East Chinook; (b) via an easement from Deer Place; (c) across Highway 101 at or near the preferred road access point; or (d) on the east side of the Highway 101 right-of-way between Warren Way and the site, separated from the Highway 101 travel surface. Of these alternatives, the City prefers alternative (d) because it does not require pedestrians to cross Highway 101; avoids the need to purchase easements to reach Deer Place; avoids steep terrain at the south end of East Chinook Street; and uses established pedestrian facilities and the overpass at Warren Way. Estimated improvement costs for pedestrian access are about $350,000. ***The City prefers pedestrian access to the SouthWind site on the east side of the Highway 101 right-of-way between Warren Way and the site, separated from the Highway 101 travel surface.***

City utilities (water and sewer) can be brought to the site by boring beneath Highway 101. The preferred location is at Orford Street, at the property's northwest corner. Water and sewer system extensions onto the site, and including connections to the water tank to the southwest of the site, and to the existing water line on East Chinook Street, are estimate to cost about $665,000. ***The City will integrate the SouthWind waterline extension with the existing water storage tank and with the water distribution system in the Haystack Heights neighborhood.***

Access to Highway 101 will likely require a left turn refuge, a right turn deceleration lane, a right turn acceleration lane, shoulder enhancements, signage, lighting, and drainage improvements. A 2014 estimate of costs for these highway improvements is $2.2 million. The access point location will need to be determined through a traffic study. The City prefers access near the central part of the site's frontage, roughly opposite Braillier Street. A shared access with the Tolovana Mainline is not preferred because of potential conflicts between log trucks using the Tolovana Mainline, and traffic such as school busses and emergency vehicles. Access via East Chinook is not preferred because neighborhood streets in Haystack Heights are not appropriate for regular emergency vehicle access; and because the topography at the end of East Chinook poses engineering, design and cost challenges for road construction. ***The City prefers a location roughly opposite Braillier Street for the primary highway access to the SouthWind site.***

Secondary/Emergency Access can be provided via the existing access point at the southwest corner of the site. ***The existing highway access point at the southwestern corner of the SouthWind site is unsuitable for primary highway access due to the potential for conflicts with the Tolovana Mainline; however, this access point may be suitable for secondary or emergency access.***



1"=500'±

CURRENT CITY LIMITS, UGB, AND ZONING

The SouthWind property is currently inside the City Limits (the yellow line on this map), and outside of Cannon Beach's Urban Growth Boundary (UGB), shown as the red line. The entire site is in the City's Institutional Reserve (IR) zone.

Property to the immediate north, the Haystack Heights neighborhood, is in the City's Moderate Density Residential (R1) zone. Across Highway 101, to the west of the SouthWind site, is land in the High Density Residential (R3) zone.

To the east and south of the SouthWind property is forest land owned by Campbell Global. This property is in Clatsop County's Forest-80 (F80) zone.

About five acres of vacant land in the County's Residential-Agriculture-Two-Acre (RA2) zone adjoins the northeast corner of the SouthWind site.

The SouthWind property's location outside of the Urban Growth Boundary, and the current Institutional Reserve (IR) zoning designation, do not support most of the development described in this master plan. ***The City will need to amend the UGB to include all or part of the SouthWind site within the boundary; and amend the zoning map accordingly, to accommodate the proposed development in this master plan.***

1"=300'±

PROPOSED DEVELOPMENT

The City intends to use the SouthWind site for critical and essential facilities and services because the property is largely above the reach of the largest predicted tsunami. The police station, fire station, day care facilities, a medical clinic, and the now closed Cannon Beach Elementary School are all within the tsunami inundation zone at their current locations. The City wishes to facilitate the relocation of the following buildings/facilities on the SouthWind site:

Police station
Fire station
School
Child care/pre-school
Food bank
Emergency shelter/emergency operations center.

These facilities would be clustered in the area shown on the map to the left, and on the more detailed map on the following page.

The City should facilitate the location of new essential facilities above the tsunami inundation line. They include: police station, fire station, school, child care/pre-school, food bank, and emergency shelter/emergency operations center.

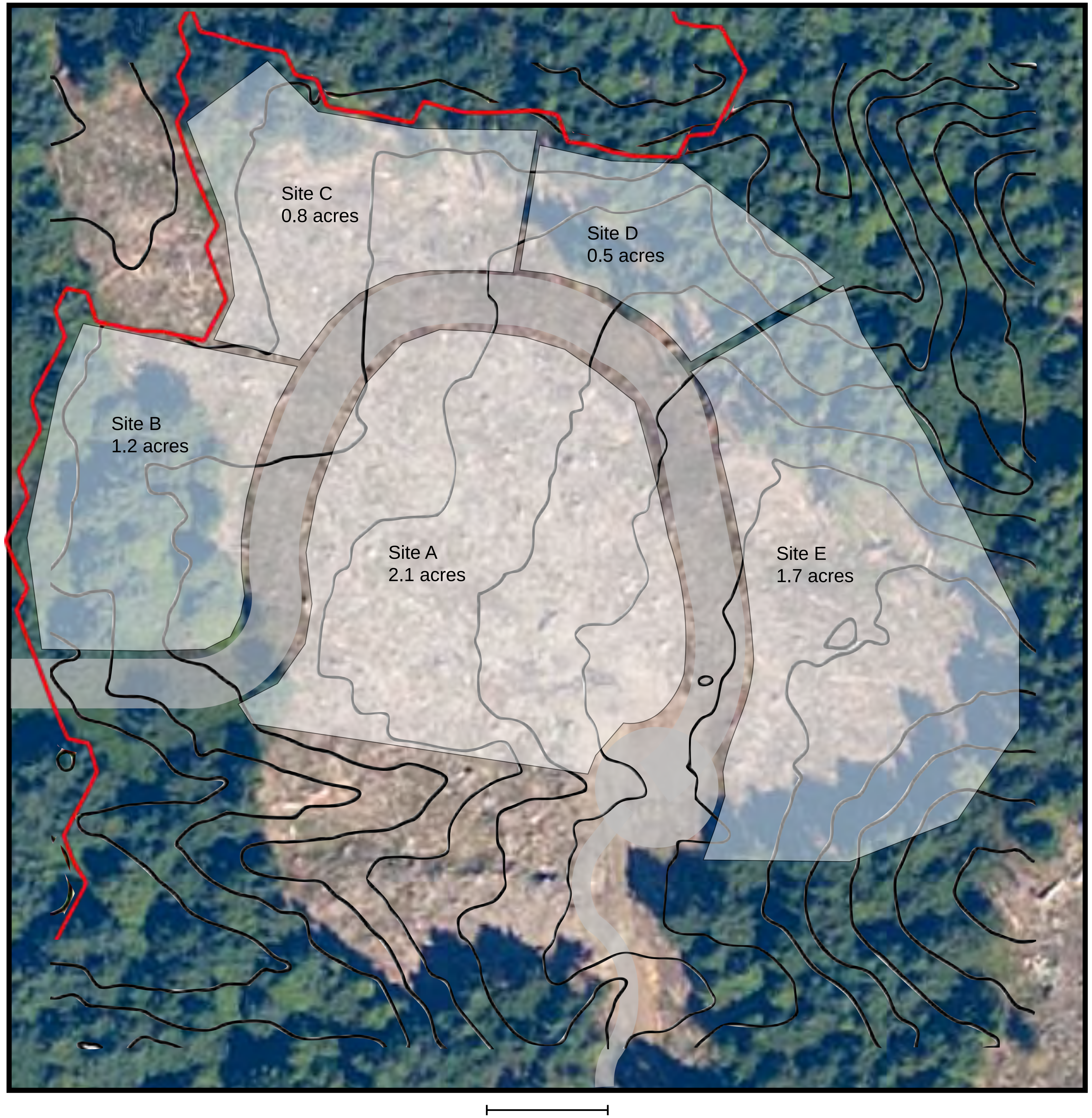
Developed facilities on the SouthWind site should be clustered in the area shown in the master plan to preserve the largest possible forested area, and to avoid conflicts with adjoining land uses.

BUFFER

Separation from adjacent incompatible land uses can be achieved with a buffer area along the east and south boundaries. The dashed yellow line on the aerial photograph to the right represents the extent of a two-hundred foot wide buffer from the property line.

The City will maintain a two-hundred foot wide buffer along the east and south property lines to separate incompatible uses on the SouthWind site from commercial forestry activity on the adjoining property.

Exhibit A-1



PROPOSED DEVELOPMENT

The road layout shown on this map is schematic only; its exact location and design will be refined based on more detailed site analysis and a traffic study. The acreage figures represent the approximate size of the shaded areas. These areas are somewhat arbitrary in size, configuration and location. All are above the tsunami inundation line, shown in red on this aerial photograph. All are entirely or largely within the central area evaluated by Horning Geosciences, and shown on the map on page 2 of this master plan.

School: The former Cannon Beach Elementary School (CBES) site covers about 2.2 acres. The City anticipates that between 1.8 and 2.1 acres will be needed for a school site. This estimate includes space for pre-school and day-care, activity space for grades 1 through 7, a library, administrative space, and gymnasium. Site A can meet the school's needs; however, it is not large enough to accommodate facilities that might be needed for field sports, such as soccer or softball. ***The City shall reserve room for a school on the SouthWind site***.

Fire Station: The Cannon Beach Rural Fire Protection District's fire station at its current Cannon Beach location covers slightly more than half an acre. Any one of sites B, C, or D are large enough to accommodate a fire station. ***The City shall reserve room for a fire station on the SouthWind site***

Police Station: The Cannon Beach Police Department currently operates out of City Hall. The City estimates that space needs for the Police Department are slightly less than one-half acre. Sites B, C, or D are large enough to accommodate this use. ***The City shall reserve room for a police station on the SouthWind site***

Emergency Services Facility: The City may develop an emergency services facility on the SouthWind site. This could include storage space for emergency supplies, emergency shelter space, and/or emergency communications and support. The space needs for such a facility are uncertain; but the City believes any of the five sites shown on this map is large enough. A location near the southwest corner of the site may also be suitable for this use: see the map on page 1. ***The City shall reserve room for an emergency services facility on the SouthWind site***

Food Bank: A food pantry is presently located in the former CBES site. The SouthWind site is not an ideal location for a food pantry: the former CBES site is more conveniently located for clients. A site above the Tsunami inundation line has some potential advantages, particularly if the food pantry also serves as an emergency food storage facility. A food bank on the SouthWind site might be incorporated into an emergency services facility, or operate as a stand-alone entity. The regional food bank in Warrenton is operated on a one-acre site, so it is likely that any of the sites here could accommodate Cannon Beach's food pantry. ***The City shall reserve room for a food pantry on the SouthWind site***

1"=300'±

FOREST RESOURCES

This 2013 aerial photograph shows three areas where timber was harvested on the SouthWind site; and remaining stands of, primarily, Sitka spruce, western hemlock, and red alder.The area on the east side of the site was harvested in 2011. It covers about 12.3 acres. This harvested area extends off-site, to the east. This area was replanted with spruce and hemlock in early 2012. The central area was logged in 2013, and covers about eight acres. This central area is where most of the development is planned. The small southern clearing was also logged in 2013, and covers about 1.7 acres. These two areas were replanted with spruce and hemlock in January 2014.

Barry Sims, a consulting forester with Trout Mountain Forestry, prepared a memorandum for the City outlining management recommendations for the forested part of the SouthWind site. The memo is included as an appendix to this master plan. His recommendations include:

- The remaining stand could be thinned to enhance views or to accelerate the development of bigger trees. Any such thinning would need to be carefully done to minimize the risk of blowdown. Thinning at this time is not recommended, as future goals for the site are not entirely clear, and with the recent harvest openings, some blowdown may occur in the next few years. A policy regarding blowdown would be advisable so the City can respond. Potential revenues from either a light thinning or small amounts of blowdown salvage would likely be negligible.
- The City is obligated under the Oregon Forest Practices Act to maintain the conifer plantations to ensure they are “free to grow” without being shaded out by brush. It appears that the earlier clearcut areas have been sprayed with herbicides at least once to give the planted trees a chance to become established. The more recent cut areas have not, and 2014 would be a good year to assess brush competition.
- The road that was either built or upgraded into the new clearings is already brushing in with alder and other vegetation. Mowing or spraying this road annually is recommended to maintain access and protect the road surface. If alder is allowed to grow large enough, removal will require uprooting and disturbing the road surface.

If the property is developed as shown on page 6, more than 40 forested acres would remain undeveloped, and potentially available for recreation, opened space and forestry.

The City shall prepare and adopt a forest management plan for the SouthWind site. Until a forest management plan is adopted, the City shall follow the requirements of its tree removal ordinance (Municipal Code Chapter 17.70) with respect to harvest or thinning operations on the SouthWind site.

Exhibit A-1

15895 SW 72ND AVE
SUITE 200
PORTLAND, OR 97224
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INFO@CIDAINC.COM
WWW.CIDAINC.COM

APPENDIX

ARCHITECTURE

ENGINEERING

PLANNING

INTERIORS

Traffic Analysis Technical Memorandum

City of Cannon Beach Police Station at
US 101 Highway and Tolovana Mainline Road

Prepared by: Red Plains Professional, Inc. (RPP)
Project Planner: Chris Robideau, President and Director of Planning
Professional Engineer: Keegan Peters, PE

EXPIRES: 12/31/2024

Summary of Project:
The City of Cannon Beach is navigating the Architectural and Engineering design process to construct the new approximately 5,270 sqft. Cannon Beach Police Station on the Cache Site which is located directly northeast of the intersection of US101 and Tolovana Mainline. The project is summarized with the following project schedule of events:

- 06/20/2023: The City of Cannon Beach Contracted Red Plains Professional Inc. to develop the traffic study required to gain approval for access for the development with Oregon Department of Transportation (ODOT).
- 06/20/2023 – 08/10/2023: Red Plains works with CIDA Architects to develop preliminary facility and site development plan and resulting Project Problem Statement (first step in ODOT Project Coordination). Field data collection, traffic counts, and turning movement counts are collected. Coordination meetings occurred with the shared user of the access road Tolovana Mainline, Nuveen Natural Capital representatives.
- 08/10/2023: ODOT Project Problem Statement submitted to ODOT with meeting request.
- 08/22/2023: ODOT, City of Cannon Beach Representatives, Nuveen, CIDA, and RPP met virtually to present, review, and discuss the Project Problem Statement to determine the level of Traffic Analysis that would be required to support the project. As important, the project team was seeking additional understanding of the level of improvement ODOT may require to the US 101 and Tolovana Mainline intersection in order to proceed with the project. Here is a summary of that meeting:

- Introductions - All
- Project Overview (previously submitted Problem Statement) – Red Plains Professional, Inc. and CIDA Architects
- ODOT preliminary review comments:
  - Tolovana Mainline is an existing permitted shared access point on US 101.
  - The proposed development will not generate enough trips to have significant impact on US 101 or the existing access permit, therefore a full TIA will not be required.
  - The proposed development will not warrant needed improvements to US101 such as the addition of turning lanes or acceleration/deceleration lanes, therefore improvements to US 101 are not a requirement of this project.
  - The Northern Access point to the development site is not an existing permitted access point.
  - The City can generate and submit for consideration an additional access permit for the Northern Access point to the proposed development, but the application is likely to be denied given the black and white nature of ODOT regulations on highway access permits.
  - The City and Project Team should continue with their design process and prepare a conceptual intersection improvement plan detailing channelization and lane configurations for the Tolovana Mainline Access Road and provide that to ODOT for review and comment.
  - Recommendations were made to consider a 3-4 lane improved access permit to improve intersection safety for ingress and egress to US101/Development Site.
- City of Cannon Beach response comments:
  - Expressed the importance of two access points for the Police Station and the use and reasons why it should be considered/approved.
  - City will make the decision to submit an access permit to support the maintenance and improvement of the Northern Access Point.

- 08/24/2023: City of Cannon Beach representatives express to the A/E project team their desire stating the project need to have the north access permitted, but agree that the design must move forward within the ODOT access limitation to utilize the US 101 and Tolovana Mainline as the ingress and egress access point for the development for the time being. The City may still pursue additional permitting and design exceptions under separate project work.
- 08/24/2023 – 10/05/2023: A/E project team works through conceptual and preliminary design of the site and the Tolovana Mainline lane configurations, geometry, and layout.
- 10/06/2023: Traffic Analysis Technical Memorandum is drafted and finalized for submittal to the City of Cannon Beach and ODOT.

Exhibit A-1

Current Conceptual Site Layout and Preliminary Design:

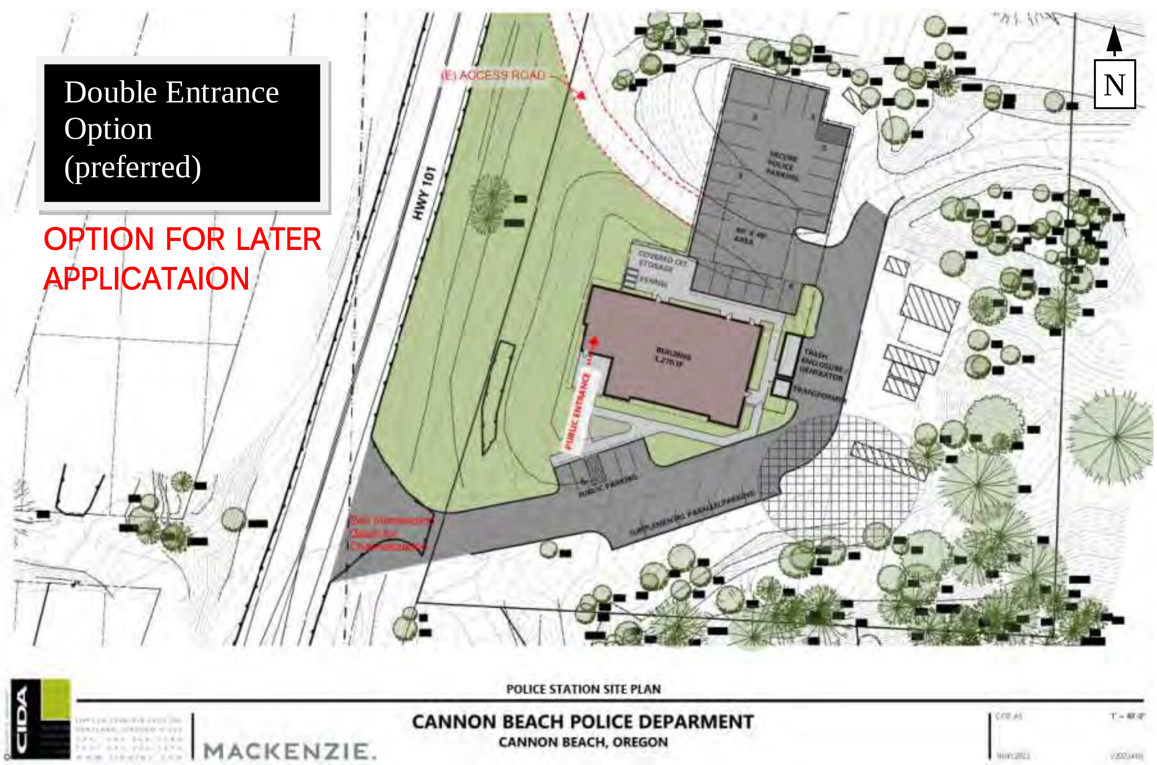
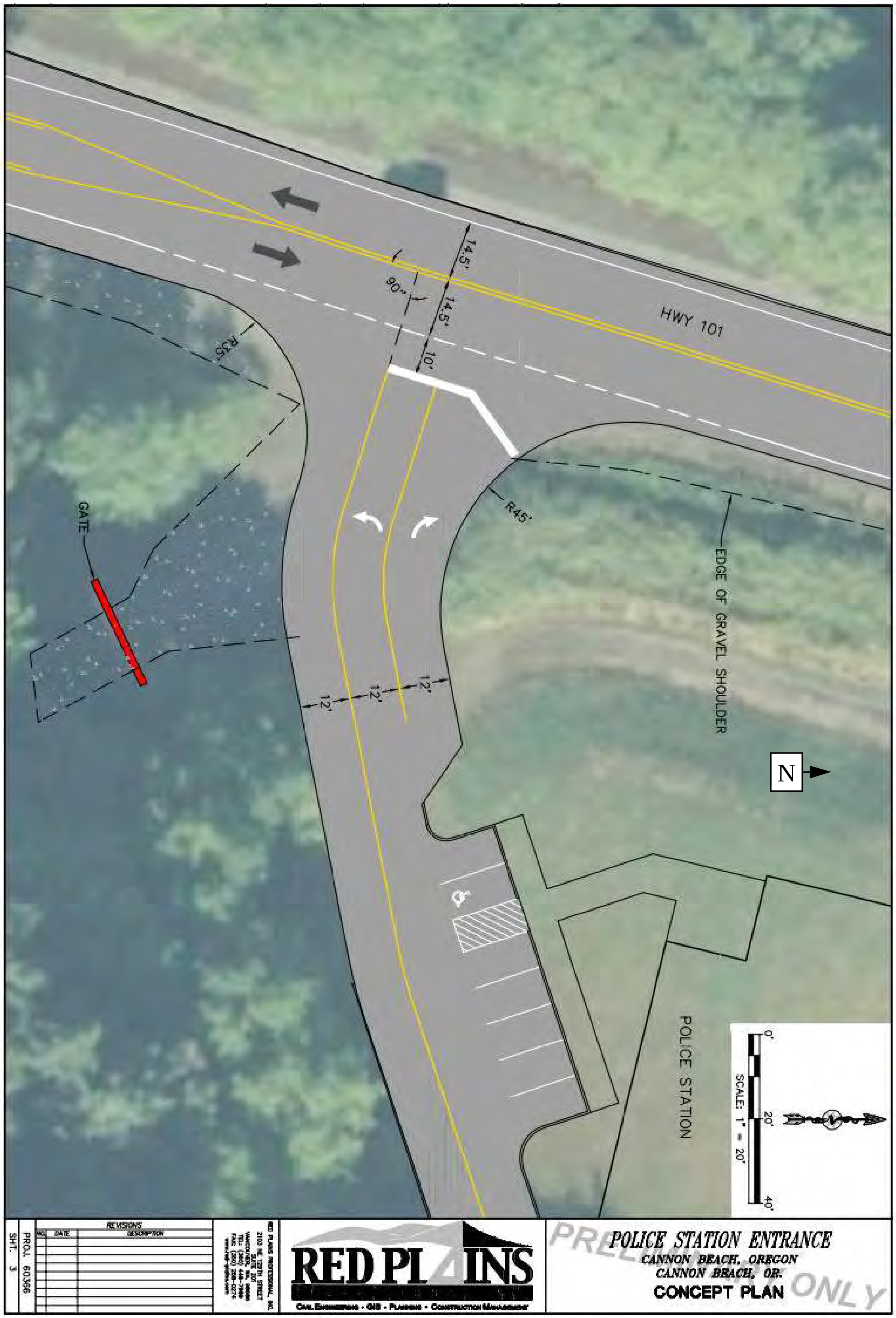


