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The authors of this publication – Melvyn Kay (RTCS Ltd) and Jerry Knox (Cranfield University) wish to make it clear that the content and views expressed are those of the authors and do not necessarily represent the views or policies of National Landscapes.

This booklet is provided for information purposes only. Always seek independent professional advice when planning an agricultural reservoir or associated irrigation water resources infrastructure.

Copies of this booklet can also be downloaded from the UK Irrigation Association website www.ukia.org

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Web links to documents referred to in the main text

[1] The Environmental Permitting (England and Wales) Regulations 2016
https://www.legislation.gov.uk/uksi/2016/1154/contents

[2] Applying for an abstraction licence:
https://www.gov.uk/guidance/water-management-apply-for-a-water-abstraction-or-impoundment-licence

[3] Colour guide available for both National Landscapes
https://dedhamvale-nl.org.uk/wp-content/uploads/2020/12/Dedham-Vale-Use-of-Colour-Guidance.pdf

https://coastandheaths-nl.org.uk/wp-content/uploads/2021/01/SCH-Use-of-Colour-Guidance-v7.pdf

[4] Reservoir Safety Reform Programme updates
https://engageenvironmentagency.uk.engagementhq.com/reservoir-safety-reform

[5] Countryside Stewardship Higher Tier and Sustainable Farming Incentive (SFI)
https://www.gov.uk/find-funding-for-land-or-farms?areas_of_interest%5B%5D=water-availability-and-storage

[6] The Farming Equipment and Technology Fund 2026
https://defrafarming.blog.gov.uk/2026/02/24/farming-equipment-and-technology-fund-2026-guidance-now-available

Suffolk & Essex Coast & Heaths National Landscape

Dedham Vale National Landscape & Stour Valley

Hawes Associates

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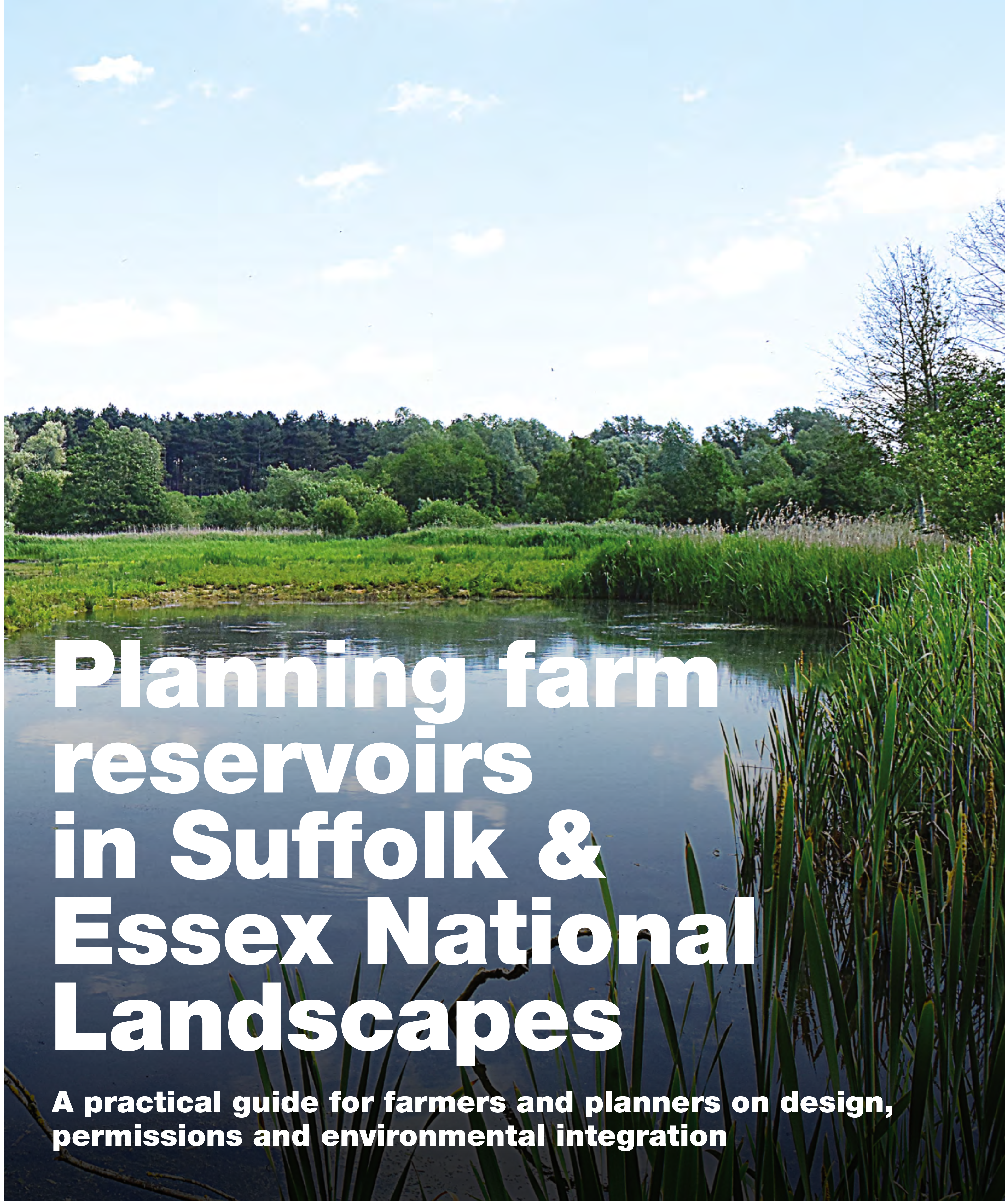


Planning farm reservoirs in Suffolk & Essex National Landscapes

A practical guide for farmers and planners on design, permissions and environmental integration

Suffolk & Essex Coast & Heaths National Landscape

Dedham Vale National Landscape & Stour Valley

Cranfield University

Stage 1: defining need 1 2 3 4

Water under pressure

Balancing irrigation security with environmental protection in the Suffolk & Essex Coast & Heaths and Dedham Vale National Landscapes

Agricultural water resources in eastern England are under growing pressure from rising demand and tighter abstraction rules. Climate change will intensify this. Well-planned reservoirs can strengthen irrigation security while respecting sensitive landscapes and minimise flood risk

Building resilience to future water risks

Recent droughts in 2018, 2022 and 2025 have highlighted the benefits of reservoir investment, with 17 reservoirs being built over the last decade in Suffolk. At Home Farm Nacton, storage capacity has recently been increased by 35,000 m^3 by extending one of its eight reservoirs, which already store 800,000 m^3 water. Although the business missed out on grant funding, Managing Director Andrew Francis emphasised that a long-term outlook is vital to encourage investment and ensure that farmers and food producers have access to adequate water. The business now has the capability to irrigate 98% of the cropped area, with a focus on high-value, early-season crops. Growing 26 different crops across 1,800 ha with an irrigation season that stretches from March to September is challenging.

