REST-COAST

LARGE SCALE RESTORATION OF COASTAL ECOSYSTEMS THROUGH RIVERS TO SEA CONNECTIVITY

RHÔNE DELTA

RESULTS & ACHIEVEMENTS REPORT

SUMMARY

The Rhône Delta pilot site — a former industrial salt pan in the Camargue — has undergone a major ecological transformation under the REST-COAST and LIFE+MC Salt programmes. The 4,600-hectare site, previously managed for salt production for decades, is being converted into a nature reserve with the dual ambition of restoring coastal and lagoon ecosystems and building long-term resilience to sea-level rise (SLR) and storm surge risk.

The restoration strategy employs a dual-sector approach: passive natural recovery in the southern sector, where former salt ponds are progressively reconnected to the sea through natural breaches and the deliberate abandonment of the exposed seafront dyke; and active water management in the northern sector, where new hydraulic infrastructure connects the site to freshwater sources from the Rhône watershed. Implementation is strong across most challenge areas, with four out of six measurable challenges at 75–100% of planned actions. Nearly 250 hectares have been colonised by halophytic plants, and coastal surveys confirm stable, natural geomorphological evolution of the overwash barrier with no acute breaching risk under SLR scenarios to 2100.

Governance has been strengthened through a participatory management plan, a fully operational CORE-PLAT stakeholder platform, and the site's formal designation as nature-dedicated by national planning authorities. The site serves as a reference model for the Conservatoire du littoral's wider coastal NbS strategy. Outstanding challenges include completion of the inland dike enhancement, long-term securing of freshwater supply, and sustained funding for monitoring and public communication..

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THREATS AND PRESSURES TACKLED

- Legacy of long-term industrial salt production and associated hydrological and ecological degradation of the former saltern.
- Exposure to climate-change-driven hazards, including sea-level rise, storm surges, and increased submersion risk.
- Unsustainable water and dike management inherited from decades of industrial operation.
- Need to realign coastal defence strategy away from an exposed and no-longer-viable seafront dyke.
- High confinement and poor water renewal in former salt ponds cause water quality deterioration.
- Complex hydrological reconfiguration required to restore natural water dynamics across a large, compartmentalised former industrial site.
- Extreme salinity and seasonal drying risks are driven by the artificial flooding and drying cycles of the saline operation.
- High governance and coordination complexity involving multiple institutional actors with overlapping mandates and interests.

BASELINE CONDITION

The Rhône Delta pilot site is a former industrial saltern managed for salt production for several decades. Under industrial management, the site's hydrology was entirely artificial: salt ponds were completely dried before October and again before February each year, eliminating natural water level fluctuations and seasonal variability. This regime produced extreme salinity conditions incompatible with most coastal and lagoon ecosystems, and severed the ecological connections between the site and the surrounding sea and river systems.

The seafront dyke, originally constructed to protect salt production infrastructure, became increasingly exposed and costly to maintain as the shift away from industrial use progressed. Coastal defence responsibility had not been formally reassigned, leaving an institutional gap. Meanwhile, the broader Rhône delta faces growing exposure to SLR and storm surge risks, for which the former saltern — if restored as a salt marsh — could function as a large-scale natural buffer.

Governance was fragmented across multiple actors — the Conservatoire du littoral (site owner), the saline company operating immediately to the east, local dike managers, and regional and national authorities — with no shared management framework. The absence of a formal management plan and participatory platform meant that restoration decisions were made in an institutional vacuum, limiting both the pace and the legitimacy of the transformation.and build shared commitment to implementation.

RESTORATION STRATEGY SELECTED AND WHY

The restoration strategy is built around a fundamental reorientation of the site's water management: replacing the artificial flooding and drying cycles of the industrial period with natural hydrological dynamics calibrated to ecological restoration objectives. Ecological and management conditions are addressed in two sectors of the site.

In the southern sector, passive restoration was selected as the most cost-effective and ecologically appropriate strategy: the seafront dyke was deliberately abandoned, allowing natural breaches to reconnect former salt ponds to the sea and initiating the gradual, unmanaged transition toward marine lagoon conditions. In the northern sector, active water management was necessary because

direct connection to the sea is not feasible; new hydraulic infrastructure was constructed to channel freshwater from the Rhône agricultural catchment, enabling controlled regulation of salinity and promoting salt marsh and macrophyte recovery.

