Chapter 1 Geotechnical Operations and Administration

1.1 Scope of Geotechnical Design, Construction, and Maintenance Support

The focus of geotechnical design, construction, and maintenance support within the context of WSDOT is to ensure that the soil or rock beneath the ground surface can support the loads and conditions placed on it by transportation facilities. Typical geotechnical activities include the following:

- subsurface field investigations
- geologic site characterization, laboratory testing of soil and rock
- structure foundation and retaining wall design
- soil cut and fill stability design
- subsurface ground improvement
- seismic site characterization and design
- rock slope design
- unstable slope management
- unstable slope (e.g., rock fall, landslides, debris flow, etc.) mitigation
- infiltration, subsurface drainage and related hydrogeologic design
- material source (pits and quarries) evaluation
- long-term site monitoring for geotechnical engineering purposes
- support to Regional construction staff regarding geotechnical issues and contractor claims
- support to Regional maintenance staff as geotechnical problems (e.g., landslides, rock fall, earthquake or flood damage, etc.) arise on transportation facilities throughout the state

A geotechnical investigation is conducted on all projects that involve significant grading quantities (including state owned materials source development), unstable ground, foundations for structures, and ground water impacts (including infiltration). The goal of the geotechnical investigation is to preserve the safety of the public who use the facility, as well as to preserve the economic investment by the State of Washington.

As defined in this manual, geotechnical engineering is inclusive of all the aspects of design and construction support as described above, and includes the disciplines of foundation engineering and engineering geology. Geotechnical engineering shall be conducted by engineers or engineering geologists who possess adequate geotechnical training and experience. Geotechnical engineering shall be conducted in accordance with regionally or nationally accepted geotechnical practice, and the geotechnical engineering practice as defined by this manual. Geotechnical engineering shall be performed by, or under the direct supervision of, a person licensed to perform such work in the state of Washington, who is qualified by education or experience in this technical specialty of engineering per WAC 196-27A. For work that does or

does not require certification by a professional engineer, but does require certification by a licensed engineering geologist (LEG), such work also shall be performed by, or under the direct supervision of, a person licensed to perform such work in the state of Washington, who is qualified by education or experience in this technical specialty per WAC 308-15.

1.1.1 Geotechnical Design Objectives for Project Definition Phase

For the project definition phase, the geotechnical recommendations provided will be at the conceptual/feasibility level, for the purpose of developing a project estimate to establish the transportation construction program to be approved by the legislature. The investigation for this phase usually consists of a field reconnaissance by the geotechnical designer and a review of the existing records, geologic maps, and so forth. For projects that lack significant geotechnical information or are complex, test pits/borings may be completed and/or geophysical investigation performed at critical locations for development of the project definition with approval of the State Geotechnical Engineer.

A key role of the geotechnical designer in this stage of a project is to identify potential fatal flaws with the project, potential constructability issues, and geotechnical hazards such as earthquake sources and faults, liquefaction, landslides, rockfall, and soft ground, for example. The geotechnical designer shall provide conceptual hazard avoidance or mitigation plans to address all the identified geotechnical issues. An assessment of the effect geotechnical issues have on construction staging and project constructability must be made at this time. Future geotechnical design services needed in terms of time, cost, and the need for special permits to perform the geotechnical investigation (critical areas ordinances), are determined at this time. This preliminary geotechnical information is intended to inform where significant modifications to the preliminary design should be considered prior to advancing to the design stage and where significant cost impacts may be realized, such as relocation of the alignment, horizontal and vertical alignment changes, addition or elimination of structures, etc. Geologic/geotechnical input during this initial project phase is critical for complex projects.

1.1.2 Geotechnical Design Objectives for Project Design Phase

It is in this phase that the Region office, or civil consultant, refines and defines the project's alignment, sets profiles and grade, and identifies specific project elements to be addressed by specialty groups within WSDOT, or other consultants. Once the preliminary project elements and alignments for the project are established, the geotechnical designer will assess feasible cut and fill slopes to enable the Region or civil consultant to establish the right-of-way needs for the project. Where walls may be needed, using approximate wall locations and heights identified by the Region, an assessment of feasible wall types is performed by the geotechnical designer, primarily to establish right-of-way and easement needs (as is true for slopes).

The Region will identify potential locations for infiltration/detention facilities, and the geotechnical designer shall begin investigating and assessing if the selected sites are suitable for infiltration. The geotechnical data and analysis needed to assess infiltration/detention facility size and feasibility, including the seasonal ground water measurements necessary to meet the requirements in the *Highway Runoff Manual*

(HRM) are also obtained. Sizing of the infiltration/detention facilities is conducted at this time to make sure enough right-of-way is available to address the project storm-water requirements.

Conceptual and/or more detailed preliminary bridge foundation design, for example, Type, Size, & Location (TS&L), if required, may be conducted during this phase, if it was not conducted during project definition, to evaluate bridge alternatives and develop a more accurate estimate of cost.

Before the end of this phase, the geotechnical data necessary to allow future completion of the PS&E level design work is gathered (final geometric data, test hole data, and so forth.)

1.1.3 Geotechnical Design Objectives for PS&E Development Phase

It is in this phase that final design of all geotechnical project features is accomplished. Recommendations for these designs, as well as special provisions and plan details to incorporate the geotechnical design recommendations in the PS&E, are provided in the geotechnical reports and memorandums prepared by the geotechnical designer. This manual, AASHTO Specifications, and WSDOT's various engineering publications provide specific design requirements for this phase of design. Detailed recommendations for the staging and constructability of the project geotechnical features are also provided.

1.2 Role of Offices Providing In-House Geotechnical Design, Construction, and Maintenance Support

1.2.1 Lead Role for WSDOT Regarding Geotechnical Policy and Design

Based on an executive level policy decision initiated in 1980, formally implemented in 1983, and later formally documented in the *Design Manual* M 22-01, geotechnical design, construction support, and maintenance support functions are centralized as a Headquarters function. As a result of this executive decision, the Headquarters (HQ) Materials Laboratory was directed to begin obtaining staff with specialized geotechnical expertise and to maintain that specialized expertise. The regions were directed to retain the Region Materials Engineer position, and that Region Materials staff be trained in the area of soils to the degree possible to be able to function as an effective liaison with the HQ Materials Laboratory geotechnical personnel. However, the major geotechnical work (see Section 1.2.2) is to be conducted by the HQ's staff, based on this executive policy.

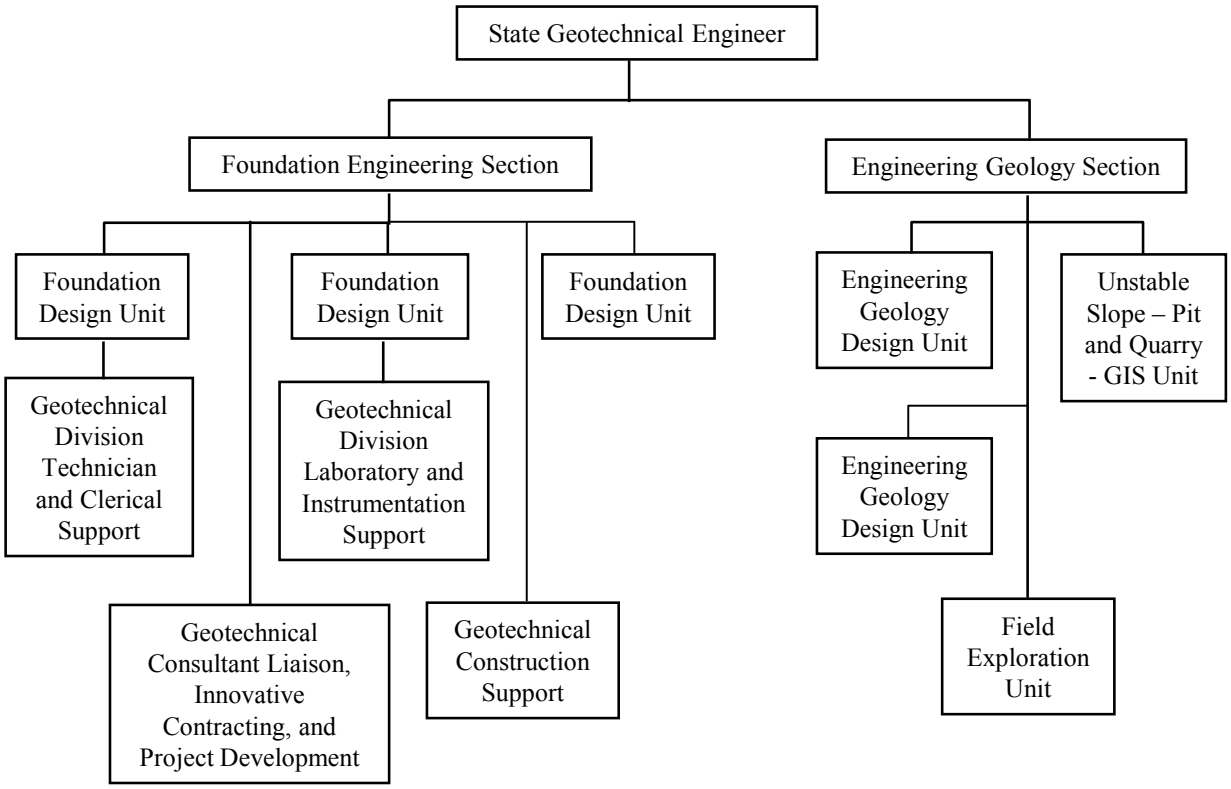
The Geotechnical Office, within the Construction Division, hereinafter referred to as the Geotechnical Office, is the State's expert for all geotechnical design and construction work. The Geotechnical Office provides direct geotechnical design, technical oversight for all consultant geotechnical design, and quality verification on design-build projects.

How the geotechnical design will be accomplished will be identified in the Project Management Plan (PMP) at the initiation of a project. The PMP will include the initial scope, schedule and budget of the geotechnical design work. As the project develops, scope schedule and budget may be revised through the change management plan. The PMP will also include how the project manager, Region Materials Lab and

the Geotechnical Office will work together to provide the oversight and expertise necessary to retain a strong owner role, thus ensuring a geotechnical design product that is consistent with WSDOT policy and developed in the best interest of the state.

The Geotechnical Office provides the lead regarding the development and implementation of geotechnical design policy for WSDOT. The State Geotechnical Engineer is the final approval authority for geotechnical policy, and for geotechnical investigations and designs conducted statewide for WSDOT projects. Geotechnical policies are contained in the *Design Manual* (e.g., Chapters 610, 630, and 730), the Standard Plans, the Standard Specifications, and in General Special Provisions in addition to this *Geotechnical Design Manual*. The State Geotechnical Engineer is also the final approval authority regarding geotechnical designs conducted by others (e.g., local agencies, developers, etc.) that result in modification to transportation facilities that are under the jurisdiction of WSDOT or otherwise impact WSDOT facilities. For cases where geotechnical design is being conducted by others on behalf of WSDOT, such as by consultants working directly for WSDOT and geotechnical consultants working for design-builders, where this GDM states that approval of the WSDOT State Geotechnical Engineer is required, that approval authority is not transferrable to the designer of record (e.g., for a design-builder). Where this GDM states that approval by the State Geotechnical Engineer is required, these are WSDOT design policy issues, not designer of record design decisions. See Section 22.6 for additional discussion on this issue as it applies to design-build contracts.