"Irrigation is not a marginal benefit in east Suffolk", says Andrew "the impact of not having enough water here is disproportionate. Reservoirs are a critical asset for our future business sustainability and expansion"

Suffolk & Essex Coast and Heaths National Landscape

The Suffolk & Essex Coast & Heaths, and Dedham Vale National Landscapes, which together extend the length of the Suffolk Coast and the eastern section of the Stour valley on the Suffolk and Essex border, sit within some of England's most productive yet water-constrained regions.

These are two of 46 areas in England, Wales and Northern Ireland safeguarded for their distinctive character and natural beauty. In November 2023, Areas of Outstanding Natural Beauty (AONB) were rebranded as National Landscapes. Legally they are known as AONBs.

High-value crops – field vegetables, salads, potatoes and protected soft fruit – depend on reliable irrigation supplies to maximise yields and meet retailer demands for quality assurance. A combination of the region's light and drought-sensitive soils with a lack of summer rainfall means droughts are a recurrent problem – 2018, 2022 and 2025 highlighted the limitations on water supplies and the vulnerability to both irrigated farming and water-dependent ecosystems.

Alongside this productive landscape lie nationally and internationally important environmental assets. Estuaries such as the Stour, Deben and Alde, and heathlands like the Sandlings, support rare species and sensitive wetlands that rely on adequate summer river flows and groundwater levels – precisely when agricultural demand peaks.

In this setting, on-farm reservoirs are not new, but their role is changing. Increasingly, they are the practical response to summer abstraction limits, allowing growers to capture water in winter and build resilience into their businesses while easing pressure on rivers during environmentally sensitive periods.

Winter storage offers a way to decouple use from summer abstraction. Yet as more sectors shift toward high-flow winter licences, competition for that water may intensify. The challenge is no longer whether to store water, but how to do so responsibly in a shared and sensitive landscape.

Drivers for change – environmental targets

In the Suffolk & Essex Coast & Heaths and Dedham Vale National Landscapes, food production and environmental protection are tightly linked through water. Historically, much of the area's irrigation relied on direct abstraction from rivers and groundwater under licences granted in very different regulatory and climatic conditions.

While these arrangements supported agricultural growth, planned licence reductions linked to national targets for environmental recovery are now reshaping the landscape. These changes could significantly affect current production and limit future expansion (Figure 1).

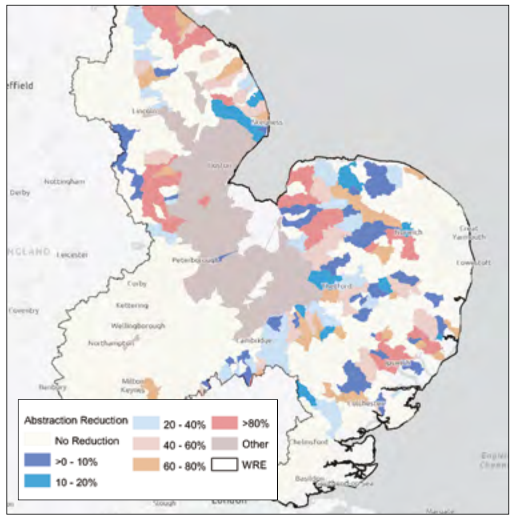


Figure 1: Planned annual licensed reductions (%) to meet environmental targets (National Framework, 2025)

Protecting jobs & livelihoods

A recent study (RPA, 2025) found that licence reductions in Norfolk and Suffolk would have significant economic consequences.

A 30% cut in irrigation abstraction could reduce output by up to £2.3 billion across the supply chain over 20 years, with around 2,500 full-time equivalent jobs lost annually.

For most farmers, the primary mitigation is investment in storage reservoirs to replace lost summer water with winter abstraction. This depends on sufficient high-flow water being available and access to capital. The study estimated that around £130 million would be needed to build enough storage to offset projected losses.

Water risks in agriculture

The East Suffolk catchment has always been an 'irrigation hotspot' with the majority of irrigation abstraction, in terms of both number of licences and licensed volume being direct (74%), rather than from storage (26%).

Category of use	Water available	Restricted water availability	Water not available
Spray irrigation – storage (%)	11%	26%	63%
Spray irrigation – direct (%)	12%	32%	56%

Table 1: Spray irrigation direct and storage licences in East Suffolk

Table 1 shows that 63% of storage licences are in sub-catchments where water is classified as 'not available', with a further 26% in areas of 'restricted availability'. More than half of direct abstraction licences (56%) are also in 'water not available' catchments, indicating a strong case for increased winter storage.

Figure 2 maps irrigation licences across the region, highlighting their concentration within the Suffolk & Essex Coast & Heaths and Dedham Vale National Landscapes area.

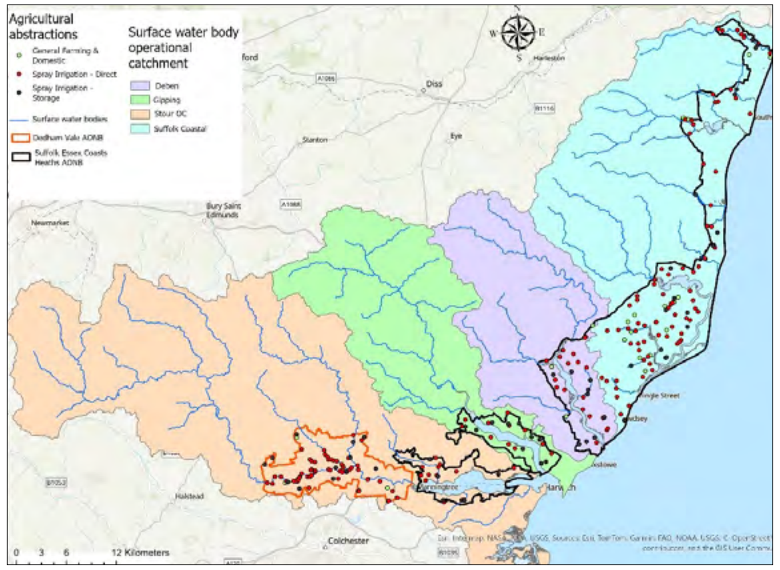


Figure 2: Location of agricultural abstractions relative to surface water body operational catchments and the Suffolk & Essex Coast & Heaths and Dedham Vale National Landscapes.

