



FAST DANUBE

***Technical Assistance for Revising and Complementing the Feasibility Study
Regarding the Improvement of Navigation Conditions on the Romanian-Bulgarian Common Sector of the Danube and
Complementary Studies***



Co-financed by the Connecting Europe
Facility of the European Union

<i>Time</i>	<i>Topic</i>	<i>Responsible</i>
09:00 – 09:30	<i>Registration / Coffee</i>	<i>All</i>
WORKSHOP ON «Options Appraisal / Selection for FAST DANUBE project»		
09.30 – 9:45	Introduction: <ul style="list-style-type: none"> – Welcome – H&S moment – Project status 	Mr. Dan TARARA Mr. Romeo SOARE
09.45 – 11.00	Session 1: <ul style="list-style-type: none"> – Initial option preferences, morphological (Prof Colin Thorne via skype) – Revised options, modelling / engineering / CBA – Environmental studies – Q&A 	Mr. Paul RAYNER Mr. Damian DEBSKI Ms. Roxana DORNEANU Ms. Charlotte HANDY
11.00 – 11.30	<i>Coffee break</i>	
11.30 – 13.00	Session 2: <ul style="list-style-type: none"> – Multi-criteria analysis: introductory session 	Mr. Dan TARARA Mr. Paul RAYNER Ms. Roxana DORNEANU Ms. Charlotte HANDY
13.00 – 13.45	<i>Lunch</i>	
13.45 – 15.30	Session 3: <ul style="list-style-type: none"> – Multi-criteria analysis: interactive session 	Mr. Dan TARARA Mr. Paul RAYNER Ms. Roxana DORNEANU Ms. Charlotte HANDY
15.30 – 16.00	Session 4: <ul style="list-style-type: none"> – Consensus view on long term sustainable options 	
16.00	Closing statement	Mr. Romeo SOARE



Option development

Engineering Structures/Navigation Channel Stability

- ***Concept is simple:*** use in-channel structures to stabilise river beds, protect river banks and constrict river widths; and force greater flows with higher stream powers through navigation channels to maintain widths and greater depths at critical locations
- ***Objective is simple:*** stabilise navigation fairway and reduce annual maintenance dredging commitment, using environmentally friendly structures: **BUT**
- ***Design approach must include uncertainties and risk:*** rivers are stochastic and not fully predictable; flows and sediment transport vary (substantially) year to year **THEREFORE**
- ***Plans for adaptive management are essential:*** allowance for on-going performance monitoring (bathymetric surveys), potential design adjustments, structure modifications

Option development

Engineered structures



Groyne

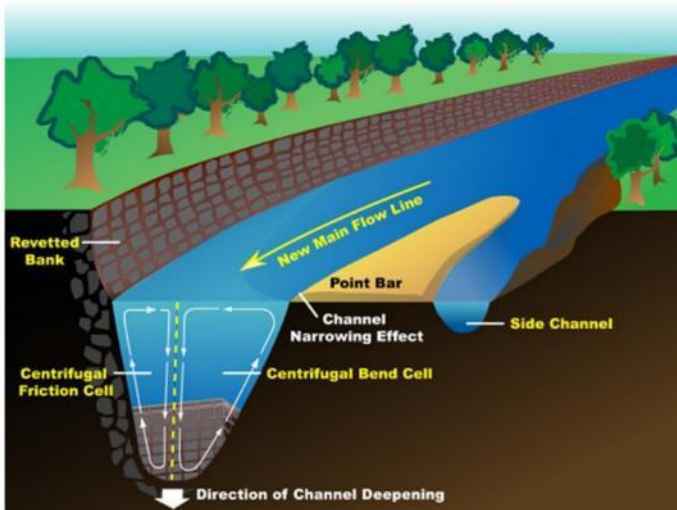
Source: USACE



Notched groyne



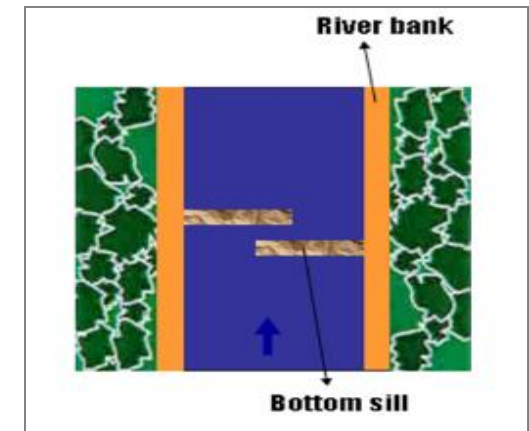
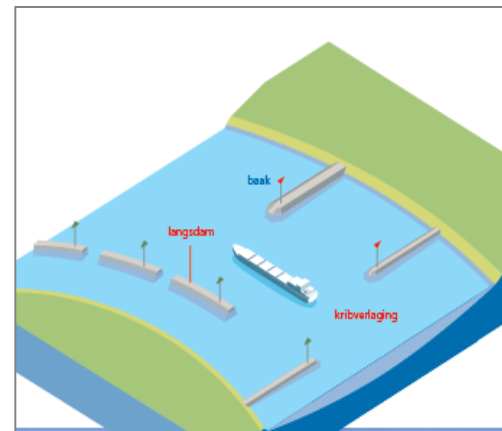
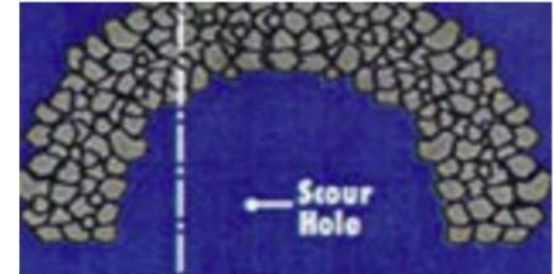
Stepped Groyne



Source: USACE



Source: USACE





*Groynes: off-bank protection/training:
Netherlands: ICPDR Workshop*



*L-Shaped Groynes:
St Louis; Source: USCE*

Notched Groyne

Typical rigid engineering structures

- advantages versus disadvantages

- Technically most proven approach but risk of unexpected river response
- Resource intensive and costly if subsequent modifications are needed
- Potentially creates need to progressively engineer more and more river
- Still dependent long-term on a certain level of dredging commitment
- Potential for significant adverse environmental impacts
- Only modest opportunities to mitigate



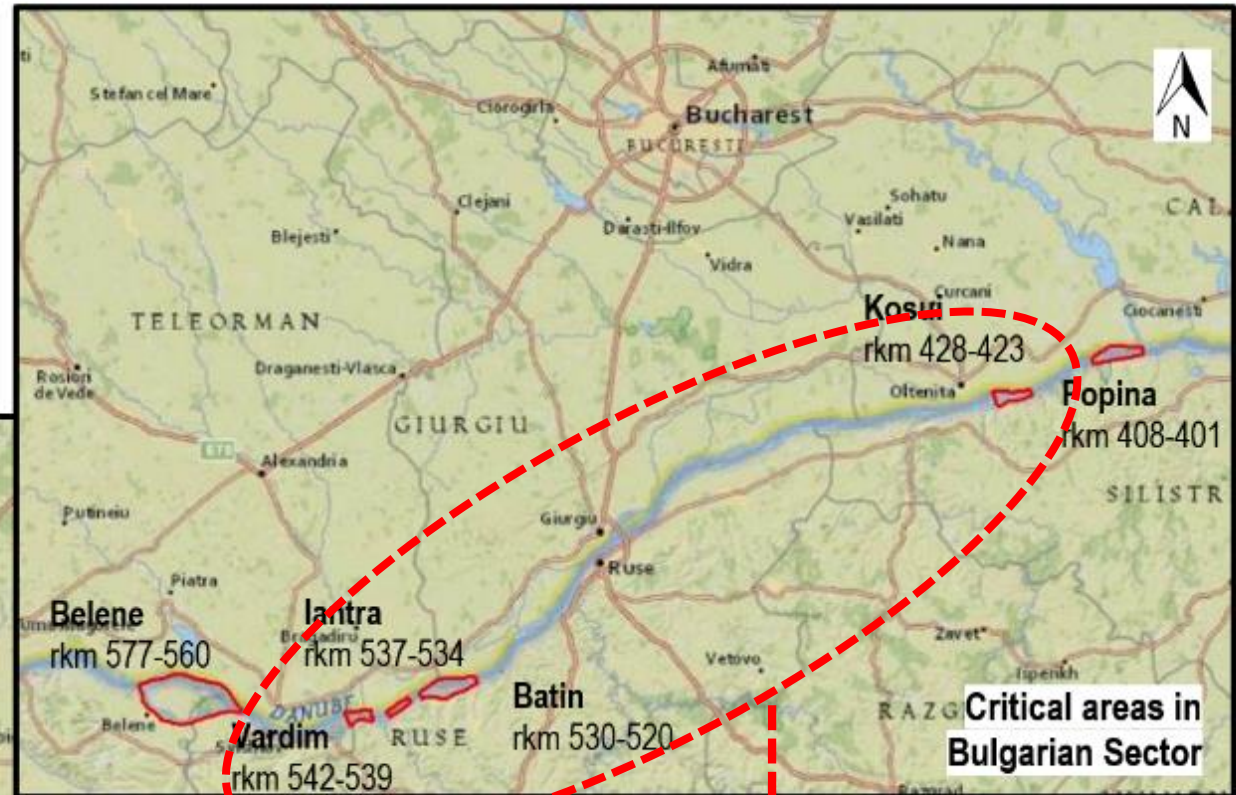
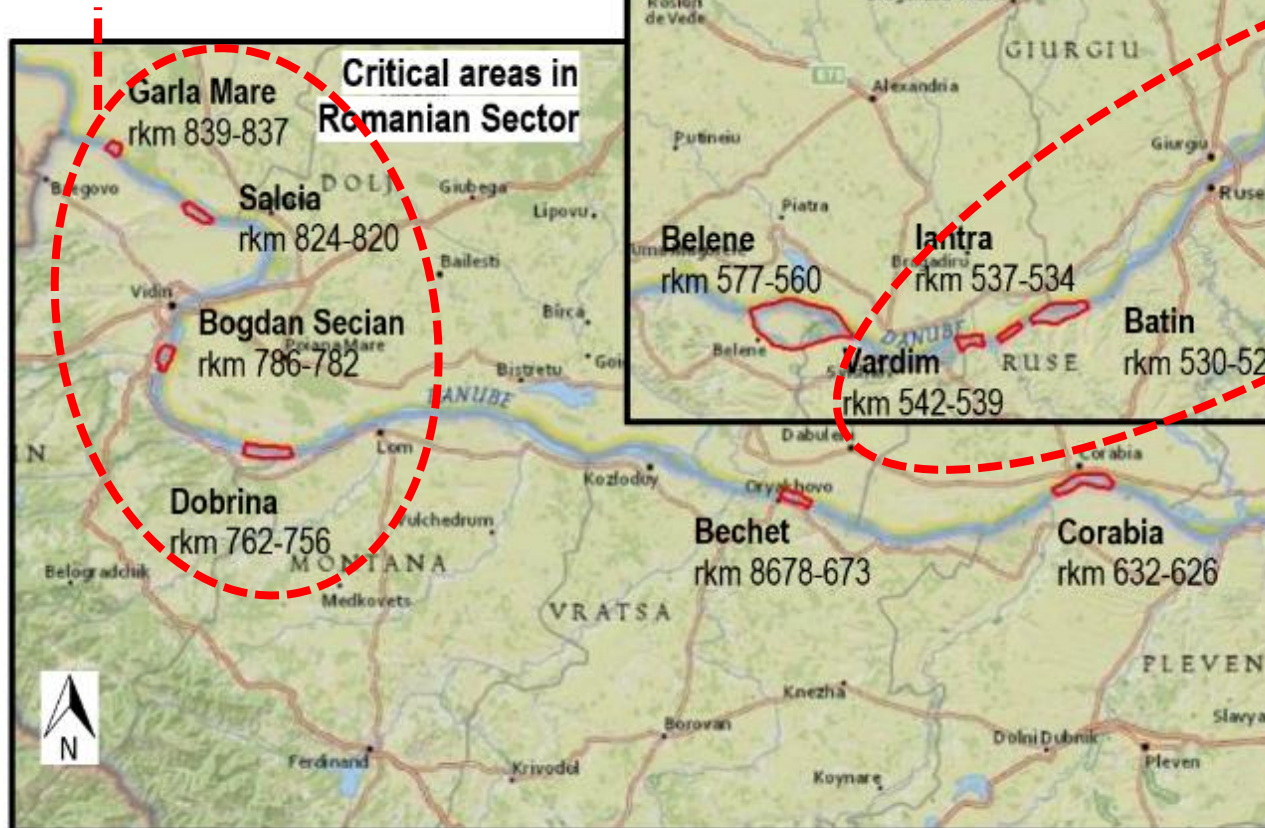
Typical morphological engineering - advantages versus disadvantages

