MOORS FOR THE FUTURE PARTNERSHIP

THE DESIGN AND EFFECT OF BLOCKING DEEP, MINERAL-BASED PEAT PIPES ON A DEGRADED BLANKET BOG

ANNEX 1

MoorLIFE 2020

Prepared by:

MOORS FOR THE FUTURE PARTNERSHIP

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Action D3
The design and effect of blocking deep, mineral-based peat pipes on a degraded blanket bog

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1. Sources of error

1.1. The relationship between water depth and water flow

The relationship between water depth and water flow at gauging points downstream of pipe blocking locations was likely to be non-linear and complex, not least due to irregular cross-sectional channel profiles. Nevertheless the relationship was assumed to be consistent between pre- and post-blocking periods, and as such, it was also assumed that a post-blocking reduction in depth, relative to the control, could be statistically tested and attributed to the effects of blocking on reducing flow, even if the degree of change was not consistent between different sites or even between the individual pipes within the site. However, the assumption of a consistent depth-flow relationship between pre- and post-blocking phases was also a possible source of error because of the potential for gradual erosional changes to the cross-sectional channel profile causing a post-blocking change of depth that could be falsely attributed to the effect of blocking. To mitigate the potential for such confounding effects, the following methods were used:

a. Measurements of cross-sectional dimensions were made at intervals during the monitoring periods (Fig. 1 and Table 1).
b. **All** pre- and post-blocking flow-response variables (water table depth, peak stage and lag time) were expressed as relative to the control (see formula in main report, section 2.5.5). This expression allowed for changes in the cross-sectional profile to occur, but assumed that any changes that may have occurred were similar in both control and treatment pipes.
c. To mitigate a situation where changes to the cross-sectional profile only occurred in blocked pipes and not in the control pipes (or vice versa), a situation that would lead to either to under- or over-estimation of the response of *relative* peak stage to blocking, raw measurements of peak stage for both the treatment and the control were examined and treated according to the following two scenarios:
    (i) Post-blocking peak stage increasing in the control pipes leading to an over-estimation of the relative blocking response (R). This could be caused by e.g. post-blocking stream bed rising in the control pipes but not treatment pipes at the position of the depth logger by re-deposition of peat from erosional action upstream. To counteract this, the correction by the control was omitted, and the "adjusted" value for R was reported along with the original value. See section 1.5, below.
    (ii) Post-blocking peak stage decreasing in the control pipes leading to an under-estimation of the relative blocking response (R). This could be caused by e.g. post-blocking stream bed falling in the control pipes but not treatment pipes at the position of the depth logger (by erosion of material). As this scenario led to an underestimation of the blocking response it was kept and reported as a conservative estimate of the blocking response.

1.2. Inequality of conditions between pre- and post-treatment monitoring periods

a. Imbalances in rainfall were found between the two six-month summer monitoring periods (Pre2 and Post2) and consequently between the two 12-month monitoring periods (PRE and POST). The disparity was mainly due to an exceptionally dry and hot summer in 2022 (see main report, section 3.4.1). Rainfall was shown in the results to be closely linked with both water storage

scores and water table level. To counteract this effect, water table responses to blocking were expressed as relative to the unblocked control. In addition, rainfall across the six-month winter comparison periods (Pre1 and Post1) were similar, providing a further check on validity.

b. Imbalances in the number of suitable hydrographic peaks selected for analysis of water flow variables between pre and post periods of both the summer and the winter periods, were also treated for bias primarily by expressing results relative to the control. However in this case, imbalances in the number of peaks between the Pre1 and Post1 periods and also between the Pre2 and Post2 periods counteracted each other, providing a more evenly matched number of peaks between the 12-month PRE and POST periods, and so providing a further check on validity.

1.3. Water table results for heather bale blocks

A single dipwell cluster monitoring water table at a block constructed from heather bales increased the chance of falsely estimating the effect of these blocks on changes in water table level. In fact, results showed that the particular heather bale block chosen for this purpose (prior to the baseline period) did not create any water storage and showed a negative benefit to post-blocking water table change. This was remedied by referring to the average post-blocking water storage scores of all nine heather bale blocks – which were similar to those of all stone blocks. It was assumed therefore that, due to the observed linear relationship between water storage scores and water table rise, that water table responses of heather bale blocks were similar to those of stone blocks (Discussed in main report, section 4.2)

1.4. Hidden cross-connections between pipes affecting flow variables

Firstly, if there was hidden connecting flow from treatment to control pipe: both flows would be lowered after blocking, thus reducing the contrasting difference between treatment and control and providing a conservative result.
Secondly, if there was hidden connecting flow from control to treatment pipe: no change in control after blocking, but reduced treatment flow after blocking – thus preserving the contrasting difference. However, in a situation where there was back-flow into the control from the blocked treatment pipes, increasing the contrasting difference and exaggerating the result, see mitigation methods outlined above, in section 1.1, c (i)

1.5. Case study of over-estimation of the blocking response

Stream bed depth in the blocked pipes did not change over the three dates of the survey (Table 1) but stream bed depth in the control pipes rose by 3 cm from a date within the Pre1 period to a date within the Post 1 period. This would have an effect of increasing measurements of peak stage in the control and thus contribute to an exaggerated lowering of relative treatment peak stage.
Results (see Table 7) showed that there was a

- Significant increase in the raw control measurement of peak stage (Pre1 to Post1; from 216 mm to 225 mm, $P < 0.001$)
- Significant decrease in the raw treatment measurement of peak stage over the same period (from 206 mm to 177 mm, $P < 0.001$)
- Resulting significant decrease in relative treatment effect on peak stage from Pre1 to Post1 (by -43.1 mm, $P < 0.0001$).

Thus the reduction in the relative treatment effect was enhanced by the changes that occurred in the control – changes that were possibly due to re deposition of peat on the

stream bed of the control pipes. A potential remedy for this was to remove the correction to peak stage made by the control pipes to give a revised "non-relative" treatment effect of -28.6 mm – a smaller but still significant reduction (P = 0.05). The conclusion was to report a "significant reduction in peak stage".

Table 1. Streambed depth (cm) at flow gauging locations in blocked (treatment) and unblocked (control) pipes

Type	Jun-21	Aug-21	Nov-21	Trend
Treatment	**82**	**82**	**82**	**0**
Control	**91**	**89**	**88**	**-3**

Note: Surveys on treatment pipes included P1, P3, P7 and P8; surveys on control pipes included P4 and P5

