APPENDIX B

GEOTECHNICAL CRITIQUE

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Critique of Mead Engineering's "Geotechnical Investigation and Geohazard Report [for] Tax Lot 8100, Tax Map 6-10-22AB, Seaside Oregon"

Introduction

I am delivering this critique under the terms of Busch Geotechnical Consultants (BGC) Work Agreement #21-045 with my client. The purpose of the critique is to explain why the Mead Engineering report (hereafter, "the report" or "the Mead report") does not meet the minimum requirements of a geohazards analysis. This critique identifies shortcomings and analyzes specific comments in the report (by page and paragraph).

A geotechnical report prepared for a proposed planned development serves three purposes when done properly. First, it provides the information that the regulatory entity overseeing the permitting process needs in order to determine if the report meets its standards. Second, as a "disclosure document" it provides future potential buyers of lots with information about regional and project-specific geologic hazards and risks. Although much of that information often is general in nature, when the project site contains hillslopes, then lot-specific information typically is necessary. Finally, the geotechnical recommendations applicable to all lots, which collectively should address foundation-soils conditions, hillslope stability and instability, drainage- and erosion-control issues, seismic considerations, and similar, should allow a

contractor to be able to build without the need for future investigative work. However, if substantial site-specific issues exist on certain lots, then the report should call out those lots as needing a site-specific geotechnical investigation prior to build-out or to recommend not building on the lot.

My scope-of-work included: (1) discussing the proposed project with attorney Zack Mittge; (2) reviewing the Mead Engineering report (ME, 2021); (3) reviewing selected professional papers and maps relevant to the project area (references cited herein); and (4) preparing this report.

Documents I reviewed in addition to the report include the geologic map of the area, the tsunami inundation map for Seaside, and SLIDO, the state's landslide database (references follow). This report is not intended to—and does not—provide a geohazards assessment for the site. The applicant is responsible for providing the necessary onsite evaluation and data analysis to demonstrate compliance with all applicable standards and that the site can be developed safely. Because the Mead report is well below the minimum standard, it was unnecessary to visit the property to verify the reported site conditions. I am delivering this critique as an engineering geologist to evaluate only the geohazards portion of the Mead report on the site. My critique does not and is not intended to comment on civil engineering aspects of the Mead report. Please refer to the Mead report for a description of the proposed project and location information.

In conclusion, this critique explains why the Mead Engineering report does not comply with the requirements of Section 4.140 [Standards Applying to Geologic Hazard Areas] of the Zoning Ordinance of the city of Seaside, Oregon.

Critique

General. Unfortunately, the Mead report is unpaginated. This defect makes it difficult to identify statements in the report for the purpose of peer review or a critique. The following list makes it possible to match the report text with my comments.

Page 1 has the report title on it, contains five paragraphs, and ends with the word "area."

Page 2 is a figure.

Page 3 contains six paragraphs, begins with the word "This," and ends midsentence in the word "assume."

Page 4 is a figure.

Page 5 begins with "that," contains five paragraphs including one with five different headings in it, and ends with the word "areas."

Page 6 begins with the heading Street Pavement Sections, contains five paragraphs, and ends with the word "of."

Page 7 has the authentication stamp.

Before addressing the shortcomings of the geohazards analysis, I want to comment on the report as a whole. While there are many ways to prepare a report that meets the standard of care, the Mead report falls below the standard. I am confident that any conscientious reviewer would identify the following issues.

1. Unless the scanned copy included with the Planning Commission's packet is different than the original, the report is not paginated.

2. The text of the report is five pages long. That is unbelievably short for a report whose function is to address a 17-lot development.

3. The report is poorly organized.

4. There are over 25 typographical errors in the five pages. One of the most glaring is, "There is a regional seduction zone nearby [sic, "subduction zone"]."

5. The report contains no references, so it is impossible for City officials or an independent reviewer to fact-check the statements made in the report.

6. The report contains many inconsistencies. For example, on p. 3, para. 2, the report recommends using a bearing value of 1500 psf [the standard presumptive value for silt] without including allowances [for wind, seismic, and others conditions]. Then on p. 5, para. 2, the report comments that "Point loadings shall not exceed 2000 psf…." A second example occurs on p. 5, under Cut Slopes. The report states, "Any [sic, "All?"] cut slopes shall be shaped to a final slope of 1.75:1 or flatter." Then the very next sentence allows a higher gradient slope by stating, "Slopes steeper than 1.75:1 shall have a rock ballast…." There are other inconsistencies, including a more serious one involving grossly varying descriptions of the site soils (see #10, following).

7. The report uses terms without defining them. For example, on p. 3, paragraph 1, "steep slope" is not quantified. On p. 5, para. 1, the report describes a presumably native soil as "a pit run rock clay mix." A "pit run" can be either a quarried or native deposit so the descriptor is not helpful.

