Presentation Format:

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1. What is civil engineering video
2. Procedure/process video
3. Expand on each section of the process video
    a. geotechnical , hydrogeological, environmental, (maybe bridges if time permits) etc
        → Basically all of the information in the information outline starting from "Proposal" will be talked about in about the same order
4. Talk about the ethics surrounding engineering

Information Outline

What is Civil Engineering

- **Types of engineering and their roles**
    - Geotechnical - relationship between soil and structures (foundations)
    - Hydrogeology - focuses on movement of groundwater through tiny openings in rock and soil layers beneath the land surface.
    - Hydrology - physical properties of surface freshwater and its chemical interactions with other substances.
    - Structural - inspection and testing. Varifies structural design in terms of loads and bearing. Compaction of till material, groundwater, rebar inspection, footing evaluation, material verification
    - Environmental - develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and water and air pollution control.
    - Construction -
    - Transportation -

Procedure/Process

1. Client and proposal
2. If RSC is required (proposed use of property is different than existing), phase one of environmental reports
3. Contact Ontario One Call to mark utility lines and pipes
4. If phase one deems it necessary (possible contamination), do phase two of the environmental reports
5. If phase two deems it necessary (contaminated soil), do remediation and then apply for an RSC again
6. Collect samples soil samples for testing
7. Make geotechnical report based on testing
8. Make hydrogeological report for city or region if asked
    a. For the discharged water, if contaminated, needs to be treated before discharged for storm sewer or sanitary sewer, after construction is complete
    b. **Wastewater** is collected and treated before being returned to Lake Ontario.
    c. **Storm water** flows directly into the storm water management ponds, or into creeks and rivers and into Lake Ontario

9. Make continuous site visits to ensure work is going according to plan
    a. Example: Soil is compacted properly, Drainage is satisfactory, excavation are according to the recommendations etc
10. After structure is done, water from pump needs to be discharged

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Proposal

- **What does it contain**
    - A project can be given through a relationship that has been developed
    - A project can be given by the city. The city can ask through 2 ways
        - By quote (RFQ): price based
        - By proposal (RFP): Qualify (past experience) and capable, point based, budget, tasks that the company will do based on the project
- **Why is it important**
    - Brings in clients and business for the company.

Tests

Laboratory Tests

- ***Concrete Strength Test***
    - **What is it**
        - Concrete cores are created in a mold (20mm - 100x200, 40 mm - 130 x 300) and are then kept in water for certain periods of time. Different blocks are taken out on different days (after 7 days, after 12 days, after 21 days etc) and are tested to verify how much pressure they can bear. Two tests are done to ensure accuracy. On the sheet, the diameter, type of cracks, weight, and pounds of pressure are recorded.
    - **Why is it important/repercussions**
        - "The role of **water** is important because the **water** to cement ratio is the most critical factor in the production of "perfect" **concrete**. Too much **water** reduces **concrete strength**, while too little will make the **concrete** unworkable." Tests the amount of load and pressure that concrete will be able to take after 7 days left in water, 12 days, 21 days etc
- ***Chloride Testing (rapid chloride permeability test)***
    - **What is it**
        - Place chemicals in glass casing and place a small piece of concrete between glass casing. Attach glass cells to the wires
    - **Why is it important/repercussions**
        - Provided further details as to the composition of the soil. Tells how many chemicals are able to pass though and give details as to the deterioration of the soil.
- ***AVS Test (Air Void Systems Test)***
    - **What is it**
        - Polish the flat surface of a concrete core and examine it under a microscope. Follow each 1cm row and check by every 2mm column to see the number of aggregates, paste, and air voids. Ultimately, this will provide a ratio for the number of air voids.
    - **Why is this important/repercussions**
        - Air voids are needed in concrete cohesion is increased and therefore segregation is reduced. Water expands on cooling (9% under freezing temperature) so these air voids provide pressure relief without destroying the concrete inside out.

- ***Liquid Limit Test***
    - **What is it**
        - Put a certain amount of soil (specific amount of distilled water added)on the Casagrande and make a groove in the middle. Record the number of blows it takes for the groove to be filled in again to less than 10mm. Using the water content and number of blows, calculations are done to find the liquid limit of the soil.
    - **Why is it important/repercussions**
        - Determines how much liquid the soil can handle without flowing and moving. When the moisture content from split-spoon samples are taken, this scale would help determine if the soil is too loose. If the soil is loose, any construction build on top of that soil would not be on stable ground and will start to sink.
- ***Plasticity Test***
    - **What is it**
        - Soil is rolled into a thread with a diameter of about 3mm and the moisture content in the soil when it just begins to crumble would be the plasticity test.
    - **Why is it important/repercussions**
        - Too much plasticity means that the soil would be plastic which means that there is a loss in sheer strength and stability. If the soil is loose, any construction build on top of that soil would not be on stable ground and will start to sink.

