Part 1: How does water use efficiency vary within the field?

Yield data was collected during harvest. Sensors in the harvest equipment monitored the amount of corn harvested in each location of the field and recorded the data in a yield map. An average of the yield in each section was calculated to measure water use efficiency (WUE) in each section.

Overall field yield:
- Irrigated yield: 190 bushels/acre
- Dry land yield: 168 bushels/acre
- Irrigation: 10 inches

\[
\text{WUE} = \frac{\text{Irrigated Yield} - \text{Dry land Yield}}{\text{Irrigation (in)}}
\]

Calculate WUE for the zones of the irrigated field:

\[
\text{WUE} = \frac{190 \text{ bushels/acre}}{10 \text{ in}} - \frac{168 \text{ bushels/acre}}{10 \text{ in}} = 2.20 \text{ bushels/acre in}
\]
Increasing Production with Precision Agriculture (continued)

Calculate the WUE for each zone of the irrigated field. Show your work.

\[
WUE = \frac{\text{Irrigated Yield} - \text{Dry land Yield}}{\text{Irrigation (in)}}
\]

Zone 1 calculations

Zone 2 calculations

Zone 3 calculations

Zone 4 calculations

Zone 5 calculations

Zone 6 calculations

Water use efficiency (WUE) values above the field average (2.2 bu/ac-in) correspond to greater yields. For instance, Zone 1 has an additional 3 bushels per acre for every inch of irrigated water compared to dry land, but the irrigated field average only has an increase of 2.2 bushels per acre.
Increasing Production with Precision Agriculture (continued)

Could we use our water more efficiently?

Assuming yield stays constant, how much water should be used in each section to match overall WUE? Calculate the irrigation for each zone of the irrigated field. Show your work.

\[
\text{Irrigation (in)} = \frac{\text{Irrigated Yield} - \text{Dryland Yield}}{\text{WUE}}
\]

Zone 1 calculations

Zone 2 calculations

Zone 3 calculations

Zone 4 calculations

Zone 5 calculations

Zone 6 calculations

If yield is assumed to be constant, adding extra water (beyond 10 inches) will not have a positive effect. However, if some sections could produce the same yield with less water we could reduce the amount of water used for irrigation.

**How many gallons of water could be saved from the under-producing zone?**

Useful information:
- Each section is 23.3 acres
- 1 acre = 43,560 ft²
- 1 gallon = 0.1337 ft³
## Part 2: Designing a VRI System

<table>
<thead>
<tr>
<th>Problem and Objective</th>
<th>Brainstorming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. Need to construct a device to vary water flow</td>
<td>Ex. Differences in straw diameters will play a factor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Constraints and Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. Allowed to use only 2 materials (limited resources)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Testing</th>
<th>Potential Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. Water flowed into amounts of 5 fl oz, 5 fl oz, 6 fl oz</td>
<td>Ex. Need to use different types of straws</td>
</tr>
</tbody>
</table>

| Final Solution | |
|----------------|
Increasing Production with Precision Agriculture (continued)

How accurate was your design? Record the amount of water that went into each cup.

Was your design successful?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What could you do to improve your design?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Why do you think that varying water amounts are useful?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________