DESIRE – DEvelopment of Sustainable adaptIve peatland management by restoration and paludiculture for nutrient REtention and other ecosystem services in the Neman river catchment

WP 3.4

Results of groundwater modeling – Amalvas Peatland (LT)

Mateusz Grygoruk, Mateusz Górecki, Robert Michałowski, Piotr Banaszuk, Paweł Osuch, Paweł Trandziuk

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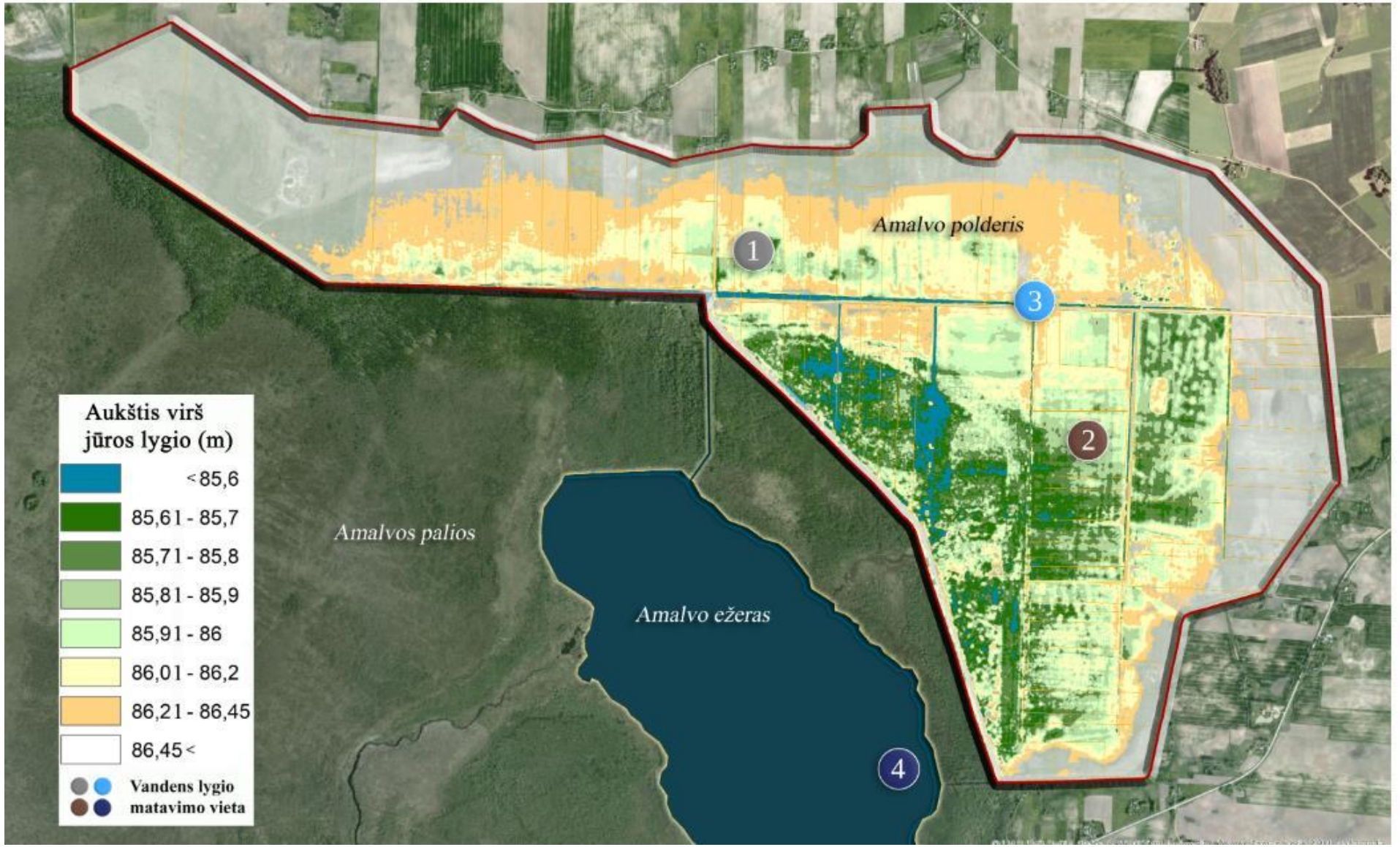
PALUDI CULTURE DESIRE

Amalvas - site



Amalvas rules (cont.)

