Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, Washington 98028

August 28, 2022
Updated January 31, 2023

Tae Park
C/O Steve Joo
Steve.joo@hotmail.com

RE: Geotechnical Evaluation
Proposed Additions
8244 SE 30th Street
Mercer Island, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to discuss the results of our geotechnical evaluation at the referenced site.

The purpose of our evaluation was to provide recommendations for foundation design, grading, and earthwork.

Site Description

The site is located at 8244 SE 30th Street in Mercer Island, Washington. The site consists of one nearly rectangular shaped parcel (No. 5452300816) with a total area of about 13,200 square feet.

The site is developed with a residence with daylight basement and driveway. The remainder of the property is undeveloped and vegetated with grasses, bushes, and variable diameter trees.

Overall, the site slopes downward from south to north at magnitudes of 5 to 15 percent and relief of about 10 feet. There is a short rockery near a deck along the east side of the residence and a likely 3 to 6 feet tall wall near the north property line (mostly obscured by vegetation).

According to the City of Mercer Island GIS maps, the site contains seismic hazard areas. The site is bordered to the north, east, and west by residences, and to the south by SE 30th Street.

The proposed development includes a building addition along the east side of the residence and a new deck along the north side of the building. Foundation loads will be light and site grading will likely include cuts of 3 feet or less. We should be provided with the final plans to verify that our recommendations remain valid and do not require updating.

Area Geology

The Geologic Map of Mercer Island, indicates that the site is underlain by Vashon Recessional Outwash.

Vashon Recessional Outwash includes mixtures of layers of silty-sand poorly graded sands, gravelly soils, and local lacustrine silts and clays.

Soil & Groundwater Conditions

As part of our evaluation, we excavated a test pit in the area of the proposed addition. Liu and Associates previously prepared a geotechnical report for the site (2017). They excavated two test pits and conducted two infiltration tests, located north of the residence. We have included their logs for reference.

The test pit encountered approximately 6 inches of topsoil and vegetation underlain by about 2 feet medium dense, silty-fine to medium grained sand trace gravel (Recessional Outwash). These materials were underlain by approximately 2 feet of medium dense, fine to medium grained sand (Recessional Outwash). These materials were underlain by stiff to very stiff, silt trace to with fine grained sand (pre-Olympia fine grained deposits) which continued to the termination depth of the test pit.

We reviewed numerous nearby explorations conducted by geotechnical consultants. These explorations described recessional type deposits underlain by finer grained materials in some areas. Groundwater was noted on most of these logs at variable depths below grade. The Liu logs were similar to our test pits logs.

Groundwater was not encountered in our test pit or the Liu test pits; however, these explorations were all conducted during the dry season. We anticipate that groundwater may be present above the silt deposits that were observed about 4.5 feet below grade in the test pit. Groundwater would most likely be present during the wet season.

Water table elevations often fluctuate over time. The groundwater level will depend on a variety of factors that may include seasonal precipitation, irrigation, land use, climatic conditions and soil permeability. Water levels at the time of the field investigation may be different from those encountered during the construction phase of the project.

City of Mercer Island GIS Mapped Hazards

The City of Mercer Island GIS maps indicate that the site is within a seismic hazard area. This is likely based on the presence of mapped recessional outwash materials in this area. The thin zone of poorly graded sand could have a slight potential for liquefaction when groundwater is present. We provide foundation recommendations to eliminate the risk of liquefaction.

19.07.100 - Mitigation sequencing.

Except as otherwise provided in this chapter, an applicant for a development proposal or activity shall implement the following sequential measures, listed below in order of preference, to avoid, minimize, and mitigate impacts to environmentally critical areas and associated buffers. Applicants shall document how each measure has been addressed before considering and incorporating the next measure in the sequence:

A. Avoiding the impact altogether by not taking a certain action or parts of an action. The applicant shall consider reasonable, affirmative steps and make best efforts to avoid critical area impacts. However, avoidance shall not be construed to mean mandatory withdrawal or denial of the development proposal or activity if the proposal or activity is an allowed, permitted, or conditional use in this title. In determining the extent to which the proposal should be redesigned to avoid the impact, the code official may consider the purpose, effectiveness, engineering feasibility, commercial availability of technology, best management practices, safety and cost of the proposal and identified changes to the proposal. Development proposals should seek to avoid, minimize and mitigate overall impacts based on the functions

and values of all of the relevant critical areas and based on the recommendations of a critical area study. If impacts cannot be avoided through redesign, use of a setback deviation pursuant to section 19.06.110(C), or because of site conditions or project requirements, the applicant shall then proceed with the sequence of steps in subsections B through E of this section;

B. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, using a setback deviation pursuant to section 19.06.110(C), using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;

C. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

D. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;

E. Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and/or

F. Monitoring the impact and taking appropriate corrective measures to maintain the integrity of compensating measures.

Relatively minor overexcavation of local sands that underlie the foundation elements will nearly eliminate the risk of liquefaction. The risk of liquefaction is relatively low to begin with, and overexcavation of sands below foundation areas and replacement with angular rock is adequate to mitigate the liquefaction risk.