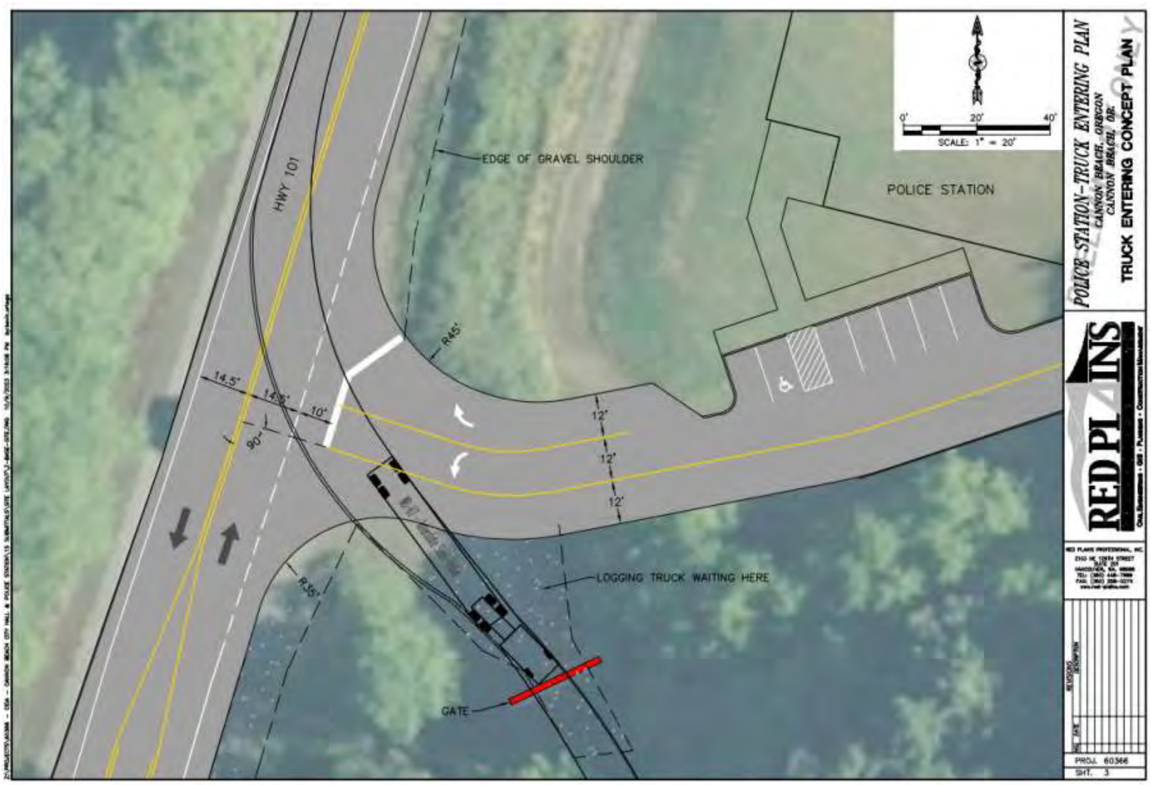
Exhibit A-1

Preliminary Design and Graphic Illustrations of the Tolovana Mainline Access Road Lane Configuration, Channelization, and Geometry:



Tolovana Mainline Shared Access – Known Potential Safety Conflict

During the initial project discussion the City representative, CIDA, and Red Plains Professional met with the current shared use stakeholder, Nuveen Natural Capital representatives, and discussed their planned continued use of the intersection and access point. The discussion centered on the potential safety hazard that would be present due to logging trucks entering and existing US101 utilizing the improved intersection. Due to the location of an entrance gate on the south leg of Tolovana, entering and exiting the Nuveen property, trucks must stop and open/close the gate upon arrival only during infrequent use times. When active logging or other activities are ongoing with frequent use, the gate is left open and this conflict does not occur. The City and Nuveen are aware of this safety risk that will infrequently occur. The graphics below show the likely path of the largest potential load vehicle utilizing this intersection. An entering truck when stopped at the gate does block other lanes of traffic. An exiting truck also blocks other lanes of traffic depending on driver and path. While this will be an infrequent occurrence, it is something that we feel must be documented in the traffic analysis. The City representatives did ask Nuveen if it were possible to move the gate further back allowing a single truck enough room to stop at the gate and not block traffic lanes. Nuveen said the gate could not be relocated due to grade concerns further up the alignment.



Supporting Traffic Analysis Findings:

While a complete Traffic Impact Analysis was not performed after our preliminary meeting with ODOT officials in review of the Project Problem Statement, Red Plains Professional did complete preliminary traffic analysis to the level required to understand and verify the minimal impacts of the proposed development. This section provides that data collection and analysis for official documentation and future use.

Trip Generation Analysis:

A finding of "little to no measurable impact" was determined. With a resulting daily trips generated of 119 Trips per day with 17 Trips occurring during the PM peak hour, Red Plains concluded that detailed level of service (LOS) analysis was not required. This was supported by ODOT in our Problem Statement meeting. The intersection improvement needed to safely convey the ingress and egress of the police station facility users will operate at an acceptable LOS and the trips generated will not have an impact or degrade that LOS on the highway traffic/users. 5-20 year future growth projection of this specific planned development, also result in little to no impact. Unless additional development is later proposed for this area, the proposed intersection will operate at an acceptable LOS for years to come. The shared use daily volume of the access point is already recorded at approximately 2-4 trips per day as was witnessed in the field counts. The current volumes with additional police station trips combine for low impact to US 101.

Trip Generation Table
City of Cannon Beach - Police Station on Tolovana Mainline and US101

Land Use	ITE Code*	ITE Description*	Intensity	Units	Trip Generation Rate	Daily Trips Generated	Daily Entering	Daily Existing
City of Cannon Beach Police Station								
Government Office Building	730	Museum	5.27	1,000 SQFT.	22.59	119	60	59
					PM Peak Hour (Only)	17	7	10

*Institute of Traffic Engineers (ITE) Trip Generation Manuals, 11th Edition was utilized for this analysis.

** There is no Accurate Trip Generator in ITE for a police station. Based on other studies of similar land uses and the police station would best align with the statistics of the Government Office Building ITE Code 730. We also looked at using ITE Code 575 (Fire and Rescue Station) but there were not enough studies to consider these statistics for use in our analysis (the intensity resulted in about 5 trips per day and we are anticipating more usage for this specific facility.

Trip Generation Analysis is for planning purposes only

Prepared by: Chris Robideau, President — Date: 07/10/2023

RED PLAINS PROFESSIONAL, INC

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Traffic Count Map:

Mechanical Traffic Counts Collected:
Red Plains Professional did perform three mechanical pneumatic traffic counters on US 101 located in strategic location intended to support full traffic impact analysis if needed: One north of the project site, the second just south of the project site and before the main southern entrance to the south end of Cannon Beach (S. Hemlock Street), and the third was located south of S. Hemlock Street all on US 101. The mechanical counts were set for a minimum of a 24-hour period collected on weekdays during what would be considered peak seasons for seasonal adjustment factor application/adjustment. The mechanical counts were collected on 07/31/2023 – 08/01/2023. Both the vehicle classification and vehicle speed reports for all three locations are provided in the memorandum attachments.

Manual Peak Hour Turning Movement Counts:
Manual Peak hour turning movement counts were collected at two intersections within the study area to support analysis and conclusions. The Manual Counts were collected from 7:00–9:00AM and 4:00–6:00PM on 07/31/2023. Due to the limited trips generated by the proposed police station development, level of service analysis was not required. The AM and PM peak hour counts specific to/from the project intersection, were very low. Accessing Tolovana Mainline specifically, the existing trips were: During the AM Count a total of 4 trips were witnessed, with zero (0) during the PM Count. The access point is used very minimally.

Conclusions

A full Traffic Impact Analysis is not required per ODOT regulations given the nature of the proposed development. ODOT concurred and approved the technical project team to proceed into the design process. The Traffic Analysis Technical Memorandum is written to conclude the traffic impact analysis, investigation, and study developed in preparation of the access design. The City of Cannon Beach, CIDA, and Red Plains Professional (the project technical team) are moving forward into the design process. As we navigate the design process we will continue to include and coordinate with City of Cannon Beach, the area's public, the shared access user Nuveen, and ODOT at critical points. Once the 30% plan set is complete it is recommended that the technical project team reach back out to ODOT for approval of the preliminary design and access road configuration. This will give the ODOT team further opportunity to recommend and shape the needed design components in which they will ultimately permit and approve for construction through the review process prior to construction.

Note on secondary (north) access to US101: As it pertains to attempting to justify and get permitted through ODOT, the northern access point as a "back entrance" utilized by law enforcement officials and staff only, it is recommended that a separate written analysis be completed in an attempt to justify this access point for other reasons outside of its necessity for safe ingress and egress to US101. As is well-documented and has been discussed within the technical team, there are many other police stations that are supported by two separate access roads with similar spacing on main state highways and interstate roads of similar classification to US101 in this area.

Attachments:
The following attachments are full size graphics of maps and exhibits provided within this Traffic Analysis Technical Memorandum. We have also provided the traffic count details which were utilized to support a finding of "no impact".

(Written Report End)

Original Problem Statement:
Submittal Date- 08/10/2023 ODOT Review Meeting Date: 08/22/2023

Project Problem Statement

City of Cannon Beach Police Station at
US 101 Highway and Tolovana Mainline Road

Section 1. Project Description

The City of Cannon Beach (CCB) has realized the need for an improved facility to preserve and enhance the services provided through the City Hall and Police Station. Below are some details about the proposed development and the needs driving the project:

- The City's goal for the Police Station project is to develop a structure that will facilitate the department's ability to provide exceptional day to day municipal services, while being constructed to withstand the impacts of natural disasters and become the epicenter of all phases of resiliency efforts.

- The City should facilitate the location of new essential facilities above the tsunami inundation line. The City intends to use the SouthWind site for critical and essential facilities and services because the property is largely above the reach of the largest predicted tsunami.

- The current City Hall/Police Station facility started its life 70 years ago as a lumber yard and has been modified over the years to house a City Hall and Police Station. During initial construction or in subsequent modifications there has been no obvious attempt to incorporate any structural elements that would make it even minimally resistant to a small to medium earthquake or tsunami event.

- After a significant natural event, residents will expect, even demand, enhanced performance from staff to manage search and rescue, street clearing, debris removal and utility restoration to improve conditions to the point that our residents and businesses will be able to start to rebuild their homes and businesses.

- Given the structural condition of the current facility, these activities will occur without the benefit of any emergency response equipment, communications technology or communications gear that had been in the current City Hall/Police Station at the time of the event.

- Most modern buildings of which we are all familiar (commercial, schools) are constructed to withstand the effects of an earthquake long enough to allow occupants to be able to exit safely. They are not required to be designed to be usable after the event.

- The Police Station will be an emergency facility designed and constructed to provide both protection for occupants within the structure during an event and to be functional immediately afterwards to provide and coordinate emergency operations and recovery operations. A well-constructed City Police Station will be an investment for and by the residents and businesses to have the City Staff in the best positions to assist, protect and help them rebuild their lives in the event of a disaster.

- What will the benefit of a Police Station be after an event:

  - The structure will be constructed to facilitate a quick transition from offices to an emergency management facility.
  - Back-up power and communication systems will be built in and protected within the facility - PD will be able to coordinate and assist in search and rescue as well as other public safety issues as they arise.
  - The Police Department portion of the facility will also be hosting at least 50 police officers from numerous jurisdictions and will be the City agency that will be getting most of the inquiries in the first few days after an event.

- Here are some of the risks that we accept if we do not build a new City Hall/Police Station:

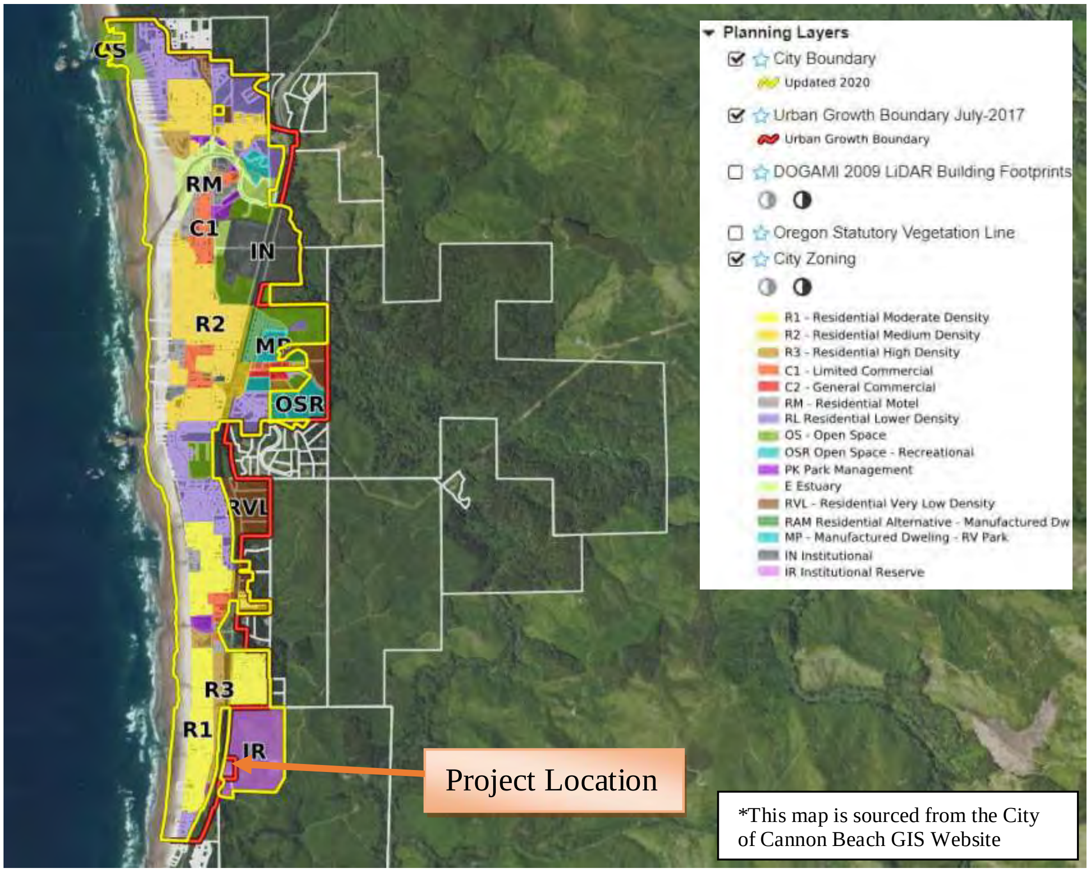
  - If it is a medium earthquake or tsunami, the existing City Hall/Police Station will most likely collapse due to the construction materials and methods originally used when it was built to function as a lumber yard.
  - Any information or equipment such as computers, Police gear, PW equipment, paper copies of utility system plans, or any equipment meant for or that would be used in responding or managing the crisis will be lost.
  - There will be no reliable location for citizens or their family members can go to seek help or information.
  - City staff will have no place from which to work or a location where we can tell outside resources coming to help to respond.
  - We will not have a place where we can effectively manage the influx and efforts of heavy equipment companies, search and rescue personnel, first responders, utility contractors, debris management companies, mass care providers and volunteers.

Through preliminary planning efforts, the City has identified a property within their City Limits and within their Urban Growth Boundary, as the slated home of the relocated and expanded CCB Police Station. The relocation of the Police Station to this new site will allow for expansion of the City Hall Facility at it existing shared location. Below if a map of the proposed project location which can be generally described as being located in the southeast corner of the City limits and directly located in the northeast corner of the intersection of US101 and Tolovana Mainline Road.

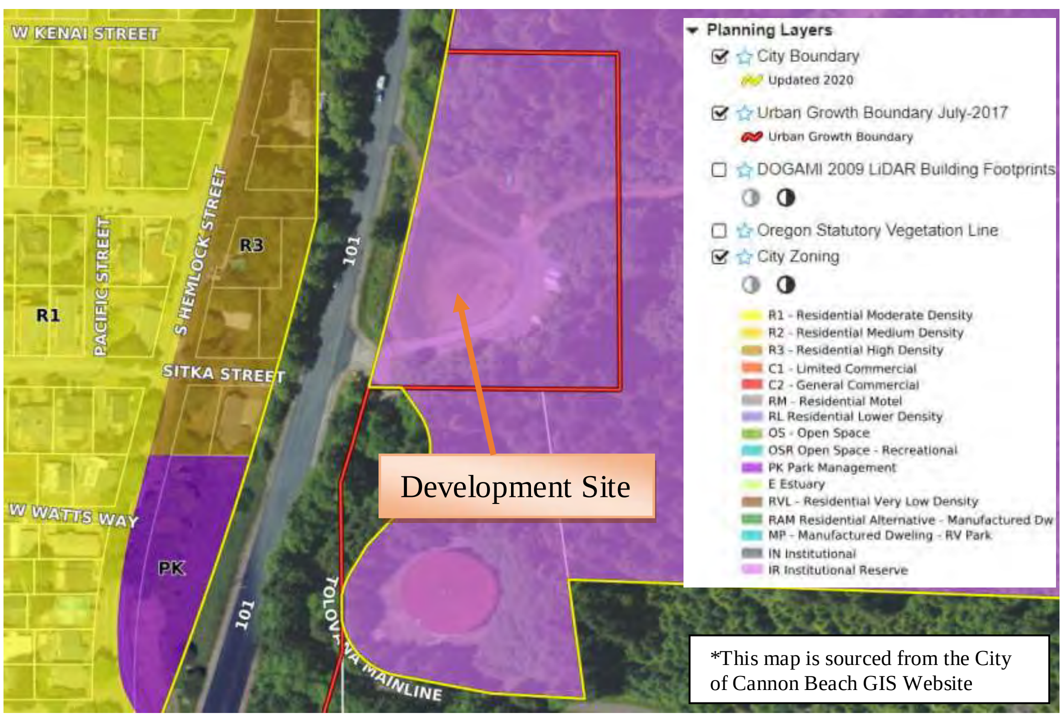
Map 1.1 – Project Location Map - Regional

Map 1.2 – Project Location Map – CCB City Limits and Zoning Map

Exhibit A-1



Map 1.3 – Project Location Map – Development Site



Map 1.4 – Project Location Map - Preliminary Police Department Site Plan

Exhibit A-1

In this site Plan it is the intention of City to maintain two access points to US 101 (55MPH). The north access point is proposed as an exit only to be used by law enforcement officers only accessing the secure fenced lot. The South Entrance is proposed to be an improved share use entrance with the Land Owner to the South – Nuveen (formerly Greenwood Timber).

Section 2. Problem Constraints

1. What is the Purpose and Need for the work? CCB plans to develop their new and expanded police station estimated at 3,500 square feet for the reasons identified in the project description on a new undeveloped site adjacent to US 101. CCB is responsibly planning the development with consideration of the new facility's required transportation improvement, designed in a manner to adequately provide safe ingress and egress to the site while having minimal impacts to the current trips on the north south running US101. Early in the planning process, CCB would like to engage with Oregon DOT (ODOT) Highway Division, Traffic-Roadway Division Roadway, and Regional Traffic Unit through the direct coordination with the Transportation District Manager and team, to determine the level of Traffic Impact Analysis (TIA) required to support this evaluation. In preliminary planning for this new facility CCB is also working to get a better understanding of the potential related costs of the overall development, to include potential required transportation system improvement to Tolovana Road and its intersection with US101.

2. What questions need to be answered? CCB is engaged with Red Plains Professional Inc. and CIDA Architects to plan, design, and estimate this new facility and infrastructure development. The questions are:

   - What level of TIA would ODOT like to see that will support permitting and approval of the CCB development?
   - Are there other area developments that should be considered and accounted for when completing a responsible TIA for this site?
   - What are the recommendations from ODOT for improvement to the US101 and Tolovana Road intersection to accommodate this development? (we would like to start collaboration as soon as possible to aid in the development of the TIA alternatives)
   - What level of analysis is needed to support the needed two access points for this development to provide the needed ingress and egress options for the CCB Police Station? The North Access will be used solely by the police station and city staff accessing the secure parking area and provide secondary access should primary access ever be blocked.
   - Should CCB plan to use the existing Tolovana Road intersection/access point for the access for this development?
   - Should CCB plan to develop another access point slightly north of the Tolovana Road access point to avoid impacting current users/usage?

3. What key issues should be considered?
   - CCB is mostly concerned about planning and designing safe ingress and egress to this proposed development while trying to understand and estimate the needed infrastructure improvement required to support the development and access permitting from ODOT.

- Analysis consideration in the TIA's projected traffic scenarios should be given to the other known regional and area developments.
- Coordination and collaboration must be considered to maintain access to the existing users of the Tolovana Road. The resulting designs must support safe dual use of this access point to and from the proposed development at the intersection of US 101 and Tolovana Road.

4. What are the Goals and Objectives of the work? Coordinate early and often throughout the life of the project with ODOT on the design development of this transportation infrastructure and project to ensure approval/permitting and efficiently navigate the required improvements determined through a collaborative effort. Ultimately developing a safe facility with well-designed ingress and egress to the new CCB Police Station, intended to maintain two access points to US 101.

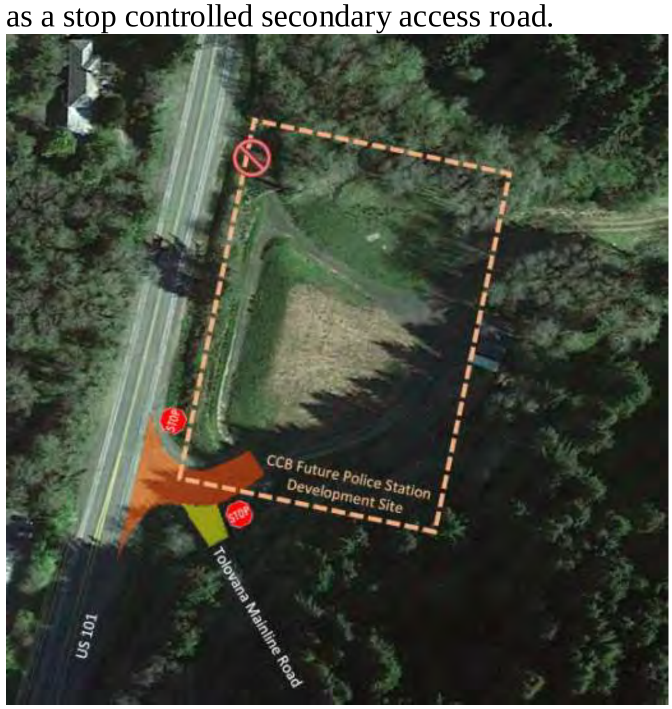
5. Who is the audience? CCB Project Representatives, ODOT Representatives, Red Plains Professional, Inc. (contracted Project Planners and Engineers), CIDA (contracted Project Planners and Architects), and current users of the Tolovana Mainline Road.

