Navigation analysis at the entrance to the bypass channel of Siarzewo barrage

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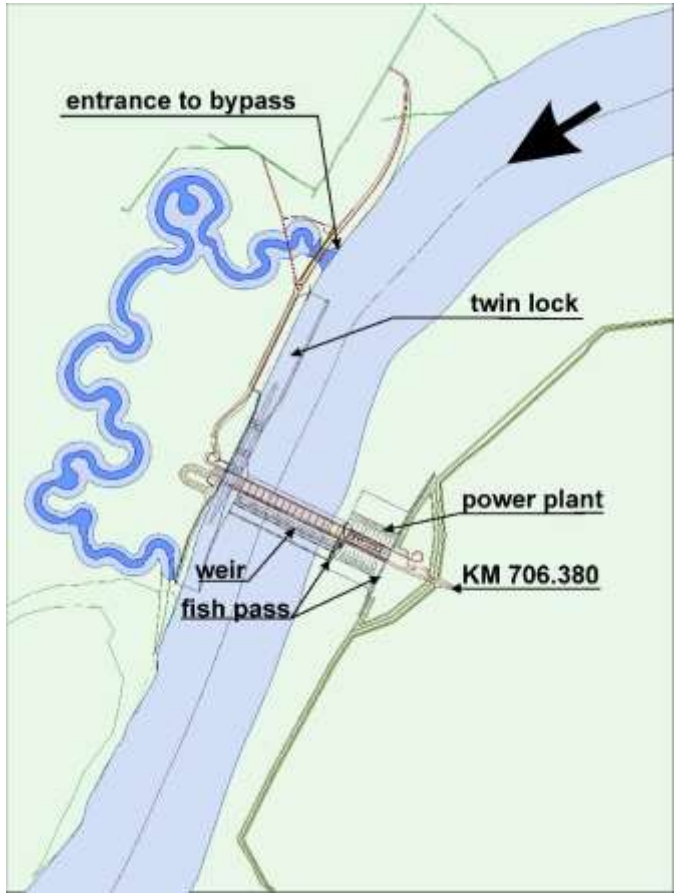
Scope of presentation

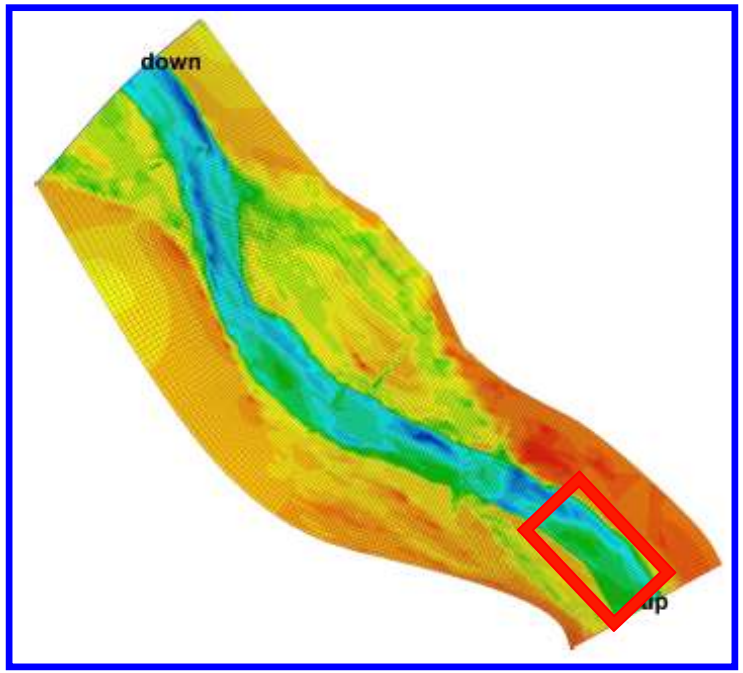
- Introduction
- Hydrodynamic conditions (natural & modified by barrage)
- Hydrodynamics is in the presence of vessels
- Navigation in the presence of the by-pass channel
- Conclusions