Sites Visits

- ***Engineering log sheets: developed on site and after lab data (there are also geological, environmental, hydrogeological etc)***
    - **Data collected before lab**
        1. Number of blows (H2 and H3) in order to obtain split spoon sample
        2. Sample type, split spoon sample
        3. Number of blows counted until 6 inches has been reached. Number of blows counted four times but the middle two are added up
        4. Depth of each sample, [insert picture of intervals]
        5. Material description (moisture, colour, materials, grain size, stratigraphy, thickness)
        6. Remarks (weather, frost, coring/casing diameters, refusal, topography, well details)
    - **What goes in a borehole log sheet after lab**
        1. Depth of the hole
        2. Description of soil found - identify the native and fill layer
        3. Strata plot - a symbolic representation of what is found
        4. Sample number (guessing for lab organization)
        5. Split spoon - soil sample
        6. Number of blows to reach 0.3 m or 6 in. 4 numbers are written and the middle two are added to find the number
        7. Groundwater conditions - during drilling, at completion, perched water
        8. Groundwater elevation
        9. Capacity of soil to take the load, not always needed - Dynamic Cone Penetration Test
        10. Moisture content percentage - helps to determine what angle the slope should be at during construction and dictates soil strength
            a. Plastic Limit: amount of moisture that a tread of soil with 3.2mm diameter can contain before it begins to crumble
            b. Liquid Limit: when a groove created in soil has less than 10mm gap after 25 blows
        11. Pocket Penetrometer - measures moisture in soils

12. Natural Unit WT
13. Remarks and Grain size distribution based on percentage (gravel, sand, silt, clay) - done by sample but does not have to be every sample

- ***Standard Penetration Test***
    - **What is it**
        - Take soil samples by drilling a hole into the ground at various points around the site location so split spoon samples can be collected. Boreholes.
    - **Why is it important/repercussions**
        - The soil can be taken back into the lab for numerous tests. To find contamination, types of soil at different depths, percentage of soils, moisture content, liquid limit
- ***Dynamic Cone Penetration Test***
    - **What is it**
        - Only for sand, when sand is excavated
    - **Why is it important/repercussions**
        - Not regularly used because cost but it would be important when constructing a large multistory structure since all of that load would ultimately fall on the foundation and soil
- ***Monitoring Well***
    - **What is it**
        - Observe groundwater levels. Possibly take water samples
    - **Why is it important/repercussions**
        - To find contamination, groundwater level, direction of groundwater flow. Helps during excavation because perched water would come out
- ***Test Pits***
    - **What is it**
        - Make a large pit in the ground so all layers, including grain sizes bigger than gravel (boulders and cobble) are visible, to be able to observe perched water, water for during construction, and to see existing footing or foundation when building right beside an existing building
    - **Why is it important/repercussions**
        - Provided further details as to the composition of the soil, preview of what the water conditions might be during construction and the problems that would arise with the perched water, allowing for contractor and engineer to plan how to deal with getting rid of the water (pump, slump, caisson wall,
- ***Nuclear gauge Test***
    - **What is it**
        - Use a rod to make hole in the ground. Use nuclear gauge to insert rod into the hole and radioactive material can detect moisture content, compactness
    - **Why is it important/repercussions**
        - Used to find if soil has been compacted enough

Reports

- ***Geotechnical Reports***
    - **What does it contain**
        - Introduction: Who is conducting the work, what work was done, what information will be found within the report

        - Field and Laboratory work: Utilities were cleared, boreholes were drilled (SPT), samples were logged for lab testing, holes were backfilled and some had piezometers installed for groundwater
        - Results of the Investigation:
            - Subsurface Conditions: what kind
            - Topsoil: Thickness
            - Fill: depth, type, grain distribution percentages, liquid limit, plasticity, normal moisture levels,
            - Native Soils: Type, density, depth, grain size distribution, liquid limit, plasticity index, plasticity limit
            - Wet Sand Deposits - water issues
            - Groundwater Conditions: depth when drilling, piezometer results when drilling, after drilling and a couple days after drilling (in this case, 20 days), perched water possibilities during rainy months
        - Discussion and Recommendations
            - Footings Founded on Native Soils: what kind of footings would work at what depth
            - Footings Founded on Engineered Fill: fill be taken out, engineered fill be put in. footing can go on that
            - Other comments on Foundation: footings be lowered to native soil (not wet sandy deposits), cohesionless soils be covered with 50 mm of concrete immediately, footings and foundations must be covered from the cold and not created during the cold, slopes,
            - Elevator pits: how to anticipate for water/drainage troubles
            - Floor damage and permanent drainage: fill be removed and have engineered fill (granular A and B) compacted there, moisture barrier under floor slab, floor slabs should not be tied to load bearing walls or columns, Frost Slab or thermal insulation is required for exterior slab subject to movement
            - Excavation or backfill: no major groundwater problems, use conventional pumping for slumps and ditches, type of soil (type 1, 2, 3, 4 etc) and the kind of slope it should have, backfill can be of compacted existing fill and topsoil
            - Earth pressure
            - Earthquake
    - **Who works on it**
        - Geotechnical engineers
    - **Why is it important/repercussions**
        - Provides client, contractors, and structural engineers with content regarding the foundation of the structure that is being built and how problems such as groundwater and backfill could be treated
- ***Environmental Reports***
    - Phase One
        - **What does it contain**
            - Report of the surrounding area at a 250m radius
            - Possible contaminants from existing area, records of ownership dated back from the crown
            - Possible contaminants from surrounding areas and their history
            - Topography, hydrogeology (monitoring wells are recorded and inferred direction of flow), geology