6. At what level will the work need to be analyzed and evaluated? We are asking ODOT for additional clarification on this. At present a TIA is contracted for completion that will include the collection of mechanical traffic counts, manual peak hour turning movement counts, trip generation, and associated analysis require to present existing conditions and project future conditions. The data to be collected will supplement the existing data provided by ODOT's Transportation Data Section (TDS) to be researched as part of the TIA.

7. What types of alternatives need to be evaluated? A combination of alternatives need to be preliminarily discussed with ODOT with the goal to reduce the number of alternatives early in the planning process to reduce the number of scenarios analyzed in the TIA. The City and project team are not anticipating this facility to be a significant trip generator in a manner that will warrant significant highway improvements, meanwhile for the operation of the public safety facility, maintaining two access points is important to site operations. Internal access road and site configurations are the two main alternatives and how they will interact with the Tolovana Mainline Road Intersection. In combination with those, what improvements may be needed on US101 in relation to each potential configuration? Many variable and alternatives to preliminarily discuss and shorten are provided. In preliminary planning level discussions with ODOT we are hopeful to reduce the alternatives for analysis to one or two that all parties find acceptable/feasible to permit and construct for betterment and preservation of the transportation network. The preliminary alternatives are identified below:
   - Primary and Secondary Access Road Configurations:

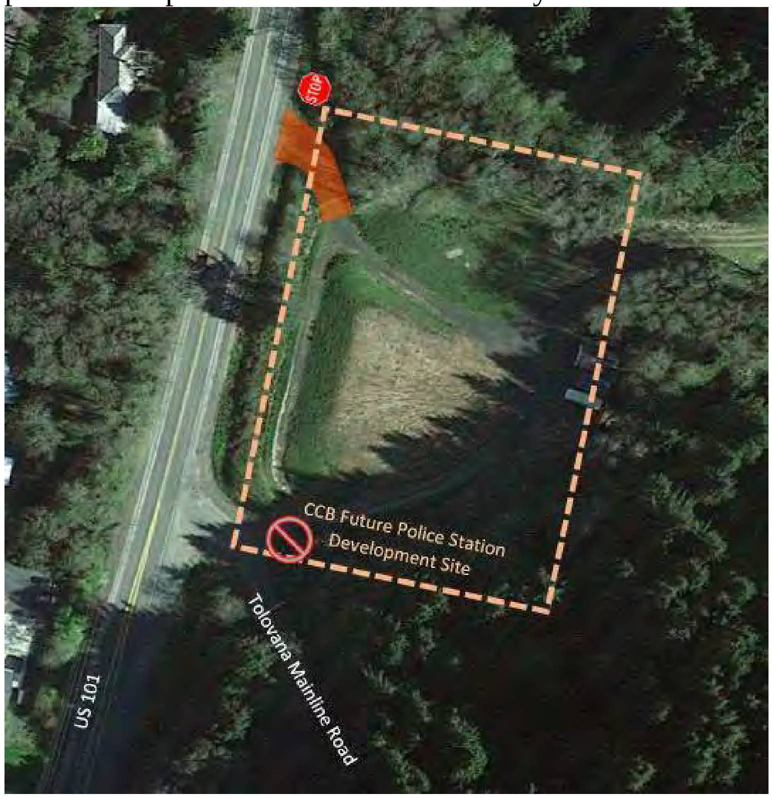
- Option #1 - Improvement of one shared access point from US101 utilizing an improved Tolovana Mainline Road intersection as an improved stop controlled access:
    - Option 1A: Maintain Tolovana Mainline Road as the primary route with a secondary stop controlled access to the Police Station.

    - Option 1B: Redesign the access road making the Police Station access the primary road with the Tolovana Mainline as a stop controlled secondary access road.



Already ruled out due to conflict between Tolovana Mainline truck usage Gate and stopping geometry.

- Option #2 – Do not utilize the Tolovana Mainline Road as the access to the Police Station and improve the northern existing access to the site for all ingress and egress. This is the least desired option giving the grade challenges and limits this access point would provide to the site and facility function.

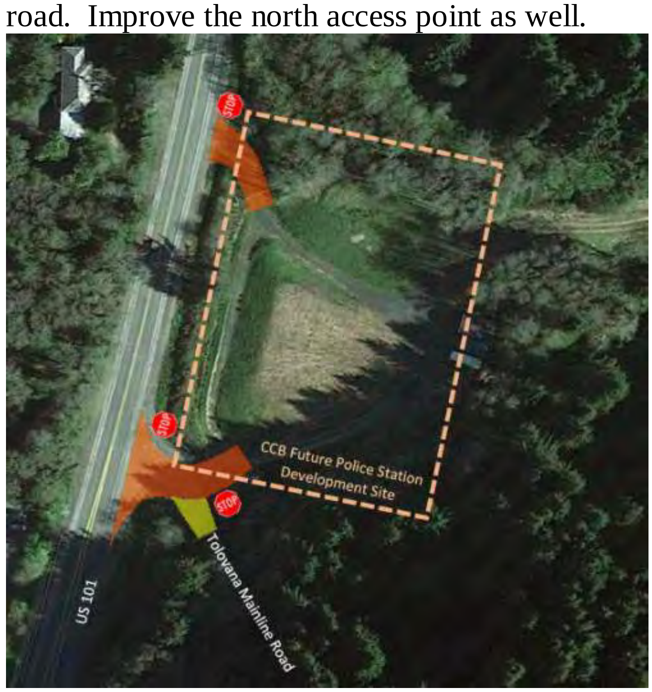


- Option #3 – Develop a "loop road" to access the site utilizing both the north and south existing access points to US101. Improve the Tolovana Mainline Intersection as the south access point and improve the existing north access point with a connection road through the site. This is the desired configuration and either option, A or B would allow for proper site function. The north access point to US 101 is proposed at this time to be an exit only utilized only by the law enforcement officers and Police Department staff.

PREFERRED OPTION

- Option 3A: For the south access, maintain Tolovana Mainline Road as the primary route with a secondary stop controlled access to the Police Station. Improve the north access point as well.

- Option 3B: For the south access, redesign the access road making the Police Station access the primary road with the Tolovana Mainline as a stop controlled secondary access road. Improve the north access point as well.



- US101 Turning Lane Configurations Requirements:
  - Will widening of US101 be required to accommodate dedicated turn lanes to safely queue turning vehicles out of the main northbound and/or southbound travel lanes?
    - Alternative #1 No Widening: Widening is not justified in the TIA and is not part of the improvement project.

    - Alternative #2 US101 South Bound Center Left Turn Lane: Is the AADT high enough on US101 in combination with a high enough site development trip generation level, to negatively impact the level of service (LOS) and vehicle capacity (V/C) of the intersection and highway to the point of requiring a dedicated southbound left turn lane with proper queue lengths? Is this improvement going to be justified/warranted by impacts analyzed in the TIA?

- Alternative #3 US 101 Northbound Right Turn Lane: With no widening to support the establishment of the southbound left turn lane, should a southbound left turn be disallowed or blocked to prevent negative impacts? If yes, does the TIA analysis still justify or warrant widening US101 to allow for a northbound left tune deceleration lane if all access to the Police Station is proposed from a northbound right in movement?

*Already ruled out in discussion with Nuveen (adjacent land owner). The majority of their trucks need to make this southbound left turn.

8. What evaluation measures will be used?
   - o We will collect 3 Mechanical 24-Hour Traffic Counts and compare those to the ODOT TVT_2021 Volumes collected on the "Oregon Coast Highway No. 9" Site ID's of 1008 (AADT 8320) and 19001 (AADT 6723). Our counts will provide current year data including vehicle classification and speed reports.
   - o We will collect 2 Manual AM and PM Peak Hour Turning Movement Counts to provide us baseline existing count information and turning movement data at the intersections of US101 and Tolovana Mainline Road, as well as US101 and S. Hemlock Street.
   - o We will meet and coordinate early and often with ODOT to ensure the proper steps are being taken to plan for and develop the TIA.
   - o From there we will follow the ODOT Analysis Procedures Manual (APM), Version 2, dated April 2023 to complete a TIA and evaluate the development impacts on the US101 and related project intersection LOS.

9. What is the overall and traffic analysis study area, if different? We will be studying US101 "Oregon Coast Highway No. 9" from milepost 31 to 32 with focused analysis on the intersection of US101 and Tolovana Mainline Road.

10. What types of useable information and tools are available and practical? ODOT's Website and GIS portal provide an significant amount of historic data providing baseline information for the study. That combined with the procedures identified in the ODOT APM and field data collected by Red Plains Professional and we have excellent data and clear guidelines for the project and analysis.

Section 3. Schedule, Resource, and Budget Constraints

1. What is the timeframe for the analysis work? TIA and project analysis to be complete by September 15th, 2023.

2. What are the impacts from changes to Purpose and Need? TBD beyond what has been expressed herein.

3. What are the risks from outside sources such as other jurisdictions, stakeholders, and private citizens? For example, local concerns/issues/ politics can easily add time to a projected schedule.
   - The main risks and concerns:
     - Navigating a planning and coordination effort, the TIA, and eventual permitting in a efficient streamlined and cost effective manner.
     - ODOT requirements for significant transportation infrastructure improvements/investments to US101 to support the New Development of the Police Station at this location.
     - Local users of the Tolovana Mainline Road may have concerns or reservations about the City of Cannon Beach development plans for this property with potential impacts to the existing shared transportation infrastructure at the intersection of US101 specifically.

4. Are there outside factors or time constraints that may dictate delivery of work items? For example, crash information is needed but cannot be obtained in the specified time frame. None at this time

5. What resources are available? Are they internal or external? Resources at the CCB, within ODOT, and to be collected as part of the research/planning and TIA Analysis are available for the project. They are internal to the project team.

6. Are tasks dependent on resources not within analyst's control? TBD

7. Does the project funding require certain analysis tools and procedures? No, we will be following the ODOT procedures as identified in the APM.

8. Is the budget adequate to perform the desired analysis and data collection? Yes at this time we believe so.

9. What is the availability and quality of existing data? TBD in the research and planning stages of the TIA.

10. Can the work be divided? Are tasks independent of each other? Are tasks sequential or concurrent? Task for this study are very much sequential and dependent of procedure.

Section 4. Additional Details

- Given the above mentioned evaluation measures and other issues what are the likely performance measures that will be needed?
    - Existing AADT information
    - Existing Crash Statistics in the study area
    - Supplemental field data collection of current year ADT and turning movements.

- Likely tools to be used?
    - ODOT Website Research and use of data from ODOT's Transportation Data Section (TDS)
    - Coordination/Collaboration with ODOT's Regional Traffic Unit through direct coordination with the Transportation District Manager and team.
    - JAMAR Pneumatic Traffic Counters and Manual Turning movement Count Collection by Red Plains Field Technicians.
    - Trip Generation analysis will be completed utilizing the latest version of the ITE Trip Generation Manuals.
    - LOS, V/C, and Queue Length analysis will be performed in HCS McTrans.

File Name: Untitled Axle Classification
Start Date: 7/31/2023
Start Time: 7:00:00 AM
Site Code: 1
Location 1: US 101
Location 2:

Hour	Date	Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed
1	7/31/2023	07:00 AM	4	87	51	3	40	1	0	5	1	4	0	0	0	18
2	7/31/2023	08:00 AM	3	146	77	4	62	10	0	10	2	2	0	1	1	17
3	7/31/2023	09:00 AM	3	219	114	5	64	5	1	18	2	1	0	0	1	21
4	7/31/2023	10:00 AM	18	347	148	9	106	6	1	18	2	1	0	0	1	18
5	7/31/2023	11:00 AM	6	355	162	9	99	8	0	18	0	1	0	0	2	25
6	7/31/2023	12:00 PM	8	358	183	10	102	5	0	35	0	1	0	0	1	27
7	7/31/2023	01:00 PM	5	383	179	5	96	3	0	21	2	2	0	0	0	67
8	7/31/2023	02:00 PM	4	403	186	4	107	1	0	16	3	3	0	0	0	75
9	7/31/2023	03:00 PM	7	407	185	6	106	1	0	15	0	0	0	0	0	35
10	7/31/2023	04:00 PM	12	371	194	4	102	1	0	15	0	1	0	0	1	19
11	7/31/2023	05:00 PM	8	324	162	5	74	1	0	12	1	0	0	0	0	18
12	7/31/2023	06:00 PM	4	225	125	0	47	0	0	4	0	0	0	0	1	13
13	7/31/2023	07:00 PM	4	171	73	2	42	0	0	7	1	0	0	0	0	14
14	7/31/2023	08:00 PM	1	106	47	3	28	0	0	0	0	0	0	0	0	1
15	7/31/2023	09:00 PM	1	80	30	0	19	0	0	1	1	0	0	0	0	0
16	7/31/2023	10:00 PM	1	42	9	0	10	0	0	0	0	0	0	0	0	0
17	7/31/2023	11:00 PM	1	22	13	0	3	0	0	0	0	0	0	0	0	0
18	8/1/2023	12:00 AM	0	12	2	0	0	0	0	0	0	0	0	0	0	0
19	8/1/2023	01:00 AM	0	3	4	0	0	0	0	0	0	0	0	0	0	0
20	8/1/2023	02:00 AM	0	5	2	2	1	0	0	1	0	0	0	1	1	0
21	8/1/2023	03:00 AM	0	3	0	2	4	0	0	1	0	2	0	0	0	1
22	8/1/2023	04:00 AM	0	7	5	2	12	1	0	2	0	0	0	0	1	1
23	8/1/2023	05:00 AM	0	15	9	2	4	0	0	1	0	2	0	1	0	0
24	8/1/2023	06:00 AM	10	51	33	4	17	0	0	6	1	2	0	0	1	4
Raw ADT by Class			**100**	**4142**	**1993**	**81**	**1145**	**43**	**2**	**206**	**16**	**22**	**0**	**3**	**11**	**374**
Total Raw ADT				**8138**												
Total Heavy Vehicle Raw ADT				**1529**	**19%**											
Total Bike Trips Raw ADT				**100**	**1%**											

Exhibit A-1

File Name: Untitled Speed Classification
Start Date: 7/31/2023
Start Time: 7:00:00 AM
Site Code: 1
Location 1: US 101
Location 2:

Hour	Date	Time	1-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96+
1	7/31/2023	07:00 AM	24	3	4	21	47	64	41	7	3	0	0	0	0	0
2	7/31/2023	08:00 AM	20	8	12	42	100	103	45	5	0	0	0	0	0	0
3	7/31/2023	09:00 AM	23	5	13	53	137	145	65	12	1	0	0	0	0	0
4	7/31/2023	10:00 AM	24	22	26	96	204	221	73	9	0	0	0	0	0	0
5	7/31/2023	11:00 AM	29	20	35	107	233	191	59	11	0	0	0	0	0	0
6	7/31/2023	12:00 PM	33	16	56	89	237	205	87	5	2	0	0	0	0	0
7	7/31/2023	01:00 PM	70	21	49	116	240	194	64	9	0	0	0	0	0	0
8	7/31/2023	02:00 PM	81	19	30	109	255	219	76	9	3	0	0	0	0	1
9	7/31/2023	03:00 PM	47	18	43	108	239	229	67	11	0	0	0	0	0	0
10	7/31/2023	04:00 PM	27	24	50	97	216	211	81	12	1	0	1	0	0	0
11	7/31/2023	05:00 PM	26	22	45	86	168	163	79	15	1	0	0	0	0	0
12	7/31/2023	06:00 PM	17	10	26	52	100	123	73	15	3	0	0	0	0	0
13	7/31/2023	07:00 PM	20	15	15	23	72	97	57	13	1	1	0	0	0	0
14	7/31/2023	08:00 PM	1	8	3	17	44	59	42	11	1	0	0	0	0	0
15	7/31/2023	09:00 PM	0	2	11	14	33	52	17	3	0	0	0	0	0	0
16	7/31/2023	10:00 PM	0	1	2	8	10	22	14	4	1	0	0	0	0	0
17	7/31/2023	11:00 PM	1	1	1	3	5	15	8	5	0	0	0	0	0	0
18	8/1/2023	12:00 AM	0	0	1	2	4	4	1	2	0	0	0	0	0	0
19	8/1/2023	01:00 AM	0	0	0	1	1	2	2	0	1	0	0	0	0	0
20	8/1/2023	02:00 AM	1	0	0	2	2	3	3	1	1	0	0	0	0	0
21	8/1/2023	03:00 AM	1	0	0	0	2	5	4	1	0	0	0	0	0	0
22	8/1/2023	04:00 AM	1	0	0	1	4	10	10	5	0	0	0	0	0	0
23	8/1/2023	05:00 AM	1	0	1	5	3	11	9	3	1	0	0	0	0	0
24	8/1/2023	06:00 AM	5	1	1	3	18	52	36	12	0	1	0	0	0	0
Raw ADT by Speed			**452**	**216**	**424**	**1055**	**2374**	**2400**	**1013**	**180**	**20**	**2**	**1**	**0**	**0**	**1**
Total Raw ADT				**8138**												

Exhibit A-1

File Name: Untitled Axle Classification
Start Date: 7/31/2023
Start Time: 7:00:00 AM
Site Code: 2
Location 1: US 101
Location 2:

Hour	Date	Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed
1	7/31/2023	07:00 AM	1	104	55	3	34	4	0	5	0	4	0	0	0	2
2	7/31/2023	08:00 AM	4	148	81	5	48	9	2	10	2	1	0	1	2	11
3	7/31/2023	09:00 AM	3	245	122	3	61	5	1	14	2	2	0	0	1	13
4	7/31/2023	10:00 AM	9	374	145	7	78	8	0	18	3	1	0	0	1	21
5	7/31/2023	11:00 AM	7	374	154	8	69	7	0	16	0	1	0	0	0	23
6	7/31/2023	12:00 PM	10	385	161	6	72	5	0	31	0	1	0	0	0	30
7	7/31/2023	01:00 PM	2	454	145	8	75	2	0	22	3	1	0	0	0	27
8	7/31/2023	02:00 PM	7	498	159	4	91	2	0	16	2	3	0	0	2	16
9	7/31/2023	03:00 PM	7	498	149	4	99	0	0	17	2	0	0	0	0	16
10	7/31/2023	04:00 PM	6	425	164	3	80	1	0	13	0	1	0	0	1	12
11	7/31/2023	05:00 PM	9	350	134	5	52	1	1	9	2	0	0	0	0	16
12	7/31/2023	06:00 PM	3	262	88	0	36	1	0	4	0	0	0	0	1	3
13	7/31/2023	07:00 PM	3	175	57	2	31	0	0	6	1	0	0	0	0	4
14	7/31/2023	08:00 PM	1	110	37	1	23	0	0	1	0	0	0	0	0	7
15	7/31/2023	09:00 PM	1	91	26	0	16	0	0	1	1	0	0	0	0	0
16	7/31/2023	10:00 PM	0	45	6	0	8	0	0	0	0	0	0	0	0	0
17	7/31/2023	11:00 PM	1	27	9	0	2	0	0	0	0	0	0	0	0	0
18	8/1/2023	12:00 AM	0	13	2	0	0	0	0	0	0	0	0	0	0	0
19	8/1/2023	01:00 AM	0	4	4	0	0	0	0	0	0	0	0	0	0	0
20	8/1/2023	02:00 AM	0	5	2	2	1	0	0	0	0	0	0	1	1	0
21	8/1/2023	03:00 AM	0	3	0	1	4	1	0	1	0	2	0	0	0	0
22	8/1/2023	04:00 AM	0	8	6	2	11	1	0	2	0	0	0	0	1	1
23	8/1/2023	05:00 AM	0	14	8	2	4	0	0	0	1	2	0	0	0	1
24	8/1/2023	06:00 AM	10	59	32	2	16	2	0	7	2	2	0	0	0	2
Raw ADT by Class			**84**	**4671**	**1746**	**68**	**911**	**49**	**4**	**193**	**21**	**21**	**0**	**2**	**10**	**205**
Total Raw ADT				**7985**												
Total Heavy Vehicle Raw ADT				**1279**	**16%**											
Total Bike Trips Raw ADT				**84**	**1%**											

Exhibit A-1

File Name: Untitled Speed Classification
Start Date: 7/31/2023
Start Time: 7:00:00 AM
Site Code: 2
Location 1: US 101
Location 2:

Hour	Date	Time	1-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96+
1	7/31/2023	07:00 AM	11	3	2	21	71	66	31	5	2	0	0	0	0	0
2	7/31/2023	08:00 AM	17	7	11	50	101	114	20	4	0	0	0	0	0	0
3	7/31/2023	09:00 AM	34	8	12	67	163	139	41	8	0	0	0	0	0	0
4	7/31/2023	10:00 AM	35	13	17	154	248	157	36	5	0	0	0	0	0	0
5	7/31/2023	11:00 AM	28	12	37	107	270	163	40	2	0	0	0	0	0	0
6	7/31/2023	12:00 PM	44	5	25	119	283	189	31	4	1	0	0	0	0	0
7	7/31/2023	01:00 PM	36	13	48	154	268	175	40	5	0	0	0	0	0	0
8	7/31/2023	02:00 PM	25	6	25	161	349	191	36	4	3	0	0	0	0	0
9	7/31/2023	03:00 PM	30	19	32	141	274	236	52	8	0	0	0	0	0	0
10	7/31/2023	04:00 PM	17	18	36	118	274	189	50	3	1	0	0	0	0	0
11	7/31/2023	05:00 PM	24	23	25	90	207	159	45	5	1	0	0	0	0	0
12	7/31/2023	06:00 PM	7	5	16	50	111	143	56	9	1	0	0	0	0	0
13	7/31/2023	07:00 PM	5	6	9	24	85	99	42	8	0	1	0	0	0	0
14	7/31/2023	08:00 PM	9	9	3	11	38	74	25	9	1	1	0	0	0	0
15	7/31/2023	09:00 PM	4	2	11	18	42	46	12	0	0	1	0	0	0	0
16	7/31/2023	10:00 PM	0	2	1	5	16	14	16	5	0	0	0	0	0	0
17	7/31/2023	11:00 PM	1	1	2	5	4	17	7	2	0	0	0	0	0	0
18	8/1/2023	12:00 AM	0	1	0	4	5	4	1	0	0	0	0	0	0	0
19	8/1/2023	01:00 AM	1	0	0	1	1	2	2	0	1	0	0	0	0	0
20	8/1/2023	02:00 AM	0	0	0	4	0	4	3	1	0	0	0	0	0	0
21	8/1/2023	03:00 AM	0	0	0	0	4	7	1	0	0	0	0	0	0	0
22	8/1/2023	04:00 AM	2	0	0	2	7	9	10	2	0	0	0	0	0	0
23	8/1/2023	05:00 AM	2	0	0	2	9	11	7	0	1	0	0	0	0	0
24	8/1/2023	06:00 AM	2	3	1	6	24	66	23	8	0	1	0	0	0	0
Raw ADT by Speed			**334**	**156**	**313**	**1314**	**2854**	**2274**	**627**	**97**	**12**	**4**	**0**	**0**	**0**	**0**
Total Raw ADT				**7985**												