19.07.110 - Critical area study.

A. A critical area study shall be required when a development proposal will result in an alteration to one or more critical areas or critical area buffers or when required to determine the potential impact to a critical area.

B. The critical area study shall be in the form of a written report supported by graphic information prepared by a qualified professional using guidance based on the best available science consistent with the standards in WAC Chapter 365-195 and shall contain the following items, as applicable to adequately evaluate the proposal, proposed alterations, and mitigation:

1. Disclosure of the presence of critical areas, including a delineation and type or category of critical area, on the development proposal site and any mapped or identifiable critical areas on or off site within the distance equal to the largest potential required buffer applicable to the development proposal area on the applicant's property;

2. A topographic and boundary survey;

3. A statement specifying the accuracy of the report and all assumptions made and relied upon;

4. A description of the methodologies used to conduct the critical area study, including references;

5. A scale map of the development proposal site;

6. Photographic records of the site before the proposed alteration occurs;

7. An assessment of the probable effects to critical areas and associated buffers, including impacts caused by the development proposal and associated alterations to the subject property and impacts to other properties and any critical areas or buffers located on them resulting from the development of the site and the proposed development;

8. A description of mitigation sequencing implementation described in section 19.07.100 including steps taken to avoid and minimize critical areas impacts to the greatest extent feasible;

9. Detailed studies, as required by this chapter, for individual critical area types in order to ensure critical area protection;

10. Assessment of potential impacts that may occur on adjacent sites, such as sedimentation or erosion, where applicable; and

11. A post-design memorandum prepared by a qualified professional confirming that the proposed improvements comply with the design recommendations.

C. The critical area study requirement may be waived or modified if the applicant demonstrates that the development proposal will not have an impact on the critical area or its buffer in a manner contrary to the purposes and requirements of this chapter.

The only mapped geologic hazard is a seismic hazard area based on the presence of Vashon Recessional Outwash. The sandier portions of these deposits can locally have a slight liquefaction risk if groundwater is present. This risk can be mitigated by either using deep foundation elements or removal of the loose sands and replaced these materials with clean angular rock.

If required, the client and their representative can provide scaled drawings and other information described in this code section. It is our opinion that the seismic hazard is low and the only necessary mitigation is minor foundation overexcavation work. Mitigation sequencing is not necessary.

The geotechnical engineer must verify removal of the loose sands and any other loose/soft soils from below foundation elements as well as the compaction of clean rock that replaces these materials. The impact of the construction on adjacent properties from the seismic hazard mitigation will be nil.

19.07.160 - Geologically hazardous areas.

A. *Designation and typing*. Geologically hazardous areas are lands that are susceptible to erosion, landslides, seismic events, or other factors as identified by WAC 365-190-120. These areas may not be suited for development activities because they may pose a threat to public health and safety. Areas susceptible to one or more of the following types of hazards shall be designated as geologically hazardous areas: landslide hazard areas, seismic hazard areas, and erosion hazard areas.

B. *General review requirements*. Alteration within geologically hazardous areas or associated buffers is required to meet the standards in this section, unless the scope of work is exempt pursuant to section 19.07.120, exemptions, or a critical area review 1 approval has been obtained pursuant to section 19.07.090(A).

1. When an alteration within a landslide hazard area, seismic hazard area or buffer associated with those hazards is proposed, the applicant must submit a critical area study concluding that the proposal can effectively mitigate risks of the hazard. The study shall recommend appropriate design and development measures to mitigate such hazards. The code official may waive the requirement for a critical area study and the requirements of subsections (B)(2) and (B)(3) of this section when he or she determines that the proposed development is minor in nature and will not increase the risk of landslide, erosion, or harm from seismic activity, or that the development site does not meet the definition of a geologically hazardous area.

2. Alteration of landslide hazard areas and seismic hazard areas and associated buffers may occur if the critical area study documents find that the proposed alteration:

a. Will not adversely impact other critical areas;

b. Will not adversely impact the subject property or adjacent properties;

c. Will mitigate impacts to the geologically hazardous area consistent with best available science to the maximum extent reasonably possible such that the site is determined to be safe; and

d. Includes the landscaping of all disturbed areas outside of building footprints and installation of hardscape prior to final inspection.

3. Alteration of landslide hazard areas, seismic hazard areas and associated buffers may occur if the conditions listed in subsection (B)(2) of this section are satisfied and the geotechnical professional provides a statement of risk matching one of the following:

a. An evaluation of site-specific subsurface conditions demonstrates that the proposed development is not located in a landslide hazard area or seismic hazard area;

b. The landslide hazard area or seismic hazard area will be modified or the development has been designed so that the risk to the site and adjacent property is eliminated or mitigated such that the site is determined to be safe;

c. Construction practices are proposed for the alteration that would render the development as safe as if it were not located in a geologically hazardous area and do not adversely impact adjacent properties; or

d. The development is so minor as not to pose a threat to the public health, safety and welfare.