- Technically most experimental approach
- Requires adaptive management capability
- Potentially with major environmental benefits
- Intelligent dredging a key component
- Some rigid engineering to promote planform and morphological features
- Strategic disposal of dredged material



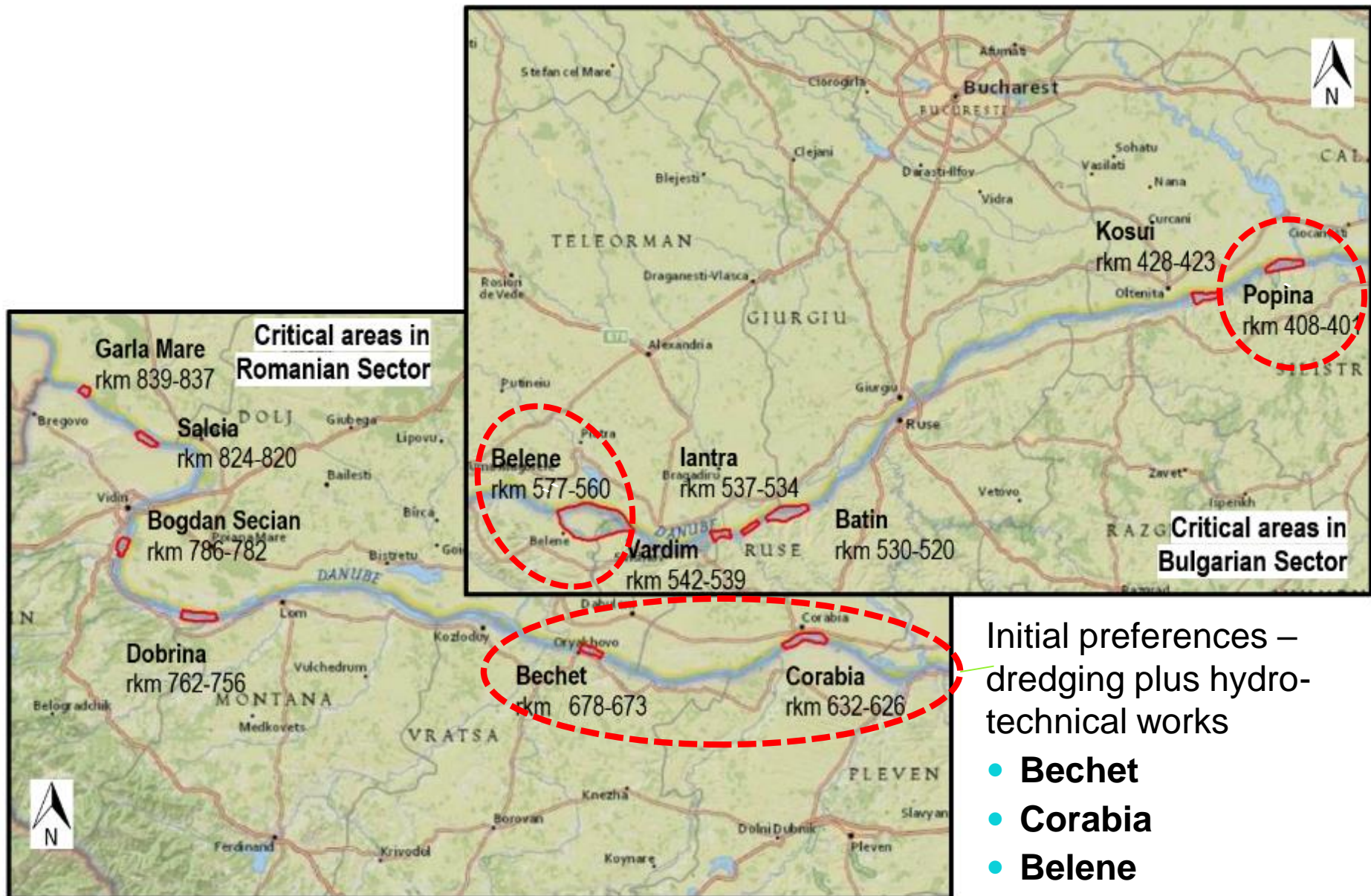
Initial preferences –
dredging in Phase I

- **Garla Mare**
- **Salcia**
- **Bogdan Secian**
- **Dobrina**



Initial preferences –
dredging in Phase I

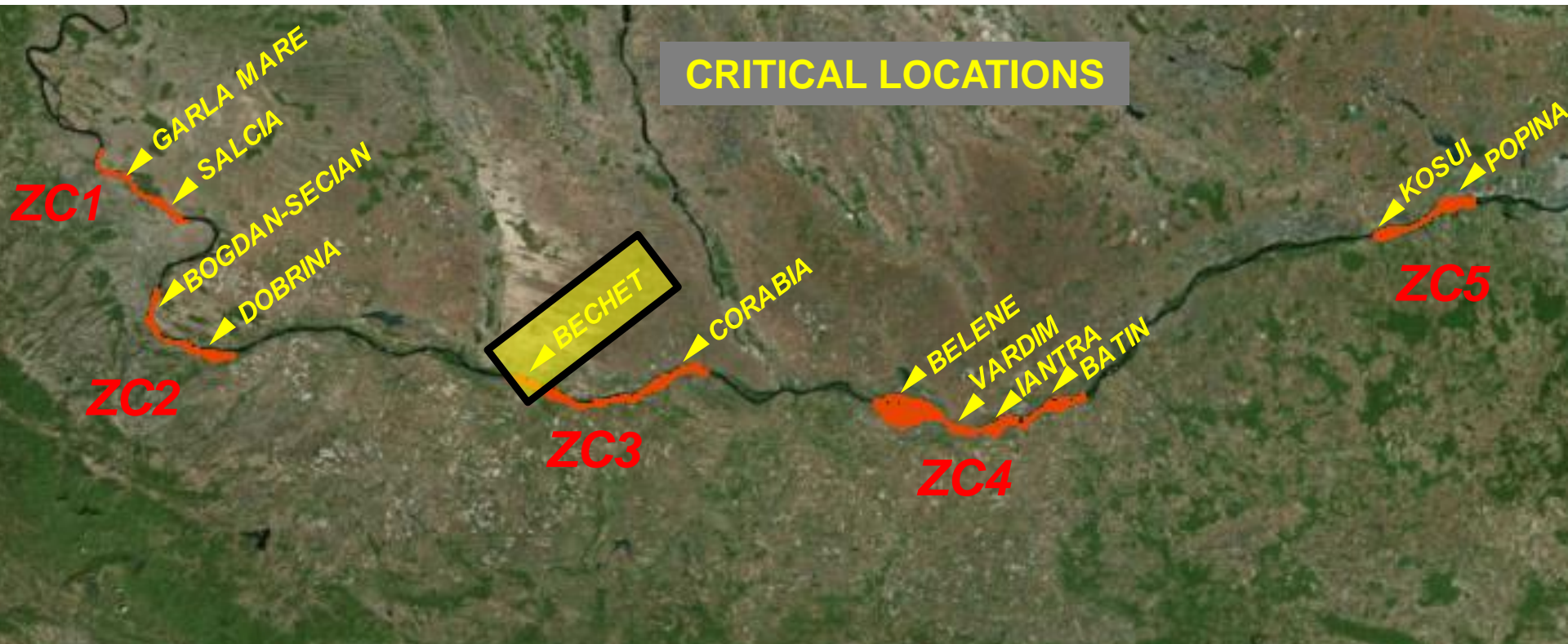
- **Vardim**
- **lantra**
- **Batin**
- **Kosui**



