WReN
Water Resources North

Smart Agricultural Water Resources Toolkit

aquaconsultants
An Adler & Allan company

NFU

Environment Agency

NORTHUMBRIAN WATER living water

YorkshireWater

hartlepool water

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Introduction

The UK's food and water systems are under increasing stress.

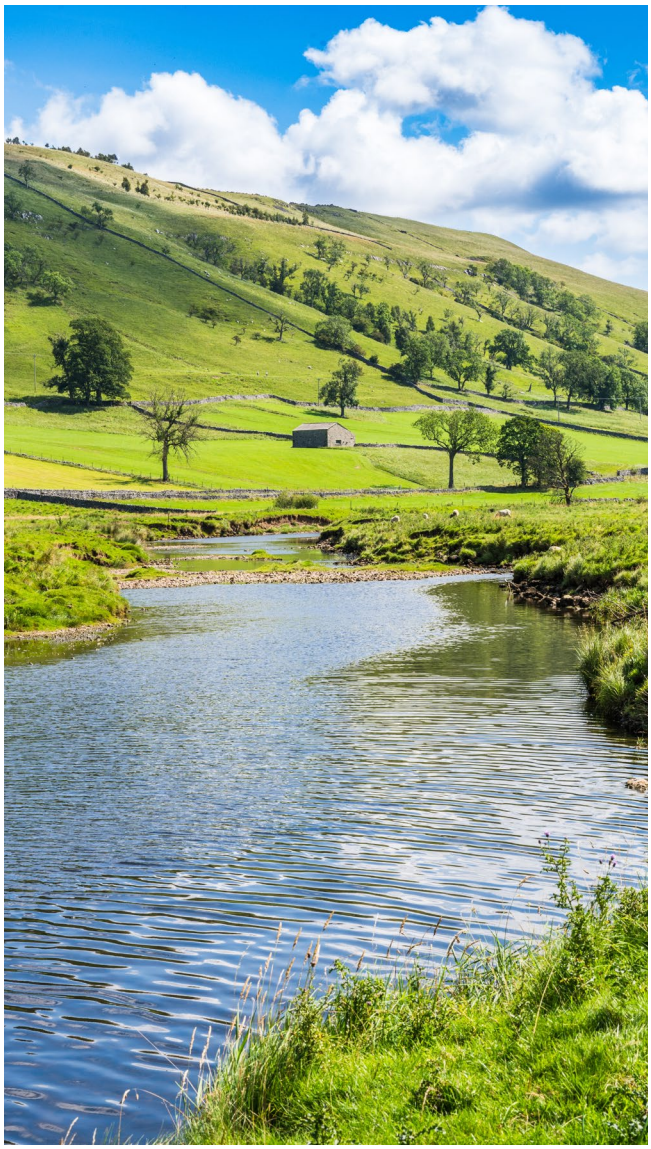
Climate change is intensifying the frequency and severity of droughts and floods, while our growing population places added pressure on already stretched water resources. Agriculture, which sits at the intersection of food production, environmental stewardship and water use, is especially vulnerable. Growing regulatory and supply pressures mean that farms must effectively manage water resources and plan for the future of their farm operations.

This toolkit has been created to help farmers, growers and land managers explore practical, achievable ways to plan for effective water use and build resilience at both farm and catchment scale. It introduces a range of interventions that could be considered from soil and crop management to monitoring technologies, storage, water recycling and collaborative approaches. The guide can be read from start to finish or dipped into by topic, depending on the user's needs.

Real-world examples from across the WReN area on page 47 demonstrate how different farms are adapting, and the toolkit signposts further guidance, funding opportunities on page 44 and initiatives, including Local Resource Options and Water Abstractor Groups. Some interventions may require planning permission, permits or early engagement with land managers and advisers, farmers are encouraged to seek advice at an early stage.

To support decision-making, a Smart Water Management Decision Tree is included on page 53, aiming to help users identify where to begin based on their farm type, budget and level of water risk. Together, this toolkit aims to support a whole-farm approach to water management and prepares farms for planning for future water resilience.

> *"A user friendly smart agri-water resource toolkit tailored specifically for the locality of the Water Resources North region and informed by real world experience."*



About WReN

Water Resources North (WReN) is a regional group to support long-term water resources for Yorkshire and the North East of England.

We are one of five regional groups which were established to put aside water company boundaries and think about the water needs of the region as a whole. They bring together water companies and other water using sectors to enable a cross-sector and collaborative approach to the planning and management of water resources.

WReN's core water companies, Northumbrian Water, Yorkshire Water and Hartlepool Water work together in collaboration with other stakeholders who have an interest in water resources across the region including representatives from regulatory bodies such at the Environment Agency and Ofwat, environmental organisations such as river and wildlife trusts, and other sectors such as energy, agriculture, navigation and manufacturing and industry.

The ambitions of WReN, through collaboration are

- Long-term water security
- Enable growth and net zero
- Environmental and climate resilience
- Early risk visibility and adaptive planning
- Integrated planning and policy influencing.

> *In the WReN region rainfall can be high but it doesn't always fall when and where crops need it.*

Effective water management enables farms to:

- Improve business resilience during dry periods and extreme weather events.
- Use available water more efficiently, supported by enhanced storage capacity and more precise application.
- Reduce environmental impacts and contribute to healthier, more resilient catchments.
- Prepare for future abstraction pressures and upcoming policy or regulatory changes.
- Unlock opportunities for collaboration, including shared infrastructure and collective water solutions.

Local Resource Options

Recognising the urgent need to enhance water resilience in farming, the government launched a fund in April 2024, and the Environment Agency (EA) set up Local Resource Options (LROs) studies, a framework to support farmers to work together on water resource solutions at a catchment scale. LROs have become an important step in exploring the sustainability and resilience of agricultural water resources, offering scalable, locally tailored solutions rooted in collaboration.

The agricultural sector faces escalating pressures including water scarcity, increased food demand, drought, flooding and potential abstraction licence reviews. To safeguard national food security, the EA set up LROs studies to enable farmers to investigate collaborative LROs in their catchments. The ambition is aligned with landmark schemes such as the Felixstowe Hydrocycle[1] and Lincoln Water Transfer[2], which demonstrate the power of catchment-scale cooperation to deliver long-term agricultural resilience. The National Framework for Water Resources 2025, published by the EA, sets out the pressures facing the sector and provides guidance on how the EA will review abstraction licences and work with licence holders where changes are required.

2024 - 2026 LRO Screening Studies at a Glance

To further explore information on LRO screening studies, including eligibility criteria, examples of water-resilience solutions, and application requirements, visit: **engageenvironmentagency.uk.engagementhq.com/local-resource-options-screening-studies**

Reach

33 studies | 177 farms | ~28,400,000m³ of water currently licenced by farms

Water Potential

12M+ m³/year potential new supply from top-ranked LROs

£0.38/m³ average cost

Economic Impact

£53M/year potential water value

Collaboration

12 Water Abstractor Groups are forming or active

100+ farmers involved

Environmental Benefit

58 farms in protected zones

"Taking part in an LRO study was an extremely positive experience for us. The application process was straightforward and quick to complete, and the support we received throughout was clear, practical and genuinely valuable. The final report set out a wide range of opportunities, giving us a realistic picture of what could be delivered on the ground. It also highlighted the potential for a more circular approach to water management and reinforced just how important it is to build long-term water resilience for the future."

- Anthony Hopkins, Wroot Farming Co.

