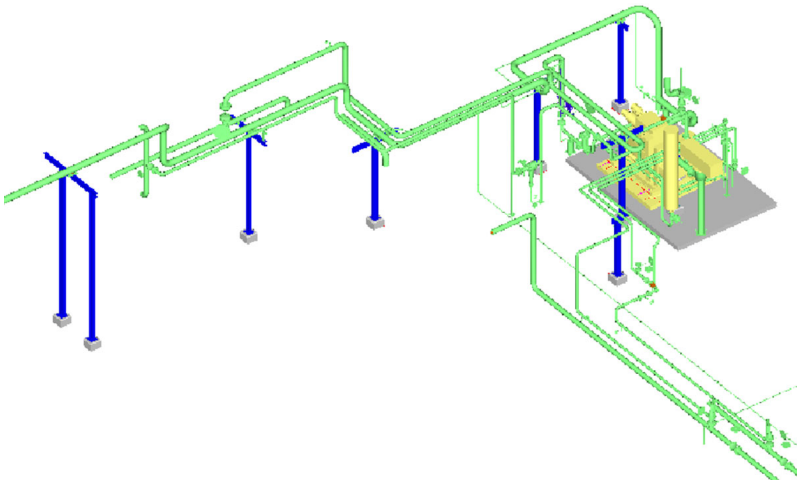
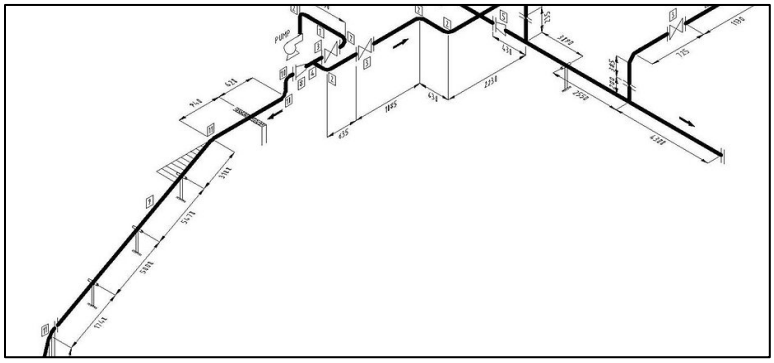
ENGINEERING PROJECT DESCRIPTION

Full Pipeline System Design of a Manufacturing Plant for CONTINENTAL AG





Fall 2021

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INTRODUCTION

This will be a semester-long project. For this project I require working in groups of 4. I will assign the members of each of the groups and announce them. Working in teams is a healthy habit for our careers. For off-campus students, I understand this might be challenging but this is how our society works now. You better start adjusting to it. What a better time than college time to do it? Few days after I assign the teammates, each team should tell me who will be the technical leader, who will be the project manager, and who will be the communications manager. The technical leader will make sure the technical requirements are understood and fulfilled. The project manager is in charge of tracking project plan including task and assignments are completed and submitted according to directions. And the communications manager will be in charge of all group communications (making sure everyone stays informed) and communications with course instructors, and also prepares meeting agendas and minutes.

As part of making the group dynamics realistic and as a way to handle problems in the group dynamics, I will allow firing a member of the group as long as the other 3 members agree on doing it and communicate the decision to me. You will have to send me an email explaining the reasons of the action. The person being fired will be responsible of finishing the project alone.

Aside from 2 short activities to get you started into the project, there will be one progress report you have to submit at some point in the semester and the final project must be delivered during finals week (see schedule). There are grading rubrics for each of them. The project manager should be fully aware of them. However, I suggest everyone to familiarize with them, for that, read this whole document.

To help you improve the quality of your course project, each of you will review the progress report of a random group following some instructions and rubrics (**peer review**). The feedback is important to the other group. Be respectful and serious in your comments. The comments have to also be complete (see peer-review guidelines in the assignment prompt). Comments like "Good job", or "This is terrible" are not enough. If it is a good job or a terrible job say why. If it is "terrible" tell the group also how to improve it. In your professional life, you will be constantly asked to review the work of some of your peers. This is the moment to get used to this.