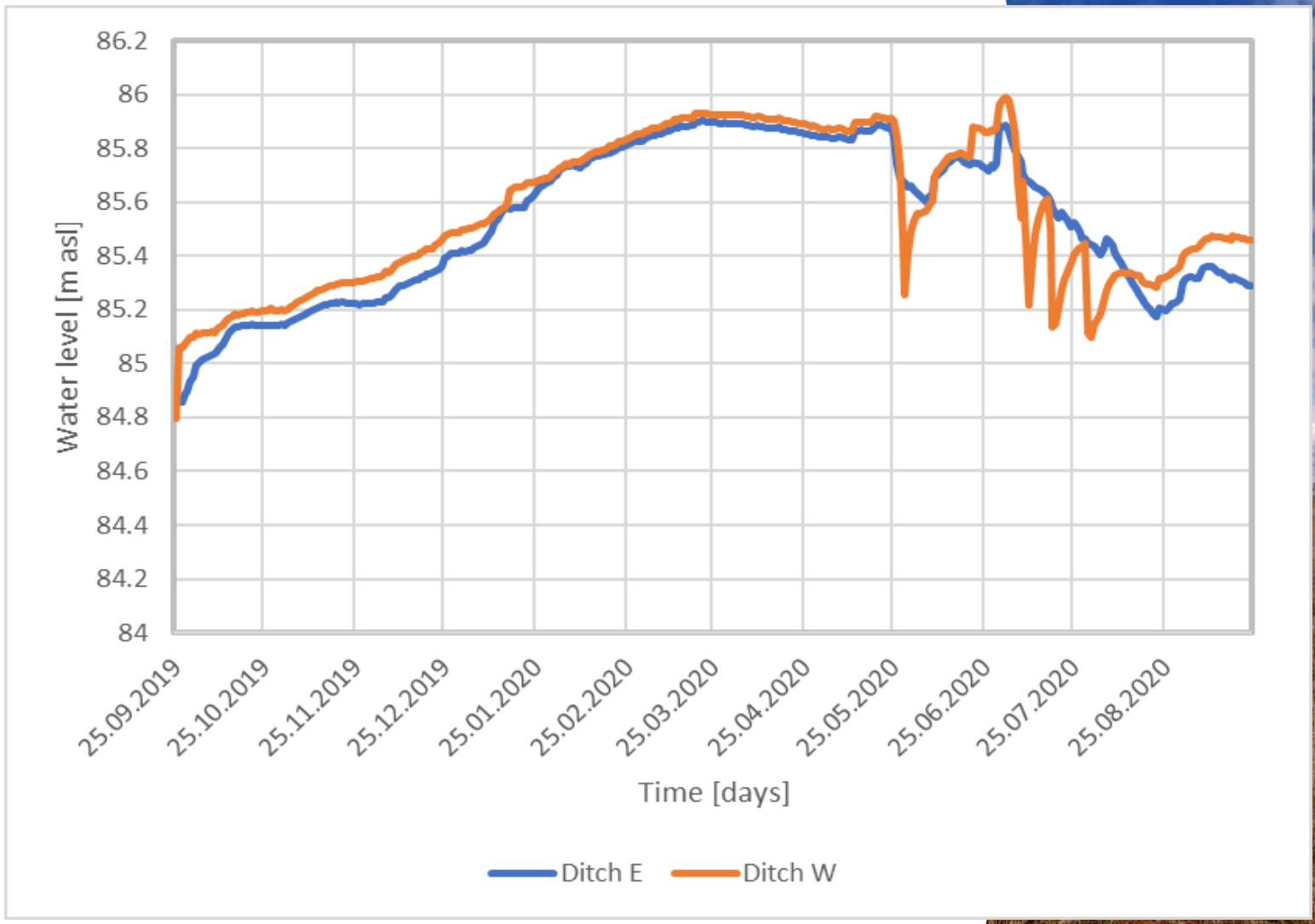
- Reconstructed to summer polder: in all cases protect the agricultural area from flooding as much as possible and ensure high water level maintenance during the autumn and early spring periods as well as to create the conditions for flooding in polder area.
- From the end of mowing/grazing season till the spring polder must maintain natural water level in Amalvas lake.
- Must ensure favorable water level (30-40 cm beneath peat the surface) during the vegetation season. Pumping station is starting to work only during the spring and autumn flood periods. Maximal water level 85,6 m, minimal – 85,10 m a.s.l.
- Water level in polder area can be lowered only in the period of real spring, when average 3 day temperature is higher than +9-11 ºC. **In all cases 30—40 cm water level in peat soils must be ensured.**

Amalvas rules (cont.)

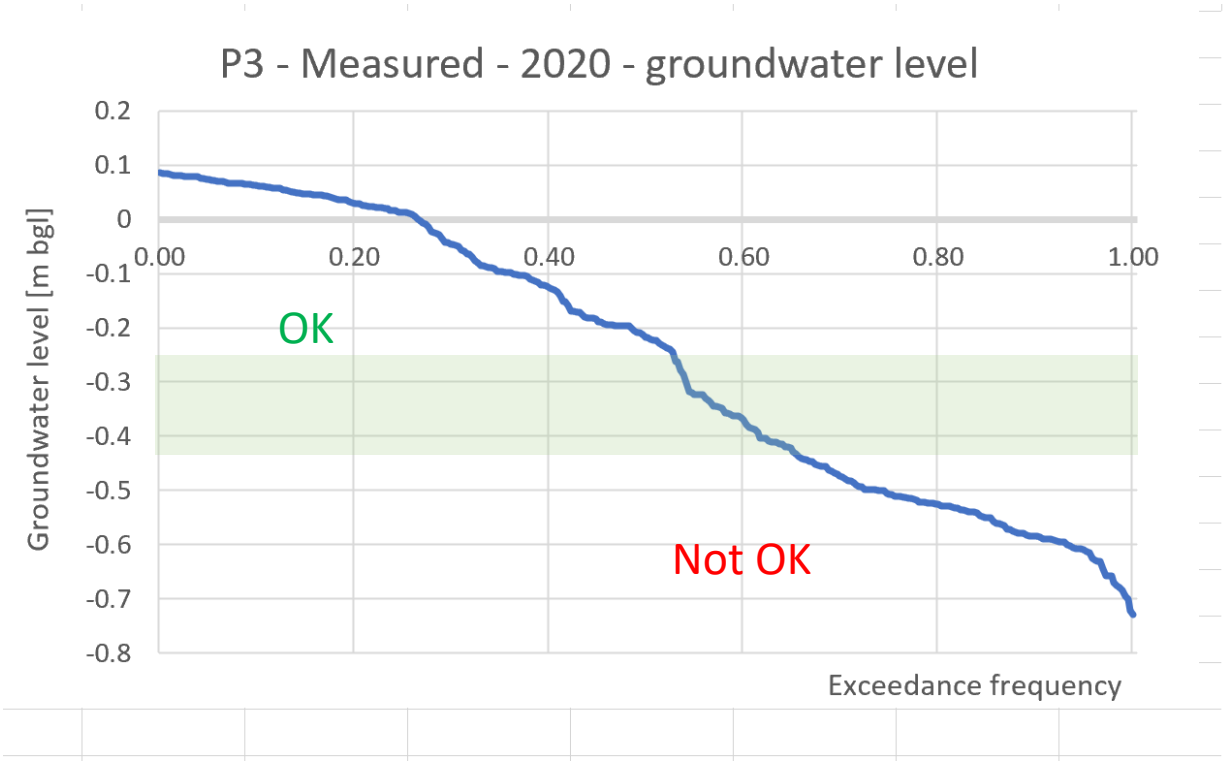
- During the driest period in case the water level in polder is lower than in Amalvas lake, favorable water level can be ensured by pumping the water from Amalvas lake. However, this process should not contradict the rules of Amalvas lake maintenance and use.
- Any lowering or raising of the water table below or above the level, which is stated in the polder usage rules, is only possible in coordination with the Žuvintas Biosphere Reserve Directorate.
- The polder basin area has protective embankments. Embankments must protect the area from flooding during the vegetation period with a 1% probability of rainwater flow.
- Only sustainable farming is recommended in the area of polder peat soils. It is recommended to grow only natural meadows and pastures in the polder area.