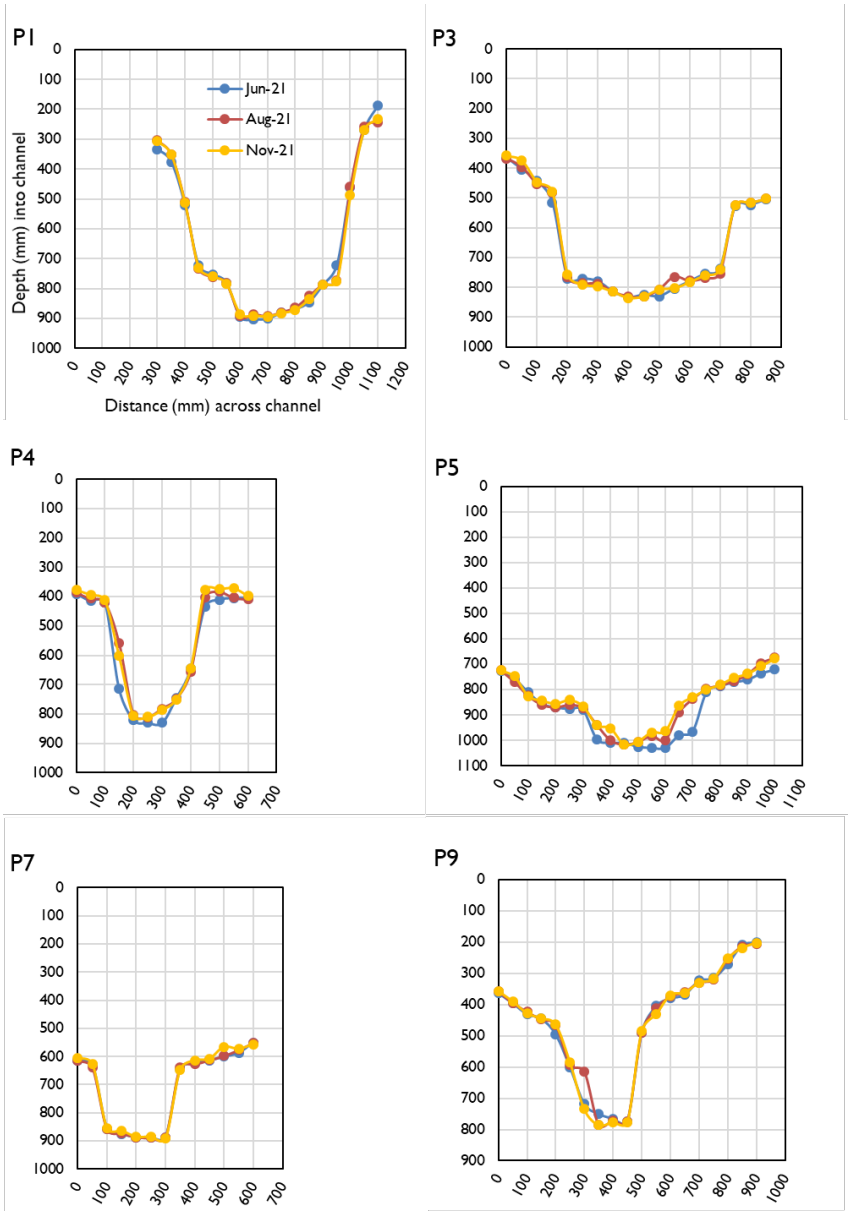


Fig. 1. Cross-sectional channel profiles at flow gauging locations

Note: Axis titles and legends for all graphs are the same as those provided in graph for P1, top left

2. Rainfall and water table depth in control

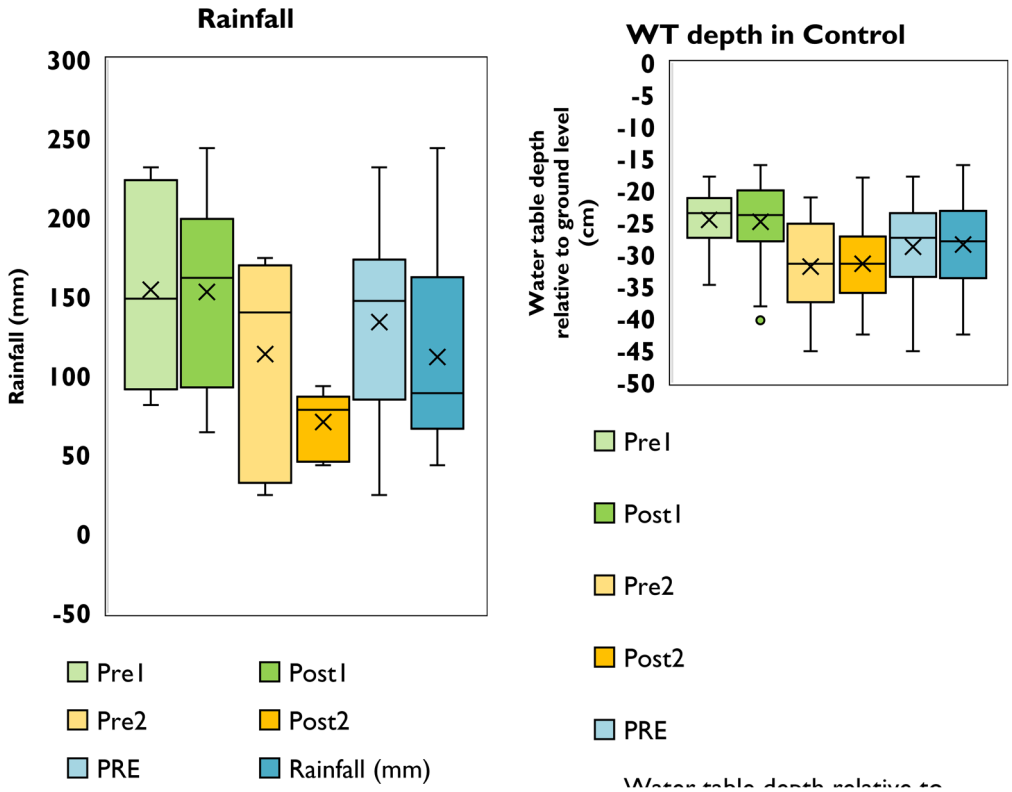


Fig. 2. Site rainfall and water table depths in the Control dipwells)

Rainfall amounts were summarised by month. Water table depth data were summarised by fortnight and are shown for the Control. The periods were Pre1 (Sep 2020 – Feb 2021); Post1 (Sep 2021 – Feb 2022); Pre2 (Mar – Aug 2021); Post2 (Mar – Aug 2022); PRE (Sep 2020 – Aug 2021); POST (Sep 2021 – Aug 2022). Data are presented as medians (line) and means (x) with Q1, Q3 and outliers. Statistical testing of differences in relative water table between periods was performed in Minitab using Mann Whitney U. No differences were found.