To make sure you are not falling behind, I will meet each of the groups at three different times in the semester (see schedule) during a time your group and I decide on the day stipulated on the schedule. Each group should show me what they have done up to the moment we meet, and I will give hints to continue the work. There are no points if you attend the meeting but failure to hold it will affect your grade.

PROBLEM DESCRIPTION

Continental AG is planning for a new manufacturing facility. As part of the new plant, there will be an automated machining line in which five machines will be supplied with coolant from the same reservoir.

The layout of the planned facility is shown in figure 1. The following data, design requirements, and limitations are given.

1. New coolant is delivered to the plant by railroad tank cars carrying 15,000 gal each. A holding tank for new coolant must be specified.

2. The reservoir for the automated machining system must have a capacity of 1000 gal.

3. The 1000-gal tank is normally emptied once per week. Emergency dumps are possible if the coolant becomes overly contaminated prior to the scheduled emptying.

4. The dirty fluid is picked up by truck only once per month.

5. A holding tank for the dirty fluid must be specified.

6. The plant is being designed to operate two shifts per day, 7 days a week.

7. Maintenance is normally performed during the third shift.

8. The building is one-story high with a concrete floor.

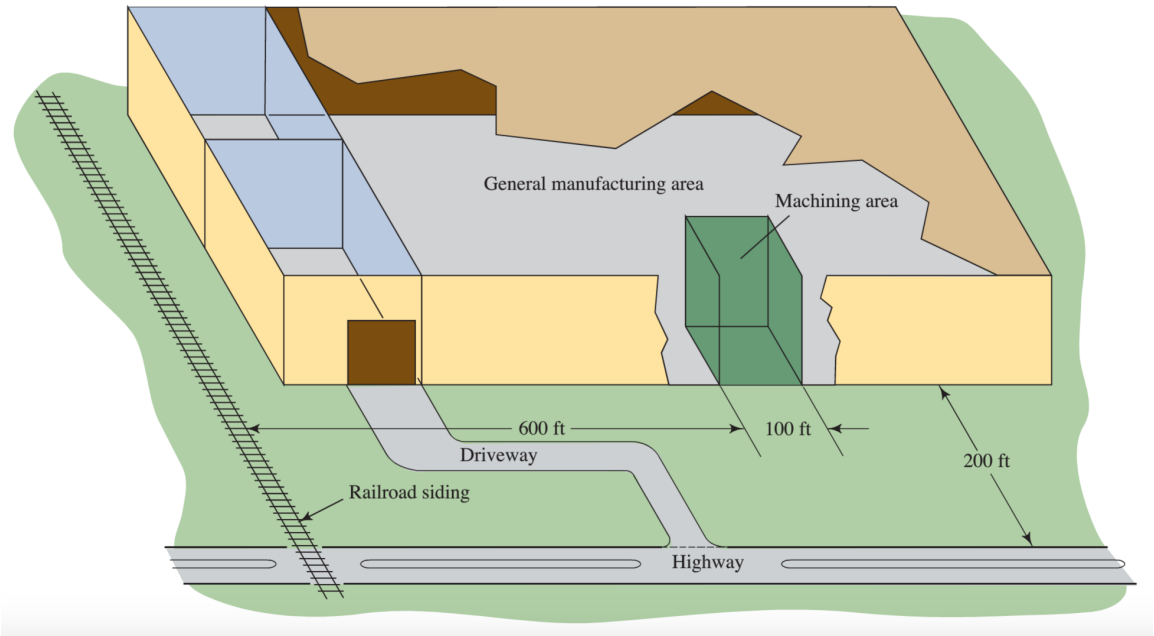

FIGURE 1. Plot plan of a hypothetical factory building for the design problem.

9. The floor level is at the same elevation as the railroad track.

10. No storage tank can be inside the plant or under the floor except the 1000-gal reservoir that supplies the machining system.