The functional structure of the Geotechnical Office is provided in Figure 1-1.



Functional Organization of the WSDOT Geotechnical Office
Figure 1-1

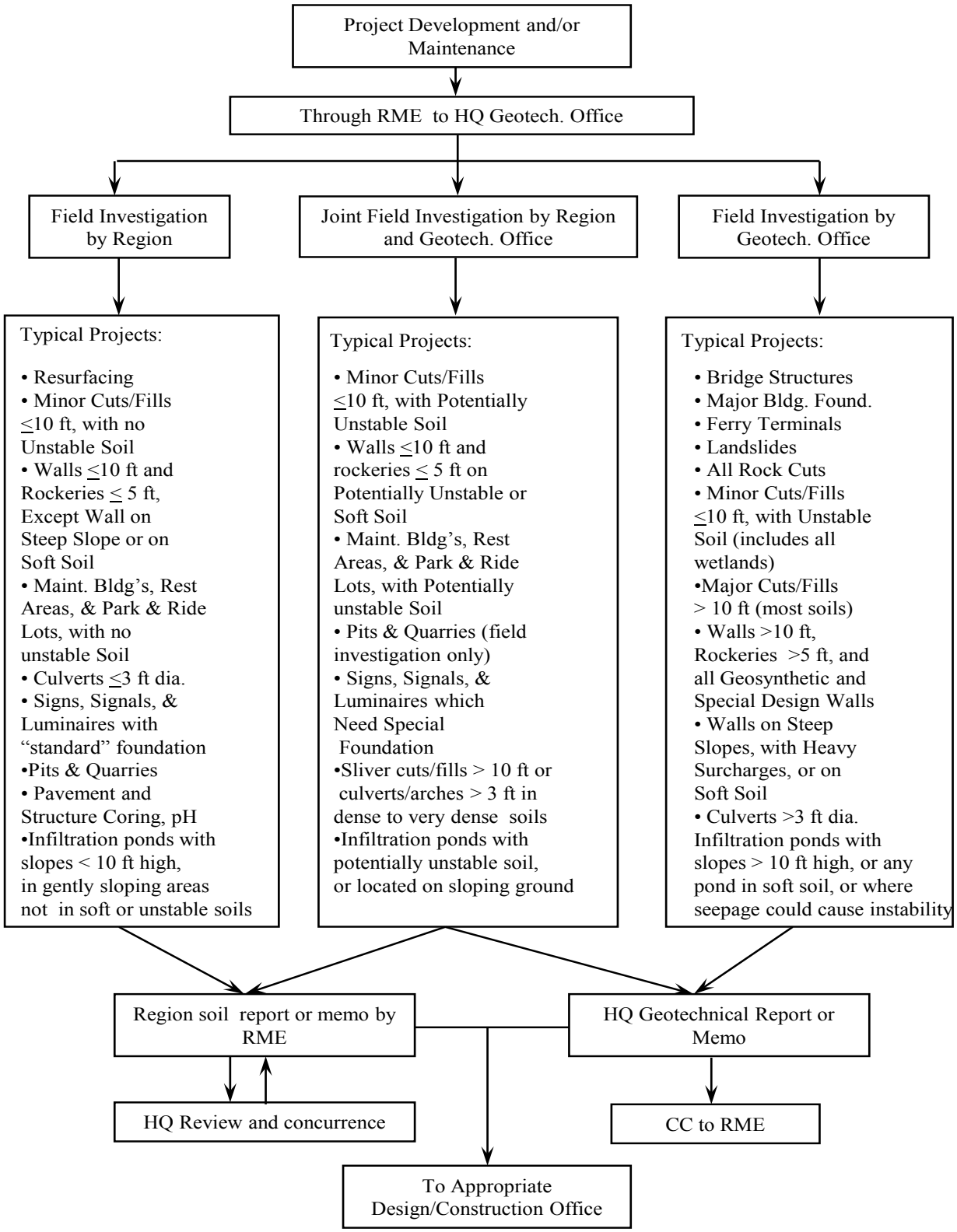
1.2.2 Geotechnical Functions Delegated to the Regions

Some geotechnical functions have been delegated to the Region Materials Engineers (RME), as described in the *Design Manual* M 22-01 Chapter 610. In general, the RME functions as the initial point of contact for all geotechnical work, with the exception of Bridge Office, Washington State Ferries (WSF), and Urban Corridors Office (UCO) projects. If the geotechnical work required is relatively straightforward (in that the ground is stable and relatively firm, bedrock is not involved, the design is not complicated by high ground water or seepage, and the design of the project geotechnical elements does not require specialized geotechnical design expertise), the RME takes the lead in conducting the geotechnical work. If this is not the case, the RME asks for the involvement and services of the Geotechnical Office. The Geotechnical Office responds to and provides recommendations directly to the WSDOT Office responsible for the project, but always keeps the RME informed. For structural projects (bridges and tunnels, for example), the Bridge and Structures Office works directly with the Geotechnical Office. For WSF projects, the Terminal Engineering Office works directly with the RME or the Geotechnical Office, depending on the nature of the project. For UCO projects, the Geotechnical Office handles all geotechnical work.

General guidelines and requirements regarding coordination of geotechnical work are provided in the *Design Manual* M 22-01 Section 610.04. Figure 1-2 illustrates the division of geotechnical design responsibility between the region materials offices and the Geotechnical Office and is consistent with the *Design Manual.* The Region Materials Engineers (RME) and their staff, and the Geotechnical Office personnel should communicate on a regular basis as projects requiring geotechnical input develop. The RME should be viewed as the Geotechnical Office's representative in the region. The RME's function as the initial point of contact for geotechnical work in their respective regions in that the RME will be evaluating the projects included in the construction program within their respective regions at the beginning of the design phase for those projects, and deciding if the nature of the work included in those projects will require Geotechnical Office involvement and design support. Similarly, during the project definition phase, the RME functions as the initial point of contact regarding geotechnical issues. If it appears the nature of the geotechnical issues that need to be addressed to develop an accurate project definition will require Geotechnical Office assistance, the RME is responsible to contact the Geotechnical Office to obtain geotechnical input for the project. Figure 1-2 should be used as a guide for this purpose for project definition, design, and PS&E development, but some judgment will be required, as specific projects and/or conditions may not completely fit the project categories listed in Figure 1-2. The RME office and the Geotechnical Office must view themselves as a team to get the geotechnical work accomplished from project inception to completion of the construction. If the RME is not sure if Geotechnical Office involvement is needed, the RME and Geotechnical Office should discuss the project needs together.

For geotechnical work that is clearly the responsibility of the RME to complete based on Figure 1-2, the RME should complete the geotechnical subsurface site investigation plan, perform the design, and complete the region soils report. For those regions that do not have the resources (i.e., drill crews) to carry out the geotechnical subsurface site investigation, the RME submits the plan to the State Geotechnical Engineer, or the individual delegated to act on behalf of the State Geotechnical Engineer. In this case, the subsurface site investigation is carried out by the Geotechnical Office's Field Exploration Unit. If the results of the site investigation demonstrate that the project geotechnical design is still a RME responsibility, the data from the site investigation will be provided to the RME and the RME will complete the geotechnical design and report. If the subsurface conditions are such that HQ involvement is required, the Geotechnical Office will discuss the design responsibility with the RME. If, due to the nature of the project or the potential subsurface conditions, it is not clear if the design will be a HQ or region responsibility, the RME should contact the Geotechnical Office for assistance in planning, and if necessary to carry out, the geotechnical investigation and design.

With regard to division of work between the Geotechnical Office and the RME, Figure 1-2 indicates that HQ involvement is required if the soils appear to be soft or unstable. As a general guide, granular soils classified as loose or very loose (i.e., $N \leq 10$ blows/ft) and clays classified as very soft to stiff ($N \leq 15$ blows/ft) should be considered potentially unstable, especially if they are wet or are exhibiting signs of instability such as cracking or slumping. When such soils are encountered by the RME, whether or not the work should be retained by the RME should be discussed with the Geotechnical Office to determine of more detailed input from HQ regarding the stability of the soils encountered is needed.



Geotechnical Design Workflow and Division of Responsibility
Figure 1-2

1.2.3 Coordination between HQ's and Region Regarding Emergency Response

The need for emergency geotechnical response is primarily the result of slope failure, rockfall events, flooding, or earthquakes. For the case of slope failure (including retaining walls) and rockfall events, and slope failure caused by flooding or earthquakes, the following process should be used:

1. Once the failure occurs, Region Maintenance conducts an initial evaluation of the site.
2. If there is any question as to the stability of the affected slope and the potential for future slope movement or rockfall, the Region Maintenance Office should contact the Regional Materials Engineer (RME).
3. The RME performs a site review as soon as possible to assess the magnitude of the problem, and to determine if Geotechnical Office assistance is needed. To save time, the RME may, at the RME's discretion, skip the RME field review and transfer the field review and all design responsibilities fully to the Geotechnical Office, if it is obvious that HQ involvement will be needed. If it is determined that a detailed geotechnical evaluation by the Geotechnical Office is not needed (e.g., conditions are not geologically complex, the failure is limited in extent, and the risk of continued slope movement or instability is low, and slope stabilization methods are not required), the RME provides recommendations to complete the cleanup and facility repair.
4. If it is determined that there is a real threat of continued slope movement, instability, or rockfall, there are geological complexities at the site that will require a more detailed geotechnical analysis to assess the potential threat, or if an engineered slope stability mitigation may be required, the RME immediately contacts the Geotechnical Office to complete the initial evaluation. This contact may initially take the form of a phone call and/or e-mail with photos, and as soon as possible a joint site review, if the Geotechnical Office feels it is warranted.
5. The Geotechnical Office specialist(s) responds as soon as possible and comes to site to make an initial assessment. The specialist provides the Region (on site) with that assessment and the risk(s) associated with that assessment. The assessment includes evaluation of the cause(s) of the instability, the potential for future instability, whether or not the threat of future instability is immediate, the potential threat to public and worker safety, and the need for slope stabilization measures.
6. The Region (typically a project office) should use the field recommendations provided by the Geotechnical Office specialist to begin developing a scope of work and cost estimate to complete the emergency work concurrently with Geotechnical Office management review of the field recommendations, and will immediately contact the region if any changes in the recommendations are needed as a result of the technical review of the recommendations.

7. Based on the assessment and recommendations, the Region evaluates risk(s) and cost to mitigate the problem. The Region then makes a decision to either immediately repair the slope and facility, opening up the facility to the public, or to close, maintain closure, or otherwise limit facility public access. If the risk is too high to immediately repair the facility and/or open it up to full public access, the Region requests the Geotechnical Office for a more complete evaluation and stabilization recommendation.
8. Once stabilization recommendations are developed, the slope is stabilized, and the facility is reopened. During the stabilization construction activities, the point of contact to address any problems that occur and to review the acceptability of the finished stabilization measures is the office which developed the stabilization recommendations.
9. Since multiple activities conducted by several offices must occur simultaneously to address an emergency slope problem, frequent stakeholder meetings or conference calls should be conducted throughout the duration of the emergency project (design and construction) to keep all stakeholders informed and to make intermediate decisions as needed. These stakeholder meetings or conference calls should occur at key junctures in the development of the project, or as needed based on the specific needs and duration of the project.

