9112 Catalina Street
Prairie Village, Kansas 66207
913.475.5851

September 18, 2025

J.E. Dunn Construction Company
525 South Main Steet, Suite 100
Tulsa, Oklahoma 74103

Attention: Dennis Cisper

Geotechnical Engineering Peer Review
Project Clydesdale CYL1A
Owasso, Oklahoma
J.E. Dunn Project 25024800
Bedrock GeoConsult Project 25118

INTRODUCTION

At the request of J.E. Dunn Construction Company (Dunn), Bedrock GeoConsult, LLC (Bedrock GeoConsult) has completed an independent third-party geotechnical engineering peer review of the following documents:

- DRAFT *Project Clydesdale, Design Level Geotech, Design Level Geotechnical Report; by* Terracon Consultants, Inc. (Terracon), project number 04255087, dated August 8, 2025
- Civil drawings in a set titled "Site Civil Package" labeled "Mass Grading – 65% Progress Set", dated July 9, 2025
- Data center building structural drawings, no title sheet, labeled "SPS 65% Design", Rev. 0.2, dated August 18, 2025
- Electrical yard structural drawings, no title sheet, labeled "SPS 65% Design", Rev. 0.2, dated August 18, 2025
- Mechanical yard structural drawings, no title sheet, labeled "SPS 65% Design", Rev. 0.2, dated August 18, 2025
- Main entrance structural drawings, no title sheet, labeled "SPS 65% Design", Rev. 0.2, dated August 18, 2025
- Division 31 specifications from the *Project Manual* dated August 18, 2025 labeled "65% SPS" including: 311000 Clearing and Grubbing, 312200 Grading, 312316 Excavation, 312316.13 Trenching for Site Utilities, 312316.16 Structural Excavation for Minor Structures, 312316.26 Rock Removal, 312323 Fill, Backfill, and Compaction, 312323.33 Flowable Fill, 313716 Rip Rap, 316329 Drilled Concrete Piers and Shafts, and 316613.13 Aggregate Columns

The purpose of this brief review was to evaluate the geotechnical report and construction documents to assist Dunn in the identification of geotechnical concerns, inconsistencies, and areas where clarification could benefit the project. This review was not a comprehensive review of all geotechnical aspects of the project. My comments on the documents provided are summarized below; their order does not imply relative importance among the comments. I intend for these comments to be helpful to the project and not critical of the design team or Terracon. I realize that some of my comments could be resolved by a discussion with the design team or Terracon.

PROJECT INFORMATION

The proposed project includes constructing one large data center building with an associated mechanical yard, HUB building, and electrical substation. A main entrance drive with a small building and gates will be constructed west of the data center building. Grading will be completed for these buildings and structures as well as for the planned area of a second data center building and mechanical yard to the north. Five stormwater detention basins are planned for the site. Paved parking areas and drives will be constructed throughout the site, but the currently available drawings do not yet include pavement plans or details.

The new data center building will have foundation support from drilled shaft foundations bearing on the shale or sandstone bedrock. The building will have a slab-on-grade floor. Other structures and buildings will use shallow spread footing, mats, slabs, or drilled shaft foundations, with bearing materials varying from soil to engineered fill to shale or sandstone bedrock.

Grading plans indicate that the data center building area will have 5 to 25 feet of fill placed to raise grades. The mechanical yard will have 10 to 23 feet of fill. The substation will have up to 31 feet of fill and 11 feet of cut. The main entrance will have up to 2 feet of fill and 27 feet of cut. The HUB building area will have up to 10 feet of fill and 5 feet of cut. For the five planned stormwater detention basins, the maximum depth of excavation at each basin will vary from 7 to 16 feet. The grading plan includes a 4 Horizontal to 1 Vertical (4H:1V) cut slope along the west edge of the site with a maximum height of approximately 30 feet, a 4H:1V fill slope east of the data center building with a maximum height of approximately 25 feet, and a 3H:1V fill slope east of the future (northern) data center building with a maximum height of approximately 25 feet. No free-standing retaining walls are planned.

The project site is previously undeveloped and has grasslands and areas with dense tree coverage. A pond is present in the northeastern portion of the site; the pond area will not be regraded and the pond will remain in place. A creek runs along the northeastern boundary of the site. The site generally runs downhill to the northeast towards the creek, with approximately 100 feet of relief across the site.

The primary geotechnical concerns for the project are the long-term settlement caused by the thick fill sections that are currently being placed, the presence of shallow bedrock in some areas, the placement of rock fill and later excavations through that rock fill, and the presence of a limited amount of expansive clay. The Terracon report addresses these concerns. These topics are discussed more below.

COMMENTS ON GEOTECHNICAL REPORT

1. The geotechnical report references an earlier preliminary report that Terracon prepared. Terracon should consider clearly stating that this report supersedes all earlier reports for the project from Terracon.

