USGS Bretwich File

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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March 18, 2002

Mr. Scott Thomas
Burien Parks Department
425 SW 144th Street
Burien, WA 98166

RE: EVALUATION OF MASS WASTING, BRANSON PROPERTY, BURIEN, WASHINGTON

Dear Mr. Thomas:

This report presents our observations and conclusions regarding mass wasting processes on the Branson Property in Burien, Washington. We understand that the City of Burien is proposing to purchase a portion of the Branson property, and requires an understanding of the contribution of sediment from the upland part of the site to the beach along Puget Sound.

The scope of our services included (1) review of an existing geologic map; (2) reconnaissance of the site on March 15, 2002; and (3) the preparation of this letter report. No subsurface explorations were performed for this evaluation, except for shallow hand shovel holes 4 to 12 inches deep. The reconnaissance was performed with the aid of a topographic map prepared by the City of Burien Public Works Department. Mr. Laprade's familiarity with the subject hillside comes from his work on residential and municipal projects in the vicinity over the past 29 years, including Seahurst Park and the Erickson property, just north of the Branson property.

SITE DESCRIPTION

The subject property is located on a steep hillside bordering Puget Sound, on the western edge of Burien, as indicate on the Vicinity Map, Figure 1. It is just north of the western end of SW 149th Place. It is reached by walking along a footpath maintained by the Seahurst Community Club that extends from SW 149th Place down to the beach. South of the Branson property are

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continuously developed residential properties for a long distance. North of the Branson property, the shoreline is undeveloped for more than a mile, except for the Erickson residence, which is a few hundred feet north of the north edge of the Branson property. The waterfront dimension of the property is 247 feet, as approximately shown on the Site Sketch, Figure 2.

As shown on the Site Sketch, the property is a steeply sloping, west-facing hillside at the toe of which is the shoreline of Puget Sound. The site can be divided topographically into two parts. The southern 3/5 of the site is very steep (80 to 100 percent) and about 10 to 15 feet high at the toe, where it borders the beach. Above this steep area, the slope rises up to the east at about 70 percent to about elevation 70 feet, above which it then becomes steeper (80 to 100 percent). On the northern 2/5 of the site, the ground rises gently up from the beach at about 20 to 40 percent to about elevation 45 feet, above which it then rises steeply at 70 to 80 percent.

On the subject property, the shoreline is unprotected; however, a number of logs, ranging from 6 to 36 inches in diameter lie on the upper margin of the beach, offering some protection to the toe of the slopes. Just south of the property, a 4-foot-high rock bulkhead protects the shoreline around a concrete stormwater energy dissipator. This property is owned by the Seahurst Community Club. To the south of this strip of land, private residences are protected by concrete bulkheads. As indicated on Figure 2, a high density polyethylene (HDPE) pipeline traverses the hillside on the Seahurst Community Club's property. That property also contains the community foot trail that provides access to the shoreline.

Vegetation on the slope is comprised mostly of deciduous trees with dense undergrowth. In the southern 3/5 of the site, the entire slope is covered with alders and maples that are slightly to severely bowed in a downhill direction. Adjacent to the beach, the trees are either leaning over the very steep slope or are missing due to erosion of the shoreline bank. In the small creek near the southern property line, even a 4-inch-diameter alder is severely bowed downhill due to the movement of soil in which it is growing. The bowing of trees (sometimes referred to as "pistol-butting), is generally agreed to be indicative of soil creep, which is the imperceptible movement of the upper few feet of soil on a slope.

On the northern 2/5 of the site, the lower-gradient portion of the hillside within about 30 to 40 feet of the beach, is a wetland with soft, wet ground. The alders in this area are either bowed severely or tipped over toward the beach. The trees upslope of the wetland are also moderately to severely bowed downhill.

GEOLOGIC CONDITIONS

The soils previously mapped on and in the vicinity of the subject slope were deposited during the last glaciation of the central Puget Lowland. The geology in this area was mapped by Mr. Howard Waldron of the U.S. Geological Survey (USGS) in the "Geology of the Des Moines Quadrangle, Washington" (1962). This map indicates that the entire slope is underlain by Vashon-age (last glaciation of the central Puget Lowland) advance outwash deposits; however, the underlying glacial deposits are covered with colluvium. Colluvium is the loose, heterogeneous deposit of soil emplaced due to gravity on steep hillsides. Such a deposit can form in-place due to root loosening, freeze-thaw action, animal burrowing or from landslide or erosion deposits that originate at higher elevations. Colluvium ranges from 2 to 20 feet thick on slopes in the Puget Lowland.