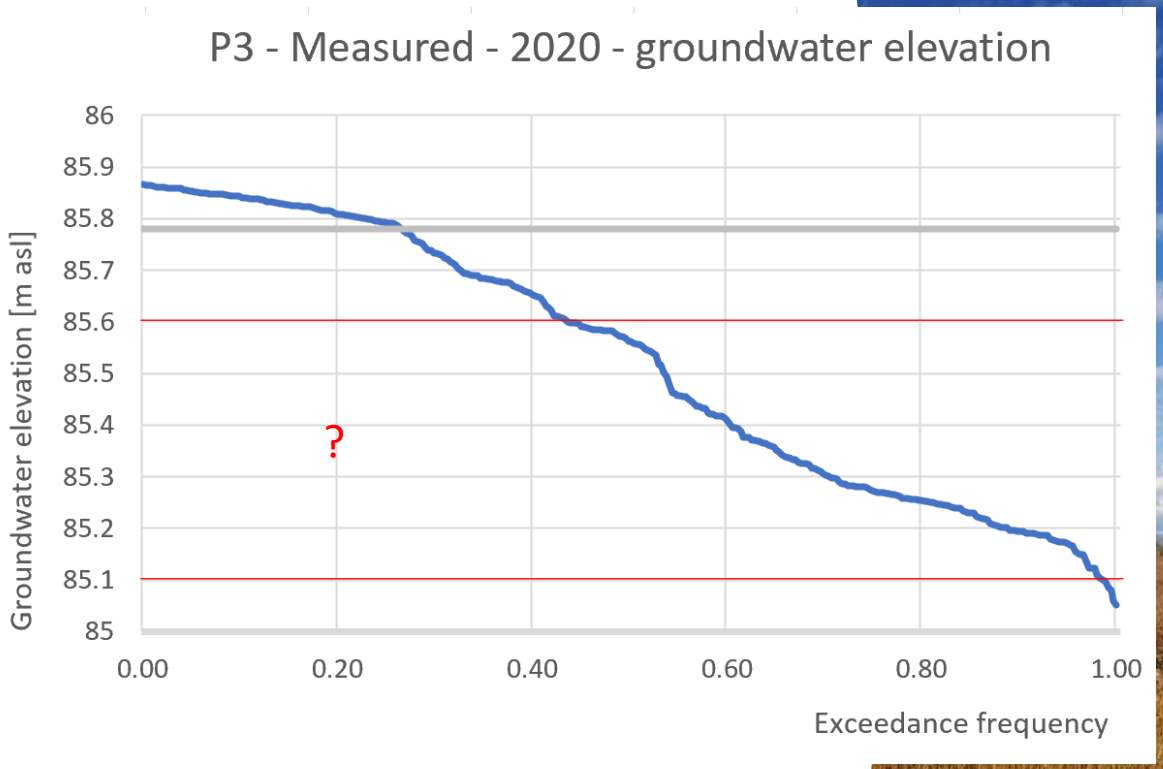
Amalvas – water management in ditches

- Very similar variability in botch canals,
- Slope of each of the canals is negligible,
- Variability +/- 1.2 m
- Efficient damming facilities
- Western ditch subjected to larger variability



Amalvas - observations



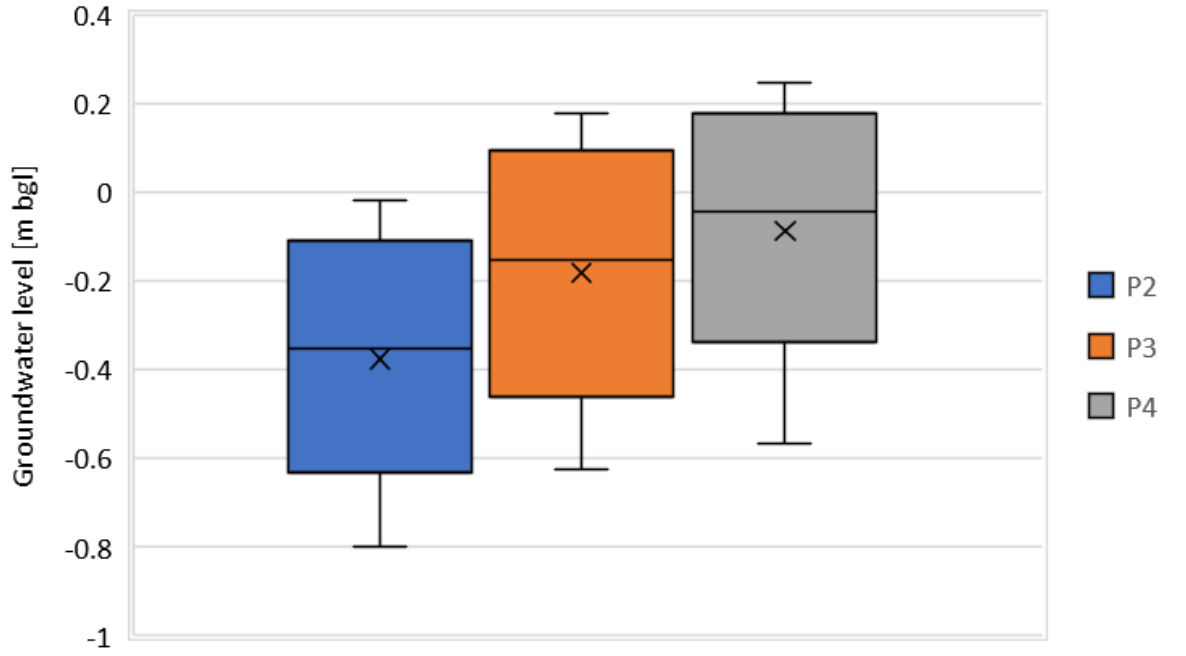


Must ensure favorable water level (30-40 cm beneath peat the surface) during the vegetation season. Pumping station is starting to work only during the spring and autumn flood periods. Maximal water level 85,6 m, minimal – 85,10 m a.s.l.

