COALINGA COLLEGE
(559) 934-2000 | 300 Cherry Lane Coalinga, CA 93210 | | www.coalingacollege.edu

COALINGA COLLEGE

AG IRRIGATION SIMULATOR

AgSTEM Kit 2025

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Instructor Guide: Ag Irrigation Simulator

Introduction

The Ag Irrigation Simulator introduces students to the science and technology of modern irrigation systems through an interactive learning environment that mirrors real-world agricultural water management.
Students explore how water moves through pumps, filters, pipes, and valves and how digital tools such as WiseConn nodes**,** pressure transducers**,** flow meters, and variable frequency drives (VFDs) enable precision irrigation and water conservation.

This kit supports inquiry-based learning, career exploration, and agricultural literacy. Aligned with NGSS and CTE standards, it encourages critical thinking, data interpretation, and applied problem-solving. Students learn how efficient irrigation systems support environmental sustainability, energy efficiency, and agricultural productivity.

Kit Components

Each AgSTEM experience includes:

- Age-appropriate presentation slides (2nd–Community College)
- Pre/Post student surveys
- Hands-on activity using the Ag Irrigation Simulator & Student worksheets & logs (leveled by grade)
- Video demonstration of simulator operation

Physical components demonstrated in the simulator:

- WiseConn node and interface (remote control & data collection)
- Solenoid valves (automated valve control for irrigation zones)
- Sand media filter station (filtration & backflush system)
- Variable Frequency Drive (pump speed & pressure control)
- Flow meter (gallons per minute monitoring)
- Pressure transducers (digital PSI readings for troubleshooting)
- Pressure relief valve (overpressure protection)
- Air vent (pressure balance and air removal)
- Flush controller (automated filter maintenance)

Sequence of Use

The full experience is designed to be delivered in a 60–90 minute block, adaptable for shorter class periods or multi-day exploration.

Before the Session

1. Power on and test simulator components (WiseConn connection, VFD, solenoid valves).
2. Print the following materials:
    - Age-specific pre-survey
    - Student worksheet or log sheet
3. Load the simulator demonstration video (optional for visual introduction).
4. Verify that pressure and flow sensors are functioning and that the flush controller is set to automatic.

Suggested Delivery Outline

Segment	Description	Time
1. Welcome & Pre-Survey	Introduce irrigation systems and student prior knowledge	5–10 min
2. Presentation	Use age-appropriate slides to explain irrigation flow and components	10–15 min
3. Video Demo	Show how the Ag Irrigation Simulator operates	5–10 min
4. Hands-On Activity	Students operate or observe simulator functions and log data	25–40 min
5. Reflection & Post-Survey	Discuss results, answer reflection questions, and collect feedback	10–15 min

Hands-On Activities by Grade Level Overview

All activities center around precision irrigation management. Students learn how pressure, flow rate, and valve control influence water distribution, efficiency, and sustainability.

Grade Level	Activity Title	Focus
Grades 2–3	*Water Flow Explorers*	Observe how opening/closing valves affects water flow
Grades 4–5	*Filter Flow Detectives*	Explore how sand filters clean irrigation water
Grades 6–8	*Pressure Power*	Measure and compare PSI and flow rate at different pressures
Grades 9–10	*Smart Irrigation Operators*	Use WiseConn to control valves and detect leaks/blockages
Grades 11–12	*Efficiency Engineers*	Adjust VFD to find optimal PSI and energy use balance
Community College	*Operational Optimization Lab*	Analyze data to recommend system efficiency improvements

Each activity is detailed in the Student Log Packet, including step-by-step instructions, guiding questions, and observation tables for PSI, flow rate, and GPM.

Pre/Post Surveys Overview

Surveys are designed for age-appropriate reflection and assessment of student learning outcomes.
They measure:

- Familiarity with irrigation systems and components
- Understanding of pressure, flow, and water efficiency
- Awareness of digital monitoring and automation in agriculture
- Interest in STEM and AgTech career pathways

Instructor Use:

- Administer pre-survey before beginning the activity to assess baseline knowledge.

- Administer post-survey immediately after reflection to gauge conceptual growth.
- Surveys also support grant reporting and outreach assessment**.**

Student Worksheets & Logs Overview

Each activity includes a leveled student worksheet and log sheet**:**

- **Elementary levels** – Visual identification and simple cause/effect observations
- **Middle levels** – Data collection (PSI, flow rate, visual changes)
- **High school and college** – Quantitative analysis, efficiency calculations, and system design reflection

Instructor Notes:

- Encourage teamwork and observation-sharing during lab time.
- Review log responses for understanding of flow dynamics and troubleshooting.
- Use logs as discussion prompts for debrief or assessment.

Video Demonstration Overview

The included video provides a short guided tour of the Ag Irrigation Simulator in operation.
It illustrates:

- Water movement through pump, filters, and valves
- Pressure and flow changes on the WiseConn dashboard
- Automatic backflush and VFD adjustments
- Real-world applications in precision irrigation

Recommended Use:

- Show before or after hands-on activity to visualize internal processes.
- Pause for discussion prompts (e.g., “What happens when PSI increases?”).

Cross-Disciplinary & Career Connections

The Ag Irrigation Simulator bridges mechanical engineering, agricultural science, and environmental stewardship.
Students gain exposure to the integration of hydraulics, automation, and data-driven decision making that defines modern agriculture.

Career Pathways Highlighted:

- Irrigation Technician
- Agricultural Engineer
- Water Resource Specialist

- Ag Data Systems Operator
- Precision Agriculture Manager

Instructor Reflection Prompts

After completing the simulator experience, consider the following for curriculum integration:

- How did students respond to using digital tools for water management?
- Which grade levels demonstrated strong understanding of flow and pressure relationships?
- Could this activity pair with a unit on soil moisture, evapotranspiration, or energy efficiency?
- What additional data visualizations (e.g., charts, dashboards) could enrich future sessions?

Safety Guidelines

- Ensure the simulator is on a stable surface before operation.
- Keep students clear of active plumbing components.
- Do not exceed recommended PSI limits.
- Avoid handling electrical wiring or VFD components while powered.
- Always supervise student access to the WiseConn dashboard.

Meet the Simulator: Ag Irrigation System

Introduction

The Ag Irrigation Simulator introduces students to the essential technologies used in modern precision irrigation systems. This simulator replicates real-world irrigation management by allowing users to remotely operate valves, monitor pressure and flow rates, and analyze data through a WiseConn control interface. By interacting with the simulator, students explore how water moves through an irrigation system, from the well or canal to the filter station, pumps, and field valves, and learn how technology ensures efficient, uniform, and sustainable water use.

System Overview

The Ag Irrigation Simulator integrates both physical components and digital controls to demonstrate the complete irrigation cycle. Students and instructors can manipulate system variables and observe real-time feedback from the WiseConn network. Key components include:

- WiseConn Node: A digital communication hub that allows remote control and monitoring of irrigation system components such as solenoid valves, flow meters, and pressure sensors.
- Solenoid Valves: Electrically operated valves that open or close water flow to specific fields or zones. These can be manually or remotely operated through the WiseConn interface.
- Sand Media Filter Station: Filters debris and impurities from water drawn from wells or ditches. Water flows through sand media sized for the system's drip emitters to prevent clogging.
- Variable Frequency Drive (VFD): Controls pump speed and maintains target pressure (PSI) in the system, adjusting automatically as valves open or close to optimize energy use.
- Flow Meter: A digital reader that measures the system's flow rate (gallons per minute) and transmits data to WiseConn for monitoring efficiency and irrigation duration.
- Pressure Transducers: Digital sensors that measure pressure at multiple points in the system to detect leaks, blockages, or irregularities in water flow.
- Pressure Relief Valve: A safety mechanism that releases excess pressure to prevent system damage if the PSI exceeds a set threshold.
- Air Vent: Allows trapped air to escape from the system to maintain accurate pressure readings and prevent air blockages.
- Flush Controller: Automates the filter backflush process, cleaning one filter at a time according to a preset PSI differential or timed interval.