3. Water table depth

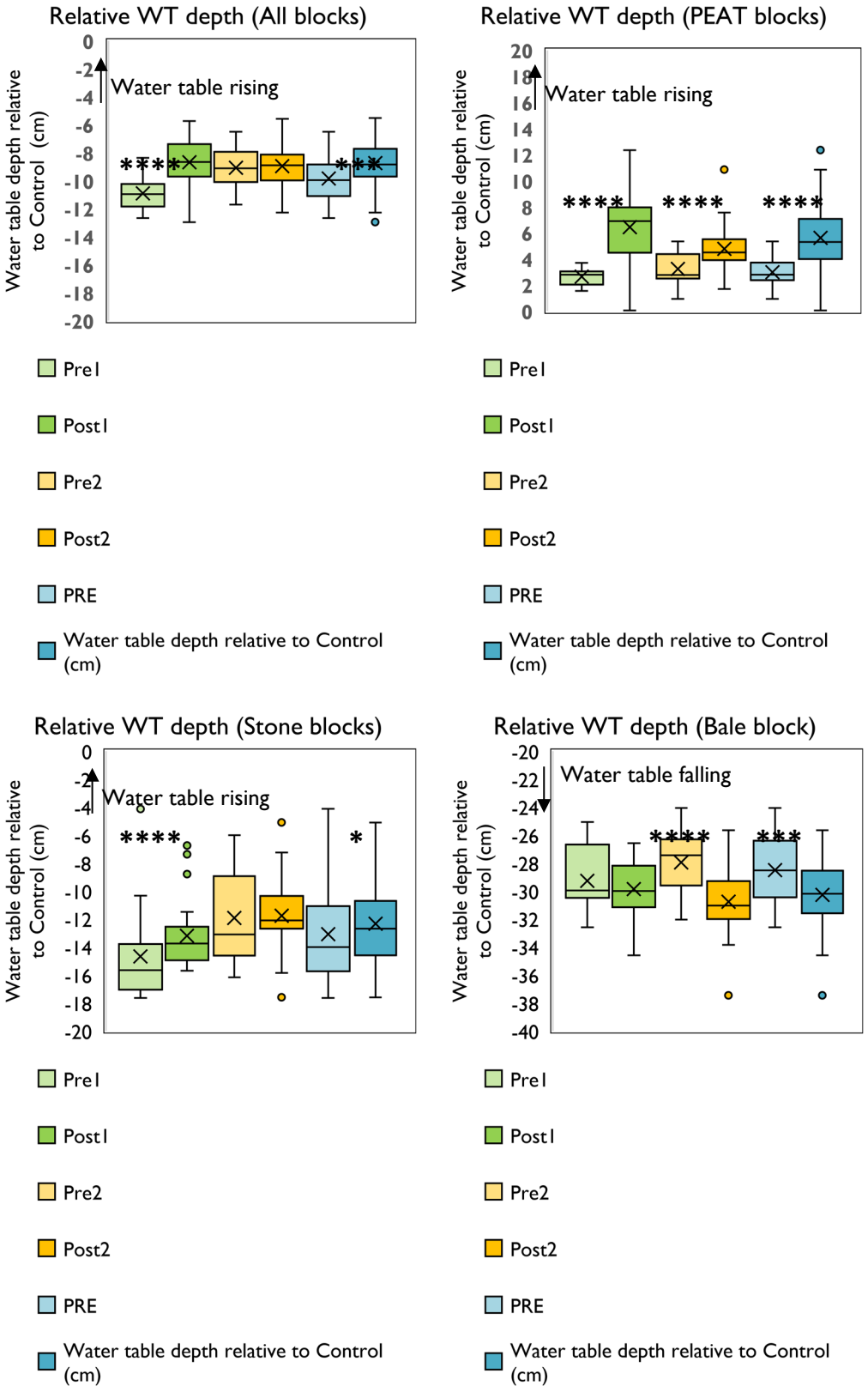


Fig. 3. Effect of comparison period and block type on relative water table depths

*Water table depth data (fortnightly) are shown relative to the Control in response to all blocks (top left), peat blocks (top right), stone blocks (bottom left) and a bale block (bottom right). The periods are as described in Fig. 2 . Data are presented as medians (line) and means (x) with Q1, Q3 and outliers. Statistical testing of differences in relative water table between periods was performed in Minitab using Mann Whitney U. Probabilities are denoted by asterisks: * (P < 0.1), ** (P< 0.05), *** (P < 0.01), **** (P < 0.001).*

Table 2. Descriptive statistics of relative water table depth data (cm) for block types and comparison periods

All blocks	**Pre1**	**Post1**	**Pre2**	**Post2**	**PRE**	**POST**
N	19	23	26	24	45	47
Mean	-10.90	-8.68	-9.07	-8.81	-9.84	-8.74
STDev	1.11	1.57	1.57	1.72	1.66	1.63
Min	-12.67	-12.96	-11.70	-12.27	-12.67	-12.96
Q1	-11.85	-9.71	-10.11	-9.83	-11.10	-9.71
Median	-10.96	-8.67	-9.11	-8.87	-9.96	-8.85
Q3	-10.24	-7.39	-7.93	-7.88	-8.84	-7.72
Max	-8.37	-5.74	-6.50	-5.51	-6.50	-5.51
Peat blocks						
N	19	23	26	24	45	47
Mean	2.64	6.44	3.24	4.81	2.98	5.61
STDev	0.66	2.45	1.15	1.78	1.01	2.26
Min	1.55	0.05	0.93	1.70	0.93	0.05
Q1	2.03	4.48	2.50	3.92	2.36	4.00
Median	2.80	6.90	2.78	4.58	2.80	5.30
Q3	3.05	7.95	4.36	5.54	3.73	7.08
Max	3.70	12.35	5.35	10.85	5.35	12.35
Stone blocks						
N	19	23	26	24	45	47
Mean	-4.14	-1.01	-11.93	-11.50	-13.09	-12.33
STDev	0.90	1.86	3.31	3.04	3.50	2.88
Min	-5.64	-5.38	-16.18	-17.60	-17.65	-17.60
Q1	-4.95	-1.83	-14.62	-12.70	-15.74	-14.60
Median	-4.13	-1.05	-13.10	-11.99	-14.00	-12.70
Q3	-3.47	0.14	-8.94	-9.71	-11.09	-10.70
Max	-2.25	2.43	-6.00	-5.10	-4.13	-5.10
Bale blocks						
N	19	23	26	24	45	47
Mean	-29.27	-29.86	-27.96	-30.65	-28.51	-30.27
STDev	2.34	2.15	2.18	2.42	2.31	2.30
Min	-32.60	-34.60	-32.05	-37.45	-32.60	-37.45
Q1	-30.50	-31.15	-29.61	-31.97	-30.45	-31.60
Median	-29.95	-30.00	-27.45	-30.78	-28.53	-30.20
Q3	-26.68	-28.20	-26.30	-29.11	-26.40	-28.55
Max	-25.08	-26.58	-24.07	-25.65	-24.07	-25.65

Note: Periods are as follows: Pre1 = Sep 2020 – Feb 2021; Post1 = Sep 2021 – Feb 2022; Pre2 = Mar – Aug 2021; Post2 = Mar – Aug 2022; PRE = Sep 2020 – Aug 2021; POST = Sep 2021 – Aug 2022.

Table 3. Change (cm) in median relative water table depth after blocking

Category	Period	Direction of change	Change (cm) overall	Change (cm) at distance from block 1m	2m	3m	4m	5m
All blocks								
	Pre1-Post1	↑	2.3****	-0.6	2.1***	4.1****	3.1****	1.0*
	Pre2-Post2	↔	0.2	0.8*	1.0	0.8	-0.4	0.3
	PRE-POST	↑	1.1***	0.4*	2.0***	1.9**	1.0*	0.3
Peat blocks								
	Pre1-Post1	↑	4.1****	2.9**	3.0***	6.9****	4.0****	2.9****
	Pre2-Post2	↑	1.8****	2.0****	1.9***	2.1*	-0.2	-0.1
	PRE-POST	↑	2.5****	2.1****	2.5****	3.8****	2.4****	1.3****
Stone blocks								
	Pre1-Post1	↑	1.9****	2.6***	-0.3	2.9**	2.3****	1.4
	Pre2-Post2	↔	1.1	0.9	0.8	-1.3	0.5	0.6
	PRE-POST	↑	1.3*	2.1**	0.5	0.8	0.8**	1.3
Bale blocks								
	Pre1-Post1	↔	-0.1	-6.9****	2.9*	2.5	-0.5	-2.3*
	Pre2-Post2	↓	-3.3****	-5.0**	0.3	-1.7	-4.4****	-5.2****
	PRE-POST	↓	-1.7***	-4.6****	2.5	-0.6	-4.0***	-3.5****

*Note: Periods are as follows: Pre1 = Sep 2020 – Feb 2021; Post1 = Sep 2021 – Feb 2022; Pre2 = Mar – Aug 2021; Post2 = Mar – Aug 2022; PRE = Sep 2020 – Aug 2021; POST = Sep 2021 – Aug 2022. The direction of change is denoted by ↑,↓ or ↔ = water table rising to the surface, falling from the surface, or not changing, respectively, and according to statistical testing of medians by Kruskal-Wallis and Mann-Whitney U in Minitab. Probabilities are denoted by asterisks: * (P < 0.1), ** (P< 0.05), *** (P < 0.01), **** (P < 0.001).*

4. Lag time

Table 4. Descriptive statistics of lag time data for the different comparison periods