Updating farm guidance for reservoirs

This guide updates advice on the design and siting of farm reservoirs within the Suffolk & Essex Coast & Heaths and Dedham Vale National Landscapes. While the Coast & Heaths landscape includes extensive open heathlands and coastal farmland, Dedham Vale is a typical lowland river valley landscape with enclosed farmland, ancient woodlands and historic villages. When shaped to follow landform, reservoirs can support biodiversity, and enhance local landscape character & natural beauty, rather than detract from it.

Nationally, agricultural water management is entering a period of change, with greater reliance on winter storage likely to shape future planning. Focusing on these areas, this booklet provides practical, farmer-focused guidance on planning, designing and constructing reservoirs that work both for irrigation and for sensitive landscapes, supported by local case studies.

Full four-stage overview

Concept to commissioning

The four stages of reservoir planning

Taking the right approach – and doing things in the right order – can save significant time and cost. Successful reservoir projects follow a clear sequence: define the need, test feasibility, secure permissions, then design and build. Skipping steps often leads to long delays and/or planning refusal.

Stage 1 — DEFINE NEED
Be clear what water is needed and why

Stage 2 — FEASIBILITY
Check water availability, sources and limits

Stage 3 — PERMISSIONS
Confirm what licences and permissions are needed

Stage 4 — DELIVERY AND OPERATION
Build and operate the reservoir as approved

Using the four-stage approach

Getting the sequence right saves time, reduces costs, and avoids frustration

Stage 1: Start by being clear about why you need storage.

What crops are you protecting? What level of resilience do you want in a dry year?

Stage 2: Next, test whether water is genuinely available and whether your preferred site will work.

There is little value in progressing design or planning if abstraction limits or site constraints make the scheme unviable.

Stage 3: Only once feasibility is clear should you move fully into permissions.

Abstraction licensing, planning approval, and environmental assessments can run in parallel, but they must be grounded in sound feasibility.

Stage 4: Finally, proceed to detailed design, construction, and commissioning.

In practice, some stages will overlap. But skipping ahead often leads to redesign, delay or planning refusal.

Early discussion with regulators, planners and advisers usually saves significant time later.

Case Study – Integrating drainage and storage

The East Suffolk Internal Drainage Board (IDB) Felixstowe Hydrocycle demonstrates how existing drainage infrastructure can be adapted to support agricultural water storage.

Farms on the Felixstowe Peninsula grow high-value irrigated crops but face increasing restrictions on summer abstraction from the River Deben. The scheme captures water during winter and stores it in on-farm reservoirs for use in the growing season.

A key feature is the use of the IDB's drainage network. In winter, large volumes of water are conveyed through managed ditches and pumping stations, normally discharged to sea. Under the Hydrocycle scheme, a proportion of this flow is intercepted and transferred via a 12 km pipeline to farm reservoirs.

This approach effectively recycles water already moving through the system, reducing IDB pumping to the estuary and helping to reduce erosional damage to the receiving salt marsh.

By integrating drainage and storage, the scheme converts surplus winter water into a reliable irrigation supply while maintaining the system's primary flood management function.

How long does it all take?

Most reservoir projects take 18–36 months from first idea to commissioning

Typical timeframes:

- Initial scoping and feasibility: 3–6 months
- Environmental work (if required): 6–12 months
- Planning and abstraction permissions: 4–12 months
- Detailed design and construction: 6–12 months

Times vary depending on catchment constraints, environmental sensitivity and regulator workload

Early engagement and good preparation can significantly shorten the process

Pitfalls to avoid

- Don't start planning before confirming abstraction feasibility
- Don't underestimate environmental constraints
- Don't design storage too small for extended dry periods
- Don't leave discussions with the EA too late
- Don't assume permissions will be straightforward
- Don't rush into construction before conditions are discharged
- Don't overlook risk of uncontrolled release from reservoir

From experience

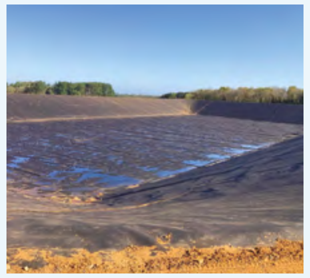
A Suffolk grower began planning a 70,000 m³ reservoir in 2022. Early feasibility work identified abstraction limits that required a change in the intake point. Adjusting the design at that stage avoided a refused application and saved nearly a year.

Feasibility

Will this work for your farm?

Assessing risks and testing your idea before major spend

Case Study – Reservoirs reduce summer abstraction risks



New Shoots is a progressive farming enterprise in East Suffolk growing spinach, babyleaf and wholehead lettuces for retailers and processors where consistency of supply and quality assurance are critical aspects of production.

These shallow rooting crops are heavily dependent on irrigation – with the majority (75%) of water now supplied from four reservoirs. Will Brice, Head of Estates says

"Our philosophy is to reduce dependence on summer abstraction and increase reliance on storage, taking winter high flows which limits our environmental impact and reduces downstream flood risks. We know future summer reductions in licensed allocation pose a major risk to our business sustainability and expansion plans."

Their latest 150,000 m³ HDPE lined reservoir will reduce their vulnerability to both drought and abstraction risks.

"It took us two years to secure planning including some major challenges linked to archaeology, but with perseverance and experienced contractors our latest reservoir is now very close to completion. It will be an invaluable asset to further enhance our water security" says Will Brice.

Before starting detailed design or formal applications, you need to test whether a reservoir is practical, proportionate and deliverable on your farm.

Feasibility goes beyond demand. It means defining your dry-year water requirement, confirming winter water availability, and testing whether the site can support safe, cost-effective storage. Early choices – reservoir size, storage strategy and whether to use clay or lined construction – influence shape, cost, planning complexity and landscape impact.

Water need, availability & storage considerations

How much water is needed?

Water demand

- ☐ Crops grown
- ☐ Irrigated area (ha)
- ☐ Peak daily demand (m³/day)
- ☐ Seasonal total (m³/year)
- ☐ Drought year requirement (1 in 5 or 1 in 10)
- ☐ Water sharing requirements with neighbours

Design for the "dry year" not the average year

Water availability

Source options

- ☐ Winter river abstraction
- ☐ Groundwater (borehole)
- ☐ High-flow capture (flood scalping)
- ☐ Shared supply

Feasibility questions

- ☐ Is water available in winter?
- ☐ Are there low-flow restrictions?
- ☐ Is a new licence likely to be approved?
- ☐ Will monitoring be required?

How much storage?