Introduction

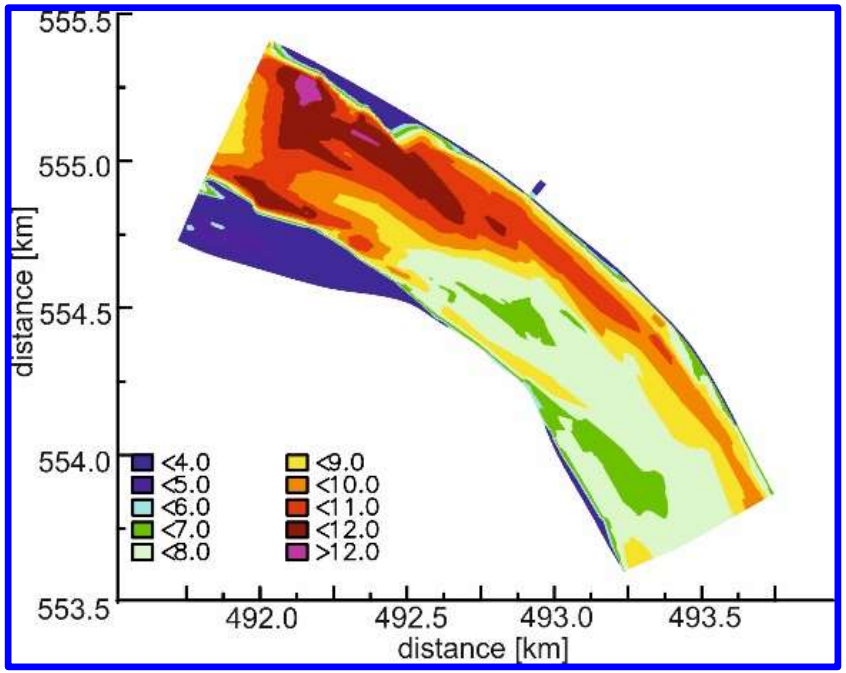


Hydrodynamics – numerical modeling

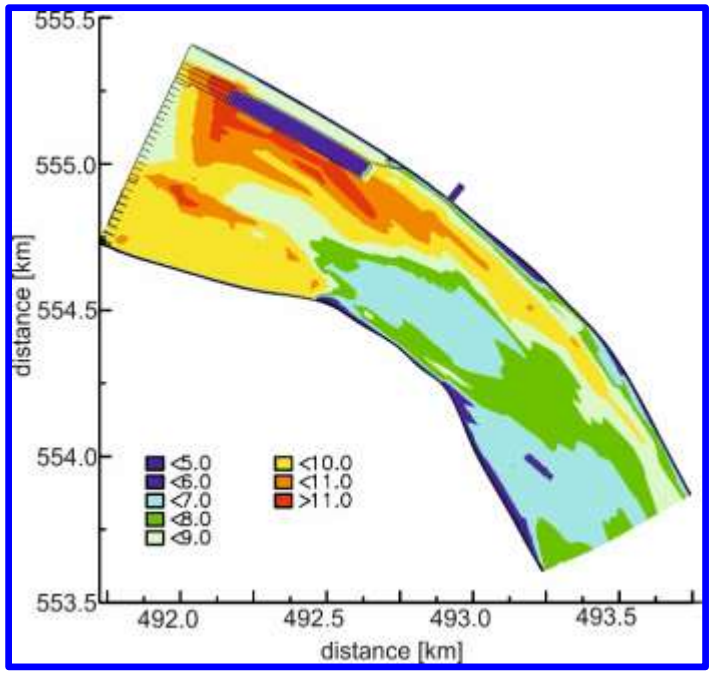
bathymetry (Popek & Niśkiewicz 2018)



