

# University of Southern Queensland

## School of Civil Engineering & Surveying

Course Number: CIV2403

Course Name: Geology & Geomechanics

Assessment No: 2

Internal

External

This Assessment carries 100 of the 1000 marks total for this Course.

Examiner: Dr Ali Mirzaghobanali

Moderator: Dr Andreas Nataatmadja

Assignment: **Assessment 2 - Geology Component**

Date Due:

18 September  
2017

Penalty for Late Submission:

Loss of *all* marks for the assessment (See note 3. of assessment information in course specification).

Assignments are to be submitted to USQ.

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Please use the naming convention:

REPORT-1-LastName.pdf

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Y is the *Report* number;

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*I hereby certify that no part of this assignment has been copied from any other student's work or from any other source except where due acknowledgement is made in the assignment. No part of this assignment has been written for me by any other person except where such collaboration has been authorised by the Examiner concerned.*

This assignment must be submitted electronically through the drop box on the CIV2403 Study Desk by the due date. No other modes of submission will be accepted. All requests for extensions must be directed to the examiner of CIV2403, Dr Ali Mirzaghobanali.

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## CIV2403 S2, 2016 Geology Assignment.

### Preamble

An existing mining company wants to build a tailings dam for their mining operation on the Ringo Diorite that contains base metals and is seeking a suitable site that will ensure a permanent storage of the contaminated material. Their choice of locations is limited to roughly a 7km x 5km region, the visible area of the regional MiddleBack Geology Map. The company needs to understand the geology as fault reactivation is common in this region and can result in the failing of the tailings dam.

**A) Regional Geology Task:** You are required to establish a geological column and determine the geology history of the region in order to help identify 3 potential dam sites for a tailings dam (Regional Geology Map; Topographic Map; Appendix 1). Therefore, a brief summary (2 pages) of the geological history of the region should be discussed, including a note on the tectonic setting. The brief summary includes a geological column that has the oldest unit at the base and the youngest at the top. It may be helpful to also identify structural features, such as the six major fault zones that are detailed, within this column.

Factors that should be identified within the geological history include aspects such as unconformities, igneous events, deformational events and metamorphic grade. Faults should be identified along with the movement along these faults. The plate tectonic settings need to be identified, where possible, and placed within the geological history. Evidence needs to be included regarding the principle of superposition for the geological history and appendices may be used.

(40 marks)

### **B) Cross Sections:**

Two cross sections, with no vertical exaggeration, need to be constructed that best highlighted the geology of the region, particularly focusing on where the potential dam sites could be located (1 page):

1. An initial cross section needs to be constructed running north east – south west.
2. A second cross section running north west – south east should be constructed.

(20 marks)

### **C) Potential Dam Sites:**

Identify three potential dam sites along any of the water ways found within the map for a dam of approximately 200m x 100m x 5m. Each potential dam site should be on a different geological unit to ensure that a range of geological factors are considered and the best potential site is chosen. An analysis of each site should be conducted and a comparison of the various sites should detail the strengths and weaknesses of each site (2 pages - appendices may be included; Geology Map; Topographic Map; Appendices 1 & 2).

There needs to be a final selection of the best dam site based on an evaluation of the three selected sites that considers all of the data presented. Further site investigation recommendations to verify the viability of the site need to be included (1 page) prior to seeking tenders to actually construct the dam.

(40 marks)