Initial preferences –
dredging plus hydro-
technical works

- **Bechet**
- **Corabia**
- **Belene**
- **Popina**

Revised options – BECHET

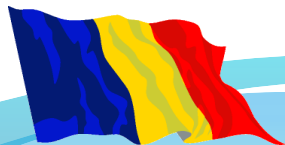




Revised options – BECHET

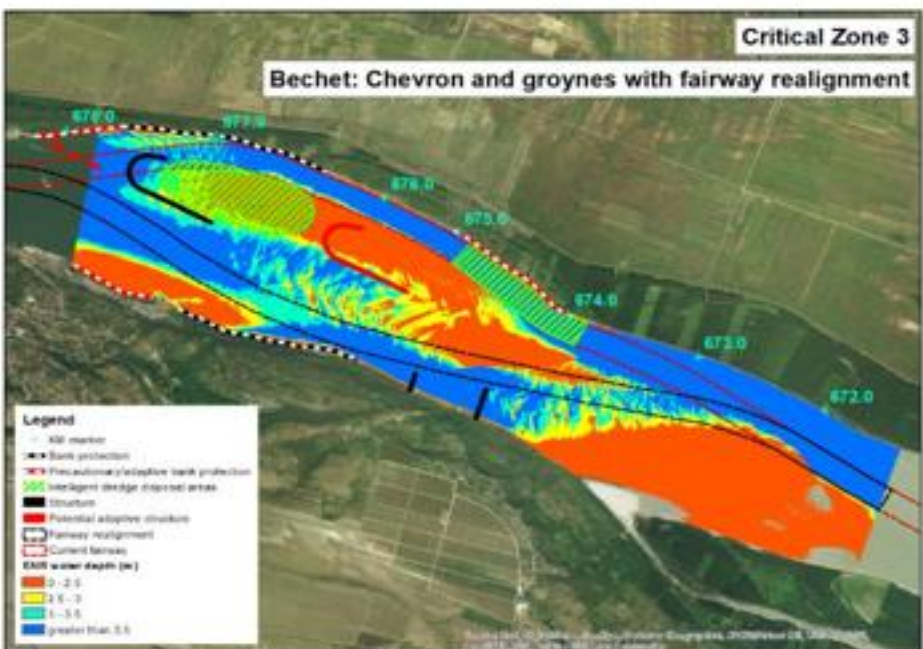
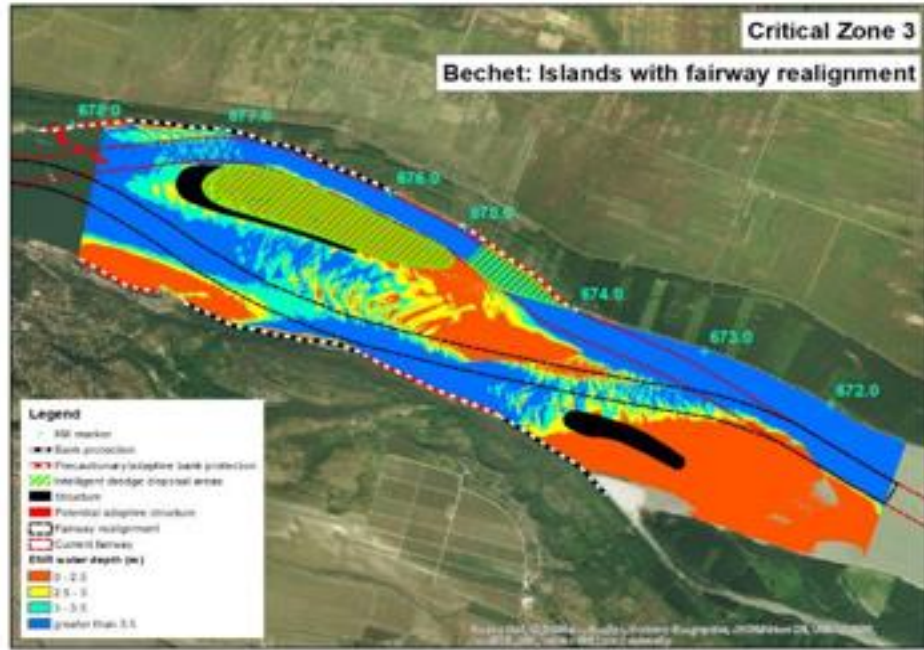
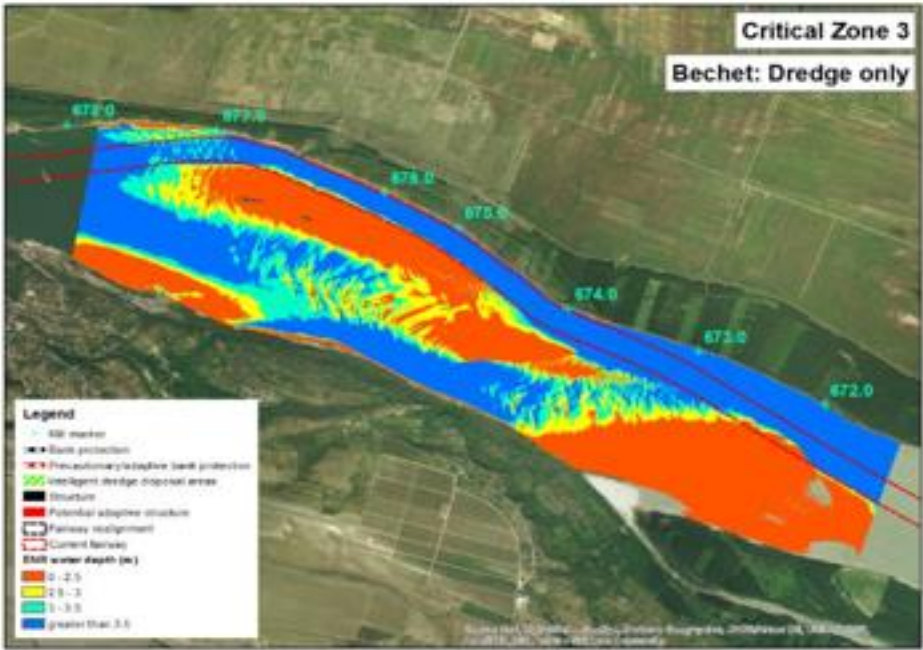
Important factors:

- SWIM project/dredging
- Regular deposition/dredging in existing fairway
- Bank erosion on Romanian side
- Ferry crossing/ports
- Likely low interdependence with other CPs (78km upstream, 41km downstream)