	Pre1	Post1	Pre2	Post2	PRE	POST
Treatment						
Mean	114.19	224.25	145.72	262.29	126.80	231.30
StDev	88.63	74.08	59.12	178.60	78.37	97.81
N	15	22	10	5	25	27
Minimum	-27.14	120.00	26.43	96.43	-27.14	96.43
1st Quartile	47.86	162.50	121.25	104.65	62.50	161.43
Median	114.29	208.93	132.86	195.00	125.00	201.43
3rd Quartile	156.43	288.75	190.36	453.57	171.08	308.57
Maximum	312.14	360.71	228.57	458.57	312.14	458.57
Control						
Mean	121.17	188.64	147.50	231.00	131.70	196.48
StDev	93.80	81.65	59.97	163.19	81.57	98.81
N	15	22	10	5	25	27
Minimum	-20.00	55.00	40.00	105.00	-20.00	55.00
1st Quartile	40.00	137.50	113.75	105.00	65.00	130.00
Median	120.00	175.00	147.50	135.00	132.50	165.00
3rd Quartile	180.00	270.00	193.75	405.00	180.00	270.00
Maximum	305.00	350.00	235.00	455.00	305.00	455.00
Treatment relative to Control						
Mean	-6.98	35.62	-1.79	31.29	-4.90	34.82
StDev	25.00	26.41	12.16	49.01	20.66	30.59
N	15	22	10	5	25	27
Minimum	-55.71	-2.14	-23.57	-8.57	-55.71	-8.57
1st Quartile	-19.64	11.96	-8.75	-7.50	-14.47	11.43
Median	-7.14	37.50	-4.29	7.86	-6.43	37.14
3rd Quartile	12.14	50.72	10.00	81.79	10.72	55.00
Maximum	40.00	109.29	15.00	103.57	40.00	109.29

Note: Periods are as follows: Pre1 = Sep 2020 – Feb 2021; Post1 = Sep 2021 – Feb 2022; Pre2 = Mar – Aug 2021; Post2 = Mar – Aug 2022; PRE = Sep 2020 – Aug 2021; POST = Sep 2021 – Aug 2022.

Table 5. Change in relative lag times (mins) after blocking

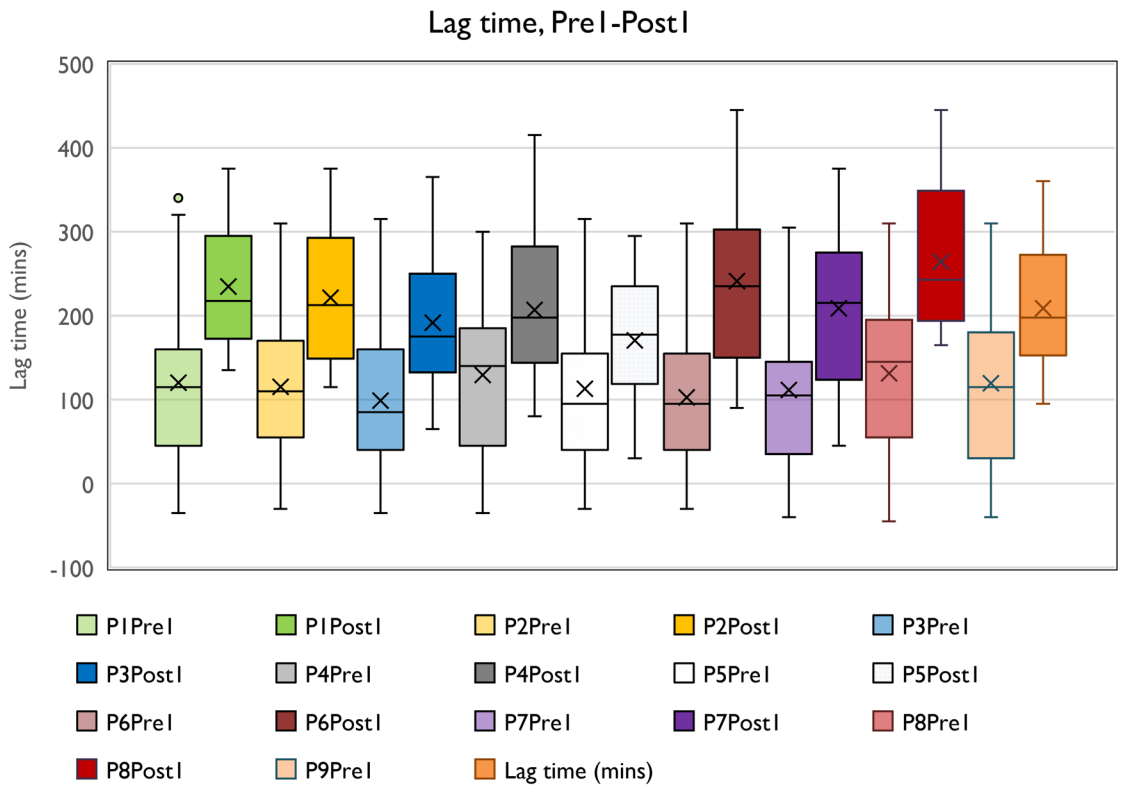
Period	Change overall	Change at individual pipes						
		P1	P2	P3	P6	P7	P8	P9
Pre1-Post1	44****	35****	38***	15*	55***	25	55****	25**
Pre2-Post2	38	23	25**	15	78*	45	15	-5
PRE-POST	44****	35****	35****	15**	55****	25	45****	23**

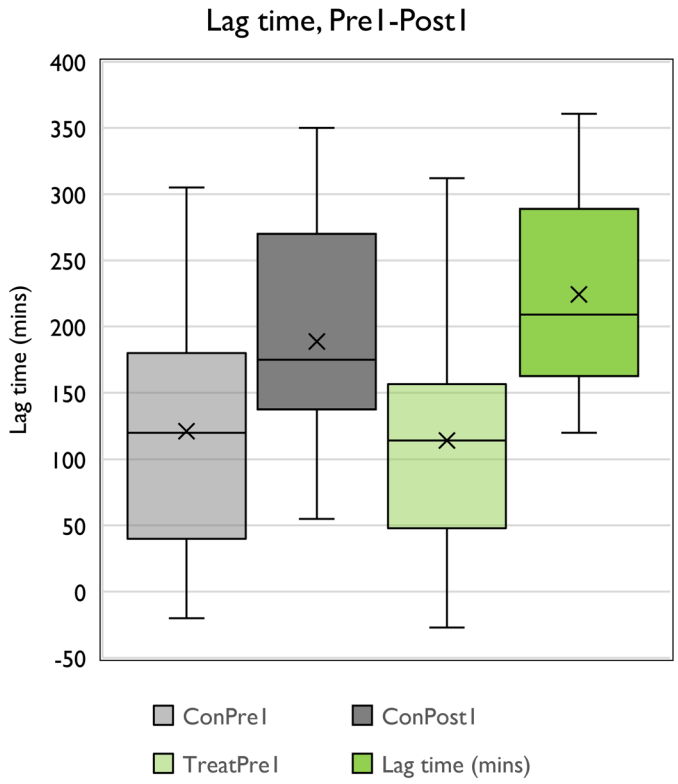
*Note Cell contents are the observed median change from a temporal sequence of relative peak stage (mm) measurements averaged over all control pipes subtracted from the equivalent set of measurements from treatment (blocked) pipes. Probabilities are denoted by asterisks: * (P < 0.1), ** (P< 0.05), *** (P < 0.01), **** (P < 0.001).*

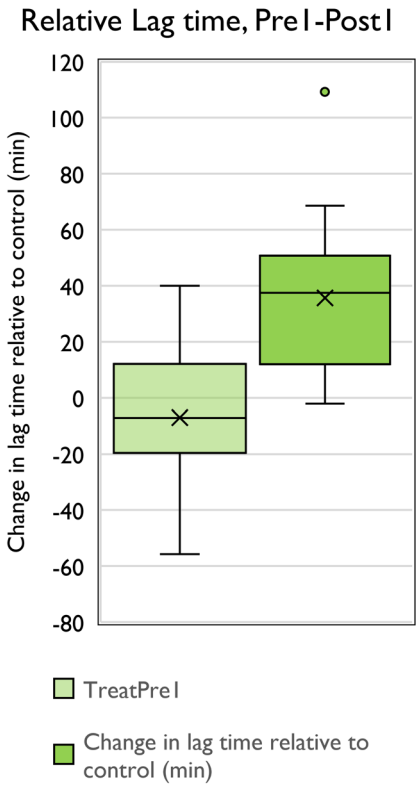
Table 6. Correlation statistics between pipe characteristics and change in lag time