2. On page 2, the report estimates that the data center building will have a finished floor elevation (FFE) somewhere between elevation 632 feet and 638 feet. Current plans indicate it will be elevation 645 feet. Therefore, more fill will be placed on the data center building pad than anticipated by Terracon. There is a similar situation with the HUB building, where the currently planned FFE is about 20 feet higher than anticipated by Terracon. The increased fill thickness may impact Terracon's recommendations. Terracon should be given the opportunity to review current plans and revise (if necessary) their recommendations based on the new information.

3. The latitude and longitude for the site given at the bottom of page 4 is not correct. Terracon should correct the latitude and longitude given for the site.

4. Groundwater conditions are discussed on pages 5 and 6. Terracon observed groundwater at depths of 3.5 to 18.5 feet in several borings; no groundwater was observed in most borings. However, Terracon did not complete any long-term groundwater observations in any borings. Terracon had field crews on site drilling borings for over four weeks in 2024 and over three weeks in 2025, providing ample opportunity to leave boreholes open for weeks to allow longer-term groundwater observations. As noted on page 6, the observed groundwater appears to be perched above the top of rock. Where rock is shallow, this perched groundwater might be encountered in excavations for utility trenches, foundations, and site grading. As discussed on page 20 of the report, typical sump pumps should be sufficient to dewater the excavations. Utility, foundation, and earthwork contractors should be prepared for dewatering some excavations that encounter groundwater perched above the top of rock, especially during rainy seasons.

5. Pages 9, 13, and 14 discuss concerns with long term settlement of thick fill sections. The report estimates that up to 4 inches of settlement will occur in the thickest fill areas and that the settlement will require a construction delay of "on the order of 15 to 30 days" after the fill is placed in those areas. Terracon recommends that a settlement surveying program be established after the fill is placed in areas with thick fill sections. The report does not give a fill thickness threshold where this monitoring would be needed. Terracon should provide a minimum thickness of fill that would necessitate a construction delay and settlement surveying; 15 feet is often used on similar projects. Based on my experience with similar projects, soils, and fill thickness, I agree that a delay of no longer than 30 days should be necessary.

6. Page 14 discusses possible options for accelerating the settlement that will occur in areas with thick fill (See Comment #5 above) such as wick drains, ground improvement, or surcharging. The report concludes that these measures would not be "economical" or practical for this project. I concur with Terracon that the typical measures to accelerate settlement of the thick fill would not be practical at this site given relatively short anticipate delay period.

7. If the construction delay that Terracon recommends for areas with thick fill (see Comment #5 above) is problematic, Dunn could review with the design team and Terracon options for constructing footings during the delay period. The settlement that will be induced by placement of thick fill sections should be relatively uniform over a large area with minimal differential settlement over short distances. Therefore, a footing that is constructed while the fill settlement is progress should not develop any distress (i.e., cracks). However, the top of that footing will settle some distance up to 4 inches depending on how quickly it is constructed, how quickly the fill settles, and how much the fill

settles. If the height of the structure immediately above the footing (such as a concrete stem wall) could be adjusted to compensate for settlement of the footing, then it should be possible to construct footings within the thick fill sections while the settlement is occurring. This option would be less feasible where precast concrete walls are planned to bear on top of the footing without a cast-in-place stem wall between the footing and the precast panels. Dunn could consider reviewing this option with the design team and Terracon.

8. The construction delay that is recommended for areas with thick fill (see Comment #5) will also delay construction of drilled pier foundations in those areas. If a drilled pier is constructed within soil or fill that is settling, that settling soil/fill will place a "drag load" on the perimeter of the drilled pier that can significantly increase loads on that foundation element. However, if the design of the drilled pier accounts for the drag load, the drilled pier could be constructed while the settlement is still in progress. Including a down-drag load on a drilled pier would likely require it to have a deeper rock socket to increase its bearing capacity. HDR, Inc. (HDR, the prime engineer for the project) wrote a comment on page 23 of the report regarding down-drag loads on the drilled piers. Dunn could consider reviewing with the design team and Terracon design changes to the drilled piers that would account for down-drag loads if it would be beneficial to the construction schedule to allow drilled pier construction while the fill was still settling.

9. On pages 11, 12, and 13, the report discusses rock excavation concerns in detail, including whether the sandstone and shale can be ripped in larger excavations. As noted on page 11, "excavation of rock in confined areas (such as trenches) is usually difficult…" Excavation of the sandstone and shale in footings and drilled pier excavations may also be difficult. The specifications indicate that the excavations will be "unclassified", no additional payment will be made for rock excavation. Utility and foundation contractors should anticipate rock excavation in utility trenches and foundation excavations when developing their construction plans and budgets.

10. Pages 15, 16, and 17 provide detailed guidance on the use of excavated shale and sandstone bedrock as fill (including engineered fill). A significant amount of rock will be excavated; it will need to be crushed and processed so it meets the particle size and gradation requirements provided by Terracon before it is used as engineered fill. These recommendations include not using sandstone or shale as fill within 5 feet of a building subgrade or 2 feet of pavement subgrade and mixing a sufficient volume of fines (soil or small rock pieces) to fill the voids between larger rock pieces. Earthwork construction plans and budgets should account for the necessary crushing and processing of excavated rock and limitations on the depth of its placement as engineered fill.

