



Mont Saint Michel - Maritime Restoration Project

A civil engineering operation of significant national importance



Presentation Summary

- *overview of island location & geology in bay natural setting*
- *religious importance for pilgrimage and sanctuary*
- *architecture of monastic buildings*
- *deterioration of maritime characteristics as tourism took precedence over ecological interests*
- *explanation of works carried out to restore the natural marine environment for the protection and enhancement of the site for future generations*

France administration

- 1 state
- 12 mainland regions
 - reduced from 22 in 2022
- 96 departments

The Hexagon



Normandy & Brittany coast





Mont Saint Michel Bay

- 450km² tidal zone
- 15m spring tidal range
- 3 rivers Sée, Sélune, Couesnon

North-west France

■ regional road layout

- from Paris 360km / 4h30m
- from Rennes 65km / 1h
- from Nantes 190km / 2h15m
- from Brest 260km / 2h45m



Mont St Michel Bay

- tidal distance up to 18km
- incoming tidal speed about 1m/second

3 rivers Sée, Sélune, Couesnon

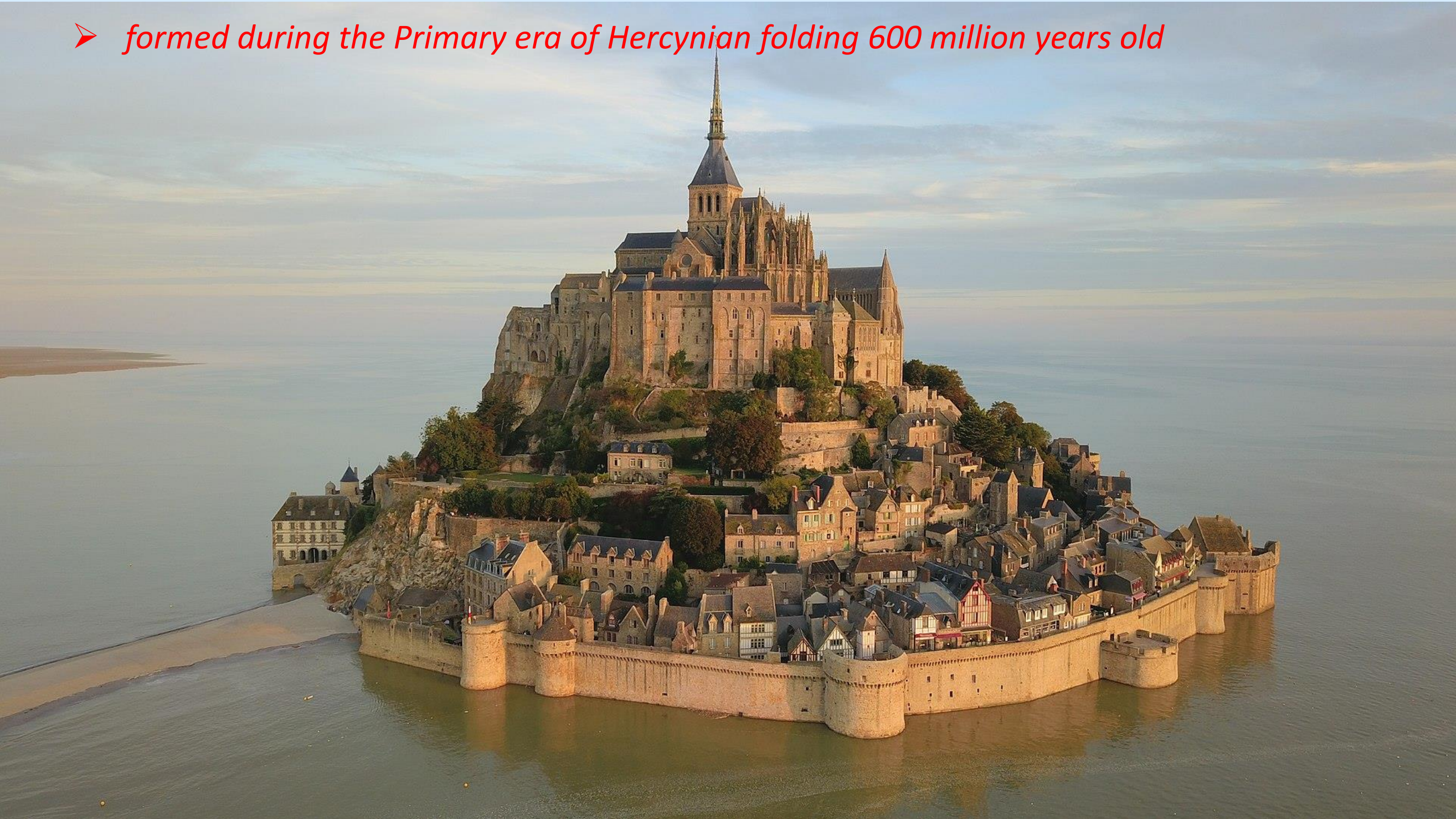
2 departments

- 50 - Manche
- 35 - Ille et Vilaine



The island of Mont Saint Michel

- *Geology : 80 metre high cone of granulite rock*
 - *formed during the Primary era of Hercynian folding 600 million years old*