11. The roof top is 32 ft from the floor level and the roof can be designed to support a storage tank.

12. The building is to be located in Dayton, Ohio, where the outside temperature may range from -20^{o}F to +105 ^{o}F.

13. The frost line is 30 in below the surface.

14. The coolant is a solution of water and soluble oil with a specific gravity of 0.94 and a freezing point of 0 ^{o}F. Its corrosiveness is approximately the same as that of water.

15. Assume that the viscosity and vapor pressure of the coolant are 1.50 times that of water at any temperature.

16. You are not asked to design the system to supply the machines.

17. The basic coolant storage and delivery system is to have the functional design sketched in the block diagram in Figure 2.

18. If pumps are required, only SULZER pumps have to be selected. **YOU ARE ALLOWED TO USE ONLY SULZER PUMP CATALOG PROVIDED IN CLASS!**

IMPORTANT NOTES: There will be times when you will lack some information to proceed in the project. You are free to use any resource you think you need to get the information, or, better, contact the instructor to seek for help. When working in a real engineering work you will have those moments. You have to train yourself on how to find information to fulfill the tasks at hand. In our course you have the advantage of having the instructor, please contact him often.

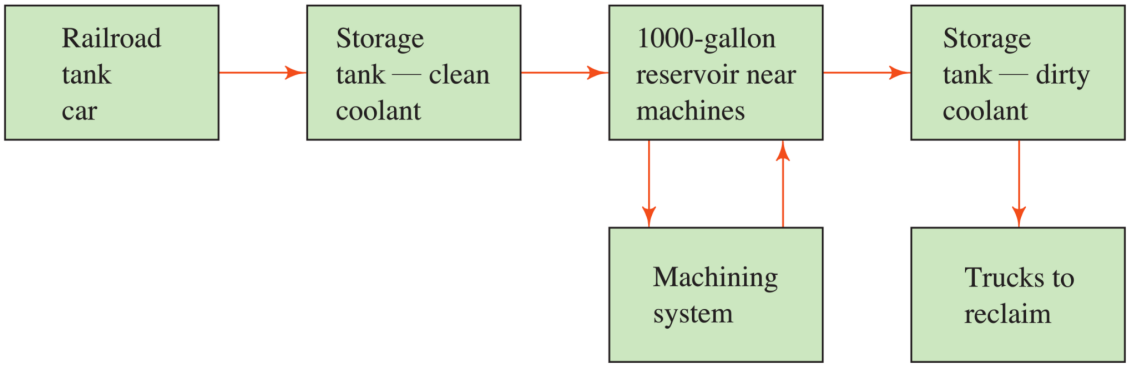

FIGURE 2. Block diagram of coolant system.

ROLE

Consider yourself to be an engineer working for an Engineering Consulting Firm that just got a contract from Continental AG. They are interested on planning a new manufacturing facility. You are responsible for the design of the system to handle the coolant from the time it reaches the plant in railroad tank cars until the dirty coolant is removed from the premises by a contract firm for reclaim.

AUDIENCE

This project report should be written towards the Engineering Head of Continental AG with plans for expansion. It should therefore be written formally. Assume the reader is familiar with engineering concepts.