        - Potentially contaminating activity (PCA *insert image*), Areas of Potential Environmental Concern (APEC)
        - Interviews, a walk through, and visual interpretation of the land has been conducted
        - Nearby soil and waters
    - **Why is it important/repercussions**
        - Record of Site Condition (RSC) is needed since there is a change in land use. This procedure is taken to ensure the land is not contaminated by surrounding properties or owners history with the property. Needs to be fixed before anything can be built on the land so that it does not pose a threat for anyone who goes there in the future or for the materials used for the structure.
- Phase Two
    - **What does it contain**
        - Refers to the Ministry of Environment soil, groundwater, and sediment standards table 1-9
        - Initial Study
            - Table 1: Full Depth Background Site Condition Standards
            - Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition.
            - Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Groundwater Condition.
        - During remediation and removal
            - Table 4: Stratified Site Condition Standards in a Potable Groundwater Condition.
            - Table 5: Stratified Site Condition Standards in a Non-Potable Groundwater Condition.
            - Table 6: Generic Site Condition Standards for Shallow Soils in a Potable Groundwater Condition
            - Table 7: Generic Site Condition Standards for Shallow Soils in a Non-Potable Ground Water Condition
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            - Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition
            - Table 9: Generic Site Condition Standards for Use within 30 m of a Water Body in a Non-Potable Groundwater Condition
        - Proximity to water, ANSI, Environmentally Significant Areas (ESAs), Niagara Escarpment Plan, the Oak Ridges Moraine Map, Municipal Official Plan,
        - What potential contaminants you are testing for, where they might be, and how many borehole/monitoring well samples that have been taken
        - PCA's were tested, how they were tested, how they made sure the information was as accurate as possible
        - Exceedances or not according to table <insert number> in MOECC
        - Elevations are used to determine the flow of groundwater and, as a result, the direction of contaminant flow, allowing a narrower possibility of the source of contamination
    - **Why is it important/repercussions**
        - Finds specific problems with the land and what is causing them so that the land could be fixed and RSC could be obtained
- Phase Three/ Remediation

        - **What does it contain**
            - Summary of previous reports
            - Make conceptual site model showing exactly what is wrong and where it was wrong
        - **Why is it important/repercussions**
            - The land is fixed from farther contamination so any structures that will be made on top of it will not deteriorate too fast and/or the land will not be harmful for people or crops that will be on that land in the future
- ***Hydrological Reports***
    - **What does it contain**
        - Direction of groundwater flow - contamination
        - Look at the hydrogeological conditions of the site, assess the need for groundwater control with the proposed construction, potential impacts to the local groundwater as a result of the proposed construction, and identify appropriate mitigative measures
        - Physical conditions (houses, agricultural etc)
        - Weather conditions → precipitation
        - Physiography and soil permeability
        - Subsurface composition from borehole logs
        - A summary of the hydraulic conductivity test (slug test)(rising head) methodology is as follows:
            • The static groundwater level in the monitoring well was initially measured and recorded;
            • For the rising head test, a known volume of water was removed using an inertial pump and low-density tubing; and,
            • The water level was then measured and recorded at regular time intervals and until the water level had recovered to a level close to the static water level measured before the start of the test;
        - Regional groundwater recharge - process by which groundwater is replenished and involves the vertical infiltration of water through the subsoil deposits and geologic materials to the saturated zone.
        - Groundwater level
        - Temporary dewater and discharge (rate, installment for trenches and footings)
    - **Who works on it**
        - Hydrogeologist makes it for the city or region
    - **Why is it important/repercussions**
        - So water doesn't get in the way when excavating and doing the construction, pumping systems are pumping water in the right city sewer, redirect water that is no longer getting absorbed by the soil in which the construction took place
- ***Site Visit Reports***
    - **What does it contain**
        - Updates of the construction. Things that have been done
        - Things that need to be fixed and discussed with the contractor
        - List at the end containing the status of the things that need to be fixed
        - Pictures of the site, things they did, things that need to be fixed
    - **Who works on it**
        - Civil engineer or whoever is on site
    - **Why is it important/repercussions**

    - This report gives updates on the conditions of the site to ensure the construction is going well and there are no major problems occuring and no little details are being overlooked

Bridges

- *Concrete Strength Test*
- *Chloride Testing (rapid chloride permeability test)*
- *Air Void Systems Test*