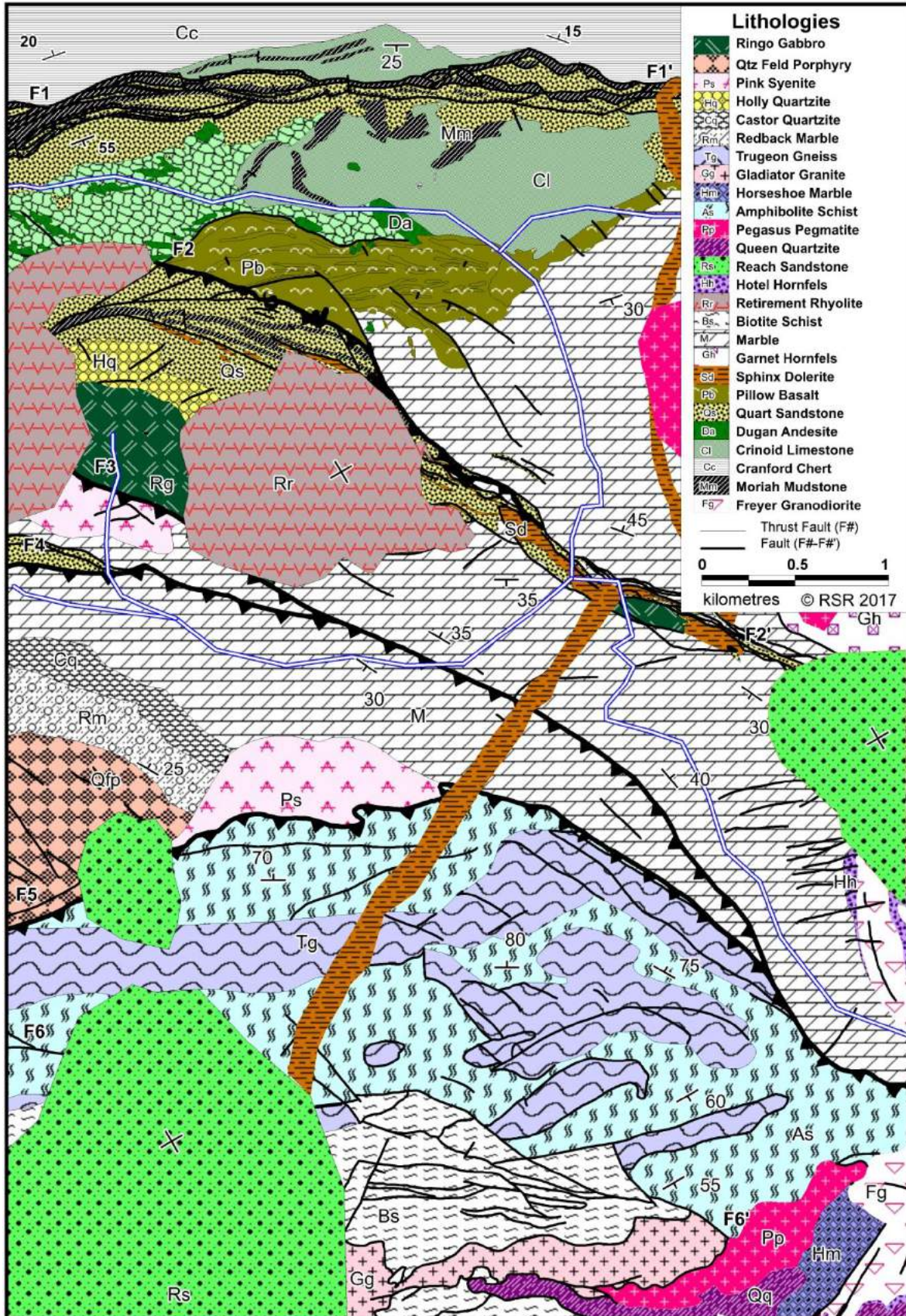


Figure 1: Geology Map

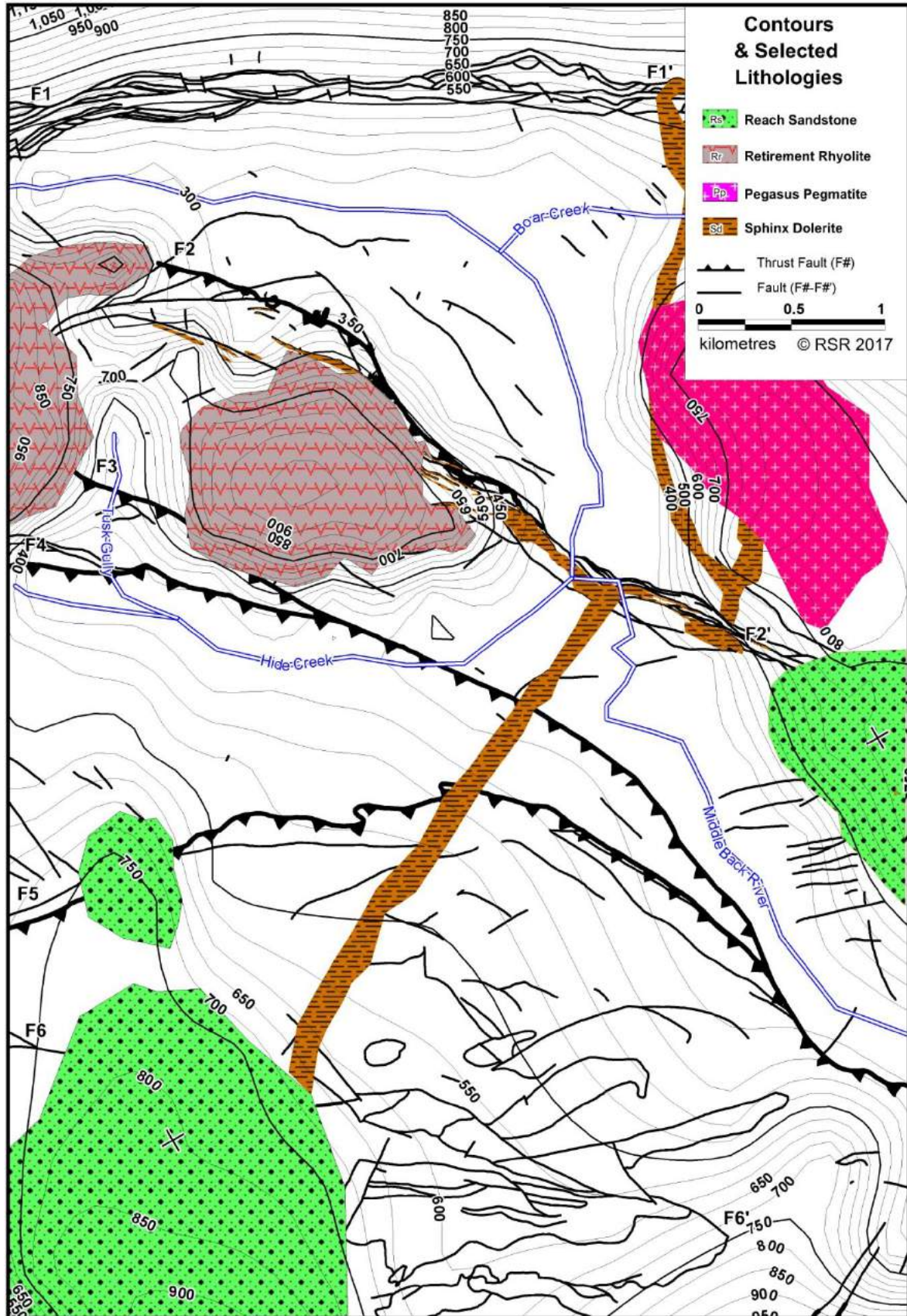


Figure 2: Topography

**Appendix 1: Rock Unit & Summary**

<b>Ringo Diorite</b>	<b>Base Metal Bearing Ore Material</b>
Retirement Rhyolite	Rhyolite plugs, domes and horizontal flows with distinct flow banding common throughout.
Freyer Granodiorite	Mostly deeply weathered regolith with kaolinite extensively found throughout saprolite and grus and rare tors at surface.
Pillow Basalt	Exhibits spherical zones within the basalt thus forming many intersecting discontinuity sets with altered chloritic material on the exteriors of the pillow basalt.
Holly Quartzite	Massive quartzite outcrops dominate the topographic profile compared to the surrounding weaker rock. Tight folding within unit where competency contrast.
Queen Quartzite	Highly deformed quartzite outcrops dominate the topographic profile. Tight folding within unit where competency contrast within unit exists.
Moriah Mudstone	Inter-bedded Quartz mudstone with inter-bedded permeable carbonaceous sandstone and impermeable shales.
Gladiator Granite	Muscovite granite and granodiorite, biotite-hornblende pegmatite with abundant sericite and kaolinite. Granite heavily jointed throughout and joints are associated with many faults that are not recorded.
Castor Quartzite	Quartzite outcrops dipping 25 NNE in the south compared to 10 SSW in the north. Relatively little cover on this rock.
Quartz Sandstone	Poorly sorted clast supported quartz sandstone with a range of rounded to angular lithic fragments contained within the matrix.
Cranford Chert	Radiolarian identified within bands of chert interbedded with fine pelitic sediments.
Dugan Andesite	Phenocrysts of plagioclase found within a fine grained matrix of augite and minor quartz inclusion.
Sphinx Dolerite	Hornblende and biotite dolerite, grey, fine to medium-grained; commonly weathered and of a hypabyssal origin.