before barrage construction

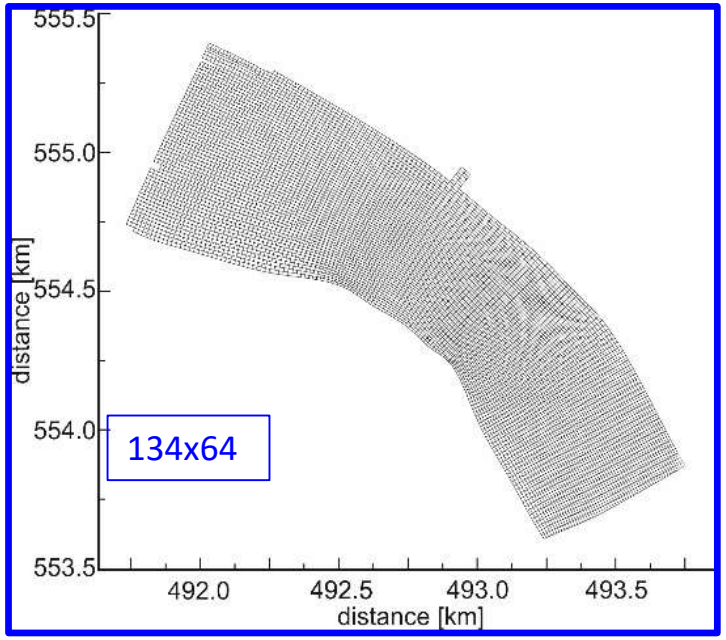


after barrage construction

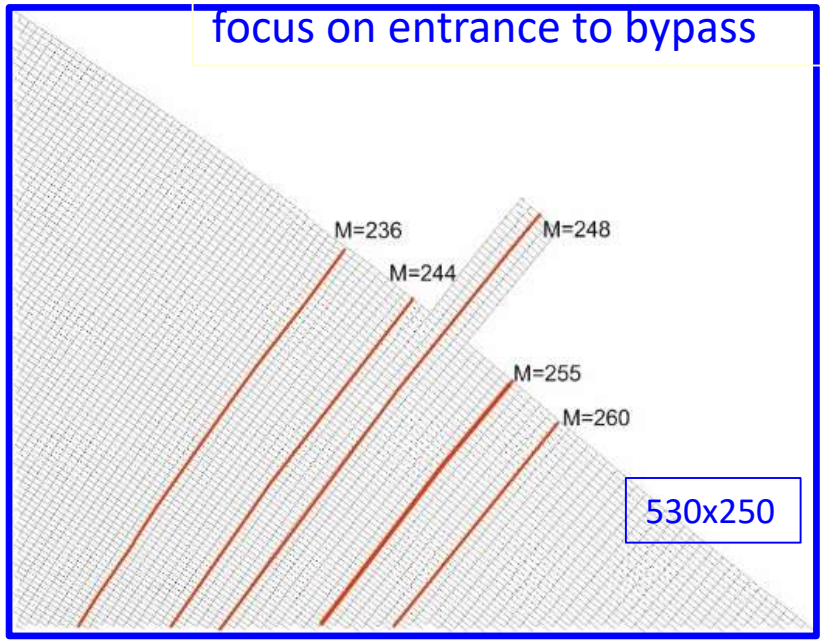


Hydrodynamics – numerical modeling

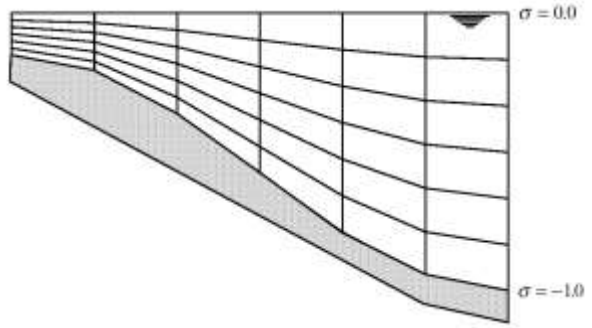
before barrage construction