Co-financed by the Connecting Europe
Facility of the European Union





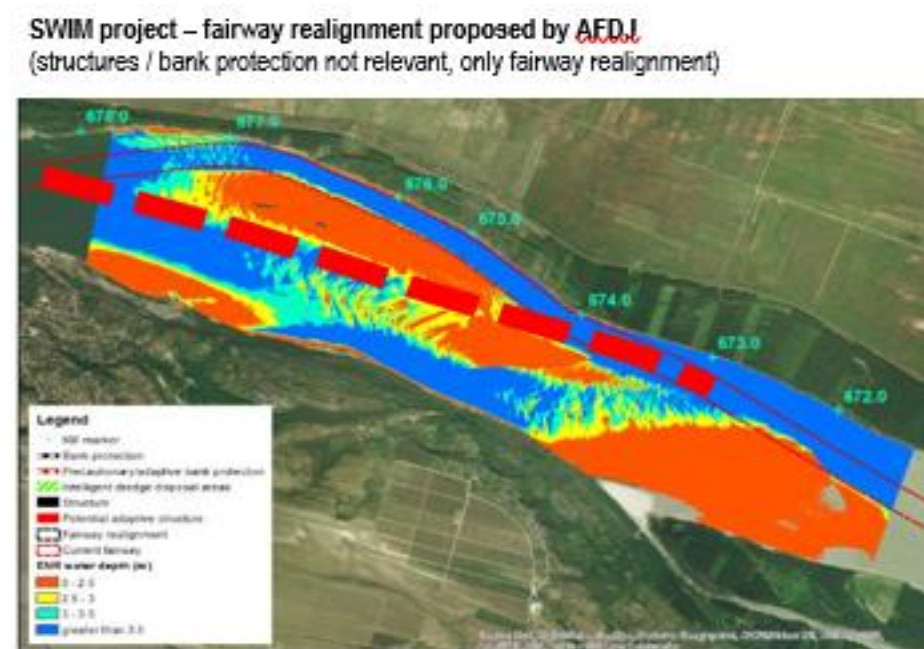
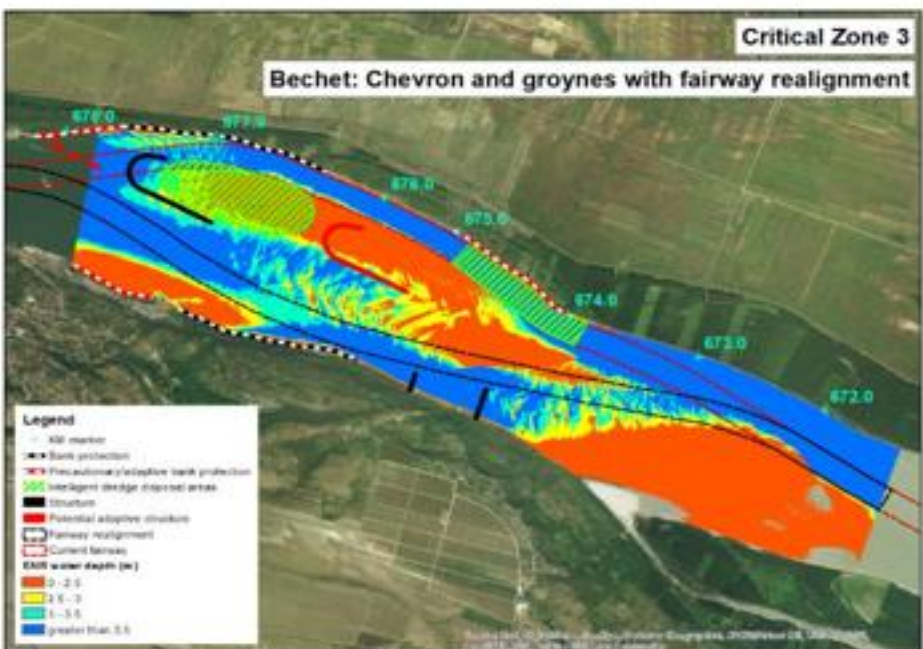
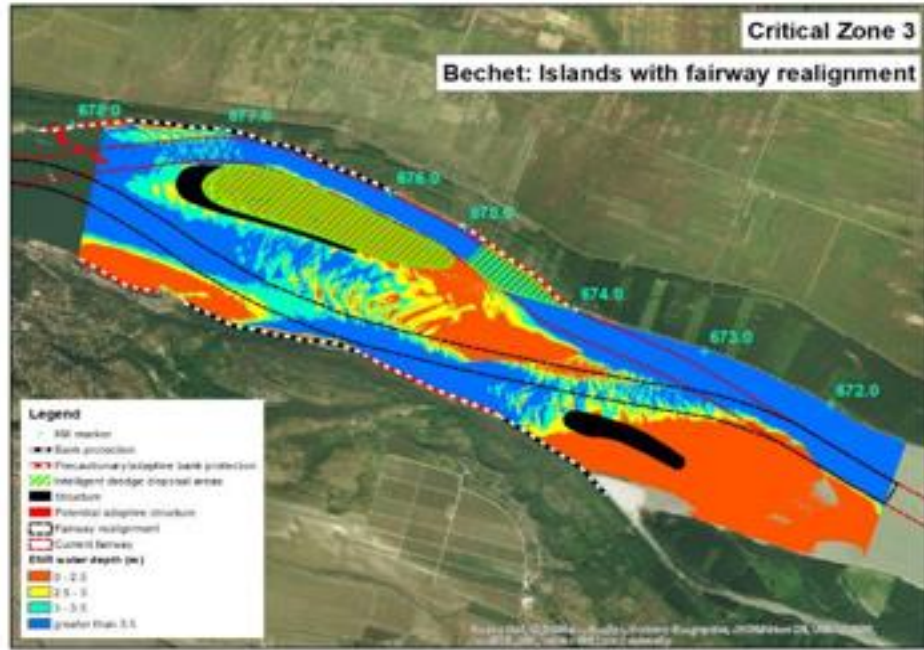
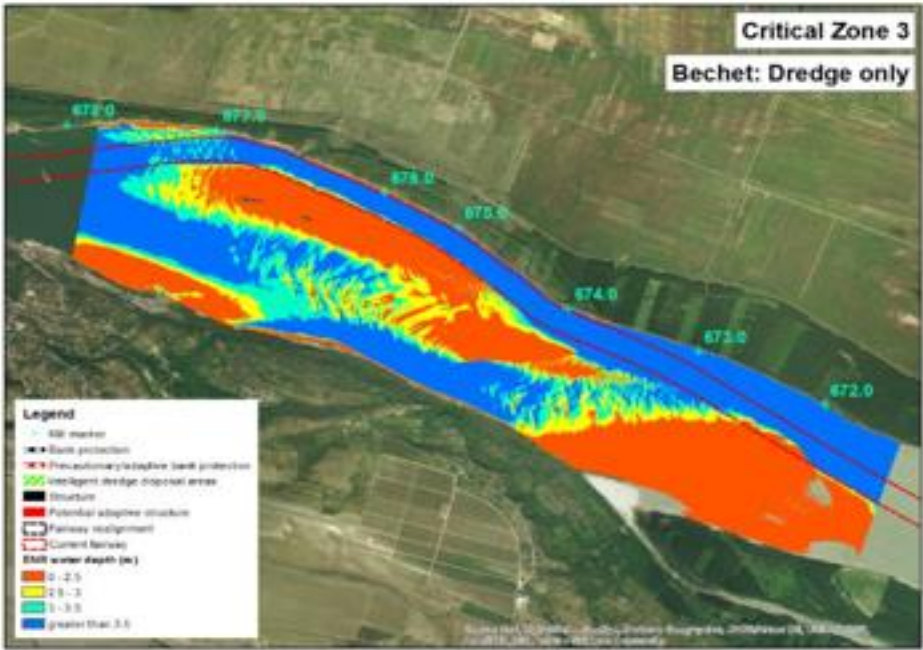
Legend

- + KM marker
- Bank protection
- Precuatory/adaptive bank protection
- Intelligent dredge disposal area
- Structure
- Potential adaptive structure
- Fairway realignment
- Current fairway

ENR water depth (m)

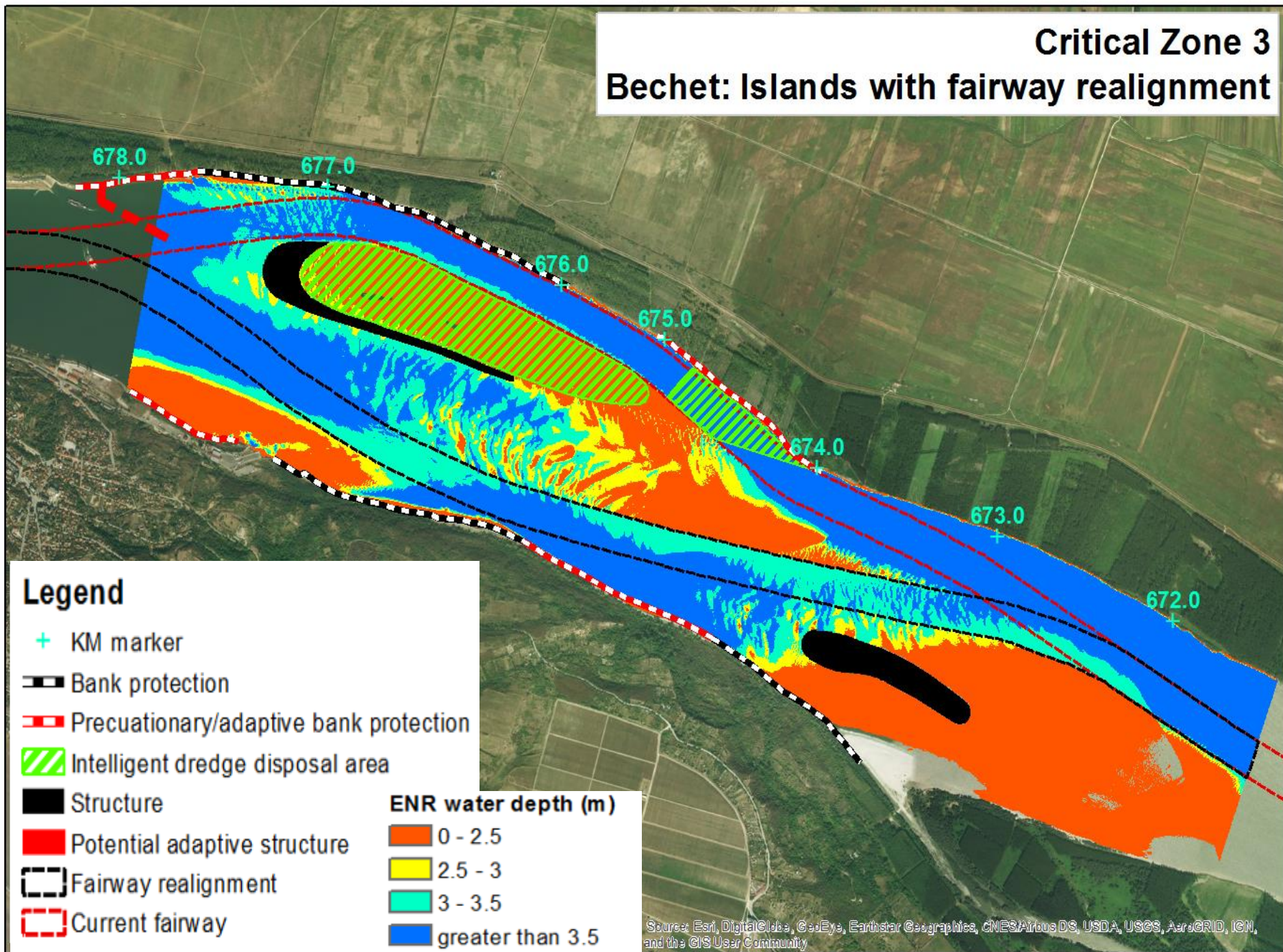
0 - 2.5
2.5 - 3
3 - 3.5
greater than 3.5