Trugeon Gneiss	Almandine garnet rich gneiss. Highly deformed with many faults.
Garnet Hornfels	Calc-Silicate hornfels prominent around margins of intrusive rock types and there is often gradational boundaries between the marble and the hornfels.
Amphibolite Schist	Predominately mafic in origin and deformed to the same grade as the Trugeon Gneiss. Highly deformed with many faults and shear zones.
Reach Sandstone	Quartz sandstone, siltstone, mudstone, sandstone, lithic conglomerate and thin coal bands common throughout. Typically friable and porous.
Crinoidal Limestone	Limestone, carbonaceous shale, chert and sandy siltstone. Common fossils found throughout, particularly crinoids. Cavities common throughout.
Hotel Hornfels	Garnet and Wollastonite found close to the Granodiorite grading to chlorite and dolomite facies minerals further away from the intrusion.
Pegasus Pegmatite	Diorite with biotite-hornblende pegmatite crystals, commonly strongly weathered with abundant sericite and kaolinite.
Pink Syenite	Hornblende phenocrysts with interspersed muscovite syenite. Mostly deeply weathered regolith with smectite extensively found in saprolite and grus.
Biotite Schist	Predominantly biotite-muscovite schist, commonly cleaved and multiply deformed. Highly weathered.
Marble	Massive marble unit with relict crinoids observed throughout the highly faulted unit.
Redback Marble	Calc silicate hornfels prominent around margins of intrusive rock types and there is often gradational boundaries between the marble and the hornfels.
Horseshoe Marble	Almandine hornfels prominent around margins of intrusive rock types and there is often gradational boundaries between the marble and the hornfels.
Qtz Feld Porphyry	Granite Porphyry with quartz, orthoclase and plagioclase phenocrysts in a coarse grained matrix with much evidence of deformation and weathering.

