Project Deliverable D: Conceptual Design

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

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Abstract:

This technical document presents the process of generating conceptual designs for our Erosion Testing System. The document includes 5 conceptual drawings made by each member of the group as well as one collaborative conceptual design that incorporates everyone’s ideas.

Zaineb Wadood’s Conceptual Design:

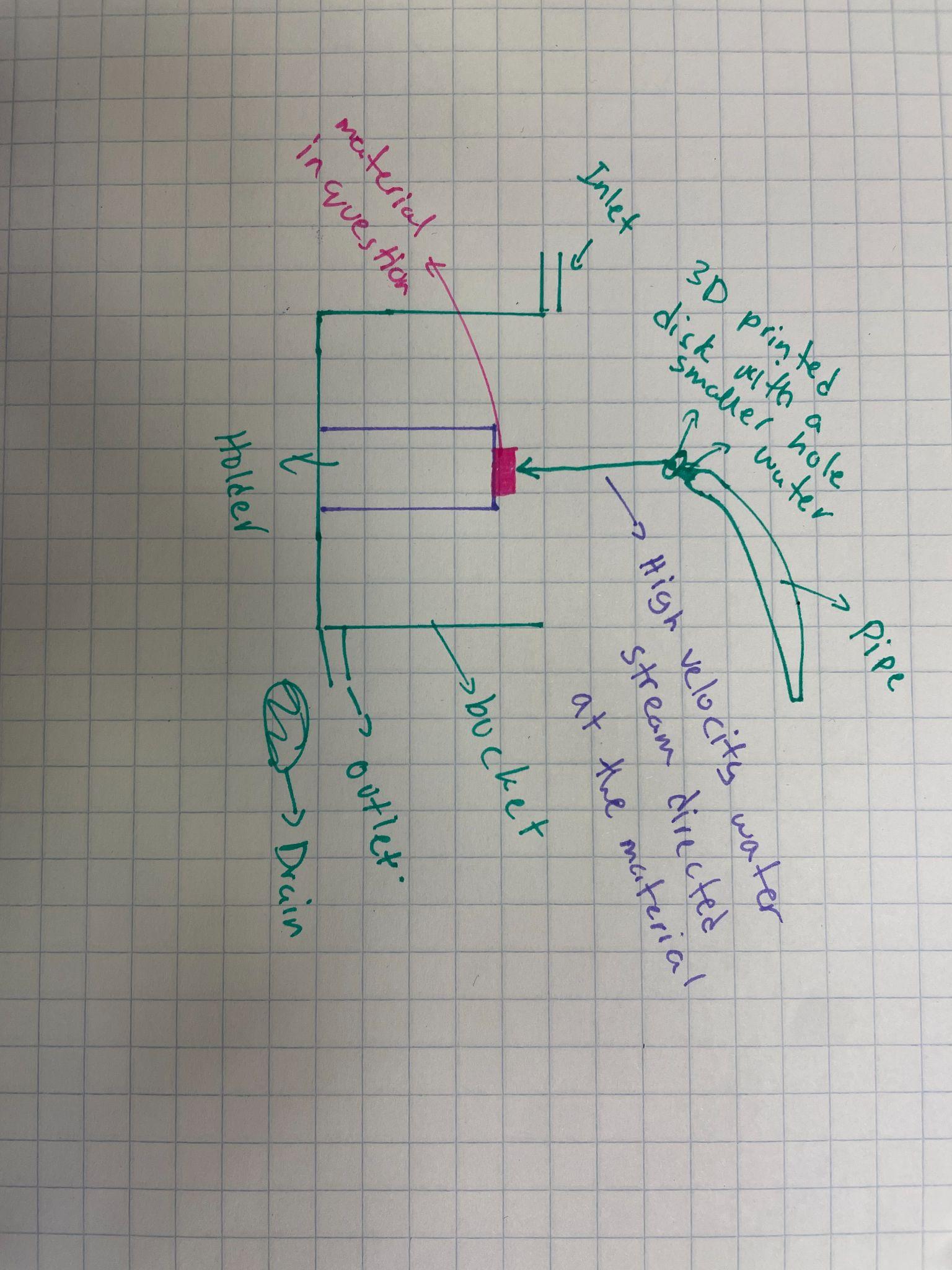


Figure 1.