The recommended loose soil removal work within foundation areas will render the development as safe as if it were not located in a geologically hazardous area and do not adversely affect adjacent properties (item C.). The risk of the seismic hazard in this area is very low to low.

Development standards—Seismic hazard areas. When development is proposed within a seismic hazard area:

1. A critical area study shall be required and shall include an evaluation by a qualified professional for seismic engineering and design, a determination of the magnitude of seismic settling that could occur during a seismic event, and a demonstration that the risk associated with the proposed alteration is within acceptable limits or that appropriate construction methods are provided to mitigate the risk of seismic settlement such that there will be no significant impact to life, health, safety, and property.

2. *Identification of seismic hazard areas*. Seismic hazard areas shall be identified by a qualified professional who references and interprets information in the U.S. Geological Survey Active Faults Database, performs on-site evaluations, or applies other techniques according to best available science.

3. When development is proposed on a site with an active fault, the follow provisions shall apply:

a. A 50-foot minimum buffer shall be applied from latest Quaternary, Holocene, or historical fault rupture traces as identified by the United States Geological Survey or Washington

Geological Survey map databases or by site investigations by licensed geologic professionals with specialized knowledge of fault trenching studies; or

b. Mitigation sequencing shall be incorporated into the development proposal as recommended based on geotechnical analysis by a qualified professional to prevent increased risk of harm to life and/or property.

As discussed above, the risk of liquefaction is very low to tow at the site and surrounding areas. The entire site is underlain by recessional deposits that locally have some minor susceptibility to liquefaction. The foundation mitigation work will reduce this risk to typical engineering standards. No buffer or setback is warranted or applicable. A setback and buffer would only make sense if there was a known fault or rupture zone. There is no need for mitigation sequencing as typical foundation preparation is anticipated to be necessary.

Erosion Hazard

The Natural Resources Conservation Services (NRCS) maps for King County indicate that most of the site is underlain by Kitsap silt loam (2 to 8 percent slopes). These soils would have a moderate to severe erosion potential in a disturbed state depending on the slope magnitude.

It is our opinion that soil erosion potential at this project site can be reduced through landscaping and surface water runoff control. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be controlled by the use of normal temporary erosion control measures, such as silt fences, hay bales, mulching, control ditches and diversion trenches. The typical wet weather season, with regard to site grading, is from October 31st to April 1st. Erosion control measures should be in place before the onset of wet weather.

Seismic Hazard

The overall subsurface profile corresponds to a Site Class *D* as defined by Table 1613.5.2 of the International Building Code (IBC). A Site Class *D* applies to an overall profile consisting of medium dense to very dense soils within the upper 100 feet.

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for S_S, S_1, F_a, and F_v. The USGS website includes the most updated published data on seismic conditions. The following tables provide seismic parameters from the USGS web site with referenced parameters from ASCE 7-16.

Seismic Design Parameters (ASCE 7-16)

Site Class	Spectral Acceleration at 0.2 sec. (g)	Spectral Acceleration at 1.0 sec. (g)	Site Coefficients		Design Spectral Response Parameters		Design PGA
			F_a	F_v	S_{DS}	S_{D1}	
D	1.395	0.486	1.0	Null	0.93	Null	0.597

Additional seismic considerations include liquefaction potential and amplification of ground motions by soft/loose soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table.

Below the thin sand zone, the site soils would have a low risk of liquefaction. We provide specific foundation recommendations to minimize the risk and effect of liquefaction on the proposed additions. For items listed as "Null" see Section 11.4.8 of the ASCE.

Conclusions and Recommendations

General

The site is underlain by recessional outwash and at depth by denser pre-Olympia fine grained deposits. We recommend supporting new foundation elements on either driven pipe piles or on rock used to replace any outwash sands that underlie foundation areas. The sands could extend 4 to 5 feet below site elevations. We must verify soil bearing and overexcavation of loose soils during construction.

We have reviewed the civil plans that show a short infiltration trench north of the addition for roof areas. This appears suitable; however, we must verify soil conditions during construction. It is imperative that the systems are located within the sandy outwash zones.

Site Preparation

Trees, shrubs and other vegetation should be removed prior to stripping of surficial organic-rich soil and fill. Based on observations from the site investigation program, it is anticipated that the stripping depth will be 6 to 12 inches. Deeper excavations will be necessary below foundation systems, below large trees, and in any areas underlain by undocumented fill.

The native soils consist of silty-sand with gravel, poorly graded sand, and at depth by silt with sand. Most of the native soils may be used as structural fill provided they achieve compaction requirements and are within 3 percent of the optimum moisture. Some of these soils may only be suitable for use as fill during the summer months, as they will be above the optimum moisture levels in their current state. These soils are variably moisture sensitive and may degrade during periods of wet weather and under equipment traffic.

Imported structural fill should consist of a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill should be placed in maximum lift thicknesses of 12 inches and should be compacted to a minimum of 95 percent of the modified proctor maximum dry density, as determined by the ASTM D 1557 test method.

Temporary Excavations

Based on our understanding of the project, we anticipate that the grading could include local cuts on the order of approximately 5 feet or less for foundation placement.