Bechet – revised options



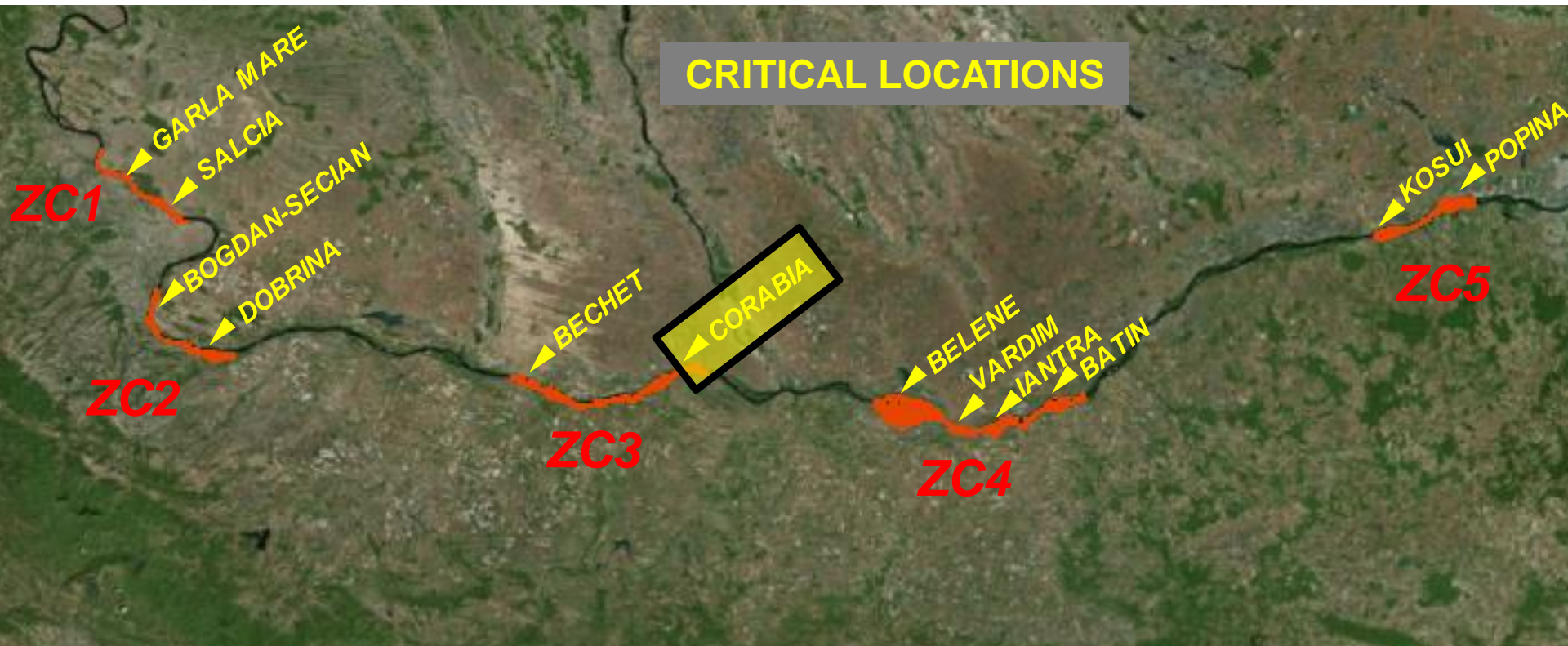
Critical Zone 3

Bechet: Islands with fairway realignment



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Revised options – CORABIA

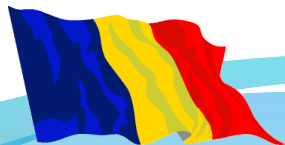




Revised options – CORABIA

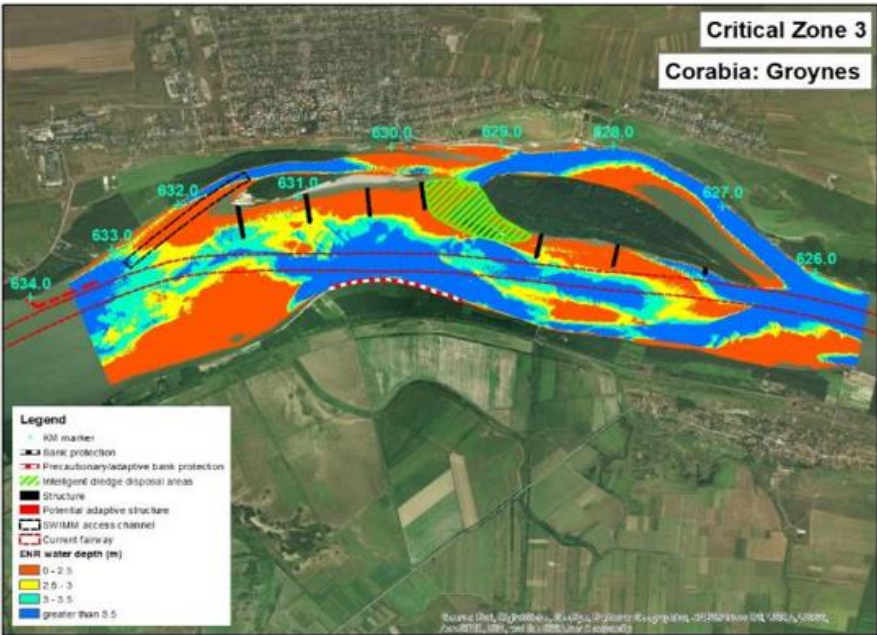
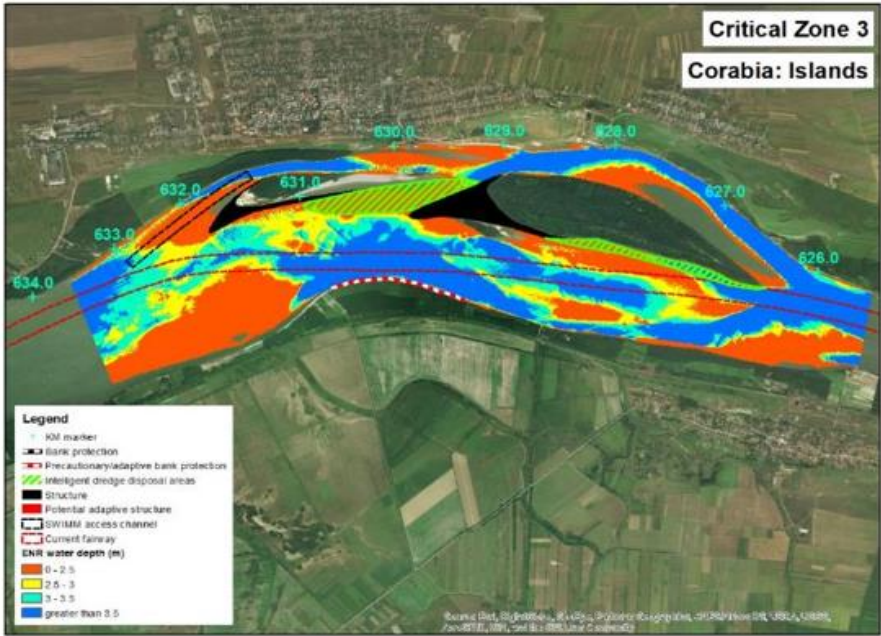
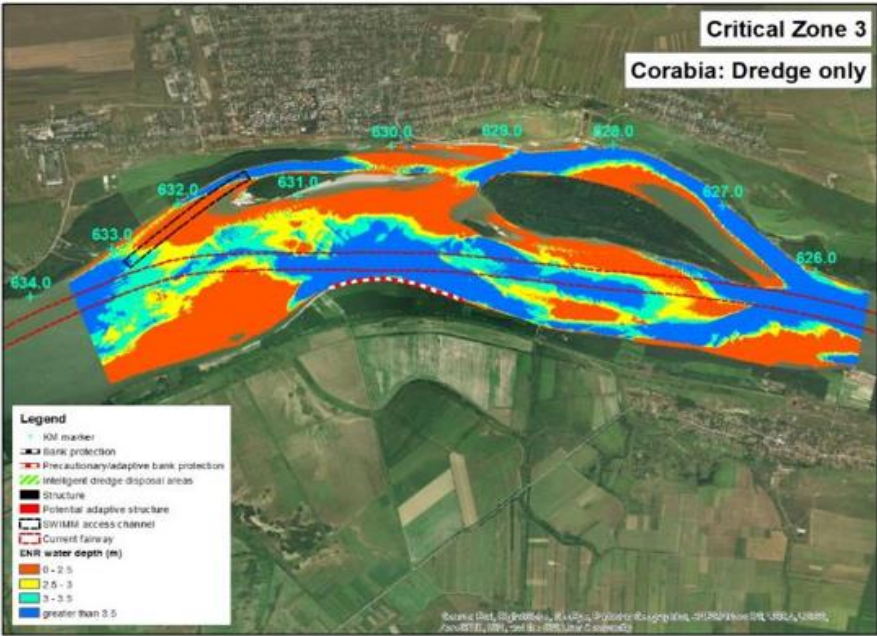
Important factors:

- SWIM project/dredging of side channel
- Deposition in existing fairway
- Bank erosion on Romanian side
- Access to port
- Likely low interdependence with other CPs (41km upstream, 49km downstream)



Co-financed by the Connecting Europe
Facility of the European Union





Legend

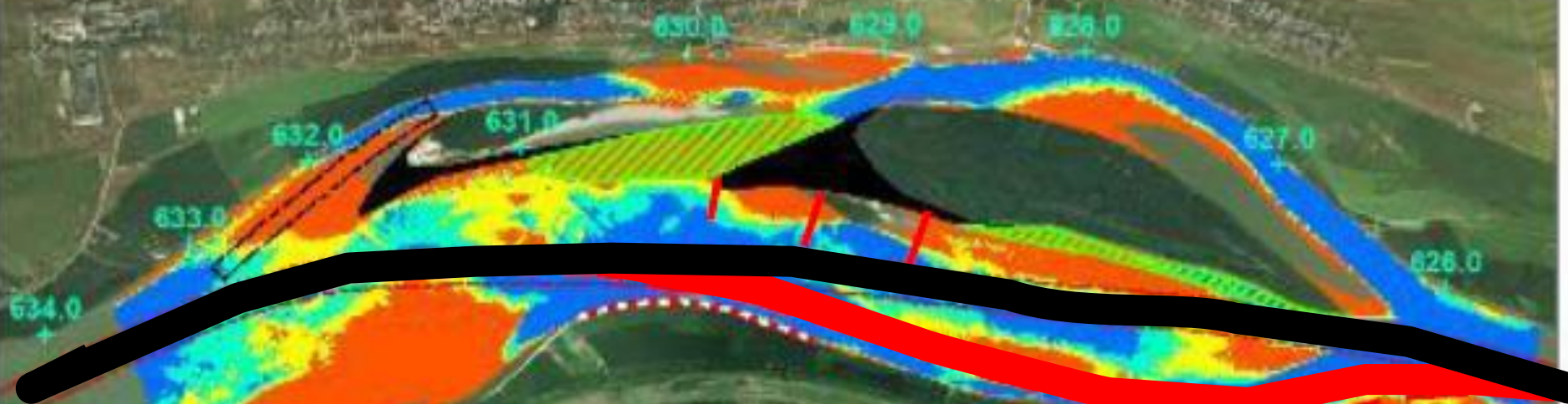
- + KM marker
- Bank protection
- Precuactionary/adaptive bank protection
- Intelligent dredge disposal area
- Structure
- Potential adaptive structure
- Fairway realignment
- Current fairway

