EQuIP RUBRIC FOR SCIENCE EVALUATION

Why does land change shape and how can we prevent land from changing?

Developer: OpenSciEd

Grade 2 | July 2024

equip
Educators Evaluating Quality Instructional Products

nsta
National Science Teaching Association

CATEGORY I Rating			CATEGORY II Rating			CATEGORY III Rating		
A.	Explaining Phenomena/ Designing Solutions	**Extensive**	**A.**	Relevance and Authenticity	**Extensive**	**A.**	Monitoring 3D Student Performance	**Extensive**
B.	Three Dimensions	**Extensive**	**B.**	Student Ideas	**Extensive**	**B.**	Formative	**Extensive**
C.	Integrating the Three Dimensions	**Extensive**	**C.**	Building Progressions	**Extensive**	**C.**	Scoring Guidance	**Extensive**
D.	Unit Coherence	**Extensive**	**D.**	Scientific Accuracy	**Extensive**	**D.**	Unbiased Tasks/ Items	**Extensive**
E.	Multiple Science Domains	**Extensive**	**E.**	Differentiated Instruction	**Extensive**	**E.**	Coherent Assessment System	**Extensive**
F.	Math and ELA	**Extensive**	**F.**	Teacher Support for Unit Coherence	**Extensive**	**F.**	Opportunity to Learn	**Extensive**
			G.	Scaffolded Differentiation Over Time	**Adequate**			
	SCORE CAT I	**3**		**SCORE CAT II**	**3**		**SCORE CAT III**	**3**
				SUM CATEGORIES	**9**			
				RATING	**E**			

Summary Comments

This unit is strong in several areas, including using a relevant phenomenon that can be found in many different parts of the country, using students' questions to drive the learning, providing explicit teacher support for unit coherence, ensuring equitable opportunities for students to express their understanding, and having a coherent assessment system that monitors students' three-dimensional learning.
Throughout the unit, students regularly return to the anchoring phenomenon of *How do water and wind change the shape of lands?* The learning progression in the materials is logical and clearly outlines how students move toward targeted elements. Lessons offer explicit support to teachers for eliciting students' questions, recognizing individual students' prior knowledge, and building progression throughout the unit. Each lesson's navigation includes strategies to help teachers connect student engagement across lessons, including the Notice and Wonder chart, Our Growing Ideas Chart, the Community Examples Chart, and the Land Change Bin Model Checklist.

Students have extensive opportunities for three-dimensional learning, with multiple elements of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts being used and/or intentionally developed throughout the unit. The unit focuses on five Disciplinary Core Ideas: ESS1.C—The History of Planet Earth, ESS2.A—Earth Materials and Systems, ETS1.A—Defining and Delimiting Engineering Problems, ETS1.B—Developing Possible Solutions, and ETS1.C—Optimizing the Design Solution, and builds on five *NGSS* Performance Expectations: 2-ESS1-1, 2-ESS2-1, K-2-ETS1-1, K-2-ETS1-2, and K-2-ETS1-3. The unit intentionally develops five Science and Engineering Practices: Asking Questions and Defining Problems, Developing and Using Models, Planning and Carrying Out Investigations, Analyzing and Interpreting Data, Constructing Explanations and Designing Solutions, and Engaging in Argument From Evidence, and intentionally develops the Crosscutting Concepts of Patterns, Stability and Change, and Structure and Function. Students develop and demonstrate understanding of the three dimensions at the element level in lessons and assessments. The materials include instructional guidance documents, assessment tools, and specific callouts in the lessons to support instruction and student progress with each of the three dimensions in every lesson.

Throughout the unit, students have multiple opportunities to relate land change and land change problems to their personal experiences or communities. The materials support teachers in connecting lessons to students' homes and communities through the lesson navigation language and "Community Connections." The lesson incorporates accessible examples to ensure that all students understand the contexts, drawing from examples found within their own communities.

Additionally, there is explicit guidance for teachers to ensure that students fully understand and can access task scenarios. Students have equitable opportunities to demonstrate their knowledge, express their thinking through various modalities, and choose the one that works best for them. A coherent assessment system includes pre-assessments, formative assessments, self-assessments, summative assessments, and peer assessments. Students have opportunities to receive feedback and revise their thinking based on the feedback received. There is also three-dimensional scoring guidance to support both the teacher and the student with interpretation of students' progress throughout the unit.

During revisions, the reviewers recommend paying close attention to the following areas:

- Clearly identify and specify the prior learning of each dimension.
- Consider providing guidance on how to scaffold all the intentionally developed SEP elements and gradually decreasing support to help students become more independent in using each element.

Please note that in the feedback provided in this report, black text indicates either neutral comments or evidence that the criterion was met. Purple text signifies evidence that does not support the claim that the criterion was

met. The purple text in these reports is specifically related to the criteria and aims to highlight areas with potential for improvements. It is important to note that *not all purple text affects the score or rating*; much of it is too minor to impact the overall rating. For instance, even criteria rated as "Extensive" may contain purple text intended to aid in continuous improvement processes. In such cases, the criterion was indeed met, and the purple text is simply not part of the justification for the "Extensive" rating.

CATEGORY I
NGSS 3D Design

I.A. Explaining Phenomena/Designing Solutions

I.B. Three Dimensions

I.C. Integrating the Three Dimensions

I.D. Unit Coherence

I.E. Multiple Science Domains

I.F. Math and ELA

I.A. EXPLAINING PHENOMENA / DESIGNING SOLUTIONS — Extensive

Making sense of phenomena and/or designing solutions to a problem drive student learning.

i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem solving.
ii. The focus of the lesson is to support students in making sense of phenomena and/or designing solutions to problems.
iii. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical, life, and/or earth and space sciences.

The reviewers found extensive evidence that making sense of the changing shape of land and designing solutions to slow down this problem drive student learning. Materials are organized so that students are figuring out the central phenomenon: land changing shapes without humans or animals moving it. Student questions and prior experiences related to the phenomenon or problem extensively motivate sensemaking and/or problem solving. When engineering is a learning focus, it is integrated with developing Disciplinary Core Ideas from Earth and space sciences. Related evidence includes the following:

i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem-solving.

There is a student-centered focus on phenomena or problems.

- 2.1 Earth Land Erosion Unit Front Matter, "The anchoring phenomenon for this unit is a puzzling newscast about land changing shape. Students have the opportunity to try and explain how land by the side of a road seemingly changed shape without people or other animals moving it, and expand to related phenomena that they find of land changing shape in their communities." (2.1 Earth Land Erosion Unit Front Matter)
- Lesson 1, Explore Section, Step 2 "Tell students you recently saw a news story about a problem some people had noticed in their community. Explain that you wanted to watch the news story together and try to figure out what is happening. Explain that as you play the video, students should be considering the three questions on the slide. Tell students that they will be sharing their ideas with a partner after we watch the video." Students watch the news story about land moving without humans or animals moving it. (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 3 "Craft the lesson question. Highlight that we now have a shared goal to develop a model to represent the land we want to test. Co-develop the lesson question with students so that it is something like "How can we develop a model to test how wind and water might change the land?" However, feel free to use terms and phrasing that reflects your class' ideas. Write this unit question, or a similar question that your class develops, on the Our Growing Ideas chart." "Teaching Tip: If students suggested something like testing land in the classroom as a possible investigation then use this moment to return to that sticky note to navigate as a way to motivate the creation of the land change bins. (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize Section "Read the first question on the slide and direct students to think first, then talk with a partner, then share with the group. Repeat with the second question. Remind students as they share that they can use their observations as evidence to support their claims." "What did we figure out today? Think, Pair, Share: 1. How do wind and water change land in our community and others? 2. How did we figure that out?"

- Lesson 4, Connect Section, Step 4 "Transition to synthesizing what we figured out. Point out that we have observed several examples of how wind and water can change different types of land. Ask students if they think we can use what we have figured out to answer the lesson question, and allow students to respond." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate Section, Step 1, "Point out student questions on the Notice and Wonder chart that relate to rocks/cement moving and not moving and/or reference the lesson 5 question that was developed at the end of the last science lesson. Suggest that the focus for today be something like, "How might wind and water change the shape of rocks and rocky land?" However, feel free to use terms and phrasing that reflects your class' ideas." (Lesson 5, Teacher Guide)
- Lesson 6, Navigate Section, Step 5 "Revise the unit question. Point out that we now have a lot of ideas about solutions, and questions about creating those solutions. Suggest that now that we have figured out the cause of this land changing shape, we could shift our focus to solutions. Ask the class how we could revise our unit question to include figuring out what we could do about our problem. Students might suggest adding on a phrase like, "what can we do about our problem?" to the end of the unit question. You may end up with a unit question similar to: "How do wind and water change the shape of land and what can we do about it?" or "How do wind and water change the shape of land and how can we design a solution to this problem?". However, feel free to use terms and phrasing that reflects your class' ideas." (Lesson 6, Teacher Guide)

There is consistent student-driven learning over time.

- Lesson 1, Navigate Section, Step 7, "Quickly look for other questions that can be investigated. Revisit the "Wonder" side of the chart and point out any questions that could be turned into ideas for investigation. Read them to students and determine how they could be investigated. Use prompts like, "We are wondering if water can move the land. How could we see for ourselves if water can move land?" when needed. Ideas to look and listen for as you develop this column: play with dirt and land to see if we can move it; use a fan or blow on the ground to see if it moves; do a scavenger hunt or other form of exploration for land changing around us; ask people outside of school to explain how they have seen the land change" (Lesson 1, Teacher Guide)
- Lesson 2, Connection Section, Step 2, "Have students take out the examples they brought in on Sharing Local Examples and/or pass out examples you had printed before class. Ask for a student to share one example of a local land change (e.g., hold up a picture). Ask them to share what the example is and how they found it. Then, ask students to turn and talk to a partner and answer the questions on the slide. Tell students that it is okay if they don't know. Remind students of our classroom agreements that "We share ideas even when we are not sure." & "We let our ideas change and grow." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate Section, Step 6 "Add questions about land around our school. Display slide Z. Record questions in students' own words to the "wonder" part of the chart. If a sticky note exists with an idea for investigation to test land outside, pull this sticky note and ask students what we could do to investigate land outside. Suggest, based on students' questions and/or the sticky note idea for investigation, that we should work to investigate the answers to our questions next time by going outside and testing the land." (Lesson 3, Teacher Guide)
- Lesson 5, Navigate Section, Step 1, "Display slide B. Point out student questions on the Notice and Wonder chart that relate to rocks/cement moving and not moving and/or reference the lesson 5 question that was developed at the end of the last science lesson. Suggest that the focus for today be something like, "How might wind and water change the shape of rocks and rocky land?" However, feel free to use terms and phrasing that reflects your class' ideas. Display slide C and write the class's version of the Lesson 5 question on the next row of the Our Growing Ideas chart, if it does not already exist from the end of Lesson 4." (Lesson 5, Teacher Guide)

- Lesson 8, Navigate Section, Step 8 "Have students refer back to the Notice and Wonder chart. Ask students if we have answered any questions on the chart and if they have any new questions. If students developed new questions or ideas during this lesson, add them to the chart now. Tell students they can put a star next to questions that they have answered." "Motivate the next lesson. Remind students that in Lesson 7 we explored different materials to build our bins with; during this lesson, we read about actual solutions to limit wind and water from changing the land and applied these solutions to our own model drawing. Ask students what they want to do next lesson with their design solution drawings. After students suggest building and testing their model design solutions, explain that next time we will have to do just that!" (Lesson 8, Teacher Guide)

ii. The focus of the unit is to support students in making sense of phenomena and/or designing solutions to problems.

There is a close match between the phenomena/problems and the student learning objectives throughout the materials.

- Lesson 5, Navigate Section, Step 1, "Display slide A and refer back to the How is Land Changing chart that we developed in Lesson 1. Ask students to share what they think about what shape changes to the land they think were caused by wind and water from our newscast. Students will share that the dirt was moved by wind and water. Focus students in on the other types of land in the model (rocks and/or pavement) and ask students, "Do you think that wind and water would also change the shape of this part of the land?" Allow students to respond with their ideas." (Lesson 5, Teacher Guide)
- Lesson 6, Navigate Section, Step 5, "Ask students to look back at their Possible Causes chart and identify that we can now explain how these changes are happening, but we also identified that these changes are affecting people. Ask students something like, 'Why did we care if this land was changing? Who did we say used this land, and how did land changing affect them?'
- Lesson 10, Assessment Guidance "What will students do; Compare multiple solutions designed for limiting wind and/or water from changing the shape of the land based on their shape and stability." "Students have had multiple opportunities in this unit to compare different design solutions, so Choosing a solution to slow land change can be used as a summative assessment opportunity for those Disciplinary Core Ideas as well as the crosscutting concepts of Structure and Function, Stability and Change." (Lesson 10, Teacher Guide)

iii. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical science, life, and/or earth and space sciences.

When students are designing solutions to problems (with or without connections to ETS DCIs)

- Lesson 7, Explore Section, Step 2, "Identify a problem that needs to be solved. Ask students to look back at the Community Examples that we have gathered over time. While looking at the chart, negotiate which Community Example the class might design a solution for. If the class does not quickly come to a consensus on a land change problem, then refer students back to the Possible Causes chart. Ask students to consider which Community Example poses a problem for those who use and live on the land that could be solved. Encourage students to respond to each other's ideas." (Lesson 7, Teacher Guide)
- Lesson 9, Explore Section, Step 3 "Testing Procedures. Display slide E. Celebrate that we have figured out more about what people do when they are engineering solutions to problems. Ask students to share ideas about how we should carry out our tests. Use the following prompt(s) to help students to recall the ways we will test little wind, a lot of wind, or a little water and a lot of water. Use the appropriate prompt below to support students in planning our test procedures." (Lesson 9, Teacher Guide)
- Lesson 10, Explore Section, Step 1, "Guide students to recall that we were testing our designs to find an effective solution to our community land change problem, and that we have not compared the design

solutions to determine what solutions for our community land change problem were most effective. Prompt to use: 'Interesting! So we wanted to find a solution that helps keep land where it is at, and keep it from changing shape. 'Did we find one solution that worked? But how would we know which solution was the most effective for solving our problem?'; Ideas to look and listen for: 'Maybe. A lot of them might have worked. Some worked! Well, I didn't get to see all of them. I don't know which one was the most effective. I think some are effective, but I don't know which one worked better. I didn't see how much land moved.

Suggestions for Improvement: NA

I.B. Three Dimensions (All 3 dimensions must be rated at least "adequate" to mark "adequate" overall)	**Extensive**

Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) *that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions.*

Document evidence and reasoning, and evaluate whether or not there is sufficient evidence of quality for each dimension separately.

Evidence needs to be at the *element level* of the dimensions (see rubric introduction for a description of what is meant by "element")

The reviewers found extensive evidence that the materials give students opportunities to build an understanding of grade-appropriate elements of the three dimensions because students regularly engage in elements of all three dimensions to make sense of the wind and water changing land phenomenon.

Rating for Criterion: SEP Extensive	i. Provides opportunities to *develop and use* specific elements of the SEP(s).

The reviewers found **extensive** evidence that the materials provide opportunities to develop and use specific elements of the SEPs. The claimed SEP elements are closely matched to evidence of their development and use in unit materials. Students use the claimed SEP elements to make sense of phenomena and design solutions to the problem of wind and water changing land.

AQDP: Asking Questions and Defining Problems (K-2)

Claimed Element: AQDP-P1: Ask questions based on observations to find more information about the natural and/or designed world(s).

Claimed in Lessons 1 and 3. Evidence was found in Lessons 1 & 3, examples include

- Lesson 1, Explore Section, Step 2, "An important element of this science practice is asking questions based on observations. Encourage students to connect their questions to their observations by asking "What made you think that?" and inviting them to point or gesture to places in the photos or to act out (or gesture like) what they saw happening with the wind and dirt." (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "To support students in this practice, guide them to develop a testable question. Support students in a question that allows for an answer that is beyond just yes or no. Example sentence starters can be found in Teacher Handbook. Help students to generate questions that will allow them to discover relationships or patterns." (Lesson 3, Teacher Guide)

Claimed Element: AQDP-P3: Define a simple problem that can be solved through the development of a new or improved object or tool.
Claimed in Lessons 2 & Lesson 7. Evidence was found in Lessons 2 and 7, examples include

- Lesson 2, Explore Section, Step 3 "Display slide E. Point out that we now have many examples of land changing and we have some ideas for what might cause the changes (i.e., wind and water)." "Highlight that we now have a shared goal to develop a model to represent the land we want to test. Co-develop the lesson question with students so that it is something like "How can we develop a model to test how wind and water might change the land?" (Lesson 2, Teacher Guide)
- Lesson 7, Explore Section, Step 2 "Encourage students to reflect on the Community Examples chart in order to identify a problem that needs to be solved that is relevant to their communities. Define the problem of needing a model that accurately represents the actual problem (community example) and leverage past work in developing bin models in order to improve and test the model to determine if it accurately represents the actual problem." "Identify a problem that needs to be solved. Ask students to look back at the Community Examples that we have gathered over time. While looking at the chart, negotiate which Community Example the class might design a solution for. If the class does not quickly come to a consensus on a land change problem, then refer students back to the Possible Causes chart. Ask students to consider which Community Example poses a problem for those who use and live on the land that could be solved." (Lesson 7, Teacher Guide)

MOD: Developing and Using Models

Claimed Element: MOD-P3: Develop and/or use a model to represent amounts, *relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).*
Claimed in Lesson 8. Evidence was found in Lesson 1, 3, and 8, examples include

- Lesson 1, Synthesize Section, Step 4 "Distribute a Land Changing Shape handout to each group. Explain that groups will draw on this handout to develop a picture explaining how this land might have moved from the before picture (on the left) to where it is in the after picture (on the right)." (Lesson 1, Teacher Guide)
- Lesson 3, Synthesize Section, Step 3, "Encourage students to use comparative terms (more/less, bigger/smaller) to describe how much the land moved/changed as a result of the wind and/or water. As students work to build the chart they will vary the number of arrows they want to display in the last column. Support students by showing images or the physical land change bins side by side to help them develop ideas about the amount of comparative movement." (Lesson 3, Teacher guide)
- Lesson 8, Explore Section, Step 5 "Draw design solutions in partner pairs. Instruct students to draw their community land change problem and the design on the first page of the Our Land Change Solution handout. Specify that it is important for students to draw their solution in the appropriate location (e.g., rocks along the perimeter of the garden bed). Students should also list the materials that they will use to build their solution they are testing in the land change bin. They should label the important features

(water, sand, etc) of their solution with pictures or words. Tell students that they can use images or words to explain how the solution will work to solve our community's land change problem." (Lesson 8, Teacher Guide)

Claimed Element: MOD-P4: Develop a simple model based on evidence to represent a proposed object or tool.
Claimed in Lessons 2, 7, and 8. Evidence was found in Lessons 1, 2, 7, and 8, examples include

- Lesson 2, Explore Section, Step 3 "Highlight that we now have a shared goal to develop a model to represent the land we want to test. Co-develop the lesson question with students so that it is something like "How can we develop a model to test how wind and water might change the land?" However, feel free to use terms and phrasing that reflects your class' ideas." "Show students the bins, dirt, sand, gravel, and/or other locally relevant materials that can be used to construct the models. Indicate that we can use these to make models of the land like we have seen in our Community Examples and in Lesson 1." "Pass out copies of Reference Images for Model Bin Construction so that students can see the land up close. Give students 1-2 minutes to talk with their groups about how the classroom materials could be used to build a model based on the image they were assigned." "Co-Construct the land models. Suggest the idea that we build one land change bin for each image today so we know what to draw. Start with picture 1 on the slide and ask students to guide you through making the model. Look for them to suggest pouring in the cup of dirt, the cup of gravel, and mixing them. If possible, invite students to come up and participate in the construction of the land change bins. Look for them to suggest the idea to move the dirt/gravel mixture to one side of the bin. Repeat this process for the other two images/bins." (Lesson 2, Teacher Guide)
- Lesson 7, Explore Section, Step 3 "Point out that we now have our problem identified, but we can't visit that site every time we want to test out our different solutions. Ask students to consider how we might be able to test how well our designs keep land from changing shape from wind and water. Use this moment to determine that we need to develop a 3D model of the area we want to test similar to the models developed in Lesson 3." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 5, "Draw design solutions in partner pairs. Instruct students to draw their community land change problem and the design on the first page of the Our Land Change Solution handout. Specify that it is important for students to draw their solution in the appropriate location (e.g., rocks along the perimeter of the garden bed). Students should also list the materials that they will use to build their solution they are testing in the land change bin. They should label the important features (water, sand, etc) of their solution with pictures or words. Tell students that they can use images or words to explain how the solution will work to solve our community's land change problem." (Lesson 8, Teacher Guide)

INV: Planning and Carrying Out Investigations (K-2)

Claimed Element: INV-P2: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.
Claimed in Lessons 2, 3, and 9. Evidence was found in Lesson 2, 3, 5, and 9, examples include

- Lesson 2, Explore Section, Step 3, "Support students in planning an investigation collaboratively by guiding students to think of ways to change the amount of wind or rain. Help students to consider how they can use the tools provided in different ways to investigate their ideas about wind and water." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "Encourage students to make careful observations about where the land moved compared to the line in the bin. Also help students to focus on the areas where the wind or water was applied and compare that to other areas of the land." (Lesson 3, Teacher Guide)

- Lesson 5, Explore Section, Step 2, "Establish a plan for investigation. Display slide E. Ask students to suggest how we could test our rocks using similar tools from lessons 3 and 4...Motivate the need to agree on how we will record our observations. Ask students to share ideas on how we can record the information we gather, and how we have recorded our observations in the past. Look for students to suggest using a piece of paper or handout. Pass out Observations of Rocks. Ask students to recall what they included in their drawn models when they investigated the different types of land in lesson 3. Display the Land Change Bin Model Checklist chart they created in lesson 3. Ask them what they think will be the same and what will be different about the model they draw to represent their observations today." (Lesson 5, Teacher Guide)
- "Lesson 9, Explore Section, Step 3, "Use the appropriate prompt below to support students in planning our test procedures...How can we model wind? How can we model a little wind? A lot of wind? Go like this. (mimics blowing in the straw) Blow air in the straw on the land. We may want to try blowing hard and softly to model different amounts of wind. How can we model rain? How can we model a little bit of rain? How can we model a lot of rain (like a storm)? Do this! (demonstrates spray bottle) Spshhhh! (making spraying water sounds) Put water in the spray bottle and spray the land. Dump water on the land for a lot of rain. How can we record our observations? Draw our solutions before and after. Use arrows to show how the land changed. Take pictures before and after we try the wind or water." (Lesson 9, Teacher Guide)

Claimed Element: INV-P4: Make observations (firsthand or from media) to collect data that can be used to make comparisons.
Claimed in Lessons 3 and 4. Evidence was found in Lesson 1, 3, 4, and 5, examples include

- Lesson 1, Explore Section, Step 2, "Introduce the word observation. Display slide E. Before playing the video, explain that the first time we were watching and noticing details about the video. They then shared those noticings. We call these noticings observations. To observe means to notice details. Ask students to make observations as we rewatch the video about what might be causing the land to move and change shape." (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "When the time is up, set a timer for 2 minutes and have that student record their observations on the Land Change Bin Observations handout. During this time encourage students to engage in their roles to help support the group. (eg, model advisor helps to make sure all parts of the drawing are present)." (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, "Frame this investigation as an exploration and remind students to look for small details, such as cracks in the pavement or mud on the edge of the sidewalk. Leverage those observations as data to compare how different types of land might be shaped by wind and water." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 2, "Hold up the salt rock and highlight that several students suggested rocks might change over a longer time while others are not sure. Pass the rock around so that students can feel, observe it up close, and confirm it is a solid rock that does not fall apart easily." (Lesson 5, Teacher Guide)

Claimed Element: INV-P6: Make predictions based on prior experiences.
Claimed in Lessons 2, 4, and 5. Evidence was found in Lesson 2, 4, and 5, examples include

