# Learning Progression

**Materials: Landforms Design Challenge 1** **Grade level: 5th**

Prerequisite skill:

Learning Target:

Student will be able to identify a problem in terms of criteria for success.

**Success Criteria:**
I can… identify a problem that needs to be solved.

**Formative Assessment:**
DC_1

Learning Target:

Student will be able to identify limits of the problem. (constraints)

**Success Criteria:**
I can…identify the limits to my problem

**Formative Assessment:**
DC_1

Learning Target:

Research the problem (activate prior knowledge, look up concepts related to the problem)

**Success Criteria:**
I can…identify information to help me solve the problem

**Formative Assessment:**
DC_1

Learning Target:

Brainstorming
Generate ideas and compare possible solution ideas based on how well it meets criteria and constraints.

**Success Criteria:**
I can…list several possible solutions to the engineering problem.

**Formative Assessment:**
DC_1

Learning Target:

Communicate results verbally or, through writing, and/or pictures

**Success Criteria:**
I can…work in a team to create a solution to an engineering problem.

**Formative Assessment:**
DC_1

**Big Idea:**

**Engineering Design is a systematic process for solving human problems.**

Later big ideas that build on this big idea include:

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## Landforms

**Challenge Title: Create a Model of School Grounds**

| **Targeted Engineering Practices** *select the engineering practices taught in this challenge* |
|---|
| ☐ Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.<br>☐ Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem<br>☐ Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. |
| **Connected Scientific Content Ideas** |
| *A model is a simplified representation of an object, event, or system in the natural world.* |
| **Description of Student Success Criteria:** |
| At the completion of this task students will be able to:<br><br>*Students will be able to accurately represent the school yard using scale and directionality in their design.* |

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**LANDFORMS Kit – Investigation 1**

Dear Students,

Each year, the safety committee meets to find the safest places on our school grounds to line up during a fire drill. I am making a presentation to that committee next week. I need you to help me with a problem. I need an accurate model of our school grounds to show the committee, but I don't have time to create one.

In order to create an accurate model, it is important that you carefully observe the features of the school grounds. It is also important that you record accurate details and take clear notes.

Thank you in advance and I look forward to seeing the models you will create.

Sincerely,

School Principal

**TASK I**

**Problem:** Create a model in the stream table that represents your school grounds.

**Available Materials:** You may use half of a stream table, earth materials, craft sticks, and blue gram pieces (and whatever additional materials are available in the room or outside).

**Criteria for a successful solution to the problem:** Your team will create a model that shows the school buildings and school grounds and any playground structures.

**Constraints:** The model must be built in the stream table. You can only use the materials available in the classroom or that you have collected from the school grounds.

**Background Knowledge**: Prior to the design challenge students will need lessons and activities on scale, map key, directionality (compass rose), and birds eye view.

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Dear Students,

Your models were very well done and showed me a lot of detail. Unfortunately, the stream table models are too difficult for me to carry to the meeting. I need you to transfer your model data to something that is flat and easy to carry.

Sincerely,

School Principal

**TASK II**:
**Problem**: Transfer your data to some material that is flat and can be easily transported.

**Available Materials:** Transparent graph sheets, wipe off markers, scotch tape, and models already created in stream tables.

**Criteria for a successful solution to the problem:** Your team will draw a map of our school grounds. The school building, playground, and parking lots need to be included on your map. Draw your map to scale with a North arrow. Your map must be clear and easy to read.

**Constraints:** You need to show the school building, all portables, fences, bus lanes and parent pick up lanes, parking lots, sidewalks, and grassy or bark areas and the paved areas of the schoolyard.

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**LANDFORMS Kit – Investigation 1**

Dear Students,

Your transparency maps were very well done, but the safety committee didn't understand what some of the symbols and areas were. They need an accurate scale map of the school grounds in order to finalize the school safety plan.

I am anxious to see the maps that you produce.