File Name: Untitled Axle Classification
Start Date: 7/31/2023
Start Time: 8:00:00 AM
Site Code: 3
Location 1: US 101
Location 2:

Hour	Date	Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classed
1	7/31/2023	08:00 AM	4	187	75	1	32	13	0	10	2	1	0	1	2	7
2	7/31/2023	09:00 AM	5	283	103	2	33	6	1	13	2	2	0	0	1	10
3	7/31/2023	10:00 AM	7	453	118	4	49	7	0	10	2	0	0	0	0	17
4	7/31/2023	11:00 AM	6	446	113	9	54	8	1	10	0	3	0	0	0	26
5	7/31/2023	12:00 PM	11	480	128	4	47	11	0	29	0	0	0	0	1	26
6	7/31/2023	01:00 PM	5	525	113	4	51	6	1	16	2	1	0	0	0	20
7	7/31/2023	02:00 PM	3	561	129	2	57	4	0	12	2	3	0	0	2	20
8	7/31/2023	03:00 PM	7	549	129	3	55	1	0	12	1	0	0	0	0	27
9	7/31/2023	04:00 PM	7	484	132	4	48	2	0	11	0	1	0	0	0	22
10	7/31/2023	05:00 PM	10	407	104	5	24	1	0	8	0	1	0	0	1	16
11	7/31/2023	06:00 PM	3	303	62	0	18	1	0	2	0	0	0	0	1	9
12	7/31/2023	07:00 PM	4	207	43	2	19	1	0	3	1	0	0	0	0	3
13	7/31/2023	08:00 PM	1	139	21	1	17	0	0	1	0	0	0	0	0	1
14	7/31/2023	09:00 PM	1	104	18	0	9	0	0	1	1	0	0	0	0	3
15	7/31/2023	10:00 PM	0	50	4	0	5	0	0	0	0	0	0	0	0	1
16	7/31/2023	11:00 PM	1	28	5	0	0	0	0	0	0	0	0	0	1	0
17	7/31/2023	12:00 AM	0	14	1	0	0	0	0	0	0	0	0	0	0	0
18	8/1/2023	01:00 AM	0	4	4	0	0	0	0	0	0	0	0	0	0	0
19	8/1/2023	02:00 AM	0	5	3	1	0	1	0	0	0	0	0	1	1	0
20	8/1/2023	03:00 AM	0	3	2	0	2	2	0	1	0	2	0	0	0	0
21	8/1/2023	04:00 AM	0	10	7	2	8	1	0	2	0	0	0	0	1	0
22	8/1/2023	05:00 AM	0	16	7	1	3	0	0	0	1	2	0	1	0	0
23	8/1/2023	06:00 AM	10	67	29	2	10	3	1	6	3	1	0	0	0	3
24	8/1/2023	07:00 AM	0	130	58	1	16	4	0	5	3	3	0	0	0	5
Raw ADT by Class			**85**	**5455**	**1408**	**48**	**557**	**72**	**4**	**152**	**20**	**20**	**0**	**3**	**11**	**216**
Total Raw ADT				**8051**												
Total Heavy Vehicle Raw ADT				**887**	**11%**											
Total Bike Trips Raw ADT				**85**	**1%**											

File Name: Untitled Speed Classification
Start Date: 7/31/2023
Start Time: 7:00:00 AM
Site Code: 3
Location 1: US 101
Location 2:

Hour	Date	Time	1-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96+
1	7/31/2023	07:00 AM	8	4	16	92	129	72	14	0	0	0	0	0	0	0
2	7/31/2023	08:00 AM	14	5	32	127	180	84	18	1	0	0	0	0	0	0
3	7/31/2023	09:00 AM	18	11	78	188	249	108	13	1	1	0	0	0	0	0
4	7/31/2023	10:00 AM	28	16	71	173	257	110	20	1	0	0	0	0	0	0
5	7/31/2023	11:00 AM	28	8	57	216	286	122	18	2	0	0	0	0	0	0
6	7/31/2023	12:00 PM	21	17	70	208	280	126	19	2	0	0	1	0	0	0
7	7/31/2023	01:00 PM	21	6	51	251	325	115	25	1	0	0	0	0	0	0
8	7/31/2023	02:00 PM	28	8	51	203	320	139	34	0	1	0	0	0	0	0
9	7/31/2023	03:00 PM	24	9	41	159	258	194	25	1	0	0	0	0	0	0
10	7/31/2023	04:00 PM	20	16	40	149	196	133	21	2	0	0	0	0	0	0
11	7/31/2023	05:00 PM	9	5	26	86	162	89	16	3	1	1	0	1	0	0
12	7/31/2023	06:00 PM	4	6	16	68	89	74	25	1	0	0	0	0	0	0
13	7/31/2023	07:00 PM	6	3	8	27	65	53	14	5	0	0	0	0	0	0
14	7/31/2023	08:00 PM	5	1	13	33	49	30	5	0	1	0	0	0	0	0
15	7/31/2023	09:00 PM	1	1	1	12	19	18	6	2	0	0	0	0	0	0
16	7/31/2023	10:00 PM	0	1	0	7	14	11	2	0	0	0	0	0	0	0
17	7/31/2023	11:00 PM	0	0	1	6	4	3	1	0	0	0	0	0	0	0
18	8/1/2023	12:00 AM	0	0	1	2	2	2	0	1	0	0	0	0	0	0
19	8/1/2023	01:00 AM	0	0	1	2	3	4	2	0	0	0	0	0	0	0
20	8/1/2023	02:00 AM	0	0	0	1	6	4	1	0	0	0	0	0	0	0
21	8/1/2023	03:00 AM	0	1	1	2	13	9	5	0	0	0	0	0	0	0
22	8/1/2023	04:00 AM	0	0	1	5	12	11	1	1	0	0	0	0	0	0
23	8/1/2023	05:00 AM	3	0	3	17	53	46	12	1	0	0	0	0	0	0
24	8/1/2023	06:00 AM	5	0	6	58	96	53	5	1	1	0	0	0	0	0
Raw ADT by Speed			**243**	**118**	**585**	**2092**	**3067**	**1610**	**302**	**26**	**5**	**1**	**1**	**1**	**0**	**0**
Total Raw ADT				**8051**												

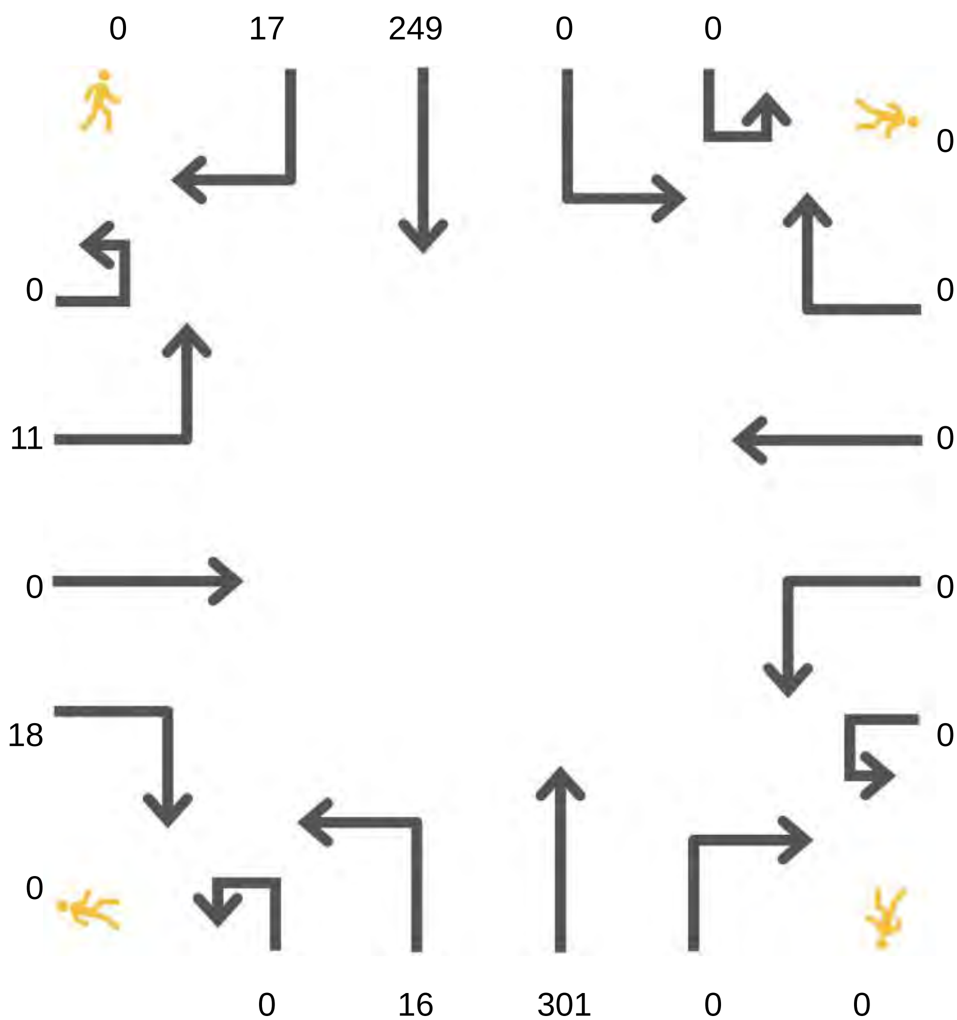
Exhibit A-1

Turning Movement Count

Study Name: Cannon Beach AM Hemlock
Date: Monday, Jul 31 2023
Location: TMC B
Observer: Jason
Weather:
Comments: ""

Southbound

US101



Eastbound
S Hemlock

Westbound

US 101

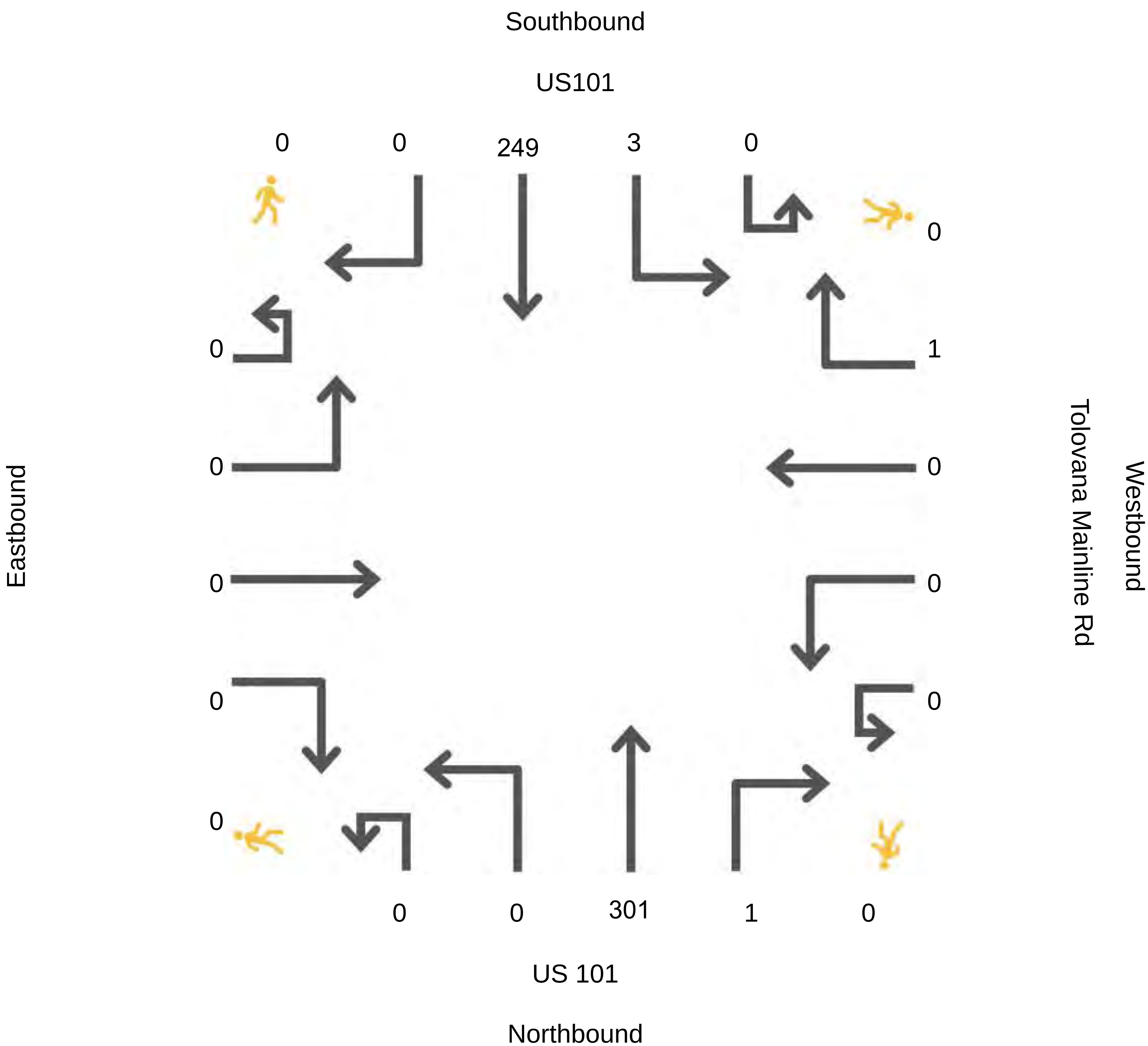
Northbound

Created with Traffic Count for iOS

Exhibit A-1

Turning Movement Count

Study Name: Cannon Beach AM Tolovana Mainline
Date: Monday, Jul 31 2023
Location: TMC A
Observer: Jason
Weather:
Comments: ""

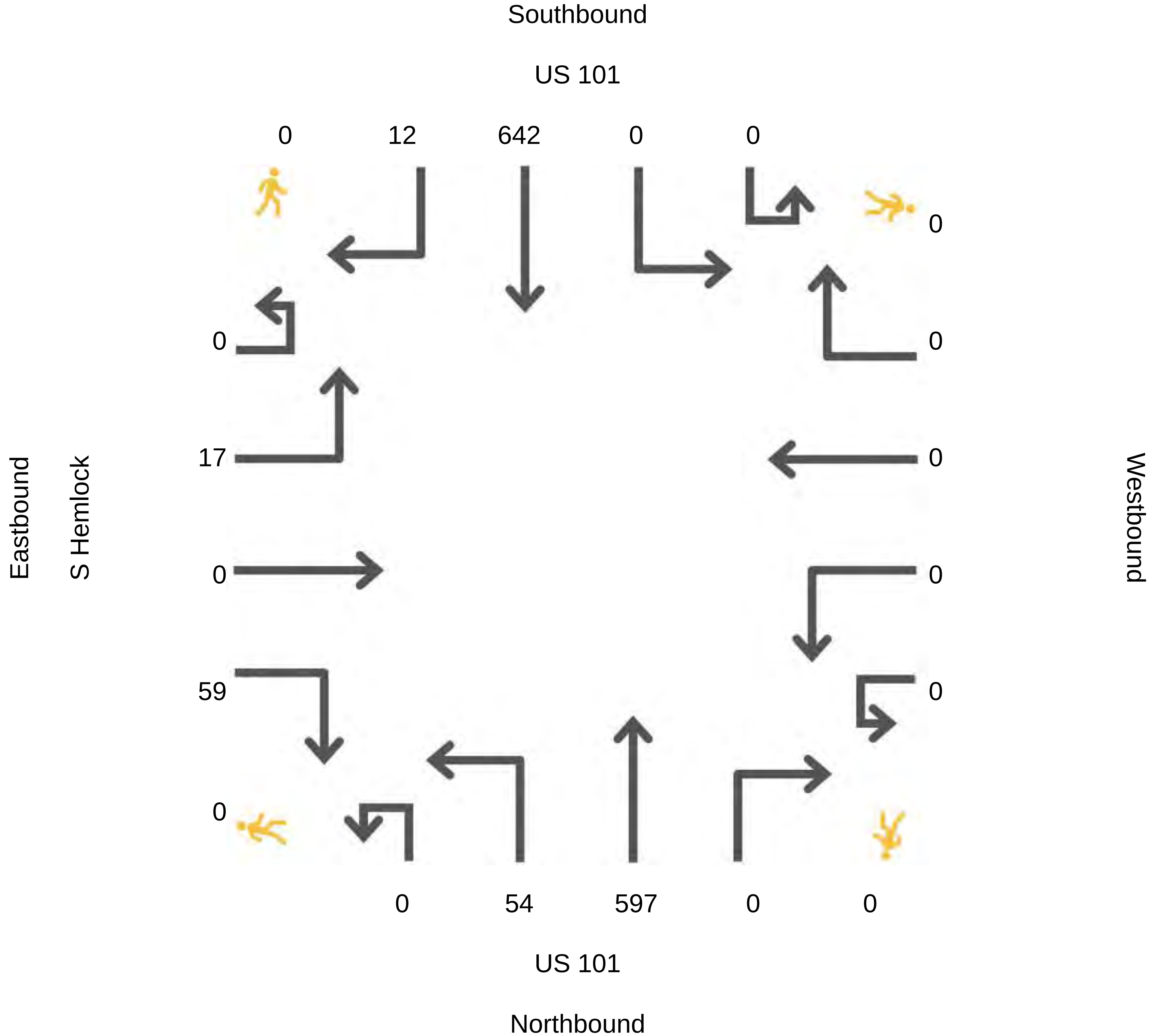


Created with Traffic Count for iOS

Exhibit A-1

Turning Movement Count

Study Name: Cannon Beach - PM S Hemlock
Date: Monday, Jul 31 2023
Location: TMC B
Observer: Jason
Weather: Clear
Comments: ""

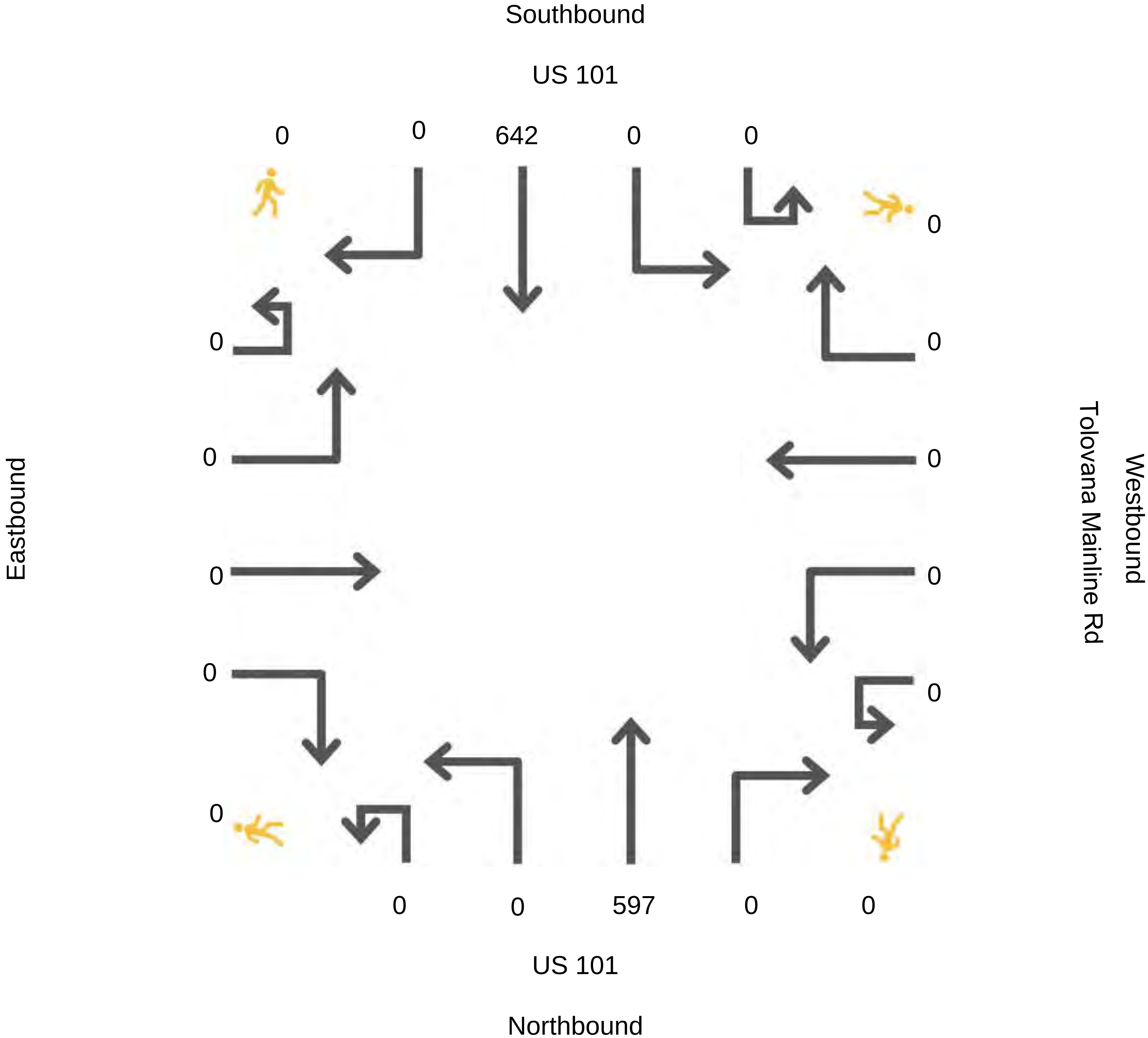


Created with Traffic Count for iOS

Exhibit A-1

Turning Movement Count

Study Name: Cannon Beach - PM Tolovana Mainline
Date: Monday, Jul 31 2023
Location: TMC B
Observer: Jason
Weather: Clear
Comments: ""



Created with Traffic Count for iOS

Exhibit A-1

MOTOR VEHICLE CRASH DATA REVIEW AND ANALYSIS

OVERVIEW AND STUDY AREA MAP

The data source for the following analysis was ODOT's Oregon Transportation Safety Data Explorer (OTSDE)[1], a GIS web mapping application. Crash Data for the period of January 1, 2015 to December 31, 2020.