**Appendix 2: Typical Permeability of Rock Units**

<b>Rock Unit</b>	<b>Permeability (mD)</b>
<b>Ringo Diorite</b>	0.001
<b>Retirement Rhyolite</b>	0.002
<b>Freyer Granodiroite</b>	Weathered: 48 Fresh: 0.001
<b>Pillow Basalt</b>	Chloritic Material: 33 Fresh Basalt: 0.001
<b>Holly Quartzite</b>	0.002
<b>Queen Quartzite</b>	0.002
<b>Moriah Mudstone</b>	Deformed: 45 Fresh: 0.001
<b>Gladiator Granite</b>	Weathered: 28 Fresh: 0.001
<b>Castor Quartzite</b>	0.002
<b>Quartz Sandstone</b>	Deformed: 25 Fresh: 12
<b>Cranford Chert</b>	0.0001
<b>Dugan Andesite</b>	0.0002
<b>Sphinx Dolerite</b>	0.0004
<b>Trugeon Gneiss</b>	Deformed: 8 Fresh: 0.001
<b>Garnet Hornfels</b>	0.002
<b>Amphibolite Schist</b>	Deformed: 25 Fresh: 1
<b>Reach Sandstone</b>	Weathered: 56 Fresh: 7
<b>Crinoidal Limestone</b>	Deformed: 25 Fresh: 10
<b>Hotel Hornfels</b>	0.004
<b>Pegasus Pegmatite</b>	Weathered: 56 Fresh: 0.003
<b>Pink Syenite</b>	Weathered: 22 Fresh: 0.006
<b>Biotite Schist</b>	Deformed: 25 Fresh: 13
<b>Marble</b>	Deformed: 68 Fresh: 15
<b>Redback Marble</b>	Deformed: 38 Fresh: 5
<b>Horseshoe Marble</b>	Deformed: 28 Fresh: 6
<b>Qtz Feld Porphyry</b>	Weathered & Deformed: 12 Fresh: 0.002