Amalvas - observations

- Rather unfavourable conditions for the peat
- Good conditions for eutrophication (high inundation frequencies – FIT)
- No match to the rules for water management

Indicator	Unit	P2	P3	P4
> 0.0	*days*	0	129	150
FIT	*%*	0.00	0.35	0.41
> -0.3	*days*	157	205	244
< -0.4	*days*	177	126	58
optimum	*days*	31	34	63
AVG	*m bgl*	-0.38	-0.18	-0.09
MIN		-0.80	-0.62	-0.57
MAX		-0.02	0.18	0.25
MAGN	*m*	0.78	0.80	0.81



Observed vs. Modelled indicators

- Good fit ☺

Observed

Indicator	Unit	P2	P3	P4
> 0.0	*days*	0	129	150
FIT	*%*	0.00	0.35	0.41
> -0.3	*days*	157	205	244
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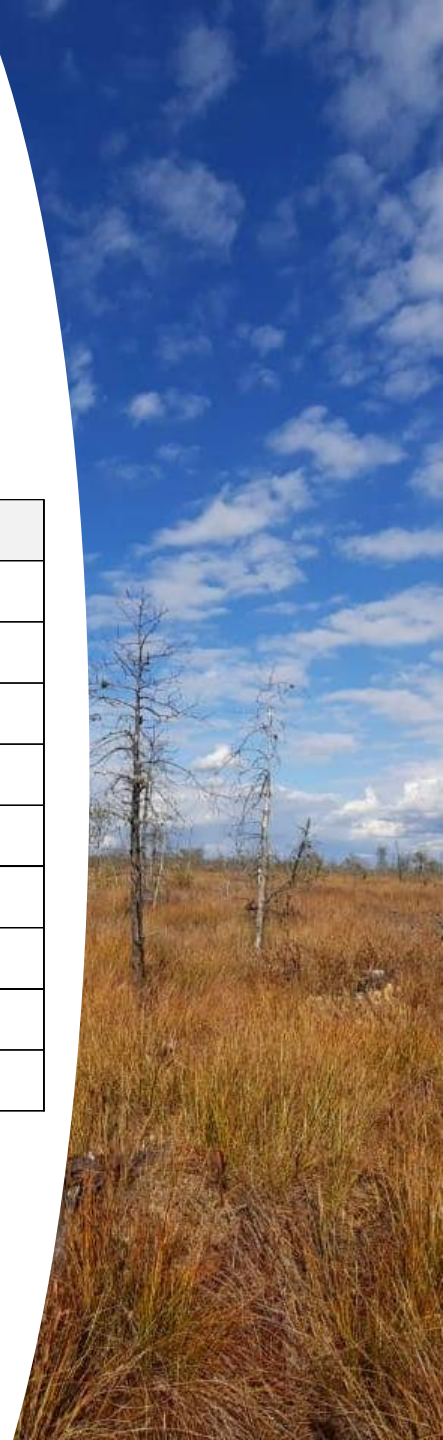
MAGN	*m*	0.78	0.80	0.81

Modelled

Indicator	Unit	P2	P3	P4
> 0.0	*days*	17	127	160
FIT	*%*	0.05	0.35	0.44
> -0.3	*days*	189	234	249
< -0.4	*days*	145	88	64
optimum	*days*	31	43	52
AVG	*m bgl*	-0.35	-0.21	-0.16
MIN		-1.07	-0.93	-0.86
MAX		0.02	0.12	0.14
MAGN	*m*	1.09	1.05	1.00



Rewetting scenarios

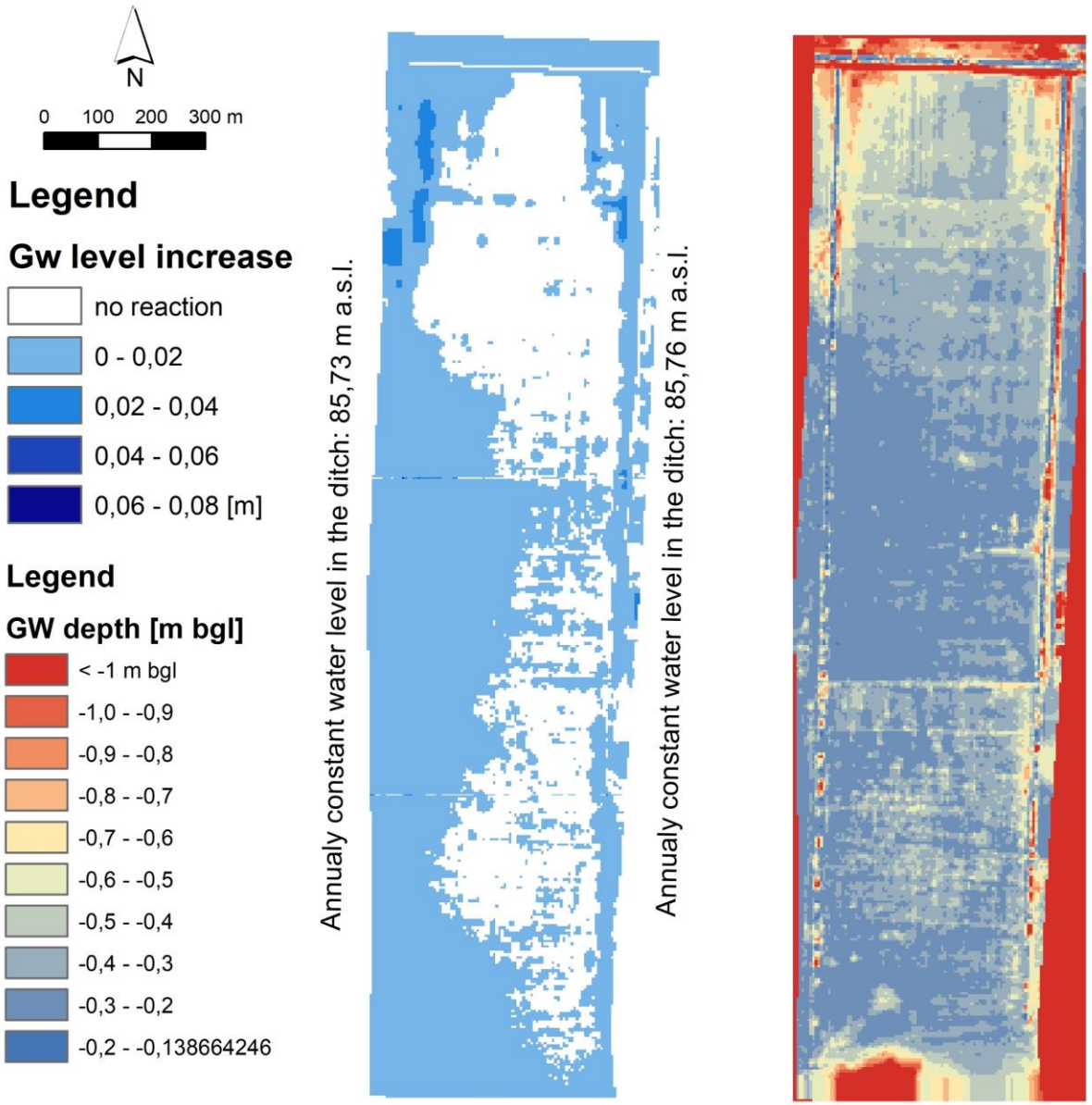
- **Variant 1** – 20 cm increase of water levels in E and W ditches throughout the whole year:

  E ditch: water level 85.76 m asl
  W ditch: water level 85.73 m asl

- **Variant 2** – maximum possible increase of water levels in in E and W ditches throughout the whole year:

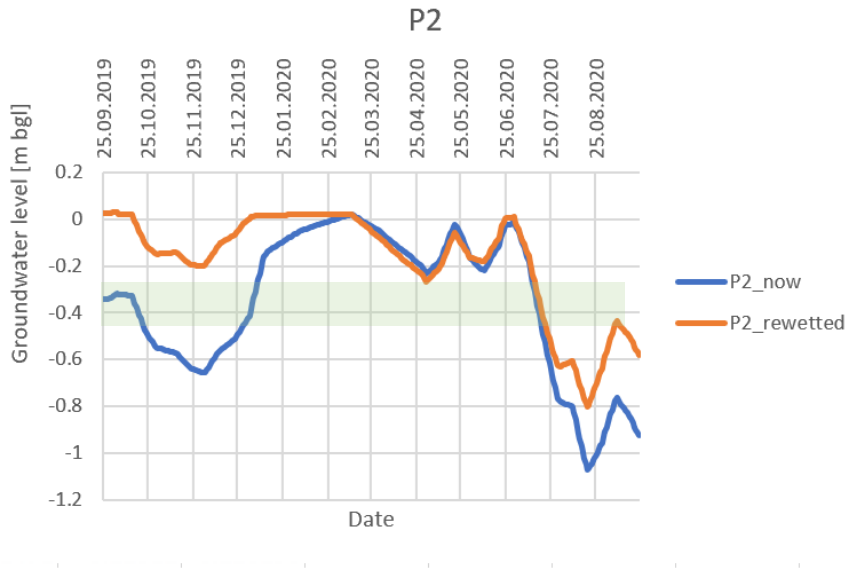
  E ditch: water level 85.80 m asl
  W ditch: water level 85.85 m asl