- Lesson 2, Navigate Section, Step 5, "During this discussion students are making predictions about possible outcomes of the upcoming investigation. Support students in developing predictions by following up with questioning to elicit reasoning for the predictions." (Lesson 2, Teacher Guide)
- Lesson 4, Explore Section, Step 2, "Allow students to share several examples of their prior experiences moving land with wind (blowing or wind that exists in nature) or water (either used by them or naturally occurring). Allowing students to share past experiences can help students better generate predictions about what will occur based on those experiences." (Lesson 4, Teacher Guide)

- Lesson 5, Navigate Section, Step 1, "Do you think that wind and water would also change the shape of this part of the land?" Allow students to respond with their ideas. Do not correct students at this point, this will drive their wondering for the lesson. Ask a few students to share the thinking behind their answer. Take a quick poll by asking students to raise their hand if they think wind and water can move rocks and pavement, and point out any controversy between students on this topic." (Lesson 5, Teacher Guide)

DATA: Analyzing and Interpreting Data

Claimed Element: DATA-P1: Record information (observations, thoughts, and ideas).
Claimed in Lessons 6. Evidence was found in 6, examples include

- Lesson 6, Explore Section, Step 2, "Students record observations of the land changes in the Then-Now images. Support students in this practice by instructing them to circle evidence of changes in the images before recording information about these changes (e.g., description of the change, fast or slow) in Images: Then and Now. (Lesson 6, Teacher Guide)

Claimed Element: DATA-P2: Use and share pictures, drawings, and/or writings of observations.
Claimed in Lessons 3 and 5. Evidence was found in Lessons 3 and 5, examples include

- Lesson 3, Explore Section, Step 2 "Carry out the Land Model investigation- Distribute the straws, goggles, and spray bottles to each group. Follow these steps to carry out the investigation. 1. Set a timer for 1 minute and have the student that is carrying out the "little wind test" go first. 2. When the time is up, set a timer for 2 minutes and have that student record their observations on the Land Change Bin Observations handout." "Circulate while students are capturing their observations and use the following prompts to support students in recording their observations." (Lesson 3, Teacher Guide)
- Lesson 5, Explore Section, Step 2 "Carry out the investigation. Provide students with all materials needed for their investigation. Suggest that we put all of our groups' rocks in the land change bin so we can test all of them at the same time. Use a phone or tablet to take a before picture of each land change bin. 1. Set a timer for 1 minute and have the student that is carrying out the "little wind test" go first. 2. When the time is up, set a timer for 2 minutes and have that student record their observations on Observations of Rocks." "Circulate while students are capturing their observations. Use the following prompts to support students as they record their observations on Observation of Rocks."
- Our Growing Ideas Chart
    - Lesson 9, Lesson Material and Preparation "Prepare for updating Our Growing Ideas chart: if possible, take photos of your students doing the Design Testing in the Explore. Use these and/or images from Printable Chart Images in Synthesize to support the Building Understandings Discussion and recording ideas on Our Growing Ideas chart." (Lesson 9, Teacher Guide)

Claimed Element: DATA-P3: Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.
Claimed in Lessons 6 and 9. Evidence was found in Lesson 6, 7, and 9, examples include

- Lesson 6, Connect Section, Step 3 "Support students to categorize examples of land changes from the book and their Community Examples chart as quick or slow changes. Prompt students to use specific observations (e.g. A piece of land was missing from the edge of the creek) to develop an evidence-based account of why these changes happened quickly or slowly (e.g. It was a fast change. It rained hard and the fast water moved a piece of the land to the ground.)." (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 4 "Ask students if they think we could test a model to see if it can represent the land we are trying to design a solution for. Gather students around one model and select the appropriate number of students to demo the changes for the class. Make sure to choose one student each

to test the way the class thinks the land has moved and one student to reset the model with a squeegee. If possible, place the model under a camera and project the process for the class. As students test the model to determine if it can represent our problem, ask the following questions: We just saw (little wind, a lot of wind, a little water, a lot of water) being tested on our model. Did our land change shape the way we thought it would? Did this land change shape with a similar pattern to the problem we are trying to solve? Does this model seem to represent the area we want it to? If not, what adjustments should we make?" (Lesson 7, Teacher Guide)

- Lesson 9, Synthesize Section, Step 3 "Have students work with their partners to review their observations and complete the questions on page 2 of the Testing Observations handout. Each student should write a brief explanation of what worked well and what did not work well with their designs. They should also think about what changes they would make if they were to do this investigation again." (Lesson 9, Teacher Guide)

Claimed Element: DATA-P4: Compare predictions (based on prior experiences) to what occurred (observable events).
Claimed in Lessons 3 and 5. Evidence was found in Lessons 3 and 5, examples include

- Lesson 3, Navigate Section, Step 6 "Revisit Predictions- Display slide Y. Display the chart or digital document that was used in lesson 2 to record the students' predictions. Ask students to reflect on their predictions from Lesson 2. Use the prompts below to help guide students toward the idea of testing land around our school community." Slide Y: "Revisit our predictions: With your class: Were you surprised by the results from our tests? Do you think the results would be the same to land outside our school?" (Lesson 3, Teacher Guide)
- Lesson 5, Explore Section, Step 4 "Revisit the salt rock. Remind students that we have had a rock that we have been pouring water over for a longer period of time. Ask students to share what they think happened to it. Accept all responses. Retrieve the salt rock from the investigation setup. Hold up the salt rock and/or place it under a camera for students to see and invite them to share their observations. Ask students what we might have seen if we checked the rock every minute. Accept all responses. Help students to make the connection that there were small gradual changes which means a much slower change overall. Ask students what they think would happen to their rocks if we let water run over them for 10-15 minutes. Accept all responses and allow for some student controversy. Ask students if they think all rocks change like the salt rock or if this one just happens to change fast. Accept all responses." (Lesson 5, Teacher Guide)

Claimed Element: DATA-P5: Analyze data from tests of an object or tool to determine if it works as intended.
Claimed in Lessons 7, 9, and 10. Evidence was found in Lesson 7, 9, and 10, examples include

- Lesson 7, Explore Section, Step 4 "Suggest testing a model and carry out the test. Display slide J. Ask students if they think we could test a model to see if it can represent the land we are trying to design a solution for. Gather students around one model and select the appropriate number of students to demo the changes for the class. Make sure to choose one student each to test the way the class thinks the land has moved and one student to reset the model with a squeegee. If possible, place the model under a camera and project the process for the class. As students test the model to determine if it can represent our problem, ask the following questions: We just saw (little wind, a lot of wind, a little water, a lot of water) being tested on our model. Did our land change shape the way we thought it would? Did this land change shape with a similar pattern to the problem we are trying to solve? Does this model seem to represent the area we want it to? If not, what adjustments should we make?" (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 5 "Display slide J. Have students work with their partners to review their observations and complete the questions on page 2 of the Testing Observations handout. Each student should write a brief explanation of what worked well and what did not work well with their designs. They

should also think about what changes they would make if they were to do this investigation again." (Lesson 9, Teacher Guide)

- Lesson 10, Synthesize Section, Step 3 "Display Slide H. Tell students that they now have the opportunity to share what they think is the most effective design solution. Remind students that as scientists and engineers we use evidence to support our claims about what is the most effective solution. Explain to students that they will be able to make these claims and use evidence we have from our tests to support our claims. Pass out Choosing a solution to slow land change to each student. Tell students that they are going to use the information that they just figured out about the effectiveness of different design solutions and their parts to decide which design solution they would choose to use for our community design solution." (Lesson 10, Teacher Guide)

CEDS: Constructing Explanations and Designing Solutions

Claimed Element: CEDS-P1 Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

Claimed in Lessons 1, 4, 5, 6, and 10. Evidence was found in Lesson 1, 4, 5, 6, and 10, examples include

- Lesson 1, Explore Section, Step 1 "Make observations while watching the video. Play Changing Land Newscast. Do not stop the video to point out important details. Students will get to watch the video a second time later in the lesson to gather more information." "Create a class list of noticings and wonderings. Display slide C. Display the Notice and Wonder chart. Use the prompts below to ask students to first share what the news story was about, then move into asking what noticings students made and what wonders they had. As students share, record these noticings and wonderings in the Notice and Wonder columns." (Lesson 1, Teacher Guide)
- Lesson 4, Explore Section, Step 2, "Give a reminder that even though we will be taking pictures, we should also be making our own observations about the movement of the land. Pictures only show a moment in time and may not show where and how the land has moved, if it moves. Remind students that we can also make observations in many different ways, such as touching the area before and after, watching with our eyes, and listening to see if we can hear land moving (such as rocks shifting or sand moving). As we are making observations, we should also be thinking about our predictions, and if our observations match our predictions." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 3 "Carry out the investigation. Provide students with all materials needed for their investigation. Suggest that we put all of our groups' rocks in the land change bin so we can test all of them at the same time. Use a phone or tablet to take a before picture of each land change bin." "Share our observations, Turn and talk with your group: How did the wind and water change the shape or size of the rocks? Did it seem to move a lot, a little, or not at all?" (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2, "Students have made observations from Then-Now images, showing how wind and water cause changes to the land. Point out to students that they should circle observations of land changes in the Then-Now images. Support students to use these observations as evidence to construct an evidence-based account for how land may change quickly or slowly and by wind or water." (Lesson 6, Teacher Guide)
- Lesson 10, Explore Section, Step 2 "Discuss questions in partner pairs, then as a class. Pause after each test and have students discuss the questions on slide F in partner pairs. Discuss the results with students, talking about the overall effectiveness (and the evidence for this effectiveness), the parts that worked well in the design, and the parts that could be made even better." "As students share their observations about the effectiveness of their designs, what worked well, and what could be made even better, try to focus students on the shape and material of the design that contribute to its stability and how it functions. During the Synthesize, students will be completing Choosing a solution to slow land change individually. This task

will ask students to think about these components of stability and function of the design solution in order to support their claims about the most effective design, using these ideas as evidence. (Lesson 10, Teacher Guide)

Claimed Element: CEDS-P3 Generate and/or compare multiple solutions to a problem.
Claimed in Lessons 8 and 10. Evidence was found in Lesson 7, 8, and 10, examples include

- Lesson 7, Synthesize Section, Step 6 "Draft a design solution. Display slide L. Leave the land change bin models and the community problem we want to solve in front of students. Pass out a single piece of paper to each student and allow students to develop a drawn model of a potential design solution they are thinking of. Explain to students that this is just so we can get our ideas out on paper and better explain how our designs might work to our other classmates." "Teaching Tip: This creation of the design solution draft will be used as a way to get students to consider the range of possible solutions for their chosen Community Example problem. Allow students to get many ideas out on the table. There is no right or wrong answer at this point. "(Lesson 7, Teacher Guide)
- Lesson 8, Connect Section, Step 2 "Document community solutions from the class. As a class, have a few students share their community solutions to reduce land change that they documented in Sharing Design Solutions. Have available the printouts of any of the images shared with you digitally so that students can refer to them as they share. For each solution shared, ask the same questions that students discussed with their partner. After each student shares their community solution, ask if their solution connects to any land change problem they previously documented on the Community Examples chart." (Lesson 8, Teacher Guide)
- Lesson 10, Explore Section, Step 2 "Close testing. Display slide G. After all tests have been conducted and discussed, pause and ask students if they have chosen which solution they believe is the most effective. Ask students to give a quick thumbs up or down to confirm. If students do not all give the thumbs up, ask the students with thumbs down to clarify what they would like to know about the design solutions before they decide what the most effective solution is. Work with the students to test the designs to gather any additional information that students feel they need to make their decision before continuing onto the Synthesize component of this lesson." (Lesson 10, Teacher Guide)

ARGU: Engaging in Argumentations

Claimed Element: ARG-P7 Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.
Claimed in Lessons 9 and 10. Evidence was found in Lesson 9 and 10, examples include

- Lesson 9, Synthesize Section, Step 5 "Have students work with their partners to review their observations and complete the questions on page 2 of the Testing Observations handout. Each student should write a brief explanation of what worked well and what did not work well with their designs. They should also think about what changes they would make if they were to do this investigation again. (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3 "Set up the writing task. Display Slide H. Tell students that they now have the opportunity to share what they think is the most effective design solution. Remind students that as scientists and engineers we use evidence to support our claims about what is the most effective solution. Explain to students that they will be able to make these claims and use evidence we have from our tests to support our claims. Pass out Choosing a solution to slow land change to each student. Tell students that they are going to use the information that they just figured out about the effectiveness of different design solutions and their parts to decide which design solution they would choose to use for our community design solution." (Lesson 10, Teacher Guide)

INFO: Obtaining, Evaluating, and Communicating Information

Claimed Element: INFO-P1 Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s).
Claimed in Lessons 8. Evidence was found in Lessons 4 and 8, examples include

- Lesson 4, Connect Section, Step 4, "Support students in this practice as you read Communities Solve Wind and Water Problems. Use the prompts to help them see patterns and find evidence about how wind and water can change land in different communities." (Lesson 4, Teacher Guide)
- Lesson 8, Connect Section, Step 3, "Students obtain scientific information from the infographic about how engineers have designed solutions to reduce or stop land change. The purpose of this activity is for students to consider how the solutions from the infographic work and how they might apply to their own community land change problem." (Lesson 8, Teacher Guide)

Rating for Criterion: DCI Extensive	ii. Provides opportunities to develop and use specific elements of the DCI(s).

The reviewers found extensive evidence that the materials provide opportunities to develop and use specific elements of the DCIs. These pieces of evidence were selected because they provide examples of when the element is developed within the claimed lesson.

ESS1.C The History of Planet Earth

Claimed Element: 2-ESS1.C.1: Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe
Claimed in Lessons 5 and 6. Evidence was found in lessons 5 and 6, examples include

- Lesson 5, Connect Section, Step 5, "Page 5: Do you think natural arches are formed quickly or slowly? Both Quickly like this (gestures a hard force). Slowly by something in the same place a lot of times. Page 15: Can you give an example of a fast and slow change to rocks? Fast: Rock breaking and falling Heavy water/wind moving the rock quickly Slow: Sand/wind/water slowly breaking the rock and giving the rock a new shape" (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4, "Do you think that the _____ picture is an example of a fast or slow change? Why do you think that? Fast change because sand changes faster than rocks. Slow change rocks take a long time to change shape. Fast because it looks like a mudslide. Slow, because it is like the Balanced Rock. It could be either. I don't know." (Lesson 6, Teacher Guide)

ESS2.A Earth Materials & Systems

Claimed Element: 2-ESS2.A.1:Wind and water can change the shape of the land.
Claimed in Lessons: 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. Evidence was found in all 10 lessons, examples include

- Lesson 1, Explore Section, Step 2, "How could the shape of the land in the video and pictures like this road have changed over time? Maybe it's the wind. The air is moving it. Sometimes I see the dirt moving when we are driving on a hill. Flooding or water. Maybe there was a flood or storm that moved everything around." (Lesson 1, Teacher Guide)

- Lesson 2, Connect Section, Step 2 "Identify the potential cause of land change as a class. After about 1 minute, bring the class back together and ask students to raise their hand if they think that wind caused the land change (and count the number of hands); then raise their hand if they think that water caused the land change (and count the number of hands); Repeat this process for both and unsure. If there is a consensus, they can place the example in one of the columns of the Developing the Community Examples Chart. If there is not consensus, you can have one student from each group share their reasons for why they think wind or water caused the land change. The example can be placed in the "not sure" column." "Discuss potential causes for other land changes in small groups. Display slide C. In each small group, ask students to look over 1-2 other examples that were brought into class and/or teacher selected. Each group should have different examples to discuss. Ask students to discuss each example and try to decide if the land changed shape due to wind or water, both, or if they are unsure. Tell students that once they have made their choice about a potential cause to add it to the Community Examples chart, as they did when they sorted their whole-class example." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize Section, Step 3, "Review the descriptions of how the land changed in the second column of the chart. Draw students' attention to the patterns of land moving a little, a lot, or not at all. During this discussion look for students to notice that the more wind or water there was, the more the land changes. Students should also notice that the water seems to change the land more than the wind." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 3, "What patterns do we see in how much the land changed? Do we have examples happening again and again with how the wind or water moved different types of land? Use your materials, data, or bodies to express your ideas. Wind did not move any land as much as water did. Wind moved land that was already in very small loose bits (dirt, sand). Students use hands to symbolize big or small changes. Small sprays of water made smaller changes than big pours of water. Neither wind nor water moved pavement/rock. Student points to the _____ column of the chart while sharing _____." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 4, "First, project the before/after photos the class collected for their rocks using Slides J-U. Next, have students turn and talk with their groups to describe how wind changed the shape, size, or location of the rocks. Repeat for how water changed them. (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2 "Set up activity. Display slide C. Tell students we have a couple of pictures of land from the past (then) and now. Explain that these are pictures of Balanced Rock, which is a landform in Arches National Park in Utah and of a railroad bridge in Mississippi. Make sure to point out the railroad tracks in both pictures of the Mississippi bridge if students do not notice them." "Highlight that students should circle evidence of changes to the land over time in the photographs as part of the first questions. In small groups, have students review the photographs individually and then discuss the following questions while looking for differences between each set of photographs: 1. What evidence do you see of changes from then to now? 2. What do you think caused the change? 3. Do you think the change happened quickly or slowly? (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 4 "Test models. Display slide I. Point out that we now have our models for our Community Examples problem made, but we don't know if the land in our models would move like the land in our Community Example problem. Guide a discussion to determine what to test the models with, and how we can use steps from the Models Checklist to test if our models can be moved by wind and water like our Community Example problem. Example prompts and responses are below." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 5 Draw design solutions in partner pairs. Instruct students to draw their community land change problem and the design on the first page of the Our Land Change Solution handout. Specify that it is important for students to draw their solution in the appropriate location (e.g., rocks along the perimeter of the garden bed). Students should also list the materials that they will use

to build their solution they are testing in the land change bin. They should label the important features (water, sand, etc) of their solution with pictures or words. Tell students that they can use images or words to explain how the solution will work to solve our community's land change problem." "Circulate while students are working. Ask them questions about the solution they are drawing. Possible questions to ask include: How does your structure going to reduce how much land moves when wind and water hit it?" (Lesson 8, Teacher Guide)

- Lesson 9, Explore Section, Step 4 "Test solutions and record observations. Display slide I. Have students use the methods discussed earlier in the lesson to test their solutions. To help students complete all of the tests in the allotted time consider using the following structure. 1. Set a timer for 1 minute and have the student that is carrying out the "little wind or little water test" go first." "6. Repeat the process for "a lot of wind or a lot of water test." (Lesson 9, Teacher Guide)
- Lesson 10, Explore Section, Step 2 "Test design solutions. Display slide F. Land with the class on the idea that as the solutions are tested for effectiveness, we can also look to see what parts work well, and what parts of each design we can make even better. Begin testing each solution, using the same tests the class decided to use in Lesson 9 (wind, water, or both). Consider asking a new partner pair to test the design solution, so the design builders can watch their design being tested." (Lesson 10, Teacher Guide)

ETS1.A Defining and Delimiting Engineering Problems

Claimed Element: K-2-ETS1.A.1: A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. Before beginning to design a solution, it is important to clearly understand the problem. Asking questions, making observations, and gathering information are helpful in thinking about problems.
Claimed in Lesson 7. Evidence was found in lesson 7, examples include

- Lesson 7, Explore Section, Step 2 "Identify a problem that needs to be solved. Ask students to look back at the Community Examples that we have gathered over time. While looking at the chart, negotiate which Community Example the class might design a solution for. If the class does not quickly come to a consensus on a land change problem, then refer students back to the Possible Causes chart. Ask students to consider which Community Example poses a problem for those who use and live on the land that could be solved. Encourage students to respond to each other's ideas. Example prompts and responses are below." "Define the problem with the class. Once a community example problem has been identified, work with the class to create a sentence that defines the problem" (Lesson 7, Teacher Guide)
- Lesson 7, Explore Section, Step 2 "Define the problem with the class. Once a community example problem has been identified, work with the class to create a sentence that defines the problem." "Ask students to consider how we might be able to test how well our designs keep land from changing shape from wind and water." "Allow students to develop modified bin models. Place students in groups. Give each group a fresh bin and the materials they said they need to make a more accurate model. Give students up to five minutes to add materials to their bin to represent the area that they are going to try to design a solution for. As students work, circulate the classroom." (Lesson 7, Teacher Guide)
- Lesson 7, Explore Section, Step 6 "Motivate creating a design solution. After updating the chart, ask students what they think the next steps should be, and guide students to suggest that we need to develop design solutions." "Draft a design solution. Display slide L. Leave the land change bin models and the community problem we want to solve in front of students. Pass out a single piece of paper to each student and allow students to develop a drawn model of a potential design solution they are thinking of. Explain to students that this is just so we can get our ideas out on paper and better explain how our designs might work to our other classmates." (Lesson 7, Teacher Guide)

ETS1.B Developing Possible Solutions

Claimed Element: Developing Possible Solutions: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Claimed in Lesson 7, 8, and 9. Evidence was found in lessons 7, 8, and 9, examples include

- Lesson 7, Synthesize Section, Step 6, "Draft a design solution. Display slide L. Leave the land change bin models and the community problem we want to solve in front of students. Pass out a single piece of paper to each student and allow students to develop a drawn model of a potential design solution they are thinking of. Explain to students that this is just so we can get our ideas out on paper and better explain how our designs might work to our other classmates. Give students roughly 5 minutes to record an idea. If students have more than one idea, suggest that they either draw both, or combine what they think are the best parts of each to make one design." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 5, "How does your structure going to reduce how much land moves when wind and water hit it? The rocks make a wall to block the wind/water. The plants cover the dirt. The roots of the tree hold the dirt in place. What shape will you build your design in? How does this shape work to limit the changes to the land? Responses will vary, but may include: I drew my design in the shape of a rectangle/straight line/ circle so it would fit right and stop land movement. I drew my design to be bigger and wider to limit more land change than smaller shapes. What ideas did you get from the solutions we looked at? I saw that one solution had little holes in it so the wind could go through and didn't pick it up and take it away. I did that in our design solution too." (Lesson 8, Teacher Guide)
- Lesson 9, Connect Section, Step 3, "Build solutions. Have students work together with their partner to build their solutions. After about 5 minutes, ask students to share what engineers might do before testing the solutions. Look for students to suggest they should record what their land change bin models (with the design solution) look like before and after testing with wind or water. Pass out Testing Observations." (Lesson 9, Teacher Guide)

ETS1.C Optimizing the Design Solution

Claimed Element: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Claimed in Lesson 10. Evidence was found in lesson 10, examples include

- Lesson 10, Navigate Section, Step 1, "So we wanted to find a solution that helps keep land where it is at, and keep it from changing shape. Did we find one solution that worked? But how would we know which solution was the most effective for solving our problem? How could we tell as a class which was most effective?...Point out that it seems that we need to actually compare them and see which was the most effective. Suggest that the class focus for today be something like "What design solution is most effective to keep the land from changing shape?" (Lesson 10, Teacher Guide)

Criterion-Based Suggestions for Improvement: NA

Rating for Criterion: CCC Extensive	iii. Provides opportunities to *develop and use* specific elements of the CCC(s).

The reviewers found extensive evidence that the materials provide opportunities to develop and use specific elements of the CCCs. The CCC elements claimed are closely matched to the evidence of their development and use in the material.

Students sometimes use the CCC elements in service of making sense of the wind and water changing land phenomenon.