The strategy was designed to deliver a 4,600-hectare climate change buffer area, providing protection against SLR and storm surge through the expansion of naturally resilient coastal habitats. The coastal defence function was transferred to the inland dike, removing the need to maintain the exposed seafront structure. Governance was addressed in parallel through the development of a participatory management plan and the strengthening of the CORE-PLAT platform, building the institutional foundations needed to sustain restoration over the long term.

HOW THE CHALLENGES WERE ADDRESSED AND KEY RESULTS ACHIEVED

Unsustainable Water and Dike Management

New water circulation infrastructure has been deployed and seasonal water level dynamics have been restored across the site. Winter water levels now reach 0.4–0.5 m NGF, compared to the baseline when ponds were completely dried before October and February each year. The monitoring network deployed before and during REST-COAST confirms these improvements.

High Confinement and Poor Water Renewal

Passive reconnection to the sea in the southern sector and freshwater inflow in the northern sector have substantially improved water renewal across the site. Monitoring aligned with EU Water Framework Directive standards documents increased species richness in benthic fauna, macrophyte recovery with target species *Ruppia spiralis*, *Zostera noltei* and red algae establishing in previously degraded lagoons, and a reduction in opportunistic green algae (Cladophora, Ulva/Chlorophyta), indicating favourable restoration progress.

Extreme Salinity and Seasonal Drying Risks

Complete pond drying has been eliminated. Greater natural salinity variability is now observed as a result of restored water flows and salt fluxes. However, some ponds still exhibit salinity levels above management plan targets (e.g. Galabert pond exceeds 150 g/L; others peak at 135 g/L and 115 g/L in summer). Ongoing monitoring informs adaptive management to bring conditions within restoration targets.

Exposure to Climate-Change-Driven Hazards

Nearly 250 hectares have been colonised by annual and/or perennial samphire through salt marsh vegetation restoration. Hydrological modelling confirms that the current restoration project provides protection against SLR-related submersion and inundation risks across all projected scenarios to 2100, functioning as a large-scale natural coastal buffer.

Need to Realign Coastal Defence Strategy

The exposed seafront dyke has been abandoned and the coastal defence function has been transferred to the inland dike. LiDAR surveys and D-GPS campaigns confirm that the overwash barrier is gradually widening to approximately 800 metres with a vertical range increase of 0.8 m. Prospective modelling shows no risk of total breaching, but rather gradual, natural geomorphological retreat in adaptation to SLR. The seafront dyke is trapping sediments, creating a positive feedback loop within the new grey infrastructure system. Enhancement of the inland protective dike is pending.

High Governance and Coordination Complexity

A participatory management plan has been developed through an inclusive process involving a broad set of stakeholders, building consensus and institutional legitimacy. The CORE-PLAT is fully operational, with improvements to its structure and financial mechanisms supported through REST-COAST. Most planned actions fall within the

75–99% implementation range. Ongoing tensions among local actors regarding dike maintenance and water governance, and the questioned legitimacy of the Camargue Natural Regional Park due to delays in charter renewal, remain active governance risks.

PERCENTAGE OF TARGET ACHIEVED

100% Water and dike management infrastructure deployed; water renewal and circulation restored across the site.

75% Salinity and drying risk mitigation, climate hazard buffering, coastal defence realignment, and governance — all substantially advanced, with specific outstanding actions in each area

Not individually rated Legacy of industrial salt production – addressed as a cross-cutting contextual framing integrated across all challenge areas rather than as a standalone measurable intervention.

SPECIFIC SOLUTIONS IMPLEMENTED

Dual-sector restoration approach

Passive natural recovery (southern sector) through deliberate abandonment of the seafront dyke and natural sea reconnection; active water management (northern sector) through new hydraulic infrastructure connecting the site to the Rhône watershed freshwater sources.

Hydraulic infrastructure works

New connections to the Rhône agricultural catchment installed in the northern sector, enabling controlled freshwater inflow to regulate salinity and support salt marsh and macrophyte recovery.

Seafront dyke abandonment and coastal realignment

Deliberate transition from engineered coastal defence to passive geomorphological evolution, with coastal defence function shifted to the inland dike.

Saltmarsh vegetation restoration

Active and passive measures resulting in nearly 250 hectares colonised by samphire (annual and perennial species of halophytes), contributing to climate buffering and carbon sequestration.

Monitoring network

Comprehensive hydrological, water quality, geomorphological (LiDAR, D-GPS) and ecological monitoring deployed before and during REST-COAST to track restoration progress and inform adaptive management.

Hydrological and coastal modelling

Numerical modelling used to assess SLR submersion risk, overwash barrier evolution, and long-term geomorphological stability under projected climate scenarios to 2100.