- *the bay between land and sea*

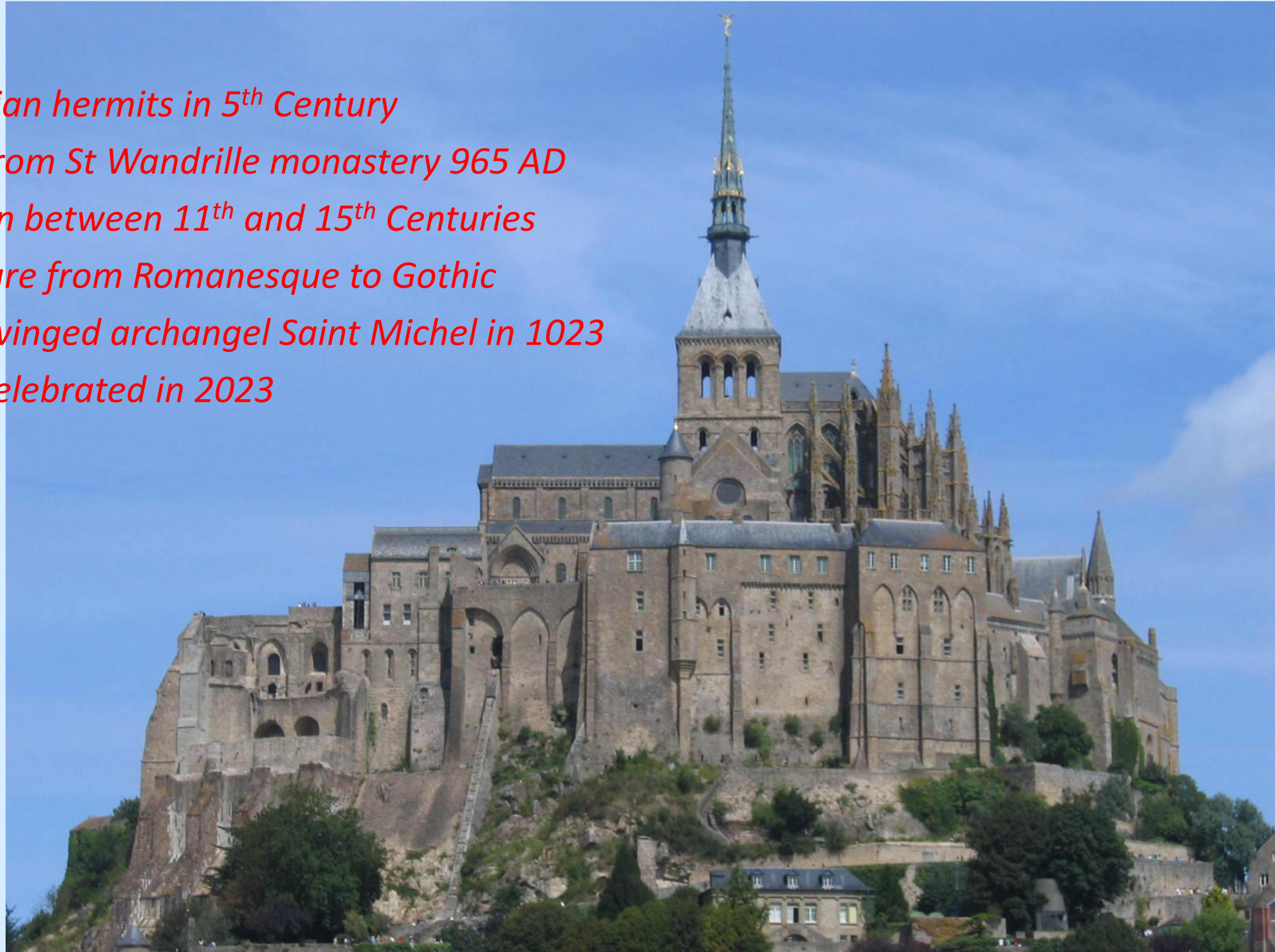


- *the sand flats at low tide*



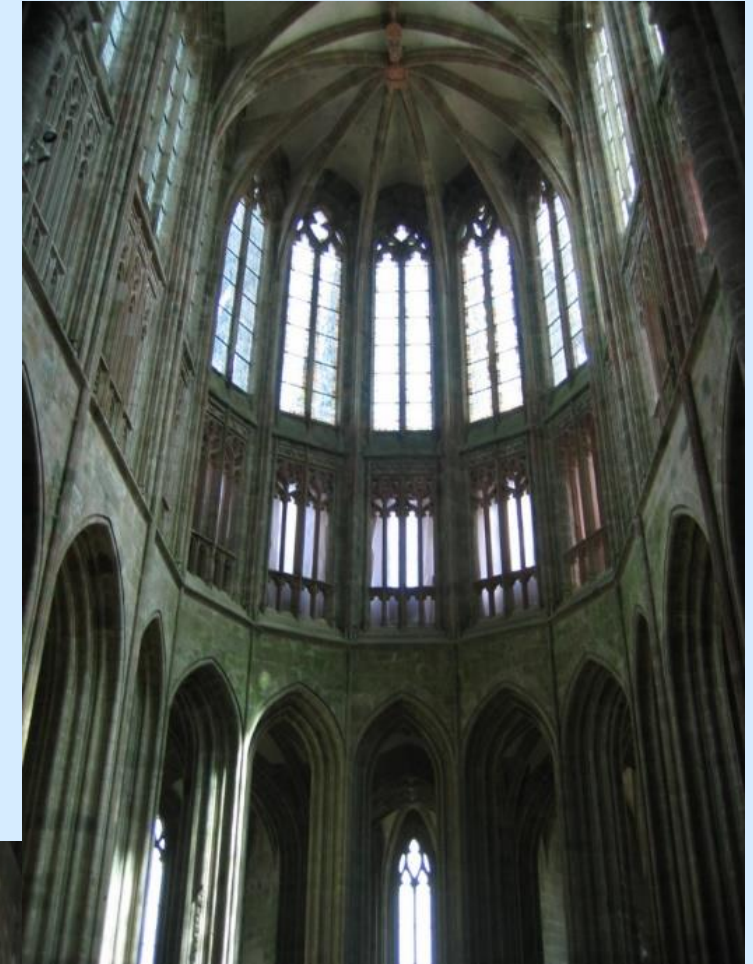
Religious history

- *first settled by christian hermits in 5th Century*
- *Benedictine monks from St Wandrille monastery 965 AD*
- *continuous expansion between 11th and 15th Centuries*
- *mixture of architecture from Romanesque to Gothic*
- *abbey dedicated to winged archangel Saint Michel in 1023*
- *1000th anniversary celebrated in 2023*



West terrace at 80m above mean sea level

- *fortified abbey church 70 m long*
- *natural granite rock floor in centre*