Sincerely,

School Principal

**TASK III**:

**Task**: Your team will draw an accurate scale map of the school grounds.

**Problem:** Draw an accurate scale map of our school grounds.

**Available Materials:** Transparencies, stream tables, wipe off markers, paper, pencils, and colored pencils.

**Criteria for a successful solution to the problem:** Your team will draw a scale map of the school grounds with a North arrow and map key included. Your map must be clear and easy to read.

**Constraints:** You need to show the school building, all portables, fences, bus lanes and parent pick up lanes, parking lots, sidewalks, and grassy or bark areas and the paved areas of the schoolyard.

- Your map must be drawn to scale.
- Use a compass rose to show the cardinal directions
- You must have a map key to explain your scale and any other symbols or colors that you use in your map.
- Your map needs to be drawn on map grid provided (student sheet #5)

**Background Knowledge**: Prior to the design challenge review with students scale, map key, directionality (compass rose), and birds eye view.

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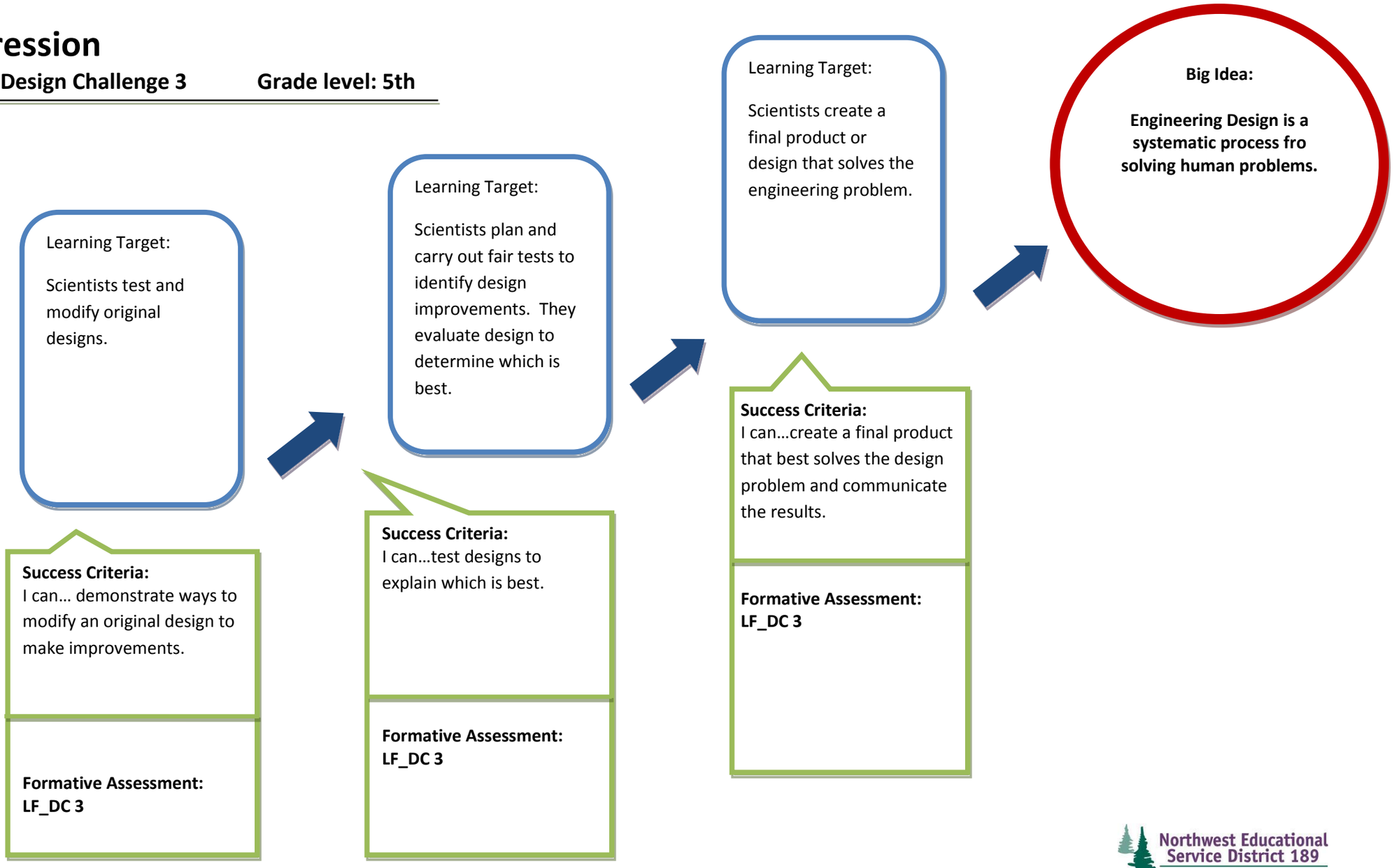
# Learning Progression