On the slopes of the Branson site, no undisturbed glacial soils were observed, because they are covered with colluvium. However, based on exposures at Seahurst Park and the relationships known about the geology in this area, it is likely that Vashon advance outwash deposits overlie glaciolacustrine clay/silt, with the contact between the two geologic units at about 40 to 65 feet elevation. This assumption is based on the presence of springs at those elevations at this site, as shown on Figure 2. The glaciolacustrine deposit consists of hard, gray, clay/silt with fine sand lenses. This is only exposed on the beach, about 75 feet west of the shoreline. The advance outwash is a very dense, brown to gray, clean to silty, sand or gravelly sand. There is commonly a transition zone of interbedded sand and silt layers about 20 feet thick at the contact between the two geologic units.

As with nearly all slopes in the Puget Lowland, colluvium blankets the ground surface. The colluvium on the steeply sloping portions of this site consists of very loose to loose, silty to clean, gravelly, fine to medium sand, with some incorporated organics. The gravel ranges from ¼ to 3 inches. Colluvium in the wetland on the northern 2/5 of the site is comprised of very loose, fine sandy silt with numerous organics.

The beach deposits are comprised of a 2- to 3-inch-thick lag deposit of ¼- to 3- inch-diameter rounded gravel, underlain by sandy gravel with shell fragments. The thickness of the beach deposit is unknown, but it thins to nothing about 75 feet west of the shoreline. At that point, the hard, gray silty clay is exposed on the beach.

Groundwater was observed at about elevation 65 feet at the head of a small chute near the southern property line. The springs form a small creek that runs down the chute to the shoreline. In the central portion of the site, at about elevation 40 feet, springs emerge from the hillside in an area about 40 feet wide. Their waters coalesce and flow to the shoreline in a small creek. Near the north property line, diffuse water emerges from the gentle slope at about elevation 25 feet. This water flows to the beach in two places, as shown on Figure 2.

Mass movement (slope instability) is apparent in three forms at this site.

(1) At the south edge of the site, a debris chute is present. Such a chute empties periodically, depositing soil at the toe of the chute. A debris deposit is present at site A, as indicated on Figure 2. The debris deposit is comprised of a fan of very loose, silty, gravelly sand. The toe of the deposit is being eroded by storm waves. There is evidence that such a process has also occurred at the head of the central springs, but no debris deposits remain at the toe of the slope, presently. However, the presence of gravel throughout the length of the small creek indicates that gravel is delivered occasionally to the beach.

(2) At site B, which appears to be a thick landslide deposit, the toe of the slope is oversteepened and cut by arcuate bowl-shaped slumped areas. These features are indicative of local undercutting by storm wave action and/or slumping due to local seepage pressures. The materials that comprise this very steep bank are clean to slightly silty, gravelly sand.

(3) At sites C and D, the spring-fed creeks are actively carrying silt, fine sand and fine organics to the beach. In some cases, the fine sediment is temporarily blocked by logs on the beach, but this material is then periodically entrained by storm waves.

CONCLUSIONS

In our opinion, the subject site is not a large supplier of sediment to the beach environment, such as some large "feeder bluffs" in other parts of the Puget Sound; however, there is no doubt that the Branson slope is a regular and consistent supplier of coarse and fine sediment due to mass movement processes. The sand and gravel on the beach are a reflection of the materials that are on the slope to the east of the beach. The coarse sediment is primarily supplied by debris flows in the chute on the south edge of the property and from periodic erosion of the toe of the very steep slope just north of the debris chute. As the colluvium moves inexorably downhill and the debris fan deposit is eroded, this material is incorporated into the beach deposits, which is comprised of sand and gravel.

Fine sediment (fine sand and silt) is delivered to the beach environment by spring runoff on the northern 2/5 of the site, and also by its separation out of the coarse deposits on the southern 3/5 of the site.

CLOSURE

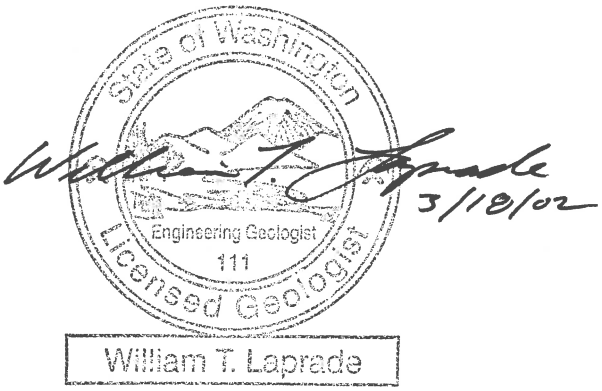
The conclusions presented in this letter are based on observed site conditions as they existed at the time of our site visit. It is not possible to fully define the geologic conditions at the site based on our limited observations. This work was done in accordance with generally accepted geologic practice in this area at this time. No other warranty is made, either expressed or implied.