- *extended over crypts around perimeter*
- *romanesque simple nave from 11thC*
- *initially 7 bays now only 4 bays*
- *flamboyant 25m high gothic chancel from 13thC*



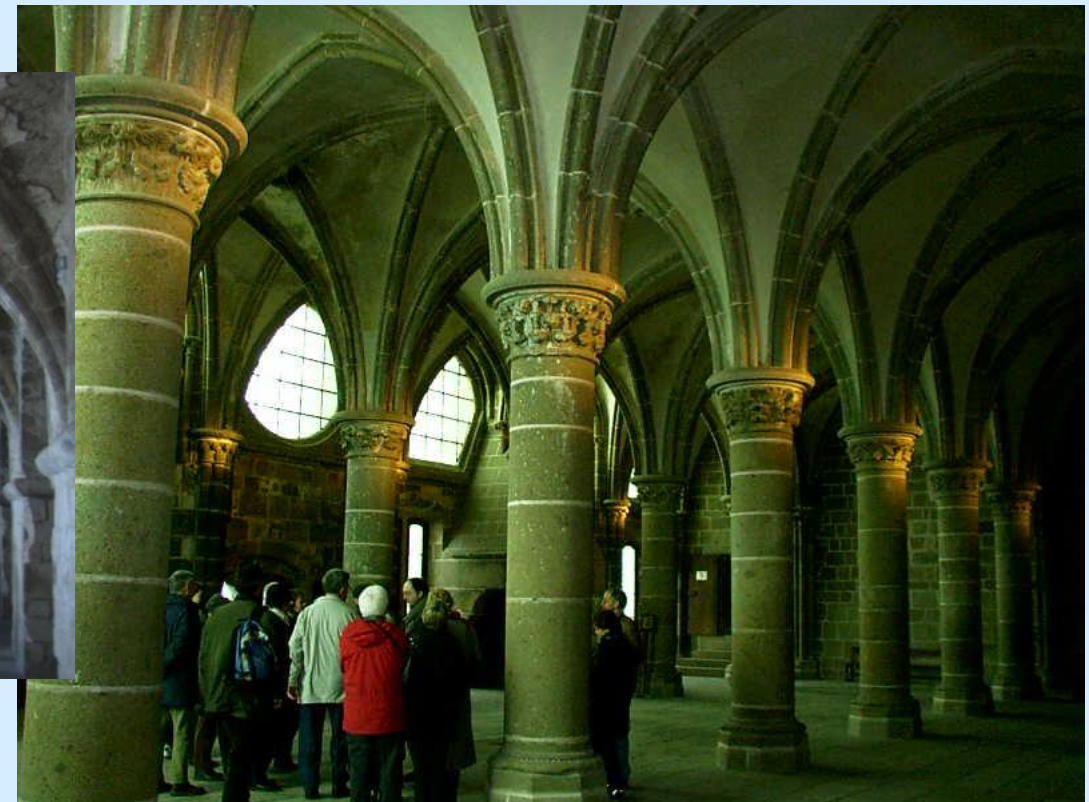
3 storey La Merveille

- top floor for the monks
- the cloisters
- the monks' refectory



La Merveille

- *middle floor for wealthy pilgrims*
- *lower floor for the poor*
- *the promenoir*
- *the crypt*
- *symbolic of medieval life and the 3 strata of society*
- *at the bottom those who toil - workers*
- *in the middle those who govern and fight - kings & knights*
- *at the top those who pray - monks*