The Cannon Beach Tolovana Traffic Impact Analysis study area includes US 101 MP 30-31.8, including intersections of S Hemlock St, Tolovana Marina, and the Tolovana Park interchange. See the following map.

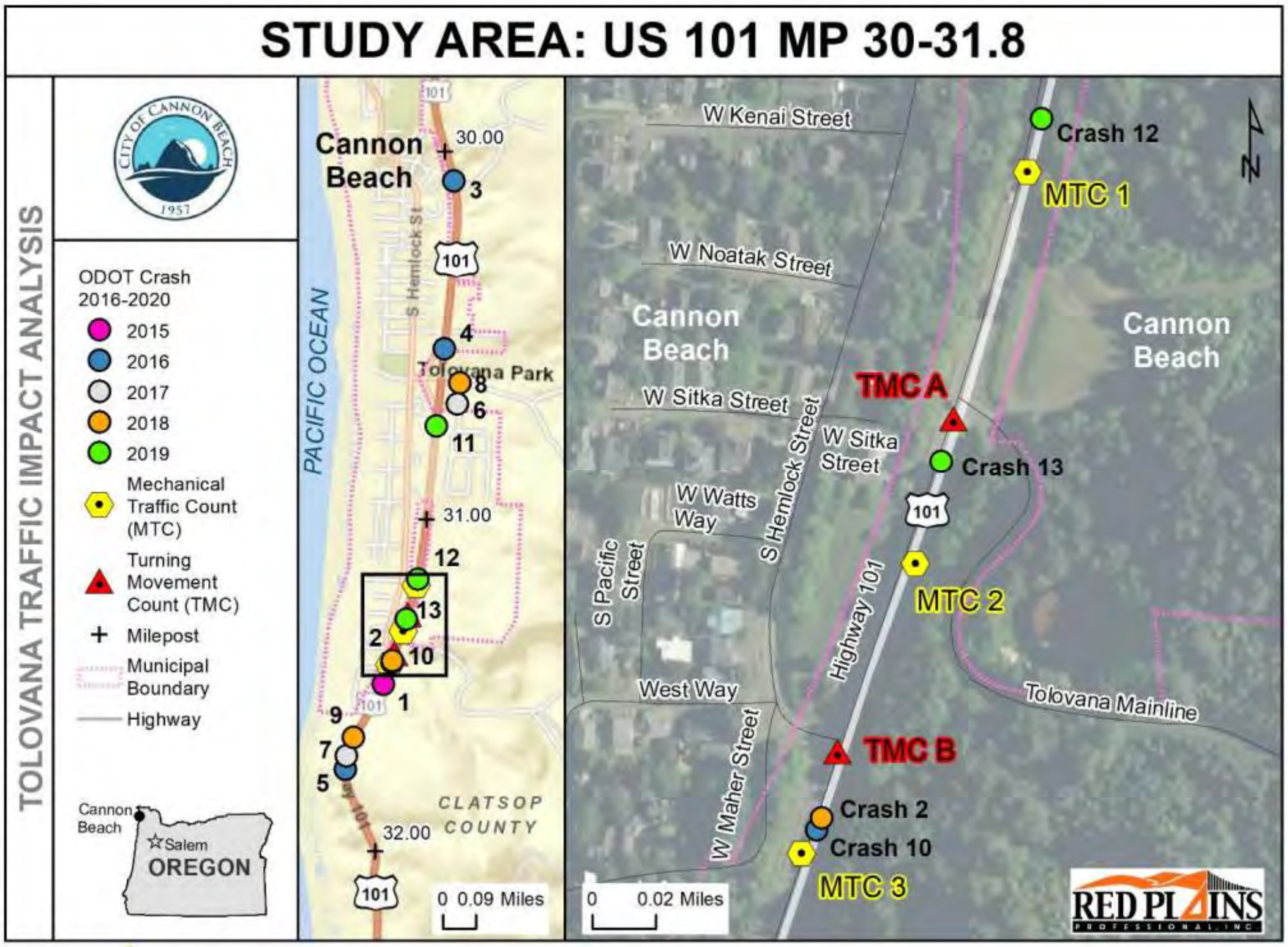


Figure 1 – Map of Study Area.

[1] Oregon Department of Transportation (ODOT), OTSDE web mapping application Oregon Transportation Safety Data Explorer (OTSDE) (arcgis.com)

Exhibit A-1

ODOT Crash 2015-2020 Table Part 1

Crash #	Crash ID	Crash Date	Year	Mix	Type	Motor Vehicle Inolvement With	Severity	Surface Condition	Vulnerable Road User
1	1634777	2015-12-31	2015	1 Vehicle	Struck Fixed Object	Single Vehicle and Fixed Object	Property Damage Only	Dry	No VRU Involved
2	1665896	2016-08-19	2016	2 Vehicles	Turning movement-From same direction	Multiple Vehicles	Moderate Injury	Dry	No VRU Involved
3	1661052	2016-09-07	2016	1 Vehicle	Struck Fixed Object and Overturned	Single Vehicle and Fixed Object	Serious Injury	Dry	No VRU Involved
4	1688230	2016-02-20	2016	1 Vehicle	Struck Fixed Object	Single Vehicle and Fixed Object	Property Damage Only	Ice	No VRU Involved
5	1674145	2016-01-26	2016	1 Vehicle	Struck Fixed Object and Overturned	Single Vehicle and Fixed Object	Property Damage Only	Wet	No VRU Involved
6	1740216	2017-09-10	2017	1 Vehicle	Struck Fixed Object and Overturned	Single Vehicle and Fixed Object	Serious Injury	Dry	No VRU Involved
7	1739296	2017-08-06	2017	2 Vehicles	Head-On	Multiple Vehicles	Moderate Injury	Dry	No VRU Involved
8	1821654	2018-12-04	2018	2 Vehicles	Turning movement-From opposite direction-one left turn,one straight	Multiple Vehicles	Property Damage Only	Dry	No VRU Involved
9	1817582	2018-12-16	2018	1 Vehicle	Struck Fixed Object and Overturned	Single Vehicle and Fixed Object	Property Damage Only	Wet	No VRU Involved
10	1796129	2018-12-11	2018	1 Vehicle	Animal	Single Vehicle and Animal (Deer or elk, wapiti)	Minor Injury	Wet	No VRU Involved
11	1842427	2019-03-25	2019	1 Vehicle	Animal	Single Vehicle and Animal (Deer or elk, wapiti)	Moderate Injury	Dry	No VRU Involved
12	1857627	2019-02-22	2019	1 Vehicle	Animal	Single Vehicle and Animal (Deer or elk, wapiti)	Property Damage Only	Wet	No VRU Involved
13	1875804	2019-11-25	2019	1 Vehicle	Animal	Single Vehicle and Animal (Deer or elk, wapiti)	Property Damage Only	Wet	No VRU Involved

ODOT Crash 2015-2020 Table Part 2

Crash #	Crash ID	Time of Day and Light Condition	Location	Primary Human Factor and Risky Driving Behavior (RDB)	RDB Impaired	RDB SE Not Used	RDB Inattention	RDB Speeding	RDB Roadway Lane Departure
1	1634777	Evening 4PM-10PM, Darkness - no street lights	Curve (horizontal curve)	RDB-Roadway Departure Flag, Other improper driving					X
2	1665896	Afternoon 12PM-4PM, Daylight	Grade (vertical curve)	RDB-Inattention-Made improper turn, Teenage driver in violation of graduated license pgm			X		
3	1661052	Morning 6AM-12PM, Daylight	Grade (vertical curve)	RDB-Roadway Departure Flag, Other improper driving					X
4	1688230	Night 10PM-6AM, Darkness - no street lights	Straight Roadway	RDB-Roadway Departure Flag, RDB-Speeding-Too fast for conditions (not exceed posted speed)				X	X
5	1674145	Morning 6AM-12PM, Daylight	Curve (horizontal curve)	RDB-Roadway Departure Flag, RDB-Speeding-Too fast for conditions (not exceed posted speed)				X	X
6	1740216	Night 10PM-6AM, Darkness - no street lights	Intersection-3 LEG	RDB-Roadway Departure-Off Roadway Flag, RDB-Impaired-Alcohol Involved, RDB-SE Not Used, Other improper driving	X	X			X
7	1739296	Afternoon 12PM-4PM, Daylight	Open access or turnout	RDB-Roadway Departure Flag and Drove left of center on two-way road; straddling					X
8	1821654	Afternoon 12PM-4PM, Daylight	Intersection-3 LEG	RDB-Inattention-Did not yield right-of-way			X		
9	1817582	Morning 6AM-12PM, Daylight	Curve (horizontal curve)	RDB-Roadway Departure Flag, RDB-Speeding-Too fast for conditions (not exceed posted speed)				X	X
10	1796129	Evening 4PM-10PM, Darkness - no street lights	Straight Roadway	Other (not improper driving)					
11	1842427	Night 10PM-6AM, Darkness - no street lights	Straight Roadway	RDB-Roadway Departure Flag, RDB-Speeding-Too fast for conditions (not exceed posted speed)				X	X
12	1857627	Night 10PM-6AM, Darkness - no street lights	Straight Roadway	Other (not improper driving)					
13	1875804	Evening 4PM-10PM, Darkness - no street lights	Straight Roadway	Other (not improper driving)					

Figure 2 – Table of ODOT Crashes in Study Area Part 1 and 2 of Study Area.

Exhibit A-1

CRASH TYPE AND INVOLVEMENT

Year

- During the five-year period from 2016 to 2020, within the study area, there were 13 reported crashes. There were no crashes reported in 2020.
- 2016 reported the highest number of study area crashes with four, 2015 reported the lowest number with only one. Increasing crash trend over time.

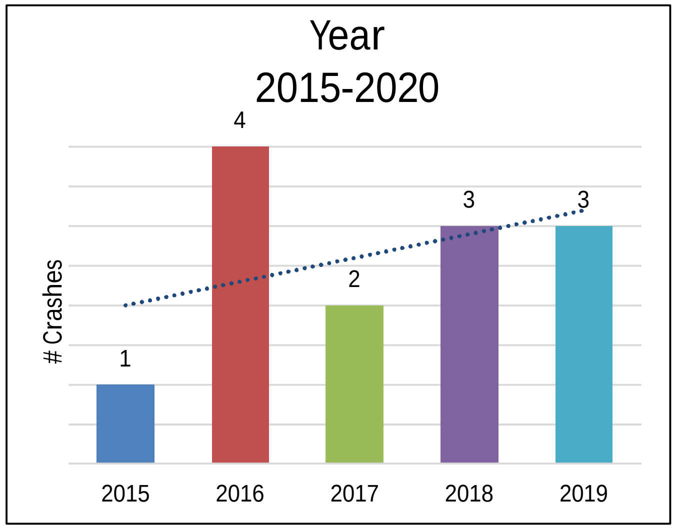


Figure 3 – Crash year in study area, totals.

Severity

- 46% of study area crashes resulted in either injuries or serious injury. 15% (2 of 13) resulted in serious injury. There were no fatal crashes.

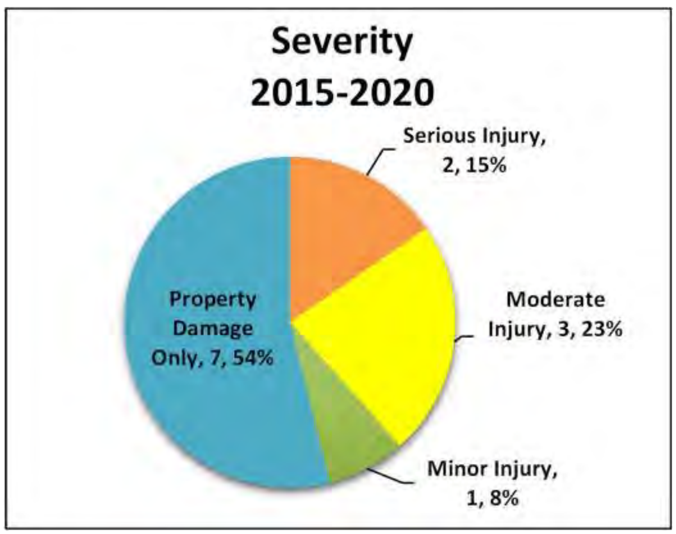


Figure 4 – Crash Severity in study area, totals and percentiles.

Exhibit A-1

Mix and Motor Vehicle Involvement With

- 77% (10 of 13) of study area crashes involved 1 vehicle, and 23% (3 of 13) involved 2 vehicles.
- The highest reported Motor Vehicle Inolvement With was Fixed Object with 46% (6 of 13).
- 31% (4 of 13) of study area crashes involved Animal (Deer or elk, wapati).
- There were no crashes reporting Vulnerable Road Users (VRU). VRUs include Pedestrians, Pedalcyclists, and Motorcycles. VRUs are more exposed than drivers operating vehicles, making them more susceptible to injury in the event of a crash.
- There were no crashes reporting Heavy Vehicle.

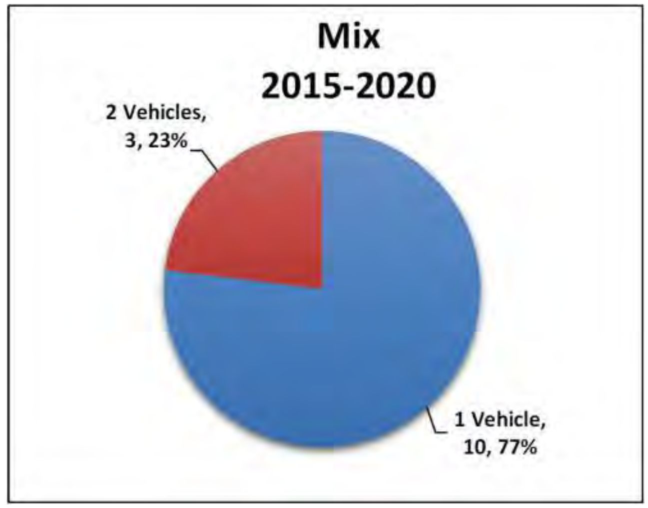


Figure 5 – Mix Involved in study area, totals and percentiles.

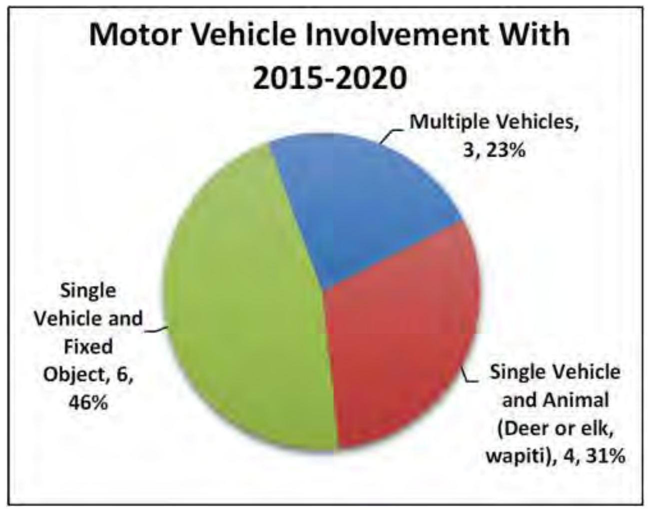


Figure 6 – Motor Vehicle Involvement With in study area, totals and percentiles.

Crash Type

- The highest reported crash types were Animal and Struck Object and Overturned, each reporting 31% (4 of 13).
- 16% (2 of 13) of study area crashes reported Turning Movement.

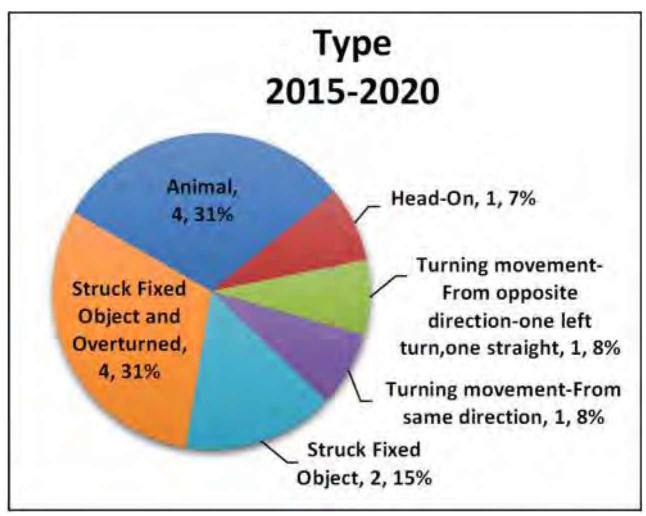


Figure 7 – Crash Type in study area, totals and percentiles.

Exhibit A-1

Time of Day and Light Conditions

- 54% (7 of 13) of study area crashes occurred in Darkness-no street lights, in Evening or Night.
- Afternoon-Daylight crashes reported the highest rate of injury with 66% (2 of 13).
- Severe injury crashes occurred in Morning-Daylight and Night-Darkness-no street lights.

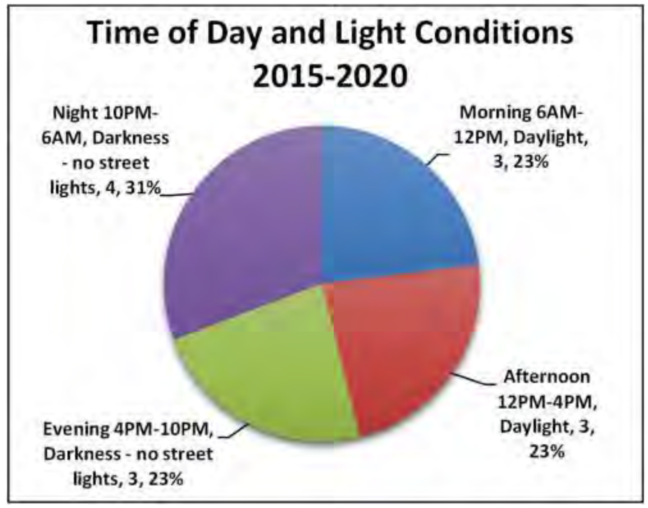


Figure 8 – Time of Day and Light Conditions in study area, totals and percentiles.

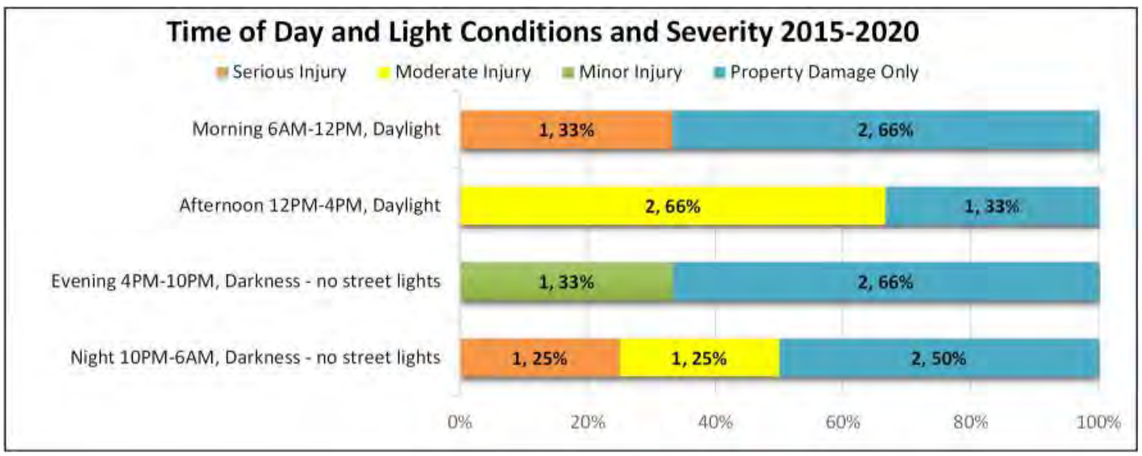


Figure 9 – Time of Day and Severity in study area, totals and percentiles.

Surface Conditions

- 46% (6 of 13) of study area crashes reported Wet or Ice.

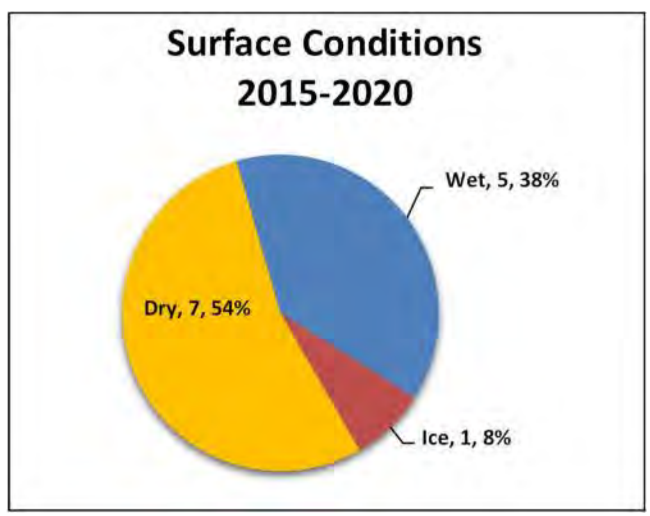


Figure 10 – Surface Conditions in study area, totals and percentiles.

Exhibit A-1

Location

- 15% (2 of 13) of study area crashes were reported within an Intersection.
- 38% (5 of 13) of study area crashes were reported within a Curve.

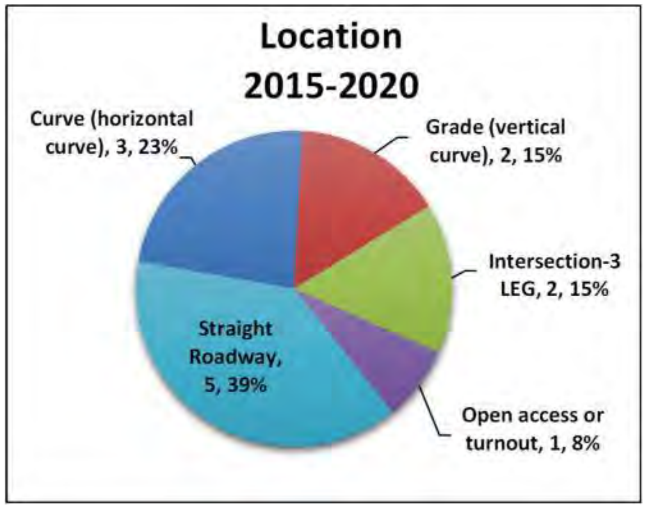


Figure 11 – Location in study area, totals and percentiles.