We have prepared an enclosure, "Important Information About Your Geotechnical Report," to assist you in the use of this letter.

We appreciate the opportunity to serve you. If you have any questions or comments, please contact me at 206-695-6891.

Sincerely,

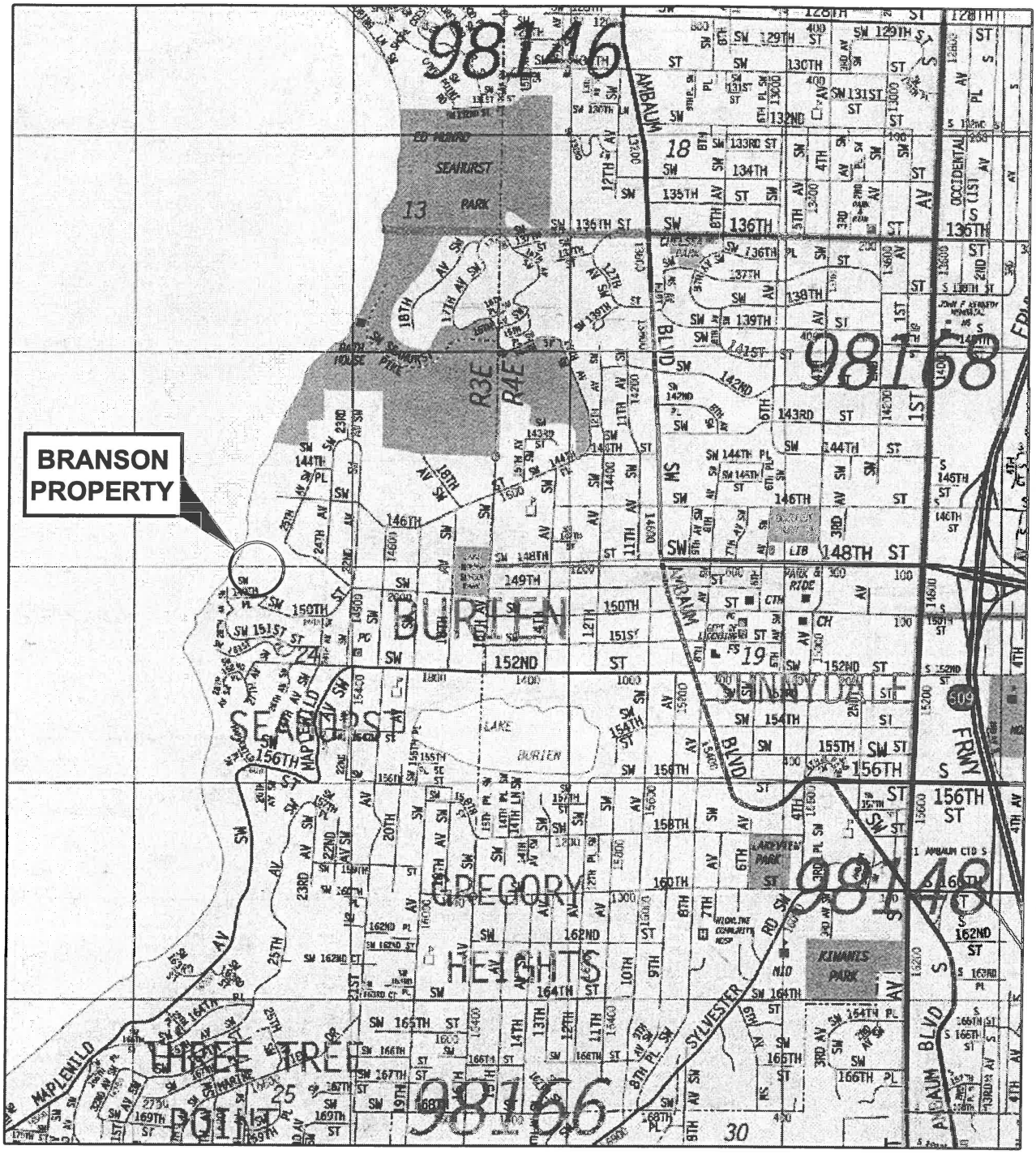
SHANNON & WILSON, INC.