11. Pages 16 and 17 recommend that shale and sandstone rock fill not be placed within 5 feet of a building subgrade and not within 2 feet of pavement subgrade. Excavations for deeper utility trenches and foundations will be difficult when they encounter the rock fill. Page 16 cautions that "To the extent practical, sandstone fill should not be placed in areas where utility trenches will be excavated." However, it would be difficult for an earthwork contractor that is completing mass grading of the site to know and track the locations and depths of future buried utility lines. Utility and foundation contractors should anticipate difficult excavations in shale and sandstone rock fill in their construction plans and budgets.

12. As discussed on page 16, typical compaction testing of fill cannot be completed on rock fill. Instead, the placement and compaction of rock fill must be visually and qualitatively evaluated by the special inspector as it is placed. Some owners are not comfortable with the lack of quantitative testing to confirm the compaction of the rock fill. The design team or Terracon should review this possible concern with the owner to make sure they will accept visual and qualitative evaluation of rock fill placement and compaction by the special inspector.

13. Most of the soil encountered in Terracon's borings was lean clay. However, some high plasticity fat clay was also encountered. Because fat clay can undergo shrink and swell with changes in moisture content, the report on page 17 recommends that fat clay (CH soil) not be used as fill within 2 feet of a slab-on-grade. Earthwork plans and budgets should account for the need to sort out any excavated fat clay and not use it as fill within 2 feet of a floor slab subgrade.

14. HDR has added a comment on pages 22 and 23 asking about "any soil expansion that needs to be accounted for in the design of underground piping systems and/or building connections." There is some high plasticity fat clay present on the site, but most of the soil is lean clay that is less prone to shrink/swell. The shale bedrock can also cause concern with swelling when it is exposed to water. Terracon should provide guidance on any necessary measures to limit concerns with the impact of swelling soil or shale on building connections or underground piping.

15. Page 23 recommends using an allowable end bearing of 20,000 psf for drilled piers bearing in shale or sandstone bedrock. This recommendation is also presented on two of the tables on the unnumbered pages after page 31. Footnotes on those tables recommend that a drilled pier penetrate at least one pier diameter into the bedrock. This recommended allowable end bearing resistance of 20,000 psf is quite conservative for the shale and sandstone bedrock at this site. Reconsidering use of a higher value would reduce foundation construction costs. Terracon should reconsider the recommended allowable bearing resistance for drilled piers socketed one diameter into the bedrock.

16. The tables on the unnumbered pages after page 31 have footnotes recommending that a drilled pier penetrate at least one pier diameter into the bedrock. Some drilled piers with lighter compressive loads will not require the full end bearing resistance that can be provided by the bedrock. For these drilled piers, bearing on top of the rock and using a lower allowable bearing resistance in the design may be possible and would reduce construction costs (avoiding unnecessary rock excavation in the drilled piers). Terracon should provide recommendations, such as a reduced allowable end bearing resistance, for drilled piers bearing on top of rock that could be used for foundations with lower compressive loads.

17. Page 23 recommends that drilled piers have a "minimum embedment" of "2 feet into competent bedrock." However, the tables on the unnumbered pages after page 31 have footnotes recommending that a drilled pier penetrate at least one pier diameter into the bedrock. These recommendations are not consistent. Terracon should revise these recommendations so they are consistent.

18. Page 26 states that "Groundwater was not encountered during the subsurface exploration in the borings." Terracon observed groundwater in several borings, as discussed on pages 5 and 6 of the report. Terracon should revise this sentence so that it accurately states the groundwater conditions that were observed.

19. Page 27 recommends a minimum drilled pier diameter of 30 inches. Page 23 of the report recommends a minimum diameter of 24 inches. Terracon should revise one of these recommendations so that the report is consistent. If Terracon uses a 30-inch minimum diameter, some of the drilled piers that are currently designed with a 24-inch diameter will require redesign.

20. Page 30 presents recommendations for mat foundations supporting larger equipment such as transformers. Allowable bearing pressure is provided for bearing on soil/fill and on rock. Some mat foundations may have mixed bearing conditions, with soil on one end of the mat and rock on the other, with a transition from soil to weathered rock to unweathered rock across the foundation bearing surface. Terracon should provide guidance on whether mixed bearing conditions within a mat foundation are of concern and if any remedial measures are recommended. Page 29 presents guidance for remedial measures for footings with "unsuitable bearing materials", but this does not directly apply to a situation where mixed bearing on stiff clay and rock are present within the same foundation.

21. There are four pages in the report between pages 31 and 32 that do not have page numbers. These pages have tables of design parameters for drilled pier foundations. Terracon should add page numbers to these pages.