Related Evidence includes

PAT: Patterns

Claimed Element: PAT-P1: Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.
Claimed in Lessons 2, 3, 4, 5, and 7. Evidence was found in Lessons 2, 3, 4, 5, and 6, examples include

- Lesson 2, Connect Section, Step 2 "Explore local examples to start seeing patterns in the causes of land changing (wind and water)." "Have students take out the examples they brought in on Sharing Local Examples and/or pass out examples you had printed before class. Ask for a student to share one example of a local land change (e.g., hold up a picture). Ask them to share what the example is and how they found it. Then, ask students to turn and talk to a partner and answer the questions on the slide." "Identify the potential cause of land change as a class. After about 1 minute, bring the class back together and ask students to raise their hand if they think that wind caused the land change (and count the number of hands); then raise their hand if they think that water caused the land change (and count the number of hands); Repeat this process for both and unsure." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize Section, Step 3 "Interpret the data by identifying patterns. Display slide T. Review the descriptions of how the land changed in the second column of the chart. Draw students' attention to the patterns of land moving a little, a lot, or not at all. During this discussion look for students to notice that the more wind or water there was, the more the land changes. Students should also notice that the water seems to change the land more than the wind." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 3 "Patterns: Encourage students to use comparative terms (more/less, bigger/smaller) to describe how much the land moved/changed as a result of the wind and/or water. Consider labeling some of the photos from the investigation with these words to help students talk about the patterns." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 4, "Support students during the discussion in noticing which size rocks moved a lot and which size rocks moved a little. Guide students to focus on comparing the amount of stars in the second column of the chart and looking for patterns between wind and water." (Lesson 5, Teacher Guide)
- Lesson 6, Connect Section, Step 3 "Refer to the Community Examples chart and point out that we have some new images from a community, and suggest that we add them to our chart. Ask students to help you categorize these changes. Ask students to turn and talk about how the change happened, whether wind or water made this change, and whether it was fast or slow." (Lesson 6, Teacher Guide)

CE: Cause & Effect

Claimed Element: CE-P1: Events have causes that generate observable patterns.
Claimed in Lessons 1, 2, and 6. Evidence was found in lessons 1, 2, and 6, examples include

- Lesson 1, Explore Section, Step 2, "Identify causes for movement. Display slide D. Point out the images from the video on the slide, starting with the image of the road. Ask students to identify what they believe

was the original shape of the dirt by the road (it was straight on the sides) and what the edge of the dirt and road looks like now (scattered, covered by land, or wavy). Ask students what they think caused the land to move in these pictures based on what they saw in the video." (Lesson 1, Teacher Guide)

- Lesson 2, Connect Section, Step 2, "Discuss potential causes for other land changes in small groups. Display slide C. In each small group, ask students to look over 1-2 other examples that were brought into class and/or teacher selected. Each group should have different examples to discuss. Ask students to discuss each example and try to decide if the land changed shape due to wind or water, both, or if they are unsure. Tell students that once they have made their choice about a potential cause to add it to the Community Examples chart, as they did when they sorted their whole-class example. Provide students 5 minutes to work in groups and add their examples to the chart." (Lesson 2, Teacher Guide)
- Lesson 6, Explore Section, Step 2, "Support students in making connections between the changes to the land (effect) and what is making the changes happen (the cause). You can also point out that there are patterns in what causes fast changes and slow changes (e.g., a lot of rain and a lot of wind often cause fast changes, especially with sandy or muddy land)." (Lesson 6, Teacher Guide)

Claimed Element: CE-P2: Simple tests can be designed to gather evidence to support or refute student ideas about causes.
Claimed in Lessons 3. Evidence was found in lesson 3, examples include

- Lesson 3, Explore Section, Step 2. "What happened when you used the straw to try wind? The sand went there. (gestures to the other side of bin) It made a hole in the dirt. The soil went (makes whoosh sound and moves hands) What happened when you used the spray bottle to try water? Small holes were made where the water hit. The dirt became wet. The water moved the dirt. What happened when you poured the water in? The side of the dirt became very wet. It made a crack in the dirt." (Lesson 3, Teacher Guide)

SC: Stability and Change

Claimed Element: SC-P2: Things may change slowly or rapidly.
Claimed in Lessons 1, 3, 5, and 6. Evidence was found in Lessons 1, 2, 3, 4, 5, and 6, examples include:

- Lesson 1, Explore Section, Step 1, "Do you think that this change happened fast, over a short period of time, or slow, over a long period of time? (Arms moving indicating fast movement) I think that the mulch moved fast, because I can move it with my feet fast. The dirt might have moved slow." (Lesson 1, Teacher Guide)
- Lesson 2, Navigate Section, Step 5, "Support students in developing ideas about how the dirt in the land change bins could change at different rates. In the upcoming experiment students will mostly experience fast changes to the dirt and notice some things do not move at all. In future lessons students will collect more evidence to determine that some things change slowly." (Lesson 2, Teacher Guide)
- Lesson 3, Lesson Assessment Guidance, "Project before/after photos and ask "How is the land different in this photo than the other one? Why do you think they are different?" Did this move fast, slow, or not at all?" (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 3, "Students may start to identify the speed of the land changing. In Lessons 5 and 6, we will investigate very slow changes to rock, so when the examples from outside are compared with the timescale of changes to rock, the changes we observed in this investigation will all be comparably fast." (Lesson 4, Teacher Guide)
- Lesson 5, Connect Section, Step 5, "Page 5: Do you think natural arches are formed quickly or slowly? Both Quickly like this (gestures a hard force). Slowly by something in the same place a lot of times. Page 15: Can you give an example of a fast and slow change to rocks? Fast: Rock breaking and falling Heavy water/wind

moving the rock quickly Slow: Sand/wind/water slowly breaking the rock and giving the rock a new shape" (Lesson 5, Teacher Guide)

- Lesson 6, Connect Section, Step 3 "Sort community examples as fast or slow changes. Display slide F and refer back to the Community Examples chart again. Remind students we also had a few examples on our chart that were still unsorted. Suggest that we revisit these examples to use our new ideas to sort them. First, ask students to share with a partner what they are now thinking about the column in which those examples belong. Then, as a class, engage in a Consensus Discussion to sort the remaining community examples as either a fast or slow land change. If all the community examples are already sorted, then engage the class in a discussion to double-check their sorting choices. Briefly go through each community example and have students discuss whether it is a fast or slow change and what evidence they have that supports this conclusion." (Lesson 6, Teacher Guide)

SF: Structure and Function

Claimed Element: SF-P1: The shape and stability of structures of natural and designed objects are related to their function(s).
Claimed in Lessons 7, 8, 9, and 10. Evidence was found in lessons 8, 9, and 10, examples include

- Lesson 7, Explore Section, Step 3, "Discuss new bin model shape. Remind students that we are trying to solve the problem of the land moving and changing shape, and we need to be able to create a model that we can use to test our solutions that we come up with. Ask students to consider what shape this land should take. Example prompts and responses are below. But were our original bin models exactly like our Community Example that we want to make a solution for? How might we need to adjust this model? Listen for students to suggest all relevant ideas. Ideas might include: Changing the shape of the initial land (such as modeling a curved sidewalk edge). Adding more or less sand or rock." It is not clear how students are connecting shape to function in this example. The questions do not explicitly guide students to think about how a certain shape serves a specific function.
- Lesson 8, Connect Section, Step 3, "Support students in connecting the shape and structure of potential solutions with how they will function. For example, ask them "how" a particular solution that they propose will function to reduce land change. Consider using prompts like, "How does the shape of the design solution help it to reduce land change?" "What other parts of this design solution help it to reduce land change?" (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 4 "Small group discussions and students recording observations on Testing Observations provide an opportunity to gather evidence about learning goal 9a and Assessment Statement 2 with the purpose of providing feedback and supporting students in analyzing and interpreting observations about how the shape of the solution relates to the function of limiting the land from changing." (Lesson 9, Teacher Guide)
- Lesson 10, Explore Section, Step 2, "As students share their observations about the effectiveness of their designs, what worked well, and what could be made even better, try to focus students on the shape and material of the design that contribute to its stability and how it functions. During the Synthesize, students will be completing Choosing a solution to slow land change individually. This task will ask students to think about these components of stability and function of the design solution in order to support their claims about the most effective design, using these ideas as evidence." (Lesson 10, Teacher Guide)

SPQ: Scale, Proportion, & Quantity

Claimed Element: SPQ-P1: Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower).
Claimed in Lessons 3 and 5. Evidence was found in lesson 3 and 5, examples include

- Lesson 3, Synthesize Section, Step 3, "Encourage students to use comparative terms (more/less, bigger/smaller) to describe how much the land moved/changed as a result of the wind and/or water. As students work to build the chart they will vary the number of arrows they want to display in the last column. Support students by showing images or the physical land change bins side by side to help them develop ideas about the amount of comparative movement." (Lesson 3, Teacher guide)
- Lesson 5, Explore Section, Step 4, "Encourage students to use comparative terms (more/less, bigger/smaller) to describe how much the land moved/changed as a result of the wind and/or water. As students work to build the chart they will vary the number of stars they want to display in the last column. Support students by showing images or the physical land change bins side by side to help them develop ideas about the amount of comparative movement." (Lesson 5, Teacher Guide)

Criterion-Based Suggestions for Improvement

- Consider clarifying the specific meaning of "shape" as discussed in Lesson 7 and Lesson 8. Consider connecting the shape of the model to the stability of the structure and emphasizing the importance of shape and how it relates to a specific function.

I.C. Integrating the Three Dimensions — Extensive

Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.

The reviewers found extensive evidence that students' sensemaking of wind and water changing land requires performances that integrate elements of the SEPs, CCCs, and DCIs. In the unit, students are expected to figure out the effects wind and water can have on land and what can be done to minimize the effects. Throughout the learning process, students use grade-appropriate elements of the three dimensions together to make sense of this phenomenon.

The learning is integrated.

- Lesson 1, Explore Section, Step 1, "Use the prompts below to ask students to first share what the news story was about, then move into asking what noticings students made and what wonders they had. Prompts to use: 'What else did you notice in the video about the land moving?', 'Have you ever seen anything like this?'": SC-P2:Things may change slowly or rapidly, 2-ESS2.A.1: Earth Materials and Systems: Wind and water can change the shape of the land. AQDP-P1: Ask questions based on observations to find more information about the natural and/or designed world(s).
- Lesson 2, Explore Section, Step 3, students integrate the use of the elements when they develop a plan to investigate if water and wind move different types of land by making 3D physical models that are similar to the land in their communities in the three dimensions: PAT-P1: Patterns in the natural and human designed

world can be observed, used to describe phenomena, and used as evidence., 2-ESS2.A.1: Earth Materials and Systems: Wind and water can change the shape of the land. INV-P2: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

- Lesson 3, Explore Section, Step 2, "Suggest students record a question that they would like to answer during today's investigation based on those patterns we had observed on the bottom of their handout. Use the sentence starters on the slide to help support students in asking a question they hope to answer using our land change bin models. 'What will happen to _____ when I try _____?', 'How does _____ amount of _____affect____ land?', 'When there is ____ then what will happen to _____?'" SC-P2:Things may change slowly or rapidly, 2-ESS2.A.1: Earth Materials and Systems: Wind and water can change the shape of the land. AQDP-P1: Ask questions based on observations to find more information about the natural and/or designed world(s).
- Lesson 4, Explore Section, Step 2: students go outside and test different types of land around our schoolyard, recording observations with before/after photos. They find patterns in how different types of land were moved by wind and water in the three dimensions. PAT-P1: Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence., 2-ESS2.A.1: Earth Materials and Systems: Wind and water can change the shape of the land. CEDS-P1: Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Lesson 5, Explore Section, Step 3, students test how rocks change shape using wind and water, record their observations of the salt before and after the wind/water, and identify patterns. PAT-P1: Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence., 2-ESS2.A.1: Earth Materials and Systems: Wind and water can change the shape of the land. INV-P4: Make observations (firsthand or from media) to collect data that can be used to make comparisons.
- Lesson 6, Explore Section, Step 2, "Read the questions to the students and explain that they should review the photographs individually and jot down their ideas to these questions before discussing them with their small group. Highlight that students should circle evidence of changes to the land over time in the photographs as part of the first questions." and Connect Section, Step 3, "Ask students to help you categorize these changes. Ask students to turn and talk about how the change happened, whether wind or water made this change, and whether it was fast or slow. SC-P2:Things may change slowly or rapidly, 2-ESS1.C.1: ESS1.C The History of Planet Earth: Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. CEDS-P1: Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Lesson 7, Explore Section, Step 4, "As students test the model to determine if it can represent our problem, ask the following questions: We just saw (little wind, a lot of wind, a little water, a lot of water) being tested on our model. Did our land change shape the way we thought it would? Did this land change shape with a similar pattern to the problem we are trying to solve? Does this model seem to represent the area we want it to? If not, what adjustments should we make?" SC-P2:Things may change slowly or rapidly, 2-ESS1.C: The History of Planet Earth: Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. DATA-P5: Analyze data from tests of an object or tool to determine if it works as intended.

Integration supports student sense-making over time.

- Lesson 1, Synthesize, Teacher Tip, "Developing and Using Models: To help students develop their understanding of models, we will intentionally use the words "picture to explain" instead of "model" in Lesson 1. After students develop explanations with their picture/drawing about this natural phenomena, we will then analyze their pictures as entry points and name them as "models" in lesson 2. This will strengthen students' access to learning goals around definitions of models and how to use them to explain and imagine, predict, and hypothesize explanations." (Lesson 1, Teacher Guide)

- Lesson 2, Explore Section, Step 5 "Developing and Using Models: Students will develop a 2D model in partner pairs to represent their community land change problem and include their design solutions to limit land change due to wind or water. In Lesson 7, students drew individual designs. While students were free to make any design decisions on their own in their individual drawing, students now have to collaborate and compromise with peers on a single design. Students also have to consider the merits of each decision, increasing the demands of this task." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 2: "Planning and Carrying Out Investigations: Encourage students to make careful observations about where the land moved compared to the line in the bin. Also help students to focus on the areas where the wind or water was applied and compare that to other areas of the land. Students will have the opportunity to practice making careful observations in lessons 4, 5, 7, and 9." (Lesson 3, Teacher Guide)
- Lesson 5, Navigate Section, Step 7, Teaching Tip: "Students will make observations and record them again in lesson 9. Use the model checklist as a reference to give students feedback on the observations they made during lesson 3 and lesson 5 to be used to inform the work they do during lesson 9." (Lesson 5, Teacher Guide)
- Lesson 9, Synthesize Section, Step 5, "Analyzing and Interpreting Data: In Lesson 7, students tested their new land change bin models and collected observations to use as data to determine if the model had functioned as intended. This was done as a whole class. Now, students are being asked to analyze data based on how much the land moved to determine if the solution works as intended in small groups and share their observations as a whole class. This is an increase in the demands of this task." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3, "Constructing Explanations and Designing Solutions: In lesson 8, comparisons of design solutions in the infographics and from the Community Example chart were made partially by the whole class. In Lesson 10 these comparisons to determine the most effective solution are made on their assessment individually." (Lesson 10, Teacher Guide)

Suggestions for Improvement: NA

I.D. Unit Coherence — Extensive

Lessons fit together to target a set of performance expectations.

i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.
ii. The lessons help students develop toward proficiency in a targeted set of performance expectations.

The reviewers found extensive evidence that the lessons fit together coherently to target a set of performance expectations because all lesson themes and content are sequenced coherently and explicitly from the student's perspective. The lessons work together to provide sufficient opportunities for students to build proficiency in all of the targeted learning for all three dimensions. Furthermore, each lesson builds directly on prior lessons, and the links between lessons are made explicit to students.

i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.

- Lesson 1, Nativate Section, Step 7, "Move to the bottom of the Possible Causes chart. Ask students to think about who and what (animals, people, plants, etc.) uses the land that is changing and how these things might be affected. Ask a few students to share their ideas and add these ideas to the Possible Causes chart. As students share out, ask them why we would care about the people, animals, or plants in those areas. How does it affect them? If the water is too dirty with mud the fish may not be able to breathe. Our houses may get messy or we might have less road to drive on. Trees might lose the dirt around them and have nowhere to root. We have less land to sit on at the beach and other places." (Lesson 1, Teacher Guide)
- Lesson 2, Connect Section, Step 2, "Discuss potential causes as a class. Display slide D. Bring students together and ask students to look across the chart. Ask students if anyone has questions about how other groups have sorted their land change examples. Students are very unlikely to agree on all examples. Use these disagreements to motivate the need to test land to see if it can actually move the way that the specific examples show." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate Section, Step 1, "Connect our questions to today's work. Display slide B and point out students' questions on the Notice and Wonder chart that relate to further observations of wind and water moving land in our community. Would wind/water change dirt? Would wind/water change sandy dirt? Would wind/water change dirt and gravel? Craft the lesson question. Suggest that our work today should center around testing some of these ideas. Work with students to develop a question like "How could wind and water change the land in our models?" However, feel free to use terms and phrasing that reflects your class' ideas." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate Section, Step 6, "Towards the end of generating new noticings and wonderings, bring up or elevate the noticings that neither wind nor water moved the pavement or large rocks in our investigation. Use prompts such as the examples below to generate questions about if rocks can change, and potentially how long it takes for those changes to occur...Add questions in students' own words to the "wonder" part of the chart and suggest that we should work to investigate the answers about rocks changing next time." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate Section, Step 7, "Looking back at our drawn model from lesson 1, do you think the gravel/wood chips moving on to the road was fast or slow? What about the road? Will it change? We saw the salt rock change over 10 minutes, but the rocks in our land change bins did not really change, how long do you think those (points to bins) might take to change shape? What about the road, how long will it take to change shape? Do we see it changing after every stormy day? Wow! It sounds like we have a lot of different ideas about how long rocks and rocky land might take to change. What new questions do you have?" (Lesson 5, Teacher Guide)
- Lesson 6, Navigate Section, Step 1 "Ask students to recall what we did last lesson. Support students in recalling that we tested rocks to see if they moved and changed shape with wind and water. They should also note that we watched a rock change shape over time and updated our models. Remind students that while we observed some rocks changing, we still had questions about how fast or slow the rocks in the land were changing shape." "Revisit notice and wonder chart. Display slide A. Refer to the Notice and Wonder chart and circle the questions related to fast and slow land changes. As a class, ask students to review these questions and discuss which they now think they can answer. Have students share answers to the questions and ask the class to raise their hands if they agree. If there is consensus, mark that question with a check mark. If there is no consensus, you can mark the question with a question mark. Leverage any controversy in the class regarding disagreements about the time it takes rock to change shape to motivate today's work. Point out that we still have a lot of questions about how long it takes for rocks to change, and in the last lesson we thought that some rocks might take a lot of time to change." (Lesson 6, Teacher Guide)

- Lesson 10, Navigate Section, Step 1, "Interesting! So we wanted to find a solution that helps keep land where it is at, and keep it from changing shape. Did we find one solution that worked? But how would we know which solution was the most effective for solving our problem? How could we tell as a class which was most effective?" (Lesson 10, Teacher Guide)

ii. The lessons help students develop toward proficiency in a targeted set of performance expectations.
2-ESS1-1: Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

- Lesson 4, Connect Section, Step 4: "While the observations about land changing from the article are not patterns at this point, we will be using these observations to discuss patterns in this next step. Having this record of what changed, how it changed, and how much it changed will allow students to have a visual representation of their ideas to draw on during this discussion. Additionally, it may also help to have the How is Land Changing Shape chart from Lesson 1 and the Land Change chart from Lesson 3 nearby for easy reference." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 4, "Compare and contrast results across the investigations. Display slide W. Display the Land Change charts from lesson 3, 4, and 5. Use the following prompts to identify patterns using evidence from this investigation, past investigations, and the Community Examples Chart. Guide students in thinking about the changes in these investigations and if they were fast changes or slow changes…. Where did we see fast changes? Where did we see slow changes? Lesson 3 Land Change Bins, Lesson 4, Playground Investigation, Lesson 5 Rock Investigation, Our Community Example Chart". (Lesson 5, Teacher Guide)

2-ESS2-1: Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

- Lesson 8, Connect Section, Step 3, "Ask students to share how each solution reduces changes to the shape of the land, then add the image from Infographic Images for the Community Examples chart to the appropriate column (Wind, Water, Not Sure) of the third row."
- Lesson 10, Synthesize Section, Step 3, "Pass out *Choosing a solution to slow land change* to each student. Tell students that they are going to use the information that they just figured out about the effectiveness of different design solutions and their parts to decide which design solution they would choose to use for our community design solution. Point out to students the different parts of the worksheet. Show them where they need to write the problem we were trying to solve, the solution they would choose, and how the shapes and materials made that solution effective."

K-2-ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

- In Lesson 8, Explore section, Step 5, "Organize students into partner pairs. Ask students to discuss the following prompts as they share their design solutions from Lesson 7 and decide on a new design solution to draw using the structure on the slides. Draw design solutions in partner pairs. Instruct students to draw their community land change problem and the design on the first page of the Our Land Change Solution handout."
- Lesson 10, Explore Section Step 2, "Before beginning testing, lead a quick discussion with students to determine if there is anything that we can learn from our solutions, other than just which solution seems to be the most effective. Guide students to determine that we could look at the designs to see what works and what could be better about each design."

Suggestions for Improvement: NA

I.E. Multiple Science Domains — Extensive

When appropriate, links are made across the science domains of life science, physical science, and Earth and space science.

i. Disciplinary core ideas from different disciplines are used together to explain phenomena.
ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.

The reviewers found extensive evidence that links are made across the science domains when appropriate because the phenomenon of wind and water changing land can be fully addressed within the Earth and space science domain.

i. Disciplinary core ideas from different disciplines are used together to explain phenomena.
The phenomena of wind and water changing land and at different rates can be fully explained by the disciplinary core ideas of Earth and Space Systems:
ESS2.A Earth Systems: Wind and water can change the shape of the land

- Earth Land Erosion Unit Front Matter, "Throughout Lessons 2-6, students develop an understanding of fast and slow changes to earth's surface. In Lessons 2 and 3, students build a model of a road and simulate wind and water to observe fast changes to the land around the road. Then, in Lesson 4, students test water and wind on land around them to add ideas that other land types change, and notice that not all changes happen at the same speed, with some land, such as rocks, that do not seem to change shape. This investigation leads the students to question about land they observed that did not seem to change. In Lesson 5, students test wind and water on rocks in their bins and do not see an immediate change in their shape. However, in Lesson 5 students also investigate a salt rock to see that even though the change did not happen in seconds, the change could occur over a longer period of time. When students read a book they observe changes to larger rocks that occur over a long period of time. The idea that some land takes a long time, longer than one can observe, to change is established. They apply these ideas in a summative assessment opportunity in Lesson 6. Over the course of Lesson Set 1, students make sense of first events that can happen quickly to change the shape of the land, and then expand their understanding by Lesson 6 to figure out that land can take a much longer period of time to change shape." (Earth Land Erosion Unit Front Matter, pages 12-13)

ESS1.C The History of the Planet Earth: Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

- Earth Land Erosion Unit Front Matter, "In Lessons 2-4, students investigate and observe how wind and water can change the shape of land in their land change bins and then outside in their schoolyard and communities. Students figure out that wind and water can change the shape of some types of land by simulating wind and water interacting with the land. In Lesson 4, students have seen changes in the shape of land such as dirt, sand, and other small sediments, but they have not seen changes in larger rocks such as the ones they find outside. In Lesson 5, students try to change the shape of rocks, simulating rocky land, but cannot make the changes happen in seconds. During that time, the class also runs an investigation using a salt rock to see that although the rock did not change over a short period of time, the rock did change shape after roughly 10 minutes, leading students to believe that some changes can take time and that all land may change shape from wind and water. Students read more about this, and compare before and after pictures of land that has been affected by wind and water over various periods of time. Students

then apply these ideas in a summative assessment in Lesson 6 to identify land that's shape was changed by wind and water, but quickly and over time. In Lessons 7-10, students work on engineering designs to prevent wind and water from changing the shape of land in their bins (which is based on a community land change problem)." (Earth Land Erosion Unit Front Matter, pages 12-13)

ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.

- Figuring how land moves and changes shape only required content ideas related to earth science. This problem did not require the crosscutting concepts developed in the unit to be used across science domains.

Suggestions for Improvement: NA

I.F. Math and ELA — Extensive

Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.