TASKS

1. Specify the size and location of all storage tanks. **(to final report section 5.f.i)**
2. Select tank material and specify wall thickness of storage tanks. **(to final report section 5.f.i)**
3. Provide a future additional connection to drain ONE OF THE TANKS. Design the blind flange required to hold the pressure for such connection (size, thickness, etc.). This should include the number of bolts and nuts and the size of them. **(to final report section 5.f.i)**
4. Estimate the time required to fill and empty all tanks (you are supposed to fix them). Specify the desired flow rate to fill and empty all tanks. **(to final report section 5.f.ii)**
5. Specify the layout of the piping system, the material type and sizes of all pipes, and the lengths required. **Please note that if choosing to have a system driven by gravity, the pipe calculations are different to the case of pumped systems**. Please also remember that for a pumped system, the pipe size is chosen with the critical velocity criteria and the desired flow rate. **(to final report section 5.f.iii)**
6. Specify the number, types, material, and size of all valves, elbows, and fittings. **Please note that if choosing to have a system driven by gravity, the pipe calculations are different to the case of pumped systems**. Please also remember that for a pumped system, the pipe size is chosen with the critical velocity criteria and the desired flow rate. **(to final report section 5.f.iii)**
7. Develop the hydraulic analysis of all parts of the system; this includes energy losses due to friction and minor losses. You should list the energy losses per section(s) of each of the coolant sub-systems. For this task, you are allowed to use software but one of the coolant sub-systems MUST be calculated by hand and compare against the software results. **(to final report section 5.f.v)**
8. How many pumps do you need? What are the requirements (this is, you have to provide pump head and flow rate) of each pump? For this task, you are allowed to use software but one of the coolant sub-systems MUST be calculated by hand and compare against the software results. **(to final report section 5.f.vi)**
9. Specify pipe wall thickness (schedule). You need for this the maximum operating pressure of the system. In a pumped system this pressure is typically at the exit of the pump. **(to final report section 5.f.iii)**
10. Check your design for water hammer problems. Check if the pipe you selected can hold such over-pressure, if not, propose the use of a water-hammer arrestor by specifying the pressure that it will handle. **(to final report section 5.f.iii)**
11. Specify wind load and weight of storage tanks for our civil engineer colleagues. **(to final report section 5.f.i)**
12. Consider that one of your storage tanks could fail. To repair it the company decided to drain it using a pumped system with same flow rate you estimated but this time the fluid

will go into an open channel that will take the fluid to a location far from the plant (you have to select such location). You are now also in charge of the design of such open channel system to dump the fluid to that location. The design should include the path of the channel and its cross section. **(to final report section 5.f.i)**

13. For one particular pipe system, decide the type of supports and determine the force acting upon each support. Your work here includes the distance between supports so the pipe does bend much. Our civil engineer colleagues need this. **(to final report section 5.f.iv)**

14. Just for one of your pipeline systems, select the required instruments. This is, pick an instrument to measure the flow of the pressure differential type (specify its dimensions) and pressure gauges (specify range of pressures to measure). **(to final report section 5.f.vii)**

15. Specify the number of pumps, their types, flow capacities, head requirements, and power required. Why did you choose the pump you chose? Argue why you need a kinetic pump (instead of a positive displacement) and prove that the radial pump is the type of kinetic pump you need. **(to final report section 5.f.vi)**

16. Specify the characteristics of the chosen pumps, point of operation, and actual pump size and weight. Some of the information is for our civil engineer colleagues. VERY IMPORTANT: Include pump curves with the system curve, and point of operation. For this task, please print out the pages in the catalog where you got the information. **(to final report section 5.f.vi)**

17. Specify electrical motor requirement for our pump for our electrical engineering colleagues. Recall that we specify the power of the electrical motor as about 1.10 times the power required by the pump. **(to final report section 5.f.vi)**

18. Evaluate the NPSH available for your design, and demonstrate that your pump has an acceptable NPSH required. Specify the installation requirements for the pumps, including the complete suction line system. **(to final report section 5.f.vi)**

19. Draw the layout of your design in both a plan view (top) and an elevation view (side). An isometric drawing should also be included. **(to final report section 6)**

20. Prepare bill of material (cost is not required on this project). Include everything you designed/selected. The bill of material should contain the materials of the system as well as all the equipment (such as pumps). **(to final report section 7)**

21. Submit the results of your design in a neat and complete report, including a narrative description of the system, plant operation narrative, the sketches, a list of materials, and the analysis to show that your design meets the specifications. Include a discussion on why your design is cost effective.

NOTE: When submitting the tasks in the corresponding progress report, make sure each task has each of the sections shown in the "Task Rubric". As each of the tasks will end up in a subsection of the final report, it is expected to see same structure in that corresponding subsection, as you will basically copy and paste.

ENGINEERING FINAL REPORT FORMAT

Your design proposal should be submitted in a form of technical report, which should include but limited to:

1. Title Page
2. Abstract

   Brief description of the project with relevant elements of the design

3. Table of Contents
4. List of Figures & List of Tables

   You are NOT supposed to include here the actual figures and tables. The figures and tables should be part of the report body but here you will indicate the page number where the figure or table is located.