Flood or seismic events can also result in emergency conditions that need geotechnical evaluation. Other than the slope stability issues addressed above, such events can affect the integrity of bridges and other structures. In these situations, other than keeping the RME informed of the situation, the process for geotechnical evaluation primarily involves the Bridge Office. If the structure is under the jurisdiction of WSF, then WSF would be responsible to initiate the geotechnical investigation instead of the Bridge Office. In these cases, the process is generally as follows:

1. Once the failure or structure distress occurs and becomes known, the Bridge Office (or WSF for marine and terminal work) conducts an initial evaluation of the structure.
2. If there is damage or potential damage to the structure foundation, the Bridge Office or WSF contacts the Geotechnical Office to conduct an initial evaluation to assess the problem, identify potential risks to the structure and the public, and develop preliminary solutions. The HQ Geotechnical Office should notify the RME regarding the problem at this point, and discuss with the RME any involvement the Region Materials Office may need to have.
3. Based on this initial evaluation, the Bridge Office, in concert with the Region, or WSF in the case of marine or terminal facilities, determines whether or not to restrict public access, or to close the facility, and whether or not to proceed with a more complete geotechnical investigation to develop a repair or replacement for the structure foundation.
4. If it is determined that a more complete geotechnical investigation is needed, the Geotechnical Office proceeds with the investigation and develops design recommendations.

1.3 Geotechnical Support within the WSDOT Project Management Process (PMP)

By Executive Order E1032.00, all phases of WSDOT capital transportation projects are to be delivered according to the principles and practices of the Project Management Process (PMP). In general, the PMP includes five main steps. These steps are "Initiate and Align," "Plan the Work," "Endorse the Plan," "Work the Plan," and "Transition and Closure."

Prior to or during the initiate-and-align step, the project manager should contact the RME to determine if the nature of the project could require Geotechnical Office involvement. If it appears that Geotechnical Office involvement may be required, the RME should make arrangements to have a Geotechnical Office representative included in PMP activities. Note that at this point, detailed project site data will likely not be available. Therefore, this determination by the RME will likely need to be made based on conceptual project data, and possibly a project site review. This determination must be made early in the project development process. For example, if the project is defined for PMP to include the development of the project definition (see Section 1.1.1), this determination must be made at the beginning of the project definition phase. If the project is defined instead to include only the project design and PS&E development phases (see Sections 1.1.2 and 1.1.3), this determination must be made at the beginning of the project design phase, as the office responsible for the geotechnical design work should be included in the planning for the project.

1.3.1 Initiate and Align

Assuming geotechnical design services will be needed to complete the project, during the "Initiate and Align" step, the individual/office responsible to provide geotechnical support (i.e., either the Geotechnical Office, the RME Office, or both) should be included in the project team by the project manager. Once included in the team, the geotechnical PMP team member (in general, this individual is also the geotechnical designer for the project) should, as a minimum, participate in the "Initiate and Align" efforts to provide input regarding roles and responsibilities, boundaries, and measures of success.

1.3.2 Plan the Work

During the "Plan the Work" step, the geotechnical PMP team member should provide input to the team regarding the project specific Work Breakdown Structure (WBS) developed from the Master Deliverables List (MDL), and the input necessary to develop the project budget and schedule. This would include a detailed analysis of how long it will take to perform the geotechnical tasks needed to complete the project, any individual task dependencies that affect task sequencing and the interrelationship between the geotechnical tasks and tasks to be completed by other team members, and how much it will cost to complete those tasks. It is the responsibility of the geotechnical PMP team member to coordinate the resource needs for the subject project with the resource needs of other projects that require geotechnical input, so that the proposed project delivery schedule can be achieved. The geotechnical PMP team member will also coordinate with the project team and with the Geotechnical Office management regarding the decision to use geotechnical consultants, if required to achieve the desired project schedule milestones. The

geotechnical PMP team member also provides technical oversight of and coordination with any geotechnical consultants being used for the project.

The geotechnical PMP team member should also provide input to the team regarding potential risks or changes in the geotechnical area that could affect project schedule, budget, or scope, and provide a strategy to deal with those risks or changes. Examples of geotechnical risk include potential difficulties in getting drilling permits or right-of-entry, uncertainties in the scope of the geotechnical investigation required due to unknown subsurface conditions, mitigation of unstable ground, liquefaction or other seismic hazards, etc.

The geotechnical PMP team member should also provide the team with a plan regarding how geotechnical investigation and design quality, as well as how the accuracy of geotechnical design schedule and budget, will be assured.

1.3.3 Endorse the Plan

Once the work has been planned, the next step is to "Endorse the Plan." In this step, the geotechnical aspects of the Project Management Plan should be endorsed by the management of the office responsible to carry out the geotechnical work (e.g., if the Geotechnical Office is responsible for completing geotechnical work for the project, the Geotechnical Office management should endorse the plan). Note: The Project Management Plan must be reviewed and endorsed by Region Management.

1.3.4 Work the Plan

In the "Work the Plan" step, the geotechnical PMP team member will track the schedule and budget for the geotechnical work as it progresses, keeping the project team informed regarding the progress of the geotechnical work as identified in the project Communication Plan. If changes in the geotechnical schedule and/or budget are likely due to unanticipated problems, scope changes, or other inaccuracies in the geotechnical schedule or budget, the geotechnical PMP team member is responsible to inform the project team as far in advance as possible so that adjustments can be made. The frequency of reporting to the team on the progress of the work is identified in the Communication Plan and should be decided based on the needs of the project, recognizing that excessive progress reporting can, in itself, impact the schedule and budget for the work due to the time it takes to develop the interim reports. As problems or changes occur in the project, the geotechnical PMP team member assists the project team to address those problems or changes.

In general for this step, the geotechnical PMP team member completes, or arranges for the completion, of the geotechnical report for the project, and assists the team in the development of contract documents needed to construct the project. In the case of design-build projects, see Chapter 22 regarding the deliverables needed.

1.3.5 Transition and Closure

The geotechnical PMP team member should coordinate with the project team regarding the "Transition and Closure" activities that require geotechnical input and assistance. This may include documenting the geotechnical design decisions made, and identifying construction contract specifications that need to be reevaluated at a later time, should the project PS&E be put on the shelf until adequate funding

is available. The geotechnical PMP team member should also make the geotechnical project file ready for long-term storage, making sure that if another geotechnical designer must work on the project, that the calculations and logic for the decisions made are easy to follow.

1.3.6 Application of the PMP to Construction

If possible, the geotechnical PMP team member should continue to provide geotechnical support to the project through construction, functioning as the Geotechnical Advisor for the construction project, to minimize any transition issues between the design and construction phases. The Geotechnical Advisor would become part of the construction project team in the initiate and align step, and would participate with the team to define roles and responsibilities, boundaries, and Measures of Success, assist in planning for risk and/or change, assist in the quality assurance and control of the project geotechnical features, and help the project team to manage risks and change as they occur.

1.3.7 Master Deliverables to be Considered

The geotechnical PMP team member will need to provide information regarding the geotechnical deliverables and tasks in the Master Deliverables List (MDL) (see Table 1-1) to the project team for consideration in developing the project schedule. For many deliverables, the region Project Office will need to provide information before the geotechnical work can begin. The master deliverables provided in Table 1-1 are current as of August 2006. Note that scoping (termed "Project Definition" in Section 1.1.1), Design, and PS & E are combined into one phase, "Preconstruction", in the MDL.

All tasks and subtasks under WBS Code PC-21 in Table 1-1 are used to accomplish the geotechnical work needed to complete the project definition (see Section 1.1.1). Regarding “Preliminary Site Data” (WBS Code PC-21.01), this information should be provided by the Project Office to the RME to be consistent with the process described in Sections 1.2.2 and 1.3. Refer to the *Design Manual* M 22-01, Section 610.04 for specifics regarding what information is to be submitted. Note that for the bigger, more complex projects where some limited field explorations may be needed, this task would also require the project office to obtain, or to make arrangements to obtain, drilling permits and right-of-entry. Supplying the necessary site data and permits should be considered a predecessor task to MDL task PC-21.03.

If it appears that Geotechnical Office involvement may be required, the RME should make arrangements to have a Geotechnical Office representative included in the geotechnical work to complete the project definition as discussed previously. Each office that is involved provides input data for these deliverables in terms of time and cost to complete the task, and the deliverables themselves. If both offices are involved, the Project Office will need to add the cost required to accomplish the work from both offices to obtain the total cost for each task.

Regarding the schedule to complete PC-21.03, the RME and Geotechnical Office efforts can, in general, be conducted concurrently. Regarding the “Conceptual Geotechnical Report,” up to two reports may need to be produced, one for the RME work and one for the Geotechnical Office work, if both offices need to be involved

in this project phase for the given project. This deliverable should contain the cost estimate, schedule, and scope of work to complete the final project design through PS&E, and should discuss the potential geotechnical risk issues that need to be addressed to construct the project, to establish the scope and budget to construct the overall project.

WBS Code	Task Name	Task Description	Work Op
PC-18.03	Discipline Reports - Earth (Geology & Soils)	*Environmental Procedures Manual* Section 420 Earth (Geology & Soils)	0136
PC-20.03	Materials Source Report	A report on a specific WSDOT material source that verifies the quality and quantity of the material requested	0156
PC-21	Geotechnical Evaluations	Development of Geotechnical reports for project.	
PC-21.01	Preliminary Site Data	Project design office is to provide a project description and location of work to be performed to Region Materials Engineer. See *Design Manual* M 22-01 Chapter 610.	0140
PC-21.02	Environmental Permit for Field Exploration	Field exploration may require permits to complete. Permits need to be provided by the Project Office to Geotechnical Office/Region Materials Office to enable required field work to be started.	0138
PC-21.03	Conceptual Geotechnical Report	RME/Geotechnical Office will provide recommendations at the conceptual / feasibility level. Some soil borings may be drilled at this time depending upon project scope and available information.	0140
PC-21.04	Project Site Data	Site information provided to RME by the project design office (specific to the type of project) to initiate geotechnical work on a project during the design and PS&E phases. See *Design Manual* M 22-01 Chapter 610.	0140
PC-21.05	RME Geotech Report(s)	Region Geotechnical Report containing geotechnical recommendations and information applicable to the project. There is a possibility of multiple reports, depending upon the scope and complexity of the project.	0140
PC-21.06	HQ Geotechnical Report(s)	HQ Geotechnical Report containing geotechnical recommendations and information applicable to the project. There is a possibility of multiple reports, depending upon the scope and complexity of the project.	0140
PC-37.02	Summary of Geotechnical Conditions	Geotechnical Office and/or Region Materials prepares summary of geotechnical conditions for inclusion into the PS&E as Appendix B.	0140
PC-43.03	Project Geotechnical Documentation Package	Printing of pertinent geotechnical reports for sale to prospective bidders. Prepared by Geotechnical Office and/or Region Materials and printed by HQ Printing Services.	0140

Geotechnical Items in Master Deliverables List (MDL)
Table 1-1

WBS codes PC-21.04, PC-21.05, PC-21.06 and WBS codes PC-37.02 and PC-43.03) in Table 1-1 are used to accomplish the geotechnical work to complete the project design and final PS&E (see Sections *1.1.2* and 1.1.3). Regarding "Project Site Data" (WSB code PC-21.04), the Project Office provides the site data to the office designated to take the lead (i.e., the Geotechnical Office, the RME, or both) regarding the geotechnical work, as determined during the "Initiate and Align" step for the project.

Refer to the *Design Manual* M 22-01 Section 610.04 for specifics regarding the information to be submitted. This task would also require the project office to obtain, or to make arrangements to obtain, drilling permits and right-of-entry, if the necessary permits were not obtained in WBS code PC-21.02 or if they need to be amended. Supplying the necessary site data and permits should be considered a predecessor task to MDL tasks PC-21.05 and PC-21.06. The RME and Geotechnical Office efforts can, in general, be conducted concurrently. Note that WBS Codes PC-21.05 and PC-21.06 must be completed before WBS Codes PC-37.02 and PC-43.03.

1.4 Geotechnical Report Review Process, Certification and Approval Requirements

The following sections provide minimum requirements to insure the quality of the geotechnical work conducted by or for WSDOT.

The following terms are used herein:

Quality Control (QC) -- QC is performed by the individual performing the work while the work is being performed and includes all activities performed to control the level of quality produced in the end product. It consists of self-checking to ensure that work is completed in conformance with this manual and standards of practice. It includes checking for errors, omissions, and making sure that all the project elements work together coherently.

Quality Assurance (QA) -- Is performed by a person's supervisor or another individual not involved in the technical details. It is a system of external review and audit procedures conducted as an independent objective review by a third party to assess the effectiveness of the QC program and the quality, completeness, accuracy, and precision of the work being performed, and that it is consistent with design standards.

Quality Verification (QV) – Is performed prior to releasing geotechnical work products to their intended recipients for geotechnical work performed internal to WSDOT. For work performed outside WSDOT (e.g., consultants), this step is performed by WSDOT prior to acceptance of the final work products. The purpose of this step in the quality process is to verify that the QC/QA process used by the designer was effective for producing a geotechnical work product of acceptable quality that meets design standards. If, through conducting the QV it appears that the QC/QA process was not fully followed or if it appears that design standards may not have been met, QV may include a more detailed review of the design, including, as needed, comparative QV geotechnical analyses, to help identify the specific concerns.

All individuals, regardless if they are WSDOT staff or not, who are involved in geotechnical design are responsible for QC self-checking of their work. Each individual shall check their own work for compliance with this manual, standards of practice, errors, and omissions. Individuals are to correct their work before sending their work to the next individual(s) in the process of producing final geotechnical products.

The following sections define and describe the Quality Control/Quality Assurance (QC/QA) process that should be used.

1.4.1 Quality Control/Quality Assurance/Quality Verification for Geotechnical Work Produced by the RME's

The RME is fully responsible for the QC/QA of the geotechnical work they perform. The RME completes their geotechnical recommendations, certifies them as described in Section 1.4.3, and sends them to the Geotechnical Office for QV review and concurrence. If the Geotechnical Office finds the recommendations are not consistent with department policy or a significant error appears to have occurred (i.e., the QC/QA process appears to have not been followed), the Geotechnical Office may require that the RME produce an amendment to the recommendations.

1.4.2 Quality Control/Quality Assurance/Quality Verification for Geotechnical WorkProduced by the Geotechnical Office

Geotechnical Project Managers (GPM) not only have a QC role for their own work, they also have a QA role for the work of geotechnical design staff, support staff, and peers who may be assisting them with portions of their projects. The GPM is tasked with ensuring that the geotechnical work for their project is complete, thorough, accurate, and error free. To accomplish this task, the GPM shall perform QA review of the work that is performed by others in support of the project. If there are issues with the work that is performed, the GPM is responsible to ensure that the issue is resolved by working with the other individuals on the team and their supervisors. If necessary, the GPM will escalate issues upward through the supervisory chain to achieve successful resolution.

It is expected that GPM's will seek QA review from their supervisors, peers, or from other subject matter experts within the Office to ensure that the work they perform is of the highest quality. A peer review process or subject-matter-expert review is encouraged for unusual or highly technical project elements. After supervisory, peer, or subject-matter-expert review is completed, QV review will be performed by senior staff and the State Geotechnical Engineer prior to work being released to office customers.

For emergency projects or projects requiring preliminary information to keep moving forward, QC, QA, and QV reviews shall not be neglected.

Field Exploration Plans

The GPM is responsible for developing the field exploration plan (See Section 2.3). Before these plans are implemented, the project manager's supervisor is responsible to provide quality assurance for these plans to make sure they are complete, that they consider the available existing data, and that they meet the standards applicable to the structure or facility to be designed. For highly complex project plans, the State Geotechnical Engineer should be consulted for QV.

Boring Logs

For boring logs, the Field Exploration Inspector is responsible to make sure that the draft electronic field boring logs as entered are free of errors and consistent with the handwritten field logs (QC). To make sure that the inspector sees the final draft electronic field boring logs, the office staff in the Geotechnical Office will produce a PDF of each log sent in by the inspector and e-mail them back to the inspector for

review. The inspector will provide any comments to correct errors in the electronic logs back to the office staff, with a copy to the inspector's supervisor to ensure that the log review process has been followed and done correctly, for production of the final field logs and confirm that they have been reviewed. The geotechnical project manager is responsible to perform a QA check of the final draft edited boring logs produced by the technical staff.

Laboratory Testing

Once the drilling is completed, the GPM is responsible to develop the laboratory testing plan (see Section 2.4). Once the geotechnical project manager who is assigned the project has received the draft field logs, has selected soil and rock samples for testing, and if rock core is obtained, has reviewed the rock cores, and quality assurance of the laboratory testing plan has been conducted, the laboratory evaluation begins. Laboratory testing of soil and rock shall meet the quality control requirements in Section 5.6.1, and as applicable the AASHTO accreditation program requirements. Once the laboratory technicians have completed the specified testing and documentation and have checked their own work for errors, the supervisor in charge of the laboratory shall check the test results and reports for errors and incorrect interpretations and document that the data has been reviewed – once determined to be free of errors and omissions, the laboratory data are provided to the geotechnical project manager for use in the project, and also provided to the staff responsible to produce final draft edited boring logs based on the laboratory test results. The geotechnical project manager is responsible to check the laboratory test results for accuracy.

Geotechnical Reports and Memorandums

For geotechnical reports produced by the Geotechnical Office, senior-level review is required at the following key project junctures:

- The letter/memo transmitting the estimate of the scope of work and estimated costs for the geotechnical services needed,
- The subsurface investigation plan,
- The laboratory testing plan, and
- The draft/final geotechnical report.

Typically, three levels of review are conducted at each of these project junctures:

- a detailed review by the immediate supervisor (who is licensed) and at other intermediate times as needed to guide the design (including a detailed review of the draft report and supporting calculations, and a spot check of the boring logs and laboratory test data),
- A detailed review by the Chief Foundation Engineer or Chief Engineering Geologist of the final geotechnical product (e.g., geotechnical report, design memorandum, or Summary of Geotechnical Conditions) and a spot check of the calculations and other supporting information, and
- A spot check review and review for consistency with design policy and standards of practice by the State Geotechnical Engineer.

The State Geotechnical Engineer may delegate final review authority to the chief or senior level. For the subsurface investigation and laboratory testing plans, formal review by the State Geotechnical Engineer is generally not required. A minimum of one level of review by a licensed professional with the necessary geotechnical or engineering geology experience must be conducted in all cases, however. Licensed professionals performing design shall seek peer review and shall obtain the State Geotechnical Engineer's approval, or the review and approval of the individual to whom final review authority has been delegated by the State Geotechnical Engineer, prior to issuing design recommendations. "Design recommendations" include those that are considered final, and those that are considered preliminary if the preliminary recommendations will result in significant design effort being expended by those who use the recommendations to perform their designs, or if they could otherwise end up being treated as final recommendations. For those design recommendations that are clearly identified as being preliminary and subject to change, and for which all parties receiving those recommendations fully understand that the recommendations are subject to change and are only to be used for preliminary alternative and scope development purposes (with the exception of EIS discipline reports, critical area ordinance reports, or similar documents), final review authority is delegated to the Chief Foundation Engineer and Chief Engineering Geologist level.

Some projects require significant input by both engineering geologists and foundation engineers (e.g., landslides contained within a bigger interchange or line project, bridges or walls founded on soils or rock in which the site geology is very complex, retaining walls used to stabilize landslides, drainage or infiltration designs where the groundwater regime is complex, etc.). In such cases, a foundation engineer/engineering geologist team (i.e., one individual from each Section of the Geotechnical Office) should perform the design, and as a minimum, senior-level review by the Chief Foundation Engineer and the Chief Engineering Geologist, in addition to a spot check review and review for consistency with design policy and standards of practice by the State Geotechnical Engineer, shall be conducted at each of the key project junctures identified above.

1.4.3 Report Certification

In general, the individual who did the design, if he/she possesses a PE or LEG, and the first line reviewer who is licensed, will stamp the report, as required by the applicable RCW's and WAC's. If the second line supervisor/manager, or above (e.g., the State Geotechnical Engineer, Chief Foundation Engineer, or Chief Engineering Geologist), through the review process, requires that changes be made in the design and/or recommendations provided in the report, otherwise provides significant input into the design, or is the primary reviewer of the report, consistent with the definition of direct supervision in WAC 196-23 and WAC 308-15-070, the second line supervisor/manager, or above, will also stamp the report/memorandum. For reports produced by the Engineering Geology Section that require a Professional Engineer's stamp, and which have been produced and reviewed by individuals that do not possess a Professional Engineer's license, the State Geotechnical Engineer, or the licensed professional engineer delegated to act on behalf of the State Geotechnical Engineer, will provide a detailed review of the design and report, consistent with the definition of direct supervision in WAC 196-23, and stamp the report. For plan sheets in

construction contracts, the first line manager/supervisor, or above, who has functioned as the primary reviewer of the geotechnical work as defined above will stamp the plans, but only if the plan sheets fully and accurately reflect the recommendations provided in the geotechnical report upon which the plan sheets are based.

1.4.4 Approval of Reports Produced by the Geotechnical Office

The State Geotechnical Engineer, or the individual delegated to act on behalf of the State Geotechnical Engineer, must sign the geotechnical report or memorandum, as the designated approval authority for WSDOT regarding geotechnical design (this includes engineering geology reports). The signature of the approval authority indicates that the report or memorandum is in compliance with WSDOT geotechnical standards and policies. This policy also applies to design recommendations that are sent out informally to other offices (e.g., the WSDOT Bridge and Structures Office, Washington State Ferries Offices, Region Project Engineer Offices, etc.) for their use in design and PS&E development prior to issuance of the final geotechnical report for the project or project element.

1.5 Reports Produced by Consultants or other Agencies for WSDOT

The Geotechnical Office reviews and accepts all geotechnical reports and design letters/memorandums produced for WSDOT projects, consistent with the division of geotechnical work as described in Section 1.2.2. However, the consultant/other agency producing the report shall take full responsibility for the accuracy of the report and its engineering recommendations.

The Geotechnical Project Manager assigned the project being designed by a consultant is responsible to develop the scope of work for the consultant task assignment, or for consultants hired through the region project office, to work with the region to develop the scope of work. The geotechnical project manager is then responsible to:

- work with the consultant to make sure that the geotechnical work is carried out in accordance with the scope of work,
- work with the consultant (and region project office as needed) to address any changes in scope of work that occur during the life of the project,
- to verify that the work is carried out in accordance with department geotechnical policies, and
- to provide an overall quality verification (QV) evaluation of the adequacy of the geotechnical work with regard to WSDOT's geotechnical policies.

As a minimum, the geotechnical project manager should review the consultant's work and recommendations regarding the subsurface investigation plan, and for the draft/final geotechnical report. If there are questions about the adequacy/accuracy of the design, the geotechnical project manager should also request and spot check the consultant's geotechnical calculations. However, the geotechnical consultant is responsible for QC/QA for their design and report. The consultant liaison for the Geotechnical Office is only responsible to assist the geotechnical project manager with setting up the consultant task assignment and other consultant administration tasks during the life of the task assignment. See Section 1.6 for a more complete description of geotechnical consultant administration.

For reports or design letters/memorandums that cover only the level of geotechnical work that is clearly region responsibility per Section 1.2.2, the RME reviews and accepts the report or design letter/memorandum, but still forwards a copy of the consultant report to the Geotechnical Office for concurrence, consistent with Section 1.2.2 for regional soils reports. Acceptance of the report or design letter/memorandum produced by consultants or other agencies shall not be considered to constitute acceptance of professional responsibility on the part of WSDOT, as well as the reviewer, for the contents and recommendations contained therein, consistent with professional responsibility as prescribed by law. Acceptance only indicates that the contractual obligations under which the report or design letter/memorandum have been met and that the contents and recommendations appear to meet the applicable WSDOT, regional, and national standards of practice.

Geotechnical reports produced by consultants shall be certified in accordance with the principles described above in Section 1.4.1 and 1.4.3, and as required by the applicable RCW's and WAC's. Note that this review and acceptance process and associated considerations also apply to reports produced by consultants for developers building facilities that impact WSDOT facilities.

For geotechnical reports and documents produced by Design-Builders, see Chapter 22.

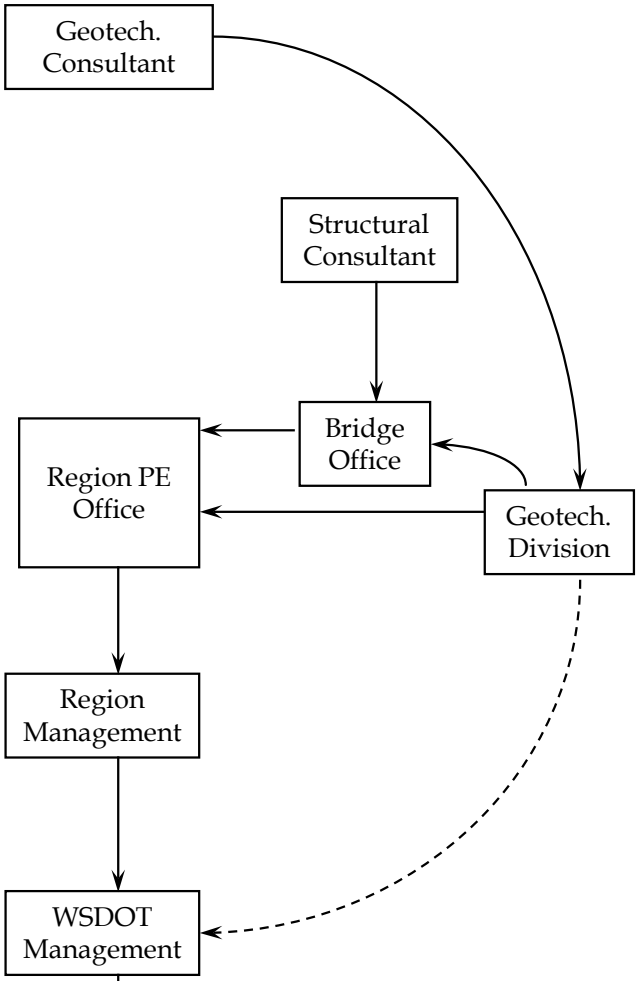
1.6 Geotechnical Consultant Administration

This section addresses geotechnical consultants working directly for the Geotechnical Office, and geotechnical consultants working for a prime consultant through a region, or other WSDOT office, contract. Geotechnical consultants are used to handle peak load work, or to obtain specialized expertise not contained within the Geotechnical Office. If a geotechnical consultant is needed, the first choice is to utilize a consultant working directly for the Geotechnical Office, as the communication lines are more straightforward than would be the case if the geotechnical consultant is working for a prime consultant, who in turn is working for another office in WSDOT. This is illustrated in Figures 1-3 and 1-4.

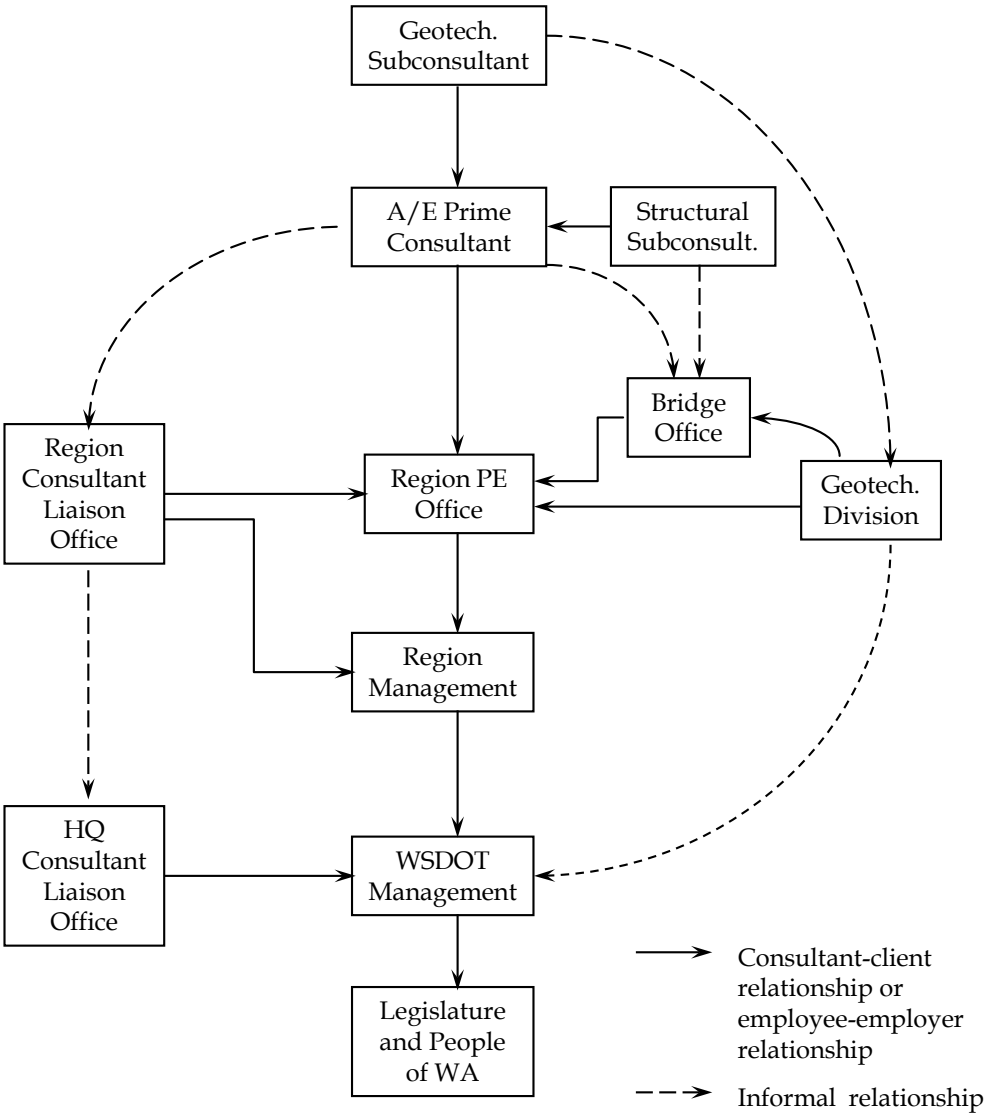
In general, consultants working directly for the Geotechnical Office will do so through an on-call master agreement in which the consultant is assigned project specific tasks. Through these tasks, the consultant is typically responsible to develop the detailed geotechnical investigation plan, perform the testing and design, and produce a geotechnical report. For these assignments, the consultant is viewed as an extension of the Geotechnical Office staff and is therefore subject to the same standards of design and review as in-house Office staff. The review and certification process for consultant geotechnical work mirrors that for in-house geotechnical work, as described in Section 1.5, except that the final certification of the report is done by the consultant rather than WSDOT staff, with WSDOT functioning in a review capacity. Frequent communication between the Geotechnical Office staff and the consultant is essential to a successful project. For this contractual scenario, the Geotechnical Office is responsible to oversee and administer the consultant agreement and task assignments.

If it is determined by the Region or other WSDOT office that a general civil or structural consultant is needed to handle the design work normally handled by that WSDOT office, the Geotechnical Office and Region Materials Office shall be contacted prior to sub-consulting the geotechnical portion of the project. Both

the Region Materials Office and Geotechnical Office may have staff available to perform the geotechnical design for the project. If it is determined that a geotechnical subconsultant is needed, the Geotechnical Office will need to assist in the development of the geotechnical scope and estimate for the project, so that the consultant contract is appropriate. A typical consultant scope of work for preliminary design is provided in Appendix 1-A, and a typical consultant scope of work to complete the geotechnical work for a PS&E level design is provided in Appendix 1-B. These typical scopes of work for geotechnical subconsultants may need adjustment or augmentation to adapt them to the specific project. A team meeting between the consultant team, the Region or other WSDOT Office (depending on whose project it is), and the Geotechnical Office is conducted early in the project to develop technical communication lines and relationships. Good proactive communication between all members of the project team is crucial to the success of the project due to the complex consultant-client relationships (see Figure 1-4).



WSDOT Consultant Relationship for Consultants Working Directly for the Geotechnical Office
Figure 1-3



WSDOT-Consultant Relationship for Consultants Working for a Prime Consultant for Other WSDOT Offices
Figure 1-4

1.7 Geotechnical Information Provided to Bidders

1.7.1 Final Geotechnical Project Documentation

The Final Geotechnical Project Documentation for a project shall consist of all geotechnical reports and memorandums, in their entirety, produced by WSDOT or consultants that are pertinent to the final PS&E for the project. Outdated or otherwise superseded geotechnical reports and memorandums should not be included in the Final Geotechnical Project Documentation. In such cases where a small portion of a geotechnical report has been superseded, the entire report should be included with the superseded text clearly identified along with the superseding document. Reports produced by the RME are generally kept under separate cover, but are included in the final publication package as described below.

1.7.2 Final Geotechnical Documentation Publication

Once a project PS&E is near completion, the Final Geotechnical Project Documentation is to be published for the use of prospective bidders. Materials Source Reports should also be included as part of the package published for bidders. The Region Project Development Office (or Terminal Engineering Department for Washington State Ferries) is responsible to notify the Geotechnical Office at least 12 to 14 weeks in advance of the Ad or Shelf Date when the final project geotechnical documentation is due in the Region (or Washington State Ferries), and which projects require final project geotechnical documentation. The Region Project Development Office (or Terminal Engineering Department for the Washington State Ferries) will also identify at that time who they have designated to receive the report to handle or continue the publication process. In general, it is desirable that the final geotechnical documentation be available for printing 10 weeks prior to the Ad or Shelf Date, but absolutely must be available no later than two Fridays prior to the Ad or Shelf date. This compiled geotechnical documentation package is typically sent to the Region Project Engineer Office (or Terminal Engineering Office for Washington State Ferries projects) by the Geotechnical Office. When transmitting the final project geotechnical documentation, the Geotechnical Office will specifically identify the geotechnical documentation as final for the project and as camera-ready. Likewise, the Region Materials Office will concurrently send a camera-ready final copy of any Region-generated reports (e.g., the Region Soils Report), as applicable, to the Region Project Engineer Office to be included as part of the geotechnical documentation for the project.

1.7.3 Geotechnical Information to be Included as Part of the Contract

Geotechnical information included as part of the contract (as an appendix) for design-bid-build projects will generally consist of the final project boring logs, and, as appropriate for the project, a Summary of Geotechnical Conditions. Both of these items are, in general, provided by the Geotechnical Office. If a Region Soils Report has been produced by the RME, the RME must provide the final boring logs and may be required to complete portions of the Summary of Geotechnical Conditions to include the information provided in the Region Soils Report. Note that Chapter 22 covers what geotechnical information is to be included in the Request for Proposals for design-build projects.

All boring logs used as the basis for the geotechnical design for the project should be included in an appendix to the contract. A legend sheet that defines the terms and symbols used in the boring logs shall always be included with the boring logs. The Geotechnical Office will provide a legend for logs they have produced. Consultants shall also provide a legend along with their logs in their geotechnical reports. The locations of all boring logs included with the contract should be shown on the contract plan sheets.

Based on specific project needs, other types of geotechnical data may also need to be included in the contract documents. Such additional data may include geophysical test results, and subsurface profiles and cross-sections for specific geotechnical project features. The goal of such data is to provide potential bidders a more complete picture of the conditions as necessary for accurate bidding, when that information cannot be conveyed by the boring logs alone.

A "Summary of Geotechnical Conditions," provided by the Geotechnical Office for most projects that contain significant geotechnical features, should also be included in the contract with the boring logs. This Summary of Geotechnical Conditions" is generally a 1 to 2 page document (see Chapter 23) that briefly summarizes the subsurface and ground water conditions for key areas of the project where foundations, cuts, fills, etc., are to be constructed. This document also describes the impact of these subsurface conditions on the construction of these foundations, cuts, fills, etc., to provide a common basis for interpretation of the conditions and bidding.

1.8 Sample Retention and Chain of Custody

In general, there are three types of samples obtained by the Geotechnical Office and geotechnical consultants: disturbed soil samples (includes sack samples from test pits), undisturbed soil samples, and rock cores. Disturbed soil samples are typically used for soil classification purposes, though on occasion they may be used for more sophisticated testing. Undisturbed soil samples are primarily used for more sophisticated testing, though they may also be used for evaluation of detailed soil structure. Undisturbed samples typically degrade significantly and are not useful for testing purposes after about 3 to 6 months. Disturbed and undisturbed soil samples that have not been tested by the Geotechnical Office or Consultant will be retained for a minimum of 90 days after the geotechnical report is completed, after which time they will be disposed. Prior to disposal, the Consultant shall contact the Geotechnical Office so that they may take possession of the samples, if they choose to do so.

Rock core is generally retained until after the construction project is complete and it is clear that claims related to the rock are not forthcoming. After construction, the core will be disposed. Rock core obtained by consultants shall be delivered to the Geotechnical Office as part of the deliverables associated with the Geotechnical Report. Subject to prior approval of the WSDOT State Geotechnical Engineer, rock core may be disposed prior to project construction if it is determined that the risk of claims related to rock quality issues is sufficiently low, if the rock core is degraded and therefore not useful for visual inspection or testing, or possibly other reasons that cause the risk of early core disposal to be low. In all cases, whether or not early disposal of the core is conducted, all rock core shall be photographed at high resolution and in color correct light, to provide a permanent record of the core.

All samples of soil or rock that are obtained on behalf of WSDOT by consultants and transported to the State Materials Laboratory Geotechnical Office shall become the property of WSDOT.

1.9 Geotechnical Design Policies and their Basis

Technical policies and design requirements provided in this manual have been derived from national standards such as those produced by AASHTO. FHWA and other nationally recognized geotechnical design manuals and publications have been used in the *Geotechnical Design Manual* to address areas not specifically covered by the AASHTO manuals. The following manuals, listed in hierarchical order, shall be the primary source of geotechnical design policy for WSDOT:

1. This *Geotechnical Design Manual* (GDM)

2. AASHTO Guide Specifications for LRFD Seismic Bridge Design
3. AASHTO LRFD Bridge Design Specifications, most current edition plus interims
4. AASHTO Standard Practice for Conducting Geotechnical Subsurface Investigations, R 13-03, 2007
5. AASHTO Manual on Subsurface Investigations (1988)

If a publication date is shown, that version shall be used to supplement the geotechnical design policies provided in this GDM. If no date is shown, the most current version, including interim publications of the referenced manuals, as of the GDM publication date shall be used. This is not a comprehensive list; other publications are referenced in this GDM and shall be used where so directed herein. FHWA geotechnical design manuals, or other nationally recognized design manuals, are considered secondary relative this GDM and to the AASHTO manuals listed above for establishing WSDOT geotechnical design policy.

Where justified by research or local experience, the design policies and requirements provided in the GDM deviate from the AASHTO and FHWA design specifications and guidelines, and shall supersede the requirements and guidelines within the AASHTO and FHWA manuals.

For foundation and wall design, the load and resistance factor design (LRFD) approach shall be used, to be consistent with WSDOT Bridge Office structural design policy. For aspects of foundation and wall design that have not yet been developed in the LRFD format, allowable stress (ASD) or load factor design (LFD) will be used until such time the LRFD approach has been developed. Therefore, for those aspects of foundation and wall design for which the LRFD approach is available, alternative ASD or LFD design formats are not presented in this manual.

In the chapters that follow, as well as within this chapter, and in the referenced AASHTO Manuals, the terms, and their definitions, provided in Table 1-2 are used to convey geotechnical policy.

Term	Definition
Shall	The associated provisions must be used. There is no acceptable alternative.
Should	The associated provisions must be used unless strong justification is available and based on well-established regional or national practice, and if supported by widely accepted research results.
May	The associated provisions are recommended, but alternative methods or approaches that are consistent with the intent of the provisions are acceptable.
Evaluate, evaluated, address, or addressed	The associated issue must be evaluated or addressed through detailed analysis and the results documented.
Consider, considered	The associated recommended provisions must be evaluated, and the reasons and analyses used to decide whether or not to implement the recommended provisions must be documented.
Geotechnical designer	The geotechnical engineer or engineering geologist who has been given responsibility to coordinate and complete the geotechnical design activities for the project

Terms Used to Convey Geotechnical Policy
Table 1-2

With regard to "should" in Table 1-2, "strong justification" relates to the veracity and consistency of the information used to justify the alternative approach or procedures, and how the data are to be interpreted or the analysis methodology is to be used based on widely accepted design codes, regional practices, manuals, published research results, etc. In order to meet the requirement for "well established regional or national practice", the practice must be demonstrably relevant to the specific project conditions and applications in question. To meet the requirement for "well-established", the practice must be defined in regionally or nationally accepted design manuals, text books, or codes of practice. Examples that meet these requirements are as follows:

1. FHWA engineering manuals.
2. AASHTO LRFD Bridge Design Specifications.
3. Widely accepted text books.
4. Practices that have been widely and successfully used by the geotechnical design firms in the region, provided they are applicable to the project conditions and applications in question, and provided that each of the following are convincingly demonstrated: details of the practice, long-term success, soil/rock conditions, and applicability.

In order to meet the requirement for "widely accepted research" the research must be published in a peer-reviewed national or international engineering journal, such as the ASCE Journal of Geotechnical and Geoenvironmental Engineering; the Canadian Geotechnical Journal; or Ground Improvement. Furthermore, the research must be demonstrably relevant to the project-specific conditions and applications in question. What would not be considered widely accepted research includes, for example, conference articles (while sometimes peer reviewed, such peer reviews are usually not thorough or rigorous); PhD theses; trade magazine articles; and any article, even if peer reviewed, that directly conflicts with the design requirements of this Geotechnical Design Manual and other documents referenced by this manual.

Justification to deviate from the policies and design requirements outlined in this manual shall not rely solely on "engineering judgment". Furthermore, strong justification must consider all the available data that applies to the site and design, not just portions of it.

1.10 Geotechnical Construction Support Policies

1.10.1 Division of Responsibilities for Construction Support of Design-Bid-Build Projects

The division of responsibilities between the Geotechnical Office and the Region Materials Office for response to geotechnical construction problems for design-bid-build projects is generally consistent with Section 1.2, which means that the RME, at least theoretically, functions as the clearing house to address geotechnical construction problems. The division of work shown in Figure 1-2 applies to construction assistance as well. However, it must also be recognized that most geotechnical construction problems need to be addressed quickly to prevent construction contract impacts. To minimize delays in getting geotechnical construction problems addressed, if it is obvious that HQ input will be required anyway (e.g., foundation construction issues,

retaining wall geotechnical construction problems, shoring wall stability or excessive deformation problems, rockslope construction issues, etc.) the Region Project Office should contact the Geotechnical Office directly. In that case, the Geotechnical Office should keep the RME informed as to the request and the nature of the problem as soon as practical. Typically, a construction project geotechnical advisor will be assigned to the project and is the first point of contact for assistance from the Geotechnical Office. For construction emergencies, such as slope failures, the process described in Section 1.2.3 should be followed, except that the Region Project Office functions as the maintenance office in that process.

There are some types of geotechnical construction issues for which the RME should always provide the first response. These include, for example:

- Evaluation of fill compaction problems;
- Evaluation of material source and borrow problems;
- Pavement subgrade problems; and
- Evaluation of the soil at the base of spread footing excavations to check for consistency with boring logs.

For the specific issues identified above, the RME will enlist the help of the Geotechnical Office if complications arise.

For evaluation of differing site conditions claims, the Geotechnical Office should always provide the geotechnical evaluation and will work directly with the HQ Construction Office to provide the geotechnical support they need.

Note that for consultant designed projects, the Geotechnical Office may request that the designer of record (i.e., the consultant) get involved to recommend a solution to WSDOT regarding the problem.

1.10.2 Division of Responsibilities for Construction Support of Design-Build Projects

For design-build projects, the first responder for geotechnical construction problems is the geotechnical designer of record for the design-builder. The next point of contact, if action on behalf of the contracting agency (i.e., WSDOT) is required in accordance with the contract RFP, is the geotechnical advisor assigned to the project from the Geotechnical Office. If it turns out that the RME should provide a response or if the RME could provide a more rapid response, considering the nature of the problem, the geotechnical advisor will contact the RME to enlist their assistance.

1.10.3 Geotechnical Office Roles and Communication Protocols for Construction Support

Geotechnical Office support to HQ Construction, Region Construction, and Region Project offices must always be technical in nature, leaving construction administration issues to the construction offices the Geotechnical Office is supporting. Since the technical support the Geotechnical Office provides could affect the construction contract, it is extremely important to contact HQ Construction as soon as possible to let them know of the situation, in addition to the specific regional offices being supported. Direct communication and directions to the contractor should be avoided, unless the boundaries of such communication have been approved in advance by the Region Project Office and as appropriate, HQ Construction. Any communication

in writing, including e-mail correspondence, must be written in a way that communicates only technical issues and does not compromise WSDOT's ability to effectively administer the contract. This is especially important if potential contractor claims are involved.