after barrage construction



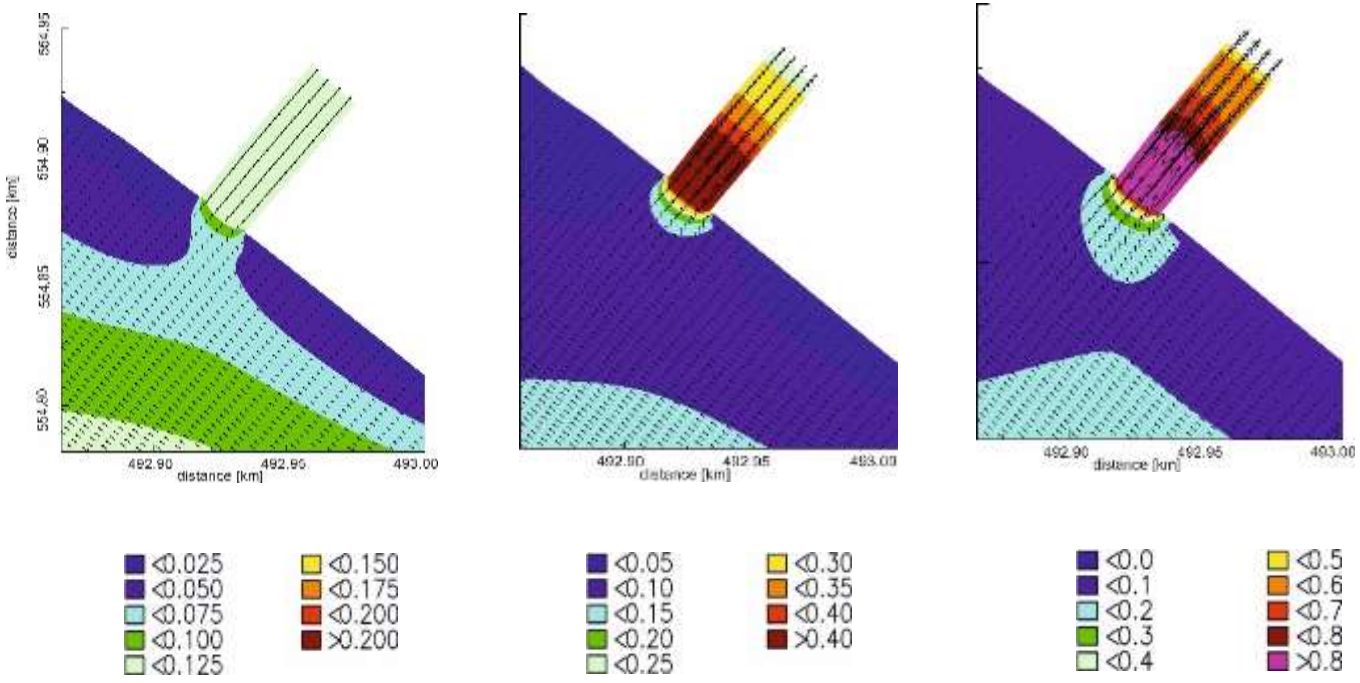
vertical discretization

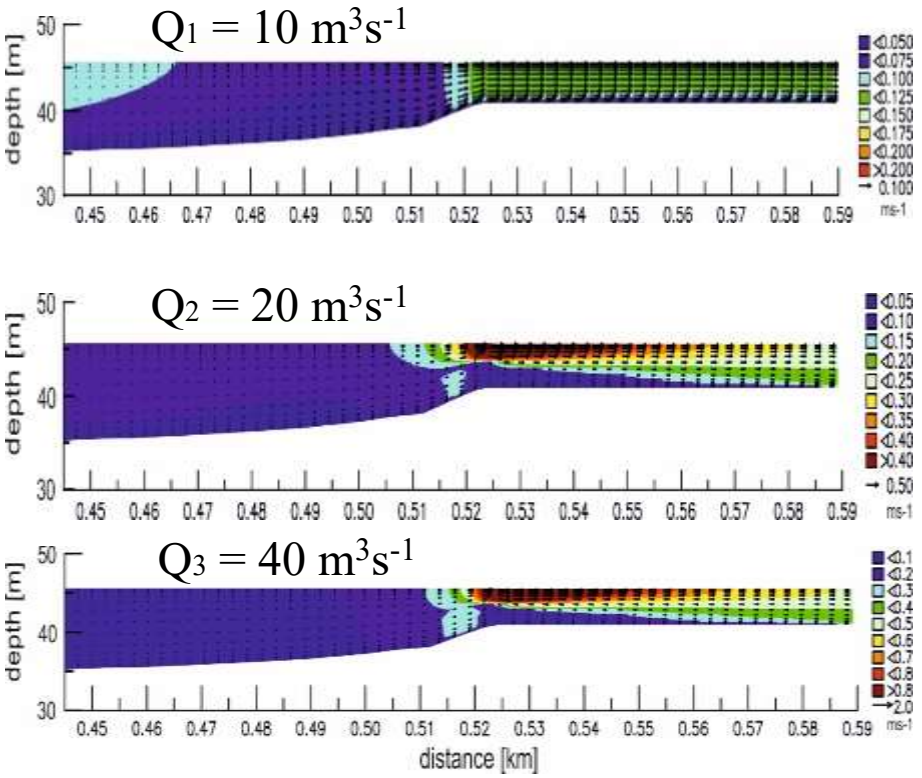


Layer No	Thickness [%]	Layer No	Thickness [%]
1	2	**7**	16
2	4	**8**	13
3	6	**9**	9
4	9	**10**	6
5	13	**11**	4
6	16	**12**	4