RISKY DRIVING BEHAVIORS

Risky Driving Behavior (RDB)

Primary human factors preceding crash are the human action or behavior error that were reported as the primary cause of the crash. National Highway Safety Transportation Administration (NHTSA) defines Risky Driving Behaviors (RDB) as: Impaired (under influence of alcohol or drug, ill or drowsy), Distracted Driving (innatention), Not Using Safety Equipment (seatbelts, helmet, etc), and speeding (includes aggressive, careless or reckless driving). RDBs are behaviors of high risk that need to be addressed to decrease the occurance of fatal and injury crashes.[2]

In addition to the NHTSA RDBs, Roadway Departure is also included as an RDB. The FHWA (Federal Highway Administration) defines Roadway Departure as a crash which a vehicle crosses an edge line, center line or otherwise leaves the traveled way.[3] For this study, roadway departure crashes include those identified by the ODOT crash attributes of Roadway Departure Flag and Off Roadway Flag. According to the 2021 Oregon Transportation Action Plan[4], Roadway Departure is the highest reported contributing factor reported in serious injury and fatal crashes.

The RDBs for this study are:

- RDB-Roadway Departure – Roadway Departure Flag, Off Roadway Flag
- RDB-Speeding – Too Fast for Conditions (not exceed posted speed)
- RDB-Inattention – Did not yield right-of-way, Made improper turn
- RDB-Safety Equipment (SE) Not Used – Safety Equipment includes safety restraints or belts, car and booster seats, and helmets
- RDB-Impaired Driving – Alcohol Involved Flag

Many crashes in the study area reported multiple RDBs. The following analysis of each RDB is mutually exclusive; therefore, a crash with multiple RDBs reported will be included in the statistical analysis for each RDB.

- RDB-Roadway Departure Flag and RDB-Speeding-Too Fast for conditions (not exceed posted speed) was the highest reported Primary Human Factor with 31% (4 of 13).
- 77% (10 of 13) of study area crashes involved RDB. 50% (5 of 10) of RDB involved crashes resulted in injury.
- RDB involved crashes resulted in 1.5 times higher rate of injury (50%) versus No RDB involved crashes (33%).

---

[2] National Highway Traffic Administration. https://www.nhtsa.gov/risky-driving
[3] Federal Highway Administration Roadway Departure Safety https://safety.fhwa.dot.gov/roadway_dept/
[4] Oregon Transportation Safety Action Plan 2021 https://www.oregon.gov/odot/Safety/Documents/2021_Oregon_TSAP.pdf

Exhibit A-1

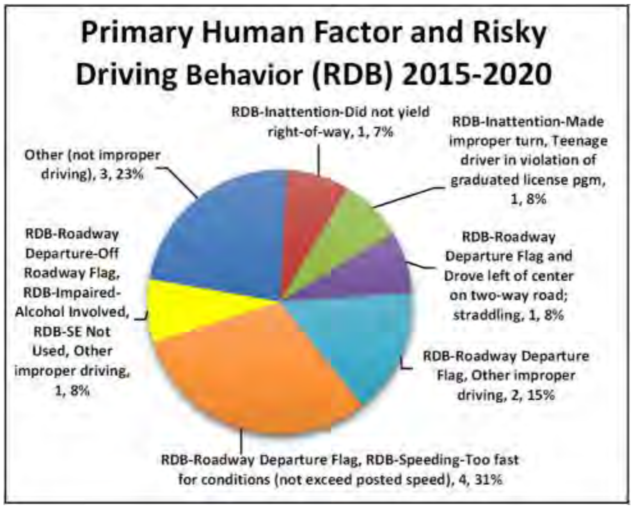


Figure 12 – Primary Human Factor and RDB in study area, totals and percentiles.

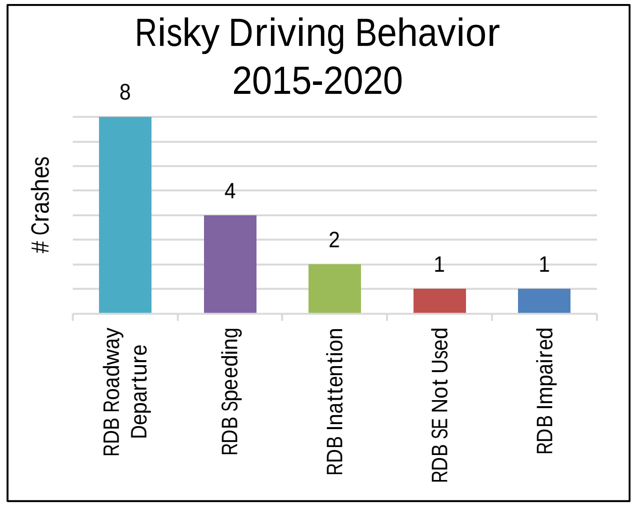


Figure 13 – RDB in study area, totals.

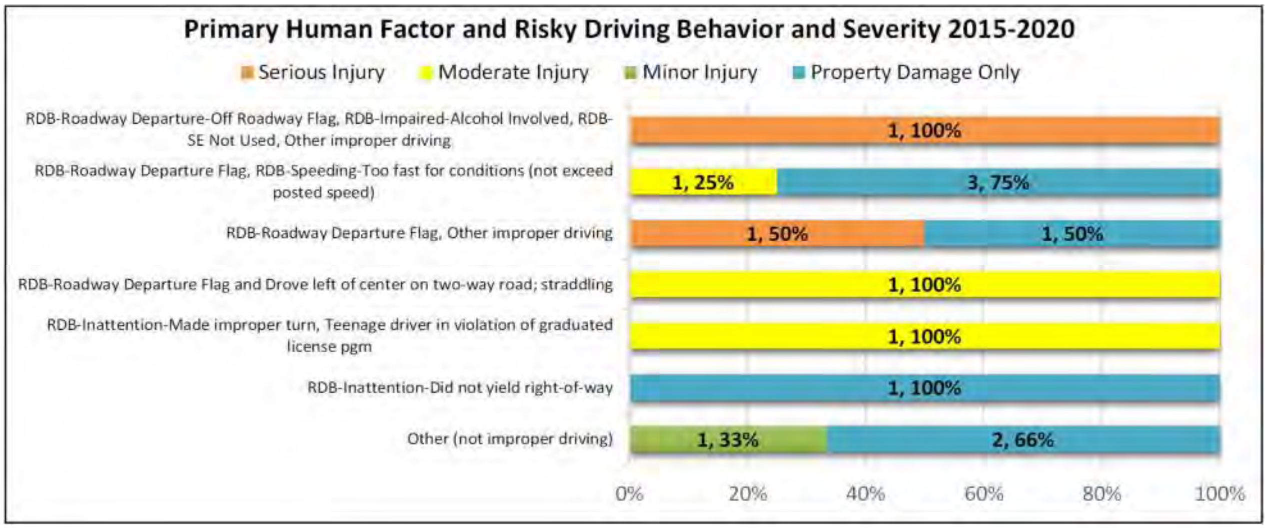


Figure 14 – Primary Human Factor, RDB and Severity in study area, totals and percentiles.

- 62% (8 of 13) of study area crashes involved RDB-Roadway Departure.
- RDB-Roadway Departure reported an injury rate of 50% (4 of 8), including 100% (2 of 2) of reported serious injury crashes.

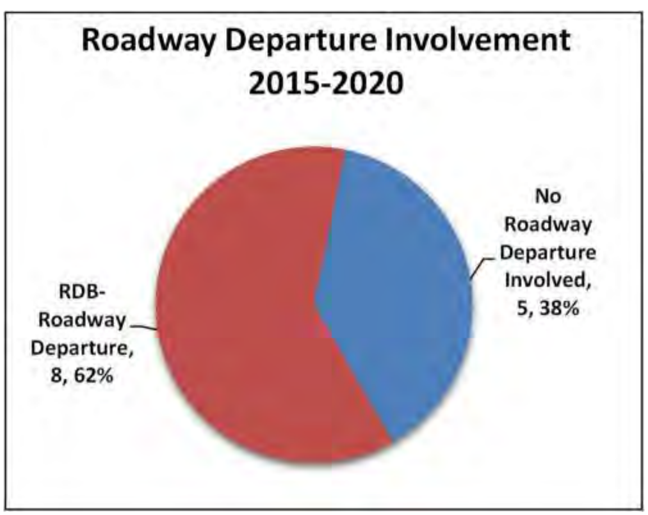


Figure 15 – Roadway Departure Involvement in study area, totals and percentiles.

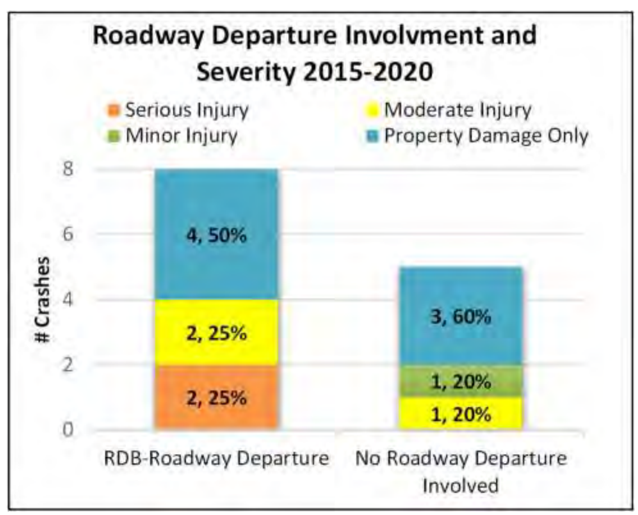


Figure 16 – RDB Involvement and Severity in study area, totals and percentiles.

Exhibit A-1

AGENDA

Project Kickoff Meeting - 7/31/2023, 1:00 PM Virtual Zoom Meeting

Meeting Link:
https://us06web.zoom.us/j/87257780772?pwd=NWVXakt3THY0YXMrUjB3eVo1ODJPQT09

Invited Participants:

- City of Cannon Beach
  - Bruce St. Denis, City Manager
  - Rusty Barrett, IT Director
  - Steve Sokolowski, Community Development Director
  - Robert St. Clair, Planner
  - Karen La Bonte, Public Works Director
  - Trevor Mount, Assistant Public Works Director
- CIDA (Project Architect)
  - Leslie Jones, Associate Architect
  - Angelica Juengel,
- Red Plains Professional (Project Planners and Engineers)
  - Chris Robideau, President and Director of Planning
  - Tim Scott, Director of Engineering Western Region
  - Keegan Peters, Project Engineer
  - Ken Picard, GIS Specialist/Planner I

Agenda Items:

1. Introductions (City, Cida, RPP)
2. Purpose of the Meeting and Project Overview – City
3. Establish the Project Team and Communication Protocol – City
4. Traffic Impact Analysis Approach – Red Plains
   a. Problem Statement
   b. Next Steps
      i. Field Data Collection (3 MTCs and 2 TMCs to be collected)
      ii. Post Processing of Data
      iii. Set Orientation Meeting with ODOT Representatives Region 1 – Area 1 Office
      iv. Establish Level of TIA
      v. Complete Analysis and Draft TIA
      vi. Submit for Review to City (approval to submit to ODOT)
      vii. ODOT Submittal and Presentation
      viii. Finalize the TIA and Acquire ODOT Approval
5. General Discussion
6. Establish Potential ODOT Kickoff Meeting Dates
7. Adjourn

Exhibit A-1

tion/Permit for City of Cannon Beach, Appl No. = 44713, Dist Id. = 01, Highway = 009

Application | Property | General | Suppl Item | Insurance/Bond | Specification | Provision | Inspection | Notes | Alerts | Findings | Collaboration | Appeals | COU

Appl Id:		Permit Spec:		Applicant Last Name:	
rmit No:		Office		Applicant Company:	
ase No:		County:		Prop Owner Last Name:	
ighway:	009 Oregon Coast	Beginning MP:	31.20	Ending MP:	31.30
wnship:		Range:		Section:	
Tax Lot:		Engineering Sta:		R/W map no:	
Plan Id:		Permit Type:		R/W File Id:	
ADT:	EQ	Sight Distance (left):	EQ	Sight Distance (right):	EQ
. Pol. #:		Deviation:		Region:	
e (from):		(through):			
Project:					

Application Status(es)

Pending
Pre-Application
Void Record
End Inquiry/No Appr.
INU (UnP,Unresolve)
Application Receivec
Suppl. Items Reqstd.
Review Suppl. Items
App. Not Accepted
Deemed Complete
Conditional Approval
Deny Application

Search | Reset

rt

Permit Number	Office	County	Hwy	MilePoint	Applicant	Reason for Request	Status	Permit Specialist	Application Date	Permit D
	Dist. 1 Astoria	Clatsop	009	31.260	Kyle Torseth	Inventory Exist	INV (PTBP, GF, UP	zzzCaswell, Matth	00/00/0000	UPermit 35
	Dist. 1 Astoria	Clatsop	009	31.205	City of Cannon Beacl	Inventory Exist	INV (PTBP, GF, UP	zzzCaswell, Matth	00/00/0000	

Rows Selected

Date 8/1

Oregon Department of Transportation

Exhibit A-1

[redacted] PERMIT TO CONSTRUCT APPROACH ROAD

PERMIT NUMBER

01 A35471

HIGHWAY NAME Oregon Coast	MILE POINT 31.26	ENGINEERS STATION 362+53
HIGHWAY NUMBER 9, U. S. Route 101 — COUNTY Clatsop	SIDE OF HIGHWAY ☐ NORTH ☒ EAST ☐ SOUTH ☐ WEST	APPROACH TO SERVE timber land
BETWEEN OR NEAR At Tolovana Mainline	REFERENCE MAP NUMBERS 6B-3-2	TAX LOT NUMBER 800
APPLICANT NAME AND ADDRESS Willamette Industries, Inc. Jim Hunt P. O. Box 998 Seaside, OR 97138	BOND REQUIRED ☐ YES ☒ NO — REFERENCE OAR 734-50-025(6)	AMOUNT OF BOND
	INSURANCE REQUIRED ☐ YES ☒ NO — REFERENCE OAR 734-50-025(3)	☒ ADMINISTRATIVE FEE ☐ TEMPORARY DEPOSIT
	AMOUNT $50.00	CHECK NUMBER 40354407/66-763
TELEPHONE NUMBER: (503)738-6351	DISTRICT MANAGER OR REPRESENTATIVE X Dennis N. Sands	DATE APPLICATION APPROVED 7/8/98
APPLICANT X [signature] — APPLICATION DATE 7/6/98	APPROACH ROAD COMPLETION DATE: REFERENCE: OAR 734-50-050(4)	October 31, 1998

The applicant declares that he/she is the owner or lessee of the real property adjoining the above described highway and has the lawful authority to apply for this permit. When this application is approved by the Department of Transportation, the applicant is subject to the terms and provisions contained herein and attached hereto; and the terms of Oregon Administrative Rule, Chapter 734, Division 50, which is by this reference made a part of this permit. Copies of the Rule may be obtained from the District Manager's office.

Issuing of permits under these regulations is not a finding of compliance with the statewide planning goals or the acknowledged comprehensive plan for the area. Permits are issued subject to the approval of city, county or other governmental agencies having either joint supervision over the section of highway or authority to regulate land use by means of zoning and/or building regulations. It shall be the applicant's responsibility to obtain any such approval including, where applicable, local government determination of compliance with the statewide planning goals. (OAR 734-50-055)

SPECIAL PROVISIONS

1--- If the proposed application requires traffic control devices and/or special road construction, the applicant shall provide a copy of this application to the affected local government. The original application must be signed by the local government official.

LOCAL GOVERNMENT OFFICIAL SIGNATURE	TITLE	DATE
X		

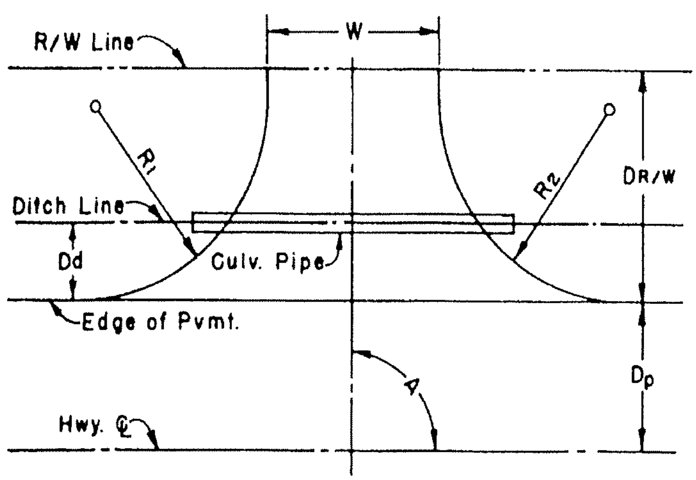
2---Within 48 hours before beginning work, and after completing the permit work, the applicant or his contractor shall notify the District Representative at telephone number: (503)325-7222 Or FAX number: (503)325-1314

3 Applicant shall establish ditch line to the north of the access to direct water flow away from the highway shoulder and pavement.

4 Applicant shall reconstruct & slope existing access to prevent water from draining onto the paved highway from the approach area; shall pave a minimum of twenty (20) feet from the existing edge of highway asphalt back to the private property line; and shall be responsible for the maintenance of the approach area.

5 Drawings on front and back of permit shall apply.

TYPE 2 APPROACH ROAD — PAVED



PLAN

NOTE: All material and workmanship shall be in accordance with the current state of Oregon Standard specifications for Highway Construction.

W = 24'	R_1 = 20'	R_2 = 20'	A = 90
D_P = 18'	D_d = 24'	$D_{R/W}$ = 52'	

CULVERT PIPE REQUIRED? ☒ YES ☐ NO

TYPE: existing

DIAMETER (INCHES)	LENGTH (FEET)

	SIZE AND TYPE / CLASS	COMPACTED THICKNESS (INCHES)
STONE BASE	4"-0 pit run	12
STONE LEVELING COURSE	1"-0 crush	3
ASPHALT CONCRETE PAVEMENT	B or C	3

734-3307C(8-96) 116

SEE PAGE 2 OF APPLICATION

CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

October 27, 2023

Leslie Jones
CIDA
15895 SW 72nd Ave, Ste. 200
Portland, OR 97224

RE: Completeness Determination for Comprehensive Plan Amendment and Zone Change at 81389 U.S. Highway 101, Taxlot 41006B000200 (File: ZO 23-03)

Dear Ms. Jones:

Your application for a Comprehensive Plan Amendment and Zone Change for Taxlot 41006BC000200 was received on October 25, 2023 and determined to be complete on October 26, 2023. The City has 120 days from this date of determination to exhaust all local review, that period ends on Friday, February 23, 2024. The first evidentiary hearing for this application will be held on December 28, 2023 at 6:00pm, you may participate in person or by Zoom. Due to statutory requirements for the City to provide a minimum 35 day notice for this application to the Oregon Department of Land Conservation and Development it will not be possible for the Planning Commission to hear this item during its November hearing.

The materials received with this application include:

- Comprehensive Plan Map Amendment application
- Project narrative with maps
- October 2023 GSI geotechnical report
- May 2023 GRI ground movement memorandum
- December 2014 South Wind Master Plan
- 2023 Red Plains Traffic Impact Analysis

Please be aware that the determination of a complete application is not a decision or a guarantee of outcome for the application.

Please feel free to contact my office at (503) 436-8053, or by email at stclair@ci.cannon-beach.or.us if you have questions regarding this information.

Sincerely,

Robert St. Clair
Planner

Exhibit C-2

CANNON BEACH COMMUNITY DEVELOPMENT
163 E. GOWER ST.
PO BOX 368
CANNON BEACH, OR 97110

MEMORANDUM

RE: Proposed Comprehensive Plan Amendment & Zone Change, ZO 23-03

October 27, 2023

The purpose of this memo is to provide a brief overview of a City of Cannon Beach proposed comprehensive plan and zoning map amendment for Taxlot 41006B000200 which is located in the southeast corner of the City. The property largely undeveloped with the exception of one storage building and multiple shipping containers that are used by the City's Emergency Management program. The reason for the comprehensive plan and zoning map amendment is for the development of a new Cannon Beach Police Station. In order for the development of the police station to occur the following comprehensive plan map amendment and rezone is proposed:

Existing Designation – Institutional Reserve (IR)

> The purpose of the existing Institutional Reserve (IR) land use designation is to reserve areas for potential future urban uses. The City of Cannon Beach is now proposing to use this currently reserved property as a police station.