William T. Laprade, C.E.G.
Vice President

WTL/wtl

Enclosures: Figure 1 – Vicinity Map
Figure 2 – Site Sketch
Important Information About Your Geotechnical Report



NOTE

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Burien Parks Department
Branson Property
Burien, Washington

VICINITY MAP

March 2002 21-1-09670-001

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FIG. 1

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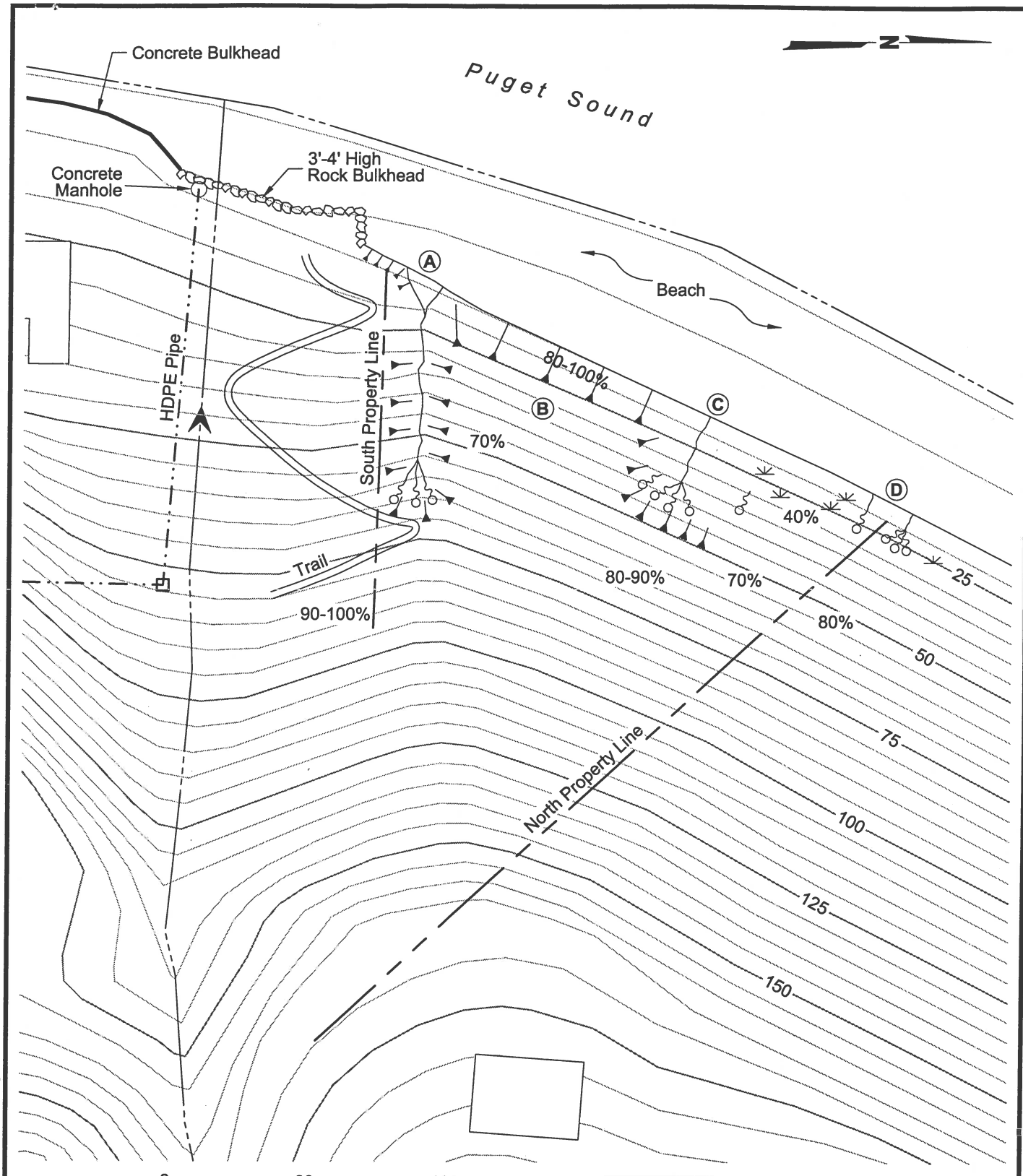

LEGEND

(A) Sites Referred to in Report Text

NOTE

Figure based on drawing provided by City of Burien 3-14-02.

Burien Parks Department
Branson Property
Burien, Washington

SITE SKETCH

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FIG. 2

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Attachment to and part of Report 21-1-09670-001

Date: March 18, 2002
To: Mr. Scott Thomas
Burien Parks Department

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland