

Civil Engineering Writing Project - Language Unit 6

SEQUENCE OF INFORMATION IN A REPORT

I. What do you need to know about effective writing in civil engineering practice?

When civil engineers report their work, the organization of information reflects the practice of engineering. Engineers work on specific problems within specific contexts – and the problem and context are the first items most documents cover. Engineers make observations (gather data), analyze the data, evaluate the analysis, and recommend actions based on their evaluations – and that sequence is also followed in writing.

This typical sequencing of information is what readers usually expect in engineers' documents. When readers' expectations are met, they can find information and understand it more easily. Although different sequencing may sometimes be needed for novel problems or unusual contexts, for most situations, your writing will benefit from attention to the sequencing of information reviewed in this unit.



What experienced engineering practitioners say

"We need creative problem solvers – but not creative writing."

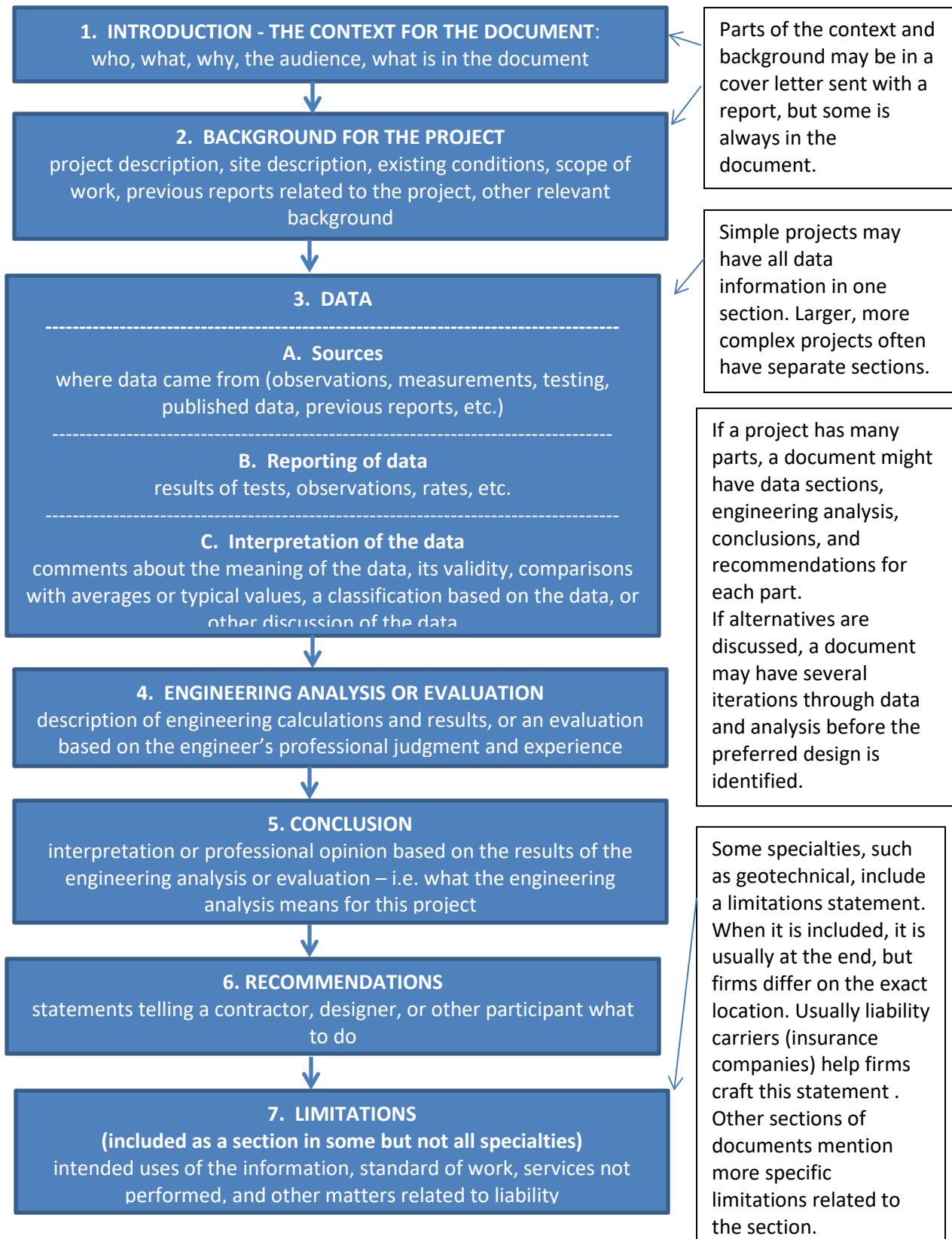
"Information presented in the sections [of a document] MUST relate to the section heading. Paying attention to the section headers will make your reports easier to follow, and more useful to your clients. An added bonus to putting information in the correct report section is that you won't feel compelled to repeat it in three other places – a "feature" of many reports that is not only annoying, but also a waste of time and effort. Doing so is usually a result of not thinking critically about what, exactly, you are trying to convey in a particular report section."

"Even when I write a short tech memo, I start with data, work through the reasoning and present conclusions and recommendations – in that order."

II. Information Flow: The Sequence of Information

A) Fundamentally, engineering practitioners' reports and memoranda follow a sequence of information that is similar to a lab reports written for courses: Introduction, Methods, Results, and Discussion. However, professional engineering documents exhibit a more detailed sequencing of information that reflects their concern for more specific contexts, engineering analysis, and professional judgments.

The sequence of information corresponds to most readers' expectations for the overall organization of documents, but this does not tell you what content is needed for any specific document. Some documents might need additional sections to address particular audience concerns. Some are not meant to include the entire sequence. For example, a traffic analysis might end with projected traffic volumes, leaving other engineers (the readers of the document) to decide how to use them in design. Nevertheless, if you pay attention to the sequencing of information when you write - incorporating it with other judgments about audience needs and the document's purpose - you will make a document more effective and improve comprehensibility.



B) The typical sequencing of information occurs in documents of different lengths and complexity – from very short memos with no sub-sections to long reports with multiple chapters. Notice the sequence in these two geotechnical engineering documents.

Example of Information Sequencing in a Short Technical Memorandum

Context: A geotechnical engineer was asked to visit a soccer field that had drainage problems and recommend a solution to the problems.

Audience: The maintenance manager for the park where the field was located. The manager had been on the site visit with the engineer, and he knew the site in detail. Since they had already discussed the problem together, the maintenance manager already knew the recommendation that would be in the memo. He was also familiar with construction methods for a subsurface drain.

Purpose: The purpose of the memo was to document the visit and the recommended solution.

Length of memo: Less than one page + one figure

<u>Memo</u> (superscript numbers in the memo correspond to the explanations from the writer)	<u>Explanations from the writer</u>
<p>Date: May 1, 2012</p> <p>To: Sam MacDonald Jackson County Recreation District</p> <p>From: Glenn Rousseau, P.E.</p> <p>Subject: Subsurface Drain</p> <p>Project: Lone Tree Park Soccer Field Subsurface Drain – Proj # 8181522</p> <p>¹At your request, we observed the cut slope and wet areas located at the northwest corner of the soccer field at Springdale Park in Roosevelt, Oregon. ²We understand there have been issues with wet areas around the perimeter of the playing field. At the time of our site visit^{3A}, we observed ground water seepage and saturated soil near the toe of the cut slope.^{3B} The excavated slope consisted of medium stiff to stiff silt as described in the geotechnical report by MEM Engineering dated June of 2010. ⁴In</p>	<p>1. The opening sentence provides the context – what the client asked, what we did, and where.</p> <p>2. Our understanding of the problem based on what he told us is the background for this simple situation. I knew the maintenance manager was very familiar with the site from having talked with him, and this was a very small project, so the memo does not include extensive background.</p> <p>3A. The site visit is the source for the data.</p> <p>3B. Our observations of groundwater seepage, saturated soil, and the type of soil are the data. A previous report by another firm is consistent with the observations, so I mentioned it, too, though it was not the source of the data.</p> <p>4. The opinion stated here is our evaluation – what the data mean</p>

<p>our opinion, the observed seepage is responsible for the wet areas. ⁵We expect construction of a subsurface drain will lower the groundwater level and improve the drainage in the perimeter of the ball field.</p> <p>⁶Therefore, we recommend a subsurface drain constructed near the toe of the existing cut slope. Construct the drain using a perforated pipe surrounded with drain rock and wrapped in a drainage geotextile. Slope the ground surface to direct the water to the drain. Backfill the drain trench with clean, crushed gravel to allow surface water to drain to the pipe. Slope the subsurface drain and perforated pipe to drain to an appropriate location. A detail of the subsurface drain is shown in the attached figure.</p> <p>⁷We expect this slope toe drain will improve the wet conditions of the northwest corner of the soccer field. If you have any questions regarding this recommended solution, please do not hesitate to call us.</p>	<p>for the problem. We didn't do testing. This is a very simple problem and we can evaluate the data from our professional experience. It's a professional opinion. Students don't have that yet – but it's often the case for experienced professional engineers.</p> <p>5. "We expect" is another sign that we are applying our professional experience here. This is the conclusion – what the evaluation means for the problem.</p> <p>6. The recommendations start with "we recommend" and then tell what to do. The plain verbs (rather than <i>should be</i> or <i>shall be</i>) are the clearest way to express that. This example shows a more complete set of recommendations than he likely needed because he knows about building drains, but it provides complete documentation.</p> <p>7. Because this was such a small project, I didn't include a whole limitations paragraph, but even this sentence shows this information applies only to this specific context.</p>
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Example of Information Sequencing in a Long Report

- Context:** The Engineering and Construction Management Department of a large city hired a geotechnical engineering to do a feasibility study for the proposed implosion of an old structure.
- Audience:** The report has been submitted to the project manager, an engineer in the department. Since this is a large city project, others may read parts of the report.
- Purpose:** The report describes exploration and testing of the area around the proposed implosion and makes recommendations for mitigating vibratory effects.
- Length of report:** 11 pages + 95 pages of appendices with figures and data

The table of contents demonstrates that the report follows the expected sequencing of information.

Table of Contents	Corresponding Component
Introduction	Introduction – Context
Project Details	Background for the project
Soil Study and Seismic Refraction Survey	Data (sources)
Site Conditions and Geotechnical Profile	Data (reporting, some interpretation)
Analysis of Results	Engineering Analysis
Conclusions and Recommendations	Conclusions from the analysis, Recommendations
References	
	The table of contents does not list the Limitations statement because the readers are unlikely to want to turn to that page.

MYTH BUSTER

Isn't "information sequencing" the same as using sections and section headings?

No. When a document has sections, the headings might reflect the information sequencing (as in the table of contents above), but they don't always. Engineering practitioners work on specific projects in specific contexts for clients who need certain information, and the sections of documents reflect that. For example, if a report presents alternatives, some sections might be labeled *Alternative 1*, *Alternative 2*, and *The No-Build Alternative* so that the client can find each alternative quickly, with each section presenting data, analysis, and conclusions related to that alternative. The typical sequencing of information is followed, but the section headings reflect a more specific focus.

Workplace documents also vary in the names used for sections even when the sections cover the same components of information. For example, all of these headings were for sections that covered the methods used to gather and analyze data:

- Traffic Analysis Methodology (a chapter in a 45-page traffic operations analysis report)
- Subsurface Exploration (a section in a geotechnical technical memorandum)
- Hydrologic Analysis (a section in a stormwater report, with no additional sub-headings for data source, analysis, and conclusions)
- Data Collection (section from a traffic crash analysis and safety review memorandum)
- no heading (in short memoranda such as the example above)

Sections may also differ between types of documents. Memoranda and letters typically do not have a heading for their first paragraph, but most reports have one (*Introduction*, *Background*, *Project Description*, *Purpose and Scope* are just a few alternatives). Individual firms and agencies also prefer different heading names. One group might label the first section *Background*, while another labels it *Introduction*.

In sum, the exact sections included in documents can vary greatly, but the sequencing of information does not.

Practice: Recognize Types of Information

In order to sequence information in your writing, you have to be able to recognize the type of information expressed in any statement. This practice focuses on that recognition.

Instructions

- For each of the following statements, identify the component of information, using the seven types of information in point A.
- Distinguish among the three data components.
- If passages include more than one component, identify each part.

The first line tells the type of document the sentence came from, but you are given no other context. Even seeing individual sentences, you should be able to identify the type of information.

1. *Report of an environmental investigation of soils*

The sampling activities included soil sampling in three boreholes up to 100 feet bgs, nested vapor probe installation, and soil vapor sampling at four depth intervals in the three borings.

2. *Reconnaissance report for a highway improvement project*

Based on the design details provided, we understand that the primary purpose of the project is to improve safety by realigning the curve at approximate Mile Point 23.40 and to increase the sight distance at the intersection of the highway with Mallard Parkway at approximate Mile Point 24.30.

3. *Structure inspection report*

The review of the structure was limited to available information. The contents of this report are not intended to provide a complete structural analysis of the building; limited structural calculations were performed.

4. *Structure inspection report*

Remove and replace the caulking/backer rods in the vertical control joints or wall changes in direction at the rear wall of the building.

5. *Bridge foundation report*

Based on this relatively conservative assessment, we calculated a post-earthquake strength of the clay/silt alluvium on the order of ± 500 psf. Slope stability analysis for the post-earthquake strengths showed a factor of safety of 1.04.

6. *Structure condition assessment report*

Osgood Engineering performed the condition assessment on July 15, 2013. The assessment consisted of visual observations of the exterior from close-up and afar with the aid of binoculars, interior observations of the exterior walls from accessible areas of the building, and select dimensional measurements. No material sampling or testing was performed.

7. *Noise level analysis technical memorandum*

The resultant noise level from the model using design year traffic data was 57.5 dBA, which is considerably lower than the noise abatement criterion of 67 dB for applicable land use category B.

8. *Traffic impact study report*

As presented in Table 1, the collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in 2007 Accident Data on California State Highways, California Department of Transportation (Caltrans). Both South Rieger Avenue/Fourth

Street and South Rieger Avenue/ Hudson Street experienced collision rates greater than the statewide average for similar facilities.

9. *Soil and hydrology report for a wetland delineation study*

The site is approximately 230 acres located between US-232 and W. Canyon Road (Old Highway 69) in Sections 7 and 9, City of Lincoln, Westfield County, Michigan. A Site Location Map is attached as Figure 1.

10. *Preliminary foundation report*

Liquefaction Evaluation

Based on the soil boring data, the saturated onsite soils consist of either dense to very dense sand or stiff to very stiff sandy silt. The relative density of the sandy soil is high enough to be resistant to liquefaction and the silty soil layer has sufficient fines and high enough Standard Penetration Test (SPT) blowcounts to resist widespread liquefaction. Therefore, liquefaction potential is not considered to be a design issue.

11. *Report of an environmental investigation of soils at a potentially contaminated site*

This report presents the methods and findings of environmental investigation activities performed in April and June 2012 at the former filling station site at 1557 SW Rosa Lane (Figure 1).

12. *Foundation report*

This report was prepared for the exclusive use of Metropolitan Transit Service and their design agents for the Signal Pole Foundation project on N Cranston Street in Priorston, Oregon.

III. Techniques for Revising the Placement of Information in Your Own Writing

These techniques address some of the most common errors in information sequencing in student reports, technical memoranda, and lab reports. Read over each technique and then apply it in the revision practice that follows. If necessary, you can invent details to make these practice revisions effective (but never for real content!).

Technique 1: Check that information is in the appropriate section of the document.	
Original	Needing Revision
<p><i>Stormwater Infiltration Gallery and Best Management Practices (BMP) Retrofit Report</i></p> <p>1. Introduction</p> <p>1.1 Background [Goals for the project and general background on the Standard University campus]</p> <p>1.2. Project Scope A geologic and hydrologic analysis of the Standard University campus was conducted in order to determine the ideal site selection for the infiltration gallery and BMP effectiveness in removing constituents of concern and tying to existing storm drain infrastructure to transport treated storm water to the infiltration gallery. <u>The proposed site location is adjacent to the horse</u></p>	<p>1.2. Project Scope The scope of work included geological, hydrologic, and geotechnical analyses of the Standard University campus. These analyses were used to evaluate sites for the infiltration gallery based on stormwater conveyance and BMP effectiveness.</p>

<u>stables on the Standard University campus as seen in Figure 1.</u>	
<p><u>Explanation</u> The final sentence is misplaced in the Project Scope section because it is not describing the scope. It must be moved to a section that describes the proposed project . The revision also makes the passage more effective by</p> <ul style="list-style-type: none"> • changing from passive voice <i>was conducted</i> to an inanimate subject + active voice verb (<i>scope of work included</i>). Passive voice is used in the second sentence (<i>These analyses were used</i>) so the subject of the sentence connects to the information of the previous sentence. Active voice (<i>We used</i>) could be used to emphasize responsibility for the work. See Units 3 and 4B for further explanation. • using shorter sentences that each convey one main idea • using more accurate vocabulary (<i>to determine the ideal site</i> → <i>evaluate sites</i>) 	

Practice 1. Identify the misplaced information in each example. Tell where misplaced sentences should be moved (to which component of information) or revise the sentences to make them appropriate for the section.

a. Discussion (*In a lab report for a course*)

The concrete mixes behaved on average as expected. Mix 1 (3000 psi mix) had an average compressive strength of approximately 3,300 psi at 21 days and mix 2 (5000 psi mix) had an average compressive strength of 7,450 psi at 21 days.

b. Project Description (*In a report*)

Currently, the proposed project site is an active asphalt paved parking lot. The lot is generally flat with planter areas between some of the parking stalls. The lot contains overhead lights, concrete parking blocks, and is delineated with parking and driveway areas.

c. Construction Recommendations (*In a report*)

We understand the City plans to replace the sanitary sewer line. We recommend 48-inch PVC pipe.

Technique 2: In each paragraph, look for any information that does not fit the focus of the paragraph. Delete it, or if it is important, develop a new paragraph around it.	
Original	Revision
<p><i>Design Report (student capstone project)</i></p> <p>The purpose of this project is to design a Green Wall structure to be installed on Standard University parking garage located at NE Madison and Fifth Avenue in Bateson, Oregon. <u>Currently, there is a very limited number of small-scale Green Walls that have been constructed in the Bateson area.</u> The primary goal of the Green Wall is to manage the stormwater generated from the approximately 50,000 square foot exposed top deck of the parking garage. Secondary goals of this project include reducing the urban heat island effect, introducing</p> <p>The purpose of this project is to design a Green Wall structure to be installed on the Standard University parking garage, located at NE Madison and Fifth Avenue in Bateson, Oregon. The primary goal of the Green Wall is to manage the stormwater generated from the approximately 50,000 square foot exposed top deck of the parking garage. Secondary goals of this project include reducing the urban heat island effect, introducing vegetation to an otherwise highly urbanized area, reducing</p>	

vegetation to an otherwise highly urbanized area, and reducing airborne contaminants.	airborne contaminants and providing a model for future Green Wall projects.
<p>Explanation.</p> <p>A paragraph should have a unified topic. Every sentence should relate to that topic. In this original paragraph, most sentences describe the goals of the project. The idea that there are few Green Walls in the area is not related to the goals. The revision deletes that sentence. (Alternatively, the authors may have thought one goal of the project was to test the effectiveness of green walls in the area; if so, they need to state that as a goal.)</p> <p>Off-topic sentences within paragraphs can make it harder for readers to recognize the sequencing of information because their attention is pulled away from your main idea for the paragraph.</p>	

Practice 2. Delete any information that does not fit the focus of each paragraph.

a. *Field Observation Memo (for an introductory course)*

Safety

Safety is taken very seriously on EFH job sites. However, Mr. Grafton and Ms. Johnson stated that they rarely enter the job sites. Mr. Grafton explained that he keeps all of the necessary safety equipment in his vehicle even though he only visits sites for an hour or two per month. He carries a hard hat, a high-visibility vest, steel-toed boots, ear protection, eye protection, a first aid kit, and a fire extinguisher.

b. *Report*

Design Guidelines

During the preliminary phases of the project, multiple site visits were made to meet with the client as well as to gather data. Jim Kovac, the maintenance manager for the park, related key information regarding his expectations for the new bridge. He was very generous with his time to help the team understand the park’s needs. The requirements for the bridge include:
[list of requirements]

Technique 3: Check that sentences do not state an evaluation without the data leading to it.	
Original	Needing Revision
We observed the slope was unstable.	We observed arc-shaped pavement cracks typical of embankment slope instability.
<p>Explanation.</p> <p>In the original, the writers say they “observe” an interpretation (that the slope was unstable). The revision tells what was observed (<i>arc-shaped pavement cracks</i>) and then interprets that observation (<i>typical of slope instability</i>). The revised sentence tells the source of data (<i>observed</i>), reports the data (<i>arc-shaped pavement cracks</i>), and interprets the data (<i>typical of embankment slope instability</i>). Although the error in the original may seem small, it is important. That sentence does not follow the expected sequencing of information or the process of engineering because it skips the data.</p>	

Practice 3. Revise the following so that they state data before interpretations or evaluations.

a. *Report - Existing Conditions section*

During the data collection at the intersection of First Avenue and Henderson Road, unsafe conditions were observed.

[Note: This is the only information about these conditions.]

b. *Report - Site Description section*

Figure 4 shows the markings and barriers at the intersection of Second Avenue and Chavez Boulevard. The current situation of markings in the street was not acceptable.

More Practice

Apply the techniques above to revise the following passages so that the information sequence meets typical expectations for civil engineering writing. As you revise, improve the effectiveness of other features too, especially vocabulary and sentence structure.

All the examples come from reports. Each begins with a section heading.

a. Proposed Cost

The cost of this project will be primarily based on hourly fees for time. The following are the hourly rates of each position that will be utilized for this project: Project Manager - \$130, Project Engineer - \$125, Environmental Scientist - \$105, and CADD - \$75. The total estimated cost is \$20,500 (Appendix A). At the beginning of the project we will establish the milestones necessary to complete this project. Upon acceptance of this proposal, BAE Engineering will work with the client in order to better finalize this schedule.

b. Site investigation

A number of site investigations were performed to determine key soil and hydrologic data. The first of these site visits was made to determine soil parameters and stratigraphy. Boreholes were made on the north and south sides of the creek. These boreholes indicate similar soil layering on both sides of the creek. Beneath the first few inches of topsoil, a layer of silty sand extends to a depth of four to six feet. At this point, gravel prevented further soil investigation by hand drilling. In addition to soil explorations, before the site visits, research into soil properties provided by the National Resources Conservation Service (NRCS) and the United States Geological Survey (USGS) was conducted.

c. Existing Conditions

The landslide is approximately 70 to 100 feet. The highest elevation part of the scarp has the inclination of approximately 80 degrees while the rest of the scarp inclination varies between 40 and 60 degrees. The above characteristics are based on the observations made during site visits and explorations as well as data from existing maps.

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This material is based upon work supported by the National Science Foundation under Grants No. DUE-0837776 and DUE-1323259. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.