Environment Agency. Local Resource Options – Screening Studies (2026) engageenvironmentagency.uk.engagementhq.com/local-resource-options-screening-studies

1 Felixstowe Hydrocycle Ltd. "Innovative, farmer-led water supply and management company." March 2, 2026. felixstowehydrocycle.com

2 "Managing Water Resources in Lincolnshire – Lincoln Water Transfer," NFUonline, March 2, 2026, nfuonline.com/news/managing-water-resources-in-lincolnshire

Water Abstractor Groups

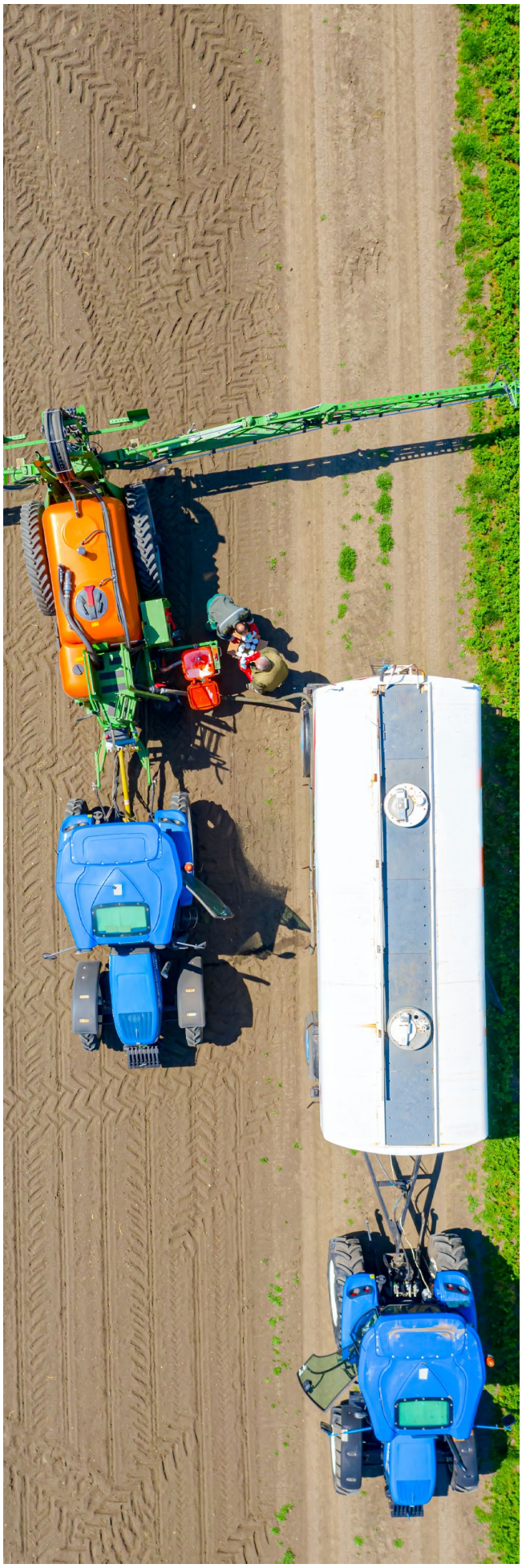
Water Abstractor Groups (WAGs) are local, farmer-led groups that coordinate water abstraction and management within a shared catchment or watercourse.
By working collectively, members can improve the effective and resilient use of their water, reduce pressures on local water resources, and support more sustainable abstraction practices. Through cooperation, WAG members are better able to align abstraction with availability, manage peak-demand periods, share information, and develop joint solutions that strengthen both individual and catchment-wide water security.

To further explore WAGs, including how they operate, the benefits they offer, and what's involved in setting one up, for more information see:

- **ukia.org/docs/booklets/Working%20together.pdf**
- **ukia.org/wags**
- **waterresourceswest.co.uk/agriculture**

These initiatives are essential mechanisms for enabling coordinated water management across a shared catchment, supporting collective planning, and decision-making that recognises the interconnected nature of water availability, abstraction pressures, and environmental requirements.

Both LROs and WAGs help strengthen communication, build trust, and develop a shared understanding of local water challenges and opportunities. This collaborative foundation allows abstractors to take a proactive approach to managing water resources during periods of scarcity, while also supporting long-term sustainable water use.



The Value of Land Managers

Land managers and professional advisers play an essential role in helping farmers plan, prioritise and implement effective water management strategies.

Their expertise provides vital context on soils, regulations, infrastructure needs and long-term business planning, and the NFU highlight the importance of seeking advice before making significant changes on farm. While this toolkit is designed to support thinking, spark ideas and guide early planning, it is not intended to replace tailored professional guidance. Farmers are encouraged to use the toolkit as a starting point for wider discussions with land managers, agronomists, catchment advisers, water specialists WAGs and LROs, ensuring that chosen interventions are practical, fully compliant and suited to the specific needs and risks of the farm.

> *"Farmers and growers rely upon a steady supply of clean and plentiful water to safeguard the nation's food security. As the weather becomes more unpredictable and the cycle of drought and flooding has become more extreme, regularly breaking records and undermining the stability and resilience of farming businesses. Managing every drop wisely isn't just good practice, it's essential for keeping British food production resilient and sustainable, both now and into the future. That's why seeking timely advice from advisers and specialists is so important, helping farmers make confident, practical decisions that help plan water management that is appropriate to their farm."* - The NFU

Signpost to water resources overall guidance

- UKIA Irrigation booklets available to purchase or free to members: **ukia.org/resources-booklets**
- UKIA guidance for Smart Water Resources: **ukia.org/3d-flip-book/smart-water-resources**
- Water-saving measures in large scale farming: **castlewater.co.uk/blog/water-saving-measures-in-large-scale-farming**
- Abstraction licensing strategies: **gov.uk/government/collections/water-abstraction-licensing-strategies-cams-process**
- EA Water Hub: **engageenvironmentagency.uk.engagementhq.com/hub-page/water-hub**
- Rivers Trust Agricultural Advice Hub **aghub.catchmentbasedapproach.org/pages/connections**
- EA guide to licence trading: **gov.uk/guidance/trade-water-abstraction-rights**
- WReN website: https://www.waterresourcesnorth.org/
- WRE agricultural practical guidance: https://wre.org.uk/agricultural-water-resources/
- WRW agricultural practical guidance: https://waterresourceswest.co.uk/agriculture

Interventions

1. Precision Irrigation Systems

Micro-Irrigation Systems (Drip or Trickle Irrigation)

Sends water straight to the base of crops so none is wasted.

What It Involves

Install a network of drip lines or trickle tapes along crop rows to deliver small, steady amounts of water directly to the root zone. A typical setup includes a pump or header tank, filtration units to stop emitter blockage, pressure regulators, mainlines and sub-mains, and emitters spaced to suit the crop. Commissioning involves pressure checks, flushing lines, and (optionally) linking to timers or soil-moisture sensors. Operates at low pressure, reducing energy use and evaporation losses.

Applies water precisely where plants take it up, cutting evaporation, runoff, and deep percolation. Lowers total abstraction, stretches on-farm storage through dry spells, and improves yield stability under drought. Works well with lower-quality water when filtration is in place.

✓ Agricultural Benefits
Higher water use efficiency
More uniform yields
Reduced disease risk from drier canopies
Improved fertiliser efficiency when using alongside fertigation
Less soil compaction and mud from machinery tracks, from less field access required

Considerations
Upfront design complexity
Emitter clogging if filtration or water quality is poor
Risk of rodent damage
Requires seasonal retrieval in some systems
Local consents for abstraction or storage still apply

Level of maintenance
Medium

£ Cost
Medium to High

1. Precision Irrigation Systems

Variable Rate Irrigation (VRI)

Applies more water where it's needed and less where it isn't.

What It Involves

Upgrade centre-pivot or linear systems with zone-controlled nozzles and a programmable controller. Create variable-rate "prescriptions" from soil maps, yield maps, elevation/ topography, and probe data. The pivot adjusts output automatically as it moves across mapped zones. Sensors and weather inputs can refine rates in-season.

Targets water to variable soils and crop needs, preventing over-watering on heavy ground and boosting dry/sandy patches. Reduces pumping volumes and energy, improves uniformity and water-use efficiency across heterogeneous fields.

✓ Agricultural Benefits
Water savings
Yield stabilisation across zones
Reduced lodging and waterlogging
Improved nitrogen use efficiency by avoiding excess water

Considerations
Needs reliable mapping and control hardware
Complexity in setup
Training required for operators
Electrical and IT reliability required
May need manufacturer support

Level of maintenance
Medium

£ Cost
High (retrofit/new hardware)

Additional information

wre.org.uk/smart-irrigation-trial

sustainability-directory.com/term/variable-rate-irrigation-vri

gardenot.com/smart-irrigation/smart-sprinkler

1. Precision Irrigation Systems

Smart Sprinkler Systems

Sprinklers turn on and off at the right time automatically.

What It Involves

Combine sprinklers with automated valves, timers, and weather/soil sensors. Controllers schedule irrigation at low-evaporation times (night/early morning) and pause automatically when rainfall occurs or moisture thresholds are met. Farmers can manage systems from a phone or web app and flow alarms can flag faults.

Prevents unnecessary irrigation by reacting to real-time conditions. Cuts evaporation and runoff, avoids watering before/after rain, and reduces peak demand on tanks/ reservoirs.

✓ Agricultural Benefits
Water savings and labour reduction
Better timing improves crop quality
Less soil compaction and mud from machinery tracks, from less field access required

Considerations
Connectivity dependence
Sensor placement critical
Hardware exposed to weather
Ensure frost and surge protection

Level of maintenance
Low to Medium

£ Cost
Low to Medium

Additional information
ukuncut.org.uk/how-a-smart-irrigation-system-can-cut-your-water-bill
smarthomeace.com/what-is-a-smart-irrigation-system

2. Soil Moisture & Environmental Sensing

Soil Moisture Sensors

Shows how wet the soil really is so you only irrigate when needed.