Reservoir volume must account for:

- ☐ Irrigation demand
- ☐ Evaporation losses
- ☐ Leakage allowance
- ☐ Drought resilience buffer
- ☐ Possible 2+ year storage

2+ year storage: increasingly relevant in water-stressed catchments and droughts

"Snakes and Ladders" of reservoir planning

Ladders

- ☐ Early EA discussion
- ☐ Early landscape, ecological and archaeological assessments
- ☐ Good hydrological, geological and topographic data
- ☐ Clear landscape, ecological and archaeological mitigation plans
- ☐ Neighbour engagement

Snakes

- ☐ Underestimating volume
- ☐ Ignoring evaporation
- ☐ Poor site access
- ☐ Late ecological survey
- ☐ Ignoring visual impact of liner

1. Clay lined reservoir

2. HDPE membrane lined reservoir

3. Construction phase

4. Finished integrated reservoir

Site selection & practical constraints

Choosing the right site is often the difference between a straightforward scheme and a difficult one. Topography, soil type, access and proximity to the abstraction point all affect viability. Just as importantly, the reservoir must sit comfortably within the wider landscape.

In sensitive areas, visual impact and environmental considerations can determine the planning route and the level of supporting information required. In some areas, archaeological sensitivity can also influence site suitability.

A well-chosen site reduces risks. A poorly chosen one can delay a project by years.

Choosing the right site

- ☐ Near abstraction point
- ☐ Close to irrigation network
- ☐ Natural fall of land
- ☐ Clay availability for lining
- ☐ Avoid high-value habitats
- ☐ Avoid land that floods or disrupts flood flows
- ☐ Ideally near suitable power supply

Landscape considerations

- ☐ Is the site within a designated National Landscape?
- ☐ Will embankments break skyline?
- ☐ Can levels be lowered to reduce visual mass?
- ☐ Will a liner be visible above waterline?
- ☐ Can planting soften edges?

Planning risks

- ☐ Sensitive landscape designation?
- ☐ Archaeology?
- ☐ Ecological sensitivity
- ☐ Flood risk from embankment failure
- ☐ Licence reductions to comply with national environmental targets
- ☐ Refill reliability

Designing with the landscape

Environmental design strengthens likelihood of planning approval and long-term stewardship

Reservoir investment is primarily a business decision, but thoughtful design can enhance biodiversity, reduce landscape impact and accelerate planning approval

Supporting wildfowl – Floating islands and ladders

Floating islands and escape ladders can significantly improve the wildlife value of farm reservoirs. Steep sides and fluctuating water levels often limit safe access and nesting.

Floating islands provide secure nesting and resting areas away from predators. Simple anchored rafts planted with grasses or covered with shingle can support ducks, terns and other water birds.

Escape ladders or ramps are essential, particularly on lined reservoirs with smooth sides. Made from timber, rope or linked tyres, they allow birds and small mammals to climb out safely.

These low-cost features are easy to install and can greatly enhance biodiversity while improving wildlife safety.

Design principles

From a landscape perspective, visibility is the defining impact of a new reservoir. Landscapes respond differently. In the Suffolk & Essex Coast & Heaths, and Dedham Vale National Landscapes, productive farmland sits alongside sensitive habitats and designated areas. The following three key landscape elements guide design.

Landscape element	Vulnerability
Sandlings plateau	Level areas with large vistas, meaning long-distance visibility
Estuary valley sides	Visibility against the skyline from within and along the valley and from the other side of the estuary
Estuary, lowland river, and coastal valley	Visibility from above, and against the skyline from the valley floor

The distinctive character of the local landscape and natural beauty can be safeguarded through careful design. This means integrating the reservoir's footprint and profile with the natural topography – blending it into the landform rather than relying on planting to disguise it. County or District and Borough level Landscape Character Assessments , including those covering the Suffolk & Essex Coast & Heaths and the Dedham Vale National Landscapes , provide useful guidance on local distinctiveness. The Management Plans for both National Landscapes include useful detailed information about the natural beauty and special qualities of these areas.

Wildlife in both landscapes depends on a mosaic of habitats shaped by centuries of farming. Areas such as the Sandlings Heaths in the Suffolk & Essex Coast & Heaths National Landscapes have evolved over more than 2,000 years and require sensitive treatment during planning, design and construction. When thoughtfully designed, farm reservoirs can enhance rather than disrupt these habitats, creating new opportunities for biodiversity.

Ecological enhancement principles:

- Link habitats to create wildlife corridors across the landscape
- Reinforce existing local habitats and characteristic species
- Plan for long-term habitat management; a wildlife management plan may be required as part of planning consent

Landscape integration principles

- Avoid breaking the skyline; site reservoirs away from ridge crests
- Use existing landform to anchor the reservoir in its setting
- Position storage in lower parts of the landscape, where water bodies sit more naturally

Reservoir siting

Select sites that work with existing landscape features – natural landforms, hedgerows, woodland and field boundaries. Many field patterns are historic and should be respected rather than disrupted.

Reservoirs that do not store water above ground level pose little risk of uncontrolled release, making them more acceptable to planners and generally outside reservoir safety regulation. A Flood Risk Assessment may be required to demonstrate that the scheme does not increase flood risk.

If excavated soil is removed from the site it may require a waste permit unless it is transferred for a genuine, planned use. See Environmental Permitting (England and Wales) Regulations 2016[1].

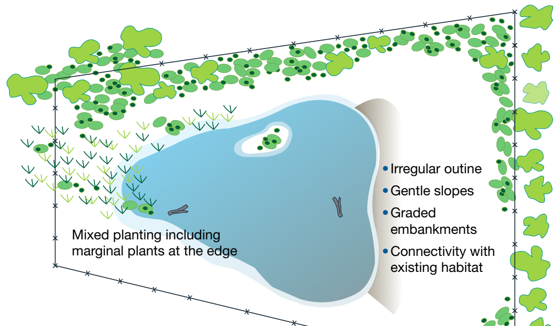
Form and profile

From a storage perspective, a circular reservoir is the most efficient form, with a low bank-to-volume ratio. However, it is difficult to construct and rarely fits comfortably within the landscape. A rectangular form is generally the simplest and most economical, using a balanced cut-and-fill approach.

An irregular outline is usually preferable from a landscape perspective. Even where the internal shape is rectangular, embankments can be graded to soften the external profile. Boundary lines, crest profiles and slope angles can all be adjusted to reduce visual impact. Gentle slopes (no steeper than 1:4) allow easier vegetation management and a less engineered appearance.

Designing for landscape integration may reduce storage efficiency and increase earthworks, and therefore cost. These trade-offs should be considered early in the design process.

Where high embankments risk breaking the skyline, the reservoir can be over-deepened, with surplus spoil used to contour the site, soften edges and create habitat features such as nesting banks or raised planting areas. Where embankment material is limited, borrow pits can be landscaped to form ponds, wetlands or south-facing slopes that support invertebrates.