8. There are no soil logs for the four test pits, three of which were in the road alignment. That is, one test pit was done for 17 lots. That is substandard to the extreme and does not conform to the standard of care.

9. The project topographic base map has an unusual contour interval (CI) of 2.25 ft instead of a standard 1- or 2-ft interval (or both when advantageous). While Mead Engineering did not prepare the map, the firm is responsible for ensuring that the project base map uses an appropriate CI.

10. On p. 3, last paragraph, the report describes the site soils [i.e., the subsoils] as clayey silt to a depth of 3 or 4 feet and then "…clayey silt, sandy soils." This soil classification is not a valid term in the Unified Soils Classification System (USCS) that engineers and engineering geologists use. The report perhaps intended to describe "clayey, silty sands" (abbreviated as SM in the USCS), but, if so, that is unclear. Finally, on p. 5, last paragraph, the report recommends using "native clay soils" to backfill utilities trenches outside of the street areas. However, there is no indication in the report that clay soils are present onsite, or at what locations.

Geohazards and Risk Analysis. A report for a coastal PNW subdivision with slopes of 15% and over should in some meaningful way address any of the following geologic hazards with an associated level of risk higher than negligible (or in some cases, low). To be clear, a geologic hazard is a geologic process or event such as settling fill, a landslide, or an earthquake. The associated risk is the qualitatively defined chance (low, moderate, high) or calculated probability (10%, 37%) that the hazard of concern will occur. The list of hazards is in no particular order, and there may be additional geohazards considering the site's characteristics.

Possible Geologic Hazards

1. Compressible soils, soils susceptible to strain softening (topsoils, disturbed soils, fill soils), expansive soils, plastic soils.
2. Soil creep.
3. Soil liquefaction.
4. Liquefaction-induced ground failure.
5. Slope instability.
6. Landslide impact.
7. Seismic shaking.
8. Tsunami inundation.

9. Settlement and differential settlement of proposed fill soils.
10. Erosion due to wind deflation, rain impact, overland flow, misdirected water.
11. Soil piping.
12. Fault rupture.

The list does not include geologic hazards that some reports need to address such as global sea level rise, vulcanism, root mass failure after logging, coseismic settlement and subsidence, and others. The following paragraphs discuss the report's treatment of each of the hazards on my list.

1. The report does not address any specific soil condition except by providing inconsistent narrative descriptions of the soils and recommending (in a confusing way) a presumptive allowable bearing value.

2. There are no slope magnitudes shown on the topographic map and the 8.5"x11" copy of the report provided with the Planning Commission packet cannot be used with confidence to calculate the slope steepness in the proposed building areas and creek valleywall. There may be a potential for soil creep to occur beyond (upslope of) the recommended 5-ft setback from the top of the valleywall on the property.

3. Although the report seems to indicate that the site subsoils are sands of some type, it does not note the genesis of the sands (whether, for example, the sands are uplifted marine terrace deposits, dune sands, or landslide debris) or the name of the geologic formation they are derived from. Slightly silty to "clean" sands are liquefiable when saturated and shaken by an intense earthquake. The report should have addressed the liquefaction potential hazard by better characterizing the sands and groundwater conditions.

4. The report does not address the liquefaction-induced ground failure potential. (Small lenses and thin layers of sandy soils can liquefy without causing a damaging ground failure, but many sand deposits pose a high level of risk of ground failure.)

5. The report does not reference the DOGAMI landslide database (SLIDO), address the potential for valleywall instability to progress into a building area, or even mention the stability of the project site. In short, the report does not contain a stability assessment. It does, however, include one worrisome statement. On p. 6, para. 4, the report states that, "A large [sic, "strong"] earthquake…could trigger the old deep seeded [sic, "deep-seated"] landslides in this area." The report provides no information about slides in the area in general or the ones to which it alludes.

6. Although there is a valley on the east side of the property that could catch landslide debris under the right conditions, the terrain has been mapped as "landslide terrain" and slopes rise to the northeast. The hazard should be addressed.

7. The report's discussion under **Earthquakes** (p. 6, para. 3), which addresses the seismic hazard and risk, is woefully inadequate and contains incorrect statements. The report notes that, "This seismic activity [a Cascadia subduction zone, or Csz, earthquake] may occur in the next 500 to 1000 years." In fact, it may occur while you are reading this report or at literally any time thereafter. In the next paragraph the report notes that, "A regional seduction [sic] earthquake...has a 15 to 50 percent chance of occurring in the next 50 to 100 years." This statement is inaccurate. The current belief, which is based on an exhaustive, comprehensive study that identified 41 past Csz events, is that the risk of a Csz earthquake varies from 10% (for a 9.0+ M_w temblor) to 37% for an 8 M_w quake (Goldfinger et al., 2012). The Mead report notes that the project area is in "zone 3, category II" without identifying the building code. In addition, this terminology and the associated methodology are out of date. Engineering reports for projects in a seismically active area now provide parameters based on the design-basis earthquake for the area. The parameters are developed using standard USGS methodologies provided by third-party graphical user interfaces (GUIs), for example, the ASCE 7 Hazard Tool.

