

Annex 2: Examples of possible measures

List of navigation needs, respective measures, their general effect and specific pressures on ecology. Ecological measures to achieve and ensure the environmental objective/sustainability are included (to be extended).

This list is not exhaustive.

Navigation Needs	Navigation Measures	General Effects	Pressures/Effects on Ecology	Ecological Needs	Environmental Measures
Minimum water depth (navigation fairway)	Transformation of the navigation fairway towards outer bank and deep water sections, low water regulation, dredging and refilling of material	Increase of water level at low flows	River channelization due to low water regulation, reduction of morphodynamics	Minimization of river engineering measures	River restoration (esp. river banks and floodplains)
Minimization of lateral flow velocity	Improvements of the flow field at confluences with tributaries and reconnected side channels by river engineering	Low cross sectional flow velocities	Reduced morphodynamics of confluences, less cross sectional flow velocity	No restriction to river bank and side channel dynamics	Side channel reconnection and restoration of tributary confluences
No sudden changes in flow field, flow velocity	Limitation of flow velocity changes (gradual changes) from reaches with e.g. new low water regulation towards not modified downstream and upstream sections	Low spatial variability of boundary conditions for navigation	Modified flow field compared to more natural conditions	Development of flow field and flow velocities towards Leitbild conditions (visions)	Development of river engineering measures to improve flow field variability

Navigation Needs	Navigation Measures	General Effects	Pressures/Effects on Ecology	Ecological Needs	Environmental Measures
Predictable position and geometry of navigation channel	Minimization of sudden sedimentation by use of groins, dredging and refilling	Less interruption / disturbance for navigation	Modified sediment transport and river morphology, habitat alteration	Variable water depths, flow widths, grain sizes, low lateral river bed gradients	Restoration measures leading to high variances of water depth, channel widths, grain sizes, moderate lateral gradients
No extreme trend towards river bed aggradation / degradation of the main channel	E.g. Construction of groins (aggradation), dredging and refilling of material, / river bed widening, granulometric bed improvement (degradation)	Dynamic river bed stability	Also a need for ecology as the pressure is not resulting from the driver navigation	No extreme trend towards river bed aggradation / degradation of the main channel	E.g. Construction of groins (aggradation), dredging and refilling of material, / river bed widening, granulometric bed improvement (degradation)
				Channel morphodynamics	Preservation or improvement of river morphology: no river bed pavement, keeping of morphodynamics, specific groins forms to improve morphodynamics, avoiding of groin fields

Navigation Needs	Navigation Measures	General Effects	Pressures/Effects on Ecology	Ecological Needs	Environmental Measures
				River bank morpho-dynamics	Initiation of more nature-like river banks: river bank restoration, removal of bank protection, side erosion, declinant groins to enhance side erosion
				Lateral connectivity	Floodplain / wetland / sidearm reconnection, more water in the floodplain/alluvial area, improvement of habitats
General needs	General measures				
Keeping of flood levels	Improvement of retention areas, river bed widening, no increase of flood risk		,		