ENR water depth (m)

- 0 - 2.5
- 2.5 - 3
- 3 - 3.5
- greater than 3.5

Critical Zone 3

Corabia: Islands



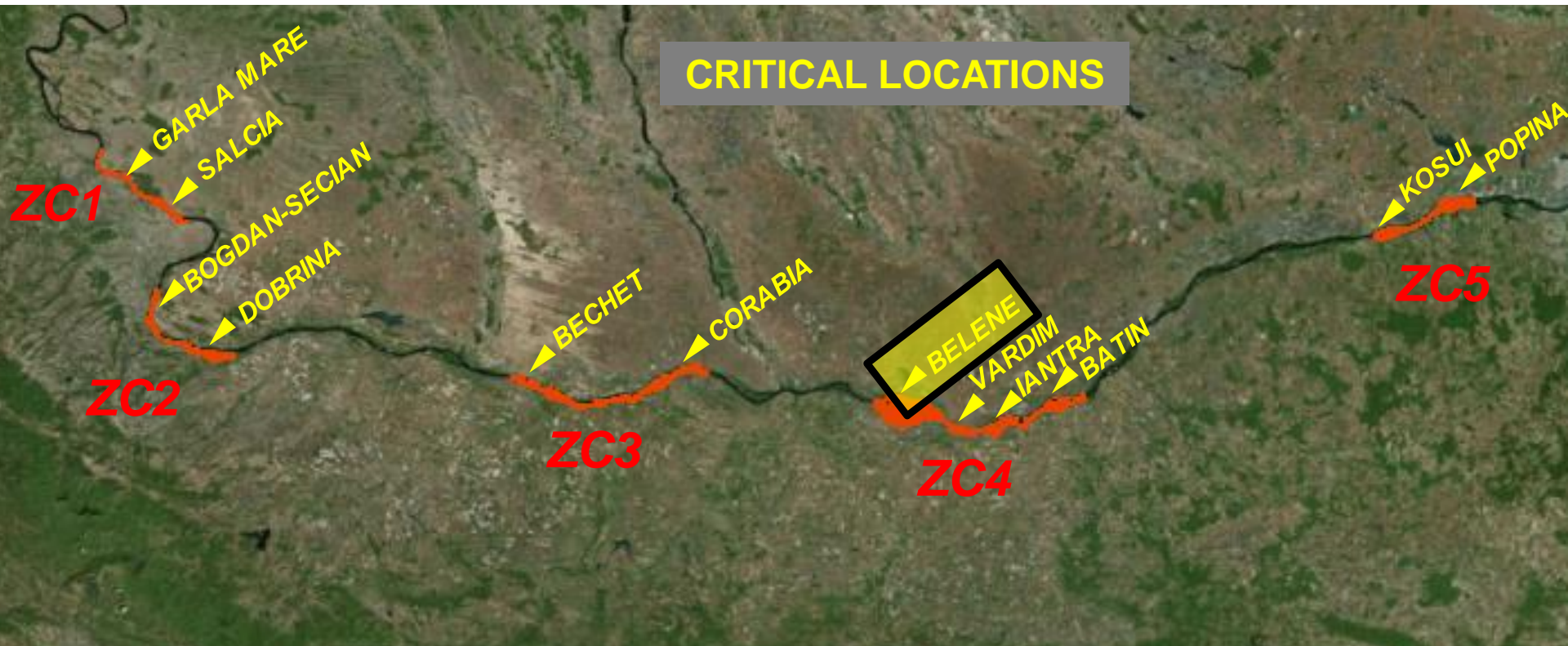
Legend

- + KM marker
- Bank protection
- Precuationaly/adaptive bank protection
- Intelligent dredge disposal area
- Structure
- Potential adaptive structure
- Fairway realignment
- Current fairway

ENR water depth (m)

- 0 - 2.5
- 2.5 - 3
- 3 - 3.5
- greater than 3.5

Revised options – BELENE

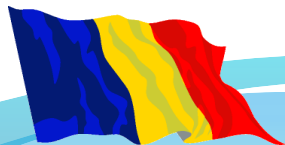


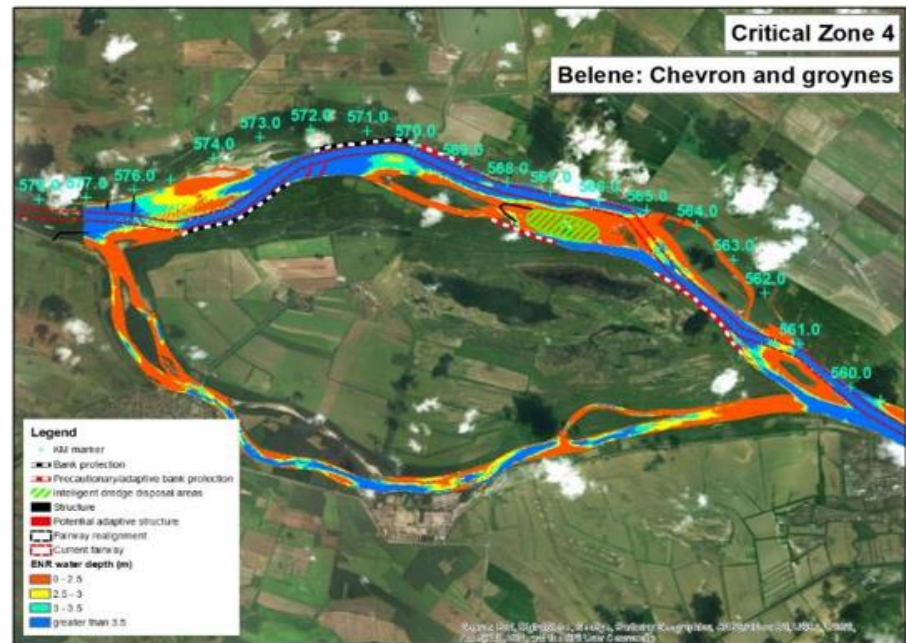
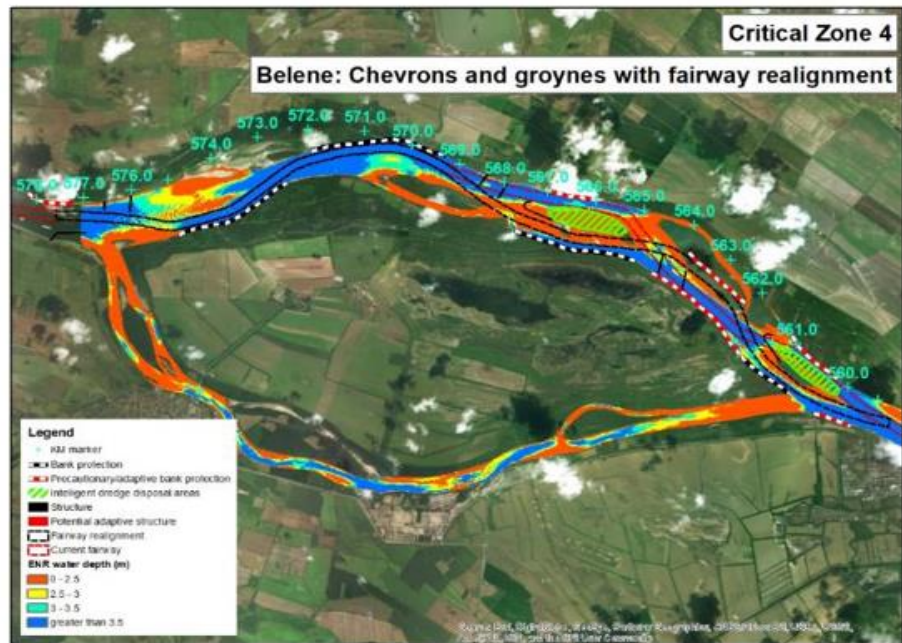
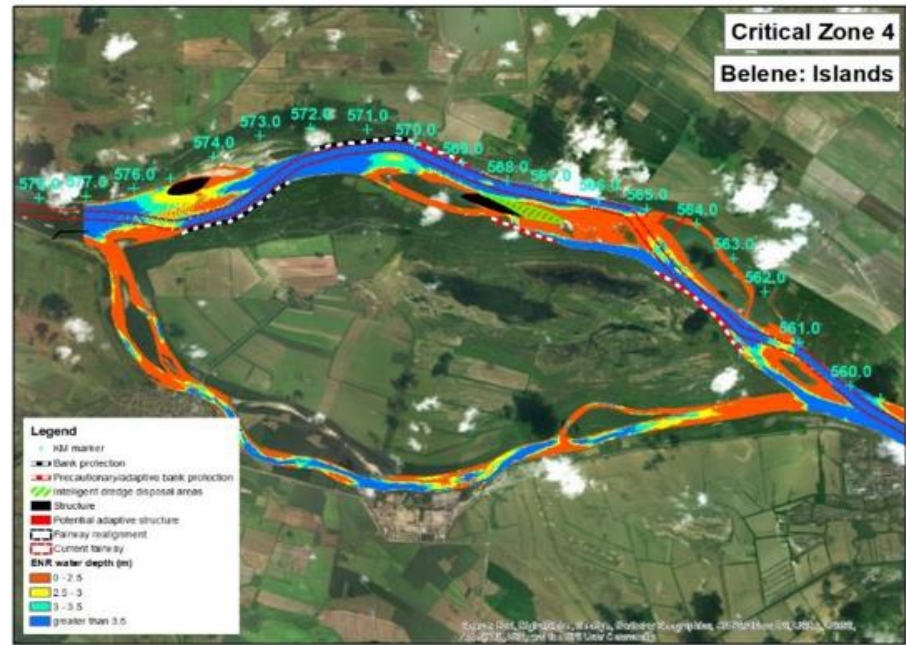