Temporary excavations should be sloped no steeper than 1.5H:1V (Horizontal:Vertical) in loose native soils and fill (likely top 1 to 2 feet), and 1H:1V in medium dense native soils. If an excavation is subject to heavy vibration or surcharge loads, we recommend that the excavations be sloped no steeper than 2H:1V, where room permits.

Temporary cuts should be in accordance with the Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. Temporary slopes should be visually inspected daily by a qualified person during construction activities and the inspections should be documented in daily

reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and reducing slope erosion during construction.

Temporary cut slopes should be covered with visqueen to help reduce erosion during wet weather, and the slopes should be closely monitored until the permanent retaining systems or slope configurations are complete. Materials should not be stored or equipment operated within 10 feet of the top of any temporary cut slope.

Soil conditions may not be completely known from the geotechnical investigation. In the case of temporary cuts, the existing soil conditions may not be completely revealed until the excavation work exposes the soil. Typically, as excavation work progresses the maximum inclination of temporary slopes will need to be re-evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed and required deadlines can be met.

If any variations or undesirable conditions are encountered during construction, we should be notified so that supplemental recommendations can be made. If room constraints or groundwater conditions do not permit temporary slopes to be cut to the maximum angles allowed by the WAC, temporary shoring systems may be required. The contractor should be responsible for developing temporary shoring systems, if needed. We recommend that Cobalt Geosciences and the project structural engineer review temporary shoring designs prior to installation, to verify the suitability of the proposed systems.

Foundation Design

The proposed addition and deck may be supported on shallow spread footing foundation systems bearing on driven pipe piles or on properly compacted structural fill placed on the suitable native soils.

Due to the presence of a thin zone of outwash sands that have a moderate potential of liquefaction, either pipe piles extending to refusal in the denser fine grained soils below the outwash or coarse rock used to replace outwash sands are necessary for foundation support. For the overexcavation option, we recommend removal of all loose sands below new footing areas extending outward at a 1/2H:1V envelope in all directions. The sand should be replaced with coarse clean angular rock 5/8 to 2 inches in size. We should verify soil conditions during foundation excavation work.

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 2,000 pounds per square foot (psf) may be used for design.

A 1/3 increase in the above value may be used for short duration loads, such as those imposed by wind and seismic events. Structural fill placed on bearing, native subgrade should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Footing excavations should be inspected to verify that the foundations will bear on suitable material.

Exterior footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower.

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than ½ inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.40 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Any extremely wet or dry materials, or any loose or disturbed materials at the bottom of the footing excavations, should be removed prior to placing concrete. The potential for wetting or drying of the bearing materials can be reduced by pouring concrete as soon as possible after completing the footing excavation and evaluating the bearing surface by the geotechnical engineer or his representative.

Pin Piles

For the pin pile option, we anticipate that 2 inch diameter pipe piles could be utilized for the new footings. Piles should consist of 2 inch diameter Schedule 80 galvanized steel pipes with mechanical couplers. These should be driven with a 140 pound pneumatic hammer with refusal criteria of 3 cycles of 60 seconds per inch of penetration. Piles may be designed using an axial capacity of 3 tons each.

Slab-on-Grade

If new slab on grade is proposed, the following recommendations may apply.

We recommend that the upper 12 inches of the existing native soils within slab areas be re-compacted to at least 95 percent of the modified proctor (ASTM D1557 Test Method).

Often, a vapor barrier is considered below concrete slab areas. However, the usage of a vapor barrier could result in curling of the concrete slab at joints. Floor covers sensitive to moisture typically requires the usage of a vapor barrier. A materials or structural engineer should be consulted regarding the detailing of the vapor barrier below concrete slabs. Exterior slabs typically do not utilize vapor barriers.

The American Concrete Institutes ACI 360R-06 Design of Slabs on Grade and ACI 302.1R-04 Guide for Concrete Floor and Slab Construction are recommended references for vapor barrier selection and floor slab detailing.

Slabs on grade may be designed using a coefficient of subgrade reaction of 180 pounds per cubic inch (pci) assuming the slab-on-grade base course is underlain by structural fill placed and compacted as outlined above. A 4- to 6-inch-thick capillary break layer should be placed over the prepared subgrade. This material should consist of pea gravel or 5/8 inch clean angular rock.

A perimeter drainage system is recommended unless interior slab areas are elevated a minimum of 12 inches above adjacent exterior grades. If installed, a perimeter drainage system should

consist of a 4-inch diameter perforated drain pipe surrounded by a minimum 6 inches of drain rock wrapped in a non-woven geosynthetic filter fabric to reduce migration of soil particles into the drainage system. The perimeter drainage system should discharge by gravity flow to a suitable stormwater system.

Exterior grades surrounding buildings should be sloped at a minimum of one percent to facilitate surface water flow away from the building and preferably with a relatively impermeable surface cover immediately adjacent to the building.

Stormwater Management Feasibility

The site is underlain by weathered to unweathered Vashon Recessional Outwash and at depth by Pre-Olympia Fine Grained Deposits.