8. There are no recommended seismic design parameters in the report. While this statement could be the introduction to a discussion of the lack of appropriate geotechnical recommendations in general, a list of the types of missing recommendations and other geotechnical shortcomings would not help the city evaluate the project so is unnecessary. It is adequate to say that report's failure to provide seismic design parameters does not meet the standard of care.

9. On p. 5, para. 3, the report indicates that "in the 1960's…a tidal wave…went up the Necanicum and Neawahana estuaries" and states in para. 4 that, "If this happens access to the site may be cut off from the rest of the surrounding area of the county." Unfortunately, the report does not identify the risk of tsunami inundation in any part of the planned development or the access road to it or cite the tsunami inundation map available on the web (DOGAMI, 2012). In short, the report does not adequately evaluate the tsunami inundation hazard.

10. The report does not discuss proposed fills other that by stating (p. 3, para. 3) that, "Since most of the lots only have 4-8 feet of fall across the building area it is

assumed that only minor excavation and filling will be required for the foundation construction." The report does not demonstrate the veracity of this statement, but even if it is true, the improper compaction of even two feet of fill can cause long-term foundation cracking and differential settlement. There are no cut-and-fill or compaction recommendations in the report.

11. The report addresses erosion without explaining the likely or possible causes of the erosion. In addition, the report's suggested mitigation measures (now called BMPs or Best Management Practices) are generalized at best. For example, the report suggests that bare areas be seeded but does not call for the area's erosion-control mix to be used nor does it provide recommendations for establishing other types of stabilizing vegetation.

12. Piping is the removal of underground fine-grained sediments by running groundwater. It is common in uncemented sands and silts of uplifted marine terraces in areas where groundwater rises seasonally and drains rapidly to a nearby lower elevation. Under the worst circumstances, a soil pipe can collapse and damage improvements. The report does not address the risks of piping on the site or provide an adequate analysis of the site soils and groundwater conditions.

13. Fault rupture occurs when an active fault (whether known and mapped or not) breaks the ground surface. A fault-rupture event modifies the landforms cut by the fault by uplifting and/or laterally shifting land on one side of the fault relative to the other. A fault-rupture event can damage or destroy improvements. During the past two to three decades, work along the Oregon coast has documented many active and potentially active faults. The report does not discuss nearby faults or mention the fault-rupture hazard.

Conclusion

In conclusion, the Mead report is not a geohazards report. Because of its gross inadequacy, it might not even qualify as a "geotechnical report."

The Mead report does not address potential geologic hazards and risks via adequate analysis, writing, and recommendations. A geohazards report needs to explain whether geologic hazards that could be present onsite, or could otherwise adversely affect the project area, either are or are not present. For those hazards of concern, the report must define the associated level of risk. The report needs to provide recommendations to mitigate risks that are unacceptably high. Those

recommendations sometimes include a "no build" recommendation for areas that are unsuitable for development due to high levels of risk associated with identified hazards.

As stated in the City of Seaside's Zoning Ordinance, the geohazards report needs to evaluate the extent and severity of geologic and erosion hazards and recommend techniques/safeguards that could be used to adequately protect life, property, and the environment on and adjacent to the site. Because the Mead Engineering report does not adequately characterize geologic conditions and hazards, assess risk levels, or provide adequate recommendations, it does not rise to the standard of care, is not a Hazard Mitigation Plan, and does not demonstrate that the proposed planned development complies with applicable standards.

Finally, I must comment on a sentence on p. 7, para. 2. It states, "The services performed by the engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time constraints." The words "…under similar budget and time constraints" act as a caveat if used to justify the poor report. That is, no firm can deliver a thorough report if the client will not pay the real cost of the work and/or makes unreasonable delivery-schedule demands. If those words are not a caveat, and "this area" includes all of the Oregon coast, then the statement is patiently false.

Comments on Geotech Solutions Inc. 4/15/2004 Report

In 2004 an engineering firm prepared a report for the first phase of development for the Vista Ridge subdivision (which had not been named yet) (GSI, 2004). The report is a geotechnical engineering report, not an engineering geology report. The report notes (p. 2/6) that a geological report was being prepared but was not available for review. (Either that report was never produced or it was but has been withheld by the developer.)