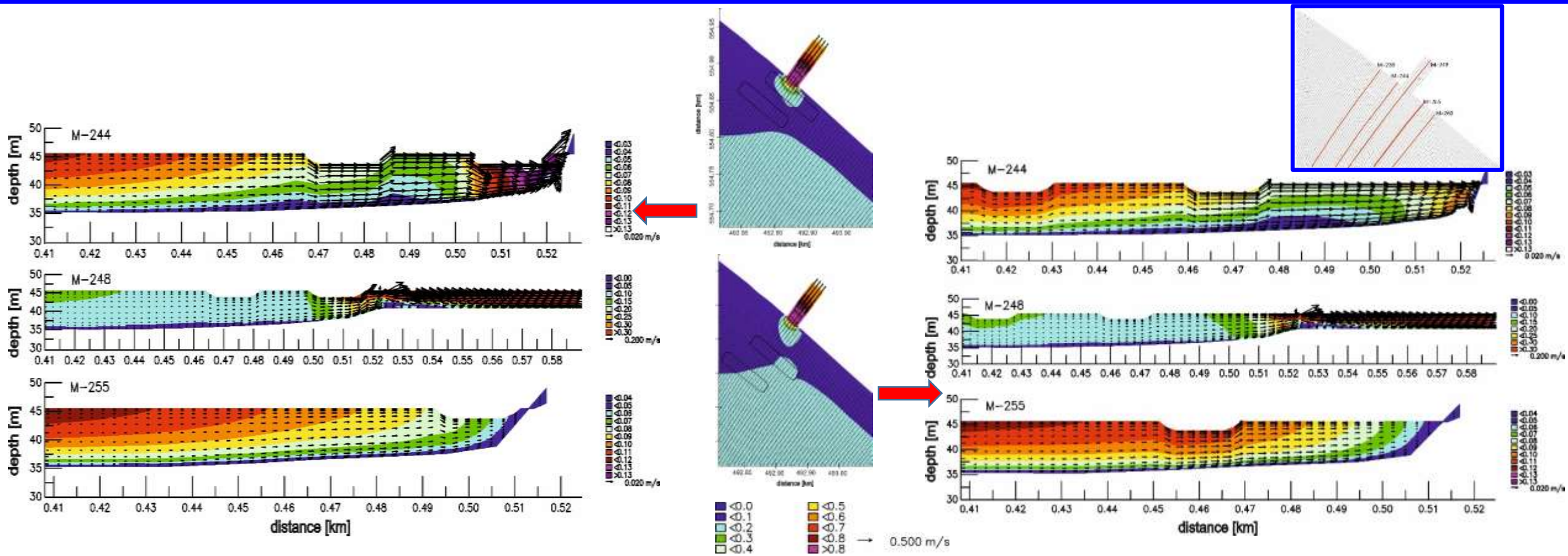
Hydrodynamics – modeling results

$Q_1 = 10\ m^3s^{-1}$ $Q_2 = 20\ m^3s^{-1}$ $Q_3 = 40\ m^3s^{-1}$

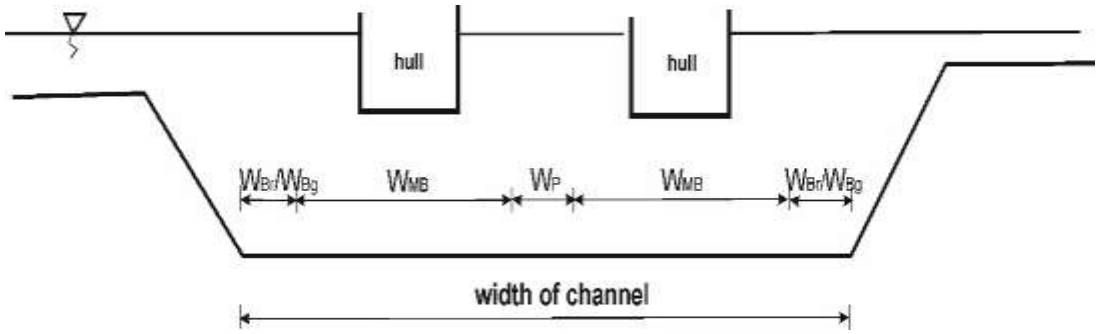




Hydrodynamics – presence of vessels



Navigation conditions



$$W_T = 2 * W_{BM} + 2 * \sum_{i=1}^{n} W_i + W_{Br} + W_{Bg} + W_p$$

NAME	CHARACTERISTIC DIMENSION [M]
Basic maneuvering width (depending on maneuverability):	W_{BM} = 1.3 - 1.8 * Bs = 14.8 - 20.50 m
Distance from the slope on the right bank (assuming the reinforced slope on the right side of the river):	W_{Br} = 0.5 * Bs = 5.70 m
Distance from the left edge (assuming a slope or sandbank):	W_{Bg} = 0.3 * Bs = 3.40 m
Crosswind impact (due to the lack of detailed data, average wind was assumed):	W_{i1} = 0.3 * Bs = 3.40 m
Dominant transverse current:	W_{i2} = 0.3 * Bs = 3.40 m
Navigation system available:	W_{i3} = 0.2 – 0.4 * Bs = 2.28 – 4.56 m
Width of the track separator (low speed):	W_P =1 * B_s = 11.40 m
Two-way track width:	W_T= **68.26 – 84.22 m**

Conclusions

Analysis carried out confirmed:

- the bypass modifies flow conditions in the main channel;
- cross-flow on the waterway reduces navigation safety; its importance increases with the increasing inflow to bypass.

Based on PIANC analysis, the two-way track should be (at least) 68.26 m wide.

It is recommended to confirm analysis on the physical model.

Acknowledgemenets:
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