Abbott's hall



Ramparts



The problems

- too many tourists
- access by the causeway

The result

- silting up the bay & river Couesnon



The situation before 2006 looking south



The proposed solution after 2014 looking south



High tide aerial view before the works



High tide aerial view today

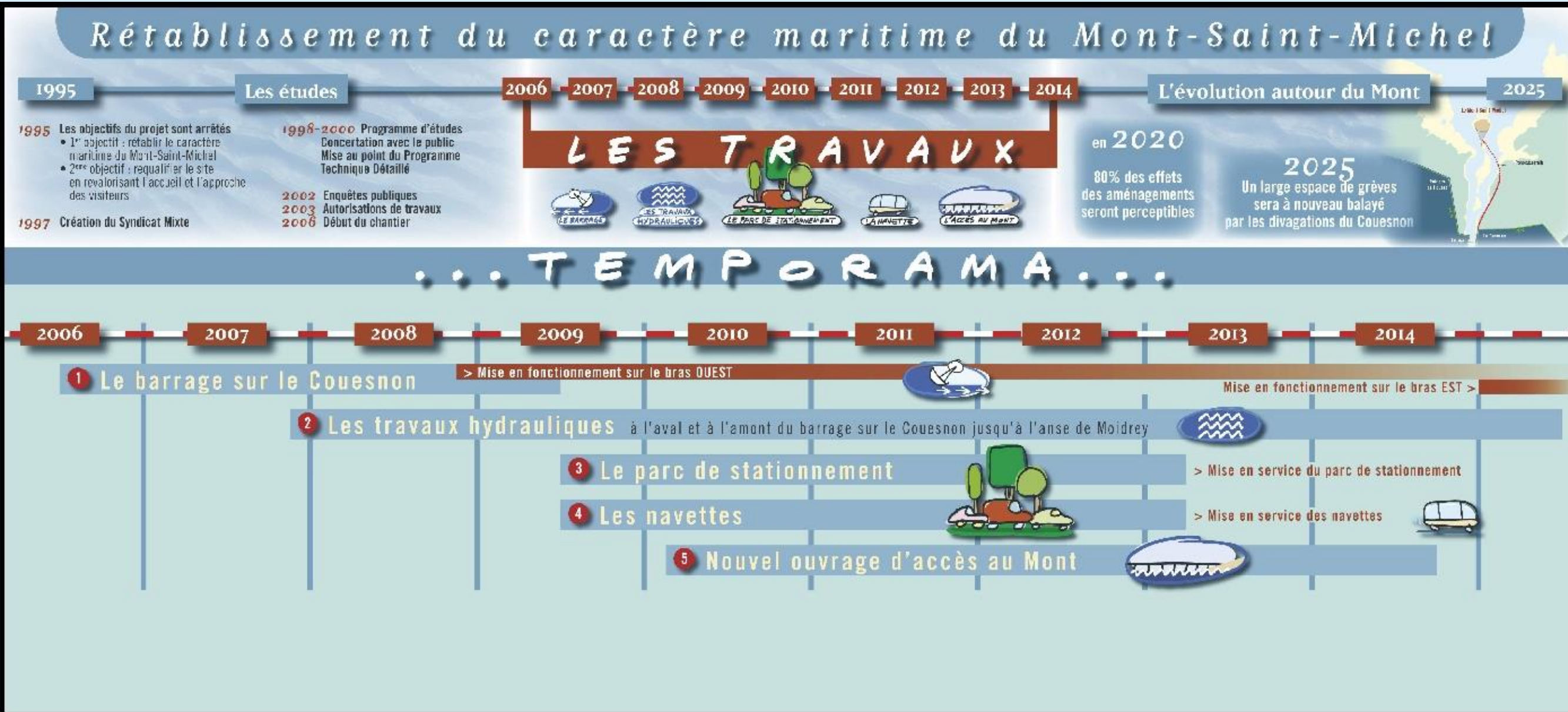


List of improvement works

- *new dam with 8 rising sector gates*
- *upstream flushing water reservoir*
- *pedestrian footbridge*
- *ford*
- *inland car park & shuttles*
- *removal of the causeway*
- *dredging of the river*
- *control of the tidal flow*