Planting and vegetation management

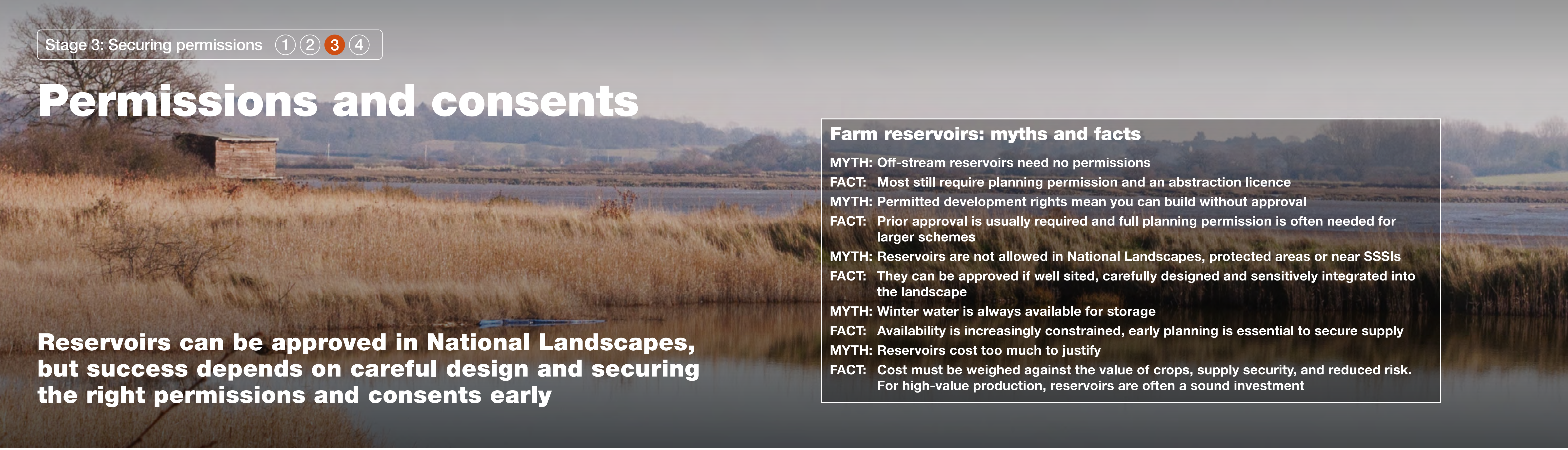
Existing hedgerows, trees and shrubs are valuable assets when landscaping a new reservoir. Additional planting can soften corners, close residual field spaces and strengthen surrounding landscape character. Choose species already present locally; they are more likely to establish successfully and will help retain local character.

Avoid planting in straight lines, which draw attention to the reservoir. The aim is integration, not concealment. Trees and shrubs should not be planted on embankments, as roots can compromise structural integrity. Invasive species such as alder, willow and poplar should be avoided.

Aquatic plants suited to fluctuating water levels include pond water-crowfoot, broad-leaved pondweed, yellow water lily and yellow iris. Creating shallow margins, ephemeral waterbodies outside or within the reservoir bank, and adjacent scrapes or small wet areas encourages reeds and rushes, supports breeding and overwintering wildfowl, and helps reduce wave erosion on embankments.

Low-intensity management of surrounding land can further enhance biodiversity and overall conservation value by establishing pollinator-friendly and species-rich grassland mixes on reservoir banks and margins. Where banks have been sown with a pollinator mix, an appropriately timed annual cut in September will be essential to prevent gradual embankment colonisation by scrub.

Plan for long-term landscape management. Timing maintenance correctly is crucial to avoid disturbing species at sensitive stages of their life cycles



Permissions and consents

Reservoirs can be approved in National Landscapes, but success depends on careful design and securing the right permissions and consents early

Farm reservoirs: myths and facts

MYTH: Off-stream reservoirs need no permissions
FACT: Most still require planning permission and an abstraction licence
MYTH: Permitted development rights mean you can build without approval
FACT: Prior approval is usually required and full planning permission is often needed for larger schemes
MYTH: Reservoirs are not allowed in National Landscapes, protected areas or near SSSIs
FACT: They can be approved if well sited, carefully designed and sensitively integrated into the landscape
MYTH: Winter water is always available for storage
FACT: Availability is increasingly constrained, early planning is essential to secure supply
MYTH: Reservoirs cost too much to justify
FACT: Cost must be weighed against the value of crops, supply security, and reduced risk. For high-value production, reservoirs are often a sound investment

Getting necessary permissions is not always easy. This guide is not a straight line – some steps run in parallel or depend on earlier decisions. Not every step will apply for every reservoir. However, good preparation in Stages 1 & 2 is the key to success in Stage 3.

Farm reservoir permissions: decision guide

Type of reservoir

Is the reservoir built across a river, stream or drain?
YES ▶ Impounding reservoir
- Impoundment licence required (EA)
- Planning permission required
- Other environmental consents likely
- Seek expert advice

NO ▶ Off-stream storage
Most farm reservoirs store water off-stream 1

Will the reservoir be filled from a river, drain or borehole?
YES ▶ Abstraction licence required (usually winter-only abstraction)
NO ▶ Rainwater harvesting may not require licensing. Seek advice from EA 2

Is the reservoir in a sensitive location?
(National Landscape, SSSI, SPA, SAC*, floodplain, drained lowland)
YES ▶ Planning permission likely
Ecology/landscape/archaeology checks likely
NO ▶ Planning permission may still be required 3

* Sites of Special Scientific Interest (SSSI); Special Protection Areas (SPA); Special Areas of Conservation (SAC)

** Ramsar Sites are wetlands of international importance designated under the Convention on Wetlands

Planning and environmental checks

Have you submitted a Prior Notification to the LPA?
NO ▶ Prior Notification required in all cases
YES ▶ Proceed to next step 4

Will the reservoir have significant environmental impacts?
(Large size, major earthworks, visual impact)
YES/UNSURE ▶ Request Environmental Impact Assessment (EIA) Screening Opinion from LPA (before Prior Notification is determined)
NO ▶ Continue 5

Does the LPA require Prior Approval?
LPA will decide whether Prior Approval is required, informed by Environmental Screening
YES ▶ Submit further details (design, landscape, ecology, drainage)
NO ▶ Proceed, subject to conditions 6

Will your proposal affect designated habitats?
(SAC, SPA, Ramsar Sites** nearby)
YES/UNSURE ▶ Habitats Regulations Assessment (HRA) may be required
This is separate from an EIA
NO ▶ Continue 7

Technical consents and approvals

Will the works affect ditches, drains or flood risk?
YES ▶ Land Drainage Consent from Lead Local Flood Authority (LLFA)/IDB or Flood Risk Activity Permit required from EA
NO ▶ Continue 8

Will the reservoir hold 25,000 m^3 or more above ground level?
YES ▶ Requires reservoir safety registration and appointment of approved reservoir construction engineer (see Reservoir safety reforms p15)
NO ▶ Continue 9

Outcome
Proceed once all required licences, permissions and consents are in place (all reservoirs must still comply with general health & safety and construction regulations) 10

Getting professional support can help anticipate the challenges and frustrations rather than responding reactively to every query

Applying for an abstraction licence[2]

In most cases, the first step is to contact the EA to obtain an abstraction licence to draw water from a river, stream, or groundwater. This should be done as early as possible, ideally alongside reservoir design, so licence conditions can be built into the scheme from the outset.

The EA manages water resources to protect the environment and existing water users. Most abstractions of more than 20 m^3 per day require a licence. If you already hold a summer abstraction licence, it may need to be varied or changed to a winter-only licence to support reservoir filling.

An early discussion with the EA will help confirm whether water is available in your catchment, explain local restrictions, and determine whether flow monitoring is required. These early checks often save time and cost later. Catchment information is also available through the EA's Abstraction Licensing Strategies (ALSs) for your area.

Allow several months for the process. The EA must advertise the application, consult statutory bodies, consider objections and assess impacts on the environment and other abstractors. In water-stressed areas, licences may be restricted or refused, so early discussion is important.

Environmental approval

As part of the planning process, the LPA will consult a range of statutory bodies, depending on the proposal's location and nature. This may include organisations such as Natural England (NE), the EA, and others with environmental responsibilities.

Where a reservoir is proposed in sensitive locations, such as National Landscapes or near designated wildlife sites, the EA and NE may request additional environmental information. This could range from targeted ecological surveys to a full statutory EIA.

These organisations will seek to understand how the reservoir will be sited, designed, and landscaped to minimise impacts and, where possible, enhance the local landscape and natural environment. Many environmentally beneficial features can be incorporated at low additional cost, such as sensitive shaping, planting, and habitat creation, as described later in the guide.

Public consultation

In some cases, the LPA may seek views from the local community as part of the planning process. This requirement often depends on the reservoir's size and its proximity to housing or public viewpoints.

In practice, smaller farm reservoirs located away from settlements and well integrated into the landscape tend to attract limited public interest, particularly where they are clearly linked to agricultural use and water security.

Archaeology

Experience suggests that up to one-third of clay-lined reservoirs may require archaeological assessment. Any application should consider the potential impact of the scheme on the historic environment, particularly where the land included in the proposal lies within an area of known or potential archaeological interest. This may include impacts on buried archaeological remains and on the setting of designated or non-designated heritage assets. This process is separate from environmental assessment, but the two can usually run in parallel to minimise delays. The LPA's archaeological advisers will review the proposal (only areas within the red line boundary) and may require further assessment, including intrusive and/or non-intrusive evaluation, that in turn may lead to further archaeological excavation and mitigation. Programmes can prove complex and expensive. Scheme promoters are therefore encouraged to engage with the LPA's archaeological advisers in the very early stages of the proposal to better understand these matters.

Access

Public access to farm reservoirs can be difficult to supervise and may raise safety and security concerns, including vandalism. For this reason, unrestricted public access is generally discouraged.

Controlled access by private groups, such as local birdwatchers or angling clubs, can sometimes be beneficial, as regular visitors may alert the landowner to problems at an early stage. Reservoirs are not suitable for swimming and are generally too small for boating. Appropriate signage and fencing are normally required.

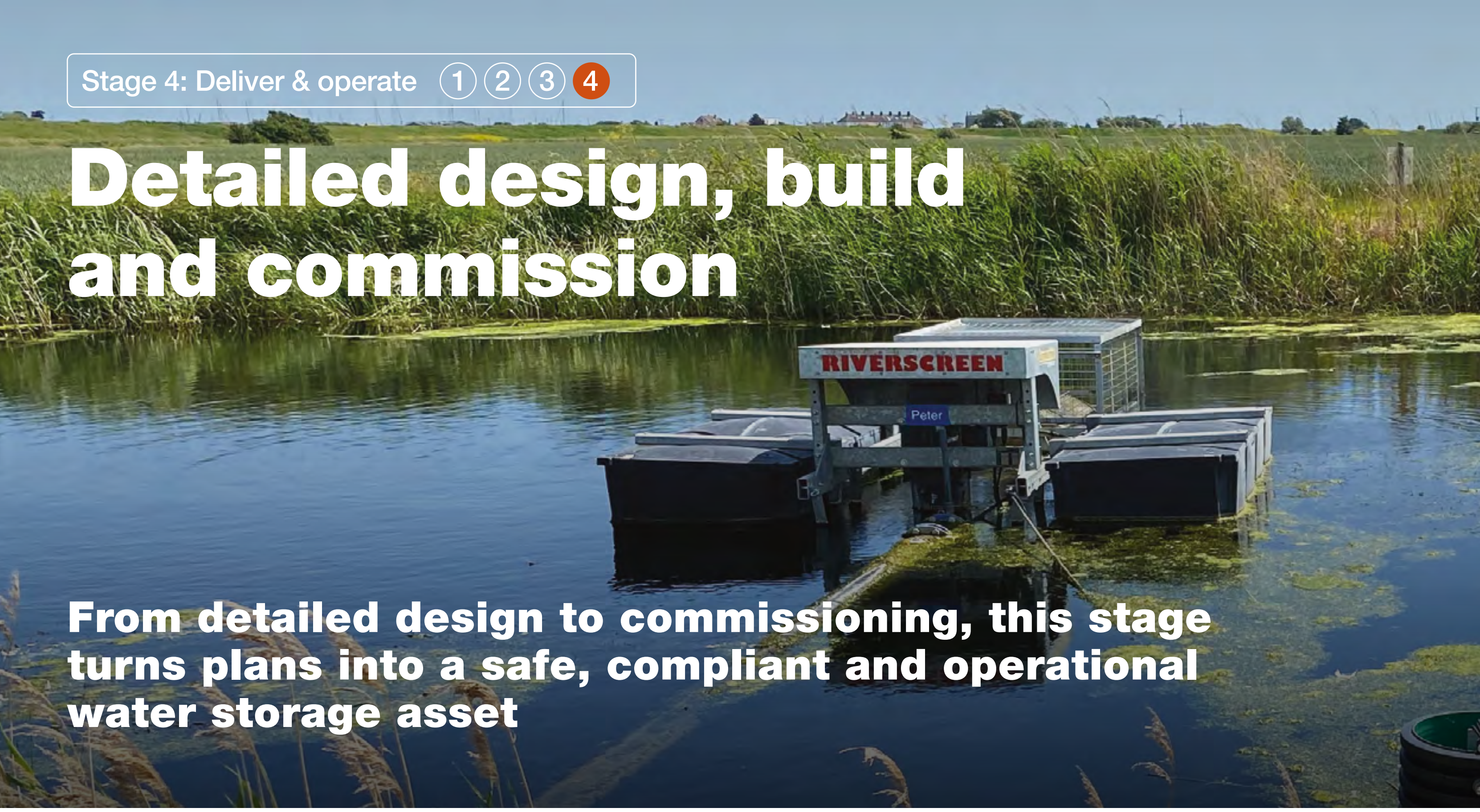
Other permissions and considerations

In addition to planning and environmental consents, other permissions or agreements may be needed. These can include:

- Temporary or permanent access across neighbouring land
- Rights for pipelines, electricity supply or telemetry
- Diversion of public rights of way
- Health and safety requirements during construction
- Protection of habitats or species not covered elsewhere
- Mineral or quarrying consent where clay or other materials are excavated
- Reservoir safety issues (p15)

For larger construction projects, a Site Waste Management Plan may be required. If excavated materials are moved off-site, waste documentation will be needed.

Identifying these issues early helps avoid delays during construction and ensures costs are properly budgeted.



Stage 4: Deliver & operate ① ② ③ ④

Detailed design, build and commission

From detailed design to commissioning, this stage turns plans into a safe, compliant and operational water storage asset

Key pumping considerations

- **Abstraction rate** – Sized to fill within the licensed winter window
- **Total head** – Allow for lift to crest plus pipe friction losses
- **Intake protection** – Screens to prevent debris, fish and eel entry
- **Energy supply** – Grid connection preferred; diesel for remote sites
- **Efficiency control** – Variable-frequency drives reduce energy use
- **Pipe sizing** – Avoid excessive velocities and friction losses
- **Compliance** – Flow metering to meet EA licence conditions

Choosing a sensitive colour for any ancillary equipment needed as part of the reservoir scheme will help integrate these structures into the landscape. A colour guide is available for both National Landscapes[3]

Every reservoir is unique. Soils, geology, water source and the farm system all influence the final design.

Design can proceed alongside planning and abstraction licensing applications to save time, but doing so before permissions are secured carries financial risk if applications are delayed or refused. Once permissions are in place, the project moves into detailed design and delivery, where decisions determine structural integrity, regulatory compliance, safety and long-term reliability. Planning drawings set out what is proposed in principle; detailed construction drawings, supported by clear specifications, contractor oversight and systematic commissioning, turn an approved scheme into a safe, durable reservoir that protects your investment for decades.

Understanding the ground

Most long-term problems originate in the foundation or embankment material

The greatest risks are often below ground. Permeable layers, weak soils, buried drains or high groundwater pressures can compromise stability and watertightness. Good delivery begins with understanding the site.

For clay-lined reservoirs, you will need to source sufficient clay suitable for compaction and embankment construction. Be aware of features that can weaken embankments and lead to leakage or failure, such as sand and gravel lenses, existing land drains, high water tables and burrowing animals.

Where uncertainty exists, geotechnical investigation may be justified before finalising design.

A reservoir is an engineered earth structure, not simply an excavated hole

Project delivery

Design & build package

A single contractor undertakes both detailed design and construction.

Advantages include a single point of responsibility, potentially faster programme, and early cost certainty.

Risks include less independent oversight, design optimisation may favour buildability over longevity.

Consultant + contractor

An independent designer prepares a detailed specification; the contractor builds to that specification, usually under the designer's supervision.

Advantages: greater design control, independent quality assurance, clear technical specification, can reduce costs if design is subject to competitive tendering.

Risks include a longer procurement process and potential interface disputes. Choice depends on project scale, complexity and risk appetite.

From construction through commissioning to operation, disciplined delivery ensures the reservoir performs safely and reliably for decades. Ongoing inspection and maintenance are part of responsible water stewardship.

Building properly

When constructing earth embankments, key issues include controlling moisture content to ensure effective compaction, compacting in appropriate layers, protecting liners from puncture, installing pipework to correct levels, and ensuring spillways are robust.

Construction quality determines long-term performance. Poor compaction or unmanaged seepage pathways can lead to leakage, slope instability or long-term maintenance issues.

Earthworks are highly sensitive to weather so summer construction is generally preferred. Winter construction increases the risk of poor compaction and programme slippage. Programming should allow time for settlement before the first filling.

Independent supervision is often prudent on larger schemes.

Building safely

Reservoir construction involves heavy plant, large earthworks and deep excavations, along with installation of major pipework. Robust health and safety planning is essential, and Construction Design Management (CDM) regulations apply. Clear contractor roles, supervision and responsibilities are critical to managing risk.

Reservoirs storing more than 25,000 m^3 above ground level must comply with reservoir safety legislation and require appointment of a qualified reservoir construction engineer.

Operating safely

Safety continues beyond construction, with secure fencing, safe access and emergency planning essential for responsible operation.

Commissioning & handover

Commissioning ensures the reservoir operates safely and complies with licence and safety requirements. Before first filling ensure that abstraction meters are installed, pumps tested and calibrated, spillways inspected, flow monitoring operational, as-built drawings retained, and licence conditions understood.

Engagement with the EA may be required where licence conditions apply.

Operating a long-term asset

A reservoir is a 40 to 60-year infrastructure asset if properly managed.

Operation involves:

- Adhering to abstraction timing and limits
- Maintaining embankments and vegetation
- Inspecting for erosion or burrowing
- Managing silt and water quality
- Replacing HDPE membrane liner
- Servicing pumps and control equipment.
- Appointing a reservoir panel engineer if storage is 25,000 m^3 above ground level

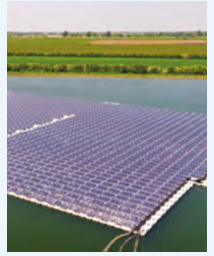
Regular inspection reduces risk and protects investment.

Good reservoirs are not straightforward investments. They are site-specific engineered structures built on variable ground. Sound design, careful construction and disciplined operation ensure reliability for decades.

Reservoir investment and operating costs

Reservoir investment is a major financial commitment. Assess capital and operating costs, integration with existing abstraction, and how to minimise pumping, energy use and drought risk

Floatovoltaics – investing in 'multi' use rather than 'single' use reservoirs



Farmers recognise the need to invest in storage to improve water security and climate resilience. However, the capital cost can be difficult to justify if reservoirs are viewed as serving irrigation alone.

A shift from 'single use' to 'multi-use' storage – combining irrigation, environmental enhancement and renewable energy – can strengthen financial viability. Floating solar panels ('floatovoltaics') offer one such opportunity, generating power while maintaining water storage.

Used year-round, reservoirs can support both irrigation and green energy production, improving business resilience, reducing greenhouse gas emissions and lowering energy costs. This approach can also help avoid conflicts over land use and reduce pressure to develop standalone solar farms on productive farmland.

If floating photovoltaic (FPV) panels are being considered for installation on a reservoir, care should be taken to ensure they do not compromise ecological benefits, for example by restricting access to open water used by wading birds and wildfowl.