The reviewers found extensive evidence that the materials provide grade-appropriate connections to the Common Core State Standards in Mathematics and/or English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects because the materials explicitly state the ELA standards that are used in the unit and support students in seeing the connections among content areas. Students use writing skills to explain and communicate and have opportunities for speaking and listening to peers.

ELA

These standards are explicitly used and named in the lesson with specific support for teachers.

Language
CCSS-ELA-LITERACY.L.2.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
Claimed in Lesson 10. Evidence was found in Lesson 10, examples include

- Lesson 10, Synthesize Section, Step 3, "Remind students to use what they know about capitalization, punctuation, and spelling in their writing. Students can apply what they know about these rules in their science writing. It is important to include these conventions of standard English to ensure that others understand our writing. This connects with L.2.2 as students demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing." (Lesson 10, Teacher Guide)

CCSS-ELA-LITERACY.L.2.4D Use knowledge of the meaning of individual words to predict the meaning of compound words (e.g., birdhouse, lighthouse, housefly; bookshelf, notebook, bookmark).
Claimed in Lesson 5. Evidence was found in Lesson 5, examples include

- Lesson 5, Connect Section, Step 5, "After reading the book, add the word "landform" to the Word Wall. As you add it to the word wall, ask students if they notice any familiar words within the compound word

"landform". Encourage students to think about the compound word and whether they can guess the word's meaning or any examples of landforms based on the two words that make up the word. Landforms are natural shapes on Earth's surface like a hill, a canyon or a hoodoo." (Lesson 5, Teacher Guide)

Reading: Informational Text
CCSS-ELA-LITERACY.RI.2.5 Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.
Claimed in Lessons 4 and 10. Evidence was found in Lessons 4 and 10, examples include

- Lesson 4, Connect Section, Step 4, "As students engage with the newspaper article, they read a text with some features that may be familiar and others that may be new. Support students in identifying these different features, such as headings, captions, bold print, and the date. This work supports RI.2.5 and reminds students that texts have features intended to help readers find key facts and information within a text." (Lesson 4, Teacher Guide)
- Lesson 10, Connect Section, Step 4, "Students learn about and use the table of contents to obtain information about the three experts featured in the book. This work supports RI.2.5 as students know and use various text features to locate key facts or information in text efficiently." (Lesson 10, Teacher Guide)

CCSS-ELA-LITERACY.RI.2.7 Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text.
Claimed in Lessons 3 and 6. Evidence was found in Lessons 3 and 6, examples include

- Lesson 3, Connect Section, Step 4, "Read Land Changing Shape aloud and use the prompts below to support students in obtaining new information about wind and water. Follow up students' ideas as they share them by asking "What makes you think that?". Remind students to consider how images in the text help to explain the events happening in the book." (Lesson 3, Teacher Guide)
- Lesson 6, Connect Section, Step 3, "As students reexamine images from the book, they are gaining practice explaining how specific images contribute to and clarify a text which supports RI.2.7." (Lesson 6, Teacher Guide)

CCSS-ELA-LITERACY.RI.2.8 Describe how reasons support specific points the author makes in a text.
Claimed in Lesson 9. Evidence was found in Lesson 9, examples include

- Lesson 9, Connect Section, Step 2, "As students read and answer the prompts associated with Engineers Test Solutions, they have the opportunity to describe how specific examples in the book explain the ways that engineers test solutions. This work supports RI.2.8 as students describe how reasons support specific points the author makes in a book." (Lesson 9, Teacher Guide)

Students use grade-appropriate reading skills to understand scientific concepts and results, supporting their sense-making and problem-solving abilities. The reading materials utilized in Lessons 3-10 include books, an infographic, and articles:

Mathematics

The unit embeds several CCSS for Mathematics. The materials explicitly state the mathematics standards students could use and are from the appropriate grade level.

Suggestions for Improvement: NA

CATEGORY II
NGSS Instructional Supports

II.A. Relevance and Authenticity — Extensive

Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.

i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations).
ii. Includes suggestions for how to connect instruction to the students' home, neighborhood, community and/or culture as appropriate.
iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

The reviewers found extensive evidence that the materials engage students in authentic scenarios that reflect real-world science and engineering practices. Students directly experience these phenomena by considering how wind and water impact land through hands-on investigations. Additionally, the materials suggest ways to relate the phenomenon to students' neighborhoods, communities, and families through community connection, such as Lesson 1, Sharing Local Examples; Lesson 4, exploring the land around the school; Lesson 7, designing a solution to slow down land changing in their community and constructing a Community Example chart as a class. Students can also connect their explanations or design solutions to their own experiences by interviewing family members or exploring their community outdoors.

i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations)

- Lesson 1, Explore Section, Step 1, "Elicit student experiences with the news. Display slide A. Ask students if they have ever heard or saw a news story where people were trying to figure out the answers to a puzzling problem...Introduce the news story. Tell students that you recently saw a news story about a problem some people had noticed in their community. Explain that you wanted to watch the news story together and try to figure out what is happening. Explain that as you play the video, students should be considering the three questions on the slide. Tell students that they will be sharing their ideas with a partner after we watch the video." (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 3, "To support student access, provide the option for physical action by inviting students to co-construct the land change bins with the teacher. This invitation to co-construct the land change bins also supports student's ongoing investment and interest in their investigation by having individual choice and autonomy in deciding what the land change bins will look like and having their ideas validated. It might be beneficial to invite students who struggle with a science identity and/or agency in their learning, such as minoritized students. Co-constructing the land models also supports a classroom climate of collaboration and community in doing science." (Lesson 2, Teacher Guide)
- Lesson 4, Explore Section, Step 2, "Point out that it sounds like we want to go outside and try to move land with wind and water. Use this as an opportunity to discuss who and what lives on the land, and how, as we test, we can preserve and protect the health and balance of living and nonliving things in our schoolyard." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 2, "All students working in pairs or groups need opportunities to work with the activity materials. For example, all students in the group need to test one type of wind or water (a lot or a little). Supporting all students engaging in science classroom experiences is important for developing science identities, and is especially critical for those from non-dominant groups (girls, minoritized students of color) that have been historically excluded from science." (Lesson 5, Teacher Guide)

- Lesson 7, Explore Section, Step 4, "Suggest testing a model and carry out the test. Display slide J. Ask students if they think we could test a model to see if it can represent the land we are trying to design a solution for. Gather students around one model and select the appropriate number of students to demo the changes for the class. Make sure to choose one student each to test the way the class thinks the land has moved and one student to reset the model with a squeegee. If possible, place the model under a camera and project the process for the class." (Lesson 7, Teacher Guide)
- Material includes books with examples and images:
    - Lesson 6, Connect Section, Step 3 "Read a book. Display slide E. Introduce Creek Explorers and explain to students that you will read through the whole book first, and will then discuss the images of land change as a class afterward." Share with students that another second grade class is also trying to determine whether changes to the land made by wind or water are happening quickly or slowly. Explain that this class went on a field trip in their community and has collected pictures of what they think are fast and slow land changes to the shape of the land, just as we did with our Community Examples chart. Mention that you have a book containing all the pictures of land changes they found. Ask if they can help this class to sort these images as fast or slow changes. (Lesson 6, Teacher Guide)
    - Lesson 7, Engineers Test Solutions "The second graders compare the rocks and the grass. They observe more dirt stays near the grass than the rocks. They use their observations as evidence to make the claim that the grass is more effective than the rocks." "The second graders share their solution with the teachers and students at their school. They are excited to explain how the grass keeps the dirt by the plants which help the plants grow!" (Lesson 9, Slides Book Engineers Test Solutions)
    - Lesson 10, Meet the Experts: Solution Scientists, page 15 "From moving sand to planting sea grass and putting oysters near the shore, these erosion experts are here to help us figure out how to protect our shorelines and keep animals healthy. (Lesson 10, Slides Book Meet the Experts)

ii. Includes suggestions for how to connect instruction to the students' home, neighborhood, community, and/or culture as appropriate.

- Lesson 1 Handout Sharing Local Examples, "Share any family or community stories about how land might be changing shape. The stories can be as simple as a ditch that has gotten wider, or a flower bed that used to have straight sides but now has wavy edges. Share the story with the student and help them draw a picture of the land that has changed shape. You can also take a picture of the land if you have access to the location…Encourage students to reach out to other family and family friends in other locations as well! Students can call or text other trusted adults to collect stories from all over." (Lesson 1 Handout Sharing Local Examples)
- Lesson 1 Handout Sharing Local Examples, "Look around your space and community for places where land might be changing shape. Take pictures of these places and send them to …. Feel free to also share what you think might have caused the land to change shape, or have your student speculate about the cause. Remember, students are working to figure out the cause together through engaging in investigations in class." (Lesson 1 Handout Sharing Local Examples)
- Lesson 1, Connect Section, Step 8, "To help students develop relevance to focal science phenomena it is important for teachers to support making connections between the diverse ways that science appears in their home and local communities in order to address and/or leverage students' lived experiences, interests and identities in support of the classroom community's sensemaking work. Documenting the land changing shape in their local communities might support students in developing a habit of making observations and asking questions about the natural world around them outside of school." (Lesson 1, Teacher Guide)

- Lesson 3, Explore Section, Step 2, "Community Connections: Consider adjusting the language of "a little water / a lot of water" to match what students experience in their community. If students typically experience flooding or heavy rains, consider using these words in place of "a lot of water." If students share traumatic experiences, follow the three steps of Be Curious, Validate, and Thank the Student linked in the resource Unit-Specific Strategies for Supporting Equitable Science Learning so you can respond in a way that continues to encourage students to connect the lesson to their own lives and discuss that with their class. In some situations a teacher may also choose to follow up with a student after a large group discussion to see if additional supports are needed."
- Lesson 4, Explores Section, Step 2, "It sounds like we share this space with many others who use and care about the land! Let's consider how we can learn from it in a kind way." Ask students to consider the question on the slide and share with a partner before sharing out with the whole class. Students might suggest the following: We won't yell or chase animals. We won't try to step on plants (other than grass). If we move land, we will put it back how we found it (the best we can). Suggest that as we figure out what we will do when we go outside, we should also think about how we can care for everything around us." (Lesson 4, Teacher Guide)
- Lesson 7, Teacher Reference "A goal of our curriculum is to provide our communities and families with a participatory role and voice to bring different perspectives to the process of learning and practicing science. This lesson involves having students engage in the Engineering Design Process which involves a team of engineers designing and testing solutions to land changing due to wind and water. This team of engineers includes our student's families and their community knowledge made up of different experiences and cultural perspectives that can be leveraged towards co-designing solutions." (Lesson 7, Teacher Reference Co-Designing with Families)
- Lesson 7, Teacher Reference Co-Designing with Families, "To support expansive and intergenerational learning and collaboration across teachers, students, and families, provide students with the opportunity to interview and brainstorm together family and/or community members in search of solutions for the community problem identified in class. Student's families make up a rich and diverse source of knowledge from different disciplines and experiences that can help create a collaborative environment in the classroom where students and families are positioned to have a central role." (Lesson 7, Teacher Reference Co-Designing with Families"
- Lesson 7, Connect Section, Step 7, "The problem of land changing shape has impacted communities both positively and negatively throughout history. Some families and communities have rich backgrounds related to agriculture and observe numerous regenerative practice-oriented solutions. Allowing all student ideas and experiences may bring in non-dominant students' family and community perspectives and experiences into the classroom community to diversify scientific practices and increase the relevancy of lessons." (Lesson 7, Teacher Guide)

iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

- Lesson 1, Synthesize Section, Step 6, "Move to the bottom of the Possible Causes chart. Ask students to think about who and what (animals, people, plants, etc.) uses the land that is changing and how these things might be affected. Ask a few students to share their ideas and add these ideas to the Possible Causes chart. As students share out, ask them why we would care about the people, animals, or plants in those areas. How does it affect them? If the water is too dirty with mud the fish may not be able to breathe. Our houses may get messy or we might have less road to drive on. Trees might lose the dirt around them and have nowhere to root. We have less land to sit on at the beach and other places." (Lesson 1, Teacher Guide)

- Lesson 2, Navigate Section, Step 1, "Ask students to recall why they decided to look for examples in their communities. Students should remember that we wanted to find examples to share with the class so that we could learn more about how land might be changing around us."
- Lesson 4, Synthesize Section, Step 3 "Compare outdoor results with the Community Examples chart. Display slide M. Remind students that we did this to try to collect evidence to support our ideas about what is causing the changes we saw on our Community Examples chart. Ask students to consider if some of the same patterns we saw outside are also present on the Community Examples chart images, and if we need to change the column that an example is in. Allow partners to talk about the examples and share their ideas with one another." (Lesson 4, Teacher Guide)
- Lesson 7, Synthesize section, Step 6, Teaching Tip: If short on time, ask students to share out a couple of ideas for designs instead of drawing individual designs. Use the different suggestions they make to ask them where they have seen that idea before, and use any real-world examples they mention to suggest that we look within our community and to our families for ideas that already exist around us. In Lesson 8, give students some time to put their initial ideas on paper before completing their small group designs."

Suggestions for Improvement: NA

II.B. Student Ideas — Extensive

Student Ideas: Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate.

The reviewers found extensive evidence that the materials provide students with opportunities to engage in productive discourse. The teacher is supported in acting as an expert facilitator to draw out student ideas. There is discourse that focuses on explicitly expressing and clarifying student reasoning, such as during scientists' circle. Students have opportunities to share ideas with peers and use others' ideas to improve or change their thinking. There are also artifacts, such as students modifying their bin models in Lesson 7 and revising their design solutions in Lesson 8, that show changes in thinking over time.

Student ideas are clarified, justified, and built upon. Materials show evidence that students have frequent opportunities to share ideas and feedback with each other directly and to use others' ideas to improve or change their own thinking.

- Lesson 1, Synthesize Section, Step 5 "Tell students that during this discussion as they share out and you draw their ideas, you may ask for them to tell or show you more about their ideas, and you may also ask the class to agree or disagree with how you show that in the picture. Students can also agree with each other, disagree with each other, or add on to someone else's idea. Explain to students that all of their ideas are important and we need to make our picture so that everyone can understand it when we look at it later." "Teaching Tip: The purpose of an Initial Ideas Discussion is to provide an opportunity for students to share and make sense of their ideas, starting toward an explanation even while the ideas are new and tentative or uncertain. Use talk moves like revoicing and say more to help clarify the ideas so that others can work with them. Ask the class, "How should we represent this idea? Are we OK with that? Where are we not sure?" The goal is to surface multiple ideas, so avoid privileging some ideas over others. Draw out possible

competing ideas to motivate students to propose investigation ideas for those areas of uncertainty." (Lesson 1, Teacher Guide)

- Lesson 2, Explore Section, Step 2 "Have students discuss in pairs and then share with the whole group how to model, or show, the effects of wind, rain, and flooding with the three dimensional models. Encourage students to ask questions to one another to build on each other's responses and get clarification as needed." (Lesson 2, Teacher Guide)
- Lesson 2, Connect, Step 2, "Remind students of our classroom agreements that "We share ideas even when we are not sure." & "We let our ideas change and grow." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "If time permits, provide multiple means of representation by encouraging students to visit other groups to see /compare their land change bins and/or model drawings. This will help students build connections across the different groups' results to support a collective consensus of patterns observed prior to synthesizing evidence. This also allows students time to share their experiences, ideas, and stories with others increasing confidence in their communication skills." (Lesson 3, Teacher Guide)
- Lesson 5, Explore Section, Step 5 "Broadening Access: Whole class discussions often turn into quick share outs of student thinking without students engaging with each other's ideas (e.g., questioning a peer, building off an idea, etc.). To support students' meaning-making work, help them spend time with, and engage with, a peer's idea. It is just as important to help students unpack and make connections with one idea as it is to have every student in the class share an idea." (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2 "Support students in agreeing and disagreeing with each other respectfully. You may have students use sentence starters such as "I agree/disagree with _____, because_____." To allow all students to participate (even if they are not speaking), you can have students agree or disagree using hand gestures (e.g., thumbs up, thumbs down). Support students in making their thinking visible by asking "why" they agree or disagree and have them share their evidence and/or reasoning." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize section, Step 6, "Teaching Tip: This creation of the design solution draft will be used as a way to get students to consider the range of possible solutions for their chosen Community Example problem. Allow students to get many ideas out on the table. There is no right or wrong answer at this point. In lesson 8, students will be able to refine their ideas in partner groups based on the shape, structure, and function of other real-world solutions." (Lesson 7, Teacher Guide)
- Lesson 9, Explore section, Step 4, "Consider reviewing the classroom agreement "we let our ideas change and grow" and the goal of modeling before building and testing. Focus students on the goal of "learning from our mistakes." Emphasize that frustration and failure can be productive for experimenting with how to make our solutions better." (Lesson 9, Teacher Guide)
- Lesson 9, Synthesize Section, Step 5 "Stand up, Hand Up, Pair Up to compare designs. Display slide K and review the protocol with students. Encourage students to share what they wrote on page 2 of Testing Observations with a new partner. Point out the sentence starters and encourage students to use them when meeting with their partner. Set a timer for 5 minutes and tell students to try to meet with at least 2 different people." "Broadening Access: Whole class discussions often turn into quick share outs of student thinking without students engaging with each other's ideas (e.g., questioning a peer, building off an idea, etc.). To support students' meaning-making work, help them spend time with, and engage with, a peer's idea. It is just as important to help students unpack and make connections with one idea as it is to have every student in the class share an idea." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3 "Once all of the students have finished *Choosing a solution to slow land change*, bring students over to view the Our Growing Ideas chart. Point out that we have done a lot of work this lesson to figure out what solution is the most effective. Lead a Building Understandings discussion to complete the Our Growing Ideas chart, and also to uncover that there can be multiple effective solutions

to a problem. Example prompts and responses are below. Encourage students to build on each others' responses." (Lesson 10, Teacher Guide)

Artifacts show evidence of students' reasoning and changes in their thinking over time.

- Lesson 1 Teacher Reference Unit Class Charts, "Keep in mind as you develop and revise the model in collaboration with your students that its purpose is to help try to explain how something works. In OpenSciEd Unit 2.1: How do wind and water change the shape of land and what can we do about it? (Land on the Move Unit), students are trying to figure out what is causing the land to change shape, specifically in this model by the side of a road. As they figure out important ideas through their investigations, students are developing a set of ideas about this phenomena. When they come together to develop and revise their Class Consensus Model, they are making their ideas about how the land changes shape explicit to themselves and one another. Engaging in modeling helps students to identify what they can explain, and what they still have questions about. Further, understanding how the land has changed in our class model can also help us explain how the land has moved in our examples from our Community Examples chart. The model then becomes an important tool for them to use to make sense of the phenomenon they are exploring and apply their ideas to their related phenomena to explain as well." (Lesson 1, Teacher Reference Unit Class Charts)
- Lesson 1, Teacher Reference Unit Class Charts, "You will gather data on the Land Change chart in Lesson 3 for what students notice inside of their land change bins. In Lesson 4, another version of this chart will be made, and a third version will be made in Lesson 5. You will continue to use the chart structure in Lessons 4 and 5 as students analyze and add data from land changing shape outside and rocks changing shape over time. All three charts will be used together in lesson 5 as students look across their observations. They will use these observations as data to provide evidence of patterns in how land changes shape. The amount of evidence progresses and builds from lesson to lesson, providing students with a rich set of data on which to base their understanding of wind and water changing the shape of land over time." (Lesson 1, Teacher Reference Unit Class Charts)
- Lesson 2, Explore Section, Step 3, "Support students in understanding how models can be developed to represent the land and to test our ideas about wind and water possibly changing the land. Students will develop a model that can represent the land that we have seen in Lesson 1 and/or in the community examples and use this model to test their ideas in Lesson 3. In Lesson 7, students will revisit the models and determine that they need to refine the model to solve for a local problem they have defined based on observations and patterns used as evidence, and then use the refined models in Lesson 8-10." (Lesson 2, Teacher Guide)
- Lesson 4, Explore section, Step 2, "Engage in a Walk and Talk. Once the investigation has been conducted, partner students up with someone they did not work with outside. Ask students to walk back to the building and share whether their observations matched their predictions we made before going outside." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize Section, Step 6, "Revisit our model from lesson 1. Display slide AA. Celebrate that we have made a lot of progress explaining what may have caused land to move, and suggest that we look back at our class model to see if we can update it. Point out that we have learned a lot about why the dirt might have moved into the road and for the shape of the side of the road to change. Draw students attention to the road itself and ask students how we can use the ideas we discovered today to add to our class model. Use the following prompts to support students in updating the class model."...Today we figured out that some changes to land can take a long time. What do we think might happen to the road in our model over many years? How can we add our new ideas to our drawn model? (Lesson 5, Teacher Guide)
- Lesson 6, Connect Section, Step 3, "Sort community examples as fast or slow changes. Display slide F and refer back to the Community Examples chart again. Remind students we also had a few examples on our

chart that were still unsorted. Suggest that we revisit these examples to use our new ideas to sort them. First, ask students to share with a partner what they are now thinking about the column in which those examples belong. Then, as a class, engage in a Consensus Discussion to sort the remaining community examples as either a fast or slow land change. If all the community examples are already sorted, then engage the class in a discussion to double-check their sorting choices. Briefly go through each community example and have students discuss whether it is a fast or slow change and what evidence they have that supports this conclusion. If the class changes their current designation of fast or slow, adjust the Community Examples chart to reflect this development." (Lesson 6, Teacher Guide)

Students receive feedback and revise their thinking accordingly.

- Lesson 3, Explore Section, Step 2, "The questions that students develop provide opportunities to gather evidence about learning goal 3a, with the purpose of providing feedback and supporting students in developing questions about the effects of wind and water and the rate that they change the land. Use the suggestions in the Assessment Guidance at the beginning of the lesson to provide feedback and determine next steps before moving on to the investigation." (Lesson 3, Teacher Guide)
- Lesson 5, Navigate Section, Step 7, "Collect handouts. Close the lesson by collecting the handout from this lesson. Their handouts, with your written feedback, will be part of an activity in Lesson 9. Emphasize that you are excited to see all of the great observations they made and you will return them with feedback during a future lesson." (Lesson 5, Teacher Guide)
- Lesson 7, Explore section, Step 3, "Allow students to develop modified bin models. Place students in groups. Give each group a fresh bin and the materials they said they need to make a more accurate model. Give students up to five minutes to add materials to their bin to represent the area that they are going to try to design a solution for. As students work, circulate the classroom. Consider using the following prompts to support the development and modification of their new land change model bins."
- Lesson 8, Teacher Assessment Tool Following Student Sensemaking, "On the Our Land Change Solution, look for: Eraser marks, scribbles, or other marks indicating decisions being made or changes made to their original drafted design in drawings 1 and 2." (Lesson 7 Teacher Assessment Tool Following Student Sensemaking)
- Lesson 8, Explore Section, Step 6, "Peer feedback: Students' sharing their designs with another partner pair provides an opportunity to review other designs and receive feedback on their own designs. This opportunity allows students to see multiple ways that engineering problems may be solved as well as give and receive feedback to improve designs. Remind students to use the Peer Feedback Discussion Prompts table tent if they struggle to begin giving feedback. Students will have an opportunity to use the feedback to improve their designs before the end of the lesson…Have each pair reflect on the feedback they received from their peers and then provide times for students to revise and improve their drawing of their design solution on the second page of Our Land Change Solution. Circulate, asking students questions about how they will incorporate the feedback they received into their solution." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 3, "Review teacher feedback on our observations and draw land change bin. Display slide H. Celebrate the good work that students have done recording observations in our previous investigations. Return Land Change Bin Observations and Observations of Rocks to students and allow them to read the feedback. After 2 minutes ask students to consider how they will use this feedback when they make observations during today's investigation. Invite students to use this feedback to draw their land change bin models (with the design solution)." (Lesson 9, Teacher Guide)

Suggestions for Improvement: NA

II.C. Building Progressions — Extensive

Identifies and builds on students' prior learning in all three dimensions, including providing the following support to teachers:

i. Explicitly identifying prior student learning expected for all three dimensions
ii. Clearly explaining how the prior learning will be built upon.