5. Report Body
   a. Job site location
   b. Specifications and design philosophy

      Establish design criteria, design requirements and limitations, time required to fill and empty all tanks, and any other criteria you personally decided to use.

   c. Sources
   d. Materials and specifications
      i. Establish the pipe and tank material to use
      ii. Fluid characteristics
   e. Preliminary drawings and sketches
      i. Plot plan
      ii. Elevations

      Every engineering work starts with preliminary sketches that help with the design calculations. You should include pipe layout and tanks. The drawings support the Design calculations section.

   f. Design calculations
      i. Tank specifications
         - Location (task 1)
         - Size design (task 1)
         - Tank thickness (task 2)
         - Future drain connection - blind flange design (task 3)
         - Wind load and weight (task 11)
         - Open channel for drainage (task 12)
      ii. Flow rate
         - Tank fill/empty times (task 4)
         - Desired flow rate (task 4)

iii. Pipe sizing
    - Piping layout (task 5)
    - Pipe diameter and lengths (task 5)
    - Pipe thickness (task 9)
    - Fittings (task 6)
    - Water hammer (task 10)

iv. Provide pipeline support info.
    - Type of supports (task 13)
    - Distance between supports (task 13)
    - Forces on supports (task 13)

v. Energy losses. (task 7)
(*Make a table of all energy losses for each pipeline section. Analyze them. Which pipeline section has the most energy losses?*)

vi. Pump selection
    - Pump requirements (tasks 8 and 15)
    - Selection of pump type (task 15)
    - Pump curves, and system curves with operating point (task 16)
    - Cavitation (task 18)
    - Summary of selected pumps (includes values at operating point, NPSH_req, pump size, pump weight, pump required power, electrical motor power) (tasks 16 and 17)

vii. Instrumentation selection.
    - Flow rate (task 14)
    - Pressure (task 14)

Design calculations must be done by hand. The use of computer programs is allowed but cannot replace your work. Excel spreadsheets are allowed but the used equations must be explicitly stated for grading purposes. Unclear outputs are not permitted.

On each of the sections, you should summarize all the results in tables.

Feel free to add as many sub-sections under each of the section of the Design Calculations part.

6. Final drawings
    a. Plot plan (task 19)
    b. Elevations view (task 19)
    c. Isometrics (task 19)

After the design calculations must of the preliminary drawings and sketches must be updated and better represented.

7. Bill of materials and equipment list (task 20)

With the help of the isometrics you should list all the material that need to be bought for final construction. You should also include the list of selected equipment (if required, use catalogs you can download from the internet).

8. Final remarks (task 21)

9. Appendix

   Add any additional material you consider related to the project.

   Also, add a reflective section where each of you separately reflect on or evaluate what was learned in this project and in this class. Answer the following questions:
   - *Do you think what you learn is important for your professional career?*
   - *Where do you think you will be using everything you learned?*
   - *How would you explain the project and your contribution to the project in a job interview?*
   - *How would you explain how your strengths helped you contribute to the project in a job interview?*
   - *How would you explain in a job interview how your weaknesses affected your ability to work on this project and how did you address them (or what part of the class helped you address them)?*
   - *Explain the technical strengths and weaknesses in your project.*
   - *If you were starting the class over again, what advice would you give yourself to ensure that you had a successful semester and a successful final project?*

NOTE:

1) *Verbally explain your ideas and add images, diagrams and graphs needed to explain your solutions. As far as preliminary and final drawing, there is no need for detailed drawings, just simple high-level sketches. Hand sketches are fine, you may take a picture with your camera, phone and insert them to the document or just attach image drawn to your exam. Use appropriate number for images, diagrams and equations used (e.g Figure 1, Figure 2, etc.) for easier understanding and explain what they are in the body of the report*.
2) *Before turning in the final report, you will be turning in progress reports completing the tasks shown below. You should be able to build your final project report by a "copy & paste" procedure of the delivered tasks**. It is good exercises to identify which section of final report section each task belongs to***.