While the outwash is very sandy and suitable for infiltration, this suitability decreases during the wet season when we suspect a relatively high groundwater table. Systems typically require specific clearance above the seasonal high groundwater table. If that is maintained, infiltration is generally feasible.

Because the recessional deposits have not been overridden by glacial ice, this soil unit is considered normally-consolidated. The Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington allows determination of infiltration rates of this soil unit by Soil Particle Size Distribution testing. This method involves using a logarithmic equation and grain size values along with correction factors for testing type, soil homogeneity, and influent control.

The equation in conjunction with sieve analysis results yields a design infiltration rate of 0.5 and 0.1 inches per hour for the soils at 3 and 5 feet below grade, respectively. These rates reflect application of correction factors for variability (0.33 used), influent control (0.9), and testing analysis type (0.4). We note that the outwash sands have some infiltration potential if not saturated while the underlying silts are generally impermeable. We note that Liu obtained infiltration rates (with correction factors) of 1.23 and 0.4 inches per hour in the similar outwash sands.

Infiltration systems should extend at least 6 inches into the sand deposits. Any fine grained soils, fill, or interbeds of fine grained soils must be removed prior to rock placement. Soils are consistent with the Medium Sand designation from the King County Surface Water Design Manual.

Systems should be located at least 15 feet from the north property line and at least 5 feet from structures. We assume that any systems would be for the added roof areas only and not the entire residence.

We should be provided with final plans for review to determine if the intent of our recommendations has been incorporated or if additional modifications are needed. Verification testing of infiltration systems should be performed during construction.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.
- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

CONSTRUCTION FIELD REVIEWS

Cobalt Geosciences should be retained to provide part time field review during construction in order to verify that the soil conditions encountered are consistent with our design assumptions and that the intent of our recommendations is being met. This will require field and engineering review to:

- Monitor and test structural fill placement and soil compaction
- Observe bearing capacity at foundation locations (if proposed)
- Observe excavations and shoring placement (if required/utilized)
- Observe slab-on-grade preparation

Geotechnical design services should also be anticipated during the subsequent final design phase to support the structural design and address specific issues arising during this phase. Field and engineering review services will also be required during the construction phase in order to provide a Final Letter for the project.

CLOSURE

This report was prepared for the exclusive use of Tae Park and his appointed consultants. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Cobalt Geosciences, LLC.

The recommendations contained in this report are based on assumed continuity of soils with those of our test holes and assumed structural loads. Cobalt Geosciences should be provided with final architectural and civil drawings when they become available in order that we may review our design recommendations and advise of any revisions, if necessary.

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of Tae Park who are identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Cobalt Geosciences should any of these not be satisfied.

Sincerely,

Cobalt Geosciences, LLC

1/31/2023
Phil Haberman, PE, LG, LEG
Principal

Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Cobalt Geosciences and the Client. Any use which a third party makes of this report is the responsibility of such third party.