Participatory management plan

Developed through an inclusive multi-stakeholder process, providing a shared governance framework and aligning institutional roles and responsibilities.

CORE-PLAT strengthening

Governance mapping, structural improvements and financial mechanism development supported through REST-COAST, with involvement of local inhabitants facilitated through Fondation de France funding.

KEY STAKEHOLDERS INVOLVED AND HOW

The Conservatoire du littoral is the site owner and primary co-manager, involved across all challenge areas and central to the management plan's development and implementation.

The Compagnie des Salins du Midi, which continues industrial salt production immediately to the east of the site, was engaged to reach an agreement on the management of the shared dike – a critical interface between the restoration site and ongoing industrial operations.

Local dike managers and coastal risk managers are engaged particularly in the context of the coastal realignment strategy, as the maintenance of the inland dike directly benefits local communities and infrastructure and is a cost-effective long-term measure.

The Camargue Natural Regional Park and relevant regional and national planning authorities are key decision-makers whose engagement underpinned the formal designation of the area as nature-dedicated by national spatial planning authorities.

Local inhabitants and site users were engaged through the CORE-PLAT process, supported by Fondation de France funding, particularly regarding potential future economic development linked to restoration activities. The CORE-PLAT is fully operational, with all members involved in the governance process.

INFLUENCE ON DECISION-MAKING

At a regional scale, the coastal realignment and NbS strategy developed at the Rhône Delta site is being used as a reference model by the Conservatoire du littoral to promote integrated coastal management across the Rhône delta and former saltern sites in the region.

At a national scale, the coastal defence manager is integrating coastal realignment and Nature-based Solutions as potential measures into the broader coastal defence strategy for the Rhône delta. The national government responsible for coastal planning has formally designated the area as nature-dedicated, reflecting the site's direct contribution to shaping national spatial planning decisions.

At an EU scale, the site has demonstrated institutional support for Nature-based Solutions and contributed evidence through the REST-COAST and similar projects. The restoration approach – particularly the use of passive restoration and adaptive coastal management – provides a scalable model relevant to EU-level discussions on coastal resilience, the Water Framework Directive, and climate adaptation policy. No specific EU policy change directly attributable to the pilot has been confirmed.

RECOMMENDATIONS FOR FUTURE DEVELOPMENT

Complete the enhancement of the inland protective dike, which remains pending and is necessary to ensure full protection of local communities and infrastructure against climate change and SLR effects.

Address the evolving institutional status of the Camargue Natural Regional Park proactively, as delays in charter renewal are creating risks for sustained engagement and long-term planning.

Secure long-term financing for hydraulic infrastructure maintenance in the northern sector and explore new connections to the watershed to enhance water management flexibility.

Manage ongoing tensions among local actors regarding dike maintenance and water governance proactively to prevent delays in implementation.

Increase freshwater input to the site: modelling and monitoring results confirm this will be necessary to maintain restoration pathways and meet water quality and salinity objectives, requiring coordination among multiple stakeholders across the Rhône delta.

Scale up public communication on the ecological and socio-economic benefits of restoration significantly, as current dissemination to the general population is insufficient to build the broad social licence needed for long-term support.

Improve integration of monitoring time series with climate projection models to better detect, attribute and communicate climate-driven trends and inform adaptive management.

Explore carbon sequestration credit mechanisms for the northern salt marsh sector as an additional long-term financing stream.

FINANCIAL MECHANISMS USED AND PROPOSED

The restoration programme has drawn on a combination of EU project funding, public co-financing, and private contributions. LIFE+MC Salt covered the initial investment in hydraulic infrastructure across the water management, water quality and salinity challenge areas, complemented by co-funding from the Water Agency and private contributions. EU Horizon 2020 REST-COAST funded monitoring improvements, CORE-PLAT governance enhancements and financial mechanism development. Fondation de France provided specific funding to involve local inhabitants in exploring future economic development opportunities linked to the restoration.

The coastal realignment strategy is highly cost-effective: it is based on the passive abandonment of the seafront dyke, with costs limited to monitoring and evaluation. In the southern sector, this approach is expected to substantially reduce long-term dike maintenance costs by allowing natural geomorphological processes to replace expensive engineered maintenance.

Future mechanisms under development include financing from the coastal defence manager through local taxation or project-based funds for the inland dike enhancement; continued external funding to maintain long-term monitoring and sustain CORE-PLAT participation; carbon sequestration credits from the northern saltmarsh sector; and scaled-up public engagement to build the case for sustained public investment and attract new funding partnerships.