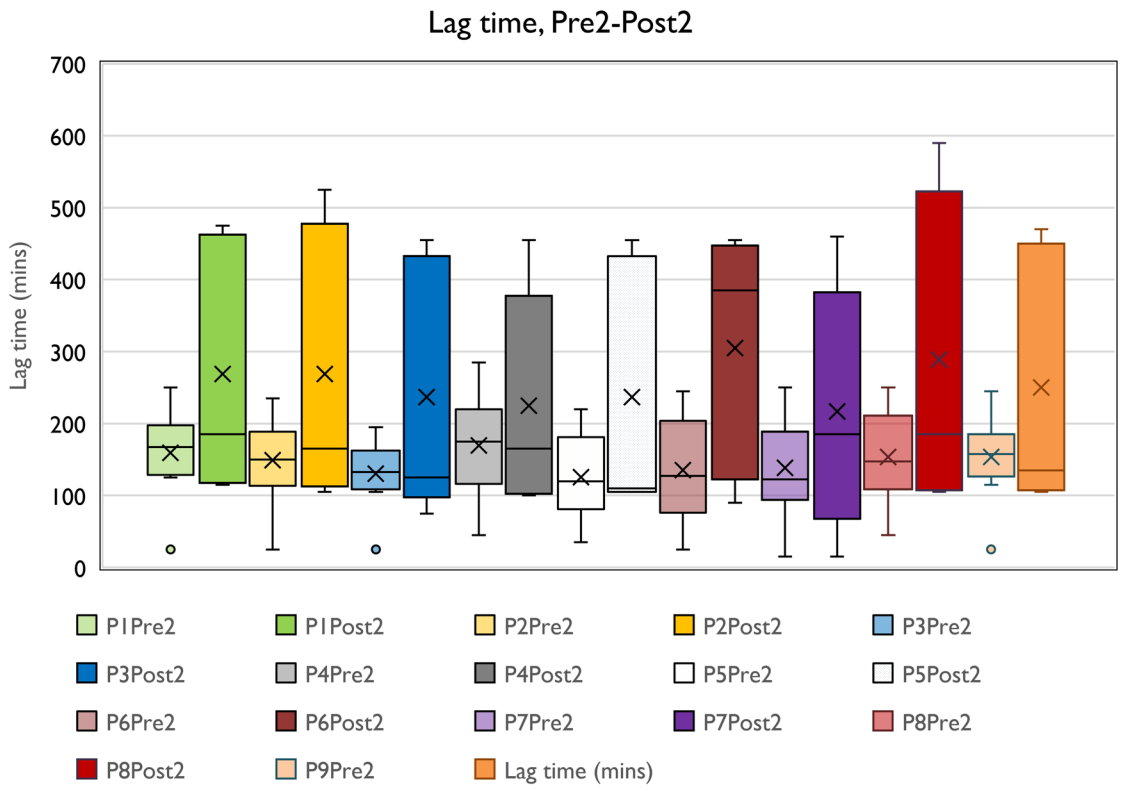
Pipe characteristic	**Pre1-Post1**		**Pre2-Post2**		**PRE-POST**	
	R^2	P-value	R^2	P-value	R^2	P-value
No. of blocks	0.18	0.35	0.05	0.64	-0.13	0.43
No. of peat blocks	0.34	0.17	0.01	0.80	0.20	0.31
No. of stone blocks	0.08	0.54	0.02	0.76	0.04	0.68
No. of bale blocks	0.29	0.21	0.00	0.91	-0.25	0.26
Water storage	0.28	0.23	0.03	0.73	0.21	0.30
Diameter	0.00	0.94	0.12	0.50	0.03	0.73

Note R^2 = Coefficient of regression for fitted line plot. P = probability that the factor has no correlation with change in median relative change in lag time


Lag time, Pre1-Post1
Lag time (mins)
500
400
300
200
100
0
-100
P1Pre1
P1Post1
P2Pre1
P2Post1
P3Pre1
P3Post1
P4Pre1
P4Post1
P5Pre1
P5Post1
P6Pre1
P6Post1
P7Pre1
P7Post1
P8Pre1
P8Post1
P9Pre1
Lag time (mins)


Lag time, Pre1-Post1
Lag time (mins)
400
350
300
250
200
150
100
50
0
-50
ConPre1
ConPost1
TreatPre1
Lag time (mins)


Relative Lag time, Pre1-Post1
Change in lag time relative to control (min)
120
100
80
60
40
20
0
-20
-40
-60
-80
TreatPre1
Change in lag time relative to control (min)


Lag time, Pre2-Post2
Lag time (mins)
700
600
500
400
300
200
100
0
P1Pre2
P1Post2
P2Pre2
P2Post2
P3Pre2
P3Post2
P4Pre2
P4Post2
P5Pre2
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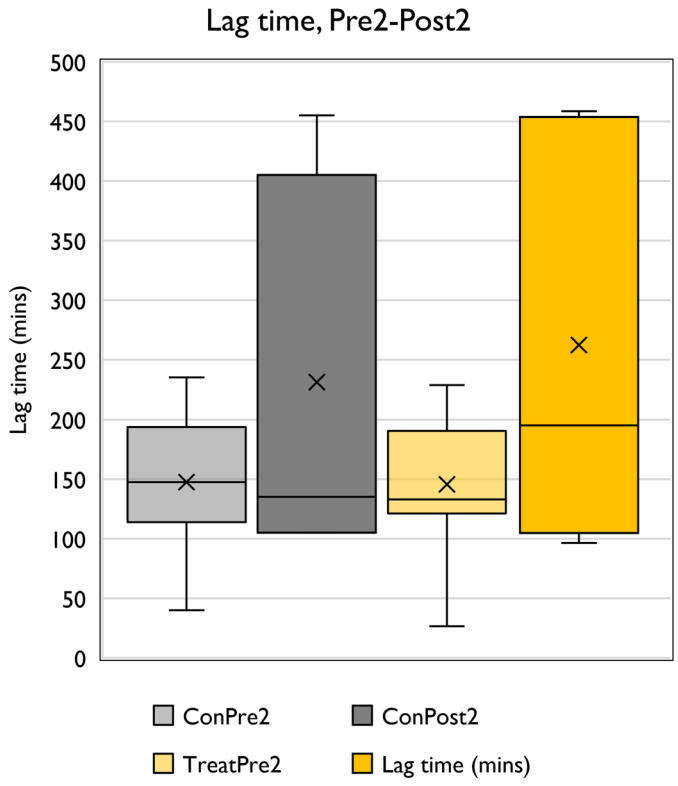
P6Post2
P7Pre2
P7Post2
P8Pre2
P8Post2
P9Pre2
Lag time (mins)