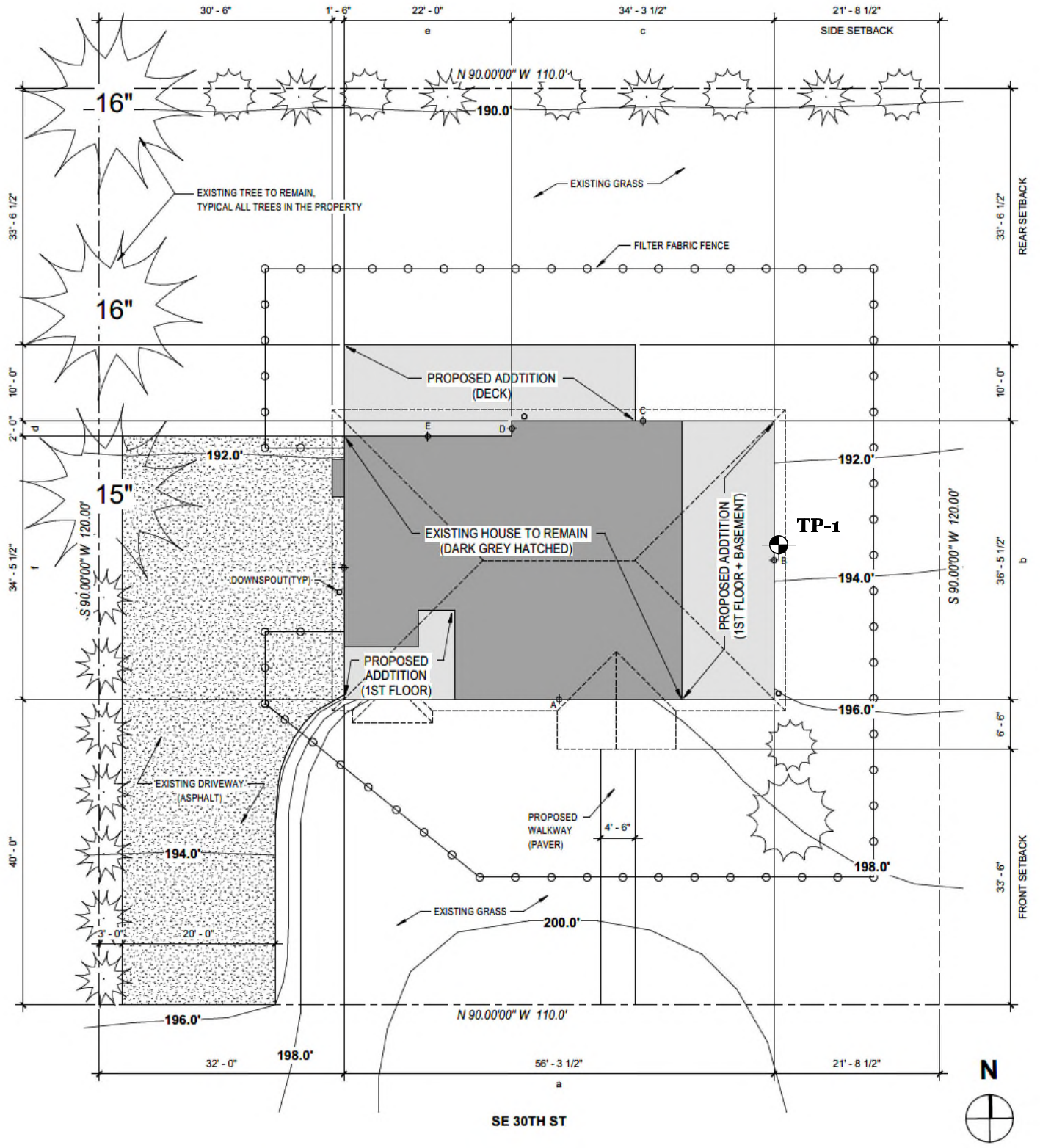
BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Cobalt Geosciences is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Cobalt Geosciences at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Cobalt Geosciences must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Cobalt Geosciences will not be responsible to any party for damages incurred as a result of failing to notify Cobalt Geosciences that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Cobalt Geosciences, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Cobalt Geosciences cannot be responsible for site work carried out without being present.



Provided site plan

TP-1 **Approximate Test Pit Location**

Not to Scale

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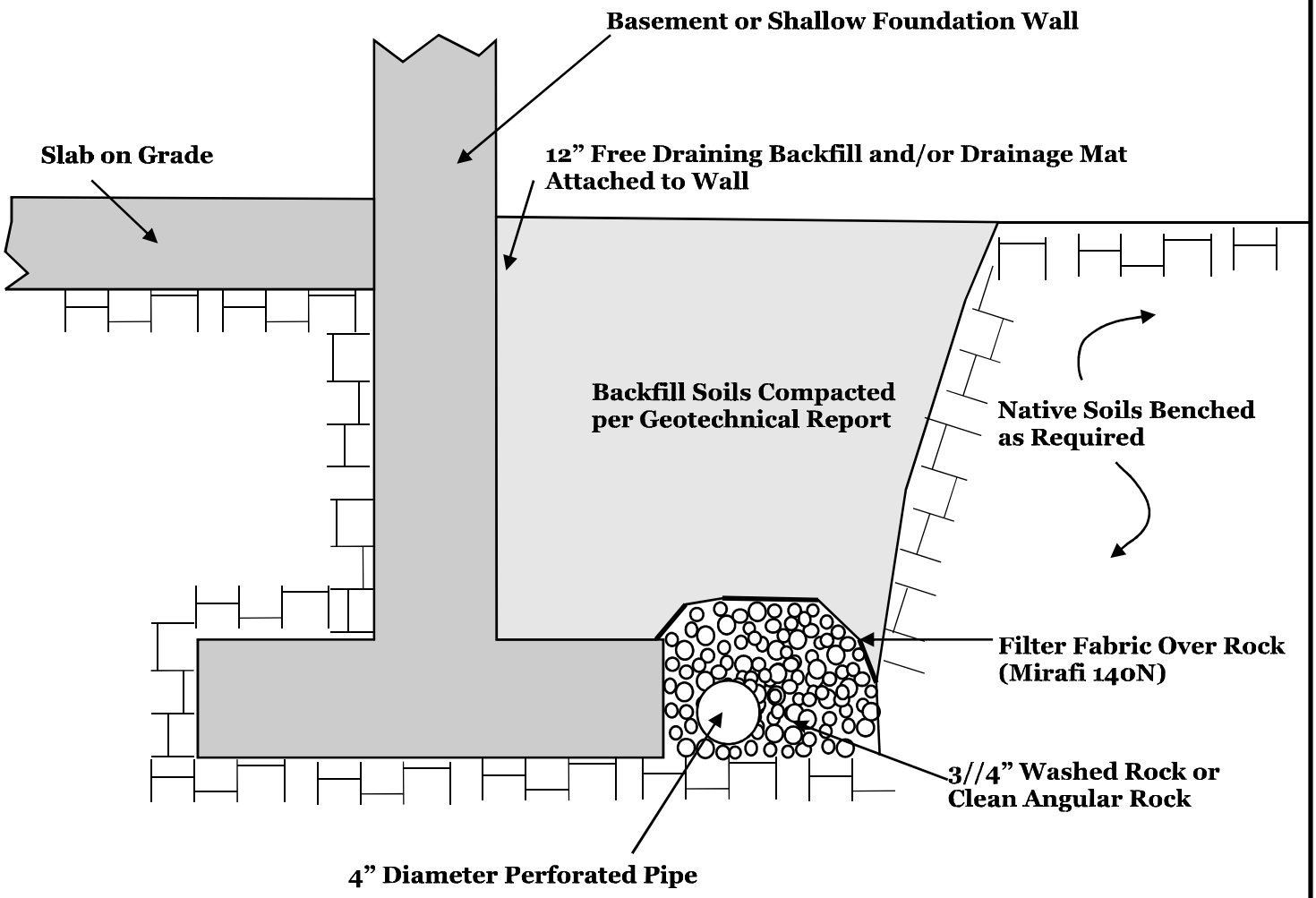
COBALT GEOSCIENCES	Proposed Additions 8244 SE 30th Street Mercer Island, Washington	**SITE MAP FIGURE 1**	Cobalt Geosciences, LLC P.O. Box 82243 Kenmore, WA 98028 (206) 331-1097 www.cobaltgeo.com cobaltgeo@gmail.com