If potential contractor claims are involved in the construction problem, the Geotechnical Office role is to provide assistance to the HQ Construction Office. For example, with changed conditions claims, the Geotechnical Office's professional evaluation of the situation should focus on determining and describing the geotechnical conditions observed during construction in comparison to what was expected based on the data available at time of bidding. The Geotechnical Office is not to determine or even imply the merits of the contractor's claim. HQ Construction will do that.

Evaluations of contractor claims, as well as geotechnical recommendations for the redesign of a geotechnical element in a contract, must be put in a formal written format suitable for sealing as discussed in Section 1.4.1. E-mail should not be used as a communication vehicle for this type of information. Furthermore, the State Geotechnical Engineer, or the individual delegated to act on behalf of the State Geotechnical Engineer, must review and approve such documents before they are distributed. Memorandums that provide an evaluation of a contractor claim should be addressed to the HQ Construction Office, and a copy shall not be sent to the Region Project Engineer in this case. The HQ Construction Office will forward the Geotechnical Office response to the Region Project Engineer with their final determination of the validity of the claim. If a claim evaluation is not involved and only technical recommendations in support of a contract redesign are being provided, address the letter to the HQ Construction Office, with a copy to the Region Project Office and others as necessary (e.g., the Bridge Office). If the resulting change order will be within the Region authority to approve, the memorandum should be addressed to the Region Project Office with a copy to HQ Construction and the Region Operations or Construction Office.

1.11 Geotechnical Construction Submittal Review Policies

Most construction contract submittals include information that both the Bridge and Structures Office and the Geotechnical Office must review. Blasting plan and rock slope submittals (e.g., rock bolting) are an exception to this, in that their technical review are purely a Geotechnical Office function.

For construction submittals that involve structures or support of structures or bridge approach fills, policies on coordination of submittal review are as follows:

1.11.1 Proprietary Retaining Walls

- All pre-approved wall manufacturer submittals required by the contract shall be reviewed by the Bridge Office. The Bridge Office shall send a copy of the submittal to the Geotechnical Office for review when the submittal is distributed to the appropriate Bridge Office Design Unit. Details of specifically what will be reviewed are provided in Appendix 15B.
- The Geotechnical Office shall respond directly to the Construction Support Unit of the Bridge Office with their submittal review comments. The Bridge Office Construction Support Unit is responsible for the response back to the Region Project Engineer, and shall attach or include Geotechnical Office comments verbatim.
- After both the Bridge Office Design Unit and the Geotechnical Office have submitted their comments back to the Bridge Office Construction Support Unit, they will be circulated to the Bridge Office Wall Specialist for this review for completeness and consistency.
- Returns for Corrections (RFC's) and Change Order Notifications will require that a copy of the submittal go to the HQ Construction Office.
- Proprietary retaining walls that have been completely detailed in the Contract Plans and Special Provisions (including manufacturer shop plans) need not come to the Bridge Office for review. The Region's Project Engineer's Office is responsible for the review of the contractor's walls in accordance with the contract documents.

1.11.2 Other Construction Submittals (Non-Proprietary walls, Excavation and Shoring, Soldier Piles, Ground Anchors, Shafts, Piles, Ground Improvement, etc.)

- Geosynthetic shoring walls without structural facing do not require Bridge Office review. These walls shall be sent directly to the Geotechnical Office for their review. To provide consistency in the review process, the review comments should be sent back to the Bridge Office Construction Support Unit in the same manner as any other submittal for forwarding to the region project engineer.
- The Bridge Office Construction Support Unit will determine the need for geotechnical input when reviewing contractor shoring submittals. If geotechnical input is needed, the Construction Support Unit will coordinate with the Geotechnical Office to obtain review comments and will submit the compiled comments from both offices to the region project office.
- For all other construction submittals with geotechnical items received by the Bridge Office, the Bridge Office Construction Support Unit will send a copy of the submittal to the Geotechnical Office for review. The Geotechnical Office shall respond directly to the Construction Support Unit of the Bridge Office with their submittal review comments. The Bridge Office Construction Support Unit is responsible for the response back to the region project engineer, and shall attach or include Geotechnical Office comments verbatim. Returns for Corrections (RFC's) and Change Order Notifications will require that a copy of the submittal go to the HQ Construction Office.

- The geotechnical designer's main emphasis in review of the shaft submittals is to ensure that the proposed construction procedure will result in a shaft that meets the assumptions used during the design phase. Casing limits, construction joints, shaft diameter(s), and surface casing installation, as well as, backfilling are areas that typically need review. For soldier piles, substitution of another pile section or possible over-stressing of the pile anchor stressing should be checked. These items will generally be flagged by the geotechnical designer.
- The Bridge Office shall in general be the clearinghouse for transmittals of submittal reviews back to the region project engineer. The Geotechnical Office will return comments to the Bridge Office only, except when previously agreed to respond separately.

1-12 References

AASHTO, 2012, LRFD Bridge Design Specifications, American Association of State Highway and Transportation Officials, Sixth Edition, Washington, D.C., USA. (Note: Most current edition shall be used)

AASHTO, 2011, AASHTO Guide Specifications for LRFD Seismic Bridge Design, Second Edition, LRFDSEIS-2, Washington DC, USA. (Note: Most current edition shall be used)

AASHTO, 2007, Standard Practice for Conducting Geotechnical Subsurface Investigations, R 13-03, Washington DC, USA.

AASHTO, 1988, Manual on Subsurface Investigations, First Edition, MSI-1, Washington, DC, USA.

Design Manual M 22-01, 2012, (Note: Most current edition shall be used)

WAC 196-27A Rules of Professional Conduct and Practice

WAC 196-23 Stamping and Seals

WAC 308-15 Geologist Licensing Services

The CONSULTANT shall provide all PRELIMINARY geotechnical services that would normally be provided by the STATE's geotechnical engineering personnel to the project office responsible for the design and preparation of plans, specifications, and estimates (PS&E) for this PROJECT. The preliminary recommendations are to identify critical design elements and provide a basis for developing a scope of work for preparing design-level (PS&E) geotechnical recommendations. Based on the information obtained and the preliminary recommendations, the Geotechnical Scope may be supplemented by the STATE to have the CONSULTANT provide detailed design recommendations for PS&E.

The CONSULTANT shall cooperate and coordinate with the STATE's Geotechnical Office, other STATE personnel, and Municipal Agencies as necessary and under the direction of the STATE Geotechnical Engineer to facilitate the completion of the PROJECT. The CONSULTANT shall:

Review Available Information
The CONSULTANT shall collect and review readily available geotechnical and geologic data for the project including, but not limited to, geologic maps from the U.S. Geologic Survey, WSDOT construction records, soils and geotechnical reports from WSDOT, Federal, Community, City or County officials, groups or individuals, and geotechnical information within the project limits that may be in the CONSULTANT's files.

For projects where the geotechnical elements of the project have not been fully defined by the STATE, the CONSULTANT shall review the project and available information to identify areas within the project limits that may require detailed geotechnical recommendations or areas that have geotechnical elements that are complex. The CONSULTANT shall identify areas of significant cuts in soil or rock, large fills, areas of soft compressible soils, potential retaining wall locations and suitable wall types.

Perform a Site Review
The CONSULTANT shall perform an on-site geologic reconnaissance of the project to identify critical design elements. The CONSULTANT shall determine general site conditions, access for exploration, conditions of existing transportation features, and identify areas of potential fills or cuts, walls, culverts or culvert extensions, and bridges or bridge widen-ings.

Summarize Project Geology
The CONSULTANT shall summarize the regional geology and geology of the projects limits based on available existing information and the site reconnaissance. Geotechnical hazards, such as liquefaction and landslides, shall be assessed and the potential impacts to the project shall be discussed for identified hazards.

Prepare a report that Provides Preliminary Geotechnical Recommendations

The CONSULTANT shall identify critical design elements and provide a basis for geotechnical recommendations. As a minimum the CONSULTANT shall address or identify the following:

1. Locations of potential cuts, fills, soft compressible soils, soils susceptible to liquefaction, landslides, and faults close to or at the site.
2. Preliminary maximum cut and fill slope inclinations shall be recommended to ensure overall stability for cut slopes, embankments, structures, and to provide a basis for right-of-way acquisition.
3. For structures, suitable foundation types shall be identified. The report shall also indicate whether the foundation bearing capacities are anticipated to be low, indicating marginal bearing conditions, or high, indicating good to excellent bearing conditions.
4. Feasible retaining wall types shall be discussed.
5. The report shall include available site maps, cross sections, end areas, and subsurface profiles, and the available subsurface information.

The CONSULTANT shall prepare a Draft Preliminary Geotechnical Recommendations Report for the project. The CONSULTANT shall prepare three copies of the Draft Geotechnical Report and submit them to the STATE for review and comment. The STATE will review the Geotechnical Report and provide written comments within three weeks. The CONSULTANT shall respond to comments from the project team and WSDOT, revise the draft report, and submit three (3) copies of the final report. Additional Draft reports may be requested by the STATE prior to completing the FINAL report until the STATE's review comments are adequately addressed.

Instructions for Preparation of the Scope of Work for Project Specific Application
The **Preliminary Geotechnical Engineering Services Scope of Work** is to be used when the civil engineering portion of the project is not defined before consultant services are requested. In general, new soil borings are not required for conceptual-level recommendations except where subsurface information is not available within the project limits and if project elements are geotechnically complex. The Geotechnical Office is available to assist in the determination of whether or not borings are required. If the Region and the Geotechnical Office determine that borings are required to adequately develop preliminary recommendations, the Geotechnical Office will provide an additional section to be included in the scope of work for the drilling of new borings.

The Geotechnical Office should be contacted to provide a cost estimate for the work anticipated. The Geotechnical Office estimate should be used to complete negotiations with the consultant. At the Region's request, the Geotechnical Office can review the consultant's estimate and provided guidance for negotiation.

Once preliminary geotechnical recommendations are provided, the prime Consultant or Region can define the civil engineering portion of the project. Once the civil engineering portion is defined, a supplement can be prepared to have the Geotechnical Consultant provide detailed PS&E level recommendations. The **Geotechnical Engineering Services Scope of Work** should be used for the supplement.

The CONSULTANT shall provide all geotechnical services that would normally be provided by the STATE's geotechnical engineering personnel to the project office responsible for the design and preparation of plans, specifications, and estimates (PS&E) for this PROJECT. The STATE will provide support services to the CONSULTANT, as described in the text below. The CONSULTANT shall cooperate and coordinate with the STATE's Geotechnical Office, other STATE personnel, and Municipal Agencies as necessary and in accordance with the policy of the STATE Geotechnical Engineer to facilitate the completion of the PROJECT.

State Furnished Services, Information and Items

Throughout the duration of the project the STATE will perform services and furnish information and items as necessary to provide ongoing support for the CONSULTANT and the PS&E preparation process.