Lag time, Pre2-Post2
Lag time (mins)
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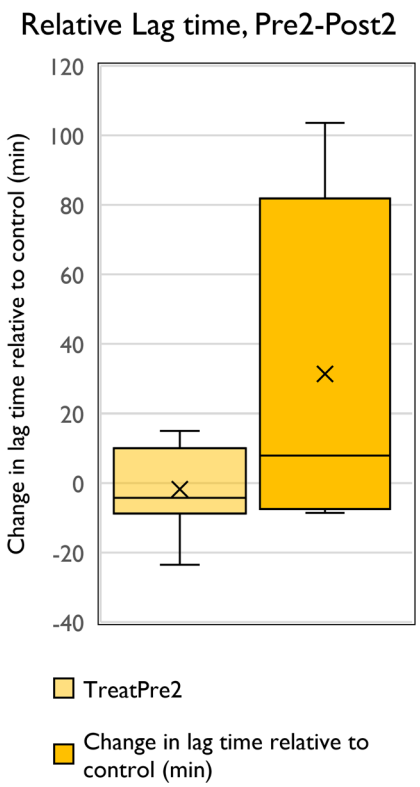
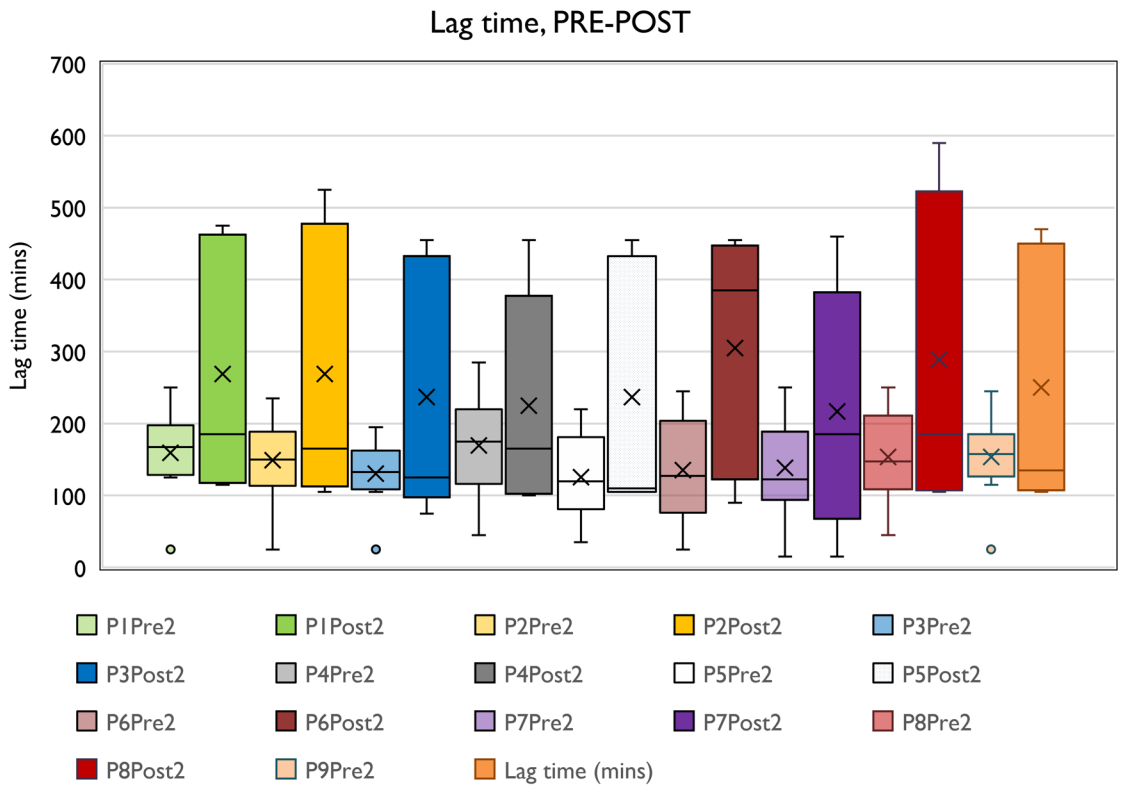
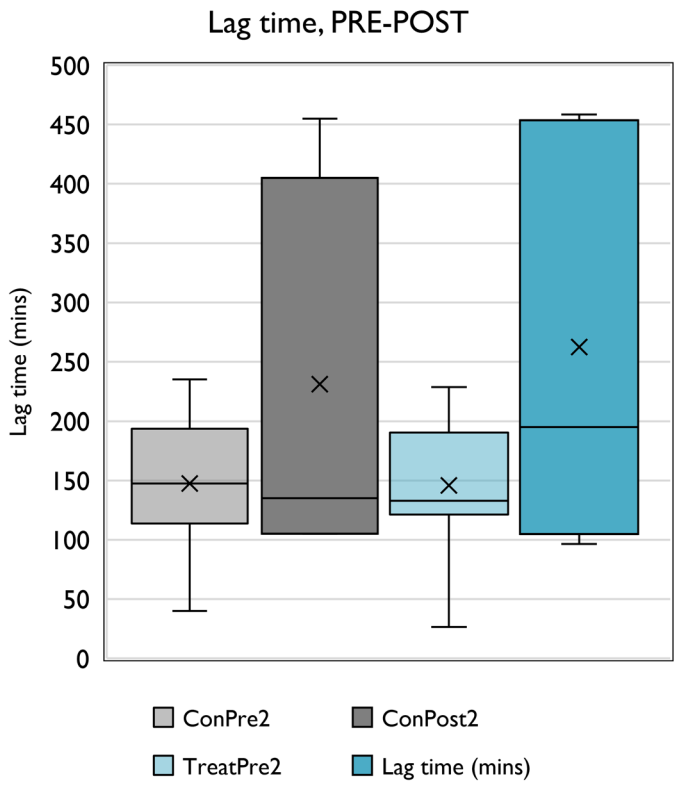
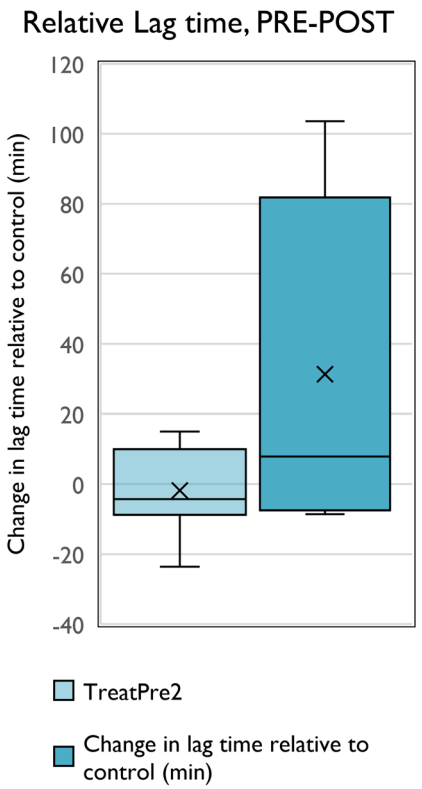
400
350
300
250
200
150
100
50
0
ConPre2
ConPost2
TreatPre2
Lag time (mins)


Relative Lag time, Pre2-Post2
Change in lag time relative to control (min)
120
100
80
60
40
20
0
-20
-40
TreatPre2
Change in lag time relative to control (min)


Lag time, PRE-POST
Lag time (mins)
700
600
500
400
300
200
100
0
P1Pre2
P1Post2
P2Pre2
P2Post2
P3Pre2
P3Post2
P4Pre2
P4Post2
P5Pre2
P5Post2
P6Pre2
P6Post2
P7Pre2
P7Post2
P8Pre2
P8Post2
P9Pre2
Lag time (mins)


Lag time, PRE-POST
Lag time (mins)
500
450
400
350
300
250
200
150
100
50
0
ConPre2
ConPost2
TreatPre2
Lag time (mins)


Relative Lag time, PRE-POST
Change in lag time relative to control (min)
120
100
80
60
40
20
0
-20
-40
TreatPre2
Change in lag time relative to control (min)

5. Peak stage

Table 7. Descriptive statistics of peak stage data in the different comparison periods