Proposed Designation – Institutional (IN)

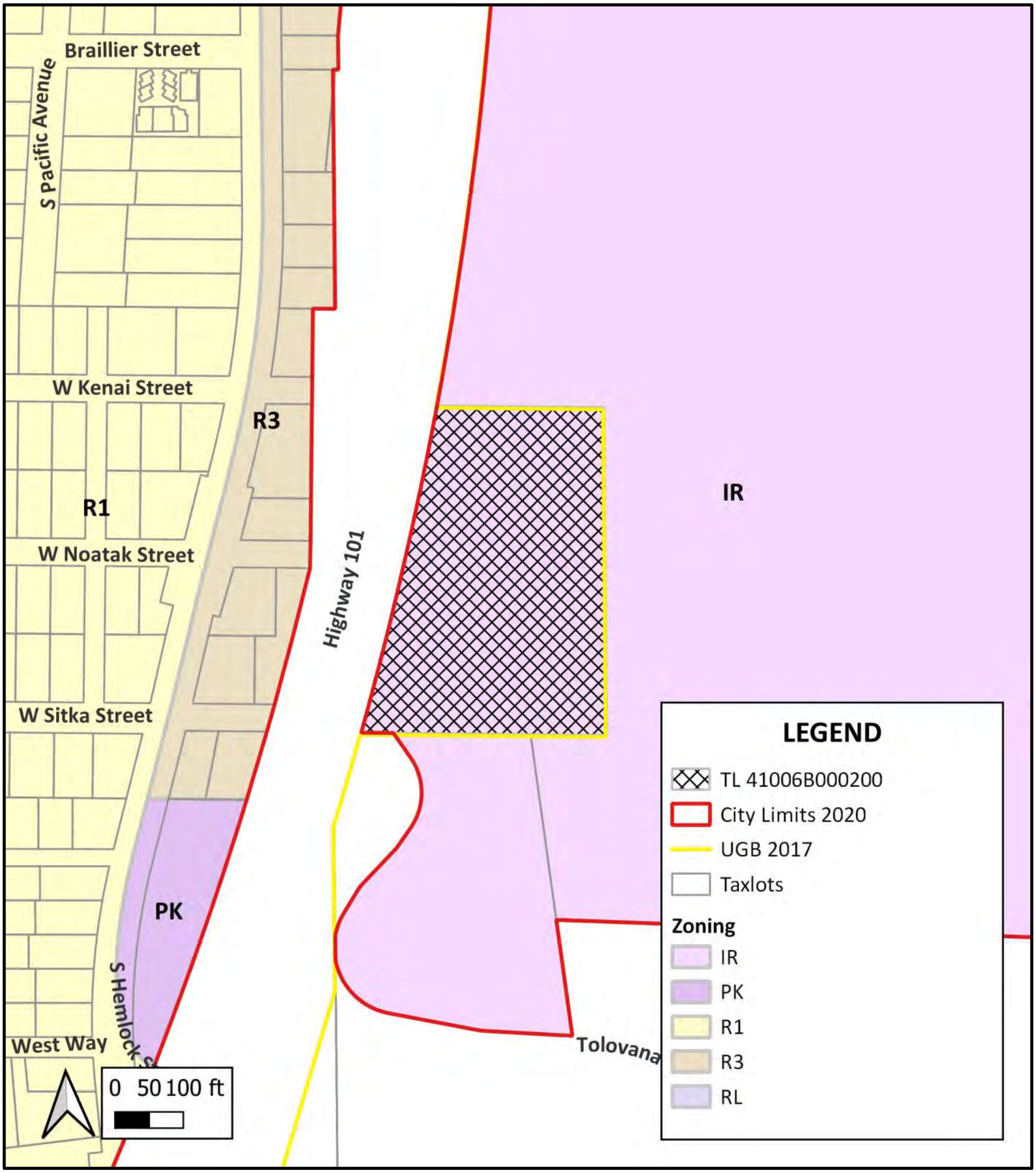
> The purpose the Institutional (IN) land use designation is to provide for a range of governmental and municipal uses. The City is proposing this land use designation change to IN to develop the new Cannon Beach Police Station on this property.

The City has long considered this property for development new essential facilities above the tsunami inundation line. The City's goal for the Police Station project is to develop a structure that will facilitate the department's ability to provide exceptional day to day municipal services, while being constructed to remain operational following a seismic or tsunami event. The proposed Emergency Operations Center will be designed to function as an epicenter during all phases of resiliency efforts. The requested zone change will allow the development of the Police Station and Emergency Operation Center to be constructed out of the tsunami inundation zone.

Exhibit C-2

Subject Property – TL 41006B000200

Mapping information taken from City of Cannon Beach GIS records.
This map is not a survey product.



SOUTH WIND MASTER PLAN

December 17, 2014

Prepared by the Master Plan Advisory Committee:

Liz Beckman
Wendy Higgens (City Council Liaison)
Beth Holland
Jim Litherland
Bob Lundy
Mark Morgans
John Nelson

Mark Barnes (City Planning Director)
Dan Grassick (City Public Works Director)

SOUTHWIND MASTER PLAN

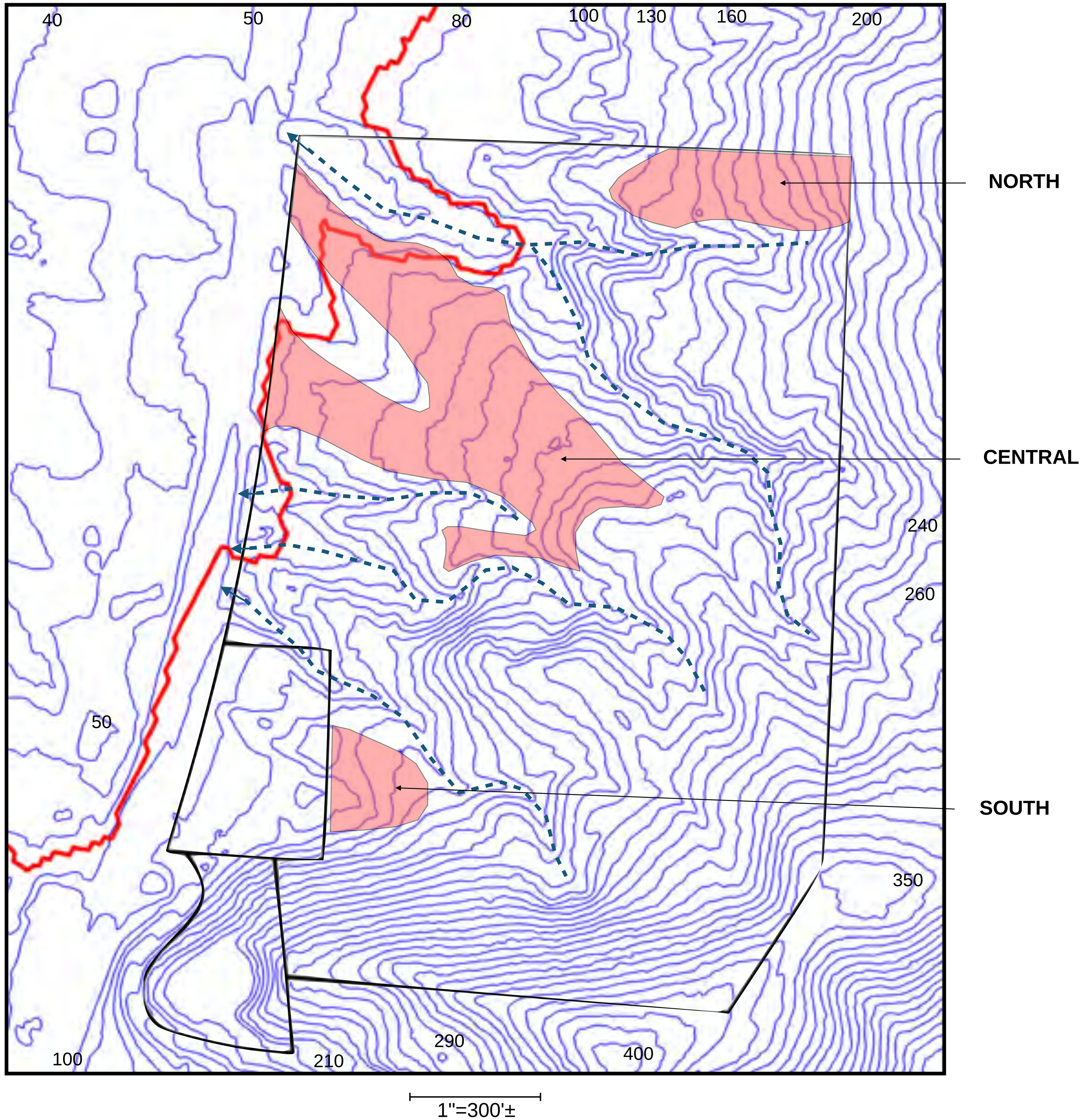
1"=300'±

CURRENT CONDITIONS

SouthWind consists of about 58.3 acres located east of Highway 101 and south of the Haystack Heights neighborhood. SouthWind is made up of two parcels. A 55-acre tract was acquired by the City from Campbell Global in 2013. A 3.3 acre parcel was acquired by the City from Clatsop County in 1990.

The site is vacant except for an existing 450 square foot garage used to store emergency supplies, visible near the southwest corner of the site.

The aerial photograph to the left was taken in 2013. Logging on the site was conducted in 2011 and 2013.



Topography, Hydrology, Geology, and Tsunami Risk

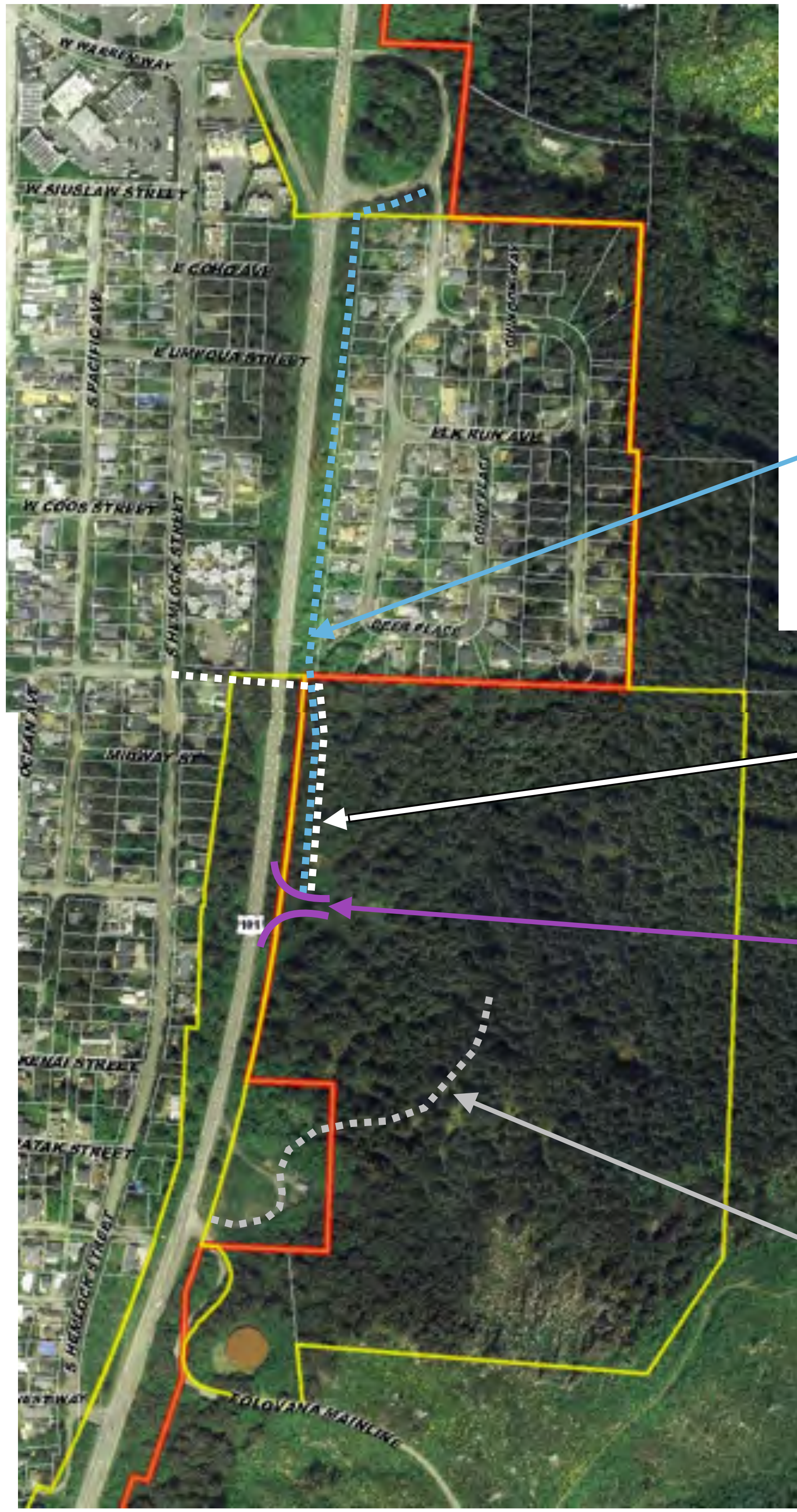
This topographic map is based on 2011 LIDAR data. Ten-foot contour intervals are shown. Elevations on the site range from about fifty feet above sea level near the site's northwest corner, to almost 400 feet near the site's southern boundary.

The Tsunami Inundation Line is shown as a solid red line on this map. It is based on data developed by the Oregon Department of Geology and Mineral Industries (DOGAMI) in 2013. Several different risk levels were considered; shown is the inundation line for a tsunami generated by the largest predicted Cascadia subduction zone earthquake. Lands to the west of this line (that is, toward the left side of the map) would be inundated by this tsunami; lands to the east are above the estimated inundation line. The earthquake in this model releases fault slip built up over about 1,200 years; earthquakes of this magnitude are infrequent, and roughly equivalent to the 2011 Tōhoku tsunami. ***The City will restrict construction of essential facilities on the SouthWind site to areas above the DOGAMI XXL inundation line.***

A report prepared by Horning Geoscience in 2013 addressed geological hazards on the site. A copy of this report is included as an addendum to this master plan. The Horning Geoscience report evaluated three potential development sites on the property, shown on the map to the left. These areas are referred to as the North, Central, and South sites in the Horning Geoscience report, and are so labeled on the map to the left. The South site covers about one acre; the Central site about eight acres; and the North site about two acres. The report concludes that these three areas are potentially developable, assuming appropriate geotechnical engineering measures are taken. The report does not rule-out development on other parts of the site given appropriate engineering solutions to the site's geological limitations. ***The City will require a site-specific geologic hazard study for each building, for road construction, and for any grading or filling on the SouthWind site.***

The site drains to the west via several drainage basins. These are shown as dark blue dotted lines on the map to the left. Culverts beneath Highway 101 convey site runoff to the west. ***The City will maintain existing drainages and stream corridors on the SouthWind site. A ten-foot wide buffer is established on each side of each stream corridor. Where it is necessary to cross a stream corridor, the crossing will be designed to maintain stream corridor hydrology, and will comply with all applicable state or federal permit requirements.***

Exhibit C-3



1"=500'±

ROAD AND UTILITY ACCESS

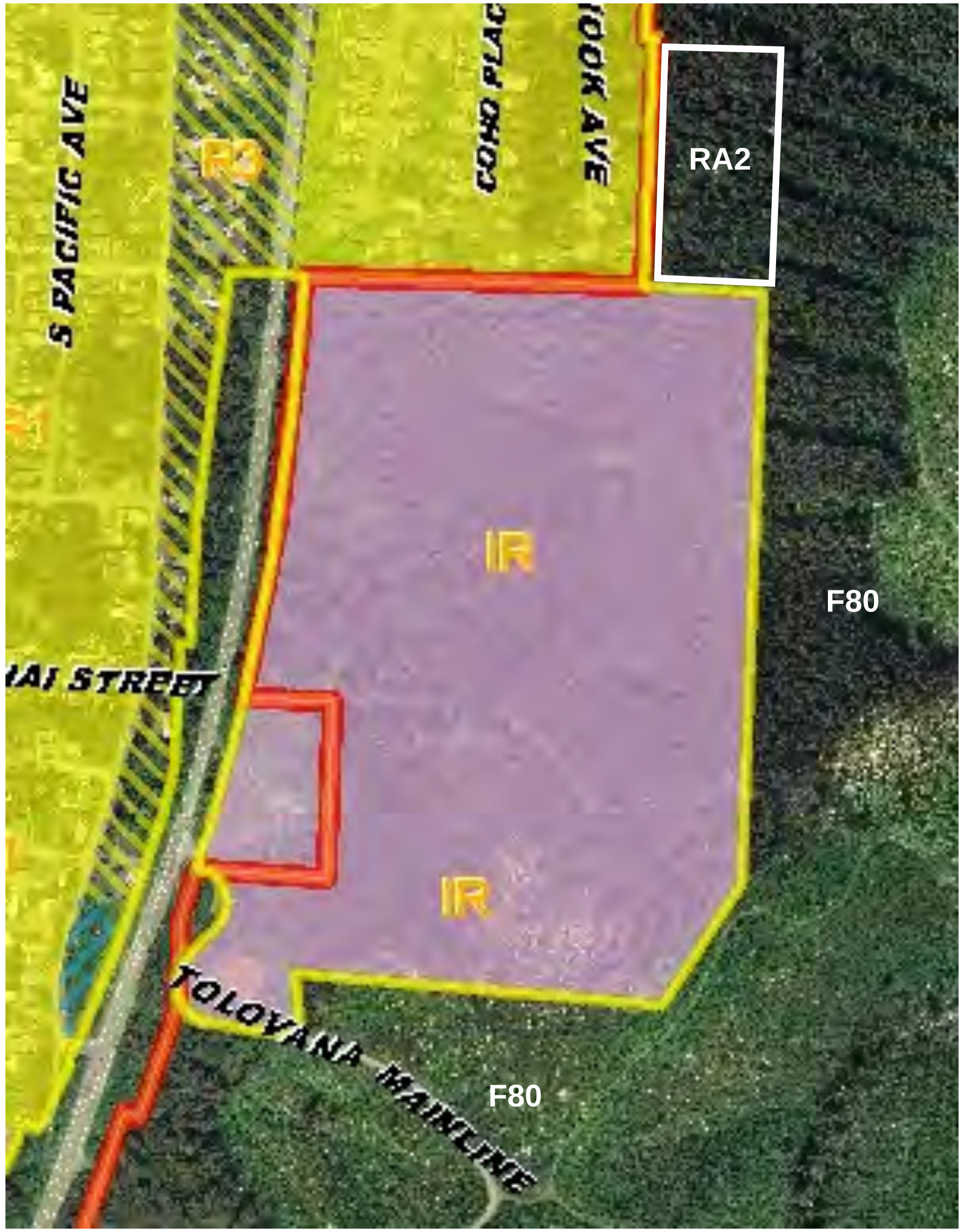
The SouthWind site has about 1,600 feet of frontage on Highway 101. East Chinook Street, a city street, ends at the site's north property line. The Tolovana Mainline, a privately-owned gated logging road, enters Highway 101 at the southwest corner of the site. Utilities (water, power, sewer) are in the Hemlock Street corridor, west of Highway 101.

Pedestrian access to the SouthWind site could be (a) via East Chinook; (b) via an easement from Deer Place; (c) across Highway 101 at or near the preferred road access point; or (d) on the east side of the Highway 101 right-of-way between Warren Way and the site, separated from the Highway 101 travel surface. Of these alternatives, the City prefers alternative (d) because it does not require pedestrians to cross Highway 101; avoids the need to purchase easements to reach Deer Place; avoids steep terrain at the south end of East Chinook Street; and uses established pedestrian facilities and the overpass at Warren Way. Estimated improvement costs for pedestrian access are about $350,000. ***The City prefers pedestrian access to the SouthWind site on the east side of the Highway 101 right-of-way between Warren Way and the site, separated from the Highway 101 travel surface.***

City utilities (water and sewer) can be brought to the site by boring beneath Highway 101. The preferred location is at Orford Street, at the property's northwest corner. Water and sewer system extensions onto the site, and including connections to the water tank to the southwest of the site, and to the existing water line on East Chinook Street, are estimate to cost about $665,000. ***The City will integrate the SouthWind waterline extension with the existing water storage tank and with the water distribution system in the Haystack Heights neighborhood.***

Access to Highway 101 will likely require a left turn refuge, a right turn deceleration lane, a right turn acceleration lane, shoulder enhancements, signage, lighting, and drainage improvements. A 2014 estimate of costs for these highway improvements is $2.2 million. The access point location will need to be determined through a traffic study. The City prefers access near the central part of the site's frontage, roughly opposite Braillier Street. A shared access with the Tolovana Mainline is not preferred because of potential conflicts between log trucks using the Tolovana Mainline, and traffic such as school busses and emergency vehicles. Access via East Chinook is not preferred because neighborhood streets in Haystack Heights are not appropriate for regular emergency vehicle access; and because the topography at the end of East Chinook poses engineering, design and cost challenges for road construction. ***The City prefers a location roughly opposite Braillier Street for the primary highway access to the SouthWind site.***

Secondary/Emergency Access can be provided via the existing access point at the southwest corner of the site. ***The existing highway access point at the southwestern corner of the SouthWind site is unsuitable for primary highway access due to the potential for conflicts with the Tolovana Mainline; however, this access point may be suitable for secondary or emergency access.***



1"=500'±

CURRENT CITY LIMITS, UGB, AND ZONING

The SouthWind property is currently inside the City Limits (the yellow line on this map), and outside of Cannon Beach's Urban Growth Boundary (UGB), shown as the red line. The entire site is in the City's Institutional Reserve (IR) zone.

Property to the immediate north, the Haystack Heights neighborhood, is in the City's Moderate Density Residential (R1) zone. Across Highway 101, to the west of the SouthWind site, is land in the High Density Residential (R3) zone.

To the east and south of the SouthWind property is forest land owned by Campbell Global. This property is in Clatsop County's Forest-80 (F80) zone.

About five acres of vacant land in the County's Residential-Agriculture-Two-Acre (RA2) zone adjoins the northeast corner of the SouthWind site.

The SouthWind property's location outside of the Urban Growth Boundary, and the current Institutional Reserve (IR) zoning designation, do not support most of the development described in this master plan. ***The City will need to amend the UGB to include all or part of the SouthWind site within the boundary; and amend the zoning map accordingly, to accommodate the proposed development in this master plan.***

PROPOSED DEVELOPMENT

The City intends to use the SouthWind site for critical and essential facilities and services because the property is largely above the reach of the largest predicted tsunami. The police station, fire station, day care facilities, a medical clinic, and the now closed Cannon Beach Elementary School are all within the tsunami inundation zone at their current locations. The City wishes to facilitate the relocation of the following buildings/facilities on the SouthWind site:

Police station
Fire station
School
Child care/pre-school
Food bank
Emergency shelter/emergency operations center.

These facilities would be clustered in the area shown on the map to the left, and on the more detailed map on the following page.