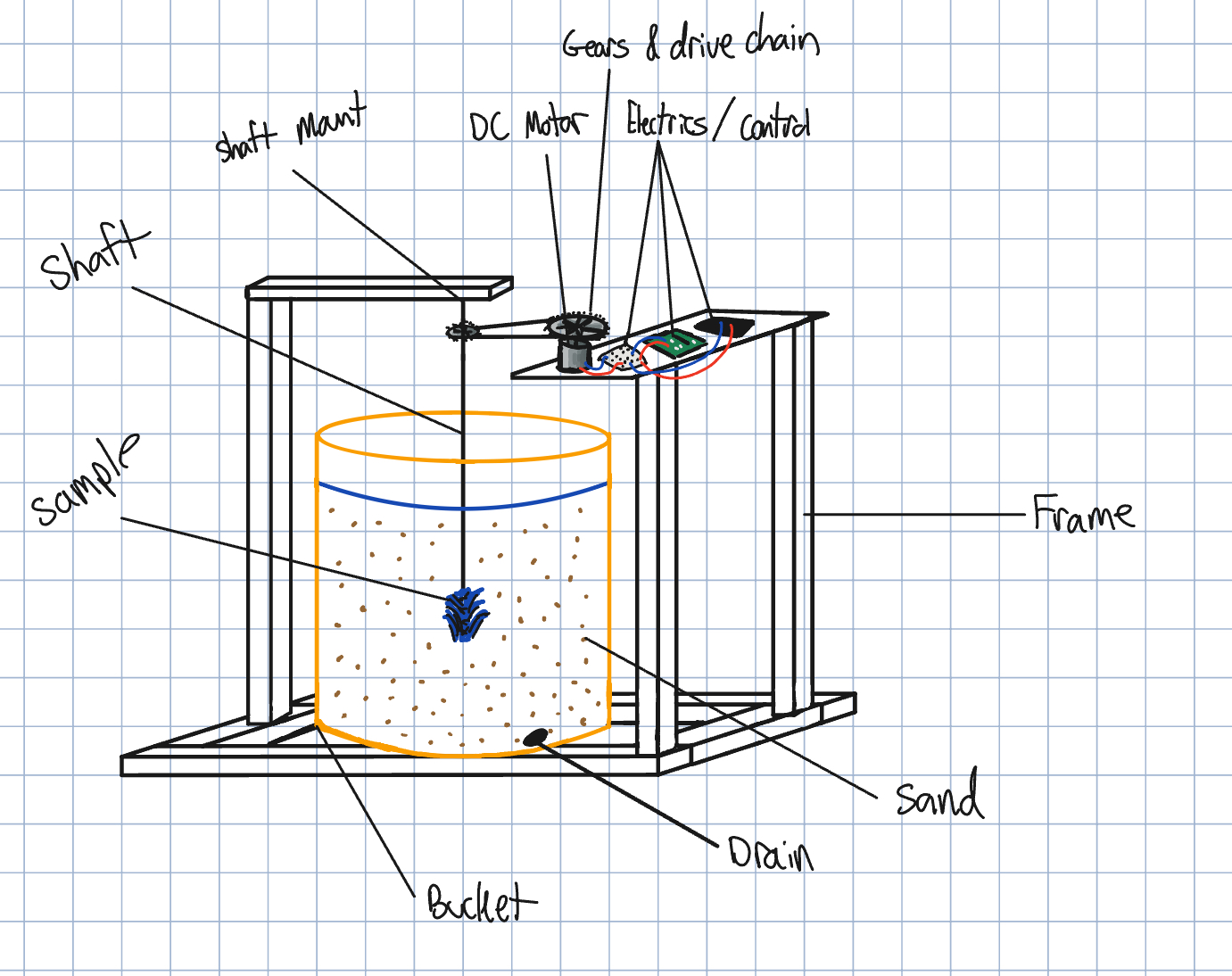
Benefits:

* Realistic simulation of water erosion scenarios.
* Versatility in testing both solid particle and liquid droplet erosion.
* Cost-effective compared to other erosion media.
* Non-abrasive nature reduces mechanical damage to materials.

Drawbacks:

* Requires complex setup with specialized equipment.
* Safety risks associated with high-velocity water streams.
* Potential sample contamination from water impurities.
* Environmental considerations for water disposal.
* Limited applicability in extreme erosion conditions.

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|  |  |  | **Figure 2.** Erosion on an industrial component by Matthew Schroeder  Benefits   * Frame provides sturdiness * Materials are cost effective * Parts are easy to find * Simulates erosion on a real-life part   Considerations   * No way to drain the water to measure the mass of eroded material * A cheap motor might not be strong enough to spin the sample at the needed speed   Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings Ink Drawings  **Figure 3.** Erosion on a rock core sample testing mechanism - Benjamin Kelly  **Benifits**   * The sand in the water will alow for faster erosion * The drive belt and gear ratio will cause the sample to spin uo to a signifacantly higher rpm then could have been achieved without it.   **Draw backs**   * The design is quite flimzy and nothing is secured. * Leakage may be an issue, because of the drainage hole in the bottom of the bucket.     **Figure 4.** Motor and target mechanism - Rebecca Heller  Benefits   * Separation of two bearings stiffens shaft to minimize deflection under heavy load * Locking clamp nut prevents accidental release of target under high rmp * Backing plate prevents vibration in target   Considerations/current drawbacks   * Direct drive servo needs to be sized to accommodate largest load |
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|  |  |  | **Figure 5.** Accelerated erosion on a component by Cameron Caudle  **Benefits**   * Sandy water increases erosion rate. * Simple mechanism to spin the shaft as it is directly attached to the DC motor * Drain is easy to use and contains room for filters.   **Draw backs**   * The spinning shaft is only attached at the top so it could be quite wobbly at the other end of the shaft (bottom) * Shaft speed is limited to the strength of the DC motor. |



**Figure 6.** Cumulative design as decided by the group

Benefits

* Sturdy design with wood frame, shaft connected at both ends
* Drain allows for water to be drained and the system to be reset
* Gear ratio allows a slower motor to spin the sample at high speed
* Bucket allows for any fluid and medium to be used
* Shaft can be removed for switching samples

Considerations

* Sample could be wobbly due to it being free at the end of the shaft
* No temperature control reduces a variable we could examine
* Some materials could be hard to find, and are located throughout the city
* Drain could create leakage