## Assessment Criteria for Geology Report 2

## Report 2 - Name

S2 2017

Criteria	Level 1 -	Level 2 -	Level 3 -	Level 4 -	Level 5 -	
Marks	0-20%	20-40%	40-60%	60-80%	80-100%	
<b>Task A</b> <b>Regional Geology Task</b> 40 marks	<b>0 - 8 marks</b> <input type="checkbox"/> Geological Column Absent or Incoherent <input type="checkbox"/> Minimal identification of unconformities, igneous events, deformational events and metamorphic grade, faults identified and plate tectonics partially identified. <input type="checkbox"/> Geological stratigraphy and events poorly explained, with little to no aspects of tectonic settings included.	<b>9 - 16 marks</b> <input type="checkbox"/> Geological Column includes most rock types in some order. <input type="checkbox"/> Limited identification of unconformities, igneous events, deformational events and metamorphic grade, faults identified and plate tectonics partially identified. <input type="checkbox"/> Geological stratigraphy and events explained incompletely, with minimal tectonic settings included.	<b>17 - 24 marks</b> <input type="checkbox"/> Geological Column includes all rock types in partial order and major events <input type="checkbox"/> Unconformities, igneous events, deformational events and metamorphic grade, faults identified and plate tectonics partially identified. <input type="checkbox"/> Geological stratigraphy and events explained partially, including aspects of tectonic settings.	<b>25 - 32 marks</b> <input type="checkbox"/> Geological Column includes all rock types in order and major events. <input type="checkbox"/> Unconformities, igneous events, deformational events and metamorphic grade, faults identified and plate tectonics correctly identified. <input type="checkbox"/> Geological stratigraphy and events explained, including tectonic settings.	<b>33 - 40 marks</b> <input type="checkbox"/> Geological Column includes all rock types in order and events. <input type="checkbox"/> Unconformities, igneous events, deformational events and metamorphic grade, faults identified and plate tectonics correctly identified in order. <input type="checkbox"/> Geological stratigraphy and events fully explained, including all aspects of tectonic settings.	<input type="checkbox"/>
<b>Task B</b> <b>Cross Sections</b> 20 marks	<b>0 - 4 marks</b> <input type="checkbox"/> Cross Sections are of <b>poor</b> quality with many inaccuracies and little relevant labelling. <input type="checkbox"/> Cross Sections present isolated data that has aspects related to the geology.	<b>5 - 8 marks</b> <input type="checkbox"/> Cross Sections are of <b>low</b> quality and have <b>several</b> inaccuracies and/or mislabeling. <input type="checkbox"/> Cross Sections present data that has aspects related to the geology.	<b>9 - 12 marks</b> <input type="checkbox"/> Cross Sections are generally of <b>acceptable</b> quality but have <b>some</b> inaccuracies and/or mislabeling. <input type="checkbox"/> Cross Sections <b>generally</b> present relevant data that reflects the geology.	<b>13 - 16 marks</b> <input type="checkbox"/> Cross Sections are generally of <b>good</b> quality and have <b>few</b> inaccuracies and/or mislabeling. <input type="checkbox"/> Cross Sections <b>mostly</b> present relevant data that accurately reflects the geology.	<b>17 - 20 marks</b> <input type="checkbox"/> Cross Sections are generally of <b>excellent</b> quality and have <b>appropriate</b> labelling. <input type="checkbox"/> Cross Sections <b>always</b> present relevant data that accurately reflects the geology.	<input type="checkbox"/>
<b>Task C</b> <b>Potential Dam Sites</b> 40 marks	<b>0 - 8 marks</b> <input type="checkbox"/> Three dam sites located. <input type="checkbox"/> Little to no geology information regarding each site researched and provided. <input type="checkbox"/> Evaluation of little data with respect to site with poor geology research recommendations.	<b>9 - 16 marks</b> <input type="checkbox"/> Three dam sites located, poorly justified with supporting evidence. <input type="checkbox"/> Partial geology information regarding each site researched and provided. <input type="checkbox"/> Evaluation of some data to determine appropriate site location with few geology research recommendations.	<b>17 - 24 marks</b> <input type="checkbox"/> Three dam sites located appropriately, partially justified with supporting evidence. <input type="checkbox"/> Geology information regarding each site researched and provided. <input type="checkbox"/> Evaluation of data to determine appropriate site location with research recommendations.	<b>25 - 32 marks</b> <input type="checkbox"/> Three dam sites located appropriately, mostly justified with supporting evidence. <input type="checkbox"/> Relevant geology information regarding each site researched and provided. <input type="checkbox"/> Evaluation of most data to determine appropriate site location with mostly appropriate geology research recommendations.	<b>33 - 40 marks</b> <input type="checkbox"/> Three dam sites located appropriately, justified with appropriate supporting evidence. <input type="checkbox"/> Highly relevant geology information regarding each site researched and provided. <input type="checkbox"/> Evaluation of all data to determine appropriate site location with appropriate geology research recommendations.	<input type="checkbox"/>
<b>Total</b>	Note: Report Presentation and Harvard AGPS Referencing, in Task A & C, will be marked within each relevant section. Comments:					<input type="checkbox"/>