Image: Delta-T Devices

What It Involves

Install probes at multiple depths (e.g., 10/30/60 cm) in representative fields. Connect to a data logger/telemetry and view moisture curves, refill points, and stress thresholds on a dashboard. Use alerts to guide irrigation starts/stops and to assess effectiveness of each event or rainfall.

Replaces guesswork with measured soil water status. Limits stress during dry periods and improves matching of irrigation to crop need, reducing abstraction and improving resilience.

✓ Agricultural Benefits
Reduced stress and improved yield quality
Fewer disease issues from over wet soils
Fuel and labour savings

Considerations
Calibration effort
Sensor drift or failure
Telemetry costs
Care required during cultivation and harvest

Level of maintenance
Low to Medium

£ Cost
Low to Medium

Additional information
fwi.co.uk/machinery/technology/guide-to-soil-moisture-sensors-why-use-them-and-the-options

2. Soil Moisture & Environmental Sensing

Weather Stations

Gives local weather data so you can plan irrigation timing.

What It Involves

Mount a station in an open, representative area away from obstructions. Sensors record rainfall, temperature, humidity, wind speed, and solar radiation. Data streams to a cloud dashboard and can feed irrigation planning or schedulers.

Local weather data prevent double-watering after showers and improve timing/volume of irrigation. Supports abstraction planning and storage sizing ahead of high-demand periods.

Image: Delta-T Devices

✓ Agricultural Benefits
Better irrigation timing
Fuel savings
Improved disease forecasting windows
Supports operational planning (sprays, haymaking)

Considerations
Occasional sensor failure
Siting errors can bias data
Subscription fees

⚙ Level of maintenance
Low

£ Cost
Low to Medium

2. Soil Moisture & Environmental Sensing

Crop Water Stress Sensors

Alerts you early when crops start to struggle.

What It Involves

Use thermal cameras or optical sensors (fixed, tractor-mounted or on drones) to detect early canopy stress not visible to the eye. Data is mapped into heat/stress layers showing hotspots that need attention. Setup includes sensor mounting, data capture routines, and software thresholds/alerts.

Finds water-stress hotspots early, enabling targeted irrigation instead of blanket applications. Saves water and protects yield by intervening where it matters most.

✓ Agricultural Benefits
Higher water productivity
Better quality uniformity
Timely intervention reduces losses

Considerations
Requires interpretation
Cloudy or windy conditions can affect readings
Data processing and subscription costs

Level of maintenance
Medium

£ Cost
Medium

Additional information
hutton.ac.uk/scientific-services/research-collaborations/agri-tech/sensors

2. Soil Moisture & Environmental Sensing

Soil Salinity Sensors

Detect salt levels affecting water uptake.

What It Involves

Install electronic conductivity (EC) probes at relevant depths in fields prone to salt build-up or using marginal/recycled water. Track trends over time and pair with drainage/irrigation adjustments or leaching events as needed.

Manages salinity that reduces plants' ability to take up water. Optimises irrigation volumes and leaching only when necessary, protecting soil and saving water over the season.

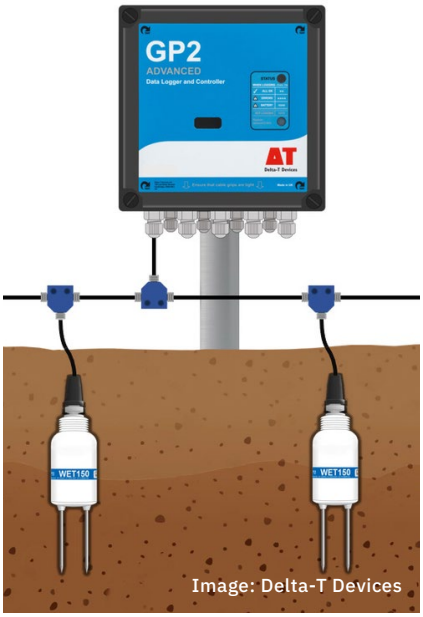


Image: Delta-T Devices

✓ Agricultural Benefits
Maintains yield and soil health
Supports use of alternative water sources safely

Considerations
Over leaching can waste water and mobilise nutrients
Sensor care and calibration needed

Level of maintenance
Low to Medium

£ Cost
Low to Medium

Additional information
intechopen.com/chapters/82324

3. Data & Decision Support Platforms

Farm Management Software

Keeps all your field and water information in one place.

Image: Delta-T Devices

What It Involves

Use thermal cameras or optical sensors (fixed, tractor-mounted or on drones) to detect early canopy stress not visible to the eye. Data is mapped into heat/stress layers showing hotspots that need attention. Setup includes sensor mounting, data capture routines, and software thresholds/alerts.

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Data processing and subscription costs

Level of maintenance
Medium

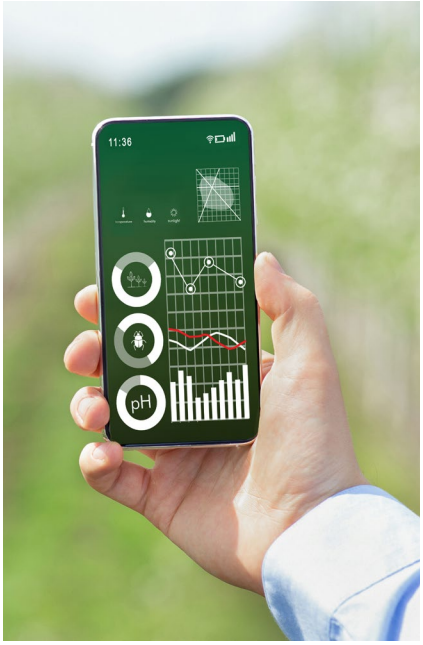
£ Cost
Medium

Additional information
hutton.ac.uk/scientific-services/research-collaborations/agri-tech/sensors

3. Data & Decision Support Platforms

Irrigation Scheduling Tools

Tells you the best day and amount to irrigate.



What It Involves

Dashboards that combine data sources including weather, evapotranspiration, soil moisture, crop stage and soil type to recommend when/how much to irrigate. Farmers input crop details and target thresholds and the tool outputs irrigation “windows” and volumes. Can run standalone or drive automated valves.

Cuts over-irrigation and prevents watering before rain. Saves pumping costs and increases water-use efficiency by aligning application with crop demand.

✓ Agricultural Benefits
Consistent yields
Reduced stress
Fuel and labour savings
Better nutrient utilisation

Considerations
Model error risk
Requires user trust and periodic recalibration
Subscription fees

Level of maintenance
Low

£ Cost
Low to Medium

Additional information
fwi.co.uk/machinery/technology/probcast-weather-app-gives-growers-insights-into-rain-risk

3. Data & Decision Support Platforms

AI & Machine Learning Models

Helps predict when crops will need more water.

What It Involves

Predictive analytics that ingest historical farm data, current sensors, weather forecasts and remote sensing to forecast water demand, stress risk and best timing. Outputs appear as maps, alerts, and recommended set-points. Learns from outcomes each season.

Enables forward planning of storage and abstraction. Increases precision of water allocation, reducing waste and improving drought resilience.

✓ Agricultural Benefits
Higher water productivity
Proactive risk management
Operational efficiency

Considerations
Black box perception
Data privacy
Model drift
Requires support

⚙ Level of maintenance
Medium

£ Cost
Medium

3. Data & Decision Support Platforms

Decision Support Systems (DSS)

Gives simple recommendations to improve water use.

What It Involves

Integrates multiple inputs (soil, crop, weather, sensors, infrastructure status) and converts them into clear, ranked actions (e.g., “Irrigate Block 3 tomorrow: 22 mm”). Often includes what-if scenarios and risk indicators.

Turns complex data into actionable decisions that save water and protect yields, improving whole-farm efficiency and resilience.

✓ Agricultural Benefits
More consistent outcomes
Better team coordination
Time savings

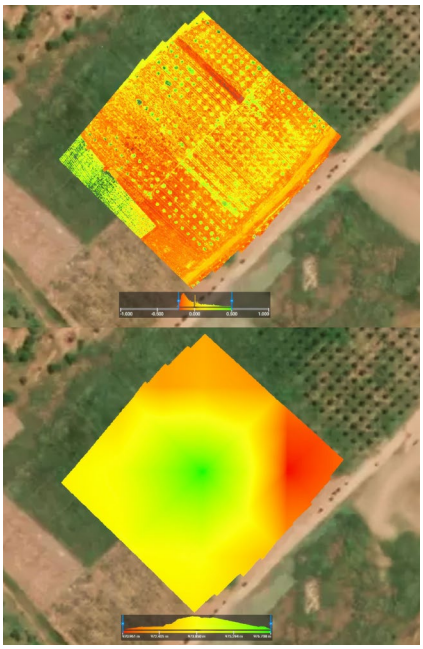
Considerations
Change management
Subscription or licensing requirements
Need for data governance

Level of maintenance
Medium

£ Cost
Medium

4. Remote Sensing & Mapping

Satellite Imagery



Shows where crops are struggling so you can target water.