**Materials: Landform Design Challenge 3** **Grade level: 5th**

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## Landforms

**Challenge Title: Save a Town**

| **Targeted Engineering Practices** *select the engineering practices taught in this challenge* |
|---|
| ☐ Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.<br>☐ Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem<br>☐ Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. |
| **Connected Scientific Content Ideas** |
| • *Erosion can affect ecosystems. (4-5 ES2F)*<br>• *Systems: A system can be analyzed by the study of its subsystems and larger more inclusive systems. (4-5 SYSA,B,C,D)* |
| **Description of Student Success Criteria:** |
| At the completion of this task students will be able to:<br><br>*Students will be able to represent a model of how erosion affects an ecosystem and make modifications to optimize their design to save the town from the river flow.* |

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Landforms Design Challenge #3:

Design Brief:

Problem: There is a town that is in danger of eroding away. Your challenge is to design a system to protect the town from erosion when a water source is introduced to the stream table.

Specifications:

Criteria: Using the materials provided, you must protect the town from erosion.

Materials:

- Standard Stream-table set-up (see poster)
- ½ of a 3 X 5 notecard
- Building materials
  $20 Popsicle sticks
  $10 Blue one gram cubes
  $5 Paper Clips
  $5 Rubber Band

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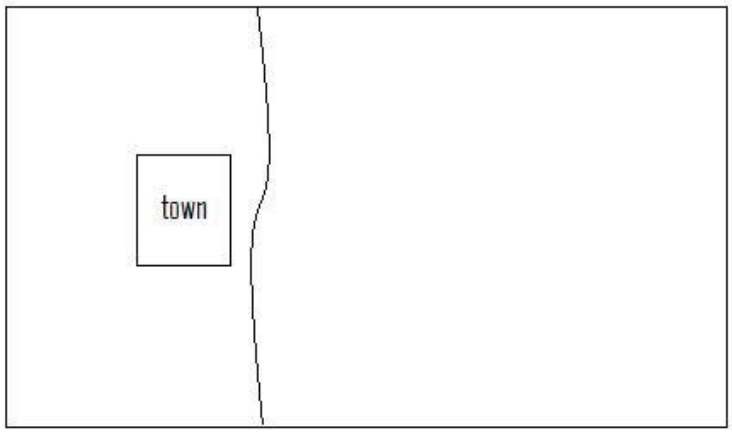
Constraints: You will have a budget of $100 dollars for materials. The town should be placed in the center of the earth material and you may not move the town.

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Background Research: You will need to access your understanding of how erosion affects landforms.

Task:

Day 1: Your team will need to set up a standard stream table, brainstorm possible designs, and select materials. Then create your first design and test it.

To test your design, you must pass one liter of water through the "flood" water source. In your teams,

observe the results and discuss what went well and what did not.

Day 2: Using your discussions and expertise from day one, modify and improve your design so that it does a better job of protecting the town. Observe the results and discuss what went well and what did not.

Day 3: Repeat the steps from Day 2. Be prepared to share your design process with the class discussing what went well and what didn't, and describe your best design.

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