Revised options – BELENE

Important factors

- Complex section of river
 - two main critical locations 10km apart
- Two alternative alignments (left/right) km568-564
- Likely low interdependence with upstream CPs (49km) possibly more likely downstream CPs (18km)



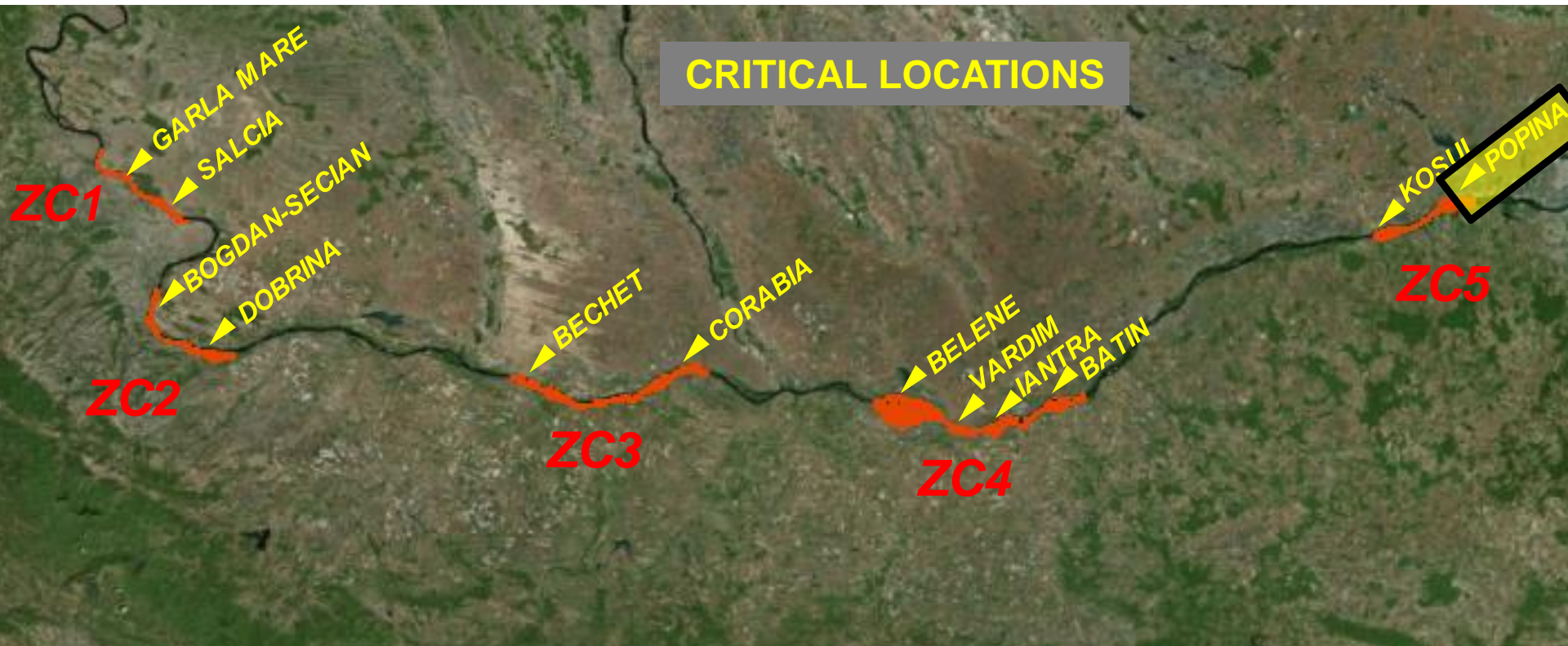


Critical Zone 4

Belene: Dredge only



Option preferences – POPINA

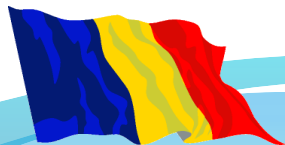




Revised options – POPINA

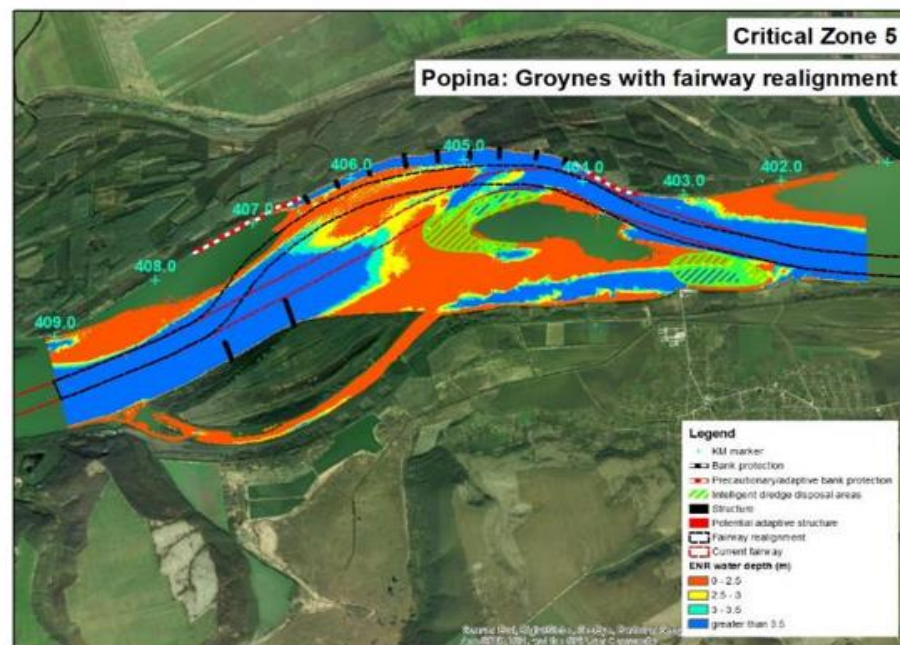
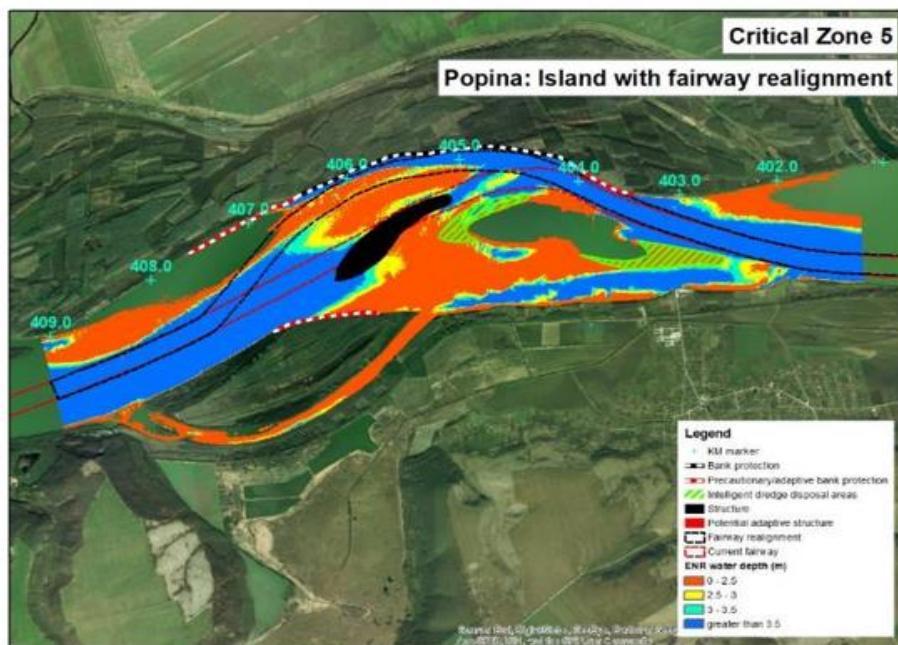
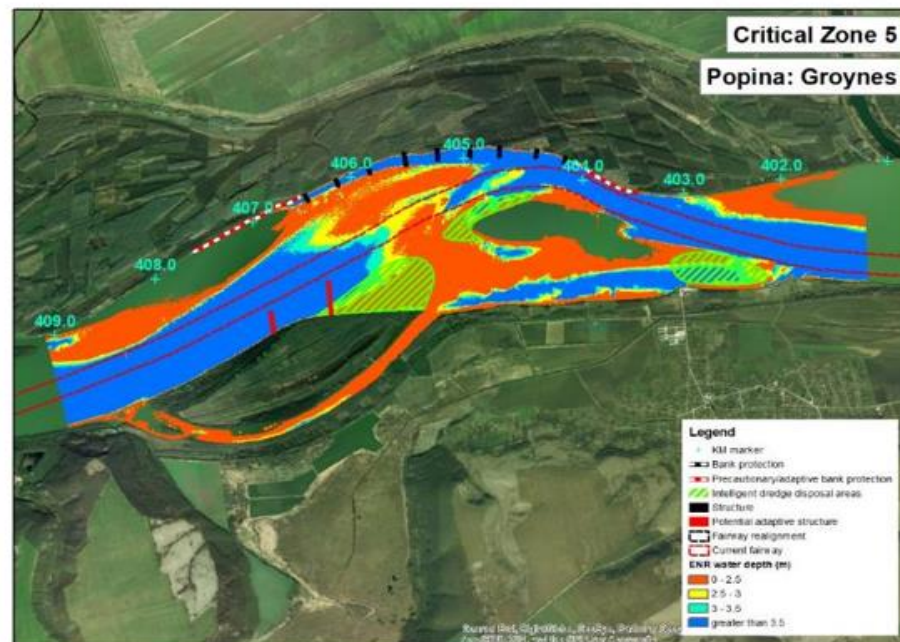
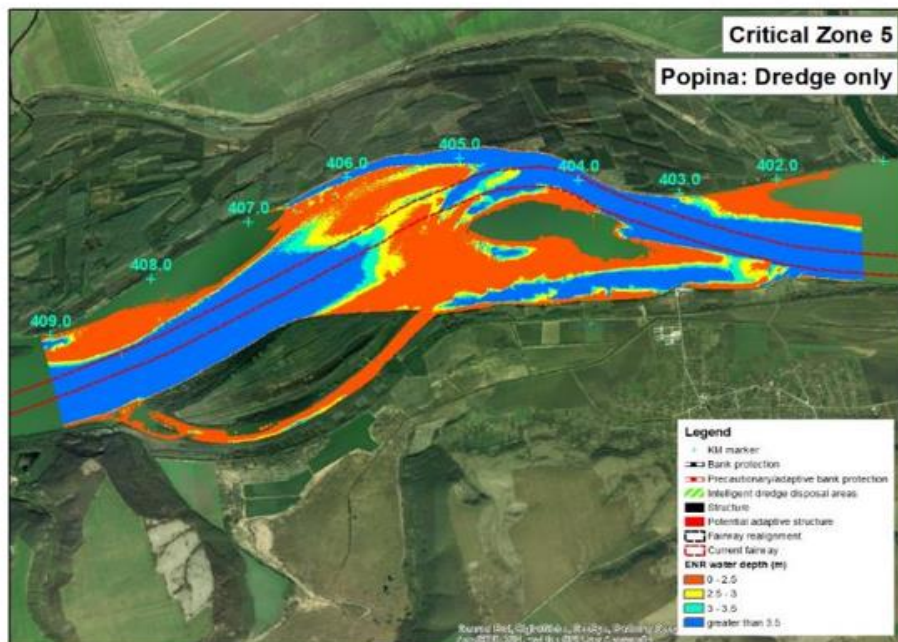
Important factors:

- Large sand bars and shallow areas
– very wide section of river
- Existing fairway in middle of river difficult to sustain
- Bank erosion on Romanian bank – rapid movement of bank, supply of sediment to fairway
- Possible interdependence with upstream CP (15km), no CPs downstream



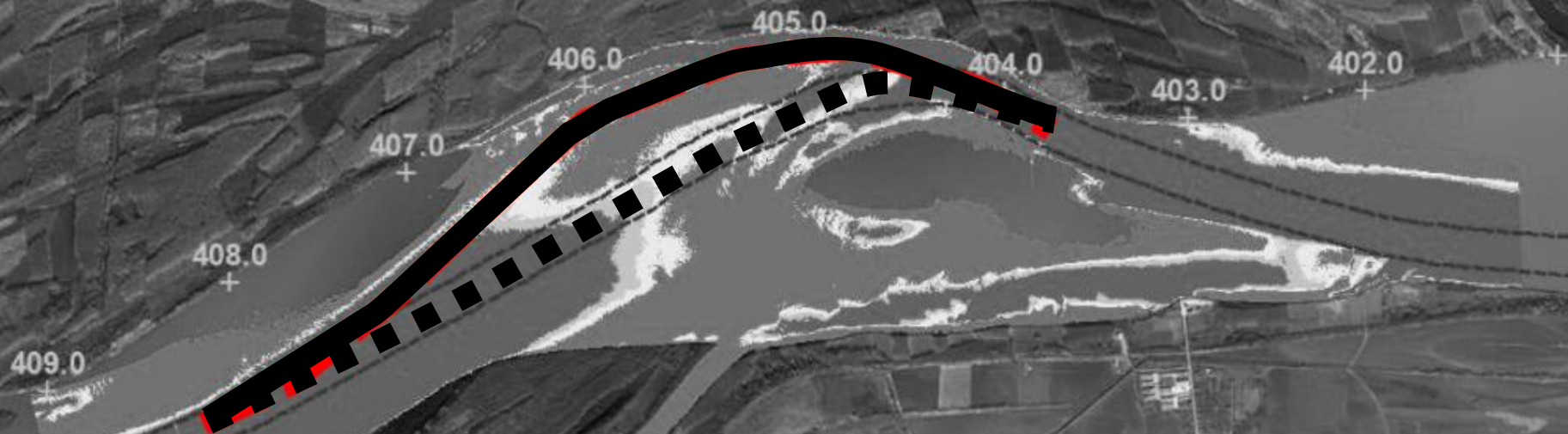
Co-financed by the Connecting Europe
Facility of the European Union





Critical Zone 5

Popina: Dredge only

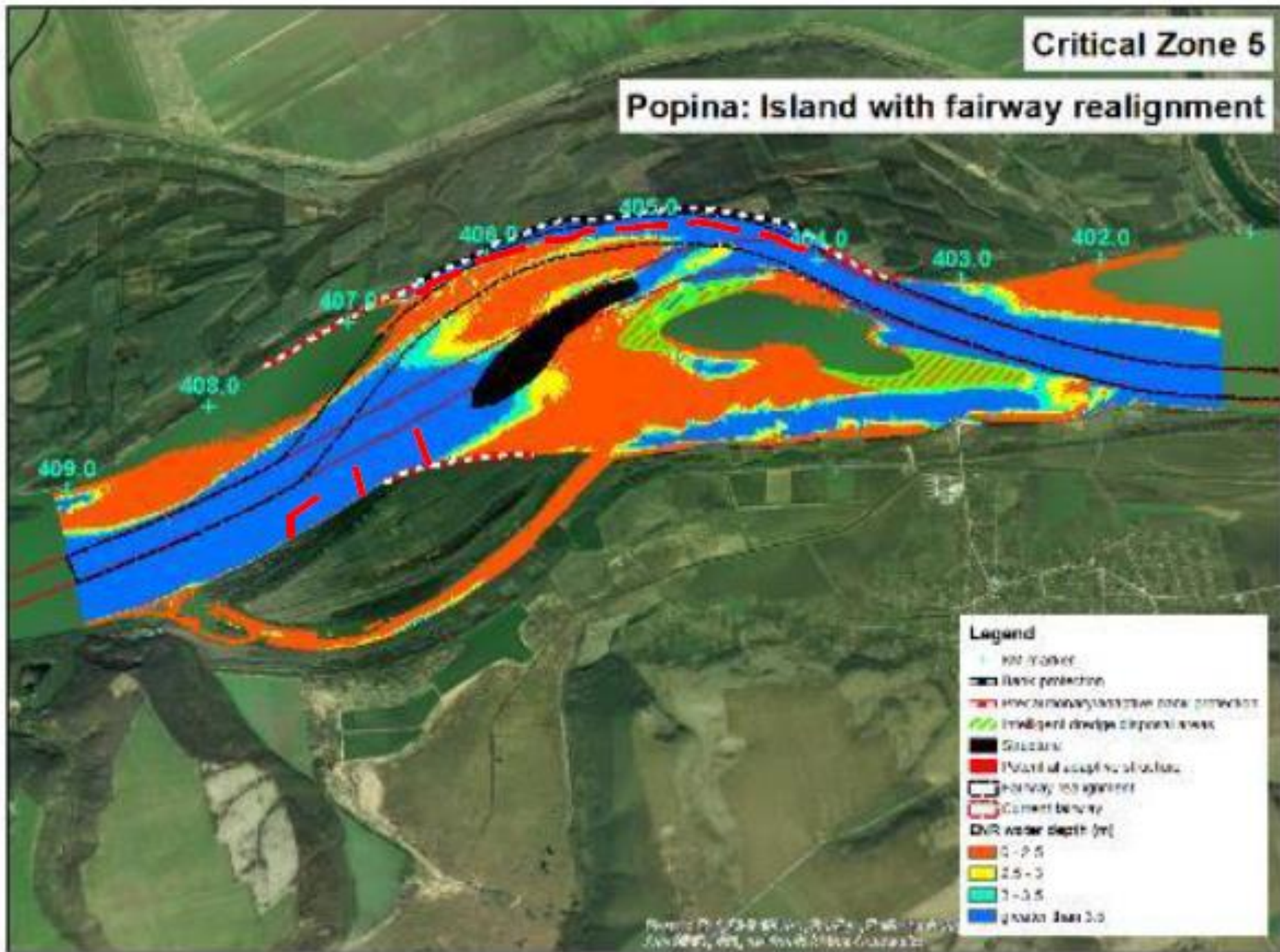


Legend

- + KM marker
- Bank protection
- Precautionary/adaptive bank protection
- Intelligent dredge disposal areas
- Structure
- Potential adaptive structure
- Fairway realignment
- Current fairway
- ENR water depth (m)**
 - 0 - 2.5
 - 2.5 - 3
 - 3 - 3.5
 - greater than 3.5

Critical Zone 5

Popina: Island with fairway realignment



<i>Time</i>	<i>Topic</i>	<i>Responsible</i>
09:00 – 09:30	<i>Registration / Coffee</i>	<i>All</i>
WORKSHOP ON «Options Appraisal / Selection for FAST DANUBE project»		
09.30 – 9:45	Introduction: <ul style="list-style-type: none"> – Welcome – H&S moment – Project status 	Mr. Dan TARARA Mr. Romeo SOARE
09.45 – 11.00	Session 1: <ul style="list-style-type: none"> – Initial option preferences, morphological (Prof Colin Thorne via skype) – Revised options, modelling / engineering / CBA – Environmental studies – Q&A 	Mr. Paul RAYNER Mr. Damian DEBSKI Ms. Roxana DORNEANU Ms. Charlotte HANDY
11.00 – 11.30	<i>Coffee break</i>	
11.30 – 13.00	Session 2: <ul style="list-style-type: none"> – Multi-criteria analysis: introductory session 	Mr. Dan TARARA Mr. Paul RAYNER Ms. Roxana DORNEANU Ms. Charlotte HANDY
13.00 – 13.45	<i>Lunch</i>	
13.45 – 15.30	Session 3: <ul style="list-style-type: none"> – Multi-criteria analysis: interactive session 	Mr. Dan TARARA Mr. Paul RAYNER Ms. Roxana DORNEANU Ms. Charlotte HANDY
15.30 – 16.00	Session 4: <ul style="list-style-type: none"> – Consensus view on long term sustainable options 	
16.00	Closing statement	Mr. Romeo SOARE