How the Simulator Works

The simulator is designed to model the complete irrigation process, beginning with water intake and concluding with controlled delivery to the field. Students can manipulate variables and monitor responses through digital and physical components.

1. Water is drawn from a well or canal and directed to the pump station.
2. The Variable Frequency Drive (VFD) controls pump speed to maintain target PSI (e.g., 50 PSI) regardless of how many fields or valves are open.
3. Water passes through the sand media filter station, where debris is removed before entering the mainline.
4. The WiseConn node receives sensor data and allows students to remotely open or close solenoid valves to irrigate specific zones.
5. Flow meters and pressure transducers send real-time data (PSI, GPM, energy use) to the WiseConn dashboard.
6. When filter pressure differentials exceed set limits, the flush controller initiates a backflush cycle, directing waste water to the flush field.
7. Students can monitor how adjustments in PSI, pump speed, or valve configuration affect flow rate, system efficiency, and uniformity.

Student Interaction and Learning Outcomes

Students engage directly with the simulator to understand both the mechanical and digital aspects of irrigation systems. Through observation and data collection, they explore how hydraulic principles, energy management, and system design contribute to efficient water use. Depending on grade level, activities may include opening and closing valves, comparing filter pressures, measuring PSI and flow rate changes, and using data to make irrigation management recommendations.

Safety Guidelines

- Do not handle electrical components or exposed wiring while the system is powered.
- Ensure that the simulator is on a stable surface and water lines are secure before operation.
- Never exceed pressure levels beyond manufacturer recommendations.
- Avoid direct contact with moving parts of the pump or valves during operation.
- Wear eye protection if observing or testing high-pressure lines.
- Always power down the simulator before making manual adjustments to plumbing or filters.

Cross-Disciplinary and Career Connections

This simulator bridges agricultural science, engineering, and data technology. Students experience firsthand how precision irrigation integrates electrical, mechanical, and environmental systems. Skills developed through this kit align with career pathways in Agricultural Systems Management, Irrigation Technology, Agribusiness, and

Environmental Engineering. Students also gain foundational knowledge applicable to industry certifications in water management, precision agriculture, and pump or VFD operation.

Presentation 2nd-3rd Grade

How Do Farms Water Their Plants?

Welcome to our adventure learning about how farmers make sure their plants get enough water to grow big and strong!

Why Do Plants Need Water?

Just like you need water to live and grow, plants need water too! Water helps plants:

- Make their own food using sunlight
- Grow tall and strong
- Stay cool when it's hot outside

Sometimes it doesn't rain enough, and the plants get thirsty. That's when farmers step in to help with something special called **irrigation**!

What is Irrigation?

Irrigation

Irrigation is a special way farmers give water to their plants. It's like using a giant watering can, but much smarter!

Different Ways to Irrigate

- Sprinklers that spray water into the air
- Drip systems that give tiny drops of water
- Flood irrigation that fills fields with water

Farmers choose the best irrigation method based on what plants they're growing and where their farm is located.

How Does Water Get to the Plants?

Step 1: Water Source

Water comes from wells deep underground or from lakes, rivers, and canals nearby.

Step 2: Pumping

Big pumps push the water through pipes that go all around the farm.

Step 3: Delivery

Sprinklers or drippers give just the right amount of water to each plant.

Farm Tools That Help

Pumps

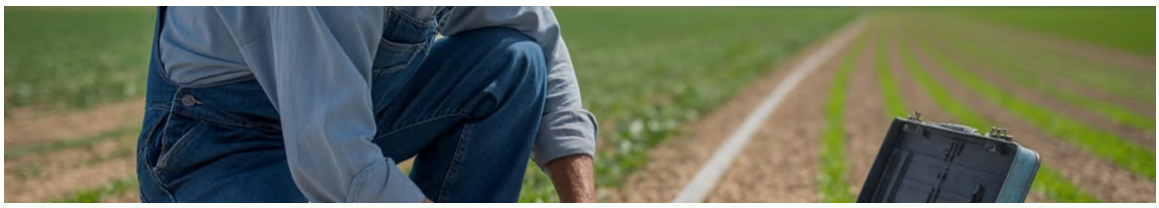
These machines are like super strong hearts that push water through the pipes. They can move thousands of gallons of water every hour!

Filters

Filters catch dirt and tiny pieces that might clog the pipes. They keep the water clean for the plants.

Valves

These are like light switches for water. They control where the water goes and how much water each area gets.



Taking Care of the Water System

1. **Check Everything**

   Farmers walk around their fields to make sure all the sprinklers and pipes are working correctly.

2. **Fix Problems**

   When something breaks, farmers need to fix it quickly so the plants don't get thirsty.

3. **Save Water**

   Farmers make sure not to waste water. They only use what the plants need to grow healthy.

Cool Jobs on the Farm!

1

Farm Technician

These people set up sprinklers and make sure water gets to all the plants. They might drive tractors with special watering equipment.

2

Engineer

When pipes leak or pumps stop working, these experts know how to fix everything! They use tools to repair the irrigation system.

3

Plant Doctor

These smart people check if plants have enough water. They look at the soil and leaves to know when it's time to water.

What Did We Learn?

- Plants need water to grow big and strong!
- Irrigation is a special way farmers water their plants.
- Water travels through pipes to reach the plants.
- Farmers use pumps, filters, and valves to help water plants.
- There are fun jobs that help keep farm irrigation working!

Questions for You!

Have you seen a sprinkler before?

What did it look like? Was it in a garden, on a farm, or in a park?

How do you help water plants at home?

Do you use a watering can? A hose? Or something else?

What job would you like to try on a farm?

Would you like to drive a tractor? Fix pipes? Or be a plant doctor?

Presentation 4th-5th Grade

How Farms Use Irrigation to Water Crops

Welcome to our exploration of farm irrigation! Today we'll learn how farmers make sure their crops get enough water to grow, even when there isn't enough rain.

Why Irrigation is Important

Plants Need Water to Survive

Just like you need water every day, plants need water to grow big and strong. Without enough water, crops will wilt, turn brown, and eventually die.

In many places around the world, farmers can't depend on rain alone to water their crops. Some farms are in dry areas that only get rain a few times a year!

Without irrigation, many of the foods we eat every day wouldn't be able to grow. Irrigation

What is an Irrigation System?

Water Source

Irrigation systems get water from lakes, rivers, wells, or reservoirs. This is where the journey begins!

Moving Water

The system uses a network of pipes, canals, and tubes to move water from the source to the crops across the entire farm.

Delivering Water

Finally, sprinklers, drip lines, or other methods deliver the water directly to the plants, making sure they get just the right amount.

Tools That Help Irrigation Work

Pump

Pumps are like the heart of the irrigation system. They create pressure to push water through all the pipes and out to the fields. Some pumps are very powerful and can move thousands of gallons of water!

Filter

Filters remove dirt, leaves, and other junk from the water. Clean water flows better through pipes and is healthier for the plants. Filters need regular cleaning to work properly.

Valves

Valves are like faucets that can be turned on or off to control where water goes. Farmers use valves to send water to different parts of their fields when needed.

Pressure Gauge

These special meters show how strong the water pressure is. Too little pressure means the water won't reach all the plants. Too much pressure could damage the pipes!

How Smart Sensors Help Farmers

Soil Moisture Sensors

These tiny devices are placed in the soil to measure exactly how wet or dry it is. They tell farmers when it's time to water and when to stop, so plants get just the right amount.

Weather Stations

These collect data about rain, temperature, and wind. They help farmers decide if they need to use their irrigation systems or if nature will water their crops.

Flow Meters

These devices measure how much water is being used. They help farmers keep track of water usage and can detect leaks in the system if water is disappearing too quickly.