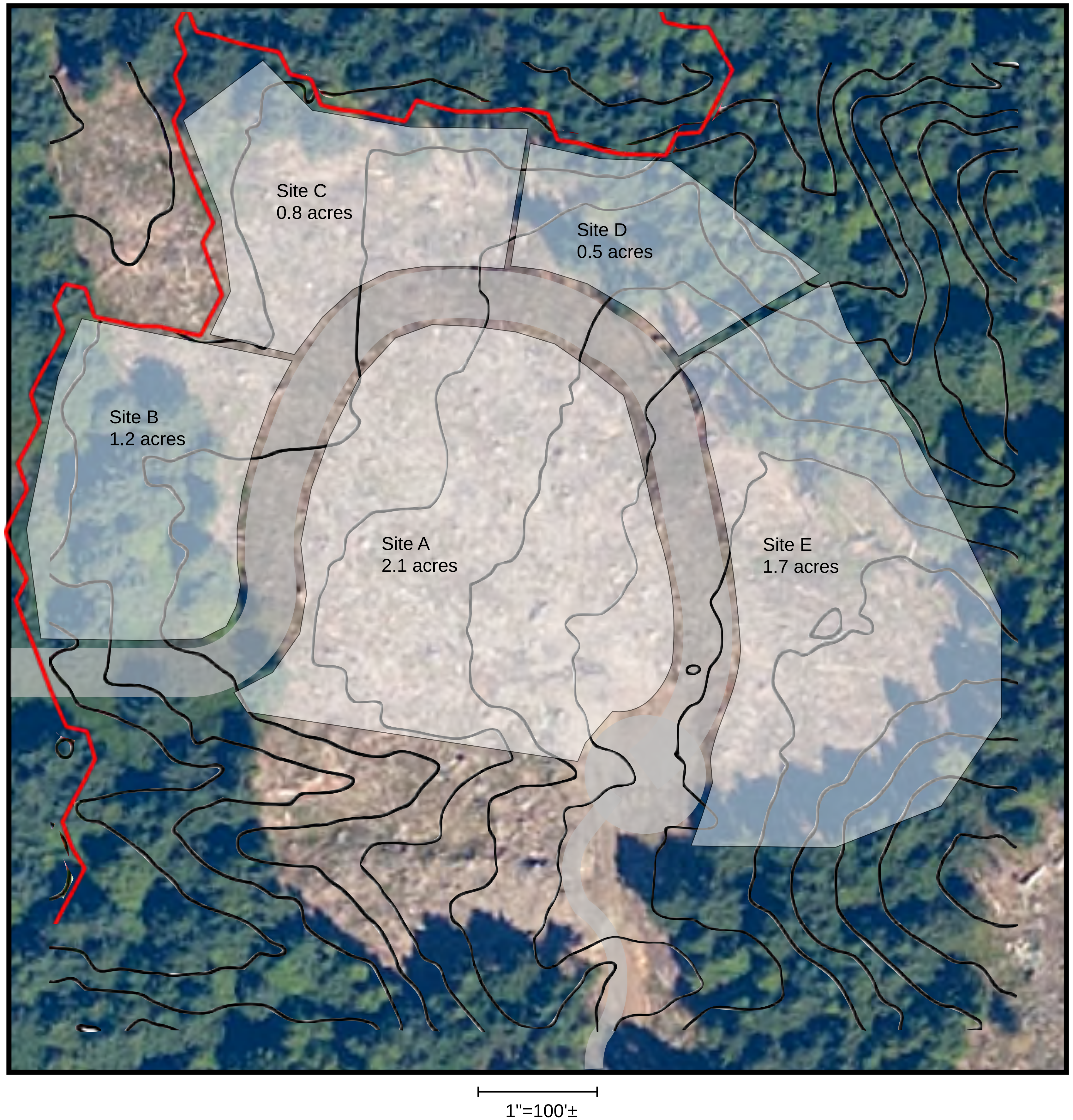
The City should facilitate the location of new essential facilities above the tsunami inundation line. They include: police station, fire station, school, child care/pre-school, food bank, and emergency shelter/emergency operations center.

Developed facilities on the SouthWind site should be clustered in the area shown in the master plan to preserve the largest possible forested area, and to avoid conflicts with adjoining land uses.

BUFFER

Separation from adjacent incompatible land uses can be achieved with a buffer area along the east and south boundaries. The dashed yellow line on the aerial photograph to the right represents the extent of a two-hundred foot wide buffer from the property line.

The City will maintain a two-hundred foot wide buffer along the east and south property lines to separate incompatible uses on the SouthWind site from commercial forestry activity on the adjoining property.



PROPOSED DEVELOPMENT

The road layout shown on this map is schematic only; its exact location and design will be refined based on more detailed site analysis and a traffic study. The acreage figures represent the approximate size of the shaded areas. These areas are somewhat arbitrary in size, configuration and location. All are above the tsunami inundation line, shown in red on this aerial photograph. All are entirely or largely within the central area evaluated by Horning Geosciences, and shown on the map on page 2 of this master plan.

School: The former Cannon Beach Elementary School (CBES) site covers about 2.2 acres. The City anticipates that between 1.8 and 2.1 acres will be needed for a school site. This estimate includes space for pre-school and day-care, activity space for grades 1 through 7, a library, administrative space, and gymnasium. Site A can meet the school's needs; however, it is not large enough to accommodate facilities that might be needed for field sports, such as soccer or softball. ***The City shall reserve room for a school on the SouthWind site***.

Fire Station: The Cannon Beach Rural Fire Protection District's fire station at its current Cannon Beach location covers slightly more than half an acre. Any one of sites B, C, or D are large enough to accommodate a fire station. ***The City shall reserve room for a fire station on the SouthWind site***

Police Station: The Cannon Beach Police Department currently operates out of City Hall. The City estimates that space needs for the Police Department are slightly less than one-half acre. Sites B, C, or D are large enough to accommodate this use. ***The City shall reserve room for a police station on the SouthWind site***

Emergency Services Facility: The City may develop an emergency services facility on the SouthWind site. This could include storage space for emergency supplies, emergency shelter space, and/or emergency communications and support. The space needs for such a facility are uncertain; but the City believes any of the five sites shown on this map is large enough. A location near the southwest corner of the site may also be suitable for this use: see the map on page 1. ***The City shall reserve room for an emergency services facility on the SouthWind site***

Food Bank: A food pantry is presently located in the former CBES site. The SouthWind site is not an ideal location for a food pantry: the former CBES site is more conveniently located for clients. A site above the Tsunami inundation line has some potential advantages, particularly if the food pantry also serves as an emergency food storage facility. A food bank on the SouthWind site might be incorporated into an emergency services facility, or operate as a stand-alone entity. The regional food bank in Warrenton is operated on a one-acre site, so it is likely that any of the sites here could accommodate Cannon Beach's food pantry. ***The City shall reserve room for a food pantry on the SouthWind site***

1"=300'±

FOREST RESOURCES

This 2013 aerial photograph shows three areas where timber was harvested on the SouthWind site; and remaining stands of, primarily, Sitka spruce, western hemlock, and red alder.The area on the east side of the site was harvested in 2011. It covers about 12.3 acres. This harvested area extends off-site, to the east. This area was replanted with spruce and hemlock in early 2012. The central area was logged in 2013, and covers about eight acres. This central area is where most of the development is planned. The small southern clearing was also logged in 2013, and covers about 1.7 acres. These two areas were replanted with spruce and hemlock in January 2014.

Barry Sims, a consulting forester with Trout Mountain Forestry, prepared a memorandum for the City outlining management recommendations for the forested part of the SouthWind site. The memo is included as an appendix to this master plan. His recommendations include:

- The remaining stand could be thinned to enhance views or to accelerate the development of bigger trees. Any such thinning would need to be carefully done to minimize the risk of blowdown. Thinning at this time is not recommended, as future goals for the site are not entirely clear, and with the recent harvest openings, some blowdown may occur in the next few years. A policy regarding blowdown would be advisable so the City can respond. Potential revenues from either a light thinning or small amounts of blowdown salvage would likely be negligible.
- The City is obligated under the Oregon Forest Practices Act to maintain the conifer plantations to ensure they are “free to grow” without being shaded out by brush. It appears that the earlier clearcut areas have been sprayed with herbicides at least once to give the planted trees a chance to become established. The more recent cut areas have not, and 2014 would be a good year to assess brush competition.
- The road that was either built or upgraded into the new clearings is already brushing in with alder and other vegetation. Mowing or spraying this road annually is recommended to maintain access and protect the road surface. If alder is allowed to grow large enough, removal will require uprooting and disturbing the road surface.

If the property is developed as shown on page 6, more than 40 forested acres would remain undeveloped, and potentially available for recreation, opened space and forestry.

The City shall prepare and adopt a forest management plan for the SouthWind site. Until a forest management plan is adopted, the City shall follow the requirements of its tree removal ordinance (Municipal Code Chapter 17.70) with respect to harvest or thinning operations on the SouthWind site.

DESIGN OPTION 01

CANNON BEACH - POLICE STATION

CANNON BEACH, OREGON

CIDA

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

DESIGN OPTION 02

CANNON BEACH - POLICE STATION

CANNON BEACH, OREGON

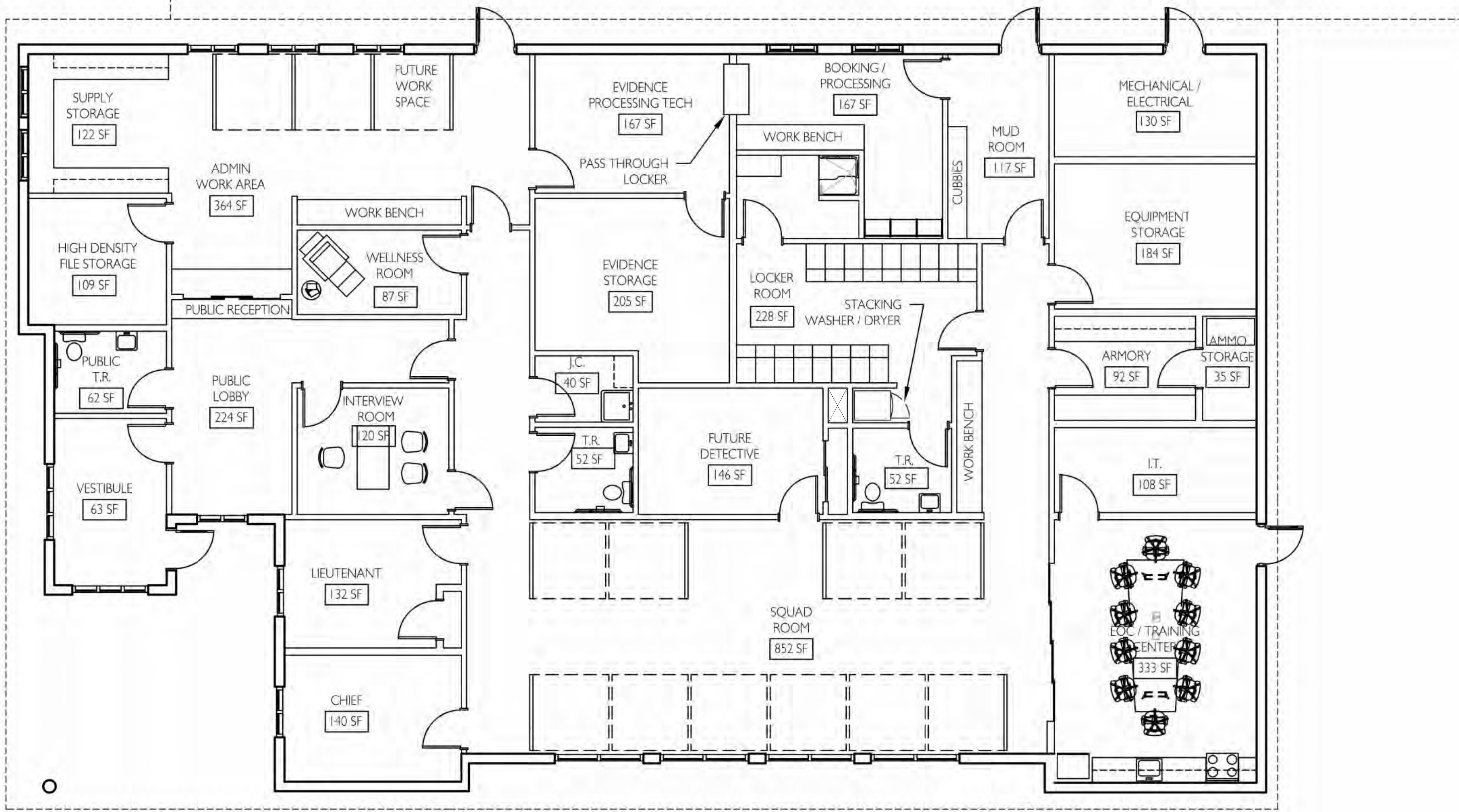
CIDA

ARCHITECTURE
ENGINEERING
PLANNING
INTERIORS

Exhibit C-4

BUILDING TOTAL: 5,328 SF

*WITHOUT VESTIBULE EXTENSION: 5,270 SF



POLICE STATION FLOOR PLAN

CANNON BEACH POLICE DEPARMENT

CANNON BEACH, OREGON

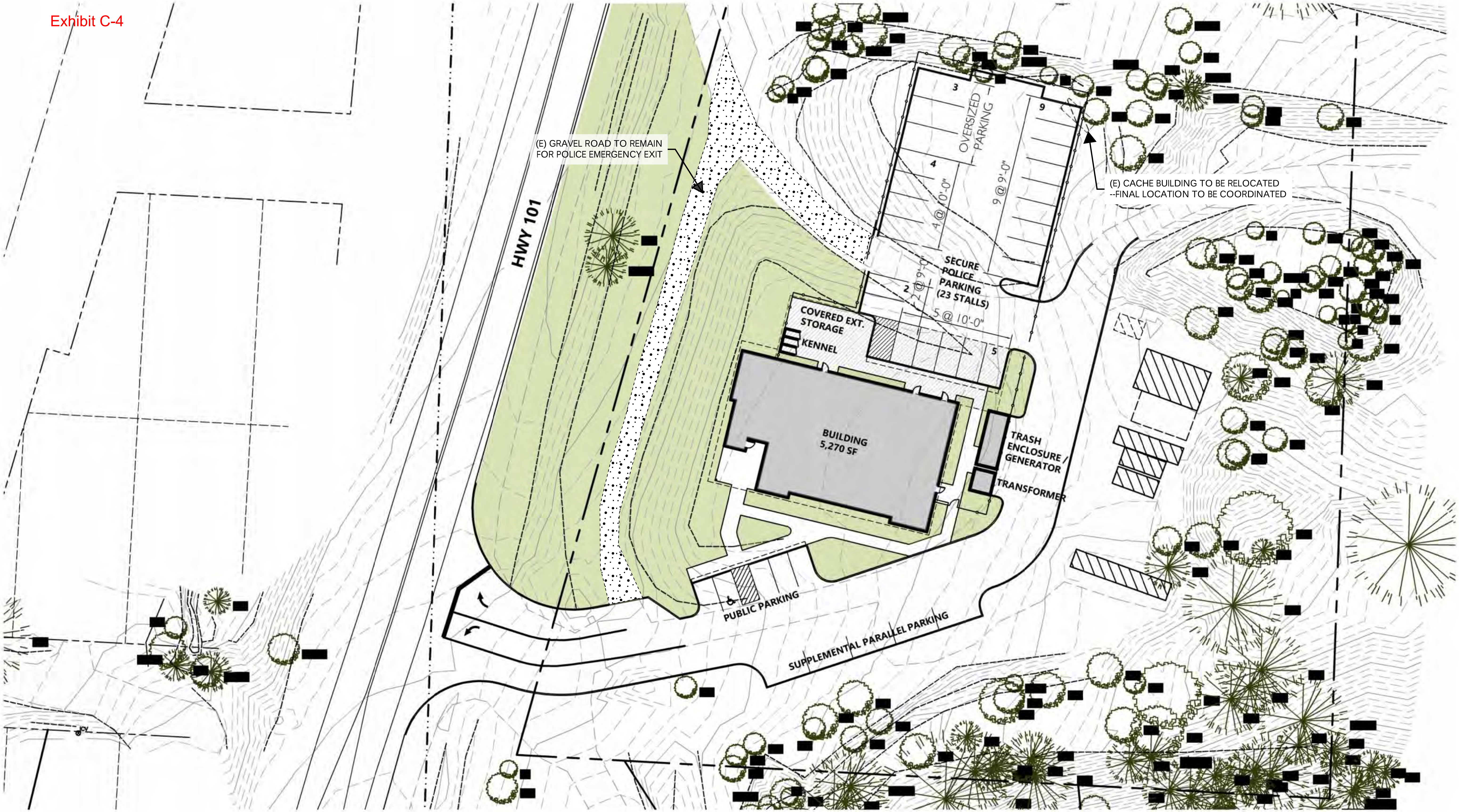
CIDA
ARCHITECTURE ENGINEERING PLANNING INTERIORS
15895 SW 72ND AVE SUITE 200
PORTLAND, OREGON 97224
TEL: 503 226 1285
FAX: 503 226 1670
WWW.CIDAINC.COM
MACKENZIE.

1/8" = 1'-0"

10.17.2023

220234.03

Exhibit C-4



POLICE STATION SITE PLAN

CIDA
ARCHITECTURE ENGINEERING PLANNING INTERIORS

15895 SW 72ND AVE SUITE 200
PORTLAND, OREGON 97224
TEL: 503 226 1285
FAX: 503 226 1670
WWW.CIDAINC.COM

MACKENZIE.

CANNON BEACH POLICE DEPARMENT

CANNON BEACH, OREGON

1" = 40'-0"

10.17.2023

220234.03

CITY OF CANNON BEACH

November 29, 2023

Dear Property Owner,

Cannon Beach Zoning Ordinance requires notification to property owners within 250 feet, measured from the exterior boundary, of any property which is the subject of the proposed applications. Your property is located within 250 feet of the above-referenced property or you are being notified as a party of record.

Please note that you may submit a statement either in writing or orally at the hearing, supporting or opposing the proposed action. Your statement should address the pertinent criteria, as stated in the hearing notice. Statements in writing must be received by the date of the hearing.

Enclosed are copies of the public hearing notice, a description of how public hearings are conducted and a map of the subject area. Should you need further information regarding the relevant Zoning Ordinance, Subdivision Ordinance or Comprehensive Plan criteria, please contact Cannon Beach City Hall at the address below, or call Emily Bare at (503) 436-8054 or email bare@ci.cannon-beach.or.us.

Sincerely,

EBare

Emily Bare
Administrative Assistant
Community Development

Enclosures: Notice of Hearing
Conduct of Public Hearings
Map of Subject Area

NOTICE OF PUBLIC HEARING
CANNON BEACH PLANNING COMMISSION

The Cannon Beach Planning Commission will hold a public hearing on **Tuesday, December 19, 2023,** at **6:00 p.m.** at City Hall, 163 E Gower Street, Cannon Beach, regarding the following:

> ZO #23-03 CIDA proposed Comprehensive Plan Amendment & Zone Change for Taxlot 41006B000200, an undeveloped property located at 81389 N HWY 101. The property is currently zoned (IR) Institutional Reserve, and the request is to change the zoning classification to (IN) Institutional. The request will be reviewed under Municipal Code section 17.86, Amendments, provisions established.

All interested parties are invited to attend the hearings and express their views. Statements will be accepted in writing or orally at the hearing. Failure to raise an issue at the public hearing, in person or by letter, or failure to provide statements or evidence sufficient to afford the decision maker an opportunity to respond to the issue precludes appeal to the Land Use Board of Appeals based on that issue.

Correspondence should be mailed to the Cannon Beach Planning Commission, Attn. Community Development, PO Box 368, Cannon Beach, OR 97110 or via email at planning@ci.cannon-beach.or.us. Written testimony received one week prior to the hearing will be included in the Planning Commissioner's meeting materials and allow adequate time for review. Materials and relevant criteria are available for review at Cannon Beach City Hall, 163 East Gower Street, Cannon Beach, or may be obtained at a reasonable cost. Staff reports are available for inspection at no cost or may be obtained at a reasonable cost seven days prior to the hearing. Questions regarding the applications may be directed to Robert St. Clair, 503-436-8053, or at stclair@ci.cannon-beach.or.us.

The Planning Commission reserves the right to continue the hearing to another date and time. If the hearing is continued, no further public notice will be provided. The hearings are accessible to the disabled. Contact City Manager, the ADA Compliance Coordinator, at (503) 436-8050, if you need any special accommodations to attend or to participate in the meeting. TTY (503) 436-8097. Publications may be available in alternate formats and the meeting is accessible to the disabled.

Robert St. Clair
City Planner

Posted/Mailed: 11/29/23

NOTICE TO MORTGAGEE, LIEN-HOLDER, VENDOR OR SELLER:
PLEASE PROMPTLY FORWARD THIS NOTICE TO THE PURCHASER

CONDUCT OF PUBLIC HEARINGS BEFORE CANNON BEACH CITY COUNCIL and PLANNING COMMISSION

A. At the start of the public hearing, the Mayor or Planning Commission Chair will ask the following questions to ensure that the public hearing is held in an impartial manner:

1. Whether there is a challenge to the jurisdiction of the City Council or Planning Commission to hear the matter;
2. Whether there are any conflicts of interest or personal biases to be declared by a Councilor or Planning Commissioner;
3. Whether any member of the Council or Planning Commission has had any ex parte contacts.

B. Next, the Mayor or Planning Commission Chair will make a statement which:

1. Indicates the criteria which apply to the action;
2. Cautions those who wish to testify that their comments must be related to the applicable criteria or other criteria in the Comprehensive Plan or Municipal Code that the person testifying believes apply;
3. States that failure to raise an issue in a hearing, or failure to provide statements or evidence sufficient to afford the decision makers an opportunity to respond to the issue precludes appeal based on that issue;
4. Prior to the conclusion of the initial evidentiary hearing, any participant may request an opportunity to present additional evidence or testimony regarding the application. The City Council or Planning Commission shall grant such request by continuing the public hearing or leaving the record open for additional written evidence or testimony.

C. The public participation portion of the hearing will then proceed as follows:

1. Staff will summarize the staff report to the extent necessary to enable those present to understand the issues before the Council or Planning Commission.
2. The Councilors or Planning Commissioners may then ask questions of staff.
3. The Mayor or Planning Commission Chair will ask the applicant or a representative for any presentation.
4. The Mayor or Planning Commission Chair will ask for testimony from any other proponents of the proposal.
5. The Mayor or Planning Commission Chair will ask for testimony from any opponents of the proposal.
6. Staff will be given an opportunity to make concluding comments or respond to additional questions from Councilors or Planning Commissioners.
7. The Mayor or Planning Commission Chair will give the applicant and other proponents an opportunity to rebut any testimony of the opponents.
8. Unless continued, the hearing will be closed to all testimony. The Council or Planning Commission will discuss the issue among themselves. They will then either make a decision at that time or continue the public hearing until a specified time.

NOTE: Any person offering testimony must first state their name, residence, and **mailing address** for the record. If representing someone else, the speaker must state whom he represents.

Printed 11 / 15 / 2023

City of Cannon Beach
Building Codes Division
Tree Permit Applications
November 2023

Date	Permit #	Name	Location	Permit Fee Paid	Notes	Total Number Removed	Hazard	Dead	Construction	Health of surrounding trees	Solar access/ landscaping	Required to Replant
11/2/2023		Wright's for Campi	334 Reservoir Rd.			15	15					0
TOTAL						15	15	0	0	0	0	0
PRIVATE												
PENDING:												
Number of Native Trees Planted by City Staff:												