	Pre1	Post1	Pre2	Post2	PRE	POST
Treatment						
Mean	214.82	186.22	185.17	188.86	202.96	186.70
StDev	39.95	22.17	20.59	39.87	36.19	25.35
N	15	22	10	5	25	27
Minimum	165.45	151.50	153.36	140.90	153.36	140.90
1st Quartile	172.17	171.38	169.28	155.28	172.76	170.76
Median	206.01	176.87	188.15	190.84	196.99	177.41
3rd Quartile	248.17	212.25	202.22	221.45	229.13	211.18
Maximum	279.40	227.78	213.06	249.38	279.40	249.38
Control						
Mean	219.76	232.43	212.96	233.56	217.04	232.64
StDev	25.55	18.55	15.83	40.94	22.05	23.15
N	15	22	10	5	25	27
Minimum	181.32	209.23	188.05	175.65	181.32	175.65
1st Quartile	195.11	223.50	198.91	197.43	195.97	222.43
Median	215.55	225.45	213.99	240.58	215.55	225.77
3rd Quartile	240.88	236.68	227.11	266.18	233.60	240.58
Maximum	264.32	278.00	232.36	288.18	264.32	288.18
Relative						
Mean	-4.95	-46.22	-27.80	-44.70	-14.09	-45.94
StDev	15.70	20.33	6.19	7.70	16.99	18.53
N	15	22	10	5	25	27
Minimum	-29.50	-62.56	-38.75	-53.33	-38.75	-62.56
1st Quartile	-19.26	-57.56	-31.42	-51.44	-27.85	-57.49
Median	-8.11	-53.80	-27.85	-47.06	-19.30	-51.21
3rd Quartile	13.34	-46.40	-21.25	-36.78	1.50	-44.52
Maximum	15.08	13.11	-19.30	-34.75	15.08	13.11

Note: Periods are as follows: Pre1 = Sep 2020 – Feb 2021; Post1 = Sep 2021 – Feb 2022; Pre2 = Mar – Aug 2021; Post2 = Mar – Aug 2022; PRE = Sep 2020 – Aug 2021; POST = Sep 2021 – Aug 2022.

Table 8. Change in relative peak stage (mm) after blocking

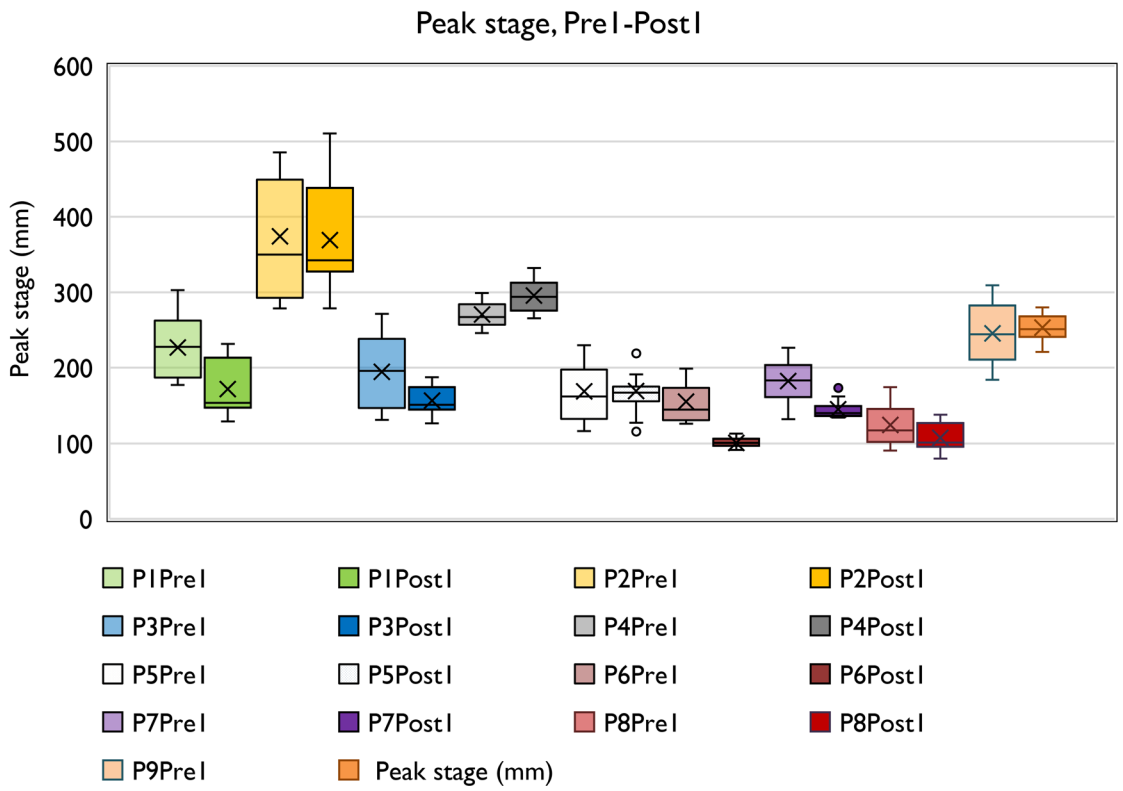
Period	Change overall	Change at individual pipes						
		P1	P2	P3	P6	P7	P8	P9
Pre1-Post1	-43****	-81****	-22	-63****	-62****	-53****	-32****	-5
Pre2-Post2	-15***	7	-19	6	-86***	-56**	-20**	37***
PRE-POST	-32****	-59****	-22	-34**	-67****	-53****	-31****	6

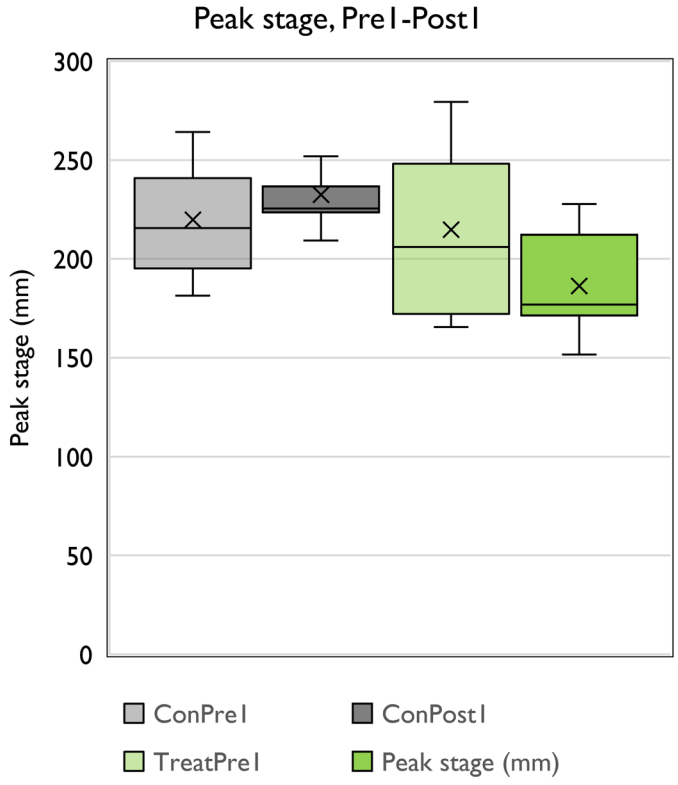
*Note Cell contents are the observed median change from a temporal sequence of relative peak stage (mm) measurements averaged over all control pipes subtracted from the equivalent set of measurements from treatment (blocked) pipes. Probabilities are denoted by asterisks: * (P < 0.1), ** (P< 0.05), *** (P < 0.01), **** (P < 0.001).*