The GSI report notes (p. 1/6) that the working plan was to develop approximately 24 lots and 1,100 lineal ft of road in the first phase (then called the eastern phase) and 12 lots and 900 ft of road in the second (or western) phase. To evaluate the entire property GSI made a reconnaissance inspection, reviewed a single DOGAMI publication that included regional information (it was DOGAMI, 1972), reviewed a topographic map provided by others (CKI, 2004) and excavated 8 test pits to a maximum depth of 11 ft. All of the test pits but two were located within the proposed road alignment. The firm's discussion of the site conditions is exceedingly

brief and ends on p. 2/6; the rest of the report contains geotechnical conclusions and preliminary recommendations.

The report shortcomings include:

- Poor descriptions of the site soils in text and on the test pit logs;
- the lack of test pit data from all of the proposed lots (36) except two (2);
- the lack of routine lab test data other than soil moisture content;
- the failure to discuss the mapped unstable ground and the rationale for the suggested 20-ft setback from the break-in-slope at the head of the steep ravines that border the ridges; and
- the failure to qualitatively note the inferred stability of the site slopes or to include the results of quantitative (Factor-of-Safety or FOS) stability modeling.

Here is a short elaboration of my criticisms (as one paragraph on each, presented in the order of the preceding bullets):

Neither the narrative soil descriptions nor the borehole logs include the Unified Soil Classification System (USCS) terminology used routinely by engineers and engineering geologists. Because the only type of soil noted on the logs is silt, which is moisture sensitive (as GSI notes), it is important to know at least the firm's qualitative opinion about the plasticity of the soils. In the USCS, silt (symbol M) is either ML or MH, meaning it has low or high plasticity (see second paragraph below). In addition, the narrative descriptions suggest that soil types in addition to silts might be present. An estimate of the percent basalt gravel, etc., would have greatly improved the descriptions and test pit logs.

GSI located only two of the eight test pits outside of the road alignment. One was nearly on it. Because soil horizons tend to change as one moves away from a ridgeline onto steeper flanking ground, it would have been appropriate to have excavated additional test pits within multiple proposed building areas.

Percent-moisture is only one of the soils index tests routinely done for a preliminary study. The data from other standard index tests typically reported on a soil log include field (moist) and/or dry density; texture (e.g., percent passing the #200 screen); unconfined compressive strength (by pocket penetrometer); and quick shear strength (by Torvane). But more important, a study that identified only silt soils should have provided the results of multiple Atterberg limits tests. The test measures soil plasticity.

The GSI report does not explain the basis for the 20-ft setback and whether it is inviolate or not. At minimum, a setback should be based on a qualitative assessment of the stability of the various site landforms (ridgelines, slopes >15%, ravine heads and walls, etc.). A map showing the level of risk of instability usually is included.

The lack of more definitive stability information is surprising because in the report states that the purpose of its work is to "…provide a geotechnical report addressing site development, with emphasis on slope stability" (paragraph 2, p. 1/6). A FOS model relies on a critical slope profile (there were no profiles or geologic cross sections provided in the report) and relatively high-quality subsurface information. Geotechnical boreholes typically are the source of that information. Boreholes and FOS evaluation are expensive when compared to a qualitative assessment, but when there are areas in the proposed development deemed unsuitable for construction (as stated in the GSI report, p. 2/6 and shown on the Site Plan), a quantitative assessment is warranted.

Closure and Authentication

This critique is not, and is not intended to be, a geologic hazard analysis for the subject property, and nothing in the report should be construed as a site investigation or analysis of the presence, absence, or magnitude of potential regional or onsite hazards. The report makes no recommendations to address hazards that could affect the site. This critique also does not include a review of the geotechnical information in either the Mead or GSI report, and it makes no statement about any specific Mead Engineering geotechnical observation, conclusion, or recommendation.

That said, I make three final comments of a geotechnical nature. First, the soil descriptions in both reports are unacceptable and are based on far too little subsurface information. Second, the only way to assess the stability of a project site mapped as "within landslide topography" is via geomorphic (landform) mapping and the study of conifer trunks of multiple age classes. And third, because mature and even submature conifers are capable of removing a high volume of groundwater daily, and their root networks add greatly to the shear strength of a soil on a slope, preserving key trees can help mitigate levels of risk associated with soil creep, slope instability, erosion, and a high groundwater table.

Thank you again for hiring me. Please call if you have any questions or need addition assistance or information.

Respectfully submitted,

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GSI [Geotech Solutions Inc.] 2004. Geotechnical engineering report, subdivision near Sunset hills – Seaside. Unpubl. rept. for client [Maltman] dated April 15. 6 pp. + site map + narrative short-form borehole logs.

ME [Mead Engineering]. 2021. Vista Ridge #2, Proposed 17 lot subdivision For Sunset Ridge LLC. Geotechnical Investigation and Geohazard Report. Report for client dated 6 August. 7 pp. + 5 over-sized maps.