The reviewers found extensive evidence that the materials identify and build upon students' prior learning in all three dimensions because the learning progression for each targeted element of all three dimensions is coherently mapped out for the entire instructional materials program through multiple teacher support documents and tools. The materials do explicitly identify prior learning expected for all three dimensions, but not at the element level. The support to teachers clearly explains how the prior learning will be built upon. The lessons provide explicit support to teachers for identifying individual students' prior learning and accommodating different entry points.

i. Explicitly identifying prior student learning expected for all three dimensions

- Lesson 1, Explore Section, Step 1, "Land can change in many ways. This unit will focus only on wind and water changing the shape of the land. Erosion is also not the only process that can change the shape of the land, which is why this unit will not specifically call out erosion or deposition. The class will also specifically define "land" in Lesson 2. For now, use whatever general terms make sense for talking about the ground, earth materials, and land moving. Students will go figure out more about the processes of erosion, weathering, and deposition in Grade 4 (NGSS Performance Expectation 4-ESS2-1)" (Lesson 1, Teacher Edition)
- Lesson 2, Explore Section, Step 3, "Students should have first encountered the word evidence in OpenSciEd Unit K.1: Why do some surfaces get hot and how can we make them less hot? (Schoolyard Engineering Unit). To support students in understanding what evidence is and how it is used to collect data and make comparisons, you can help students make the connection that the land change bins will be used to collect evidence that wind and water can change the shape of the land. Students will make observations using their eyes, ears, and possibly hands to help answer a question about if wind and water could change the shape of land." (Lesson 2, Teacher Guide) This information does not specify which SEP element is being addressed.
- 2.1 Earth Land Erosion About the Science, "Slow and Fast Changes. In many lessons, students work to develop the crosscutting concept that things can happen rapidly or slowly. However, the unit authors decided to use the words fast and slow or quickly and slowly in the unit materials as these are words that second graders are more likely to use when describing the changes that they are observing or discussing. As mentioned in the section above, students at this age are still developing concrete ideas about time." (2.1 Earth Land Erosion About the Science) This information does not specify which CCC element is being addressed.

ii. Clearly explaining how the prior learning will be built upon.

- Lesson 1, Synthesize Section, Step 6, "During the construction of the class picture (which will be identified as a model in Lesson 2), students considered what patterns they saw with land and in their past experiences that might have caused the land to change shape. Students have now identified some potential causes from these observable patterns. Taking time to list these causes now will give students a quick list to reference later as they design investigations to test their ideas and gather evidence about these possible causes." (Lesson 1, Teacher Guide)

- Lesson 1, Synthesize section, Step 4, "Developing and Using Models: To help students develop their understanding of models, we will intentionally use the words "picture to explain" instead of "model" in Lesson 1. After students develop explanations with their picture/drawing about this natural phenomena, we will then analyze their pictures as entry points and name them as "models" in lesson 2. This will strengthen students' access to learning goals around definitions of models and how to use them to explain and imagine, predict, and hypothesize explanations." (Lesson 1, Teacher Guide)
- Lesson 7, Explore Section, Step 2 "Teaching Tip: Depending on how comfortable students are with defining problems, some students may need some extra support in determining how to identify a problem to solve. Consider reading Engineers Test Solutions to figure out what those who solve engineering problems for a living do when they first encounter problems. Then, use what we figure out about how engineers define problems to help students determine that we can look for problems that affect others and design a solution based upon need." (Lesson 7, Teacher Guide)
- 2.1 Earth Land Erosion About the Science, "Qualitative evidence. At the 2nd grade level, students use qualitative observations of change to land. They use a reference line to see how much land has moved as compared to where it started. They also analyze before and after images. These qualitative observations provide a foundation built on in the next grade band where they will begin using quantitative evidence of change over a longer period. Evidence of rock layers and fossils are used to explain the amount of time it takes for the slow changes." (2.1 Earth Land Erosion About the Science)
- 2.1 Earth Land Erosion About the Science), "Engineering design: Designing solutions. In Lessons 7-10, students develop design solutions and test the solutions to determine how effective the solutions are at solving our local and change problems. While students test their solutions, students do not redesign their solutions and test them again. This will not occur until the third grade. The redesigning of a design solution would involve an evaluation (either implicitly or explicitly) of criteria and constraints, and how well the design met those criteria and constraints. Students also do not compare their design solution drawings and ideas before testing using criteria and constraints. Students also only test their designs based on the common way that land changes shape for their land change problem, and do not test the full range of possible conditions (tornadoes, storms, etc.) on their designs." (2.1 Earth Land Erosion About the Science)
- 2.1 Earth Land Erosion About the Science, "In lessons 2-5 students explore their questions about what is causing the land to change which motivates them to develop models of different types of land they encountered in their community or other images. Students develop and use models to show the effects of wind and water on Earth's materials (i.e., sand and rocks) through investigations to simulate different amounts of wind and water in their modeled bin environments. Students may have developed models to explain an idea in the past, but now students will shift in this unit to use models to test ideas and collect evidence." (2.1 Earth Land Erosion About the Science)
- 2.1 Earth Land Erosion About the Science, "Students at this age do not have fully developed, concrete ideas about time. In this unit, they develop ideas about stability and change through observations of land changes that can happen fast and slow. In Lessons 3 and 4 students observe that things like sand and dirt seem to change very fast, but notice that concrete and some rocks do not seem to change. In Lesson 5, students conduct an investigation with rocks to make observations for any changes when wind and water are applied. They also help co-design an investigation where water is poured over a salt rock for 10-15 minutes. While they do not see many changes to the rocks in their bins, they observe that the salt rock did in fact change over a time period larger than a few seconds. Students start to develop the idea that changes to rocks might not be observable in the short time because the changes are so small and slow, but over a long time we can observe the changes." (2.1 Earth Land Erosion About the Science)

Suggestions for Improvement

- Consider calling out the individual elements of all three dimensions as additional support for teachers to the expected level of prior proficiency students should have.

II.D. Scientific Accuracy — Extensive

Scientific Accuracy: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.

The reviewers found extensive evidence that the materials use scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning. All science ideas and representations in the materials are accurate, and student-facing materials use grade-appropriate wording to help scaffold students' understanding across all three dimensions, which avoids creating misconceptions.

Evidence from the materials where the criterion was met,

- Lesson 1, Explore Section, Step 1, Teaching Tip: "Land can change in many ways. This unit will focus only on wind and water changing the shape of the land. Erosion is also not the only process that can change the shape of the land, which is why this unit will not specifically call out erosion or deposition. The class will also specifically define "land" in Lesson 2. For now, use whatever general terms make sense for talking about the ground, earth materials, and land moving. Students will go figure out more about the processes of erosion, weathering, and deposition in Grade 4 (NGSS Performance Expectation 4-ESS2-1)." (Lesson 1, Teacher Guide)
- Lesson 2, Connect Section Step 2, "If students bring in examples that are clearly the result of humans or animals and there is evidence of this, ask students to reflect on their sorting. Guide students to determine that there might be tracks or prints. Use the idea of tracks, prints, or other signs of animals or people to separate out any examples that were caused by humans or people, and possibly add a new column to the Community Examples chart. This will signal to students that their input is important and valued, but still keep the focus on wind and water as causes for land changing shape for this unit." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "Dirt and sand can fly out of the bins and get in students' eyes. Be sure to remind all students to wear goggles for the duration of testing." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 3, "Cause and Effect: While the observations about land changing from the article are not patterns at this point, we will be using these observations to discuss patterns in this next step. Having this record of what changed, how it changed, and how much it changed will allow students to have a visual representation of their ideas to draw on during this discussion. Additionally, it may also help to have the How is Land Changing Shape chart from Lesson 1 and the Land Change chart from Lesson 3 nearby for easy reference."
- Lesson 6, Explore Section, Step 2, "Balanced Rock is actually made of two different rock formations. The top boulder is made of Entrada Sandstone and the bottom part (pedestal) is made of mudstone, which erodes more easily. Wind and rain cause this land change. Students may notice that the small pillar, which

was called "Chip off the Old Block" is missing. It fell in the winter of 1975-1976. Eventually, the top boulder will fall off of Balanced Rock when the land change of the pedestal continues. So, the land change actually happens both slowly (pedestal eroding) and quickly (boulders falling). This is an image of railroad tracks before and after Hurricane Katrina in 2005. Hurricane Katrina had very high winds and a lot of rain. The very high winds caused a "storm surge," which is when the sea levels get extremely high. This storm surge (waves) along with the rain flooded many areas causing damage. This was a fast change caused by wind and water." (Lesson 6, Teacher Guide)

- Lesson 8, Learning Plan Snapshot, "If you do not anticipate any stories or images being shared, print off images of design solutions that are relevant to your community or design problem and have them ready for students to discuss. See Land Change Solution Images for some examples you can use with descriptions of images for students." (Lesson 8, Teacher Guide)
- 2.1 Earth Land Erosion About the Science, "This unit includes conversations about the strengths and weaknesses of the design solutions but does not explore criteria and constraints. Instead, students think about the effectiveness of their designs in relation to solving the problem. While this inherently involves criteria of what the solution should do, criteria will not be introduced or utilized until 3rd grade. There is no specific quantitative data for the students to measure to make their solution successful." (2.1 Earth Land Erosion About the Science)
- 2.1 Earth Land Erosion About the Science, "Land changing shape. In this unit, students do not use the terminology or distinguish between processes such as erosion, weathering, and deposition. These processes causing land changing shape have occurred before we have provided interventions in the form of design solutions, and will continue far into the future. While we cannot prevent these changes, we can only mitigate their effects. Thus, language such as the word "prevent" has been avoided in this unit and instead utilizes words such as "slow down" "limit" or "reduce" in place of "prevent." (2.1 Earth Land Erosion About the Science)
- 2.1 Earth Land Erosion About the Science, "Erosion. This unit does not introduce or use the word erosion. Instead, the writers chose to focus on how wind and water can change the shape of land. The process of erosion can often be intermingled with weathering and even deposition as multiple processes can be at work to cause a particular phenomenon. Most of the examples of land changing shape that students observe in this unit are in fact observations of deposition. Using the word erosion to describe what students are seeing could lead to students developing misconceptions about what erosion is and is not. Erosion is introduced in the 3-5 grade band when students also discover the process of weathering." (2.1 Earth Land Erosion About the Science)
- 2.1 Earth Land Erosion About the Science, "Cement and pavement. In this unit, students puzzle over cement and pavement as they likely observe that they do not experience fast changes due to their wind and water tests, as this is part of many student's home and community environments. Students consider cement and pavement as rocks since they seem to fit the category of being a hard object that is held together (does not easily break into smaller pieces). This definition of a rock is co-constructed by the class and is developmentally appropriate for grade 2. While cement and pavement are not rocks, students will generate a more scientific definition of a rock in future grade bands when they better understand the concept of minerals and Earth's materials. In addition, the word dirt is used to describe soil and other materials that resemble dirt. Students will not figure out about the nutrient content of soil and the distinction between dirt and soil until 5th grade." (2.1 Earth Land Erosion About the Science)

In Earth Land Erosion Unit Front Matter, Earth Land Erosion SEP-DCI-CCC-ELA-Math-Matrix, Teacher Guide in both Lessons 5 and 6, Lesson 5 Teacher Assessment Tool Instructional Guidance, and Lesson 6 Teacher Assessment Tool Scoring Guide, the term "salt rock" is used. Though the term conveys that it is a rock made of salt, it is not a scientifically accurate term. The scientifically accurate term is "rock salt".

- Lesson 5, Explore section, Step 3, "Start the pump for the salt rock. After the first round (little wind) of tests are complete, take a picture of the salt rock and place the salt rock under the stream of water to begin the investigation. The salt rock should change shape and be ready to be taken out after about 10 minutes." (Lesson 5, Teacher Guide)
- Lesson 6, Teacher Assessment Tool Scoring Guide, under class evidence "Salt Rock investigation (lesson 5)" (Lesson 6, Teacher Assessment Tool Scoring Guide, page 3)

Suggestions for Improvement

- Use the scientifically accurate term *rock salt*. Geologists say "rock salt" instead of "the rock form of salt" for efficiency. https://geokansas.ku.edu/rock-salt
- Consider making all naming conventions consistent for the unit (Land on the Move Unit vs. Earth Land Erosion). It is recommended to avoid using the word *erosion* in the unit title because erosion is not introduced until grades 3–5.

II.E. Differentiated Instruction — Extensive

Provides guidance for teachers to support differentiated instruction by including:

i. Supportive ways to access instruction, including appropriate linguistic, visual, and kinesthetic engagement opportunities that are essential for effective science and engineering learning and particularly beneficial for multilingual learners and students with disabilities.
ii. Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.
iii. Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts.

The reviewers found extensive evidence supporting teachers in differentiated instruction. Teacher resources guide students in accessing learning related to all targeted objectives, including Broadening Access, Teacher Tips, the Adaptive Straws and Spray Bottles document, and Lesson Assessment Guidance. The materials offer detailed guidance for accommodating individual students with diverse needs, ensuring their access and engagement in each activity. Additionally, there is extra support for English language learners and students who have not yet met the standard. Extensions are provided for high-interest topics or for students who have already exceeded performance expectations.

i. Supportive ways to access instruction, including appropriate linguistic, visual, and kinesthetic engagement opportunities are essential for effective science and engineering learning and particularly beneficial for multilingual learners and students with disabilities.

- Lesson 1, Explore section, Step 1, "The Notice and Wonder chart should capture not only students' ideas, but also the rich ways that students' express their ideas. This is especially important for multilingual students because their language resources and practices are not always noticed or valued in school spaces. If a student shares an idea using words or phrases in a named language other than English (e.g., in Spanish, Arabic, Mandarin, etc.), record their idea exactly as they shared it and then add a translation in English next to it. If possible, have students record ideas onto the chart themselves." (Lesson 1, Teacher Guide)

- Lesson 1, Synthesize section, Step 4, "As students work, circulate from group to group. Remind students that they can share and communicate their ideas in many different ways. For example, if a student is gesturing wind, another student can put their gestures into words while another student puts the same ideas into the drawing. For groups that are having trouble putting their ideas on paper, prompt them to be ready to share verbally or with their bodies and sounds about how the land might be changing shape by the roadside." (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 3 "Elevate the need for an agreed upon definition of the word land. Have students turn and talk about what they think the word land means. Accept all responses/languages." "Teaching Tip: Offering students an opportunity to work with peers gives them a chance to use their linguistic and nonlinguistic resources to express their ideas (and learn from other students' uses of these resources too) before sharing their ideas in a larger discussion. This is especially beneficial for multilingual learners, but provides an opportunity for all learners to review their developing thoughts allowing for self-reflection. This might promote confidence, which ultimately optimizes motivation to engage in whole class discussions. Consider forming groups that are heterogeneous in terms of language, math, writing, and other abilities to allow students the opportunity to learn from one another." (Lesson 2, Teacher Guide)
- Lesson 3, Teacher Reference Adaptive Straws and Spray Bottles, "Some students may have difficulties holding the straw or spraying the spray bottle with small hands or weak grip. Guidance is given below to show how each of these materials can be adapted for small or weak hands." (Lesson 3, Teacher Reference Adaptive Straws and spray bottles)
- Lesson 3, Synthesize section, Step 3, "Broadening Access: Offering students an opportunity to work with peers gives them a chance to use their linguistic and nonlinguistic resources to express their ideas (and learn from other students' uses of these resources too) before sharing their ideas in a larger discussion. Additionally, consider printing out images of one and two arrows using Arrow Cards to distribute to students. Ask students to visually display no arrows, one arrow, or two arrows to indicate their ideas about how much land was moved. This will allow all students to communicate their ideas by using a visual representation instead of verbal representation, and allow for more ideas to be shared at once." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 4, "Consider having out the land change bins from Lesson 3 as well as the straws and spray bottles as students identify patterns. To support multilingual and/or speech impaired students, encourage students to use whatever modalities of expression they choose. For example, allow students to point to specific materials, gesture the use of the spray bottle or straw, and show movement of specific materials to help them communicate any patterns they saw amongst the land outside. Encourage both scientific and everyday language to express their ideas." (Lesson 4, Teacher Guide)
- Lesson 6, Connect Section, Step 3, "To support multiple ways of expressing and communicating science ideas, consider allowing students to physically move as they sort community examples. As the class sorts and double-checks their community examples, have students move to different parts of the room designated as "fast," "slow," or "unsure." Then, prompt students from each group to explain why they moved to that particular part of the classroom. This accommodation can reduce barriers for students by providing an option for physical action as a means to express their ideas." (Lesson 6, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4, "The images are pre-cut for this activity because some students might find using scissors challenging. However, if you want your students to practice their fine motor skills you can have them cut the images themselves." (Lesson 6, Teacher Guide)

ii. Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.

- Lesson 1, Explore section 3, "Broadening Access: Think, Pair, Share allows students a few moments to form their thoughts (Think), then discuss with a partner (Pair), then volunteer to explain their partners thinking to

the class (Share). This structure is helpful for multilingual learners and children who are more comfortable sharing with one person than the whole class. Encourage student pairs to use whatever modalities of expression they choose: gestures, named languages other than English, etc. To allow for equitable sharing, consider labeling one partner A and one partner B. Signal when it is time for partner A to share, and instruct students when it is time for partner B to share. This can help ensure that each partner has roughly the same amount of time to share their ideas."

- Lesson 2, Explore Section, Step 3 "Elevate the need for an agreed upon definition of the word land. Have students turn and talk about what they think the word land means. Accept all responses/languages." "Teaching Tip: Offering students an opportunity to work with peers gives them a chance to use their linguistic and nonlinguistic resources to express their ideas (and learn from other students' uses of these resources too) before sharing their ideas in a larger discussion. This is especially beneficial for multilingual learners, but provides an opportunity for all learners to review their developing thoughts allowing for self-reflection. This might promote confidence, which ultimately optimizes motivation to engage in whole class discussions. Consider forming groups that are heterogeneous in terms of language, math, writing, and other abilities to allow students the opportunity to learn from one another." (Lesson 2, Teachers Guide)
- Lesson 3, Lesson Assessment Guidance "If you notice students need more support in asking questions you might:
    - Use repeated words, sketches, and/or gestures to help them develop their ideas around the amount of time it takes land to change.
    - Invite students to the Community Example chart and highlight certain examples that show more or less change. Provide sentence starters to help students develop questions around the quantity of wind or water such as: How will ___ change when I use (a lot of, a little bit) of (wind, water)? Will (a little, a lot) of (water, wind) change how much (insert material here) moves?
    - Return to the Notice and Wonder chart and highlight some of the wonders that relate to the quantity of wind or water that might have caused the change.
    - Provide sentence starters to help students develop questions about how fast or slow changes could happen. Lesson 3, Teacher Guide)
- Lesson 5, Teacher Assessment Tool Instructional Guidance, "Students are not yet comparing how much time it might take to change different types of land…Before starting Lesson 6 (or during the first Navigate), reflect on the investigations in Lesson 5. Have students consider the timescale over which the salt rock changed, and compare that to the timescale over which we could cause a change to the shape of the land with our land change bins and sand or soil…At any point, revisit the Community Examples chart. Point out that we have fast changes and slow changes in different columns. Ask students to reflect on what evidence we have from Lessons 2-4 about the speed of these changes, and why they might be in different columns. Revisit the Our Growing Ideas chart and look for supporting evidence for their ideas." (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2 "Teaching Tip: If you notice that students are not identifying specific evidence of land changes over time in the images, consider projecting the Then-and-Now images during the following class discussion. When you ask students what evidence they see of changes, have them reference the projected images or come up to the front of the class to circle the evidence of changes from the then image to the now image (ie. for smartboards or projecting on a whiteboard)." (Lesson 6, Teacher Guide)
- Lesson 7, Explore section, Step 2, "In Lesson 2, we identified that we needed to develop a bin (a new tool) to test our ideas about wind and water changing the shape of the land. Now that we understand that wind and water can change the shape of land, and this change can happen from slowly to rapidly, we need to refine our bin design to test our design solutions for our Community Example problem. While the problem being defined in Lesson 2 led to the development of many possible bins, the problem at this point (the

Community Example problem) has been narrowed, creating a more targeted problem (the construction of the bin to test possible solutions) to be solved. If students need more support at this moment, consider asking students to focus on a problem that they could implement the solution to, if constructed as a class." (Lesson 7, Teacher Guide)

- Support for learners who read below grade level:
    - Lesson 3, Connect section, step 4, "Read a book and discuss the associated prompts. Read Land Changing Shape aloud and use the prompts below to support students in obtaining new information about wind and water. Follow up students' ideas as they share them by asking "What makes you think that?". Remind students to consider how images in the text help to explain the events happening in the book." (Lesson 3, Teacher Guide)
    - Lesson 5, Connect section, step 5, "Read Rocks Over Time using the associated prompts. Display slide X and read Rocks Over Time aloud." (Lesson 5, Teacher Guide)
    - Lesson 9, Connect section, step 2, "Look for students to suggest we read a book. Encourage students to pay attention to the key details in the text that the author wants to explain about testing design solutions. These details will help us figure out how we can test our solutions. Display slide D and read pages 10-18 aloud in Engineers Test Solutions." (Lesson 9, Teacher Guide)
    - Lesson 8, Connect section, step 3, "If you want to make this reading more interactive, consider organizing students into small groups to jigsaw the different solutions for the relevant portion of the infographic. After allowing students to read their assigned solution, students will share how their solution limits changes to the land caused by wind or water in their jigsaw small group. Have the other students ask clarifying questions about how the solution works." (Lesson 8, Teacher Guide)

iii. Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts.
Evidence from the materials where the criterion was met,

- Lesson 2, Explore Section, Step 3, "Extension Opportunity: If time and/or materials permit you may consider having the class test more than 3 types of land. You may decide to introduce the additional "land types" at the beginning of the lesson or save additional land types for students who finish early or demonstrate a high interest." (Lesson 2, Teacher Guide)
- Lesson 6, Navigate Section, Step 5, "Extension Opportunity: If students are interested in exploring other land changes, consider providing additional examples related to wildfires and melting ice. See Extension: Other Ways Land can Change for examples of changes to the land related habitat loss. This Extension: Other Ways Land Can Change provides images and guidance for students to consider whether these images are fast or slow land changes." (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 2, "Extension Opportunity: In addition to the suggestion above, you can provide multiple means of engagement by optimizing students' individual choice and autonomy by giving high interest learners the choice to figure out more about those that solve engineering problems for a living by reading the first part of Engineers Test Solutions. The second part of this book will be read as a full class in a later lesson." (Lesson 7, Teacher Guide)
- Lesson 8, Navigate Section, Step 8, "Extension Opportunity: After the lesson, consider giving students the opportunity to read about the remaining solutions from the Wind Solutions Infographic or Water Solutions Infographic infographic that the class did not read about. If there is time, allow interested students to read about these solutions as a small group in class. If there is no time, give students the opportunity to 'borrow' the infographic to read in their free time. These solutions may contain ideas that students might want to utilize in the development and construction of their design solutions in lesson 9." (Lesson 8, Teacher Guide)

- Lesson 9, Lesson Extension Options "Lesson 9 offers several opportunities for learners to go further with developing their design solutions. Below are 3 different options for how the lesson can be extended to meet the needs of high interest or gifted learners." Options include:
    - Extension Option #1 Increased Variable Testing. If there is more time or students are able to move at faster pace consider testing the additional variable (wind or water) that was not seen in the community land problem. Consider developing a larger Design Solutions Chart to collect the students' additional responses.
    - Extension Option #2 Testing Additional Solutions. For students who demonstrate an increased interest or are gifted learners consider having students try multiple designs. In grades K-2 students are striving towards the following performance expectation; K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. Students with higher interest or who are advanced may be challenged by developing multiple solutions to the community land problem and then determine if they were effective using the methods outlined in lesson 9. Having students develop more than two solutions would move them into the 3-5 performance expectation for engineering which is as follows; 3-5-ETS1-2. 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. If students choose to engage in this activity you may consider developing a design matrix for them to track their design ideas that mirrors the design solution chart that was used in class. If possible, have students share their findings with the class and consider adding their designs to the Design Solutions Chart…" (Lesson 9. Teacher Reference Lesson Extension Options)

Suggestions for Improvement: NA

II.F. Teacher Support for Unit Coherence — Extensive

Supports teachers in facilitating coherent student learning experiences over time by:

i. Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).

ii. Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

The reviewers found extensive evidence of teacher support for unit coherence. The materials support teachers in facilitating coherent learning experiences over time by providing guidance on how to recognize what students figure out in a lesson, what questions are left unanswered, and what new questions could be answered in the next investigation. Materials provide explicit teacher guidance and strategies to ensure students view their learning in all three dimensions as coherently linked to the progress they make toward explaining the phenomena and designing the solution, such as Lessons 5, 6, and 9 instructional guidance tools; gray margin guidance; and each Lesson Assessment Guidance document.

i. Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).

