# Unit 9 - Rubric for Module Final Assessment

## Unit 9 Learning Goals

Upon completion of Unit 9, students should be able to:

1. Plan a sustainable urban water system for a particular scenario
2. Articulate pros and cons of water system options
3. Conduct a triple bottom line decision analysis
4. Communicate plan via a poster presentation and short oral report illustrating decision matrix

## Module Learning Goals

At the completion of the ***Water Sustainability in Cities***module, students will be able to:

1. explain key concepts related to water sustainability
2. use systems thinking to identify opportunities to enhance water system sustainability in cities
3. apply knowledge and skills from atmospheric science and hydrologic science to plan for water sustainability in cities
4. create feasible alternatives and recommend options to improve the sustainability of water systems at building and catchment scales in cities

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| **Unit 9 learning goal** | **Module learning goal** | **Review Criteria** | **0** | **1** | **2** | **3** | |
| 1, 3, 4 | **1** | **Clearly explain, using the triple bottom line as a framework, why their development proposal is more sustainable than a typical development** | Explanation does not address sustainability and no evidence of application of triple bottom line principles, or major misconceptions are present | Minimal mention of sustainability and triple bottom line | Good evidence of understanding of sustainability and triple bottom line, but not explicitly and clearly explained | Clear explanation of how the triple bottom line was used to evaluate how their proposed design is more sustainable than a typical development  Includes demonstration of understanding of the concepts of sustainability and triple bottom line | |
|  | **2** | **Clear application of systems thinking to the coupled urban-natural hydrologic and atmospheric systems** | No mention of systems and no evidence of systems thinking | Minimal evidence of systems thinking and mention of systems | Some mention of systems and some evidence of systems thinking but not explicit | Presentation demonstrates application of systems thinking and recognition of potential feedbacks and coupled human-natural systems | |
|  | **3** | **Demonstration of understanding of the impact of urban development on the hydrologic cycle and atmospheric processes** | No connection demonstrated between urban development and hydrologic and atmospheric processes, or major misconceptions are present | Minimal demonstration of connection between urban development and hydrologic and atmospheric processes | Some demonstration of connection between urban development and hydrologic and atmospheric processes, but could be clearer | Clearly explains throughout presentation the connection between urban development and hydrologic processes, and how urban development impacts hydrologic processes | |
| **Unit 9 learning goal** | **Module learning goal** | **Review Criteria** | **0** | **1** | **2** | **3** |
| **Sustainable design: Reduction in water consumption** | | | | | | |
| 1 | **1** | * **Explanation of implemented sustainable strategies for reduction of water consumption in the landscape and in the buildings** | Sustainability of chosen design is unclear | Minimal evidence of sustainable design, but not explicit | Sustainable strategies were implemented, but not well described or understood | Clear description and implementation of a sustainable design that utilizes methods to reduce water consumption |
| 1, 2 | **3** | * **Explanation of rationale for their selection of strategies including the scientific basis** | Lack of explanation re. why certain strategies were chosen | Minimal rationale given for selection of strategies | Some rationale given, but not well explained or described | Clear explanation re. why strategies were chosen including the scientific basis for their selection |
|  |  | * **Documentation of their work with defensible and accurate calculations** | Major confusion or mistakes in the methods and major errors in results | Calculations mostly done correctly, but some mistakes in the methods | Calculations done correctly, but some minor mistakes like errors in unit conversion | Calculations done correctly |
|  | **4** | * **Evidence of iteration on different options** | No iteration on different options | Minimal iteration on different options | Some iteration performed, but either the results were not implemented, or not explained | Iteration between different options in decision process resulted in selection of chosen strategy |
| **Sustainable design: Reduction in storm water runoff** | | | | | | |
| 1 | **1** | * **Achieved sustainability goal of developed runoff = natural runoff** | Sustainability of chosen design is unclear and no attempt made to reduce developed runoff to natural levels | Minimal evidence of sustainable design, but not explicit | Sustainable strategies were implemented, but not well described or understood | Consideration of storm water in sustainability of design and clearly achieved goal of reducing developed runoff to natural levels |
| 1, 2 | **3** | * **Explanation of their rationale for their selection of strategies including the scientific basis** | Lack of explanation re. why certain strategies were chosen | Minimal rationale given for selection of strategies | Some rationale given, but not well explained or described | Clear explanation of why strategies were chosen including the scientific basis for their selection |
| **Unit 9 learning goal** | **Module learning goal** | **Review Criteria** | **0** | **1** | **2** | **3** |
|  |  | * **Documentation of their work with defensible and accurate calculations** | Major confusion or mistakes in the methods and major errors in results | Calculations mostly done correctly, but some mistakes in the methods | Calculations done correctly, but some minor mistakes like errors in unit conversion | Calculations done correctly |
|  | 4 | * **Evidence of iteration on different options** | No iteration on different options | Minimal iteration on different options | Some iteration performed, but either the results were not implemented, or not explained | Evidence of iteration on different options |
| 3 | 4 | **Estimation and explanation of cost of selected strategies** | No consideration of cost | Cost was considered, but not estimated or explained well | Cost was considered and estimated, but not explained clearly | Cost of different strategies was considered, estimated and explained |
| 1 | 3 | **Considers connections between the development and extreme hydroclimatic events and possible management strategies for extreme events.** | No consideration of extreme events | Minimal consideration of extreme hydroclimatic events | Some consideration of extreme hydroclimatic events, but not well explained or understood | Clear explanation of the connection between extreme hydroclimatic events and urban development with inclusion of strategies to minimize impacts |
| 1 | 3 | **Considers the connection between the proposed development and the urban climate and considers possible strategies to minimize the urban climate impact of the development** | No consideration of urban climate impacts from the proposed development | Minimal consideration of urban climate impacts | Some consideration of urban climate impacts, but not well explained or understood | Clear explanation and understanding of the connection between the proposed development and the urban climate with consideration of possible strategies to minimize any impacts |
| 4 |  | **Quality of writing, presentation materials and oral presentation or report** | Significant incorrect grammar, spelling and sentence structure. Unclear or illegible presentation material. | Considerable spelling/grammar errors and/or issues with organization or presentation of materials | Few spelling/grammar errors and/or minor problems with organization or presentation of material | Clear presentation materials, presentation or report is organized and logical. No spelling or grammar errors. |
|  | | **Total score out of 45:** | | | |  |