Capital costs

The cost of constructing a reservoir depends on site conditions, particularly whether suitable local clay is available or a synthetic HDPE liner is required. Early geotechnical advice is critical to avoid costly problems later.

Figure 3 compares earthworks costs (£) for 30 recently constructed irrigation reservoirs built over the past two years against their storage capacity (m³). For clay reservoirs, the costs reflect excavation only; for lined reservoirs, they also include the HDPE liner. The scatter in the data reflects the complexity of local site conditions.

The data show a broadly parallel linear trend between both reservoir types. Clay reservoirs (red dotted line) are generally cheaper, although the gap has narrowed considerably following the removal of red diesel entitlement for construction in 2022. The average storage capacity across the sample was 100,000 m³.

Figure 4 compares unit costs (£/m³ of usable storage) against reservoir capacity (m³). It shows that clay reservoirs typically cost £2.00–£3.00/m³ of gross storage (average £2.75/m³), while HDPE-lined reservoirs ranged between £2.50–£4.50/m³ (average £3.25/m³).

Irrespective of construction type, smaller reservoirs are disproportionately more expensive, so larger schemes do benefit from clear economies of scale.

These costs exclude permissions, site investigations and professional fees. Investigation, design, supervision and statutory certification can add around 15% to construction costs for larger reservoirs. EIAs may also be required on sensitive sites, with upfront costs at risk if the scheme does not proceed.

Additional infrastructure must also be included, such as easements, inlet and outlet structures, pumps, pipework, access roads, landscaping and fencing. Securing a three-phase electricity supply can exceed £100,000 where capacity is limited, so careful site selection can help reduce these costs.

Reservoir sizing should also allow for 'dead storage' to cover evaporation, seepage and liner integrity – typically around 5%.

There is also an opportunity cost from land taken out of production – either as capital tied up or lost cropping – but this can be offset by the higher value and productivity of irrigated land.

Plan for future expansion – limited summer abstraction and potential Environmental Destination reductions may restrict growth in irrigated areas without additional storage

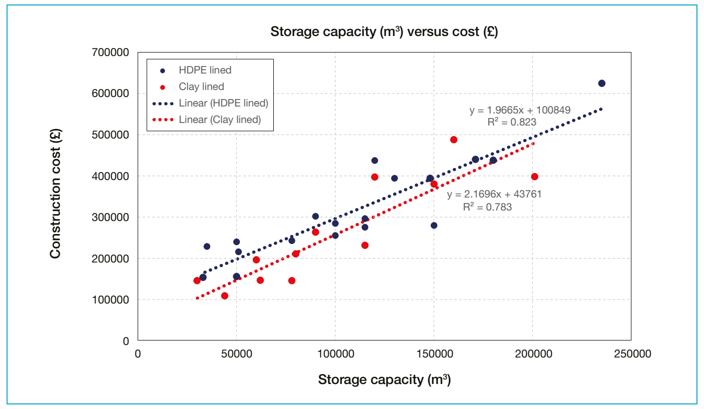


Figure 3: Construction costs (£) vs storage capacity (m³) for a sample of recently constructed clay-lined and HDPE membrane-lined reservoirs.

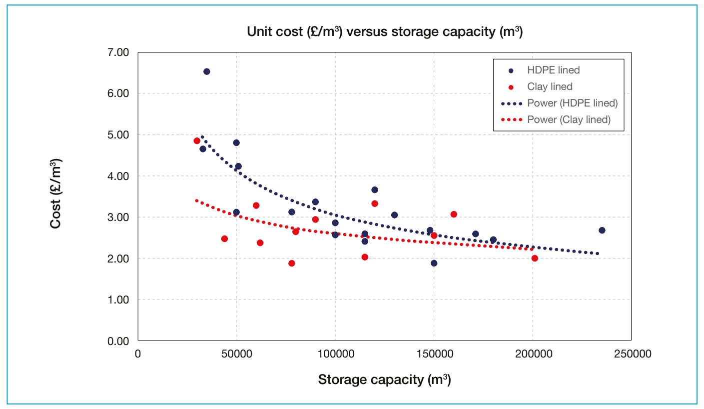


Figure 4: Unit cost (£/m³) vs storage capacity (m³) for recently constructed clay and HDPE membrane-lined reservoirs.

Operation and maintenance costs

While capital investment dominates, annual operating and maintenance costs should not be overlooked. For clay-lined reservoirs, these are typically around 1–2% of capital cost.

Clay reservoirs are long-lasting and generally do not require perimeter fencing, although businesses still have a duty of care to prevent accidents. In contrast, HDPE-lined reservoirs require secure boundary fencing due to safety risks (steep, slippery embankments). This adds to the overall costs. Escape measures such as roped tyre ladders at 50 m intervals are now commonly installed. Liners also require periodic repair and typically have a lifespan of around 25 years, so allowance for replacement is advisable.

Energy is another high cost. Most systems involve "double pumping" – into storage and then into distribution – often adding around 1 bar of pumping pressure. Variable speed pumps and off-peak tariffs can help manage energy use and costs.

The Reservoirs Act 1975

In England, reservoirs holding 25,000 m³ or more above natural ground level must be registered with the EA where they are regulated under the Reservoirs Act 1975. Once registered, the EA will designate each reservoir as either 'high-risk' or 'not high-risk', based on whether an uncontrolled release of water could endanger human life. 'Not high-risk' reservoirs must still be registered with the EA but are not subject to the same level of oversight.

High-risk reservoirs must comply with additional statutory requirements, including ongoing supervision and periodic inspections by qualified panel engineers, usually at least every ten years. These engineering inspection costs are the responsibility of the reservoir owner. Owners must also meet all statutory safety and inspection obligations set out in the Reservoirs Act.

Reservoir safety reforms

Work is underway to modernise reservoir safety regulation. Proposals include a hazard-based classification system to better align safety requirements with risk, and extending regulation to smaller raised reservoirs (10,000–25,000 m³). Monitor the "Reservoir Safety Reform Programme" for updates[4].

Further information and grant opportunities

The British Dam Society (britishdams.org) provides guidance on engineering and regulatory requirements for reservoir construction, including panel engineers and health and safety compliance.

Recent funding was available through the **Water Management Grant** to support winter storage, reduce reliance on summer abstraction and encourage collaborative reservoirs. Grants have typically ranged from £35,000 to £500,000, covering up to 40% of eligible costs.

The Farming Equipment and Technology Fund 2026, launched in March 2026, includes items related to irrigation management, rainwater harvesting and agricultural demand management[5].

While the grants above may be time-limited, funding is available to farmers for many water-storage actions through **Countryside Stewardship Higher Tier and Sustainable Farming Incentive** (SFI)[6].