Evidence from the materials where the criterion was met,

- Lesson 1, "Every time that students complete a row for Our Growing Ideas they will add images that represent our sources of evidence, or "how we figured out" our ideas. Each lesson has its own file titled, "Lesson X Printable Chart Images." Consider printing images from each lesson and laminating these. This will allow images to be used from unit to unit or year to year." (Lesson 1 Teacher Reference Planning for Future)
- Lesson 1, Teacher Reference Unit Class Charts, "The Notice and Wonder chart is developed in Lesson 1. This is where you will record students' ideas and questions about the shared phenomenon of land changing shape from the news story. After Lesson 1, the Notice and Wonder chart is an important navigational tool that elevates students' ideas and emphasizes to students how their questions drive investigating lesson-level phenomena. For this reason, you will want to retain the chart (or charts) to refer back to during the unit in order to invite students to add new questions. Depending on the space constraints in your classroom, you may choose to write those questions directly onto the chart (in digital form or on paper) or record them on sticky notes to add to the paper chart at a later time. If the same questions come up again, you might add another question mark or indicator that it is still a wondering. Always acknowledge students' questions (existing and new) and connect them to the work students are doing." (Lesson 1 Teacher Reference Unit Class Charts)
- Lesson 1, Teacher Reference Unit Class Charts, "You will co-construct each row of your class's Our Growing Ideas chart in most lessons to track the class' growing ideas about the unit question of How do wind and water change the shape of land and what can we do about it? Use the sample chart rows shown here for reference, but be sure to use your students' own language, ideas, images, artifacts, and examples as you add each row. Sample images are provided in each lesson for you to print or use digitally as you co-construct the chart with the class. Consider increasing student engagement in the work of charting by inviting students to help with shared writing of words they know and/or adding images to the chart." (Lesson 1, Teacher Reference Unit Class Charts)
- Lesson 3, Navigate Section, Step 6, "We had some ideas about what would happen when we used our land models, what things surprised you? We have some great observations about land in our land change bins, but what about the land around our school? Do you think it will change like our land change bins? What could we do to find out more? What questions do you have about land changing around our school?" (Lesson 3, Teacher Guide)
- Lesson 3, Connection Section, Step 4, "If students are not convinced that wind and water move gravel or small rocks or notice that it takes a lot of wind or water to move small rocks or grave, add a question(s) about if wind and water can move rocks to the Notice and Wonder chart at this time to motivate future investigations in Lesson 4 and 5." (Lesson 3, Teacher Guide)
- Lesson 4, Connect Section, Step 4, "The article Communities Solve Wind and Water Problems is presented to help students consider other areas where land is changing shape, and how that process occurs due to wind and water. While this is one purpose of the article, the article prompts also start to get students thinking about the time it takes for these changes to occur, and ways in which design solutions have been used to slow this problem. If controversy arises over how much time these changes take, make sure to add those student questions to the Notice and Wonder chart to help motivate Lessons 5 and 6." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 4 "Compare and contrast results across the investigations. Display slide W. Display the Land Change charts from lesson 3, 4, and 5. Use the following prompts to identify patterns using evidence from this investigation, past investigations, and the Community Examples Chart. Guide

students in thinking about the changes in these investigations and if they were fast changes or slow changes." (Lesson 5, Teacher Guide)

- Lesson 6, Navigate Section, Step 1, "Refer to the Notice and Wonder chart and circle the questions related to fast and slow land changes. As a class, ask students to review these questions and discuss which they now think they can answer. Have students share answers to the questions and ask the class to raise their hands if they agree. If there is consensus, mark that question with a check mark. If there is no consensus, you can mark the question with a question mark. Leverage any controversy in the class regarding disagreements about the time it takes rock to change shape to motivate today's work. Point out that we still have a lot of questions about how long it takes for rocks to change, and in the last lesson we thought that some rocks might take a lot of time to change." (Lesson 6, Teacher Guide)
- Lesson 9, Navigate Section, Step 1 "Briefly review what we figured out in prior lessons. Display slide A and refer to Our Growing Ideas chart. Ask students to recall what we have been working on. Invite students to turn and talk with a partner about the last few lessons. Ask students to share what their partner said. Support students in recalling that in Lesson 7, we defined a problem that the changing land is affecting people and in Lesson 8 we drew a model of a solution with a partner and received some feedback. Elevate a few of the solutions that students drew during the last class by asking a few groups to recall and describe their design solution ideas. Ask students what we should do next. Accept all responses. Look for students to suggest that we should build the design solutions. Ask students to share what we might do after we build the design solutions. Look for students to suggest that we test them." (Lesson 9, Teacher Guide)

ii. Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

Evidence from the materials where the criterion was met,

- Lesson 1, Teacher Reference Unit Class Charts, "You will introduce the task that begins this chart in Lesson 1 in the Connect component. These community examples of related phenomena become a focal point of the unit over time. This chart will be used in Lessons 2, 3, 4, 5, 6, 7, 8, and 10. It is suggested that this chart is placed on a bulletin board or other highly visible space that is easily revisited and modified. It is meant to be highly interactive and students should be able to move their examples around from lesson to lesson on the chart." (Lesson 1, Teacher Reference Unit Class Charts)
- Lesson 2, Connect Section, Step 2 "Developing and Using Models: Students will have opportunities to revisit and re-sort any community examples they are not certain about at the end of lesson 3 after they have designed a simple test to gather evidence. These examples will also help drive students to develop an investigation outdoors in Lesson 4 to help them support or refute their ideas about what is causing these changes." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate Section, Step 1 "Teaching Tip: At this point in the unit students have not yet collected evidence to support their claims about wind and water changing the shape of the land. For this reason the lesson question should highlight the uncertainty that we have to help us motivate the testing we will do during this lesson." (Lesson 3, Teacher Guide)
- Lesson 4, Connect Section, Step 4 "If students mention that these changes are happening over a larger period of time, capitalize on this noticing. Use that moment to ask if we think all changes happen over long periods of time, or if changes can happen at different speeds. Suggest that we need to figure out if the shape of land can change over a longer period of time, and maybe we should do that next lesson!" (Lesson 4, Teacher Guide)
- Lesson 5, Navigate section, Step 7, "Teaching Tip: Students will make observations and record them again in lesson 9. Use the model checklist as a reference to give students feedback on the observations they made during lesson 3 and lesson 5 to be used to inform the work they do during lesson 9." (Lesson 5, Teacher Guide)

- Lesson 7, Explore Section, Step 2, "If students do not automatically mention that we have developed land change bin models to test different types of land in the past, ask students to look back at Our Growing Ideas chart. Allow students to recall with a partner what they have done in the past to test our ideas about wind and water changing the shape of the land, and then ask students to share out to the group. Use the images of the land change bin models to seed the idea that these land change bins can also be developed for the area from our Community Example chart." (Lesson 7, Teacher Guide)
- Lesson 8, Connect Section, Step 2, "Add a new row to the Community Examples chart. Display slide E. Create a third row at the bottom of the Community Examples chart, and add "Solutions" to the left-most column in this row. If students would like to organize the chart in a different manner, also consider their alternate organization. Document community solutions from the class. As a class, have a few students share their community solutions to reduce land change that they documented in Sharing Design Solutions. Have available the printouts of any of the images shared with you digitally so that students can refer to them as they share. For each solution shared, ask the same questions that students discussed with their partner. After each student shares their community solution, ask if their solution connects to any land change problem they previously documented on the Community Examples chart. If they think their solution addresses an existing problem on the chart, consider drawing a line connecting or another method to show this solution addresses a specific community land change example. (Lesson 8, Teacher Guide)
- Lesson 9, Navigate section, Step 1, "Ask students to recall what we have been working on. Invite students to turn and talk with a partner about the last few lessons. Ask students to share what their partner said. Support students in recalling that in Lesson 7, we defined a problem that the changing land is affecting people and in Lesson 8 we drew a model of a solution with a partner and received some feedback." (Lesson 9, Teacher Guide)

Suggestions for Improvement: NA

II.G. Scaffolded Differentiation Over Time — Adequate

Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems.

The reviewers found adequate evidence that there is a clear expectation of increased independence for student use of some SEP elements from the beginning to the end of the unit. The Earth Land Erosion Unit Front Matter identifies elements of these SEPs—Asking Questions and Defining Problems, Developing and Using Models, Engaging in Argument from Evidence, Constructing Explanations and Designing Solutions, and Analyzing and Interpreting Data—as intentionally developed. Scaffolding is explicitly reduced over time for the use of both claimed elements for Developing and Using Models, one of two elements for Asking Questions and Defining Problems, the claimed element of Engaging in Argument From Evidence, one of five elements claimed for Analyzing and Interpreting Data, and one of two elements claimed for Constructing Explanations and Designing Solutions.

AQDP: Asking Questions and Defining Problems

Claimed AQDP-P1: Ask questions based on observations to find more information about the natural and/or designed world(s).

- Lesson 1, Explores Section, Step 1, "Create a class list of noticings and wonderings. Display slide C. Display the Notice and Wonder chart. Use the prompts below to ask students to first share what the news story was about, then move into asking what noticings students made and what wonders they had. As students share, record these noticings and wonderings in the Notice and Wonder columns. Accept all student ideas." (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 2 "Suggest students record a question that they would like to answer during today's investigation based on those patterns we had observed on the bottom of their handout. Use the sentence starters on the slide to help support students in asking a question they hope to answer using our land change bin models." "What will happen to ___ when I try____? How does _____ amount of _____ affect _____ land? When there is _____ then what will happen to _____?" (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "In lesson 1 students asked questions about the news cast and generated questions with the class. Now, students are being asked to generate questions individually. If students need more support, consider generating a couple questions as a class to practice before allowing students to draft their own individual question." (Lesson 3, Teacher Guide)

Claimed AQDP-P3: Define a simple problem that can be solved through the development of a new or improved object or tool.

There is insufficient evidence that students gradually move from doing this work with the whole class to using this element more independently for their sensemaking. The teacher facilitates discussions, and there is no evidence that students are using this element independently or building proficiency in it over time.

- Lesson 2, Explore Section, Step 3 "Display slide E. Point out that we now have many examples of land changing and we have some ideas for what might cause the changes (i.e., wind and water)." "Highlight that we now have a shared goal to develop a model to represent the land we want to test. Co-develop the lesson question with students so that it is something like "How can we develop a model to test how wind and water might change the land?" (Lesson 2, Teacher Guide)
- Lesson 7, Explore Section, Step 2, "Identify a problem that needs to be solved. Ask students to look back at the Community Examples that we have gathered over time. While looking at the chart, negotiate which Community Example the class might design a solution for. If the class does not quickly come to a consensus on a land change problem, then refer students back to the Possible Causes chart. Ask students to consider which Community Example poses a problem for those who use and live on the land that could be solved. Encourage students to respond to each other's ideas." (Lesson 7, Teacher Guide) In this example, the teacher is leading the discussion, and there is no evidence that students are using this element independently or build proficiency in it over time.
- Lesson 7, Explore Section, Step 2, "In Lesson 2, we identified that we needed to develop a bin (a new tool) to test our ideas about wind and water changing the shape of the land. Now that we understand that wind and water can change the shape of land, and this change can happen from slowly to rapidly, we need to refine our bin design to test our design solutions for our Community Example problem. While the problem being defined in Lesson 2 led to the development of many possible bins, the problem at this point (the Community Example problem) has been narrowed, creating a more targeted problem (the construction of the bin to test possible solutions) to be solved. If students need more support at this moment, consider asking students to focus on a problem that they could implement the solution to, if constructed as a class." (Lesson 7, Teacher Guide) The teacher leads the discussion and defines the problem for students, stating that they need to refine the bin design to test possible solutions. There is no evidence that students are

using this element independently or building proficiency over time. There is evidence of support to give to students who are struggling.

MOD: Developing and Using Models

Claimed MOD-P3: Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).

- Lesson 3, Synthesize Section, Step 3, "Introduce the idea of using arrows to indicate the amount of change in the land. Explain that we will leave the row blank if there was no change, use 1 arrow for a little change and 2 arrows for a lot of change. Ask the student in the communicator role to share the amount of arrows we should add to the Land Change chart. Encourage them to use Arrow Cards, hold up the number of fingers, or use words to communicate their ideas." (Lesson 3, Teacher guide) In this example, students are creating the model as a class
- Lesson 5, Explore Section, Step 2, "Establish how we will record our observations. Display slide F. Motivate the need to agree on how we will record our observations. Ask students to share ideas on how we can record the information we gather, and how we have recorded our observations in the past. Look for students to suggest using a piece of paper or handout. Pass out Observations of Rocks. Ask students to recall what they included in their drawn models when they investigated the different types of land in lesson 3. Display the Land Change Bin Model Checklist chart they created in lesson 3. Ask them what they think will be the same and what will be different about the model they draw to represent their observations today. Review the checklist with the following prompts." (Lesson 5, Teacher Guide) and Lesson 5, Explore Section, Step 4, "Turn and Talk to analyze the data we collected. Display slide I. Invite students to bring the models they drew to the Scientist Circle on the rug." (Lesson 5, Teacher Guide). Students are creating the model in small groups and do not complete a task on their own.

Claimed MOD-P4: Develop a simple model based on evidence to represent a proposed object or tool.

- Lesson 1, Synthesize Section, Step 4, "To help students develop their understanding of models, we will intentionally use the words "picture to explain" instead of "model" in Lesson 1. After students develop explanations with their picture/drawing about this natural phenomena, we will then analyze their pictures as entry points and name them as "models" in lesson 2. This will strengthen students' access to learning goals around definitions of models and how to use them to explain and imagine, predict, and hypothesize explanations." (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 3, "Introduce materials for building models. Display slide H. Show students the bins, dirt, sand, gravel, and/or other locally relevant materials that can be used to construct the models. Indicate that we can use these to make models of the land like we have seen in our Community Examples and in Lesson 1...Decide how to use the materials. Display slide I. Assign groups one image of land as seen on the slide (e.g. group 1 works with image 1, group 2 works with image 2, etc.). Pass out copies of Reference Images for Model Bin Construction so that students can see the land up close...Develop a model checklist. Display slide J. Record the students' ideas on a chart titled Land Change Bin Model Checklist to be used in future lessons." (Lesson 2, Teacher Guide)
- Lesson 2, Explore Section, Step 3, "Co-Construct the land models. Suggest the idea that we build one land change bin for each image today so we know what to draw. Start with picture 1 on the slide and ask students to guide you through making the model. Look for them to suggest pouring in the cup of dirt, the cup of gravel, and mixing them. If possible, invite students to come up and participate in the construction of the land change bins." (Lesson 2, Teacher Guide)
- Lesson 7, Explore Section, Step 3, "In Lesson 2, students were given more support in developing their land change bin models. Some supports have been removed for this lesson, such as directing students

to what materials to use, building and explicitly going over the checklist, and providing the paper prior to the land materials, as students have already had experience in building this type of model. If needed, these supports from Lesson 2 can be added back in to support learners who could benefit from additional guidance." (Lesson 7, Teacher Guide)

- Lesson 7, Explore Section, Step 3, "Allow students to develop modified bin models. Place students in groups. Give each group a fresh bin and the materials they said they need to make a more accurate model. Give students up to five minutes to add materials to their bin to represent the area that they are going to try to design a solution for." (Lesson 7, Teacher Guide) In Lesson 2, students co-construct the model with the teacher with an example to follow along. In Lesson 7, students become more independent and construct the model in small groups using their own ideas.
- Lesson 8, Explore Section, Step 5, "Students will develop a 2D model in partner pairs to represent their community land change problem and include their design solutions to limit land change due to wind or water. In Lesson 7, students drew individual designs. While students were free to make any design decisions on their own in their individual drawing, students now have to collaborate and compromise with peers on a single design. Students also have to consider the merits of each decision, increasing the demands of this task." (Lesson 8, Teacher Guide)

DATA: Analyzing and Interpreting Data

DATA-P1: Record information (observations, thoughts, and ideas).
There is insufficient evidence that students gradually develop more independent use of this element for sensemaking.

- Lesson 3, Synthesize Section, Step 3, "Ask for the student in the "group sharer" role to share the group's ideas. Record student ideas on the chart. Introduce the idea of using arrows to indicate the amount of change in the land. Explain that we will leave the row blank if there was no change, use 1 arrow for a little change and 2 arrows for a lot of change. Ask the student in the communicator role to share the amount of arrows we should add to the Land Change chart. Encourage them to use Arrow Cards, hold up the number of fingers, or use words to communicate their ideas. Ask students from other groups if there are any additional ideas, based upon the images of the land change bins, that they may like to add." (Lesson 3, Teacher Guide) In this lesson, the teacher guides students on what to record, and the discussion is held as a whole class.
- Lesson 5, Explore Section, Step 2, "Establish how we will record our observations. Display slide F. Motivate the need to agree on how we will record our observations. Ask students to share ideas on how we can record the information we gather, and how we have recorded our observations in the past. Look for students to suggest using a piece of paper or handout. Pass out Observations of Rocks. Ask students to recall what they included in their drawn models when they investigated the different types of land in lesson 3. Display the Land Change Bin Model Checklist chart they created in lesson 3. Ask them what they think will be the same and what will be different about the model they draw to represent their observations today." (Lesson 5, Teacher Guide) In this lesson, students figure out how to record data during a whole class discussion. It is not clear that students become more independent in using this element over time.

Claimed DATA-P2: Use and share pictures, drawings, and/or writings of observations.
Students may engage with this element in the same way in Lessons 4 and 8. There is insufficient evidence that students gradually develop more independent use of this element for their sensemaking.

- Lesson 4, Explore section, Step 2, "Remind students to make observations. Give a reminder that even though we will be taking pictures, we should also be making our own observations about the movement of the land. Pictures only show a moment in time and may not show where and how the land has moved,

if it moves. Remind students that we can also make observations in many different ways, such as touching the area before and after, watching with our eyes, and listening to see if we can hear land moving (such as rocks shifting or sand moving). As we are making observations, we should also be thinking about our predictions, and if our observations match our predictions. Consider distributing Moving Schoolyard Land for students to record their predictions and the observations of the land. Tell students that even though they are in partner pairs, they can each draw and record their own observations about different changes if they like." (Lesson 4, Teacher Guide). Students can choose how they want to record their observations with a partner or individually.

- Lesson 8, Explore section, step 5, "Say, It seems like we have some great ideas! How could we record our ideas? Allow students to respond, and guide students to determine that we could draw our design solutions on paper.…Introduce the drawing task. Display slide J and distribute Our Land Change Solution handout. Remind students that in the last lesson we individually drew a design solution for our community's land change problem. Point out that we now have a lot of more ideas for solutions and for potential materials we could use to build and test them in our bins. Organize students into partner pairs. Ask students to discuss the following prompts as they share their design solutions from Lesson 7 and decide on a new design solution to draw using the structure on the slides. With your partner: Share your design solution drawings. Come up with one solution you want to design and test in our bins. Draw your design solution. Show how your solution will solve our problem." (Lesson 8, Teacher Guide) Students figure out how to record their ideas in small groups and do not complete a task on their own.

Claimed DATA-P3: Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.
There is insufficient evidence that students gradually develop more independent use of this element for their sensemaking.

- Lesson 3, Synthesize Section, step 3, "Interpret the data by identifying patterns. Display slide T. Review the descriptions of how the land changed in the second column of the chart. Draw students' attention to the patterns of land moving a little, a lot, or not at all. During this discussion look for students to notice that the more wind or water there was, the more the land changes. Students should also notice that the water seems to change the land more than the wind. Use the prompts below to help students notice the patterns." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 3 "Patterns: Encourage students to use comparative terms (more/less, bigger/smaller) to describe how much the land moved/changed as a result of the wind and/or water. Consider labeling some of the photos from the investigation with these words to help students talk about the patterns." (Lesson 4, Teacher Guide)
- Lesson 6, Connect Section, Step 3 "Refer to the Community Examples chart and point out that we have some new images from a community, and suggest that we add them to our chart. Ask students to help you categorize these changes. Ask students to turn and talk about how the change happened, whether wind or water made this change, and whether it was fast or slow." (Lesson 6, Teacher Guide) Although students are identifying patterns, it is not clear whether they are engaging in this element more independently over time.

Claimed DATA-P4: Compare predictions (based on prior experiences) to what occurred (observable events).
There is insufficient evidence that students gradually move from comparing prediction to more independent use of this element for their sensemaking. There are only two lessons where students reflect on their prediction, and both lessons have similar amounts of scaffolding.

- Lesson 3, Navigate Section, Step 6, "Support students in returning to their predictions by asking them what was surprising or different than they expected. Consider displaying the before/after photos to help students visualize the changes as they recall their predictions." (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, "To support students in reflecting on their predictions based upon their prior experiences, consider asking students to write down their predictions on a piece of paper or draw a quick image of what they expect will happen when we blow or put water on the land. Creating a representation of their ideas will allow students to more easily remember their ideas and reflect on those ideas later in the lesson…Engage in a Walk and Talk. Once the investigation has been conducted, partner students up with someone they did not work with outside. Ask students to walk back to the building and share whether their observations matched their predictions we made before going outside." (Lesson 4, Teacher Guide)

Claimed DATA-P5: Analyze data from tests of an object or tool to determine if it works as intended.

- Lesson 7, Explore Section, step 4, "Suggest testing a model and carry out the test. Display slide J. Ask students if they think we could test a model to see if it can represent the land we are trying to design a solution for. Gather students around one model and select the appropriate number of students to demo the changes for the class. Make sure to choose one student each to test the way the class thinks the land has moved and one student to reset the model with a squeegee. If possible, place the model under a camera and project the process for the class. As students test the model to determine if it can represent our problem, ask the following questions: We just saw (little wind, a lot of wind, a little water, a lot of water) being tested on our model. Did our land change shape the way we thought it would? Did this land change shape with a similar pattern to the problem we are trying to solve? Does this model seem to represent the area we want it to? If not, what adjustments should we make?" (Lesson 7, Teacher Guide) In this lesson, the teacher guides the students to analyze the data as a class while the students observe the demonstration.
- Lesson 9, Synthesize Section, Step 5, "In Lesson 7, students tested their new land change bin models and collected observations to use as data to determine if the model had functioned as intended. This was done as a whole class. Now, students are being asked to analyze data based on how much the land moved to determine if the solution works as intended in small groups and share their observations as a whole class. This is an increase in the demands of this task. If students need more support, consider creating a design quickly for yourself, and testing it in front of students. Then evaluate the design quickly as a class before asking students to then evaluate their own." (Lesson 9, Teacher Guide) In this lesson, students practice using this element in small groups, and the process of analyzing the data is less teacher-directed.