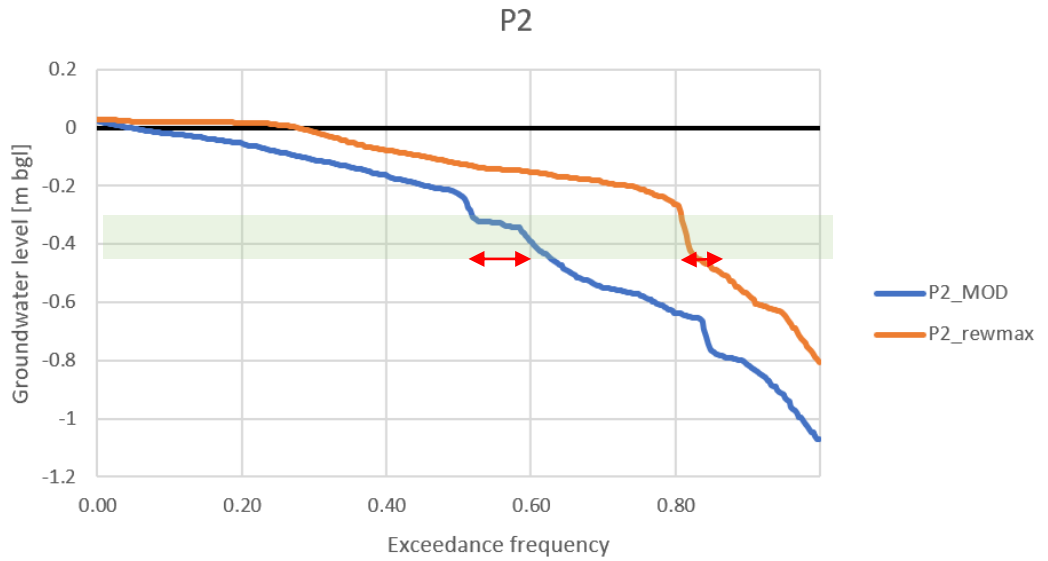
Variant 1 – average change

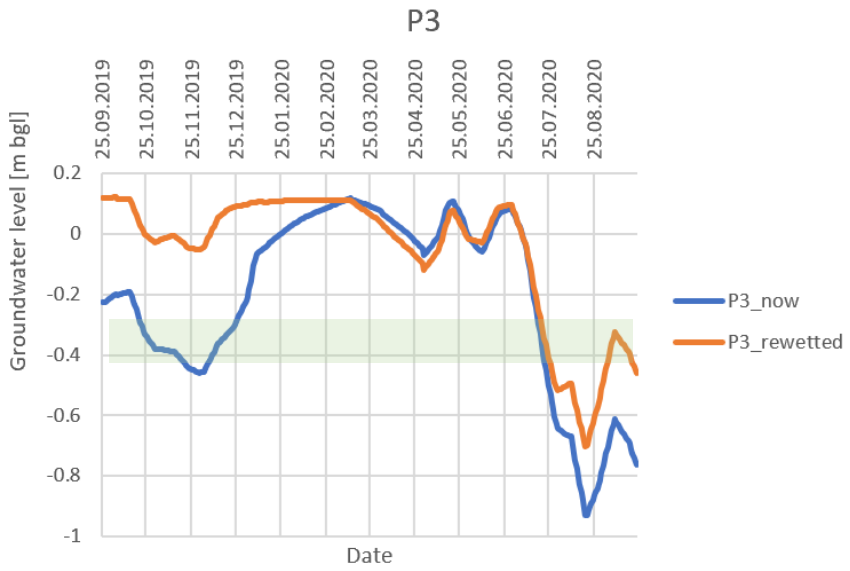


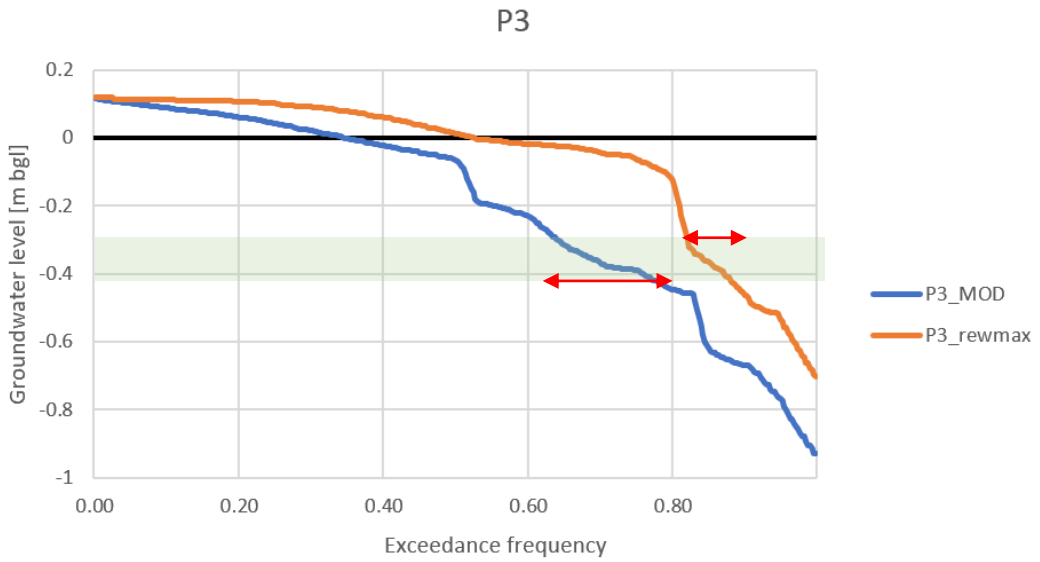
- Average increase of groundwater levels in the site is small (less than 5 cm)

Variant 2:

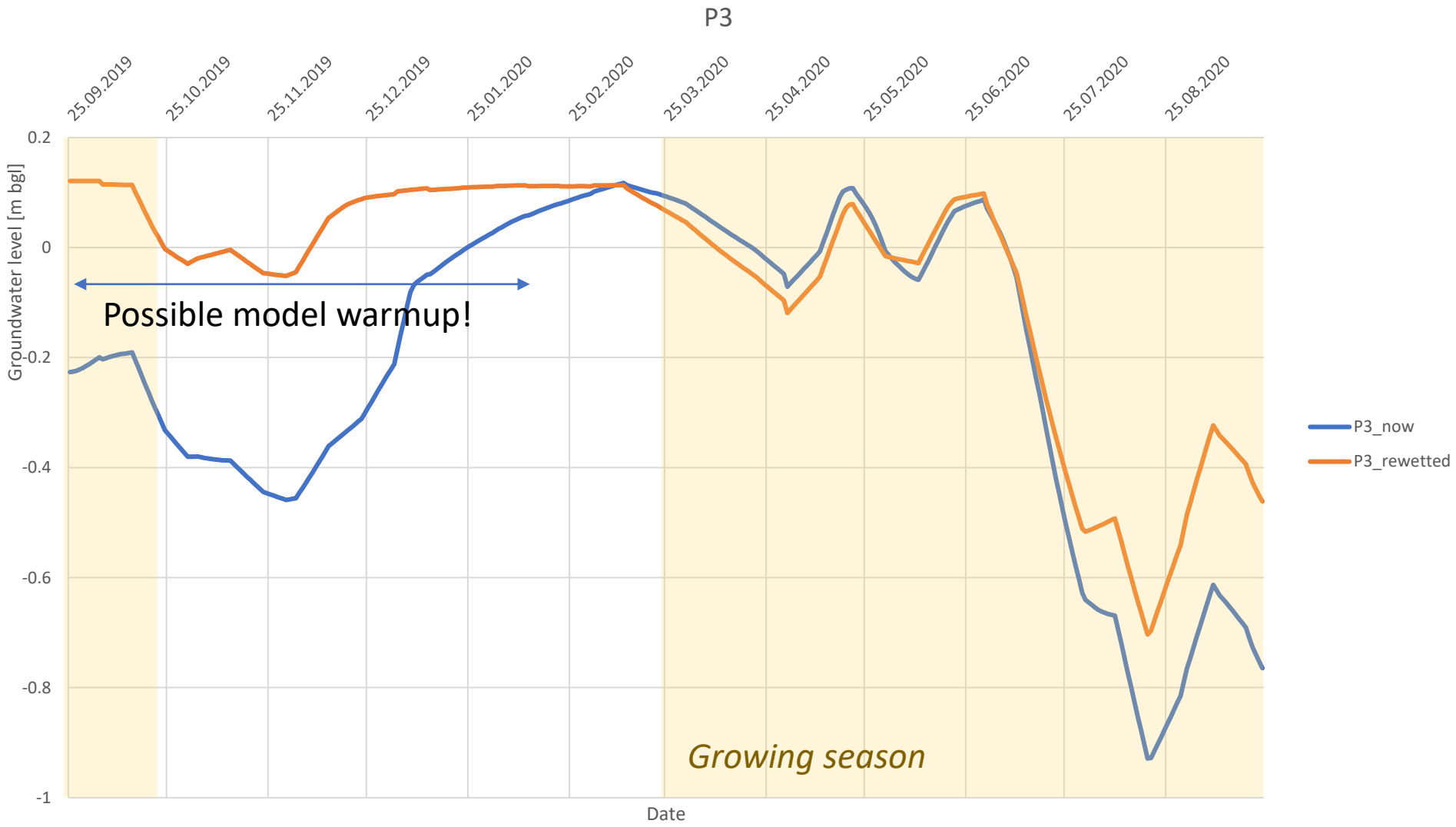

P2
Groundwater level [m bgl]
25.09.2019
25.10.2019
25.11.2019
25.12.2019
25.01.2020
25.02.2020
25.03.2020
25.04.2020
25.05.2020
25.06.2020
25.07.2020
25.08.2020
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
Date
P2_now
P2_rewetted


P2
Groundwater level [m bgl]
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
0.00
0.20
0.40
0.60
0.80
Exceedance frequency
P2_MOD
P2_rewmax

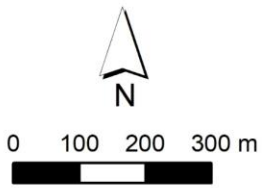

P3
Groundwater level [m bgl]
25.09.2019
25.10.2019
25.11.2019
25.12.2019
25.01.2020
25.02.2020
25.03.2020
25.04.2020
25.05.2020
25.06.2020
25.07.2020
25.08.2020
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Date
P3_now
P3_rewetted


P3
Groundwater level [m bgl]
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0.00
0.20
0.40
0.60
0.80
Exceedance frequency
P3_MOD
P3_rewmax

Variant 2:


P3
25.09.2019
25.10.2019
25.11.2019
25.12.2019
25.01.2020
25.02.2020
25.03.2020
25.04.2020
25.05.2020
25.06.2020
25.07.2020
25.08.2020
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
Groundwater level [m bgl]
Possible model warmup!
Growing season
Date
P3_now
P3_rewetted

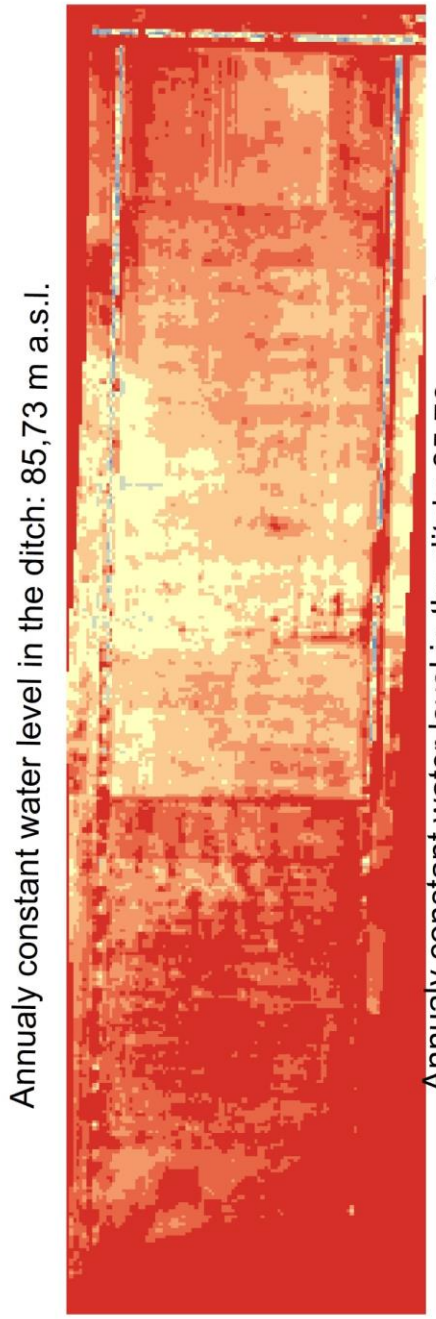
9th Sep. 2020

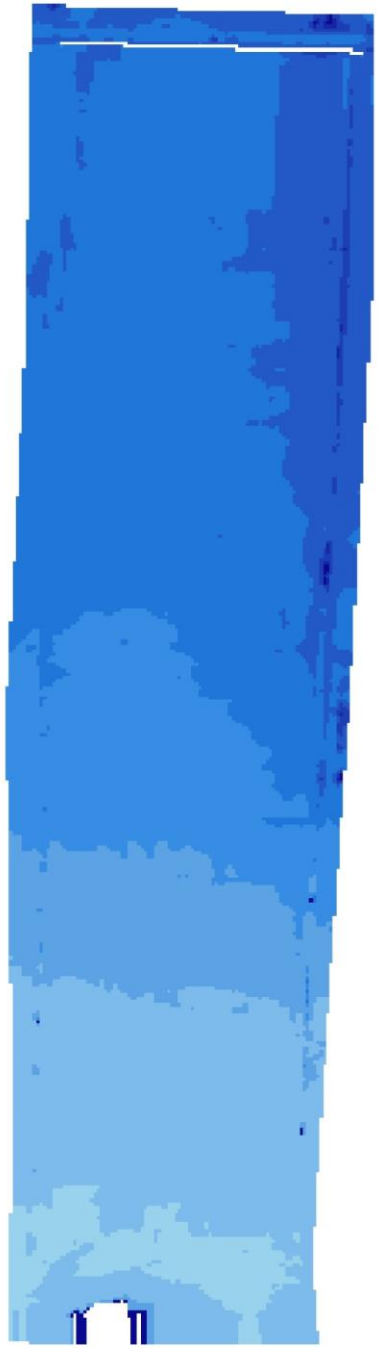


Legend

351_water level [m bgl]

- > -0,8
- -0,8 - -0,7
- -0,7 - -0,6
- -0,6 - -0,5
- -0,5 - -0,4
- -0,4 - -0,3
- -0,3 - -0,2
- -0,2 - -0,1
- -0,1 - 0,0



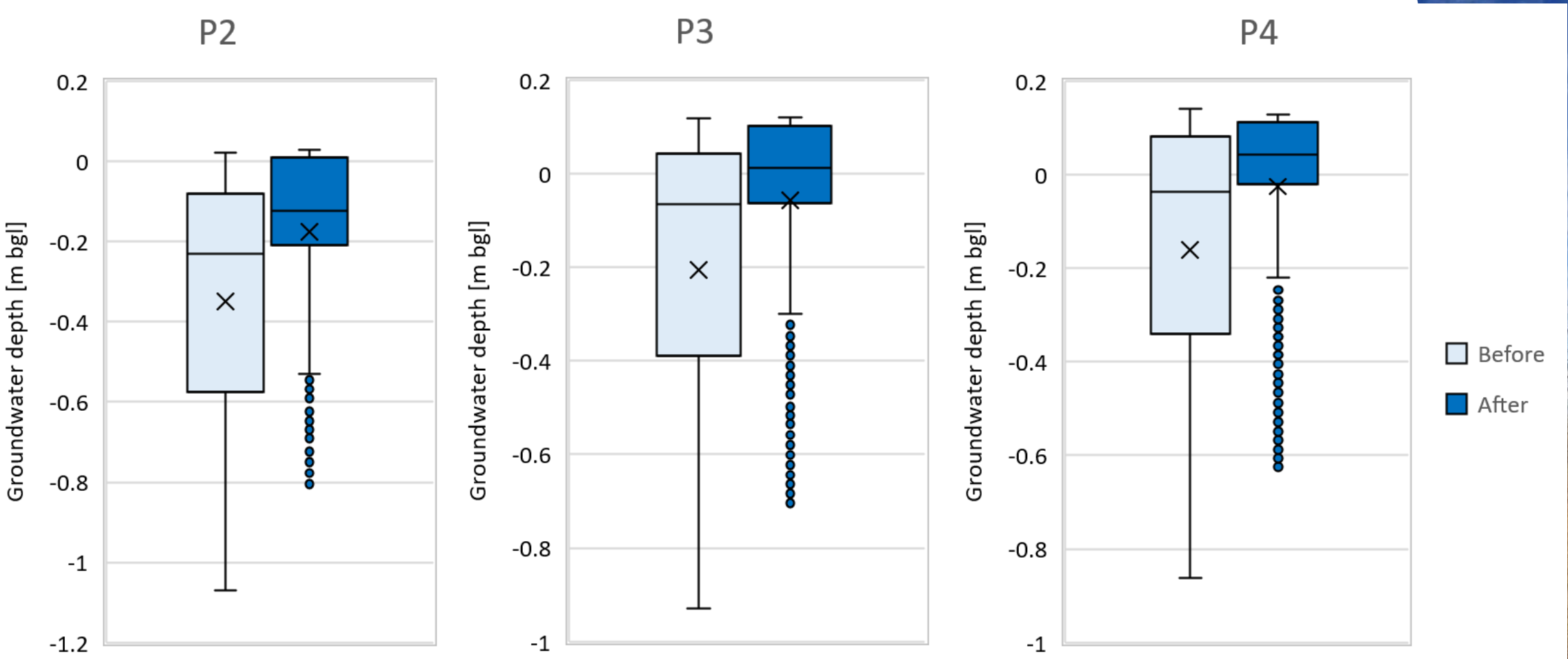


Legend

351_rewetting height [m]

- 0
- 0 - 0,05
- 0,05 - 0,1
- 0,1 - 0,15
- 0,15 - 0,2
- 0,2 - 0,25
- 0,25 - 0,3
- 0,3 - 0,35
- 0,35 - 0,4
- 0,4 - 0,45

Variant 2:


P2
P3
P4
Groundwater depth [m bgl]
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
Before
After

Amalvas - modelling

Now

Indicator	Unit	P2	P3	P4
> 0.0	*days*	17	127	160
FIT	*%*	0.05	0.35	0.44
> -0.3	*days*	189	234	249
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optimum	*days*	31	43	52
AVG	*m bgl*	-0.35	-0.21	-0.16
MIN		-1.07	-0.93	-0.86
MAX		0.02	0.12	0.14
MAGN	*m*	1.09	1.05	1.00

Max Rewetting

Indicator	Unit	P2	P3	P4
> 0.0	*days*	102	192	249
FIT	*%*	0.28	0.53	0.68
> -0.3	*days*	295	300	313
< -0.4	*days*	66	47	35
optimum	*days*	4	18	17
AVG	*m bgl*	-0.19	-0.07	-0.03
MIN		-0.80	-0.70	-0.62
MAX		0.02	0.12	0.13
MAGN	*m*	0.83	0.82	0.75

Rewetting – annual basis – change of indicators

Indicator	Unit	P2	P3	P4
> 0.0	*difference*	85	65	89
FIT		0.23	0.18	0.24
> -0.3		106	66	64
< -0.4		-79	-41	-29
optimum		-27	-25	-35
AVG		0.17	0.14	0.13
MIN		0.27	0.23	0.24
MAX		0.00	0.00	-0.01
MAGN		-0.27	-0.22	-0.25

Average annual increase of water level within the site: 0.15 m,
Optimum (-0.3- -0.4 m) threshold not met,
Lowered magnitudes,
Significantly wetter (especially after rains in growing season)

Conclusions

- Rewetting of parts of the polder is possible;
- Neither now nor in the Var2 scenario the rules of polder maintenance are not met (in general)
- Entire site is affected by the modelled rewetting (approximately 150 m range of the rewetting, the ranges overlap).
- Rewetting height in the most critical time step (351)
- Volume of water stored in the site - 95 000 m^3
- Carbon/Nutrients flush and internal eutrophication – to be better quantified (5 g P/m.sq.)
- Update of polder management rules to be done?
- Better for paludiculture!

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Thank you

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