Time line for improvement works



The new barrier dam

- *gates raised in closed position at high tide*



- *gates lowered in open position*



- *general view at low tide*

The barrier dam explanation panel

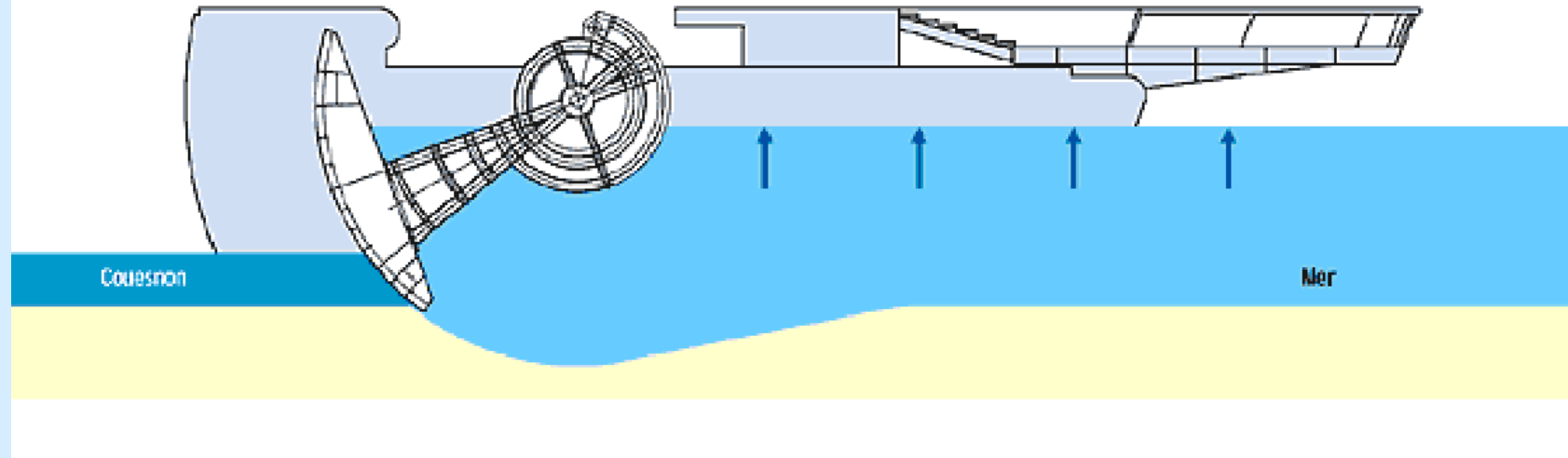


■ pier numbering

- Latin
- Hebrew
- Greek
- Arabic

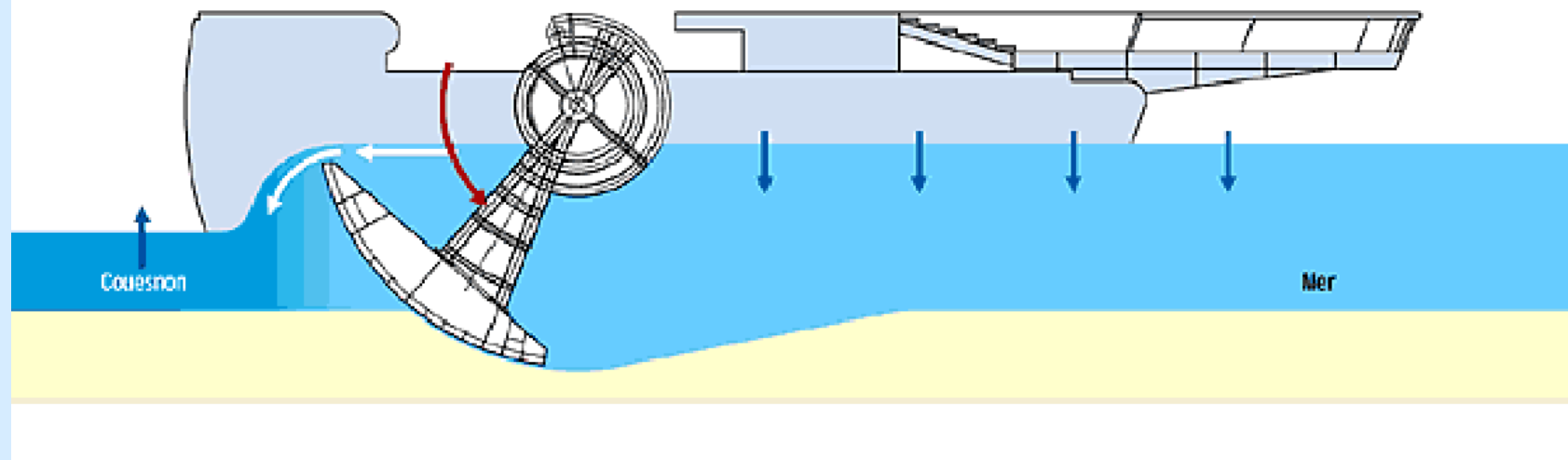
Dam radial gates control cycle

■ phase n° 1



*one hour before high water
gate closed in raised position*

■ phase n° 2

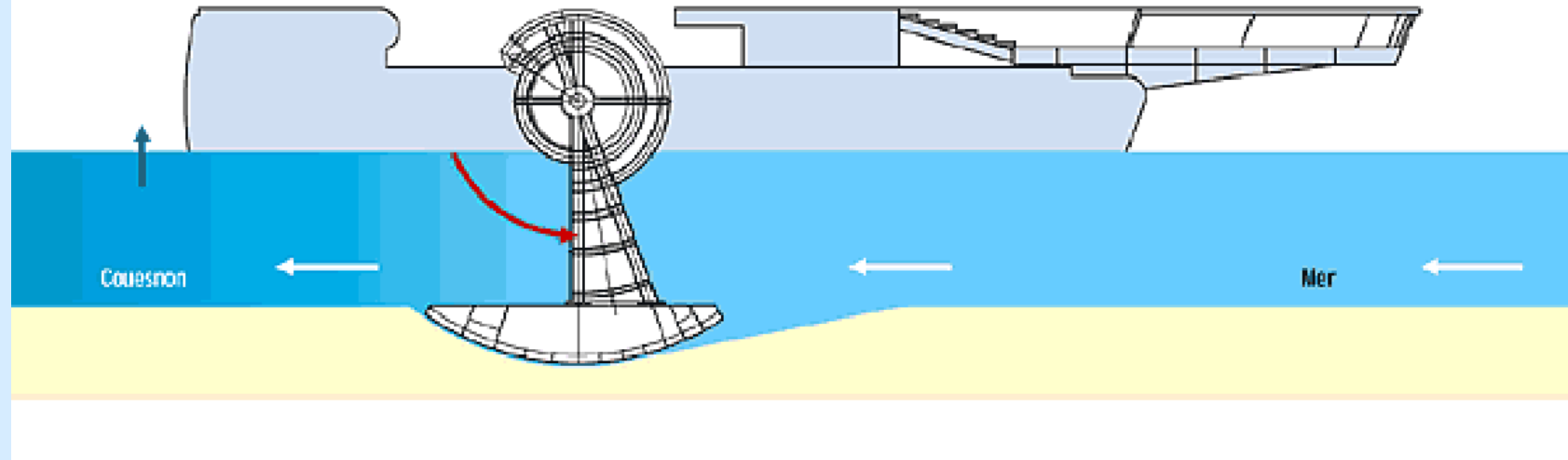


*10 minutes before high water
gate lowered for over topping*

Dam radial gates control cycle

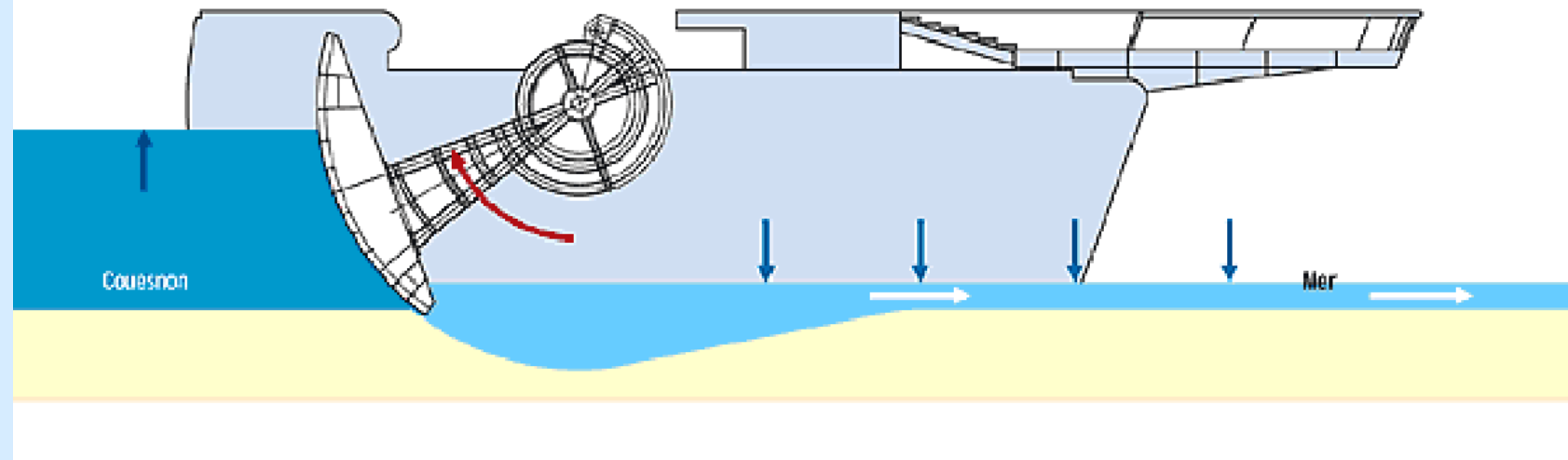
■ phase n° 3

*filling one and a half hours after high water
lowering of the radial gate*



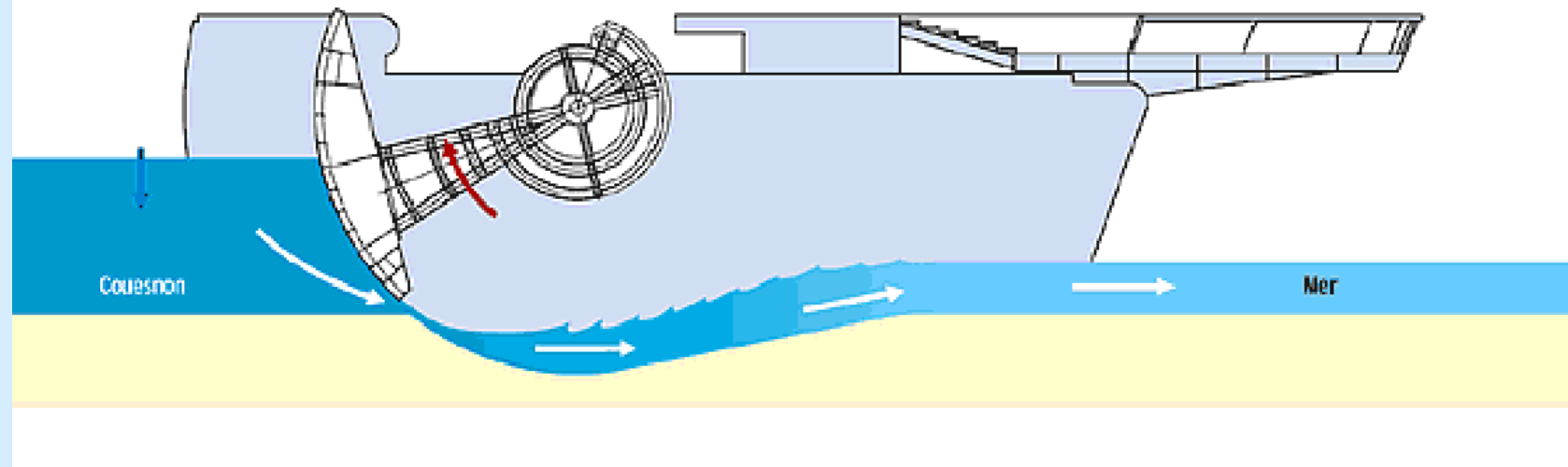
■ phase n° 4

*wait for the chase out 6 hours after high tide
raising of the radial gate*



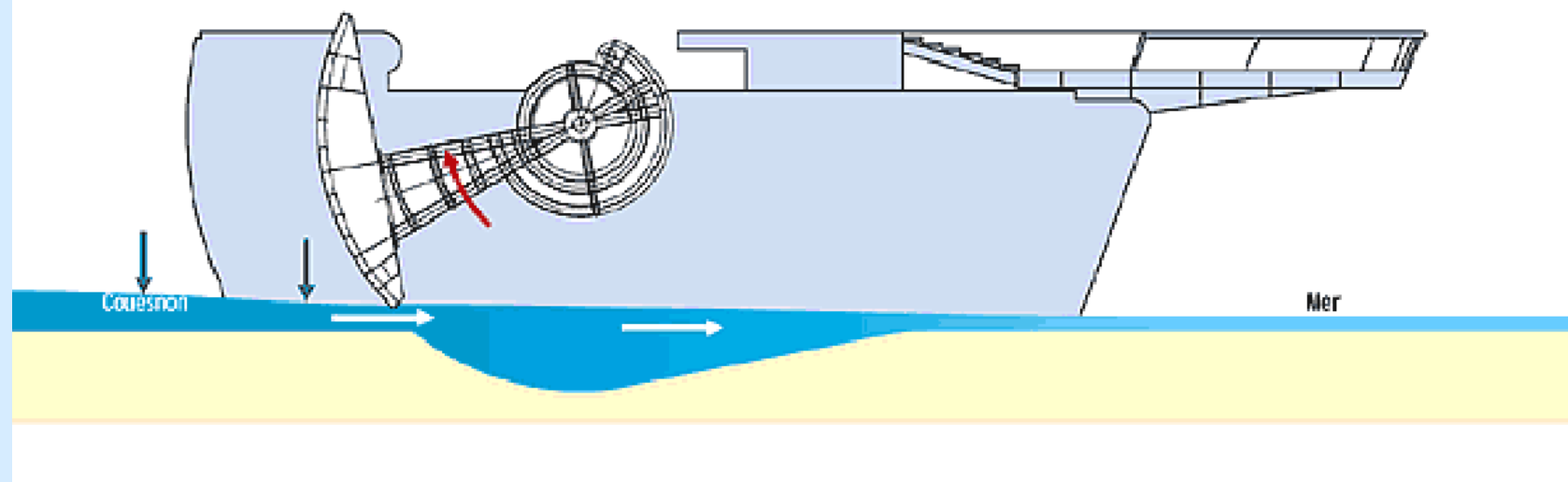
Dam radial gates control cycle

■ phase n° 5



*six hours after high water
progressive raising of radial gate*