DUE DATES, ACTIVITIES, AND GRADING

Due Date	Assignment	TO TURN IN	FINAL GRADE
Thursday 09/02	**Group formation**		
Thursday 09/09	**FE and Content tests / Consent Forms**	Indicated in Blackboard	2.5%
Thursday 09/16	**Team contract / Team tasks**	Indicated in Blackboard	2.5%
Thursday 09/30	**Meeting client**		
Thursday 10/14	**Progress report** TASKS 1 to 9	1) Followed the task rubric? 20% 2) Followed the content rubric? 20% 3) Completeness & correctness 60%	15%
Thursday 10/28	**Peer-review to progress report**	INDIVIDUAL ACTIVITY. FOLLOW PROVIDED INSTRUCTIONS (see next pages). 1) Prove of progress report submission to peer 25% 2) Actual report 75%	10%
Thursday 11/04	**CATME midterm survey**		2.5%
Thursday 11/16	**Meeting client**		
Thursday 12/09	**Meeting client**		
Tuesday 12/14	**Final Engineering Report**	1st PDF FILE: 1) Comments to the peer-review and instructor comments. Be specific on how you addressed each of the comments. **(*)** 5% 2) Reflection on whole peer-review process and fill out survey on the peer-review 5% 2nd PDF FILE: 1) Followed the tasks and content rubric? (include all tasks?) 10% 2) Followed the writing rubric? 25% 3) Correctness 55%	65%
Thursday 12/16	**FE and Content tests / CATME final survey / Project reflection**		2.5%

(*) This is a one-pager where you will discuss on the fairness of reviews you received, how you incorporated the comments into your corresponding project progress report, and why you did not incorporate the comments you received from peers and instructor.

NOTES:

1) The leader of the group will be submitting the assignments through Blackboard. It should always be the same person submitting. This person will keep track of the grade and my comments to the group.

2) Keep in mind that you want also to upload your submissions to the Google drive for your ePortfolio, if you chose this optional assignment.

3) For the grading of the progress report I will follow the task rubric attached to this document and verify that you correctly completed all the tasks at hand. For the final report, you will also submit a one-page report on the corresponding reviews (from your peers and me). Again, in this review report you will comment on the fairness of reviews you received and how you incorporated the comments into your corresponding project progress report. Failure to submit the comments to the peer-review report will affect your grade.

4) For the grading of the final report, I will follow the attached content rubric and the writing rubric. I will also check for correctness in the calculations. I also want you to write a short reflection on the peer-review exercise you were involved during the whole project. The percentage of each of them in the final grade is shown in the table. Please read the rubrics so you are aware of what you are supposed to deliver.

PEER-REVIEW ACTIVITY

In your professional life, you will be constantly asked to review the work of some of your peers. This is the moment to get used to this.

Each of you will review the project progress reports of a random group following some instructions and rubrics. The feedback is important to the other group. Be respectful and serious in your comments. The comments have to also be complete (see peer-review guidelines). Comments like "Good job", or "This is terrible" are not enough. If it is a good job or a terrible job say why. If it is "terrible" tell the group also how to improve it.

This part of the peer-review process is designed to help each of the groups to improve the quality of the course project. Please, follow the "peer-review report guidelines" I provided in this document to review the report. You just need to keep an eye only on:

a. Number of completed tasks in the current progress report.
b. Writing format of the current progress report.
c. Quality and appropriateness of the design and correctness of the calculations for each task in the current progress report.

Peer-review report guidelines

1) Following the scale provided, evaluate if the group completed the assigned tasks on this progress report.

0 points	Did not complete them
40 points	Less than half of the tasks completed
70 points	More than half of the tasks completed but not all
100 points	All task completed

GRADE1 =

What did they miss?

2) Follow the task rubric to assess each of the assigned tasks. Write the scores on the rubrics per each task and submit them. Using your grades per tasks, provide the average grade:

GRADE2 =

Comment on what they should do to improve in their task format. What should they do?

3) Did they follow the content rubric? Calculate GRADE3 following the provided content rubric. Please be aware that not all the sections of the report have been completed yet as this is just a progress report.