The following services will be performed by the STATE:

1. The STATE will handle public information.
2. The STATE will accomplish field survey work as required to complete the project, unless the STATE resources are not available. The CONSULTANT may request any necessary survey work, giving a minimum of 14-calendar-days notice prior to need. The CONSULTANT shall furnish information for the locations and the type of work required.

The following information and items shall be made available by the STATE to the CONSULTANT:

1. The STATE will provide or make available information from its files and answer questions.
2. Existing utility plan sheets.
3. Right of way and access plans.
4. Agreements between the STATE and utilities or any other agency where the agreements affect the project.

Geotechnical Consultant Engineering Services

The CONSULTANT shall provide to the STATE all geotechnical engineering services required by the STATE in order to design and prepare PS&E. The following is an outline of anticipated areas of significant CONSULTANT work:

Project Review and Scoping

The CONSULTANT shall collect and review readily available geotechnical and geologic data for the project including, but not limited to; Geologic maps from the U.S. Geologic Survey, WSDOT construction records, soils and geotechnical reports from WSDOT, Federal, Community, City or County officials, groups or individuals, and geotechnical information within the project limits that may be in the CONSULTANT's files.

Site Review

The CONSULTANT shall perform an on-site geologic reconnaissance of the project. The CONSULTANT shall determine general site conditions, access for exploration, and condition of existing transportation features.

Project Geology

The CONSULTANT shall summarize the regional geology and geology of the project limits. The CONSULTANT shall review the site seismicity and provide recommendations for suitable response spectra and the design acceleration. Geotechnical hazards shall be assessed and the potential impacts to the project shall be discussed. Recommendations for mitigating the hazards shall be provided at the STATE's request. Liquefaction potential shall be assessed and liquefaction mitigation methods shall be provided at the STATE's request.

Field Exploration

The CONSULTANT shall, in consultation and coordination with the STATE, plan and conduct a subsurface investigation program utilizing exploratory borings, test pits, geophysical methods, and insitu tests to provide information relative to soil, groundwater, and other geologic conditions along the project alignment. The CONSULTANT shall develop an exploration plan showing the locations of existing information, the locations for new explorations, the anticipated depths and sampling requirements for the borings, and field instrumentation requirements. Existing subsurface information shall be fully utilized and considered when preparing the field exploration plan. The CONSULTANT shall submit the plan to the region project engineer and the Geotechnical Office for review and approval. Upon approval, the CONSULTANT shall stake all boring locations in the field.

The STATE will provide all traffic control for the field exploration. The CONSULTANT shall obtain utility locates prior to field investigations requiring digging or boring and shall field locate the borings or test pits relative to station, offset, and elevation.

The _____ shall perform the field investigation, and the _____ shall secure Right of Entry for the field exploration.

If the STATE will perform all subsurface exploration drilling and taking of cores, the CONSULTANT shall provide a Drilling Inspector to obtain samples, and keep records. The STATE will commence drilling or coring operations as soon as practical after approval of the CONSULTANT's drilling plan.

All soil samples from drilling operations will become the property of the CONSULTANT. The CONSULTANT shall retain the samples for a period of 90 days after submittal of the final geotechnical report, at which time the samples may be disposed of unless the STATE requests that they be made available for pick-up at the CONSULTANT's office. All rock cores from drilling operations will become the property of the STATE and shall be delivered to the Geotechnical Office with, or prior to, the final geotechnical report. The CONSULTANT shall provide logs for the borings and test pits. The logs shall be edited based on laboratory or field tests in accordance with WSDOT Soil And Rock Classification Guidelines.

The results of the field exploration and all of the equipment used shall be summarized. Down hole hammers or wire-line operated hammers shall not be used for Standard Penetration Tests (SPT). Boring logs with station, offset, elevation, groundwater elevations, uncorrected SPT test results with blows per 6 inches shall be provided. Soil units encountered in the field exploration shall be described and their extent and limits shall be identified. Soils profiles shall be developed and shown for all structures or significant cut and fill slopes. Plan views shall be prepared that show the actual locations of the borings in relation to project elements.

Testing

The CONSULTANT shall conduct field and laboratory tests in general accordance with appropriate American Society for Testing Materials (ASTM) and WSDOT standards, including Standard Penetration Tests (SPT's), natural moisture content, grain size analysis, Atterberg limits, moisture/density (Proctor) relationships, resilient modulus for use in pavement design, pH, and resistivity and specialized geotechnical tests such as triaxial tests, direct shear tests, point load tests, and soil consolidation. All test results shall be included in the Geotechnical Report.

Instrumentation

The CONSULTANT shall provide the STATE with recommendations for field instrumentation to be installed in the exploratory borings of the project to monitor water levels and slope movements during both design and construction. If necessary, the CONSULTANT shall provide the STATE with recommendations for instrumentation for construction control of the project, e.g., monitoring slope movement, wall movement, pore pressure, settlement, and settlement rates. Included shall be the recommended instrument types, locations, installation requirements, zones of influence, and critical readings or levels. The CONSULTANT shall coordinate with the Geotechnical Office to ensure that recommended instruments are compatible with STATE readout/recording devices. During design, all instruments shall be installed and monitored by the CONSULTANT. The STATE shall monitor all instrumentation during construction or if long term monitoring is required.

Engineering Analysis

The CONSULTANT shall perform necessary geotechnical engineering analysis to identify critical design elements and provide a basis for geotechnical recommendations. Descriptions of the analysis and/or calculations shall be provided at the STATE's request. Comprehensive geotechnical engineering design recommendations shall be provided for preparation of project PS&E documents. The recommendations shall be detailed and complete for use by STATE engineering personnel or other CONSULTANTs in design of structures, cut slopes, fill slopes, embankments, drainage facilities, rock fall control, and landslide correction. As a minimum the CONSULTANT shall address the following:

1. Overall stability for cut slopes, embankments, and structures shall be assessed. For structures, minimum foundation widths, embedments, over-excavation, and ground improvement shall be addressed to satisfy overall stability requirements. Maximum cut and fill slope inclinations shall be recommended. Any mitigating measures needed to obtain the required level of safety for slopes shall be fully developed for the PS&E.

2. For structures, suitable foundation types shall be assessed and alternate foundation types recommended. For spread footings, allowable bearing capacity and settlement shall be provided. For seismic design of spread footings, ultimate bearing capacity and shear modulus values shall be provided for strain levels of 0.2% and 0.02%. For piles and shafts, ultimate capacity figures shall be developed that show the capacity in relation to tip elevation for both compression and tension. Settlement shall be assessed and group reduction factors shall be recommended. Downdrag and lateral squeeze shall be reviewed. Parameters for P-y curve development using L-Pile or COM624 shall be provided. Minimum tip elevations, casing requirements, and estimates of overdrive shall be provided. For piles with maximum driving resistances of 300 tons or more, wave equation analysis shall be performed to assess driveability, pile stress, and hammer requirements.
3. Suitable retaining wall types shall be recommended. For all walls (including standard, preapproved proprietary, and non-preapproved proprietary walls), bearing capacity, settlement, construction considerations, and external stability shall be addressed. For non-standard, non-proprietary walls, internal stability shall be addressed.
4. Earthwork recommendations shall be provided including subgrade preparation, material requirements, compaction criteria, and settlement estimates. In areas where compressible soils are encountered, overexcavation, staged construction, instrumentation, settlement, and creep characteristics and estimates shall be addressed as well as details of any mitigating measures needed to keep embankment performance within project constraints.
5. At stream crossings, evaluation of alternatives and recommendations shall be provided for extending the existing culvert, pipe jacking a new culvert, installing a bottomless culvert, or constructing of a bridge structure. Pipe bedding, subgrade preparation, bearing capacity, and settlement shall be addressed. For pipe jacking, jacking pit construction shall be assessed along with the potential for caving soils.
6. General drainage, groundwater, pH, and resistivity values as they apply to the project.
7. For signals, illumination, and sign structures, allowable lateral bearing capacity shall be evaluated. Where poor soils are present design recommendations for special design foundations shall be prepared. These shall address bearing capacity, lateral capacity, rotational capacity, settlement, and construction of the foundations.
8. Where possible, design recommendations shall be provided in tabular or graphical form.

Construction Considerations

Construction considerations shall be addressed. Temporary slopes and shoring limits shall be identified for estimating purposes. Advisory Special Provisions shall be prepared for elements that may encounter difficult ground conditions or that may require non-typical construction methods. Over-excavation recommendations and backfill requirements shall be discussed and details prepared for the PS&E. Construction staging requirements, where applicable, shall be addressed. Wet weather construction and temporary construction water control shall be discussed.

State Standards

Whenever possible, the CONSULTANT's recommendations shall provide for the use of WSDOT standard material, construction methods, and test procedures as given in the current *Standard Specifications for Road, Bridge, and Municipal Construction*. The CONSULTANT shall follow AASHTO Guide Specifications in design except where STATE design methods are applicable. State design methods are provided in the *Design Manual, Bridge Design Manual, Construction Manual, Hydraulics Manual*, and Standard Plans.

Report

The CONSULTANT shall prepare a Draft Geotechnical Report for the project summarizing the Geotechnical recommendations for the areas of significant CONSULTANT work as discussed under **Geotechnical Consultant Engineering Services** above.

Prior to Draft report submittal, the CONSULTANT shall meet with the Geotechnical Office to discuss the recommendations, assumptions, and design methodology used in preparation of the report. After the meeting, the CONSULTANT shall incorporate or address WSDOT's comments in the Draft Report. The CONSULTANT shall prepare three copies of the Draft Geotechnical Report and submit them to the STATE for review and comment. The STATE will review the Geotechnical Report and provide written comments within three weeks. The CONSULTANT shall respond to comments from the project team and WSDOT, revise the draft report, and submit ten (10) copies of the final geotechnical report. In addition, the CONSULTANT shall provide one unbound, camera ready copy of the report so that the report can be reproduced with the bid documents. Additional Draft reports may be requested by the STATE prior to completing the FINAL report until the STATE's review comments are adequately addressed.

Special Provisions and Plans

Where elements of geotechnical complexity are identified, the CONSULTANT in cooperation and coordination with the STATE shall develop or modify Special Provisions as appropriate to meet the project construction requirements. Wherever possible, the CONSULTANT shall utilize existing STATE specifications. All recommended Special Provisions shall be included in the geotechnical report as an appendix. All details necessary for design and construction of the project elements shall be included in the Geotechnical Report such as earth pressure diagrams, over-excavation details, wall details, and staged construction details. Details developed by the geotechnical engineer shall be provided in electronic form to the STATE or other CONSULTANTs for incorporation into the PS&E.

Instructions for Preparation of the Scope of Work for Project Specific Application
The **Geotechnical Engineering Services Scope of Work** is to be used when the civil engineering portion of the project is well defined before consultant services are requested. The following elements of the project should be well defined or guidelines should be available as to what is acceptable to WSDOT:

1. Right of way
2. Wetland boundaries and limits
3. Roadway alignments and roadway sections
4. Retaining wall locations, profiles, cross sections, and aesthetic requirements
5. Structure preliminary plans

There are fill-ins that need to be completed to designate who will perform the drilling and secure Right of Entry. Region Materials should be contacted to determine availability for drilling prior to completing the fill-in.

The Geotechnical Office should be contacted to provide a cost estimate for the work anticipated. The Geotechnical Office estimate should be used to complete negotiations with the consultant. At the Region's request, the Geotechnical Office can review the consultant's estimate and provided guidance for negotiation.