22. The unnumbered page after page 31 indicates that drilled piers with end bearing on soil is "not recommended." I assume that also means that drilled piers bearing on engineered fill are not recommended. A comment from HDR on this page asks for clarification of this recommendation. The table on this page provides recommendations for the electrical substation. The borings in this area indicate that bedrock is very shallow in this area, consistently within a few feet of the ground surface. However, grading plans indicate that up to 30 feet of fill will be placed in the northeastern portion of the substation. Therefore, requiring all drilled piers for the substation to bear on bedrock would be overly conservative for some lightly loaded equipment where drilled piers are used to resist higher lateral loads. Terracon should provide bearing recommendations for drilled pier foundations bearing within soil or engineered fill as well as for drilled piers bearing on top of bedrock (i.e., no rock socket) for structures where drilled piers are used for support of lateral loads but compressive loads are not high. These recommendations will likely be needed in other areas of the project as well.

23. Page 33 recommends that 24 inches of select low volume change (LVC) fill be placed below the floor slabs to limit the risk of swelling clay damaging the slab. Criteria for the LVC fill is given on page 17 of the report. Some of the on-site lean clay would be suitable for use as the LVC fill. However, it would be necessary to test and sort the excavated soils. The report on pages 15 and 17 mentions stabilizing the on-site clay with cement so that it could be used as LVC fill, but no details are provided. I recommend that construction plans and budgets be based on importing aggregate base material as the LVC fill or using cement to stabilize the on-site clays. Construction budgets should plan on using either cement stabilization of the clay subgrades below the floor slabs or importing aggregate base material as the 24 inches of select LVC fill that will be used below floor slabs-on-grade.

24. Some floor slabs or pavements in areas with shallow rock or deep cuts planned for the earthwork may have a subgrade consisting of sandstone or shale bedrock. In some situations, a bedrock subgrade can be problematic. Terracon should provide guidance for floor slabs and pavements with a bedrock subgrade.

25. The bottoms of some of the storm water detention basins are anticipated to be in bedrock. Having a sandstone or shale subgrade in a detention basin may preclude any permanent water level within the basin and make it impossible to establish vegetation where rock is present. If a permanent water level is desired in the basins, Terracon should provide guidance on constructing a clay or synthetic liner in the basins. If vegetation is desired at the bottom of the basin, Terracon or the landscape architect should provide guidance on over-excavating the rock so that soil can be placed in the pond bottom to support the vegetation.

26. The report does not mention any planned large water tanks that will be constructed for the project. Data centers often have several large water storage tanks. Drawings 1A.0-S-100MY, - 100MYA, -100MYB, -100MYC, -100MYD, -100MYF, and -100MYH all have notes that mention an "Area allocated for future work for water storage tanks", but no details are provided yet on these drawings. Foundation design of large tanks is typically controlled by settlement, not bearing capacity of the footing that will be present under the tank wall. Differential settlement along the perimeter of the tank and differential settlement where water lines connect to the tank are typically the most significant concerns. I anticipate these tanks will settle a few inches when they are initially filled with water. If these are steel-walled tanks, they will likely be flexible enough to tolerate the settlement, but the connections to the tank may require special details so that they can tolerate the settlement. Terracon and the tank designer should work together to evaluate the likely settlement of the tank (including the differential settlement around the perimeter, from the center to the perimeter, and at the connections) and whether the tank and its connections can tolerate that settlement. If the excessive settlement is anticipated, use of ground improvement such as aggregate piers under the tanks to reduce the settlement could be considered. Also, the connections can be delayed until after the tank has been hydrotested to limit the differential settlement that is experienced at that connection.

27. The unnumbered pages in the attachments at the end of the report that discuss Terracon's exploration procedures state that the elevations for the boring locations "were estimated using Google Earth." No surveying of boring ground surface elevations was completed. Elevations that are estimated using Google Earth may be off by a few feet. This uncertainty in the elevation could lead to inaccuracies in estimates in the volume of rock excavation that will be necessary for site grading, foundations, or utility trenches. Anyone using the top of rock elevations in the borings to develop construction plans (such as the depth of drilled piers) or rock excavation budgets should account for the possible inaccuracies in the elevations provided.

NOTE ON REVIEW OF DRAWINGS

All the drawings I reviewed are still in development. They are currently at the 65 percent complete stage. Therefore, some of the comments I present below may have been addressed by the design team as the work on the drawings progressed, even if I had not commented on the topic here.

COMMENTS ON DRAWINGS – Site Civil Package

28. Drawing C-0001 Grading Notes H and M say that the special inspector "will be paid by the contractor." The Project Manual indicates that the owner will retain and pay the special inspector. The note should be deleted or revised to indicate that the owner will retain the special inspector.

29. Drawing C-3104 indicates that the FFE in the substation pad will be 664.0 feet. The correct FFE is 694.0 feet. The civil engineer should correct the FFE number.

COMMENTS ON DRAWINGS – Data Center Building Structural

30. Drawing 1A.0-S-005 note 1 under "Foundations and Earthwork" refers to a Terracon geotechnical report dated June 24, 2025. The note should be revised to refer to the current Terracon geotechnical report dated August 8, 2025 (or later once the draft report is finalized).

31. Drawing 1A.0-S-005 note 1 under "Foundations and Earthwork" says, "Recommendations contained in the geotechnical report are to be considered part of the contract document unless specifically modified herein." However, the *Project Manual* in section 02 32 00 says the geotechnical report is "not a part of the Contract Documents." There are many legal and potential cost implications if a geotechnical report is a "contract document". Usually, a geotechnical report is provided to contractors "for information only" and is not a "contract document" so that unexpected subsurface conditions that are encountered during construction are less likely to generate an expensive change order. The structural engineer should reconsider the wording of this note so that the geotechnical report is not a "contract document" and so the note does not contradict the *Project Manual*.

32. Drawing 1A.0-S-005 note 6 under "Foundations & Earthwork" requires compacting the upper 3 feet of soil below a fill subgrade to 98 percent compaction per a **modified** proctor after that subgrade has been proof-rolled. This note is not addressing compaction of new fill but is requiring compaction of a fill subgrade (native soil) to a depth of 3 feet. Compaction efforts on a fill subgrade cannot achieve compaction to a depth of 3 feet below the subgrade. Compacting a subgrade can typically only densify soil to a maximum depth of only 9 to 12 inches. The Terracon report on page 10 recommends proof-rolling fill subgrades but does not provide a specific compaction recommendation when preparing the subgrade. The geotechnical report on page 18 recommends compaction of all engineered fill to only 95 percent of a **standard** proctor, except fill that will be more than 5 feet below finished grade is to be compacted to at least 98 percent compaction per a **standard** proctor. The structural engineer should consult with Terracon regarding this compaction requirement for fill subgrades.

33. Drawing 1A.0-S-005 note 15 under "Foundations & Earthwork" requires fill in the building area to be compacted to 98 percent of a standard proctor. The Terracon report on page 18 recommends compaction of all engineered fill to only 95 percent of a standard proctor, with fill that will be deeper than 5 feet below finished grade compacted to at least 98 percent. The note should be revised to either refer to the specifications for fill compaction requirements or should be revised to match the recommended minimum compaction in the Terracon report.

34. Drawing 1A.0-S-005 note 2 under "Subgrade and Base Notes" says, "… evaluates the subgrade by proof-rolling … repair soft areas that depress deeper than ½ inch…" The Terracon geotechnical report recommends proof rolling to evaluate the stiffness of subgrades but does not give a maximum rut depth. A proof roll rut depth limit of 1-inch is commonly used. Using the ½ inch criteria that is in this note is significantly more stringent. Using the more stringent criteria may be of no benefit to the project and could increase costs. The structural engineer should consult with Terracon and reconsider the ½ inch criteria for acceptable depth of ruts during the proof roll of a subgrade.

35. Drawings 1A.0-S-201A-C, -201B-D, -201E-G, -201F-H, -202I-K, -202J-L, -202K-M, and -202L-N have a note that says that foundations for the "FSA Area" have been designed for a bearing capacity of 2,650 psf. Another note says that the footings in the DC area have been designed for a bearing capacity of 2,500 psf. The Terracon report on pages 28 and 32 recommends using 2,500 psf. The structural engineer should review the bearing capacity that was used for design of footings in the FSA and revise the note to reference 2,500 psf.

COMMENTS ON DRAWINGS – Electrical Yard Structural

36. Drawing 1A.0-S-002-EY in the Design Loads notes indicates that seismic site class D was used in the structural design. The Terracon geotechnical report on page 8 recommends the use of seismic site class C. The structural engineer should review what seismic site class was used in the structural design and revise the note.

37. Drawing 1A.0-S-002-EY in the Foundations and Earthwork Notes on Note 1 says the footings were designed to bear on bedrock. Much of the substation area will have fill placed to raise grades. The fill will be as thick as 30 feet in some areas. Therefore, many of the footings and mats will bear on native soil or engineered fill. The structural engineer should revise the design of the footings for bearing on soil or fill and revise the note accordingly.

38. Drawing 1A.0-S-002-EY in the Drilled Piers notes in note 1 says "the self-weight of the drilled pier shall be subtracted from the allowable compressive capacities…" That should not be necessary. Bearing capacity recommendations for drilled piers are typically considered to be net pressures: the weight of the foundation concrete is not usually considered to contribute to the compressive foundation load. The structural engineer should consult with Terracon on this topic and based on their guidance revise this note and the drilled pier designs accordingly.

39. Drawing 1A.0-S-002-EY in the Drilled Piers notes in note 2 has an "XXXX" in two locations where parameter values should be written. Note 3 has a similar "XXXX". The structural engineer should complete these notes.

40. Note 1 on Drawing 1A.0-S-301-EY calls for electrical trenches "to bear on suitable shale or sandstone bedrock." Much of the substation area will have fill placed to raise grades. The fill will be as thick as 30 feet in some areas. Therefore, many of the trenches will bear on native soil or engineered fill. The structural engineer should revise the design of the trenches for bearing on soil or fill and revise the note accordingly.

41. Details 1 to 7 on Drawing 1A.0-S-301-EY say "See Note 2" for the subgrade below the electrical trenches. Note 2 on this drawing does not address subgrades or bearing conditions. This reference should likely be for Note 1. The structural engineer should review these references to Note 2.

COMMENTS ON DRAWINGS – Mechanical Yard Structural

42. Drawing 1A.0-S-005MY note 2 under "Geotechnical Information" refers to a Terracon geotechnical report dated June 24, 2024. The note should be revised to refer to the current Terracon geotechnical report dated August 8, 2025 (or later once the draft report is finalized).

43. Drawing 1A.0-S-005MY note 6.C.c under "Geotechnical Information" requires drilled piers to be socketed a minimum of 5 feet into the bedrock. This same 5-foot rock socket is listed on the Drilled

Pier Schedule on Drawing 1A.0-S-500MY. The Terracon report on pages 23 and 31 recommends that drilled piers have a "minimum embedment" of "2 feet into competent bedrock" (on page 23) or one diameter (on page 31). See Comment #17 above for more details on this topic. The structural engineer should revise this note to match the recommendations in the Terracon report.

44. Drawing 1A.0-S-352MY on Detail 2 – MWT Piping Support Section and Drawing 1A.0-S-355MY on Detail 2 – Pipe Support Foundation Section call for these footings "to bear on suitable shale or sandstone bedrock." Grading plans indicate that nearly all the mechanical yard will have fill placed to raise grades. As much as 30 feet of fill will be placed. Therefore, most of the footings in the mechanical yard will bear on engineered fill. The structural engineer should revise the design of these footings for bearing on soil or fill and revise the detail accordingly.

45. Drawing 1A.0-S-355MY on Detail 2 – Pipe Support Foundation Section says "See note 3" for the thickness/depth of the footing. This detail and the drawing do not have a note 3. The structural engineer should provide the appropriate note.

COMMENTS ON DRAWINGS – Main Entrance Structural

46. Drawing S-001 in the General notes indicates that seismic site class D was used in the structural design. The Terracon geotechnical report on page 8 recommends the use of seismic site class C. The structural engineer should review what seismic site class was used in the structural design and revise the note.

47. Drawing S-001 Note 1 under "Foundations & Earthwork" says the "foundations have been design assuming 3000 psf allowable soil bearing pressure." The Terracon report on page 32 recommends either 1500, 2500, or 5000 psf allowable bearing pressure. The structural engineer should review the value used in the design and revise the note.

48. Drawing S-001 note 4 under "Foundations & Earthwork" calls for compacting the upper 3 feet of soil below a fill subgrade to 98 percent compaction per a **modified** proctor after that subgrade has been proof-rolled. This note is not addressing compaction of new fill but is requiring compaction of a fill subgrade (native soil) to a depth of 3 feet. Compaction efforts on a fill subgrade cannot achieve compaction to a depth of 3 feet below the subgrade. Compacting a subgrade can typically only densify soil to a maximum depth of only 9 to 12 inches. The Terracon report on page 10 recommends proof-rolling fill subgrades but does not provide a specific compaction recommendation when preparing the subgrade. The geotechnical report on page 18 recommends compaction of all engineered fill to only 95 percent of a **standard** proctor, except fill that will be more than 5 feet below finished grade is to be compacted to at least 98 percent compaction per a **standard** proctor. The structural engineer should consult with Terracon regarding this compaction requirement for fill subgrades.

49. Drawing S-301 Detail 1 has three notes saying "See Note 3" regarding the subgrade below the floor. There are similar references to "Note 3" for the floor slab subgrade on Details 4 and 5 on this drawing. Note 3 on this drawing does not address floor slab subgrades. The structural engineer should provide the applicable note.

COMMENTS ON SPECIFICATIONS

50. The *Project Manual* includes five different sections that all address fill materials and placement of engineered fill (312200 Grading, 312316 Excavation, 312316.13 Trenching for Site Utilities, 312316.16

Structural Excavation for Minor Structures, 312323 Fill, Backfill, and Compaction). Each section has different wording and requirements regarding fill materials and how they are placed. This redundancy and inconsistency create uncertainty in the requirements. Also, as commented on below, many of the requirements in these specifications do not follow the recommendations in the Terracon report. The design team should consider reducing the number of sections within Division 31 so that redundancy and uncertainty is reduced. The design team should engage Terracon to help prepare more concise and consistent earthwork specifications that follow the recommendations in the project geotechnical report.

31 11 00 Clearing and Grubbing

I have no comments on this section.

31 22 00 Grading

51. Section 3.5.I says to place topsoil "in accordance with the recommendations set forth in the project Geotechnical Investigation." The Terracon geotechnical report does not provide guidance on placement of topsoil. Geotechnical reports typically do not address this topic. The specification should be revised to remove this reference to the geotechnical report.

31 23 16 Excavation

52. Section 1.3.B.1 says, "Contractor will hire the Geotech to inspect earthwork and to conduct in-place compaction moisture-density tests." The special inspector on this project will be hired by the owner. Other sections of the specifications state that the inspector will be "retained by the Owner". The specification should be revised to state that the owner will hire the special inspector.