CEDS: Constructing Explanations and Designing Solutions

Claimed CEDs-P1: Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

- Lesson 3, Synthesize Section, Step 5, "Bring the students together in a Scientists Circle to engage in a Building Understandings Discussion. Read the first question on the slide and direct students to think first, then talk with a partner, then share with the group. Repeat with the second question. Remind students as they share that they can use their observations as evidence to support their claims." (Lesson 3, Teacher Edition) In this lesson, students are discussing and constructing explanations as a whole group. They write down their observations instead of writing an explanation.
- Lesson 6, Explore Section, Step 2, "Discuss images in small groups. Distribute Images: Then and Now to each student. Explain that this handout has each set of images and the questions they will discuss. Read the questions to the students and explain that they should review the photographs individually and jot down their ideas to these questions before discussing them with their small group. Highlight that students

should circle evidence of changes to the land over time in the photographs as part of the first questions. In small groups, have students review the photographs individually and then discuss the following questions while looking for differences between each set of photographs: What evidence do you see of changes from then to now? What do you think caused the change? Do you think the change happened quickly or slowly?...Have a discussion. Bring students back together and have small groups share their ideas about the three questions above for the Balanced Rock example in a Building Understandings Discussion." (Lesson 6, Teacher Guide) In this lesson, students first write down their explanations by answering the three questions in the handout, share ideas in small groups, and then construct a consensus explanation as a whole group.

- Lesson 9, Synthesize Section, step 5, "Have students work with their partners to review their observations and complete the questions on page 2 of the Testing Observations handout. Each student should write a brief explanation of what worked well and what did not work well with their designs. They should also think about what changes they would make if they were to do this investigation again." (Lesson 9, Teacher Guide) In this lesson, students share ideas in small groups and then individually construct an explanation.
- Lesson 10, Synthesize section, step 3, "Set up the writing task. Display Slide H. Tell students that they now have the opportunity to share what they think is the most effective design solution. Remind students that as scientists and engineers we use evidence to support our claims about what is the most effective solution. Explain to students that they will be able to make these claims and use evidence we have from our tests to support our claims. Pass out Choosing a solution to slow land change to each student. Tell students that they are going to use the information that they just figured out about the effectiveness of different design solutions and their parts to decide which design solution they would choose to use for our community design solution. Point out to students the different parts of the worksheet. Show them where they need to write the problem we were trying to solve, the solution they would choose, and how the shapes and materials made that solution effective." (Lesson 10, Teacher Guide) In this lesson, students construct the explanation individually.
- Lesson 10, Synthesize section, step 2, "Constructing Explanations and Designing Solutions: In lesson 8, comparisons of design solutions in the infographics and from the Community Example chart were made partially by the whole class. In Lesson 10 these comparisons to determine the most effective solution are made on their assessment individually. In addition, the types of solutions narrow, asking students to look for finer details in the structure and function of the designs." (Lesson 10, Teacher Guide)

Claimed CEDS-P3: Generate and/or compare multiple solutions to a problem.
There is insufficient evidence that students gradually move from comparing multiple solutions to more independent use of this element for their sensemaking. In both examples, students are comparing solutions as a whole class.

- Lesson 9, Synthesize Section, step 5, "Compare the general shape of different design solutions. Display slide L. Invite students to form a scientist circle on the rug and have them bring Testing Observations with them. Celebrate all the great ideas you heard students sharing about their design solutions. Point out that you noticed that our design solutions had many different shapes. Display Solutions Chart and ask students to describe the general shape of their design….Determine if our design solution was effective. Revisit our lesson question and ask students to recall why we were doing all of this testing and comparing of our design solutions. Ask students to remind you what would make our solutions effective." (Lesson 9, Teacher Guide)
- Lesson 10, Explore Section, Step 2, "Determine what design solutions to compare. Display slide D. Gesture to the design solutions from last class. Point out that we have a lot of design solutions we tested as a class. Use the questions on the slide to help students determine that we should use the Solutions Chart chart to choose solutions to test as a class….Pick solutions and determine what we can learn from testing. Display slide E. Gather the chosen solutions at the front of the room, and place them in a highly

visible area. Consider asking all students to come to the classroom rug and position the testing area in the middle of all students, or place the testing area under a document camera or tablet displaying the testing area for all students to see. Before beginning testing, lead a quick discussion with students to determine if there is anything that we can learn from our solutions, other than just which solution seems to be the most effective. Guide students to determine that we could look at the designs to see what works and what could be better about each design." (Lesson 10, Teacher Guide). In this example, students are comparing different solutions as a class.

ARG-P7: Engage in Argumentation

Claimed ARG-P7: Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.

- Lesson 9. Synthesize Section, Step 5, "Invite students to form a scientist circle on the rug and have them bring Testing Observations with them. Celebrate all the great ideas you heard students sharing about their design solutions. Point out that you noticed that our design solutions had many different shapes. Display Solutions Chart and ask students to describe the general shape of their design. Capture the shape on the chart. Then ask students to describe the land movement using words like none, a little, or a lot. Use the arrow convention from lessons 3, 4, and 5, to note the movement on the second column of the chart. Use the following prompts to support students in focusing on the shape and material of their design as it relates to the land movement." "Use the following prompts to support students in connecting their observations of the land movement to develop a claim about the effectiveness of the solution. Repeat the process of making claims until the chart is complete." (Lesson 9, Teacher Guide) In this lesson, the teacher supports the students to make a claim on whether the solution shape is effective in preventing the land from moving. This is done as a large group, and prompts are provided to help students make their claims.
- Lesson 10, Synthesize Section, Step 3, "Set up the writing task. Display Slide H. Tell students that they now have the opportunity to share what they think is the most effective design solution. Remind students that as scientists and engineers we use evidence to support our claims about what is the most effective solution. Explain to students that they will be able to make these claims and use evidence we have from our tests to support our claims…Allow students time to complete the task. Provide students with an opportunity to individually work on the Choosing a solution to slow land change worksheet." (Lesson 10, Teacher Guide) Students construct a claim individually with less support from the teacher.

Suggestions for Improvement

Consider reducing the number of claimed intentionally developed SEP elements, or consider providing guidance on how to scaffold all targeted learning objectives that gradually decrease support to help students become more independent, specifically for the following elements:

- AQDP-P3: Define a simple problem that can be solved through the development of a new or improved object or tool.
- DATA-P1: Record information (observations, thoughts, and ideas).
- DATA-P2: Use and share pictures, drawings, and/or writings of observations.
- DATA-P3: Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.
- DATA-P4: Compare predictions (based on prior experiences) to what occurred (observable events).
- CEDS-P3: Generate and/or compare multiple solutions to a problem.

CATEGORY III
Monitoring NGSS Student Progress

III.A. Monitoring 3D Student Performance — Extensive

Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.

The reviewers found extensive evidence that students can demonstrate mastery of targeted learning objectives. Formal assessments focus on understanding the phenomenon of land changing shape, requiring students to apply the three dimensions at the element level. These tasks are based on real-world scenarios, emphasizing sensemaking and connecting existing knowledge to new information. Student performances provide clear evidence of integrating the three dimensions, aligning with learning objectives.

The materials' formal tasks are driven by well-crafted phenomena and problem-based scenarios that can elicit rich student performances.

- Lesson 4, Connect Section, Step 4, "Making observations from the articles and comparing to the patterns in past data provide an opportunity to gather evidence about learning goal 1, with the purpose of supporting students in establishing patterns of land movement that explain how wind and water can change the shape of the land near our school." (Lesson 4, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4, "Make observations and find patterns. Have students work individually to sort and glue the pictures to the appropriate side of the chart. As you are walking around, you can ask students the following questions to better understand their reasoning…Summative assessment: Categorizing and explaining why examples of land changes were fast or slow provides an opportunity to gather evidence about learning goal 6b, with the purpose of using their observations of these land changes images to explain patterns in how wind and water can cause land to change quickly and slowly." (Lesson 6, Teacher Guide)
- Lesson 8, Synthesize Section, Step 4, "Connect real-world solutions to the problem. Display slide G. Recap that we just looked at a variety of existing land change solutions we documented in the community and from the infographic. Ask students to reflect on their community land change problem and if any of these solutions might be useful in our area, and if so why. Example prompts and responses are below to engage students in this discussion." (Lesson 8, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3, "Pass out Choosing a solution to slow land change to each student. Tell students that they are going to use the information that they just figured out about the effectiveness of different design solutions and their parts to decide which design solution they would choose to use for our community design solution. Point out to students the different parts of the worksheet. Show them where they need to write the problem we were trying to solve, the solution they would choose, and how the shapes and materials made that solution effective." (Lesson 10, Teacher Guide)

Student performances produce artifacts of integrating the three dimensions in service of sense-making or problem-solving.

- Lesson 2, Explore section, Step 3, "Display Slide K. Ask students to share ideas on how to draw the model. Use the prompts below to support students in the development of their drawings. Record the students' ideas on a chart titled Model Checklist Land Change Bin Model Checklist to be used in future lessons. Point out to students that they should record the type of land that is being modeled in their bin at the top of the handout." for Ask students what they think caused the land to move in these pictures based on what they saw in the video. Accept all student ideas, and only add questions to the Notice and Wonder chart at this time. Example prompts are below." (Lesson 2, Teacher Guide)

- Lesson 3, Connect section, Step 4, "Hand out the Observations Self Reflection worksheet to each student. Tell students that this is an opportunity for them to pause and reflect on their own sensemaking and that it is okay if they still think that they need to work on their sensemaking. Read each statement aloud and ask students to circle the appropriate image (thumbs up or thumbs down) based on their own experiences throughout this lesson." (Lesson 3, Teacher Guide)
- Lesson 4, Teacher Assessment Tool Following Student Sensemaking, "On the material Moving Schoolyard Land, look for…Stating or drawing that materials such as sand, dirt, mulch, and other small materials are easily moved by wind or water. Stating or drawing that materials such as rocks and concrete may be harder to move or not move at all." (Lesson 2, Teacher Assessment Tool Following Student Sensemaking)
- Lesson 6, Explore Section, Step 2, "Discussing what causes fast changes and slow changes to Balanced Rock and the land around the railroad bridge, provides an opportunity to gather evidence about learning goal 6a, with the purpose of giving feedback and supporting students to use information from the before and after photos as evidence to explain how wind and water can cause land to change quickly and slowly." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize Section, Step 7 "Draft a design solution. Display slide L. Leave the land change bin models and the community problem we want to solve in front of students. Pass out a single piece of paper to each student and allow students to develop a drawn model of a potential design solution they are thinking of." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 5, "How does your structure going to reduce how much land moves when wind and water hit it? The rocks make a wall to block the wind/water. The plants cover the dirt. The roots of the tree hold the dirt in place. What shape will you build your design in? How does this shape work to limit the changes to the land? Responses will vary, but may include: I drew my design in the shape of a rectangle/straight line/ circle so it would fit right and stop land movement. I drew my design to be bigger and wider to limit more land change than smaller shapes. What ideas did you get from the solutions we looked at? I saw that one solution had little holes in it so the wind could go through and didn't pick it up and take it away. I did that in our design solution too." (Lesson 8, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3 "Set up the writing task. Display Slide H. Tell students that they now have the opportunity to share what they think is the most effective design solution. Remind students that as scientists and engineers we use evidence to support our claims about what is the most effective solution. Explain to students that they will be able to make these claims and use evidence we have from our tests to support our claims. Pass out Choosing a solution to slow land change to each student. Tell students that they are going to use the information that they just figured out about the effectiveness of different design solutions and their parts to decide which design solution they would choose to use for our community design solution. Point out to students the different parts of the worksheet. Show them where they need to write the problem we were trying to solve, the solution they would choose, and how the shapes and materials made that solution effective." (Lesson 9, Teacher Edition)

Students routinely produce artifacts with evidence of using the grade-appropriate elements of SEPs, CCCs, and DCIs that are targeted as learning objectives.

- Lesson 2, Teacher Assessment Tool Following Student Sensemaking, "On the material Land Change Bin Observations used across Lessons 2-3, look for: Before drawing may include… Land (dirt, sand, etc.) placed in the agreed-upon location. After drawing might include… Arrows showing movement of the land. The land spilling out into another area. Words saying that the land had moved/ changed shape from straight to wavy." (Lesson 2, Teacher Assessment Tool Following Student Sensemaking"
- Lesson 3, Explore Section, Step 2 "The model drawing and individual/small group discussions while students carry out their investigation, provide opportunities to gather evidence about learning goal 3b,

with the purpose of providing feedback and supporting students in clarifying and communicating their ideas about the effects of wind and water on land." (Lesson 3, Teacher Guide)

- Lesson 4, Synthesize Section, Step 3, "Making observations from outside and comparing the observations to identify patterns provide an opportunity to gather evidence about learning goal 1, with the purpose of supporting students in identifying patterns of land movement that explain how wind and water can change the shape of the land near our school." (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section, Step 2, "Students record observations of the land changes in the Then-Now images. Support students in this practice by instructing them to circle evidence of changes in the images before recording information about these changes (e.g., description of the change, fast or slow) in Images: Then and Now. (Lesson 6, Teacher Guide)
- Lesson 6, Handout 1 Images Then and Now. "What evidence do you see of changes from then to now? Circle the evidence of changes on the photographs. What do you think caused the change? Do you think the change happened quickly or slowly?" (Lesson 6, Handout 1, Images Then and Now)
- Lesson 9, "On the material Testing Observations, look for…What changes would you make to your design? Suggestions about changing the shape of the structure and/or the materials used. Explaining how these changes would help the design function better and help solve the problem of land changing shape. Possible mention of shapes and/or materials used by other groups and how the student would like to adjust their designs to have or not have that specific material and/or shape in their designs." (Lesson 7 Teacher Assessment Tool Following Student Sensemaking)

Suggestions for Improvement: NA

III.B. Formative	Extensive
Embeds formative assessment processes throughout that evaluate student learning to inform instruction.	

The reviewers found extensive evidence that the materials embed formative assessments throughout the unit to evaluate student learning and guide instruction. These assessments are clearly highlighted in the Teacher Guide, Teacher Assessment Tool Following Student Sensemaking, and Unit Assessment Overview, and include support for the next instructional steps. There is frequent and varied support for instructional next steps and student self-assessment. The processes support student thinking across all three dimensions, address student equity, and offer various ways for students to demonstrate understanding.

Materials include explicit, frequent, and varied supports for formative assessment processes.

- Lesson 2, Assessment Guidance "What students will do: Develop a model (3D and drawn) to collect evidence of patterns in how the shape of land may be changed by wind or water." "Where can I check for understanding? What to look and listen for: Look for evidence that students have developed a model that will be used to collect evidence of patterns in how wind and water may be changing the shape of the land in their land change bins. Students referencing patterns from images and video (observations used as evidence) from lesson 1 video, images, and models about the shape of land and how it changes to represent the land in their land change bins (model to test). Students referencing patterns from the Community Examples chart (observations used as evidence) about the shape of land and how it

changes to represent the land in their land change bins (model to test)." "How can I use this assessment information: Use this formative assessment opportunity to see if students need more support in developing 3D models in their bins (called land change bin models) to investigate their ideas about how wind and water may be changing the land. Students will have additional opportunities in future lessons to explore and gather evidence that wind and water can cause a change to the shape of land in their communities." (Lesson 2, Teacher Guide)

- Lesson 3, Synthesize Section, Step 3, "This discussion provides a second opportunity to gather evidence about learning goal 3a, with the purpose of providing feedback and supporting students in describing patterns in their observations of how wind and water moved land. They may point out that wind did not move land as much as water, or that nothing seemed to move the gravel / small rocks. Use the suggestions in the Assessment Guidance at the beginning of the lesson for providing feedback and supporting students." (Lesson 3, Teacher Guide)
- Lesson 5, Teacher Assessment Tool Instructional Guidance, "Students needing support in describing changes to different types of land. In lessons 2-5, students have explored changes to different types of land. In lessons 2-3 students experienced different types of land changing shape in their land change bins. In Lesson 4, students experienced land changing in their school yard. In Lesson 5 students returned to their bins and saw some rocks change location, and a salt rock change over time. Before starting Lesson 6, project before and after photos with different types of land (e.g., images from Lessons 2-5) and guide students in comparing the amount of change in each pair of images. If possible, create images of before and after for the individual students or small groups to mark up. Images from the Land Change Patterns chart can be used and stacked/layered on top of each other to allow students to see the changes." (Lesson 5, Teacher Assessment Tool Instructional Guidance)
- Lesson 6, Lesson 2 Teacher Assessment Tool Following Student Sensemaking, "On the material Images: Then and Now, look for: Drawing circles or other symbols around areas that have changed shape over time from image 1 to image 2. Discussing or sharing ideas related to the shape change over time, and then writing or drawing something on their papers communicating these ideas. Gesturing towards any changes on a board displayed by the teacher that are then drawn or labeled, and pointing out shape changes that have occurred over a large period of time with arrows or other indicators. Using arrows or other conventions that indicate distance for timescales on their papers, or specifying before and after, indicating that they see a change over time." (Lesson 2 Teacher Assessment Tool Following Student Sensemaking)
- Lesson 9, Synthesize section, Step 5, "Key formative assessment: Small group discussions and page 2 of Testing Observations provide an opportunity to gather evidence about learning goal 9b and Assessment Statement 2, with the purpose of providing feedback and supporting students in making claims about how the shape of their solutions related to it being effective or not. Refer to the Instructional Guidance for Lesson 9 tool and the Assessment Guidance at the beginning of the lesson before moving on to the Navigate component of the lesson." (Lesson 9, Teacher Guide)

Formative assessment processes routinely provide varied support for student thinking across all three dimensions.

- Lesson 2, Explore Section, Step 3, "This discussion and creation of this agreed-upon model provides an opportunity to gather evidence about learning goal 2 (aligned to Assessment Statement 1), with the purpose of providing feedback and supporting students in developing a model to clarify, test, and communicate their ideas based on patterns about how land changes over time due to wind and water. Use the suggestions in the Assessment Guidance at the beginning of the lesson for providing feedback and supporting students." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "The questions that students develop provide opportunities to gather evidence about learning goal 3a, with the purpose of providing feedback and supporting students in developing questions about the effects of wind and water and the rate that they change the land. Use the

suggestions in the Assessment Guidance at the beginning of the lesson to provide feedback and determine next steps before moving on to the investigation." (Lesson 3, Teacher Guide)

- Lesson 4, Lesson Assessment Guidance, "If students need help identifying patterns in the data, use repeated words, sketches, and/or gestures to describe the movement of the land, such as "a little bit", "a lot", and "not at all". Also consider using the arrow system from lesson 3 to help students make comparisons and identify patterns in movement." (Lesson 4, Teacher Guide)
- Lesson 5, Teacher Assessment Tool Instructional Guidance, "Students are considering that land changes shape, and if it is happening on the scale of the images in Lesson 6, then it might be happening at a larger scale than we can see from our viewpoint…If students are considering a scale larger than what we can see from our viewpoint, suggest that they might look at what the land looks like from above (a birds eye view). Look up images of places where land has changed shape due to wind and water. Coastlines and rivers have provided changes such as this over time. Project or print out images to allow students to consider how land can more broadly change shape over time. Alternatively, you could show a timelapse, explaining how much time passed for each video. Some example videos that could be used are below." (Lesson 5, Teacher Assessment Tool Instructional Guidance)
- Lesson 6, Navigate Section, Step 1, "If you notice that students are not identifying specific evidence of land changes over time in the images, consider projecting the Then-and-Now images during the following class discussion. When you ask students what evidence they see of changes, have them reference the projected images or come up to the front of the class to circle the evidence of changes from the then image to the now image (ie. for smartboards or projecting on a whiteboard)." (Lesson 6, Teacher Guide)
- Lesson 7, Learning Goal: "Analyze data to determine if the bin models have similar patterns in their shape and function (stability) as the land change problem before and after being tested with wind and water."
  "What to look and listen for:
  - Students identifying and analyzing shape and structure data from 3D land change bin model after being tested with wind and water.
  - Students identifying patterns between the shape change of the land movement of the bin model after it has been tested with wind and/or water and the actual land change problem.
  - Students analyzing/comparing patterns in the bin model and actual land change problem to determine if the land has moved and changed shape as intended.
  - Students suggesting changes to the model based on observed patterns from tests being used as evidence of land movement if the model does not work as intended."
- Lesson 8, Lesson Assessment Guidance, "If students are not giving feedback about the shape and stability of the structures to each other, ask students to consider what would happen if the shape of the design or the materials the partners picked were different, and how that might impact how well the design would work. If students are not making connections between their structure and the function it should serve, ask students to explain why we are designing this solution. From there, ask students what they believe the design solution would need to do to solve our community's land change problem." (Lesson 8, Teacher Guide)

Formative assessment processes routinely address multiple aspects of student equity. Broadening Access callouts in the gray margins of each lesson support teachers in ensuring equity and inclusion expressly relevant to an associated lesson activity.

- Lesson 1, Synthesize section, Step 5, "Broadening Access: Sitting in a circle where they can face one another can help support students' engagement and build a sense of shared mission. The Scientists Circle is an important tool for developing students' agency in their figuring out as they take stock of what they have figured out and decide where they need to go next. Share with students that professional scientists also collaborate with one another to brainstorm, discuss, and review their work."

- Lesson 2, Connect section, Step 2, "Broadening Access: Provide multiple means of action and expression when students explain using Sharing Land Examples. Some students will use drawings, pictures, gestures, and written words to explain their ideas completely. Other examples/options for students: Comics, video, music, dance/movement, or visual arts for communication."
- Lesson 3, Explore section, Step 2, "Broadening Access: Provide multiple means of engagement by having students choose a role they like or rotate roles as they work together so that they can practice either blowing wind or spraying/pouring water. Review group roles (e.g. Model Helper, Group Sharer, etc) and the importance of these roles for helping student groups carry out their investigations and make sense of their findings. Establishing roles beforehand minimizes threats and distractions to foster a safe space to learn. This also helps foster collaboration and community amongst students and the knowledge construction work they are doing in the classroom."
- Lesson 6, Explore section, Step 2, "Broadening Access: A Building Understanding Discussion provides an authentic opportunity for you to enhance students' language learning and language use for sensemaking work. You might find it helpful to use the Discussion Type Prompts teacher reference during the discussion. This handout provides teacher prompts that you could use to encourage students to build understandings around the timescales over which these wind and water processes can occur."
- Lesson 8, Explore section, Step 5, "Broadening Access: To support multiple ways of expression and communication of science ideas provide options for students to plan their design solutions using drawing, writing, or a combination of the two. Also allow for students to access and point to materials as they try to convey their ideas to their team. This accommodation can reduce barriers for students by allowing them to express their ideas in flexible ways."
- Lesson 9, Synthesize section, Step 5, "Broadening Access: Whole class discussions often turn into quick share outs of student thinking without students engaging with each other's ideas (e.g., questioning a peer, building off an idea, etc.). To support students' meaning-making work, help them spend time with, and engage with, a peer's idea. It is just as important to help students unpack and make connections with one idea as it is to have every student in the class share an idea."
- Lesson 2, Teacher Assessment Tool Following Student Sensemaking, "Possible evidence of student sensemaking: Students might say We saw that wind makes the land go like this. (shows movement with hands). Students might gesture Moves hands or body quickly to show how different land moves quickly/a lot." (Lesson 2, Teacher Assessment Tool)
- Lesson 3, Synthesize Section, Step 3, "Provide multiple means of engagement by reviewing the classroom agreements before whole class discussions. This helps to minimize possible threats so students can share ideas even when they are not sure and to support, listen and respond to each other's ideas. Consider having students pick one agreement to focus on during this discussion. To support equitable discussions for all learners, encourage students to share their thinking in a variety of ways. Validate and invite all the ways we communicate our ideas, such as with gestures or body movements, pointing at the photos, drawings, models, and words from any languages your students use." (Lesson 3, Teacher Guide)
- Lesson 8, Connect Section, Step 3, "Ask students to share how each solution reduces changes to the shape of the land, then add the image from Infographic Images for the Community Examples chart to the appropriate column (Wind, Water, Not Sure) of the third row. In an effort to hear from all voices, ask students who have not yet had a chance to share to voice their ideas to the whole class." (Lesson 8, Teacher Guide)

Suggestions for Improvement: NA

III.C. Scoring Guidance — Extensive

Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.