What It Involves

Satellite imagery provides a cost-effective, large-scale method for monitoring crop water stress and supporting water resource management decisions. Satellites enable regional to national-scale assessment, making them particularly useful for catchment planning.

Rapidly identifies stressed or uneven areas so irrigation can be targeted. Reduces blanket watering and improves return on each m^3 applied.

✓ Agricultural Benefits
Better targeting
Early issue detection
Improved uniformity

Considerations
Weather windows
Pilot or contractor availability
Data processing workload

Level of maintenance
Low to Medium

£ Cost
Medium

4. Remote Sensing & Mapping

Drone Mapping

Highlights water stressed planted areas you can't see from the ground.

What It Involves

Drones can help identify and respond to crop water stress quickly and accurately. Equipped with multispectral or thermal cameras, drones can capture high-resolution imagery that highlights variations in plant health and soil moisture across fields.

Early stress detection supports water savings by focusing irrigation or changing timing where it will have the biggest impact.

✓ Agricultural Benefits
Improved water productivity
Better quality
Reduced inputs

Considerations
Cost of sensors/processing
Need for interpretation
Weather dependency

Level of maintenance
Medium

£ Cost
Medium to High

4. Remote Sensing & Mapping

Thermal & Multispectral Sensors

Use light reflectance and crop temperature to detect where plants are under water stress.

What It Involves

Thermal and multispectral sensors are key tools for detecting crop water stress and supporting efficient water resource management. These sensors can be mounted on drones, aircraft, or satellites and provide detailed insights into plant health and moisture status.

When used together, multispectral sensors provide early vegetative stress detection, while thermal sensors offer a direct physiological measure of water stress. Combined, they provide a robust evidence base for precision irrigation and strategic water resource planning.

✓ Agricultural Benefits
Broad coverage
Historical trends
Benchmarking across fields/farms

Considerations
Cloud cover limits some products
Spatial resolution varies
Subscription costs

⚙ Level of maintenance
Low

£ Cost
Low to Medium

5. Automated & Controlled Irrigation

Centralised Control Systems

Sends field information to your phone or computer.

What It Involves

Install a farm gateway (LoRa/Cellular) and pair soil probes, weather nodes, flow meters, trough sensors, and tank level monitors. Data flows to one dashboard with alerts and APIs to other tools.

Real-time visibility of water status/use reduces waste, enables fast fixes (e.g., leak alerts), and improves scheduling accuracy.

✓ Agricultural Benefits
Faster fault detection
Labour savings
Better coordination

Considerations
Signal coverage
Device robustness
Battery life
Subscription fees

Level of maintenance
Medium

£ Cost
Medium

5. Automated & Controlled Irrigation

IoT Actuated Valves & Pumps

Irrigation runs automatically without constant checks.

What It Involves

Fit solenoid valves/variable-speed pumps and link to timers, soil thresholds, or DSS commands. Configure start/stop rules, safety interlocks, and fail-safe modes. Remote control via app; logs for audit.

Ensures water runs only when needed, stabilises soil moisture, and prevents over-irrigation, saving water and energy.

✓ Agricultural Benefits
Water and labour savings
More consistent crop performance
Lower night time labour

Considerations
Electrical/control complexity
Power quality
Spares/servicing

Level of maintenance
Medium

£ Cost
Medium to High

5. Automated & Controlled Irrigation

Smart Timers & Flow Controllers

Helps stop over-watering and saves time.

What It Involves

Install digital timers at pump panels and inline controllers to cap flow or maintain set rates. Use calendars to avoid hot/ windy periods and utalise rain skip features.

Caps duration/flow to prevent excess application; avoids peak-loss periods, cutting evaporation and runoff.

✓ Agricultural Benefits
Immediate water savings with minimal disruption
Labour efficiency

Considerations
Limited by existing hydraulics
User discipline still needed

⚙ Level of maintenance
Low

£ Cost
Low

6. Water Recycling & Storage Enhancements

Water Recycling

Re-use of water from on-site operations.

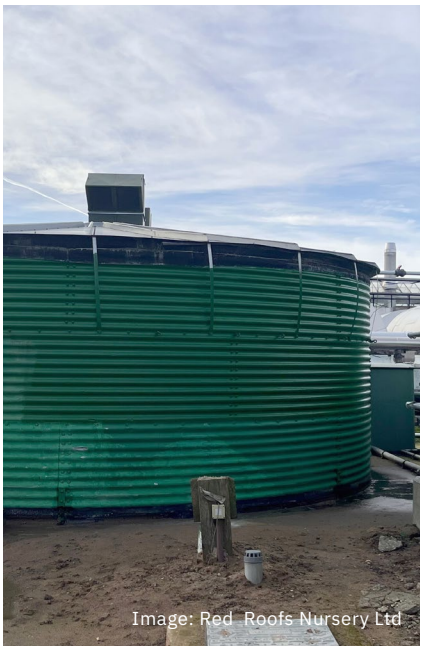


Image: Red Roofs Nursery Ltd

What It Involves

Water recycling helps farms make better use of the water they already have. Instead of allowing used water from produce wash lines, dairy operations, packhouses or yard cleaning to go straight to waste, it is collected, cleaned and used again for suitable farm tasks. This reduces the amount of fresh water the farm needs to abstract or purchase, which is especially valuable during dry periods or when water supplies are restricted.
By re-using on-site water, farms strengthen their resilience and lessen pressure on local water sources.

Water recycling reduces net agricultural water demand by substituting appropriately treated process water for abstracted or mains supplies. By capturing internal wastewater streams and passing them through staged treatment processes such as sediment removal, filtration, biological polishing or disinfection, farms can lower peak abstraction requirements, reduce total consumptive use and stabilise supply throughout the season. This increases the efficiency of each cubic metre entering the farm system, improves water-use ratios and reduces hydrological pressure on local surface water and groundwater bodies. Recycling also decreases the volume and pollutant load of wastewater released to the environment, lowering nutrient, sediment and biochemical oxygen demand impacts.

✓ Agricultural Benefits
Reduced water bills and abstraction costs
More reliable supply during droughts or restrictions
Supports future proofing
Cleaner yards and reduced sediment pollution
Lower pressure on on farm boreholes
Enables higher water availability for priority uses (e.g. irrigation)
Can improve wash down efficiency with a constant supply of non potable water

✓ Agricultural Benefits for packhouses or processors
Stabilises supply costs
Reduces wastewater disposal volumes
Improves environmental performance metrics for buyers/retailers

Considerations

Water quality can limit for food contact or irrigation use and will need to meet red tractor and hygiene standards

Incorrect separation of clean/dirty water can undermine system efficiency

Potential odour or sludge build up if tanks/ settlement not maintained

Capital costs can be significant for advanced filtration or UV systems

Some recycled water unsuitable for irrigation of edible crops

Permits may be required depending on discharge or reuse type

Storage can attract algae or mosquito growth without covers/management

Winter freezing risk if tanks/pipes not insulated

£ Cost

Medium to High

Level of maintenance

Medium (UV treatment could make it High)

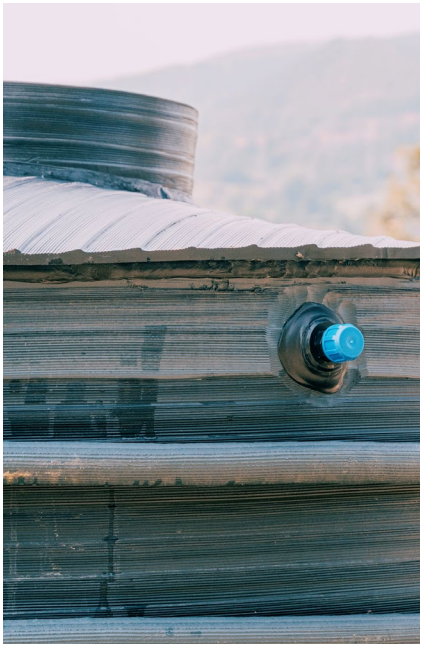
Image: Red Roofs Nursery Ltd

Additional information

anglianwater.co.uk/globalassets/non-potable-reuse-summary-report_april-2025.pdf

6. Water Recycling & Storage Enhancements

Rainwater Harvesting Systems



Collects and stores rain for later use.