53. Section 3.2.E says, "do not interfere with degree bearing splay of foundations." The sentence is missing a number (45?) between "with" and "degree". The missing number should be included in the specification.

54. 3.3.E says that over-excavated footings must be backfilled below the planned bottom of footing "with concrete of same strength as foundation concrete…" The Terracon report on page 22, 23, 29, and 30 recommends using "lean concrete" to backfill footing over-excavation. Using higher strength concrete would provide no benefit, would be more expensive, and would increase the carbon footprint. The specification should be revised to match Terracon's recommendation to use lean concrete to backfill over-excavation below footings.

55. Section 3.4.E requires that fill and backfill be placed with a moisture content "between 0 and 4% above optimum moisture…" The Terracon report on page 18 recommends a moisture content range of -2 to +2 percent relative to optimum for lower plasticity clay fill. The specification should be revised to match the recommendations in the Terracon report.

31 23 16.13 Trenching for Site Utilities

56. Section 3.2.F says, "do not interfere with degree bearing splay of foundations…" The sentence is missing a number (45?) between "with" and "degree". The missing number should be included in the specification.

57. Section 3.4.H.3 calls for utility trench backfill to be compacted to "not less than 100% of an ASTM D698 (standard) Proctor curve." The Terracon geotechnical report on page 18 recommends compaction of all engineered fill, including utility trench backfill, to 95 or 98 percent of a standard proctor depending on the depth of the fill below final grade. The specification should be revised to match the recommendations in the Terracon report. Alternatively, the specification author could clarify that they intend to require more stringent fill compaction requirements than recommended in the project geotechnical report.

31 23 16.16 Structural Excavation for Minor Structures

58. Section 1.1.D.6 states that high plasticity clay (CH soils) is "unsuitable material" that cannot be used as engineered fill on the project. Some of the on-site soil is high plasticity CH soil. The Terracon geotechnical report states that CH soil can be used as engineered fill as long as it is not used within 24 inches of a floor slab subgrade. The specification should be revised to remove CH soils from the list of "unsuitable" fill materials.

59. Section 1.1.D.7 states only soils type SC (clayey sand) and CL (low plasticity or "lean" clay) are "suitable material" for use as engineered fill. The Terracon report provides recommendations for other soil types including high plasticity "fat" clay (CH), gravel (GP, GW, GC, or GM), silty sand (SM), and sand (SW or SP). The specification should be revised to match Terracon's recommendations and include more soil categories as "suitable material".

60. Section 1.1.D.7 requires that all engineered fill material have a "plasticity index (PI) of **XXX** or less…" The Terracon report on page 17 recommends using fill material with a PI of less than 20 as the select LVC fill that will be placed within 24 inches of the building floor subgrade. This limitation does not apply to other engineered fill materials (i.e., in pavement areas or deeper fill in building areas). The specification should be revised to include the PI limit of 20 recommended by Terracon and to state that this restriction of the PI is only for the LVC fill within 24 inches of the building floor subgrade.

61. Section 3.3.D.2 says, "provide the optimum moisture content within -1 to +3%" for fill materials. This moisture content range does not match the recommendations on page 18 of the Terracon geotechnical report. The specification should be revised to give moisture content ranges that match Terracon's recommendations.

62. Section 3.3.E calls for a minimum of 95 percent compaction for all engineered fill. The Terracon report on page 18 recommends that engineered fill that will be more than 5 feet below finished grade be compacted to at least 98 percent compaction. The specification should be revised to include this requirement for greater fill compaction in deeper fill.

31 23 16.26 Rock Removal

I have no comments on this section.

31 23 23 Fill, Backfill, and Compaction

63. Section 1.5.B requires that all engineered fill material have a "liquid limit (LL) less than 45 and a plasticity index (PI) of 20 or less…" The Terracon report on page 17 recommends these limitations for the select LVC fill that will be placed within 24 inches of the building floor subgrade. These limitations do not apply to other engineered fill materials (i.e., in pavement areas or deeper fill in building areas).

The specification should be revised to state that this restriction of the LL and PI is only for the LVC fill within 24 inches of the building floor subgrade.

64. Section 1.5.B says that all rock fragments larger than 3 inches in size are "unsuitable" for use as engineered fill. The Terracon report on pages 15, 16, and 17 provides detailed guidance on the use of larger fragments of rock as engineered fill. A significant amount of the engineered fill on this project will be rock fill. The specification should be revised to allow rock fill as recommended by Terracon.

65. Section 3.3.B limits the sulfate and sulfide contents in the soils that are used as fill. Terracon's report on page 7 indicates that testing of the sulfate and sulfide content of the on-sites has been completed, but the data is not yet included in the draft report. The specification author should clarify if additional chemical testing of the soil must be completed and who will complete it.

66. It appears that Section 3.3.L.1 is to provide a minimum compaction for fill. However, there is no number before the word "percent." The specification author should provide the number (95 percent?) for the required fill compaction.