Taking Care of Irrigation Systems

Keeping Everything Working

Irrigation systems need regular care to work properly. Here's what farmers must do:

- Check for and fix leaky pipes and sprinklers
- Clean or replace filters when they get clogged
- Make sure pumps are working at the right pressure
- Clear debris from sprinkler heads
- Prepare systems for winter by draining water
- Update or upgrade parts of the system as new technology becomes available

Cool Jobs in Irrigation

Irrigation Technician

These experts design, install, and repair irrigation systems. They're like doctors for water systems! They need to understand pipes, pumps, and how water flows.

Farm Scientist

These scientists study plants to figure out exactly how much water different crops need. They help create watering schedules that keep plants healthy while saving water.

Drone Pilot

Using special cameras on drones, these pilots can spot dry areas or broken irrigation equipment from high above the fields, helping farmers fix problems quickly.

What Did We Learn?

1. ### *Plants Need Water to Grow*

   Without enough water, crops can't grow properly. Irrigation helps farmers provide water even when there isn't enough rain.

2. ### *Irrigation Systems Use Many Parts*

   Pumps, pipes, filters, valves, and sprinklers all work together to move water from a source to the plants that need it.

3. ### *Technology Helps Save Water*

   Smart sensors and tools help farmers use just the right amount of water, which is important for conserving this precious resource.

4. ### *Many People Work to Keep Farms Watered*

   From technicians to scientists to drone pilots, many different jobs help make sure crops get the water they need to grow.

Discussion Time!

1

Why is saving water important?

Think about all the ways we use water every day. Why should we be careful not to waste it? What might happen if we run out of clean water?

2

Have you ever helped water plants?

Have you watered a garden at home or at school? How did you know how much water to use? Was it different for different types of plants?

3

Which farm job would you want?

Of all the irrigation jobs we learned about, which one sounds most interesting to you? Why would you choose that job?

Presentation 6th-8th Grade

Irrigation in Agriculture: Technology & Tools

Welcome to our exploration of irrigation technology in modern farming! In this presentation, we'll discover how farmers use water smartly, the tools that help them monitor their irrigation systems, and exciting careers in this growing field.

Why We Need Irrigation

Many regions around the world don't receive enough natural rainfall to grow crops successfully. Irrigation systems solve this problem by:

- Providing consistent water to crops in dry areas
- Ensuring plants get water during droughts
- Extending growing seasons beyond rainy periods
- Allowing farmers to grow crops in otherwise unsuitable locations

Modern irrigation also helps conserve water by delivering it precisely where and when plants need it most.

Components of an Irrigation System

1. ***Water Source***
   Irrigation water comes from underground wells, rivers, lakes, canals, or reservoirs. The quality and reliability of the water source directly affects crop health.

2. ***Pump Systems***
   Electric or fuel-powered pumps move water from the source through the entire irrigation system, providing the necessary pressure for proper operation.

3. ***Filters***
   These critical components remove sand, algae, and other debris that could clog sprinklers and drippers, ensuring smooth water flow throughout the system.

4. ***Valves & Pipes***
   A network of pipes carries water to different areas of the farm, while valves control which sections receive water and when they receive it.

5. ***Water Delivery***
   Sprinklers spread water over large areas, while drip systems deliver water directly to plant roots, reducing waste through evaporation.

Monitoring Tools: The High-Tech Side of Irrigation

Flow Meters

These devices measure exactly how much water is moving through the irrigation system. Farmers use this data to track water usage, detect unusual patterns, and ensure crops receive the right amount of water.

Pressure Gauges

Pressure gauges monitor water force in the system. Too high pressure can damage equipment and waste water, while too low pressure means water won't reach all plants effectively.

Smart Sensors

Modern sensors measure soil moisture, temperature, and even plant stress. These sensors connect to computers that automatically adjust irrigation schedules based on real-time conditions.

Why Monitor Irrigation?

Conservation

Monitoring helps farmers avoid wasting water, a precious resource. A single leak can waste thousands of gallons per day!

Plant Health

Too little water stunts growth. Too much can drown roots and promote disease. Monitoring ensures plants get exactly what they need.

Equipment Protection

Monitoring pressure and flow helps detect problems before they damage expensive irrigation equipment.

Maintenance Matters

Regular Inspections

Farmers walk their fields weekly to check for leaks, broken sprinklers, and other visible problems. This "boots on the ground" approach catches issues early.

Filter Cleaning

Filters must be cleaned or replaced regularly to prevent clogging. Dirty filters reduce water flow and pressure throughout the entire system.

System Flushi

Pipes need regular flushing to remove built-up sediment and prevent blockages. This is especially important at the beginning and end of growing seasons.

Without proper maintenance, even the most advanced irrigation systems will fail. Maintenance costs time and money, but prevents much more expensive problems later!

Careers in Agricultural Irrigation

Irrigation Engineer

Designs irrigation systems that maximize efficiency while minimizing water use. They consider land topography, crop types, and water availability.

Skills needed: Physics, math, computer modeling, problem-solving

Precision Agriculture Specialist

Uses technology like sensors, GPS, and drones to monitor crops and irrigation systems, making data-driven recommendations.

Skills needed: Technology, data analysis, agricultural science

Drone Technician

Operates drones equipped with special cameras that can detect plant stress and irrigation problems invisible to the human eye.

Skills needed: Drone piloting, image analysis, technical troubleshooting

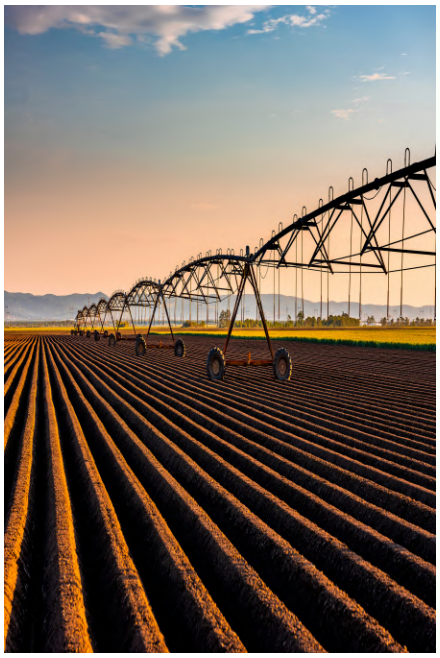
Water Resource Manager

Develops strategies for sustainable water use across multiple farms or entire regions, balancing agricultural needs with conservation.

Skills needed: Environmental science, policy knowledge, communication

Putting It All Together: Why Irrigation Technology Matters

- Modern irrigation systems make farming possible in areas that would otherwise be too dry for crops
- Technology helps monitor water use and save this precious resource
- Regular maintenance keeps systems running efficiently
- Many exciting STEM careers connect to irrigation technology
- As climate change affects rainfall patterns, irrigation technology becomes increasingly important for food security



Let's Discuss!

Water Conservation

What would happen if farmers didn't monitor their water use? How might this affect your community?

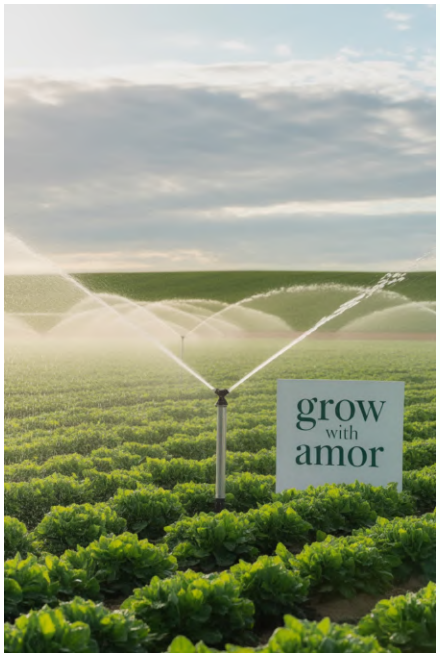
Technology Benefits

How does technology help save water on farms? Can you think of any other technologies that might help?

Future Careers

Which irrigation-related career interests you most? What skills would you need to develop to succeed in that field?

Presentation 9th-10th Grade



Irrigation in Agriculture: How We Deliver Water to Crops

Exploring the tools, technology, and careers that make modern agricultural irrigation possible. This presentation will take you through the fascinating world of how farmers ensure their crops receive exactly the water they need to thrive.

What We'll Learn Today

1

Irrigation Fundamentals

Understand the basics of agricultural irrigation systems and why they're essential for modern farming.

2

System Components

Identify the key parts of an irrigation system and how they work together to deliver water efficiently.

3

Technology Integration

Explore how technology helps monitor water use and makes irrigation more precise and sustainable.

4

Career Pathways

Discover exciting career opportunities in irrigation and agricultural technology fields.

Why Irrigation Matters

Water: The Lifeblood of Agriculture

Plants need precise amounts of water to develop strong roots, stems, and produce high yields. Too little water causes stunted growth, while too much can lead to root diseases.

In regions with unpredictable rainfall or during drought periods, irrigation becomes essential for crop survival and food security.

Modern irrigation methods can reduce water usage by up to 60% compared to traditional flooding methods, helping conserve this precious resource.

Tabletop Irrigation Model

Hands-On Learning

Our classroom tabletop model replicates a real-world farm irrigation system at a smaller scale.

- Demonstrates water movement from source to delivery points
- Shows pressure changes throughout the system
- Allows for testing different water delivery methods
- Helps visualize the effects of blockages or leaks

The model provides a safe environment to experiment with irrigation concepts before

Key Components of an Irrigation System

Water Source

Groundwater wells, rivers, lakes, or canals provide the initial water supply. The water quality and reliability of these sources directly impact crop health.

Pump

Creates pressure to move water through the system. Different crops and field sizes require specific pump types and capacities.

Reservoir

Stores water for use during peak demand periods or when the primary water source is unavailable.

Filter Station

Removes sediment, debris, and contaminants to prevent clogging in smaller pipes and emitters downstream.

Pipes & Valves

Transport water and control its direction and flow rate. Modern systems use PVC or polyethylene for durability.

Water Delivery

Sprinklers, drip lines, or micro-sprayers apply water directly to crop root zones for maximum efficiency.

Technology Behind Modern Irrigation

Flow Meter

Measures water volume passing through the system, helping farmers track usage and detect leaks. Modern meters can transmit data wirelessly to farm management systems.

Pressure Gauge & Switch

Monitors and maintains optimal water pressure. Too low pressure results in uneven distribution; too high can damage pipes and emitters.

Transducer & Air Release Valve

Transducers convert water pressure into electrical signals for monitoring, while air release valves prevent air pockets that block water flow and cause pipe damage.

Monitoring & Control Systems

Smart Irrigation Technology

Modern systems incorporate digital monitoring that transforms farming:

- Soil moisture sensors determine exactly when crops need water
- Weather stations adjust irrigation schedules based on rainfall and evaporation rates
- Smartphone apps allow remote system control from anywhere
- Automated controls adjust water pressure and flow in real-time
- Data analytics identify patterns to optimize water and energy use

These technologies can reduce water usage by 30-50% while improving crop yields.

Maintaining an Irrigation System

Regular Inspection

Check for clogged emitters, broken sprinkler heads, and leaking pipes. Walk the fields weekly during growing season to spot issues early.

Pressure Monitoring

Track system pressure daily during operation. Sudden drops may indicate leaks, while increases could signal blockages that might damage equipment.

Filter Maintenance

Clean or replace filters regularly based on water quality. Dirty filters restrict flow and force pumps to work harder, increasing energy costs.

Component Service

Follow manufacturer schedules for lubricating pumps, replacing valves, and servicing electronic components to prevent costly breakdowns.

Careers in Irrigation & Agriculture Technology

Irrigation Technician

Installs, repairs, and troubleshoots irrigation systems. Average salary: $35,000-$55,000. Usually requires technical certification and hands-on experience.

Agricultural Engineer

Designs water-efficient systems and solves complex agricultural challenges. Average salary: $71,000-$114,000. Requires engineering degree and strong problem-solving skills.

Environmental Scientist

Studies water conservation methods and ensures agricultural practices meet environmental regulations. Average salary: $63,000-$98,000. Typically needs science degree.

Precision Agriculture Specialist

Uses technology like GPS, drones, and sensors to improve irrigation efficiency. Average salary: $48,000-$85,000. Combines agriculture knowledge with tech skills.

Key Takeaways

Irrigation Is Critical for Food Security

Proper irrigation systems help farmers produce reliable crop yields even during drought conditions, ensuring stable food supplies for growing populations.

Technology Makes Irrigation Smarter

Modern irrigation combines mechanical components with digital technology to optimize water use, saving resources while improving crop health and yields.

Career Opportunities Are Diverse

From hands-on technical work to design engineering and environmental science, irrigation offers pathways for many interests and skill sets in a growing field.

Discussion & Questions

Think About...

- Why is monitoring water use on farms becoming increasingly important in today's world?
- What could happen to crops and equipment if water pressure is too low or too high in an irrigation system?
- Which career in irrigation technology sounds most interesting to you and why?
- How might irrigation systems need to adapt as climate changes affect rainfall patterns?

Take a moment to reflect on how the water reaches your food. Every fruit and vegetable in your

Presentation 11th-12th Grade

Irrigation in Agriculture: Systems, Technology, and Sustainability

Explore how irrigation systems are revolutionizing modern agriculture, enhancing crop yields while conserving our most precious resource: water.

The Importance of Irrigation

Global Impact

Irrigation systems are vital for sustainable agriculture, especially in regions with inconsistent rainfall or arid conditions. Without irrigation, approximately 40% of the world's food production would be impossible.

Modern irrigation technologies have transformed previously unproductive land into fertile growing areas, supporting global food security for our growing population.

Irrigation systems can increase crop yields by 100-400% in areas with insufficient rainfall,

Anatomy of an Irrigation System

Water Sources

Agricultural water typically comes from groundwater wells, surface water (rivers, lakes, reservoirs), or municipal sources. The quality and reliability of these sources directly impact irrigation efficiency.

Pump & Motor Systems

The heart of the irrigation system. Pumps move water from the source to the field, while motors provide the necessary power. Modern systems use variable frequency drives to optimize energy usage.

Filtration & Control

Includes filters to remove debris, check valves to prevent backflow, and pressure regulators to maintain optimal water flow. These components protect the system and ensure consistent delivery.

Delivery Systems

The visible components that distribute water to crops, including sprinklers, drip lines, micro-sprays, and center pivots. Each is designed for specific crops and field conditions.

Digital Monitoring & Control

1. ### Flow Meters

   Precision instruments that measure water volume and flow rate, allowing farmers to track exactly how much water is being used and identify potential leaks or inefficiencies.

2. ### Pressure Sensors

   Monitor pressure throughout the system to ensure optimal operation. Too little pressure results in inadequate coverage; too much can damage equipment and waste water.

3. ### Automation Controls

   Transducers and switches that automatically adjust system operation based on soil moisture, weather conditions, and crop needs. These can be programmed and monitored remotely.

Efficiency & Conservation

Pressure Management

Maintaining proper pressure throughout the system is critical for water conservation. Even a 10 PSI reduction in excess pressure can reduce water usage by 10-20% while maintaining crop health.

Precision Agriculture

Combining soil moisture sensors, weather data, and crop monitoring allows for targeted irrigation only when and where needed. This approach can reduce water consumption by up to 60% compared to traditional methods.

Water Recycling

Advanced systems capture and filter runoff water for reuse, creating closed-loop systems that dramatically reduce overall water consumption and minimize environmental impact from agricultural activities.

Maintenance Practices

Regular Inspections

Weekly visual checks of pumps, filters, and delivery systems to catch small issues before they become major problems. Look for leaks, clogs, or damaged components.

- Check sprinkler heads and emitters for clogging
- Inspect for leaks in pipes and connections
- Verify pressure gauge readings

Seasonal Servicing

Comprehensive maintenance at the beginning and end of growing seasons. Include pump servicing, filter replacement, and system-wide testing.

- Clean and flush all lines and filters
- Lubricate moving parts
- Calibrate sensors and controls

Performance Analysis

Review system data to identify inefficiencies and opportunities for improvement. Compare water usage to crop yields to optimize the return on water investment.

- Analyze flow patterns and pressure data
- Review energy consumption metrics
- Assess water distribution uniformity

Careers in Agricultural Irrigation

The agricultural irrigation industry combines technology, environmental science, and agricultural knowledge, creating diverse career opportunities for students interested in sustainable food production.

Irrigation System Designer

Creates custom irrigation solutions based on field conditions, crop types, and water availability. Combines engineering knowledge with agricultural expertise.

Precision Agriculture Specialist

Analyzes data from sensors and satellite imagery to optimize irrigation schedules and application rates for maximum efficiency.

Environmental Consultant

Ensures irrigation practices comply with regulations and develop strategies to minimize environmental impact while maximizing crop production.

AgTech Data Scientist

Develops algorithms and models that predict water needs based on multiple variables, helping farmers make data-driven decisions.

Key Takeaways

1 *Critical Agricultural Infrastructure*

Irrigation systems represent one of the most important technological advances in agriculture, enabling food production in otherwise unsuitable environments and increasing yields in traditional farming regions.

2 *Technology Integration*

Modern irrigation combines mechanical systems with digital technology, creating "smart" systems that respond to real-time conditions and conserve resources while optimizing crop growth.

3 *Sustainability Focus*

The future of irrigation is centered on water conservation, energy efficiency, and environmental protection while maintaining or improving agricultural productivity to meet global food demands.

4 *Career Opportunities*

The field offers diverse career paths that combine technology, environmental science, and agricultural knowledge–ideal for students interested in addressing real-world challenges.

Critical Thinking Discussion

1

Environmental Impact

What are the potential ecological consequences of inefficient irrigation systems on local watersheds, groundwater supplies, and wildlife habitats?

How might climate change affect irrigation needs and water availability in different agricultural regions over the next 50 years?

2

Technological Future

How might artificial intelligence and machine learning transform irrigation practices beyond what we see today?

What barriers exist to widespread adoption of advanced irrigation technologies, particularly for small farms or in developing nations?

3

Global Sustainability

How does efficient irrigation contribute to meeting the UN Sustainable Development Goals, particularly those related to hunger, clean water, and climate action?

Should water-intensive crops be grown in naturally arid regions, even with efficient irrigation? What are the ethical considerations?

Presentation Community College Level

Irrigation in Agriculture: AgSTEM Kit

An exploration of agricultural irrigation systems, their components, functionality, and importance in sustainable farming practices for the next generation of agricultural scientists and engineers.

Objective of Irrigation in Agriculture

Primary Goals

- Provide consistent water supply to crops regardless of natural rainfall
- Optimize crop yields and quality through precise water delivery
- Extend growing seasons and enable cultivation in arid regions
- Increase food production efficiency to meet global demands

Economic Benefits

Increases crop yield by 100-400% in many regions, providing significant return on investment for farmers

Water Conservation

Advanced systems reduce water usage by up to 70% compared to traditional flood irrigation methods

Climate Resilience

Helps agricultural systems adapt to changing precipitation patterns due to climate change

Modern irrigation systems aim to maximize water use efficiency while minimizing environmental impact and energy consumption.

Tabletop Model of Irrigation System

1

Water Flow Components

- 1.5 hp pump delivers water from source
- Inlet from tank draws water into system
- Outlet from pump pushes water to distribution network
- Return to tank creates circulation when needed

2

Monitoring & Control Equipment

- Digital Flowmeter measures water volume
- Pressure Gauges monitor system pressure at key points
- Transducer converts pressure to electrical signals
- Pressure Switch triggers actions at predetermined thresholds

3

Safety & Regulation Devices

- Check Valve prevents backflow
- Bermad Pressure relief valve prevents system damage
- #3 Bermad 3-way solenoid controls water direction
- Air Release valves remove trapped air from lines
- Filter removes particulates to protect downstream components

This tabletop model demonstrates the integrated components of a complete irrigation system, allowing students to visualize water flow and understand component interactions before scaling to field applications.

Sources of Water for Irrigation

1 ***Groundwater Sources***

Wells tap into aquifers at various depths, providing reliable water sources independent of surface conditions. Deep wells may reach 1,000+ feet to access ancient aquifers, while shallow wells (30-100 feet) tap local water tables.

2 ***Surface Water Systems***

Irrigation canals transport water from rivers, lakes, and reservoirs to agricultural areas. Modern canal systems may include concrete lining to prevent seepage losses of up to 40% that occur in unlined channels.

3 ***Alternative Water Sources***

Reclaimed wastewater and harvested rainwater are increasingly utilized in water-scarce regions. These sources require specialized treatment and monitoring to ensure safety for agricultural use.

Water rights and allocation systems vary significantly by region, creating complex legal frameworks that determine who can access water sources, in what quantities, and at what times.

Pumps and Motors: The Heart of Irrigation Systems

Common Pump Types

- **Centrifugal pumps:** Most common in agriculture, using rotating impellers to create water pressure
- **Submersible pumps:** Installed inside wells, eliminating priming issues
- **Turbine pumps:** Effective for deep wells with high capacity needs
- **Positive displacement pumps:** Used for precision applications like fertilizer injection

Power Sources

- **Electric motors:** Clean, efficient, but require reliable grid connection
- **Diesel/gasoline engines:** Portable and independent of power grid
- **Solar-powered systems:** Increasingly popular for remote locations
- **Wind-powered pumps:** Traditional option gaining renewed interest

25%

Energy Consumption

On average, pumping accounts for approximately one-quarter of all energy used in agricultural operations

30-70%

Efficiency Range

The efficiency of irrigation pumps varies dramatically based on design, maintenance, and operating conditions

15-20 yrs

Service Life

Well-maintained pumping systems can operate effectively for nearly two decades before requiring replacement

Agricultural Water Reservoirs

Types of Agricultural Reservoirs

- Large-scale constructed lakes serving multiple farms
- Farm ponds collecting surface runoff and rainfall
- Lined basins preventing seepage in permeable soils
- Enclosed tanks for smaller operations or specialty crops
- Underground cisterns in areas with limited space

Key Benefits

- Buffer against seasonal water availability fluctuations
- Reduced pressure on natural water sources during peak demand
- Pre-warming of water in cold climates to prevent crop shock
- Sediment settling improves water quality and reduces filter load
- Opportunity for aquaculture integration (fish farming)

Design Considerations

- Capacity based on irrigation needs and reliable refill rate
- Evaporation control through depth optimization or covers
- Overflow and emergency drainage systems
- Wildlife protection measures (escape ramps, fencing)
- Water quality maintenance through aeration or circulation

Modern agricultural reservoirs often incorporate multiple functions beyond irrigation storage, including recreational use, wildlife habitat, and stormwater management, creating additional value from the investment.

Filter Station: Protecting Your Irrigation System

Filter Types

- **Screen filters:** Metal or plastic mesh that physically blocks particles
- **Disc filters:** Stacked grooved discs creating pathways that trap particles
- **Media filters:** Sand or crushed rock beds that capture organic matter
- **Centrifugal separators:** Use centrifugal force to remove heavier particles
- **Pre-filters:** Coarse screens for initial removal of large debris

Critical Functions

Proper filtration prevents:

- Clogged emitters and sprinklers that cause uneven irrigation
- Premature wear on pumps and valves
- Damage to pressure regulators and flow meters
- Introduction of pathogens and weed seeds to fields
- Reduced system efficiency and increased operating costs

Initial Water Intake

Water enters the system containing various contaminants (organic matter, sand, silt, algae)

Primary Filtration

Coarse particles removed through screens or separators (typically down to 80–120 mesh)

Secondary Filtration

Finer particles trapped in disc or media filters (down to 200+ mesh for drip systems)

Backwash Cycle

Automatic or manual cleaning process flushes accumulated debris from filters

Monitoring Equipment: The Eyes and Ears of Irrigation

Critical Measurements

Modern irrigation systems rely on continuous monitoring of multiple parameters to maintain optimal performance and water use efficiency.

- Water flow rate (gallons per minute)
- System pressure at multiple points
- Soil moisture at various depths
- Weather conditions (temperature, wind, humidity)
- Electrical conductivity (for fertilizer injection)
- pH level of irrigation water

1

Flow Meters

Measure water volume delivery, detect leaks, and ensure compliance with water allocations. Digital models can transmit data to central management systems and trigger alarms when flow exceeds programmed parameters.

2

Pressure Transducers & Gauges

Monitor system pressure to prevent damage to components and ensure proper operation of emitters. Transducers convert pressure readings to electrical signals for automated control systems.

3

Soil Moisture Sensors

Measure available water in the root zone using capacitance, resistance, or neutron technology. Networks of sensors throughout fields create moisture maps for precision irrigation management.

4

Weather Stations

Track environmental conditions affecting evapotranspiration rates and irrigation requirements. Data feeds into irrigation scheduling algorithms for automated adjustments to water application.

Modern monitoring systems increasingly incorporate wireless connectivity and cloud-based data platforms, allowing farmers to monitor irrigation systems remotely via smartphones and receive alerts when conditions require attention.

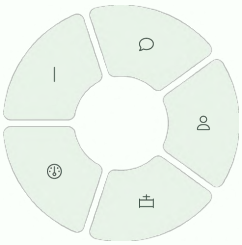
Pipes and Valves: The Irrigation Network

Mainlines

Large diameter pipes (typically 4-12 inches) that transport water from the source to the field. Usually made of PVC, aluminum, or HDPE with pressure ratings of 100-200 PSI.

Specialty Valves

Include pressure regulators, air release valves, check valves, and pressure relief valves that maintain system integrity and performance.



Submains

Medium diameter pipes (2-4 inches) that distribute water from mainlines to different zones or blocks within a field.

Laterals

Smaller diameter pipes (0.5-2 inches) that carry water directly to the crop rows, often containing the emitters or sprinklers.

Control Valves

Regulate water flow to different irrigation zones, allowing sequential watering for optimal pressure management. May be manual, electric, or hydraulic.

Modern irrigation networks are designed using hydraulic modeling software that optimizes pipe diameters, valve placements, and pressure zones to achieve uniform water distribution while minimizing infrastructure costs and energy consumption.

Irrigation Distribution: Lines and Sprinklers

Drip irrigation lines delivering precise amounts of water directly to plant root zones

Center pivot sprinkler system providing uniform coverage across large areas

Drip/Micro Irrigation

- Delivers water directly to root zone at 0.5-4 gallons per hour
- Achieves 90-95% application efficiency
- Reduces weed growth and foliar disease
- Ideal for row crops, orchards, and vineyards

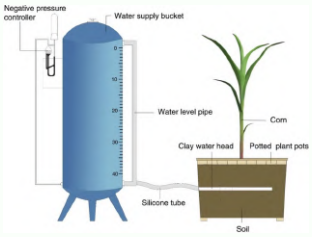
Sprinkler Systems

- Distributes water through overhead sprayers at 5-100+ gallons per minute
- Achieves 70-85% application efficiency
- Options include center pivot, linear move, and solid set systems
- Suitable for field crops, pastures, and frost protection

Surface Irrigation

- Traditional method using gravity flow through furrows or basins
- Achieves 40-70% application efficiency
- Low initial cost but higher labor requirements
- Common for flood-tolerant crops like rice

Maintaining Proper Pressure in Irrigation Systems



Pressure Requirements by System Type

System Type	Operating Pressure Range
Drip Irrigation	10-25 PSI
Microsprinklers	20-30 PSI
Solid Set Sprinklers	40-60 PSI
Center Pivots	30-80 PSI
Big Gun Sprinklers	70-100 PSI

Pressure Regulation Devices

- **Pressure Regulators:** Reduce and stabilize pressure to optimal levels for specific irrigation components
- **Pressure Relief Valves:** Protect system from pressure spikes that could damage pipes and components
- **Pressure Sustaining Valves:** Maintain minimum pressure requirements for system operation
- **Variable Frequency Drives (VFDs):** Adjust pump speed to maintain target pressure while reducing energy consumption

- ***Pressure Issues: Causes and Solutions***

  Too Low: Results in poor distribution uniformity and insufficient coverage
  - Check for pipe leaks or breaks
  - Verify pump performance and increase output if necessary
  - Reduce system demands by irrigating fewer zones simultaneously

- ***Pressure Issues: Causes and Solutions***

  Too High: Causes component damage, misting, and excessive wear
  - Install pressure regulators at critical points
  - Use pressure-compensating emitters
  - Implement VFD controllers to match pump output to system needs

Careers in Agricultural Irrigation

The agricultural irrigation industry combines technology, environmental science, and agricultural knowledge, creating diverse career opportunities for students interested in sustainable food production.

Irrigation System Designer

Creates custom irrigation solutions based on field conditions, crop types, and water availability. Combines engineering knowledge with agricultural expertise.

- Typical salary range: $60,000-$90,000
- Education: Bachelor's in Agricultural Engineering or related field

Precision Agriculture Specialist

Analyzes data from sensors and satellite imagery to optimize irrigation schedules and application rates for maximum efficiency.

- Works with AI and machine learning algorithms
- Creates prescription maps for variable rate irrigation
- Integrates multiple data streams into actionable insights

Environmental Consultant

Ensures irrigation practices comply with regulations and develops strategies to minimize environmental impact while maximizing crop production.

- Conducts water quality assessments
- Develops water conservation plans
- Assists with permitting and compliance documentation

AgTech Data Scientist

Develops algorithms and models that predict water needs based on multiple variables, helping farmers make data-driven decisions.

- Creates forecasting models for irrigation scheduling
- Develops software interfaces for farm management
- Optimizes resource allocation across operations

Key Takeaways

1

Critical Agricultural Infrastructure

Irrigation systems represent one of the most important technological advances in agriculture, enabling food production in otherwise unsuitable environments and increasing yields in traditional farming regions.

2

Technology Integration

Modern irrigation combines mechanical systems with digital technology, creating "smart" systems that respond to real-time conditions and conserve resources while optimizing crop growth.

3

Sustainability Focus

The future of irrigation is centered on water conservation, energy efficiency, and environmental protection while maintaining or improving agricultural productivity to meet global food demands.

4

Career Opportunities

The field offers diverse career paths that combine technology, environmental science, and agricultural knowledge–ideal for students interested in addressing real-world challenges.

Understanding irrigation systems provides insights into the complex relationship between water resources, agricultural production, environmental stewardship, and technological innovation. These interconnected aspects make irrigation a fascinating area of study with significant real-world implications.

Critical Thinking Discussion

1

Environmental Impact

- What are the potential ecological consequences of inefficient irrigation systems on local watersheds, groundwater supplies, and wildlife habitats?
- How might climate change affect irrigation needs and water availability in different agricultural regions over the next 50 years?
- Should water-intensive crops be grown in naturally arid regions, even with efficient irrigation? What are the ethical considerations?

2

Technological Future

- How might artificial intelligence and machine learning transform irrigation practices beyond what we see today?
- What barriers exist to widespread adoption of advanced irrigation technologies, particularly for small farms or in developing nations?
- How could autonomous systems and robotics integrate with irrigation management in the next decade?

3

Global Sustainability

- How does efficient irrigation contribute to meeting the UN Sustainable Development Goals, particularly those related to hunger, clean water, and climate action?
- What policy changes might help balance agricultural water needs with growing urban demands and ecosystem requirements?
- How might traditional knowledge and indigenous irrigation practices inform modern sustainable water management?

These questions are designed to stimulate deeper thinking about the complex interactions between technology, agriculture, environment, and society. Consider the multiple perspectives and stakeholders involved in each issue.

Pre-Presentation Survey: "How Farms Water Their Plants!" (2nd–3rd Grade)

Name: _____ Date: _____

1. Have you ever seen plants being watered on a farm or in a garden?

☐ Yes ☐ No ☐ Not sure

2. What do you think farmers use to water their plants? (Check all you think are true!)

☐ Hoses
☐ Buckets
☐ Sprinklers
☐ Giant watering cans

3. What do you want to learn about watering plants on farms?

---

4. Which of these jobs sounds interesting to you?

☐ Farm Technician
☐ Engineer
☐ Plant Doctor

Post-Presentation Survey: "How Farms Water Their Plants!" (2nd–3rd Grade)

Name: _____ Date: _____

1. What is one thing you learned about irrigation?

2. Which tool helps push water through the pipes?

☐ Filters ☐ Pump ☐ Tractor ☐ Shovel

3. Which job would you like to try?

☐ Farm Technician
☐ Engineer
☐ Plant Doctor
☐ Something else: _____

4. How do you help water plants at home?

Pre-Presentation Survey: "How Farms Use Irrigation to Water Crops" (4t – 5th Grade)

Name: _____ Date: _____

1. Have you ever seen how farms water their crops?

☐ Yes ☐ No ☐ Not sure

2. What do you think helps move water to plants on a farm? (Check all that apply.)

☐ Sprinklers
☐ Buckets
☐ Pipes and pumps

3. What would you like to learn about irrigation?

_____

_____

_____

4. Which job sounds the most interesting to you?

☐ Irrigation Technician
☐ Farm Scientist
☐ Drone Pilot

Post-Presentation Survey: "How Farms Use Irrigation to Water Crops" (4th–5th Grade)

Name: _____ Date: _____

1. What is one thing you learned about how irrigation works?

_____

_____

_____

2. What tool helps farmers know how wet or dry the soil is?

☐ Flow Meter ☐ Moisture Sensor ☐ Pump ☐ Filter

3. What job would you like to try?

☐ Irrigation Technician
☐ Farm Scientist
☐ Drone Pilot
☐ Something else: _____

4. Why is it important to save water on farms?

_____

_____

_____

Pre-Presentation Survey: "Irrigation Technology & Tools" (6th–8th Grade)

Name: _____ Date: _____

1. Have you ever learned about irrigation or how farms water their crops?

☐ Yes ☐ No ☐ Not sure

2. What tools do you think farmers use to deliver water to plants? (Check all that apply.)

☐ Sprinklers
☐ Pumps
☐ Buckets
☐ Pipes

3. What is one thing you're curious to learn about irrigation?

---

4. Which irrigation-related job sounds interesting to you?

☐ Irrigation Engineer
☐ Precision Agriculture Specialist
☐ Drone Technician
☐ Water Resource Manager

Post-Presentation Survey: "Irrigation Technology & Tools" (6th–8th Grade)

Name: _____ Date: _____

1. What is one way technology helps farmers use water more efficiently?

2. What does a flow meter do?

☐ Measures water pressure ☐ Tracks water usage
☐ Cleans pipes ☐ Delivers water

3. What irrigation career would you like to explore and why?

4. What could happen if farmers don't maintain their irrigation systems?

Pre-Presentation Survey: "Irrigation and Ag Technology" (9th–10th Grade)

Name: _____ Date: _____

1. How familiar are you with how farms water their crops?

☐ Very familiar
☐ Somewhat familiar
☐ Not familiar

2. What parts do you think are used in an irrigation system? (Check all that apply.)

☐ Pipes
☐ Pumps
☐ Sprinklers
☐ Electricity
☐ Cell phones

3. What are you most interested in learning today?

_____

_____

_____

4. Which irrigation-related career are you most curious about?

☐ Irrigation Technician
☐ Agricultural Engineer
☐ Environmental Scientist
☐ Precision Agriculture Specialist

Post-Presentation Survey: "Irrigation and Ag Technology" (9th–10th Grade)

Name: _____ Date: _____

1. What is one new thing you learned about irrigation systems?

2. What is the purpose of a flow meter in an irrigation system?

☐ To clean water ☐ To track water use ☐ To increase water pressure ☐ To water plants

3. What happens if water pressure is too low or too high?

4. Which career discussed today seems the most interesting to you and why?

Pre-Presentation Survey: "Irrigation Systems & Sustainability" (11th–12th Grade)

Name: _____ Date: _____

1. How would you rate your understanding of how farms use irrigation systems?

☐ Strong understanding
☐ Some understanding
☐ Limited or no understanding

2. What parts or tools do you think are used in modern irrigation systems? (Check all that apply.)

☐ Pumps
☐ Sprinklers
☐ Pressure sensors
☐ Drones
☐ Soil moisture sensors

3. What are you hoping to learn more about during this presentation?

4. Which career pathway related to irrigation interests you most?

☐ Irrigation System Designer
☐ Precision Agriculture Specialist
☐ Environmental Consultant
☐ AgTech Data Scientist

Post-Presentation Survey: "Irrigation Systems & Sustainability" (11th–12th Grade)

Name: _____ Date: _____

1. What is one new concept you learned about irrigation systems or technologies?

2. How can data analysis and digital monitoring improve irrigation outcomes?

3. Which sustainability practice stood out to you most and why?

4. How could careers in irrigation and ag technology help address global food and water challenges?

Pre-Presentation Survey: "Irrigation Systems & Sustainability" (Community College)

Name: _____ Date: _____

1. How familiar are you with agricultural irrigation systems?

☐ Very familiar
☐ Somewhat familiar
☐ Not familiar at all

2. What components or technologies do you think are used in modern irrigation? (Check all that apply.)

☐ Flow meters
☐ Pressure sensors
☐ Soil moisture sensors
☐ Drones
☐ Solar panels

3. What do you hope to gain from this presentation?

---

4. Which career pathway in irrigation are you most curious about?

☐ Irrigation System Designer
☐ Precision Agriculture Specialist
☐ Environmental Consultant
☐ AgTech Data Scientist

Post-Presentation Survey: "Irrigation Systems & Sustainability" (Community College)

Name: _____ Date: _____

1. What is one key takeaway you learned about irrigation systems?

2. How does digital monitoring improve irrigation efficiency?

3. What are some environmental or social challenges tied to irrigation?

4. How might the role of technology in irrigation evolve over the next decade?

Hands-On Activity Grades 2–3: Water Flow Explorers- Turning Valves and Watching Water Move

Learning Objectives:

• Observe how opening and closing valves changes water flow.

• Identify parts of the irrigation system such as valves, pumps, and sprinklers.

• Understand the cause-and-effect relationship in irrigation flow.

Materials Needed:

• Ag Irrigation Simulator with WiseConn node

• Solenoid valves

• Observation worksheet

Procedure:

1. Watch as your instructor opens and closes a solenoid valve using the WiseConn system.

2. Observe how water moves through the simulator when the valve is open versus closed.

3. Record what happens when one field valve is open and another is closed.

Student Questions & Reflection:

What happens when the valve is open?

Answer:

What happens when the valve is closed?

Answer:

Why do you think valves are important in farming?

Answer:

Hands-On Activity Grades 4–5: Filter Flow Detectives- Clean vs. Dirty Water

Learning Objectives:

• Understand how sand media filters clean irrigation water.

• Observe how water clarity and flow change after filtration.

• Recognize why filtration is necessary in irrigation systems.

Materials Needed:

• Ag Irrigation Simulator with sand media filter station

• WiseConn node and solenoid valves

• Observation worksheet

Procedure:

1. Observe the simulator before and after water passes through the sand media filter station.

2. Record the difference in water clarity and pressure.

3. Discuss what would happen if filters were not used in irrigation.

Student Questions & Reflection:

How does the filter change the water flow?

Answer:

What might happen to the system without a filter?

Answer:

What materials do you think could clog drip lines?

Answer:

Hands-On Activity Grades 6–8: Pressure Power- Measuring Flow and PSI

Learning Objectives:

• Measure how water pressure affects flow rate and uniformity.

• Understand how PSI determines irrigation performance.

• Analyze how high or low pressure impacts water delivery.

Materials Needed:

• Ag Irrigation Simulator with pressure transducers and flow meter

• WiseConn node and VFD control

• Student data sheet

Procedure:

1. Record PSI readings at the filter inlet and outlet.

2. Adjust the system PSI using the VFD and note the flow rate (GPM) change.

3. Compare high and low pressure readings and discuss uniformity of water flow.

Grades 6–8 Log Sheet - Pressure Power

Field or Valve Tested	
PSI at Filter Inlet	
PSI at Filter Outlet	
Flow Rate (GPM)	
Field or Valve Tested	
PSI at Filter Inlet	
PSI at Filter Outlet	
Flow Rate (GPM)	
Field or Valve Tested	
PSI at Filter Inlet	
PSI at Filter Outlet	
Flow Rate (GPM)	

Student Questions & Reflection:

What happens to water flow when pressure increases?

Answer:

What happens when pressure decreases?

Answer:

Why is maintaining correct PSI important?

Answer:

Hands-On Activity Grades 9–10: Smart Irrigation Operators- System Monitoring and Troubleshooting

Learning Objectives:

• Operate irrigation valves using the WiseConn digital control system.

• Interpret system alerts related to leaks or blockages.

• Troubleshoot irrigation issues using sensor feedback.

Materials Needed:

• Ag Irrigation Simulator with WiseConn node and solenoid valves

• Pressure transducers

• Student log sheet

Procedure:

1. Log into the WiseConn control dashboard.

2. Open and close different solenoid valves to simulate irrigation in multiple fields.

3. Use pressure readings to detect a simulated blockage or leak.

4. Record actions and results on your worksheet.

Grades 9–10 Log Sheet – Smart Irrigation Operators

Valve or Zone Controlled	
Pressure Reading (PSI)	
Flow Rate (GPM)	
Leak Indicator (Yes / No)	
Blockage Indicator (Yes / No)	
System Action Taken (Open/Close Valve, Adjust PSI, etc.)	
Outcome of Action	
What did the data show about your system performance?	
Valve or Zone Controlled	
Pressure Reading (PSI)	
Flow Rate (GPM)	
Leak Indicator (Yes / No)	
Blockage Indicator (Yes / No)	
System Action Taken (Open/Close Valve, Adjust PSI, etc.)	
Outcome of Action	
What did the data show about your system performance?	
Valve or Zone Controlled	
Pressure Reading (PSI)	
Flow Rate (GPM)	
Leak Indicator (Yes / No)	
Blockage Indicator (Yes / No)	
System Action Taken (Open/Close Valve, Adjust PSI, etc.)	
Outcome of Action	
What did the data show about your system performance?	

Student Questions & Reflection:

How can you tell if there is a blockage in the system?

Answer:

____

____

What data helps you detect a leak?

Answer:

How can technology make irrigation more efficient?

Answer:

Hands-On Activity Grades 11–12: Efficiency Engineers- Balancing PSI, Flow, and Energy

Learning Objectives:

• Test how pump speed (VFD) affects PSI, GPM, and energy efficiency.

• Understand the relationship between energy use and irrigation performance.

• Optimize irrigation settings for uniform water distribution.

Materials Needed:

• Ag Irrigation Simulator with VFD, flow meter, and pressure sensors

• WiseConn node

• Energy and efficiency worksheet

Procedure:

1. Use the VFD to adjust pump speed and record PSI and GPM readings.

2. Compare energy use at different PSI settings.

3. Discuss which PSI provided the most uniform irrigation with the least energy use.

Grades 11–12 Log Sheet- Efficiency Engineers

VFD Setting (Speed %)	
PSI Reading	
Flow Rate (GPM)	
Energy Use (Watts or % Load)	
Calculated Efficiency (%)	
Notes on Water Uniformity	
VFD Setting (Speed %)	
PSI Reading	
Flow Rate (GPM)	
Energy Use (Watts or % Load)	
Calculated Efficiency (%)	
Notes on Water Uniformity	
VFD Setting (Speed %)	
PSI Reading	
Flow Rate (GPM)	
Energy Use (Watts or % Load)	
Calculated Efficiency (%)	
Notes on Water Uniformity	

Student Questions & Reflection:

What happens to energy use when PSI increases?

Answer:

What is the most efficient setting you found?

Answer:

How could farmers use this data to save energy and water?

Answer:

Hands-On Activity Community College: Operational Optimization Lab-Data Analysis and System Design

Learning Objectives:

• Analyze system data from the Ag Irrigation Simulator (PSI, GPM, energy use).

• Interpret pump efficiency curves and make recommendations for optimization.

• Apply real-world irrigation management principles to system operation.

Materials Needed:

• Ag Irrigation Simulator with full WiseConn integration

• VFD, pressure transducers, and flow meter

• Lab data sheet and technical report template

Procedure:

1. Collect PSI and flow rate data at different VFD pump speeds.

2. Use the pump efficiency curve to identify the optimal operating range.

3. Prepare a short report summarizing your findings and recommending best practices.

Community College Log Sheet – Operational Optimization Lab

VFD Speed (%)	
Field or Zone	
Pressure In (PSI)	
Pressure Out (PSI)	
Flow Rate (GPM)	
Energy Draw (Watts)	
System Efficiency (%)	
Comments & Observations	
VFD Speed (%)	
Field or Zone	
Pressure In (PSI)	
Pressure Out (PSI)	
Flow Rate (GPM)	
Energy Draw (Watts)	
System Efficiency (%)	
Comments & Observations	
VFD Speed (%)	
Field or Zone	
Pressure In (PSI)	
Pressure Out (PSI)	
Flow Rate (GPM)	
Energy Draw (Watts)	
System Efficiency (%)	
Comments & Observations	

Student Questions & Reflection:

At what PSI and flow rate did the system operate most efficiently?

Answer:

How can VFD adjustments improve irrigation sustainability?

Answer:

What data trends would you monitor in a real farm setting?

Answer:

Video Demonstration

The video demonstration introduces viewers to the Ag Irrigation Simulator, a scaled model designed to show how modern irrigation systems manage water efficiently.

It begins with an overview of the WiseConn node, highlighting remote access and real-time valve control through a digital dashboard. Viewers then see how water flows through the sand media filter station, where impurities are removed.

Next, the video demonstrates the Variable Frequency Drive (VFD) adjusting pump speed to maintain constant pressure (PSI), supported by live readings from the flow meter and pressure transducers. The pressure relief valve**,** air vent, and flush controller are shown maintaining safe and consistent operation through automatic pressure release, air regulation, and backflush cycles.

The demonstration concludes by showing how all components work together to form a precision irrigation system: balancing water flow, energy use, and environmental stewardship, while modeling the same technology used in professional agricultural operations.

https://www.youtube.com/watch?v=h14K7xPQSa0