4) Give your suggested grade for this progress report using the formula:

   GRADE = (GRADE1 + GRADE2 + GRADE3) / 3

   GRADE =

5) Please comment on their design and the procedure they used for calculations. Is the implemented procedure correct? If not, what can they do to make it correct? Does the design make sense? Is it economical? Do you foresee any operational issue in their design? Always explain the reasoning of your comments.

6) Assuming the company is deciding whether to continue or not the contract with this group of young talented engineers, based on their performance completing the tasks, how do you think the Engineering Head of the company would be excited about the project? Why? What concerns the Engineering Head would have? Why? The answer to these questions should include your take on all the following: overall design, correctness of the calculation procedure, and progress report presentation.

7) Give the group the most important comment you think they should know. As you write the comment, be sure to describe what you see (positive or negative), explain why it is important your observation, and provide specific information to help them improve their work.

RUBRICS

Task Rubric

	Exceeds Standard	Meets Standard	Approaches Standard	Needs Attention
	100 points	**70 points**	**40 points**	**0 points**
1. Purpose **5%**	The purpose of the section to be answered is clearly identified and stated.	The purpose of the section to be answered is identified, but is stated in a somewhat unclear manner.	The purpose of the section to be answered is partially identified, and is stated in a somewhat unclear manner.	The purpose of the section to be answered is erroneous or irrelevant.
2. Drawings & Diagrams **10%**	Clear and accurate diagrams are included and make the section easier to understand. Diagrams are labeled neatly and accurately.	Diagrams are included and are labeled neatly and accurately.	Diagrams are included and are labeled.	Needed diagrams are missing OR are missing important labels.
3. Sources **5%**	Several reputable background sources were used and cited correctly.	A few reputable background sources are used and cited correctly.	A few background sources are used and cited correctly, but some are not reputable sources.	Background sources are cited incorrectly.
4. Design considerations (safety, cost, etc) **10%**	Design is carried out with applicable assumptions and full attention to safety and cost, etc.	Design is generally carried out with assumptions and attention to safety, cost, etc.	Design is carried out with some assumptions and some attention to safety, cost, etc.	Assumptions, safety and cost were ignored in the design.
5. Data and variables **5%**	All data and variables are clearly described with all relevant details. The units of all values are shown.	All data and variables are clearly described with most relevant details.	Most data and variables are clearly described with most relevant details.	Data and variables are not described OR the majority lack sufficient detail.
6. Procedure **25%**	Procedure is described in clear steps. The step description is in a complete and easy to understand short paragraph.	Procedure is described in clear steps but the step description is not in a complete short paragraph.	Procedure is described in clear steps. The step description is in a complete short paragraph but it is difficult to understand.	Procedure is not described in clear steps at all.
7. Calculations **20%**	All calculations are shown and the results are correct and labeled appropriately. The units of all values are shown.	Some calculations are shown and the results are correct and labeled appropriately.	Some calculations are shown and the results labeled appropriately.	No calculations are shown OR results are inaccurate or mislabeled.
8. Summary **5%**	Summary describes the design, the relevant information and some future implications.	Summary describes the design and some relevant information.	Summary describes the design.	No summary is written.
9. Materials **5%**	All materials used in the design are clearly and accurately described.	Almost all materials used in the design are clearly and accurately described.	Most of the materials used in the design are clearly and accurately described.	Many materials are described inaccurately OR are not described at all.
10. Analysis **10%**	The design is discussed and analyzed. Argumentative predictions are made about what might happen in case of change in the operation and how the design could be change.	The design is discussed and analyzed. Argumentative predictions are made about what might happen in case of change in the operation.	The design is discussed and analyzed. No argumentative predictions are made about what might happen in case of change in the operation and how the design could be change.	The design is not discussed and analyzed.