67. Section 3.3.N.1 calls for compaction of fill to 98 percent standard proctor where it is placed to backfill an over-excavated soft subgrade. The Terracon geotechnical report on page 18 recommends compaction of all engineered fill to 95 percent of a standard proctor, with fill that will be deeper than 5 feet below finished grade compacted to at least 98 percent. The specifications should be revised to match the recommended minimum compaction in the Terracon report.

68. Section 3.5.H.2 calls for utility trench backfill "under roads, streets, and other paved areas" to be compacted to 100 percent standard proctor. The Terracon geotechnical report on page 18 recommends compaction of all engineered fill, including utility trench backfill, to 95 percent standard proctor, with fill that will be deeper than 5 feet below finished grade compacted to at least 98 percent. The specifications should be revised to match the recommended minimum compaction in the Terracon report. Alternatively, the specification author could clarify that they intend to require more stringent fill compaction requirements than recommended in the project geotechnical report.

69. Section 3.6.A calls for fill material to have a "moisture content within -2 to +2 percent of optimum…" This moisture content range does not match the recommendations on page 18 of the Terracon geotechnical report. The specification should be revised to give moisture content ranges that match Terracon's recommendations.

70. Sections 3.6.A.1.a and 3.6.A.1.b call for fill compaction to 100 percent standard proctor "under footings" and 98 percent standard proctor "under slabs-on-grade". The depth "under" a footing or slab is not given for this more stringent compaction requirement. Some of the fill on this project will be more than 30 feet "under" a slab. The Terracon geotechnical report on page 18 recommends compaction of all engineered fill to 95 percent of a standard proctor, with fill that will be deeper than 5 feet below finished grade compacted to at least 98 percent. The specifications should be revised to match the recommended minimum compaction in the Terracon report.

71. Section 3.6.A.4 calls for fill within the upper 2 feet below the pavement subgrade to be compacted to a minimum of 95 percent compaction per a **modified** proctor (ASTM D1557). The Terracon geotechnical report on page 18 recommends compaction of all engineered fill to 95 percent of a **standard** proctor, with fill that will be deeper than 5 feet below finished grade compacted to at least

98 percent. The specification should be revised to match the recommended minimum compaction with a standard proctor that is in the Terracon report. If a firmer or more durable pavement subgrade is desired, consideration should be given to using a geogrid or chemical stabilization.

31 23 23.33 Flowable Fill

I have no comments on this section.

31 37 16 Rip Rap

I have no comments on this section.

31 63 29 Drilled Concrete Piers and Shafts

72. Section 2.1.B is missing the maximum size of the aggregate that is allowed in the concrete. The "3/4" has been struck out in the text. The specification author should clarify what maximum aggregate size is allowed in the drilled pier concrete.

73. Section 3.1.D says "temporary casings may be left in place … at Contractor's option." Leaving a temporary casing in place significantly changes the axial and lateral capacity of a drilled pier. Temporary casing should not be left in place without the approval of Terracon and the structural engineer. The specification should be revised to require approval by the structural engineer and Terracon for a temporary casing to be left in place.

31 66 13.13 Aggregate Columns

74. Current plans do not call for the use of aggregate columns on this project. The Terracon geotechnical report does not recommend their use. The specification author should clarify why this specification is included.

75. There is a note highlighted in yellow after Section 1.4.F that instructs the "A/E" to "add names and dates of geotech reports…" The specification should be revised to include information on the project's geotechnical report, and this note should be deleted.

76. There is a note highlighted in yellow before Section 1.8 that instructs the "A/E" to "enter design requirements…" The specification should be revised as suggested by this note, and the note should be deleted.

LIMITATIONS

The brief review of the documents referenced above was conducted as an independent third-party review, focused solely on potential geotechnical issues. The recommendations in the project geotechnical report by Terracon are not revised by this letter. Terracon remains the geotechnical engineer-of-record for the project. The drawings and specifications are not modified by this letter.

Bedrock GeoConsult did not complete a site visit, subsurface exploration, soil testing, numerical analysis, or a review of analyses completed by the project geotechnical-engineer-of-record. Bedrock GeoConsult offers various levels of peer review services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies will yield more information, which may help understand and manage the level of risk involved. Since detailed study and analysis involves greater expense, clients participate in determining levels of service that provide adequate information for their

purposes at acceptable levels of risk. More extensive reviews could be performed to reduce these uncertainties.

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Bedrock GeoConsult's profession practicing in the same locality, under similar conditions, and on the date the services are provided. The conclusions, opinions, and recommendations presented in this letter are based on the limited information that was provided for review. Bedrock GeoConsult makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

CLOSING

Bedrock GeoConsult appreciates the opportunity to be of service to J.E. Dunn Construction. Please email (steve@bedrockgeoconsult.com) or call (913.475.5851) if you would like to discuss the project further.

Sincerely,
Bedrock GeoConsult, LLC
Oklahoma Certificate of Authorization #9019, Expires 6/30/2026

2025.09.18 10:05:44-05'00'

Steve Wendland, PE, PG, BCGE
President

LICENSED PROFESSIONAL ENGINEER
STEVEN WENDLAND
19663
OKLAHOMA
9/18/2025