What It Involves

Rainwater harvesting systems collect and store rainfall from roofs or other surfaces for later use, reducing demand on mains water and abstraction sources.

Reduce reliance on mains supply and licensed abstraction by capturing and storing rainfall for beneficial reuse. Acts as a demand-reduction and resilience measure, helping balance water supply and demand.

✓ Agricultural Benefits
Cuts bills and abstraction
Buffers dry spells
Improves biosecurity (clean water for wash down)

Considerations
Storage safety
Water quality management
Mosquito/algae control
Structural loading checks

Level of maintenance
Low to Medium

£ Cost
Medium

Additional information

ukwra.org.uk/rainwater-harvesting

ecosystemsdirect.co.uk/uploads/documents/Rainwater%20Harvesting%20on%20Farms(2).pdf

d-risk.eu/index.php?params=rwhtool

ukia.org/3d-flip-book/rwh-book-1

gov.uk/government/publications/rainwater-harvesting-regulatory-position-statement/rainwater-harvesting-regulatory-position-statement

6. Water Recycling & Storage Enhancements

Storage with Sensors (Reservoir, Constructed Wetland, Ponds)

Builds or upgrades water stores for use in dry periods.

What It Involves

Water storage systems such as on-farm reservoirs, constructed wetlands and ponds, fitted with sensors to monitor water levels, quality and availability in real time.

Increases dependable stored volume, supports summer supply from winter capture, and improves water quality via settlement/ treatment.

✓ Agricultural Benefits
Strong drought resilience
Potential biodiversity co benefits
Stable irrigation quality

Considerations
Planning and permits
Capital intensive
Liner integrity
Safety and biosecurity
Evaporation losses in heat

Level of maintenance
Medium

£ Cost
High

Additional information

assets.publishing.service.gov.uk/media/5a7b9110ed915d414762136e/gemi0408bnzp-e-e.pdf

gov.uk/guidance/reservoirs-owner-and-operator-requirements

wre.org.uk/wp-content/uploads/2026/05/Irrigation-Reservoir-Guidance-East-of-England.pdf

wre.org.uk/wp-content/uploads/2026/05/Planning-farm-reservoirs-in-Suffolk-and-Essex-National-Landscapes.pdf

7. Soil & Crop Management Practices

No-till or Reduced Tillage

Helps soil hold onto more water.

What It Involves

Plant with no-till drills or shallow disturbance, retain residues and adapt rotations. Over time, builds structure, macropores and organic matter, while reducing traffic passes.

Improves infiltration and water-holding, reduces runoff/ erosion and often lowers irrigation frequency.

✓ Agricultural Benefits
Fuel and labour savings
Soil health and resilience
Trafficability gains

Considerations
Transition yield dip risk
Pest/weed shifts
Learning curve

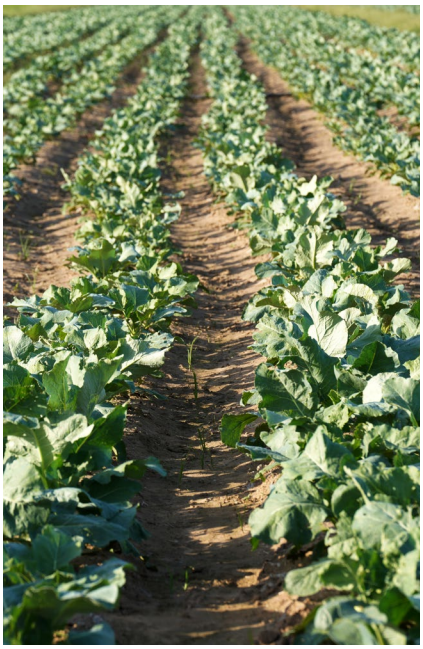
Level of maintenance
Low

£ Cost
Low to Medium (capex for drill)

Additional information
defrafarming.blog.gov.uk/sustainable-farming-incentive-pilot-guidance-use-min-till-or-no-till-farming

7. Soil & Crop Management Practices

Cover Cropping



Keeps soil protected and improves moisture.

What It Involves

Establish covers post-harvest (e.g., rye, clover, radish). Manage termination (roller, mow, spray) ahead of drilling. Choose mixes to suit goals (structure, N-fixing, rooting depth).

Shields soil and boosts organic matter, raising infiltration and moisture retention while reducing evaporation from bare ground.

✓ Agricultural Benefits
Soil health
Weed suppression
Nutrient cycling
Better spring tilth

Considerations
Seed and termination costs
Moisture tie up if termination late
Pest carryover if poorly managed

Level of maintenance
Low

£ Cost
Low

Additional information
covercropsguide.co.uk/selection

7. Soil & Crop Management Practices

Organic Matter Enhancements

Makes soil spongier and better at holding water.

What It Involves

Regular applications of compost/manure/digestate. Match rates to nutrient plans, incorporate or surface-apply as appropriate.

Higher soil carbon increases sponge-like capacity, supporting moderating drought stress and reducing irrigation need.

✓ Agricultural Benefits
Yield stability
Nutrient efficiency
Reduced runoff and erosion

Considerations
Nutrient loading compliance
Odour/logistics
Potential weed seeds
Timing around wet periods

Level of maintenance
Low to Medium

£ Cost
Low to Medium

Additional information
defrafarming.blog.gov.uk/increase-soil-organic-matter

7. Soil & Crop Management Practices

Precision Fertiliser Placement

Reduces nutrient losses and runoff.

What It Involves

Band/place/inject nutrients near roots using GPS-guided kit, variable-rate based on soil maps. Time applications to crop demand.

Cuts nutrient loss to water, reducing pollution risk and avoiding growth imbalances that can increase water demand.

✓ Agricultural Benefits
Higher NUE
Better uniformity
Potential yield lift with stable water needs

Considerations
Capex for equipment and mapping
Operator training
Data upkeep

Level of maintenance
Low to Medium

£ Cost
Medium

Additional information

defrafarming.blog.gov.uk/sustainable-farming-incentive-pilot-guidance-use-precision-application-of-fertiliser-manure-and-other-inputs

agrii.co.uk/sustainable-farming/sfi/precision

7. Soil & Crop Management Practices

Mulching

Helps stop soil drying out on hot days.

What It Involves

Apply straw/compost/woodchip or films to cover soil, suppress weeds, cool the surface and slow evaporation. Spread mechanically or with mulch layers to maintain coverage.

Lowers evaporation and soil temperature, conserving moisture and reducing irrigation frequency.

✓ Agricultural Benefits
Better moisture retention
Weed suppression
Improved fruit cleanliness/quality

Considerations
Material costs/availability
Slug/rodent habitat risk
Plastic end-of-life management

Level of maintenance
Low to Medium

£ Cost
Low to Medium

Additional information
rhs.org.uk/soil-composts-mulches/mulch

8. Livestock Water Management

Smart Water Troughs

Stops animals running short on water.

What It Involves

Troughs fitted with level sensors, telemetry, and efficient float valves. Dashboards/alerts flag low levels or abnormal use. Could even look at solar pumps for remote sites.

Prevents animal shortages and detects leaks early, avoiding large unseen water losses.

✓ Agricultural Benefits
Animal welfare
Labour savings
Water conservation

Considerations
Connectivity/power
Frost protection
Vandalism risk in open sites

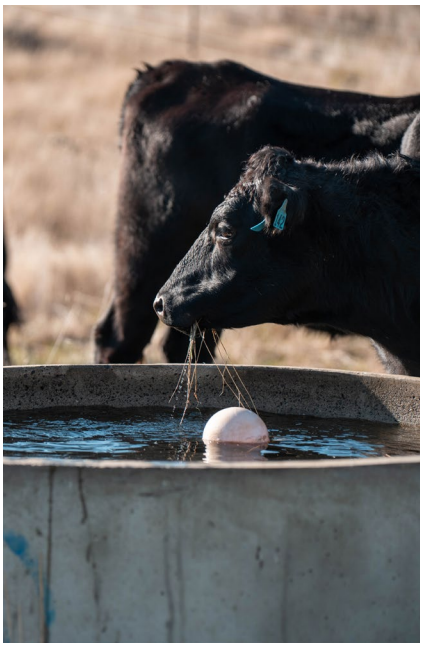
Level of maintenance
Low to Medium

£ Cost
Low to Medium

Additional information
onlinelibrary.wiley.com/doi/10.1155/je/4418322

8. Livestock Water Management

Automatic Shut-offs & Flow Limits



Stops troughs overflowing and wasting water.

What It Involves

Fit float/pressure shut-off valves or digital controllers on trough inlets. Able to set safe fill heights and max flows.