Content Rubric

	POINTS
1. Title Page	
2. Abstract	100
3. Table of Contents	25
4. List of Figures & List of Tables	25
5. Report Body	
a. Job site location	50
b. Specifications and design philosophy	150
c. Sources	50
d. Materials and specifications	100
i. Establish the pipe and tank material to use	
ii. Fluid characteristics	
e. Preliminary drawings and sketches	100
i. Plot plan	
ii. Elevations	
f. Design calculations	1000
i. Tank specifications	
ii. Flow rate	
iii. Pipe sizing	
iv. Provide pipeline support info	
v. Energy losses	
vi. Pump selection	
vii. Instrumentation selection	
6. Final drawings	300
g. Plot plan	
h. Elevations view	
i. Isometrics	
7. Bill of materials and equipment list	200
8. Final remarks	50
9. Appendix	50
TOTAL POINTS	**2200**

The total points need to be converted to a 100-point based grade following:

GRADE = SUM_OF_POINTS * (100/2200)

Writing Rubric

Student Learning Outcomes	Exceeds Standard 100 points	Meets Standard 70 points	Approaches Standard 40 points	Needs Attention 0 points
1. **Students will be able to clearly state a focused problem, question, or topic appropriate for the purpose of the task.** FOCUS ON: **Sections 2, 5a, and 5b**	The description of the design in sections 2, 5a, and 5b is **comprehensive, clearly stated, creative, focused, manageable**, and demonstrates a **clear understanding** of the purpose of the task.	The description of the design in sections 2, 5a, and 5b is **clearly stated**, **focused, manageable**, and demonstrates **adequate consideration** of the purpose of the task.	The description of the design in sections 2, 5a, and 5b is **ambiguous** and **too broadly or narrowly focused**, but demonstrates **awareness** of the purpose of the task.	The description of the design in sections 2, 5a, and 5b is **weak (or missing)** and demonstrates **minimal knowledge** of the purpose of the task.
2. **Students will be able to identify relevant knowledge and/or credible sources** FOCUS ON: **Sections 5c, and 5d**	Identified knowledge or sources are **relevant, credible, and high quality**.	Identified knowledge or sources are **mostly relevant and credible.**	Identified knowledge or sources are **minimally relevant and credible**.	Identified knowledge or sources are **not relevant or credible (or are missing).**
3. **Students will be able to synthesize information and multiple viewpoints related to the problem, question or topic.** FOCUS ON: **Section 5f**	Information from sources and the design ideas is synthesized to **reveal insightful patterns, differences and similarities** among multiple viewpoints.	Information from sources and the design ideas is synthesized to **reveal patterns, differences and similarities** among multiple viewpoints.	Information from sources and the design ideas is minimally synthesized and **may not reveal patterns, differences and similarities** among multiple viewpoints.	Information from sources and the design ideas is **not synthesized** to reveal patterns, differences and similarities among multiple viewpoints **(or is missing)**.
4. **Students will be able to apply appropriate research methods and/or theoretical framework to the problem, question or topic.** FOCUS ON: **Section 5f**	The critical elements of the design methodology are **skillfully developed or described** to address the problem, question, or topic.	The critical elements of the design methodology are **satisfactorily developed or described** to address the problem, question, or topic.	The critical elements of the design methodology are **minimally developed or described** to address the problem, question, or topic.	The critical elements of the design methodology are **weak (or missing)**.
5. **Students will be able to formulate conclusions that are logically tied to inquiry findings and consider applications, limitations and implications** FOCUS ON: **Section 6,7, and 8**	The stated conclusion **thoroughly evaluates** and organizes **all essential** information and is the logical outcome of the design.	The stated conclusion **evaluates** and relates logically to **all essential** information.	The stated conclusion **minimally evaluates** and relates logically to **some essential** information.	The stated conclusion is **absent or weakly evaluates** essential information **(or is missing)**.
6. **Students will be able to reflect on or evaluate what was learned.** FOCUS ON: **Section 9**	Reflection of results shows a **strong relationship** among content, lessons learned, and/or changes in personal perspective.	Reflection of results shows a **relationship** among content, lessons learned, and/or changes in personal perspective.	Reflection of results shows a **minimal relationship** among content, lessons learned, and/or changes in personal perspective.	Reflection of results shows a **weak or no relationship** among content, lessons learned, and/or changes in personal perspective **(or is missing)**.