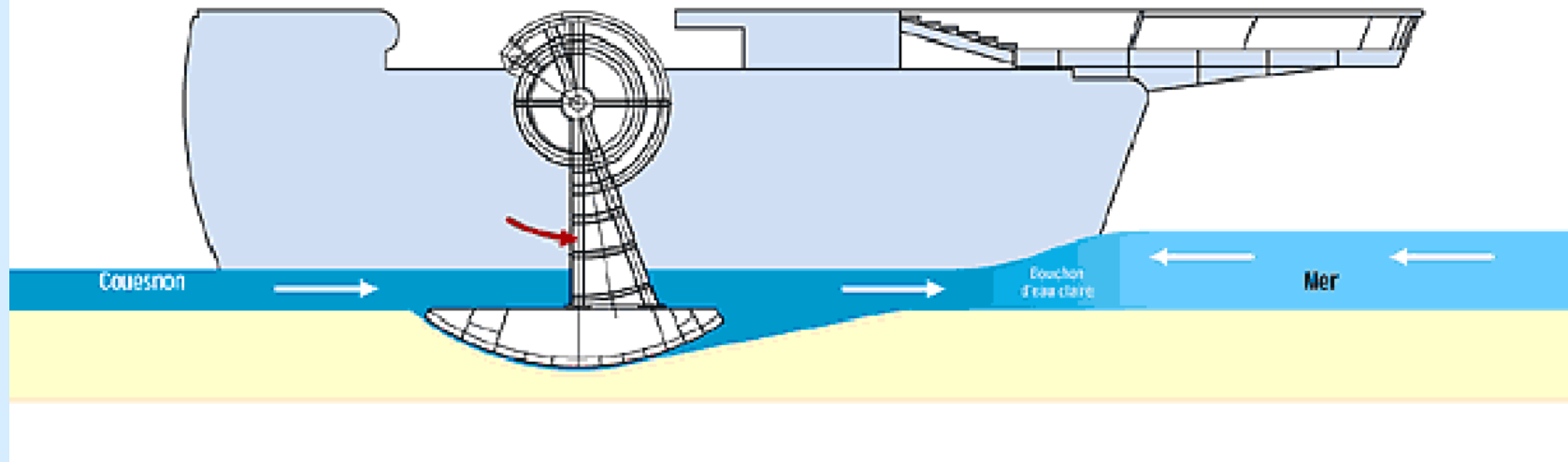
■ phase n° 6



*low tide
gate completely raised*

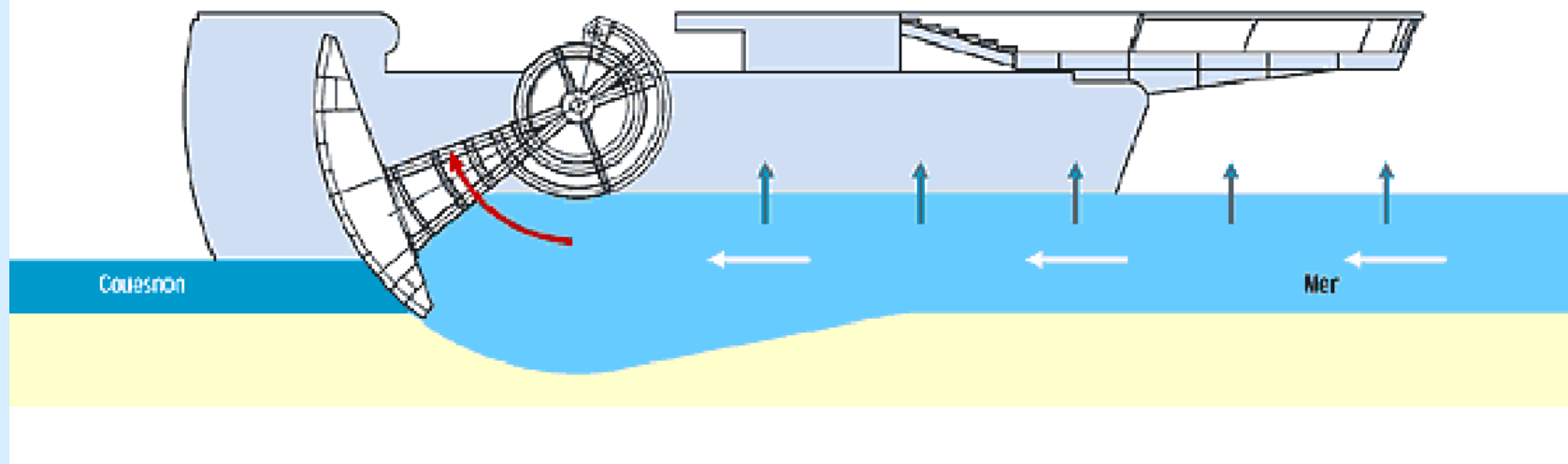
Dam radial gates control cycle

■ phase n° 7



*11 hours 15 minutes after high water
creation of clear water blockage*

■ phase n° 8



*11 hours 25 minutes after high water
dam closure with raised gates*

Water management hydraulic works

■ *down river of the new dam*

- *removal of causeway*
- *dredging new channels*

■ *up river of the new dam*

- *Moidrey Cove reservoir*
- *dredging existing channel*



Pedestrian footbridge



Ford



Car parks & shuttles



Project financing - cost of works : 176,3m€ (2006 prices)

- **hydraulic works : 76,82m€ (43,6%)**
 - dam : 34,60m€ (19,6%)
 - upstream dredging : 26,00m€ (14,8%)
 - downstream dredging : 16,22m€ (9,2%)
- **access works : 38,94m€ (22,1%)**
 - footbridge : 36,14m€ (20,5%)
 - historic monuments : 2,80m€ (1,6%)
- **reception works : 20,64m€ (11,7%)**
 - buildings & landscaping : 8,34m€ (4,7%)