Stops overflow and continuous trickle losses, conserving stored/abstracted water.

✓ Agricultural Benefits
Reduced water waste
Less poaching
Lower pumping

Considerations
Valve wear
Debris blockage
Periodic checks needed

Level of maintenance
Low

£ Cost
Low

9. Predictive Modelling & Forecast Integration

Seasonal Water Demand Forecasts

Shows how much water you'll likely need months ahead.

What It Involves

Use seasonal climate outlooks with crop/area data and past records to estimate monthly demand. Present scenarios (dry/median/wet) and confidence ranges for planning storage and pumping.

Enables proactive storage/abstraction planning, reducing emergency demand and improving allocation across the season.

✓ Agricultural Benefits
Fewer surprises
Better procurement and energy planning
Improved resilience

Considerations
Forecast uncertainty
Communication/training needed
Subscription costs

Level of maintenance
Low

£ Cost
Low to Medium

Additional information

studysmarter.co.uk/explanations/environmental-science/agriculture-and-forestry/water-demand-forecasting

assets.publishing.service.gov.uk/media/57ab0dafe5274a0f6c000062/AN1.8.1-Demand_forecast_rev03FINAL.pdf

d-risk.eu/index.php?params=about

9. Predictive Modelling & Forecast Integration

Drought Risk Models

Gives early warning of dry periods.

What It Involves

Combine soil moisture deficits, rainfall history, temperature anomalies and forecasts into risk indices, maps and alerts. Integrate with farm plans (e.g., trigger points for switching water sources).

Early warning supports timely conservation measures and prioritisation, reducing scarcity impacts.

✓ Agricultural Benefits
Smoother operations in dry spells
Better collaboration across farms

Considerations
False alarms or misses possible
Requires disciplined response plans

Level of maintenance
Low

£ Cost
Low to Medium

Additional information
wheatleywatersource.co.uk/Drought/Map/Index#

9. Predictive Modelling & Forecast Integration

Crop Evapotranspiration (ET) Predictors

Helps plan irrigation based on crop water loss.

What It Involves

Compute reference evaportranspiration from weather (temp, wind, humidity, radiation) and adjust for crop coefficients by stage. Feed daily evaportranspiration and irrigation recommendations to schedulers.

Aligns irrigation with actual crop water loss, reducing over-application.

✓ Agricultural Benefits
Steadier crops
Water savings
Reduced disease from avoiding over wet soils

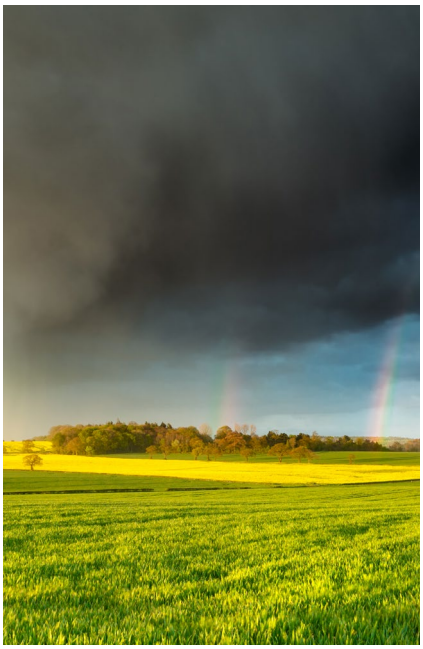
Considerations
Accuracy depends on good weather data and correct Kc
Training required

✪ Level of maintenance
Low

£ Cost
Low

9. Predictive Modelling & Forecast Integration

Integration with Weather Forecast Services



Helps plan irrigating around the weather so irrigation isn't done just before it rains.

What It Involves

Link controllers to short-/medium-range forecasts for rain-skip, wind/heat avoidance and frost routines. Automate starts/stops and push alerts for favourable windows.

Avoids irrigating before rain, reduces evaporative losses and pumping costs, improving timing and efficiency.

✓ Agricultural Benefits
Lower costs
Better timeliness
Fewer operator hours overnight

Considerations
Forecast error risk
Internet dependence
Subscription fees

⚙ Level of maintenance
Low

£ Cost
Low

10. Water Trading Platforms

Water Trading Platform

Helps farms share or trade spare water in dry periods.

What It Involves

A water trading platform enables the temporary or permanent transfer of water rights or abstraction volumes between users, helping to allocate water more efficiently within a catchment.

Enable the reallocation of licensed water between users to improve efficiency, flexibility and resilience within a catchment. Balances supply/demand at scale, while maintaining productive use.

✓ Agricultural Benefits
Access to water in dry years
Monetise surplus in wet years
Planning certainty
Higher overall resilience
Supports shared storage investment

Considerations
Regulatory complexity
Transaction fees
Equity concerns within catchment
Need for trust and governance
Set up/admin costs
Legal frameworks

Level of maintenance
Low

£ Cost
Low to Medium

Additional information

ofwat.gov.uk/regulated-companies/markets/water-bidding-market/water-trading

environment.data.gov.uk/defra/8a682192-4a1b-4e40-84d4-5671bfa5671c/details

gov.uk/guidance/trade-water-abstraction-rights

11. Infrastructure Automation

Pressure Management in Pipes

Reduces bursts, leaks, and water loss.

What It Involves

Install pressure-reducing valves, sensors and controllers to smooth peaks, segment the network and set safe limits. Retrofit into older pipework to prevent bursts and monitor trends.

Cuts leakage and bursts, preserving stored water and improving delivery efficiency.

✓ Agricultural Benefits
Lower losses
Fewer repairs
Steadier flows for irrigation and stock

Considerations
Initial tuning
Occasional nuisance trips
Requires access for servicing

Level of maintenance
Low to Medium

£ Cost
Medium

11. Infrastructure Automation

Flow Meters & Leak Detectors

Shows where water is being lost on your farm.

What It Involves

Fit mechanical/ultrasonic meters at key branches, add loggers/ telemetry for dashboards and alarms. Use night-flow analysis to pinpoint losses and conduct step testing if needed.

Finds and fixes leaks fast, preventing large cumulative losses and supporting accurate abstraction reporting.

✓ Agricultural Benefits
Water savings
Compliance confidence
Reduced infrastructure damage

Considerations
Meter accuracy/calibration
Frost protection
Reading/telemetry reliability

Level of maintenance
Low

£ Cost
Low to Medium

Additional information

waterindustryjournal.co.uk/fpi-mag-flow-meter-next-generation-mag-meter-a-tool-for-leak-detection

11. Infrastructure Automation

Automated Gates for Distribution

Stops water flooding if a pipe bursts.

What It Involves

Add valves that close on abnormal high flow/pressure drop or remote command. Set thresholds and test fail-safe behaviour, position at tanks, mains branches and vulnerable runs.

Stops catastrophic losses from bursts or failures, protecting limited storage and keeping systems online.

✓ Agricultural Benefits
Risk reduction
Water security
Reduced repair costs and downtime

Considerations
False trips if thresholds poorly set
Requires power and controls
Periodic testing

Level of maintenance
Medium

£ Cost
Medium

Funding Opportunities

A range of funding is available to help farmers and land managers improve water efficiency, strengthen drought resilience and to enable the adoption of smart water management technologies.

These schemes could help fund practical measures such as more efficient irrigation, on-farm water storage, sustainable soil management and nature-based approaches.

As eligibility, payment rates and application windows vary, farmers and land managers are encouraged to review current guidance and where applicable discuss suitable options with their land manager or advisor before applying.

Funding opportunities to explore

Ofwat innovation fund for supporting efficiency in public water supplied businesses -

ofwat.gov.uk/regulated-companies/innovation-in-the-water-sector/water-innovation-competitions

DEFRA funded opportunities can vary year on year. Examples include:

Water Management Grant – DEFRA

The Water Management Grant, part of the Farming Investment Fund, provides capital funding for arable and horticultural businesses in England to improve productivity through more efficient irrigation and to secure reliable water supplies, including constructing on-farm reservoirs and adopting best-practice irrigation equipment.

The grant can fund a wide range of capital items that support efficient irrigation and reliable water availability. Examples include on-farm reservoirs, capable of storing abstracted winter water or harvested rainwater, helping farms increase resilience to drought and reduce pressure on summer abstraction. It can also support the adoption of high-efficiency irrigation systems, such as replacing older rain guns with more sustainable boom or trickle irrigation systems to enhance precision and reduce water waste.

Farming Innovation Programme – DEFRA/UKRI

The Farming Innovation Programme (FIP) is a major DEFRA and UKRI partnership supporting research, development, and practical innovation to boost productivity, sustainability, and resilience across agriculture, horticulture, and forestry in England. Funding is awarded competitively through multiple themed competitions, ranging from early-stage Research Starter Projects to large Research and Development partnerships and multi-year Farming Futures innovation calls. Most projects require collaboration between farmers, researchers, and businesses. Farmers could receive funding to trial precision farm technologies, improve water and nutrient management and to develop climate-resilience production systems. Funding levels vary by competition but can range from small feasibility grants to multi-million-pound collaboration projects.

farminginnovation.ukri.org/adopt

Countryside Stewardship – DEFRA

Countryside Stewardship (CS) is a DEFRA scheme that provides financial incentives for farmers, foresters, and land managers to protect and enhance the natural environment through multi-year management agreements and capital grants. The scheme supports actions that improve water quality, enhance wildlife habitats, reduce runoff, and diffuse pollution, and deliver wider environmental benefits. Capital grants can also fund targeted infrastructure such as sediment traps, water-quality improvements, and natural flood-management features. Most CS options are competitively scored, with priority given to applications that address local environmental priorities and deliver the greatest environmental value.

Sustainable Farming Incentive (SFI) – DEFRA

The Sustainable Farming Incentive (SFI) is a DEFRA scheme that pays farmers for actions that improve soil health, biodiversity, water quality, climate resilience, and sustainable food production. It supports a wide range of actions including soil management practices, nutrient planning, habitat creation and measures that protect watercourses. The scheme is designed to be flexible and accessible, allowing farmers to choose actions that fit their business while delivering environmental benefits. There are typically two application windows each year: one in June for smaller farms and those without an existing Environmental Land Management (ELM) agreement, and a second in September for all farmers. Agreements typically run for three years, with payments made quarterly.

Landscape Recovery – DEFRA

Landscape Recovery is a DEFRA Environmental Land Management (ELM) scheme designed to support long-term, large-scale projects, typically across entire landscapes, that restore nature, improve biodiversity, enhance water quality, and deliver climate and ecosystem benefits. The scheme brings together farmers, landowners, and environmental organisations to co-design bespoke agreements lasting 20 years or more. Projects often involve major land-use change such as river and floodplain restoration, wetland creation, peatland recovery, and habitat restoration, with funding blended from public and private sources. While farming can continue within project areas, the scheme's primary aim is landscape-scale environmental recovery rather than farm-level resilience or routine soil-health improvements.

More information

To further explore information on funding available to farmers, growers, and land managers, including details on schemes, payment rates, application windows and how to apply, visit the government's central funding page:

gov.uk/guidance/funding-for-farmers

Case Studies

Hobson Farming Ltd

- Precision irrigation systems – Irrigation responds to real-time field conditions.
- Environmental sensing – On-farm weather stations record local climate data.
- Decision-support platforms – Machine-learning tools guide irrigation planning
- Soil and crop management – A 10-crop rotation maintains soil health.

Hobson Farming Ltd is a large scale carrot and root vegetable producer, with carrots grown as part of a 10-crop rotation to support soil health and long-term productivity. This rotational approach underpins the farm's resilience, making careful irrigation planning critical throughout the growing season.

To support precise irrigation management, Hobson Farming Ltd operates a network of on-farm weather stations across its estate. These stations are connected to the Sencrop platform and form a central component of the farm's irrigation and operational decision making.

The stations record rainfall, air temperature, relative humidity, wind speed and direction, and solar radiation. This ultra local monitoring provides real time data directly from the business's own land. Within the platform, this information is viewed alongside forecast data, with meteorological model outputs cross referenced against ground-based station readings. This enables identification of the most reliable forecast model for the specific locality and has resulted in a high level of confidence in short- and medium-term rainfall and temperature forecasts.

Sencrop is also used as a practical irrigation management tool. Field specific information, including crop type and growth stage, is entered into the system. Using recorded climate parameters, the platform calculates evapotranspiration and provides a field-by-field water balance view. Outputs are presented in a clear traffic light format, indicating when irrigation is required and supporting proportionate abstraction aligned to actual crop demand.

Alongside this technology enabled approach, Hobson Farming Ltd continues to rely on experienced land managers undertaking regular visual inspection of crop and soil condition. Practical field assessment remains integral to decision making. The combination of precision weather monitoring, evapotranspiration modelling and long-standing agronomic experience supports water resilience, abstraction planning and efficient irrigation management across the estate.

Rodger Hobson, Managing Director, commented:

> *"We've tried all sorts of systems over the years, but we've found Sencrop to be incredibly accurate. We have several weather stations of our own and one of the real benefits is the network within the app. You can see other weather stations in the network and rely on their data as well as your own, allowing flexibility across farmed land. Being able to cross check conditions across nearby farms gives us much more confidence in our decisions. That said, technology works best when it is combined with experienced land managers who understand their soils and crops. It is the combination of good data and practical field knowledge that really strengthens our decision making."*

Red Roofs Nursery Ltd

- Precision irrigation systems – Pressure-compensated drip irrigation
- Environmental sensing – Real-time light sensors guiding irrigation demand.
- Decision-support platforms – Electrical Conductivity, pH and light data used to automate irrigation and fertigation control.
- Water Recycling & Storage Enhancements - Filtration, and reuse of drain water - Full closed-loop capture.

Red Roofs Nursery Ltd is a commercial glasshouse nursery within the WReN region, producing high-wire tomatoes across approximately 5 hectares. The business operates an integrated and highly efficient irrigation and fertigation strategy designed to support intensive, long-season production while minimising net water abstraction.

Precision drip irrigation is combined with environmental sensing and automated control systems to ensure that water and nutrients are supplied accurately and in line with real-time crop demand. Irrigation scheduling is driven by accumulated light levels within the glasshouse, allowing applications to respond directly to plant transpiration rates. Continuous monitoring of Electrical Conductivity and pH maintains optimal root-zone conditions and supports consistent crop performance.

The nursery operates a fully closed-loop fertigation system. All drainage water is captured, filtered, rebalanced and reused, preventing routine discharge and significantly reducing reliance on new abstraction. This approach enables high water-use efficiency per unit of production while maintaining crop quality and yield across an extended growing season, typically from January through to November.

Kieran Dunford stated:

> *"Everything we do is about matching water and nutrients precisely to what the crop actually needs. By monitoring light, root-zone conditions and drainage in real time, we can respond quickly and avoid waste. The closed-loop system means we are not just using water efficiently, we are reusing it responsibly. That gives us confidence in both crop quality and our long-term water resilience."*

E. Reed & Son

- Environmental Sensing- Localised weather monitoring using the Sencrop weather station network and forecast modelling platform
- Soil Moisture Sensing – Neutron probe soil moisture monitoring and soil water deficit measurements to inform irrigation scheduling
- Data & Decision Support Platforms - Integrated Agri-Tech decision support systems combining soil, crop and weather data to optimise application timing and volumes
- Soil & Crop Management – Long term sustainable land management maintaining strong soil organic matter to improve water retention and nutrient availability

E. Reed & Son, part of the Dewhirst Farming Group, is an arable farming business on the Yorkshire Wolds, growing potatoes alongside a range of other combinable crops. The business places emphasis on water stewardship and soil management, combining data led irrigation with long standing sustainable land practices to support crop quality and resilience.

Irrigation decisions are informed by neutron probe soil moisture monitoring, which provides accurate measurement of soil water deficit across key cropping areas. This information is integrated with data from a network of on farm Sencrop weather stations. The Sencrop system combines local weather monitoring with modelled forecasts, enabling the farm to select the most reliable forecasting data for its location and cropping context.

These data streams are brought together through a smart irrigation decision support platform, supporting both day to day operational decisions and forward planning. By aligning soil moisture status, crop growth stage and forecast weather conditions, the farm is able to apply water only where and when it is required. This approach reflects best practice in modern agricultural water management, where sensor technology and telemetry are used to optimise abstraction and improve on farm water efficiency.

The farm utilises boom irrigation systems to deliver controlled and uniform application. Compared with traditional rain guns, boom systems reduce wind drift and improve canopy targeting, which is particularly beneficial in exposed Wolds conditions. This enables more efficient use of licensed abstraction volumes while maintaining crop performance during dry periods.

Sustainable land management underpins this water strategy. The business operates within a circular farming model in which arable crops supply livestock and an anaerobic digestion facility, with slurry and digestate returned to land as organic fertiliser. As a result of this long term approach, soils have strong organic matter levels, supporting good structure, improved water retention and enhanced nutrient availability. These characteristics contribute to overall crop resilience and help reduce unnecessary irrigation demand.

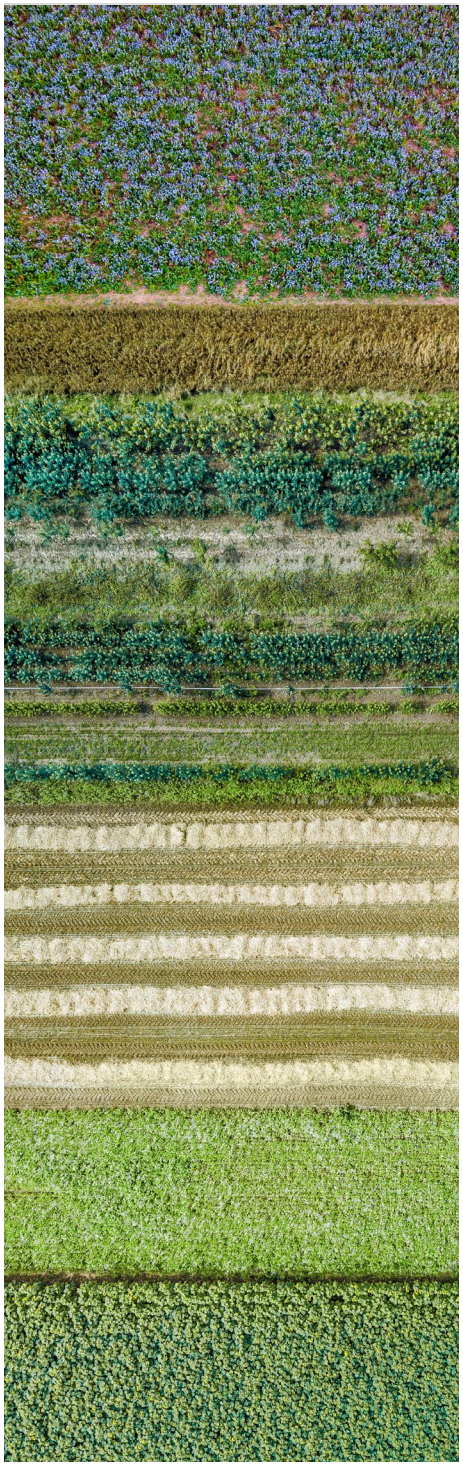
Jim Whitely, Farm Manager explains:

> *"Using our smart irrigation platform has transformed how we manage water on farm. By combining neutron probe soil moisture data with information from our on farm Sencrop weather stations, we can accurately assess soil moisture deficit and anticipate irrigation requirements in advance. This allows us to apply water in a controlled and targeted way and operate efficiently within our licensed abstraction volumes during dry periods.*
>
> *Our soils have strong organic matter levels as a result of long standing sustainable land management, including the careful use of slurry and digestate. This supports good soil structure, improves water retention and enhances nutrient availability, strengthening crop resilience and reducing unnecessary irrigation demand."*

Summary

Effective water management will always look different from one farm to another.

Every business operates with its own combination of soils, landscape, rainfall patterns, cropping or livestock systems, infrastructure and budget. Because of this, there is no single solution that works everywhere. The most successful approaches are those that are tailored to the specific needs, risks and opportunities of each farm. Good planning considers the nature of the farming system, the availability and cost of water, local soil types, levels of seasonal risk, and the practical realities of day-to-day operations.



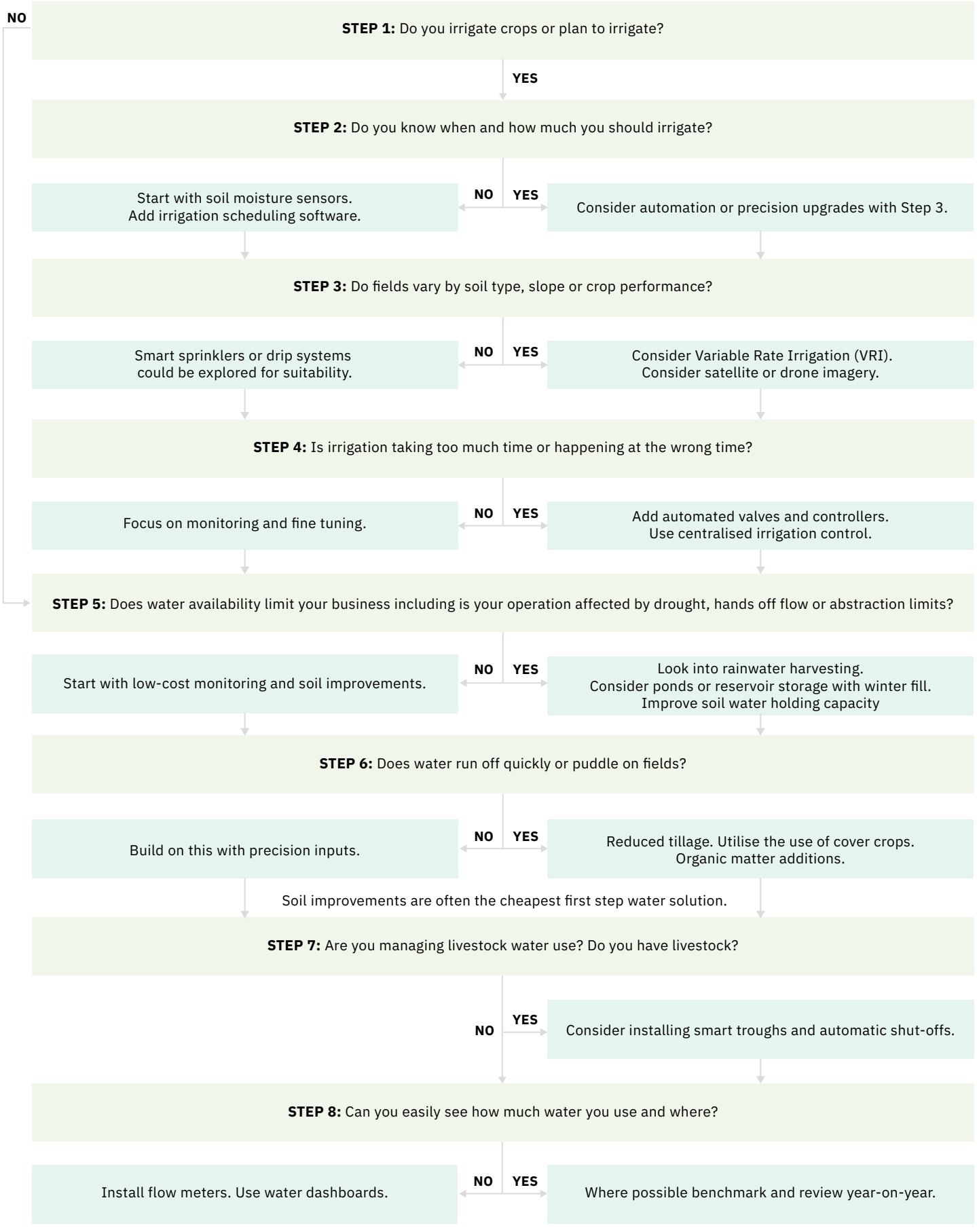
A resilient water strategy typically combines multiple interventions rather than relying on just one. The right blend of tools and techniques depends on the farm's type, budget, water risk, and the characteristics of its land and environment. Integrating a range of measures such as soil management, improved infrastructure, accurate monitoring, on-farm storage, water recycling and more efficient irrigation. This helps spread risk and achieve benefits that no single intervention can deliver on its own. Engaging early with land managers, advisers and technical specialists will help ensure that chosen interventions are appropriate for local conditions and deliver the best value.

Water resilience is also strengthened when farmers work together. Participating in LROs and joining or forming WAGs provides opportunities to collaborate across the catchment, share knowledge, trial new approaches and plan at a larger scale. Catchment-level cooperation helps balance supply and demand, supports regulatory compliance, and creates shared benefits that contribute to long-term sustainability for the whole farming community.

Before progressing with any significant changes, farmers should take time to understand whether planning permission, permits, abstraction licence variations or consultation with local community and regulators may be required. Checking these requirements early helps avoid delays and ensures that interventions are compliant.

To support decision making and help determine where to begin, this toolkit includes a Smart Water Management Decision Tree. By using this toolkit alongside expert advice, farmers can identify possible quick wins, longer-term priorities and the most suitable combination of actions for their farm. Bringing these elements together creates a whole-farm approach in which soil, water, infrastructure and management practices work together to help farmers plan for the future.

Use this step-by-step guide to work out which smart water options you could explore first, based on your farm type, water risk and budget.



WReN
Water Resources North

To find out more about Water Resources North visit: **waterresourcesnorth.org**

aquaconsultants
An Adler & Allan company

NFU

Environment Agency

NORTHUMBRIAN WATER living water

YorkshireWater

hartlepool water