The reviewers found extensive evidence that the materials offer guidance for teachers to interpret student performance, monitor progress, and adjust instruction while providing ongoing feedback to students. Guidance is provided for teachers to interpret student progress and for students to interpret their own progress. Teachers receive support to track student progress toward three-dimensional assessment goals using the Assessment Tool Scoring Guide. Scoring guidance for key assessments includes annotated student work to illustrate a range of responses that include Beginning, Developing, and Secure descriptions for each question.

Support for planning instruction

- Lesson 2, Explore Section, Step 3 "Suggest to students that it would be helpful for us to record what our land change bin models looked like before we test our ideas. Pass out Land Change Bin Observations. Explain to students that the drawings they do to record their observations are also models. Remind students that any time they are making drawings to try and explain something, they are creating a model." "Ask students to share ideas on how to draw the model." "Record the students' ideas on a chart titled Model Checklist Land Change Bin Model Checklist to be used in future lessons." (Lesson 2, Teacher Guide)
- Lesson 4, Lesson Assessment Guidance "How can I use this assessment information: If students do not differentiate between the changes they observed, you might project before/after photos and ask "How is the land different in this photo than the other one? Why do you think they are different?" If students need help identifying patterns in the data, use repeated words, sketches, and/or gestures to describe the movement of the land, such as "a little bit", "a lot", and "not at all". Also consider using the arrow system from lesson 3 to help students make comparisons and identify patterns in movement. Project several pictures side by side and ask students if there is anything in common with the changes. Group images by the type of change (wind or water) and look for patterns amongst specific groupings. If students need additional data, consider setting up the land change bins with a comparable land type (rocky dirt, just dirt, sand, etc.) in front of a projected image. Ask students to simulate wind and water and compare the type of land movement seen with other pictures to determine what patterns exist across the images." (Lesson 4, Teacher Guide)

Support for ongoing feedback

- Lesson 6, Teacher Assessment Tool Scoring Guide, a three dimensional rubric is provided. It describes criteria in students' responses that align to Beginning, Developing, and Secure proficiency in their ability to use observations to construct an evidence-based account of how wind and water have changed the land quickly or slowly.
- Lesson 9, Explore Section, Step 4 "Prompt to use: Did your solution limit wind or water from changing the land? Why or Why not?" "Ideas to look and listen for: Responses will vary. When students share solutions that did work, they may talk about how the placement of the solution was important or how choosing the proper material was important. If a group's solution is not working, you may suggest that they change the placement of the solution on the land model or suggest that they try a different material." (Lesson 9, Teacher Guide)

- Lesson 10, Teacher Assessment Tool Assessment Guidance includes a "Rubric for Design Solution worksheet" with an "NGSS Reference Table" and "Beginning" "Developing" and "Secure" descriptions for each of the three questions. For example:
    - Question 1: "What problem were you trying to solve?"
    - Beginning: "Indicates a problem unrelated to wind and/or water changing the shape of land."
    - Developing: "Indicates the problem is wind and/or water, the land is changing the shape but does not connect the two.
    - Secure: "Indicates that the problem that the solution was trying to solve was that wind and/or water was changing the shape of the land." (Lesson 10, Teacher Assessment Tool)

Suggestions for Improvement: NA

III.D. Unbiased Tasks/Items — Extensive

Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.

The reviewers found extensive evidence that vocabulary and text volume in student assessments are grade-level appropriate. The tasks are fair and unbiased and refrain from assuming students know culturally specific information. Teachers are provided with examples of student responses that include words and gestures, and students are able to communicate in a variety of ways to demonstrate their understanding.

Multiple modes of communication

- Lesson 1, Synthesize Section, Step 4, "As students work, circulate from group to group. Remind students that they can share and communicate their ideas in many different ways. For example, if a student is gesturing wind, another student can put their gestures into words while another student puts the same ideas into the drawing. For groups that are having trouble putting their ideas on paper, prompt them to be ready to share verbally or with their bodies and sounds about how the land might be changing shape by the roadside." (Lesson 1, Teacher Guide)
- Lesson 3, Synthesize Section, Step 3 "Broadening Access: Offering students an opportunity to work with peers gives them a chance to use their linguistic and nonlinguistic resources to express their ideas (and learn from other students' uses of these resources too) before sharing their ideas in a larger discussion. Additionally, consider printing out images of one and two arrows using Arrow Cards to distribute to students. Ask students to visually display no arrows, one arrow, or two arrows to indicate their ideas about how much land was moved. This will allow all students to communicate their ideas by using a visual representation instead of verbal representation, and allow for more ideas to be shared at once." (Lesson 3, Teacher Guide)
- Lesson 6, Connect Section, Step 3, "To support multiple ways of expressing and communicating science ideas, consider allowing students to physically move as they sort community examples. As the class sorts and double-checks their community examples, have students move to different parts of the room designated as "fast," "slow," or "unsure." Then, prompt students from each group to explain why they

moved to that particular part of the classroom. This accommodation can reduce barriers for students by providing an option for physical action as a means to express their ideas." (Lesson 6, Teacher Guide)

- Lesson 7, Explore Section, Step 3, "Having materials present for students to touch and gesture towards can help students express their ideas about what materials might work best to develop the new land change bin model. Consider placing these materials at tables so that students can share their ideas in ways beyond verbal communication. This can provide access to tools and options for physical action." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 5 "Draw design solutions in partner pairs. Instruct students to draw their community land change problem and the design on the first page of the Our Land Change Solution handout. Specify that it is important for students to draw their solution in the appropriate location (e.g., rocks along the perimeter of the garden bed). Students should also list the materials that they will use to build their solution they are testing in the land change bin. They should label the important features (water, sand, etc) of their solution with pictures or words. Tell students that they can use images or words to explain how the solution will work to solve our community's land change problem." "Broadening Access: To support multiple ways of expression and communication of science ideas provide options for students to plan their design solutions using drawing, writing, or a combination of the two. Also allow for students to access and point to materials as they try to convey their ideas to their team. This accommodation can reduce barriers for students by allowing them to express their ideas in flexible ways. (Lesson 8, Teacher Guide)

Supports success for all students

- Lesson 1, Synthesize Section, Step 5 "Ask students to sit next to their group members in a whole-class circle. If your class does not often sit in a circle, explain that sitting in a circle allows students to see and hear everyone (not just the teacher) as they share their ideas." "Remind students that they have spent time in their groups drawing a picture and/or talking about how the land by the road might have changed shape from a straight side to a wavy side. Explain that you will record all their ideas on the class picture as they share them so that we can have a class record of all of our ideas. Tell students that since this is a discussion where we are collecting ideas, there is no right or wrong answer. We are sharing ideas to learn from each other and all ideas are valuable." (Lesson 1, Teacher Guide)
- Lesson 3, Explore section, Step 2, "Present slide E. Tell students that they will each get a chance to test their models with either the straws or spray bottles and we each have a role during the investigation. Use the prompts on the slide to help students determine their role, and that we will all get a lanyard with their roles on them to help us know what we are doing in our investigations. Explain to students that we will trade roles in the future, so all students will have the opportunity to have a new role next time. Pass out the lanyards for students to wear." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize section, Step 3, "Teaching Tip: Consider having out the land change bins from Lesson 3 as well as the straws and spray bottles as students identify patterns. To support multilingual and/or speech impaired students, encourage students to use whatever modalities of expression they choose. For example, allow students to point to specific materials, gesture the use of the spray bottle or straw, and show movement of specific materials to help them communicate any patterns they saw amongst the land outside. Encourage both scientific and everyday language to express their ideas." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 4 "Provide multiple means of engagement by reviewing the classroom agreements before whole class discussions. This helps to minimize possible threats so students can share ideas even when they are not sure and to support, listen and respond to each other's ideas. Consider having students pick one agreement to focus on during this discussion. To support equitable discussions for all learners, encourage students to share their thinking in a variety of ways. Validate and invite all the ways

we communicate our ideas, such as with gestures or body movements, pointing at the photos, drawings, models, and words from any languages your students use." (Lesson 5, Teacher Guide)

- Lesson 6, Explore section, Step 2, "Teaching Tip: Support students in agreeing and disagreeing with each other respectfully. You may have students use sentence starters such as "I agree/disagree with _____, because____." To allow all students to participate (even if they are not speaking), you can have students agree or disagree using hand gestures (e.g., thumbs up, thumbs down)." Support students in making their thinking visible by asking "why" they agree or disagree and have them share their evidence and/or reasoning. (Lesson 6, Teacher Guide)
- Lesson 8, Explore Section, Step 5, "To support multiple ways of expression and communication of science ideas provide options for students to plan their design solutions using drawing, writing, or a combination of the two. Also allow for students to access and point to materials as they try to convey their ideas to their team. This accommodation can reduce barriers for students by allowing them to express their ideas in flexible ways." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 3, "Make sure that every student has an opportunity to work with the activity materials. For example, if students are in pairs, one student could test one type of wind or water (a lot or a little) and the other student tests the other type. Supporting all students engaging in science classroom experiences is important for developing science identities, and is especially critical for those from non-dominant groups (girls, minoritized students of color) that have been historically excluded from science." (Lesson 9, Teacher Guide)

Multiple modalities and student choice

- Lesson 2, Connection Section, Step 2, "Provide multiple means of action and expression when students explain using Sharing Land Examples. Some students will use drawings, pictures, gestures, and written words to explain their ideas completely. Other examples/options for students: Comics, video, music, dance/movement, or visual arts for communication." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 2, "Provide multiple means of engagement by having students choose a role they like or rotate roles as they work together so that they can practice either blowing wind or spraying/pouring water. Review group roles (e.g., Model Helper, Group Sharer, etc) and the importance of these roles for helping student groups carry out their investigations and make sense of their findings. Establishing roles beforehand minimizes threats and distractions to foster a safe space to learn. This also helps foster collaboration and community amongst students and the knowledge construction work they are doing in the classroom." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize section, Step 4, "Broadening Access: To support multiple ways of expression and communication of science ideas provide options for students in answering the questions allowing multiple media for communication such as writing, drawing, comics, flipgrid or a combination of any. If drawing, direct students to utilize the agreed-upon representations from the Lesson 1 Land Changes model. This accommodation can reduce barriers for students in expressing ideas who are not yet writing in full sentences."
- Lesson 8, Explore Section, Step 6, "Provide multiple means of action and expression by allowing students to express learning in flexible ways. Explain to students that each partner pair can explain their design and provide to other partner pairs verbally, as well as through gestures, facial expressions, acting out ideas, etc." (Lesson 8, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3, "Tell students that they are going to use the information that they just figured out about the effectiveness of different design solutions and their parts to decide which design solution they would choose to use for our community design solution. Point out to students the different parts of the worksheet. Show them where they need to write the problem we were trying to solve, the

solution they would choose, and how the shapes and materials made that solution effective." (Lesson 10, Teacher Guide)

- Lesson 10, Synthesize Section, Step 3, "If students are struggling with writing their ideas on Choosing a solution to slow land change, you may want to have them tell you their answer and write it down on their handout. Also consider allowing students to use a recording device to record their answers, using the actual designs to point to the specific shapes and materials as they discuss their ideas." (Lesson 10, Teacher Guide)

Suggestions for Improvement: NA

III.E. Coherent Assessment System — Extensive

Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.

The reviewers found extensive evidence that the system of assessments works together to measure the three-dimensional learning objectives. The three-dimensional assessment system is clearly described. The Lesson Assessment Guidance supports teachers in identifying where to check for student understanding and what it looks like when students demonstrate understanding. There are also a variety of assessments, such as pre-assessments, formative assessments, summative assessments, self-assessments, and peer assessments, that are aligned to the learning goals to assess students' progress.

Matches three-dimensional learning objectives

- Lesson 2: Develop a model (3D and drawn) to collect evidence of patterns in how the shape of land may be changed by wind or water is demonstrated in the Explore Section, Step 3, Ask students to share ideas on how to draw the model. Use the prompts below to support students in the development of their drawings. Record the students' ideas on a chart titled Model Checklist Land Change Bin Model Checklist to be used in future lessons. Prompts to use: 'How would someone know that one side of our model was land and the other was the road?'."; and "Have students discuss in pairs and then share with the whole group how to model, or show, the effects of wind, rain, and flooding with the three dimensional models. Prompts to use: 'If the land moves how can we show what happened on our model drawings?'" (Lesson 2, Teacher Guide)
- Lesson 4: Make observations about patterns of land movement to explain how wind and water can change the shape of the land near our school in the Synthesize Section, Step 3, "Ask for students to share their ideas and record them on the chart using the same process and agreed upon symbols on the Land Change chart. (Lesson 4, Teacher Guide)
- Lesson 6: Use observations to construct an evidence based account of how wind and water have changed the land quickly or slowly in the Synthesize section, Step 4, when students complete *Change: Fast or Slow* where they sort and explain fast and slow pictures of land changes by wind and/or water. (Lesson 6, Teacher Guide)
- Lesson 8: Analyze data to determine if the bin models have similar patterns in their shape and function (stability) as the land change problem before and after being tested with wind and water in the Explore

Section, Step 6 when students compare design solutions to existing solutions and other student's solutions and give feedback on the effectiveness of the design. (Lesson 8, Teacher Guide)

Pre-, formative, summative, and self-assessment
Pre-Assessment

- Lesson 1, Explore Section, Step 1 "Pre-assessment: This discussion and sharing of questions provides an opportunity to gather evidence about learning goal 1a (aligned to Assessment Statement 1), with the purpose of determining support students may need in upcoming lessons as they ask questions and identity problems related to land changing shape quickly and/or slowly." (Lesson 1, Teacher Guide)
- Lesson 1, Synthesize Section, Step 4 "Pre-assessment: This creation of a representation to explain how the land has changed shape provides an opportunity to gather evidence about learning goal 1b (aligned to Assessment Statement 1), with the purpose of determining supports that students may need in upcoming lessons as they develop a model to explain how land can change shape quickly and/or slowly. Use the suggestions in the Assessment Guidance at the beginning of the lesson for providing feedback and supporting students. (Lesson 1, Teacher Guide)

Formative Assessment

- Lesson 2, Explore Section, Step 3 "Formative Assessment: This discussion and creation of this agreed-upon model provides an opportunity to gather evidence about learning goal 2 (aligned to Assessment Statement 1), with the purpose of providing feedback and supporting students in developing a model to clarify, test, and communicate their ideas based on patterns about how land changes over time due to wind and water." (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 2 "Formative assessment: The questions that students develop provide opportunities to gather evidence about learning goal 3a, with the purpose of providing feedback and supporting students in developing questions about the effects of wind and water and the rate that they change the land." (Lesson 3, Teacher Edition)
- Lesson 4, Synthesize Section, Step 3 "Formative assessment: Making observations from outside and comparing the observations to identify patterns provide an opportunity to gather evidence about learning goal 1, with the purpose of supporting students in identifying patterns of land movement that explain how wind and water can change the shape of the land near our school. (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 2 "Key formative assessments: The model drawing and individual/small group discussions while students carry out their investigation provide opportunities to gather evidence about learning goals 5a and 5b, with the purpose of providing feedback and supporting students in clarifying and communicating their ideas about the effects of wind and water on rocks." (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2 "Formative assessment: Discussing what causes fast changes and slow changes to Balanced Rock and the land around the railroad bridge, provides an opportunity to gather evidence about learning goal 6a, with the purpose of giving feedback and supporting students to use information from the before and after photos as evidence to explain how wind and water can cause land to change quickly and slowly." (Lesson 6, Teacher Guide)
- Lesson 6, Connect Section, Step 3 "Formative assessment: Categorizing examples of land changes from a book as caused by wind or water and as fast or slow changes provides an opportunity to gather evidence about learning goal 6a, with the purpose of using information from the book as evidence to explain how wind and water can cause land to change quickly and slowly." (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 3 "Formative assessment: Comparing the structure and function of the new bin model to the real-life design problem provides an opportunity to gather evidence about learning goal

7, with the purpose of supporting students in identifying and clarifying patterns to analyze land movement in relation to their design problem." (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize Section, Step 4 "Formative assessment: The discussion of existing land change solutions provides an opportunity to gather evidence about Learning Goal 8, with the purpose of providing feedback and supporting students in comparing these solutions and applying them to their land change bin model and community land change problem." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 4 "Key formative assessment: Small group discussions and students recording observations on Testing Observations provide an opportunity to gather evidence about learning goal 9a and Assessment Statement 2 with the purpose of providing feedback and supporting students in analyzing and interpreting observations about how the shape of the solution relates to the function of limiting the land from changing." (Lesson 9, Teacher Guide)

Summative Assessment
- Lesson 6, Student Assessment 3 Change Fast or Slow, "Choose a picture that shows a FAST change and glue or tape it below. What happened to the land in this image? What caused this FAST change? Circle what we did in class (your evidence) to explain why you think this is a FAST change." (Lesson 6, Student Assessment 3 Change Fast or Slow)
- Lesson 10, "The problem we were trying to solve with our solutions was…Look at the other solutions your class made. Which other solution do you think was the most effective at solving the problem?...How did the shape and materials of that solution help to make it effective? Answer this question in words and/or pictures, using the lines and box below." (Lesson 10, Student Assessment Choosing a Solution)

Self Assessment
- Lesson 3, Connect Section, Step 4, "Hand out the Observations Self Reflection worksheet to each student. Tell students that this is an opportunity for them to pause and reflect on their own sensemaking and that it is okay if they still think that they need to work on their sensemaking. Read each statement aloud and ask students to circle the appropriate image (thumbs up or thumbs down) based on their own experiences throughout this lesson." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 4, "Return Observations Self Reflection to students. Remind students that last class period they had the opportunity to reflect on how they were identifying patterns in land changing shape. Give students a moment to look over their responses and think about if, during our discussion about our pictures, if they should focus on finding patterns and/or making more observations. Tell students that this is their reflection, so they can write on it or mark it up if they feel that it would help them as we compare our pictures." (Lesson 4, Teach Guide)
- Lesson 5, Connect Section, Step 5, "Hand out the Observations Self Reflection worksheet to each student. Point out that this is like the handout that they have used in Lessons 3 and 4. Remind students that this is an opportunity for them to pause and reflect on their own sensemaking and that it is okay if they still think that they need to work on their sensemaking. Read each statement aloud and ask students to circle the appropriate image (thumbs up or thumbs down) based on their own experiences throughout this lesson." (Lesson 5, Teacher Guide)

A coherent three-dimensional assessment system rationale is clearly described.
- The Assessment System Overview document includes a table listing key assessment opportunities in the unit and the purpose of each assessment. It includes pre-assessment, formative and summative assessments, and self-assessment.
- "There are two tables below that outline where each type of assessment can be found in the unit. The first table, Unit Assessment Plan by Assessment Type, lists the purpose, placement, and tools for each

assessment type. The second table, Lesson-by-Lesson Assessment Opportunities, chronologically lists the assessment guidance for each lesson." (Earth Land Erosion Assessment System Overview)

- "Each OpenSciEd unit includes an assessment system that offers many opportunities for different types of assessments throughout the lessons. These opportunities include: pre-assessment, formative assessment, summative assessment, peer-assessment, and self-assessment. Formative assessment opportunities are embedded and called out directly in the lesson plans. Please look for the yellow "Assessment Opportunity" support in each lesson plan to identify suggested assessments. In addition, the table below outlines where each type of assessment can be found in the unit. For more information about the OpenSciEd approach to assessment, visit the OpenSciEd Elementary Teacher Handbook." (Assessment Overview, p.1).

Suggestions for Improvement: NA

III.F. Opportunity to Learn — Extensive

Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback.

The reviewers found extensive evidence that the materials explicitly include both claimed Assessment Statements (learning objectives) in more than one activity and assessment, allowing students to develop and improve their performance over time. Students also have opportunities to apply peer and teacher feedback from prior activities to help them progress in their learning.

Multiple, interconnected opportunities over time

- Lesson 5, Lesson Assessment Guidance "What will students do: Use observations to describe patterns about how wind and water can change the shape of the rocks and/or rocky land." "How can I use this assessment information: If you notice students need more support in describing the changes they observed, you might: Use repeated words, sketches, and/or gestures to help them develop and record their observations. Project before/after photos and ask "How are these rocks different in this photo than the other one? Why do you think they are different?" Focus students on comparing the movement of the rocks. Invite students to return to land change bins and look at the rocks up close. Use repeated words, sketches, and/or gestures to help them develop their ideas around the rocks changing a lot, a little, or not at all. Refer to the Instructional Guidance for Lesson 5 for instructional guidance suggestions based on students' current sensemaking." (Lesson 5, Teacher Guide)
- Lesson 7, Lesson Assessment Guidance "What will students do: Analyze data to determine if the bin models have similar patterns in their shape and function (stability) as the land change problem before and after being tested with wind and water." Synthesize Section, Step 6, "This creation of the design solution draft will be used as a way to get students to consider the range of possible solutions for their chosen Community Example problem. Allow students to get many ideas out on the table. There is no right or wrong answer at this point. In lesson 8, students will be able to refine their ideas in partner groups based on the shape, structure, and function of other real-world solutions." (Lesson 7, Teacher Guide)
- Lesson 9, Lesson Assessment Guidance "What will students do: Make a claim about the stability of structures (usefulness of shape and materials) in design solutions as they relate to the function of the

design to limit land from changing shape." Explore Section, Step 4, "Students will rebuild a model to represent the land from the community land change problem that students selected during lesson 7. They will design a solution to limit the land from changing shape. The observations they collect will later be used to make a claim on how effective their solution was at solving the problem of land changing shape." (Lesson 9, Teacher Guide)

- Lesson 10, Lesson Assessment Guidance "What will students do: Compare multiple solutions designed for limiting wind and/or water from changing the shape of the land based on their shape and stability." Synthesize section, Step 3, "Constructing Explanations and Designing Solutions: In lesson 8, comparisons of design solutions in the infographics and from the Community Example chart were made partially by the whole class. In Lesson 10 these comparisons to determine the most effective solution are made on their assessment individually. In addition, the types of solutions narrow, asking students to look for finer details in the structure and function of the designs." (Lesson 10, Teacher Guide)

Multi-modal feedback loops

- Lesson 3 Explore Section, Step 2, Broadening Access "If time permits, provide multiple means of representation by encouraging students to visit other groups to see /compare their land change bins and/or model drawings. This will help students build connections across the different groups' results to support a collective consensus of patterns observed prior to synthesizing evidence. This also allows students time to share their experiences, ideas, and stories with others increasing confidence in their communication skills.
- Lesson 4, Connect Section, Step 5, "Formative assessment: Making observations from the articles and comparing to the patterns in past data provide an opportunity to gather evidence about learning goal 1, with the purpose of supporting students in establishing patterns of land movement that explain how wind and water can change the shape of the land near our school. Use the suggestions in the Assessment Guidance at the beginning of the lesson to provide feedback and determine next steps before moving on to the next Synthesize section." (Lesson 4, Teacher Guide)
- Lesson 8, Explore Section, Step 6, "Have each pair reflect on the feedback they received from their peers and then provide times for students to revise and improve their drawing of their design solution on the second page of Our Land Change Solution. Circulate, asking students questions about how they will incorporate the feedback they received into their solution." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 4, "During this time encourage students to use the feedback they received on their work from lessons 3 and 5. Circulate and ask students to share how they are attending to the feedback they received." (Lesson 9, Teacher Guide)

Suggestions for Improvement: NA

CATEGORY RATINGS			Total Score
CATEGORY I: NGSS 3D Design	CATEGORY II: NGSS Instructional Supports	CATEGORY III: Monitoring NGSS Student Progress	
0 1 2 (3)	0 1 2 (3)	0 1 2 (3)	9

Overall ratings: The score total is an approximate guide for the rating. Reviewers should use the evidence of quality across categories to guide the final rating. In other words, the rating could differ from the total score recommendations if the reviewer has evidence to support this variation.	**E: Example of high quality NGSS design**–High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9) **E/I: Example of high quality NGSS design if Improved**–Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7) **R: Revision needed**–Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5) **N: Not ready to review**–Not designed for the NGSS; does not meet criteria (total 0–2)	**Overall rating below:** **E**