 - shuttles & car parks : 12,30m€ (7,0%)
- **professional fees : 24,65m€ (14,0%)**
- **inflation & indexation : 15,25m€ (8,6%)**

Coût des ouvrages : 176,3 M€

- > **Ouvrages hydrauliques : 76,82 M€**
 - Barrage : 34,60 M€
 - Hydraulique amont : 26,00 M€
 - Hydraulique aval : 16,22 M€
- > **Ouvrages d'accueil**
 - Espaces et bâtiments publics
(hors Délégation de Service Public) : 8,34 M€
 - Délégation de Service Public
(navettes et parc de stationnement) : 12,3 M€
État et Syndicat Mixte
- > **Ouvrages d'accès : 38,94 M€**
 - Pont-passerelle : 36,14 M€
 - Travaux sur Monuments
Historiques : 2,80 M€
- > **Frais de maîtrise d'ouvrage : 24,65 M€**
- > **Provisions d'indices : 15,25 M€**

Project financing - sponsors for 176,3m€

- *European Federation : 21,15m€ (12,0%)*
- *French State : 81,43m€ (46,0%)*
- *Syndicat Mixte via local authorities : 63,92m€ (36,5%)*
 - *Lower Normandy region : 33,57m€ (19,0%)*
 - *Brittany region : 14,75m€ (8,5%)*
 - *Manche department : 11,20m€ (6,5%)*
 - *Ille et Villaine department : 4,40m€ (2,5%)*
- *Syndicat Mixte via auto-financing : 6,00m€ (3,5%)*
- *Water Authorities : 3,80m€ (2,0%)*
 - *Seine-Normandy & Loire-Brittany*



Europe
Fonds Feder
21,15
millions €



État
81,43
millions €

Syndicat Mixte via ses adhérents,
les collectivités territoriales :
63,92 millions d'€



Région
Basse-Normandie
33,57 millions €



Région
Bretagne
14,75 millions €



Département
de la Manche
11,20 millions €



Département de
l'Ille-et-Vilaine
4,40 millions €

Autofinancement : 6 millions €



Agence de l'eau
Seine-Normandie



Agence de l'eau
Loire-Bretagne

3,80 millions €

Dam construction progress photos





Conclusions

- 10 years of design & approvals
- 8 years of work on site
- new dam to control hydraulic flows & natural flushing
- reinstatement of island site
- removal of vehicle access & associated pollution
- restoration of the natural maritime environment
- protection & enhancement of the site for future generations





Ladies & Gentlemen

Thank you for your attention