Not to Scale

COBALT GEOSCIENCES	**Typical Foundation Drain Detail**	**Attachment**	Cobalt Geosciences, LLC PO Box 1792 North Bend, WA 98045 (206) 331-1097 www.cobaltgeo.com phil@cobaltgeo.com

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
		Organic	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat, humus, swamp soils with high organic content (ASTM D4427)

Classification of Soil Constituents

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

Grain Size Definitions

Description	Sieve Number and/or Size
Fines	<#200 (0.08 mm)
Sand	
-Fine	#200 to #40 (0.08 to 0.4 mm)
-Medium	#40 to #10 (0.4 to 2 mm)
-Coarse	#10 to #4 (2 to 5 mm)
Gravel	
-Fine	#4 to 3/4 inch (5 to 19 mm)
-Coarse	3/4 to 3 inches (19 to 76 mm)
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	>12 inches (305 mm)

Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
Over 30	Hard

Moisture Content Definitions

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

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Soil Classification Chart

Figure C1

Test Pit TP-1

Date: August 2022	Depth: 9'	Groundwater: None
Contractor: Jim	Elevation:	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description
				Topsoil/Vegetation
1 – 2			SM	Loose to medium dense, silty-fine to medium grained sand with gravel dark yellowish brown to grayish brown, moist. (Recessional Outwash)
3 – 4			SP	Medium dense, fine to medium grained sand trace gravel, reddish brown to yellowish brown, moist. (Recessional Outwash)
5 – 9			ML	Stiff to very stiff, silt with fine grained sand, mottled tan to yellowish brown, moist. (Pre-Olympia Fine Grained Deposits)
10				End of Test Pit 9'

Groundwater

Moisture Content (%)
Plastic Limit — Liquid Limit

DCP Equivalent N-Value
0 10 20 30 40 50

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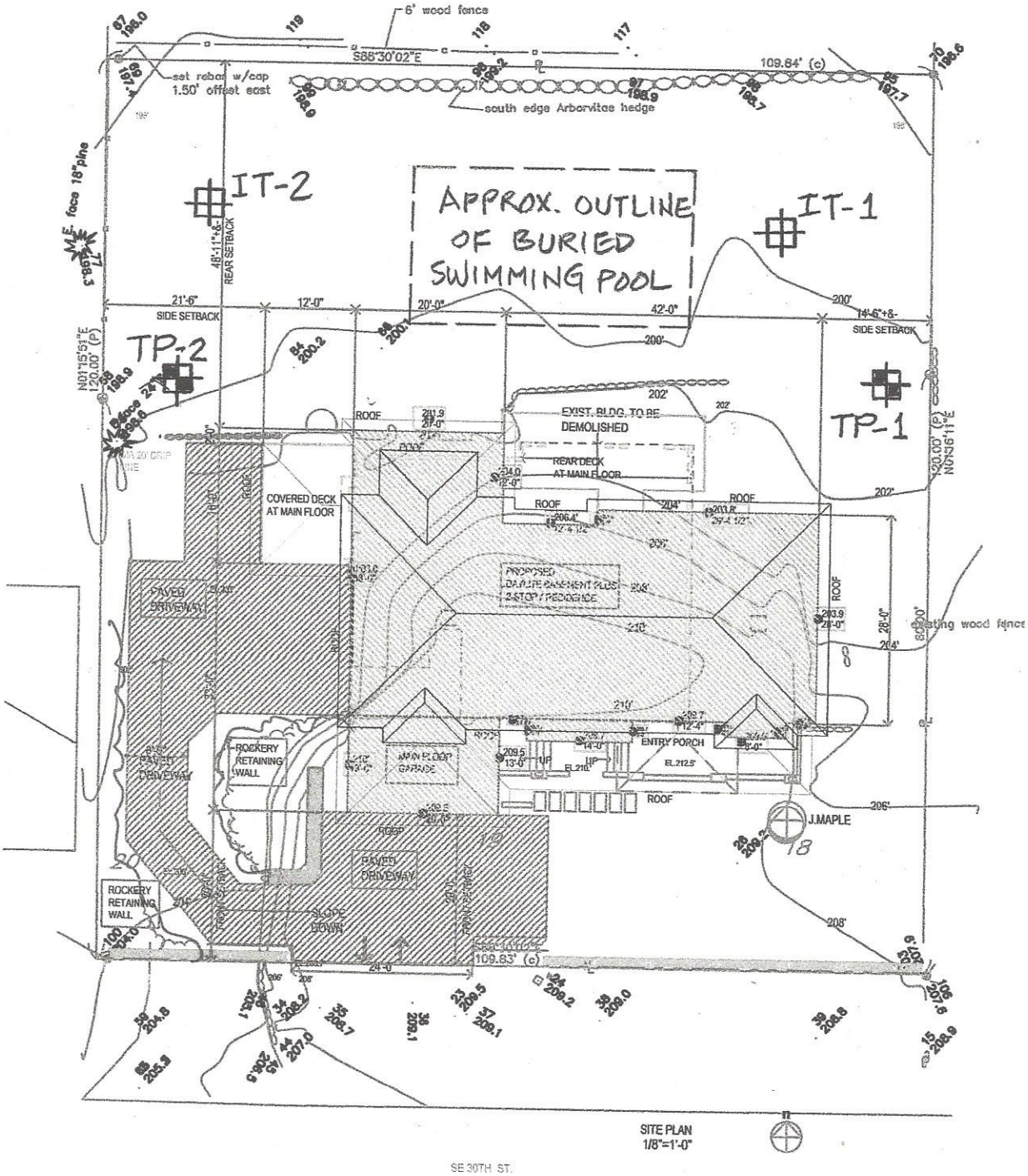

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SITE AND EXPLORATION LOCATION PLAN
PARK RESIDENCE
8244 SE 30TH STREET
MERCER ISLAND, WASHINGTON

JOB NO. 17-061	DATE 7/1/2017	PLATE 2

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE-GRAINED SOILS MORE THAN 50% RETAINED ON THE NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE-GRAINED SOILS MORE THAN 50% PASSING ON THE NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50%	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILTY AND CLAY LIQUID LIMIT 50% OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC SILT, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

NOTES:

1. FIELD CLASSIFICATION IS BASED ON VISUAL EXAMINATION OF SOIL IN GENERAL ACCORDANCE WITH ASTM D2488-83.
2. SOIL CLASSIFICATION USING LABORATORY TESTS IS BASED ON ASTM D2487-83.
3. DESCRIPTIONS OF SOIL DENSITY OR CONSISTENCY ARE BASED ON INTERPRETATION OF BLOW-COUNT DATA, VISUAL APPEARANCE OF SOILS, AND/OR TEST DATA.

SOIL MOISTURE MODIFIERS:

DRY - ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH

SLIGHTLY MOIST - TRACE MOISTURE, NOT DUSTY

MOIST - DAMP, BUT NO VISIBLE WATER

VERY MOIST - VERY DAMP, MOISTURE FELT TO THE TOUCH

WET - VISIBLE FREE WATER OR SATURATED, USUALLY SOIL IS OBTAINED FROM BELOW WATER TABLE

TEST PIT NO. 1

Logged By: JSL Date: 6/7/2017 Ground El. ±

Depth ft.	USCS CLASS.	Soil Description	Sample No.	W %	Other Test
1	SM	Tannish-brown, loose, silty fine SAND, trace gravel, moist (FILL?)			
5	SW	Light-gray, loose, gravelly, fine to medium SAND, moist (RECESSIONAL OUTWASH?)			
9	SM/ML	Light-brown, dense, silty fine SAND to fine-sandy SILT, weakly-cemented, moist (TILL like)			
10		Test pit terminated at 9.5 ft; groundwater not encountered.			

TEST PIT NO. 2

Logged By: JSL Date: 6/7/2017 Ground El. ±

Depth ft.	USCS CLASS.	Soil Description	Sample No.	W %	Other Test
1	OL	Dark-brown, loose, organic, silty fine SAND, over plastic liner, moist (FILL?)			
2	SM	Light-brown, loose, silty fine SAND, slightly-moist, moist			
6	SP	Brown-gray, loose to medium-dense, slightly-silty, fine SAND, slightly-moist (RECESSIONAL OUTWASH)			
9	SM	Light-brown, dense, silty fine SAND to fine-sandy SILT, trace gravel, weakly-cemented, moist (TILL like)			
10		Test pit terminated at 9.0 ft; groundwater not encountered.			

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TEST PIT LOGS
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JOB NO. 17-061 DATE 6/7/2017 PLATE 4