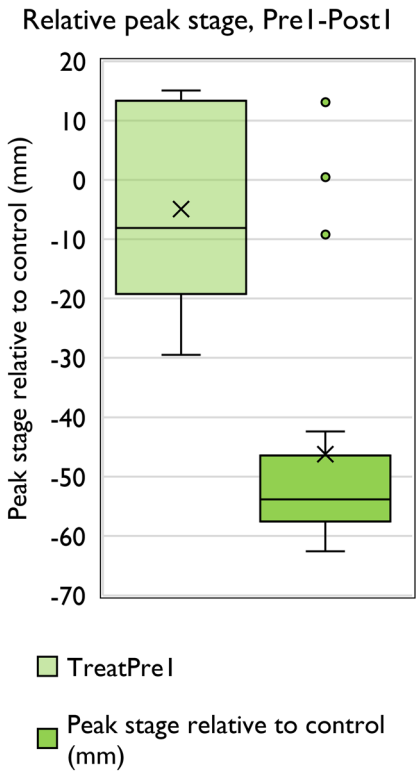
Table 9. Correlation statistics between pipe characteristics and changes in peak stage

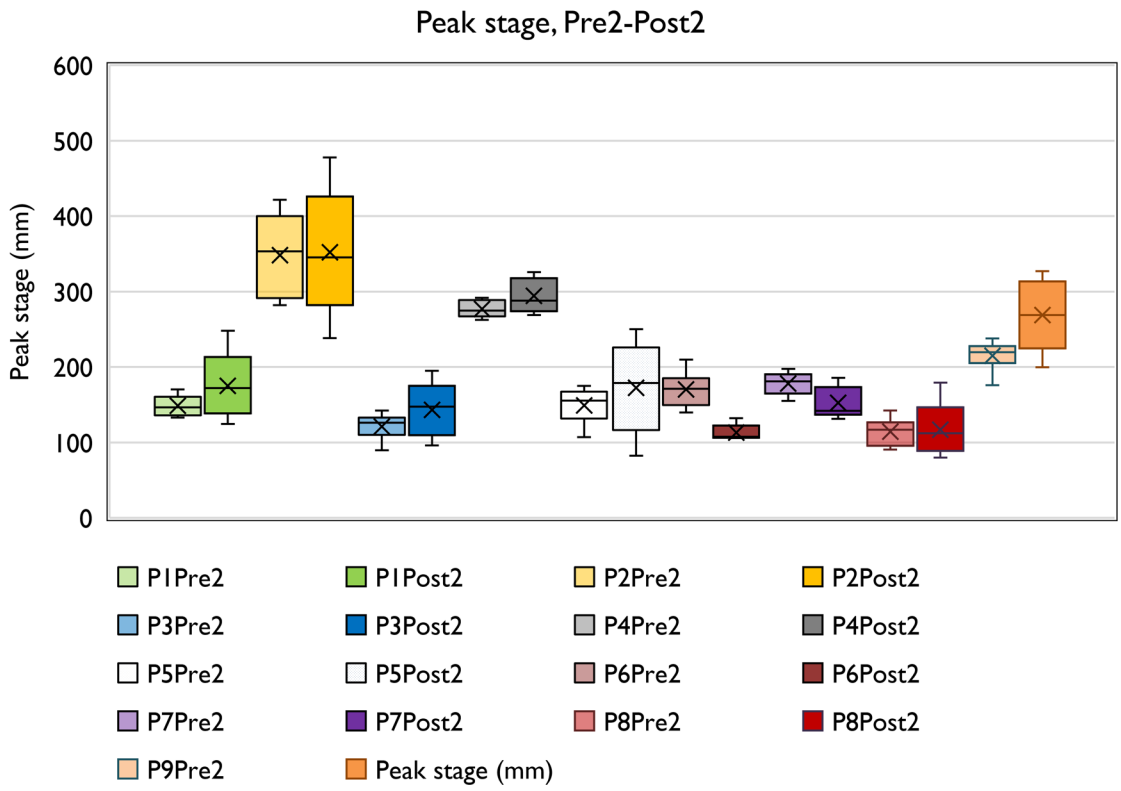
Pipe characteristic	**Pre1-Post1**		**Pre2-Post2**		**PRE-POST**	
	R^2	P-value	R^2	P-value	R^2	P-value
No. of blocks	0.04	0.65	0.10	0.49	0.00	0.94
No. of peat blocks	0.27	0.23	0.00	0.98	0.14	0.40
No. of stone blocks	-0.20	0.31	0.11	0.46	0.04	0.67
No. of bale blocks	0.00	0.97	0.02	0.79	0.00	0.93
Water storage	0.24	0.27	0.09	0.51	0.06	0.61
Diameter	0.08	0.59	0.04	0.69	0.02	0.77

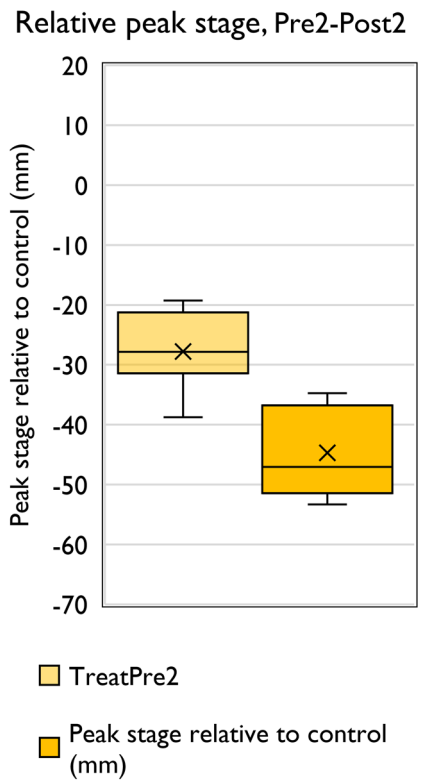
Note R^2 = Coefficient of regression for fitted line plot. P = probability that the factor has no correlation with median relative change in peak stage

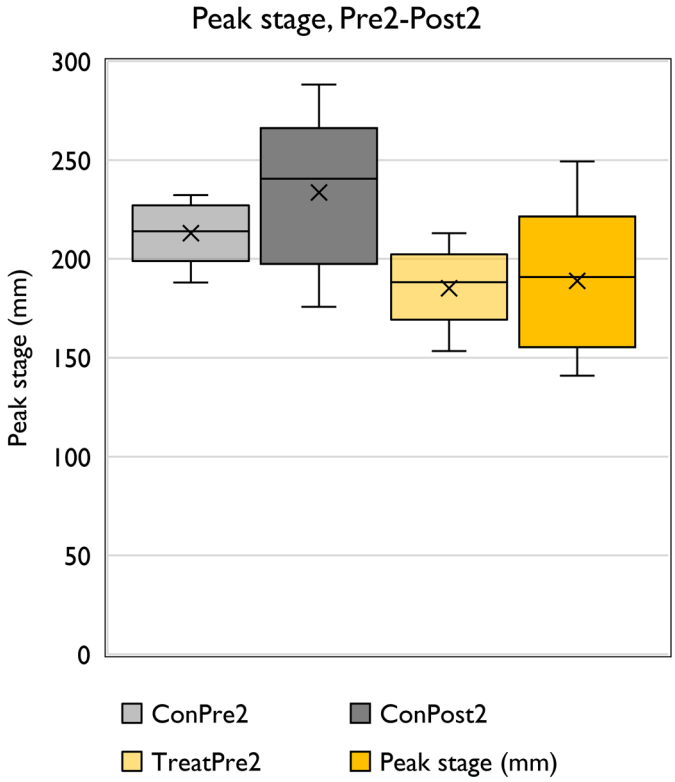

Peak stage, Pre1-Post1
Peak stage (mm)
600
500
400
300
200
100
0
P1Pre1
P1Post1
P2Pre1
P2Post1
P3Pre1
P3Post1
P4Pre1
P4Post1
P5Pre1
P5Post1
P6Pre1
P6Post1
P7Pre1
P7Post1
P8Pre1
P8Post1
P9Pre1
Peak stage (mm)

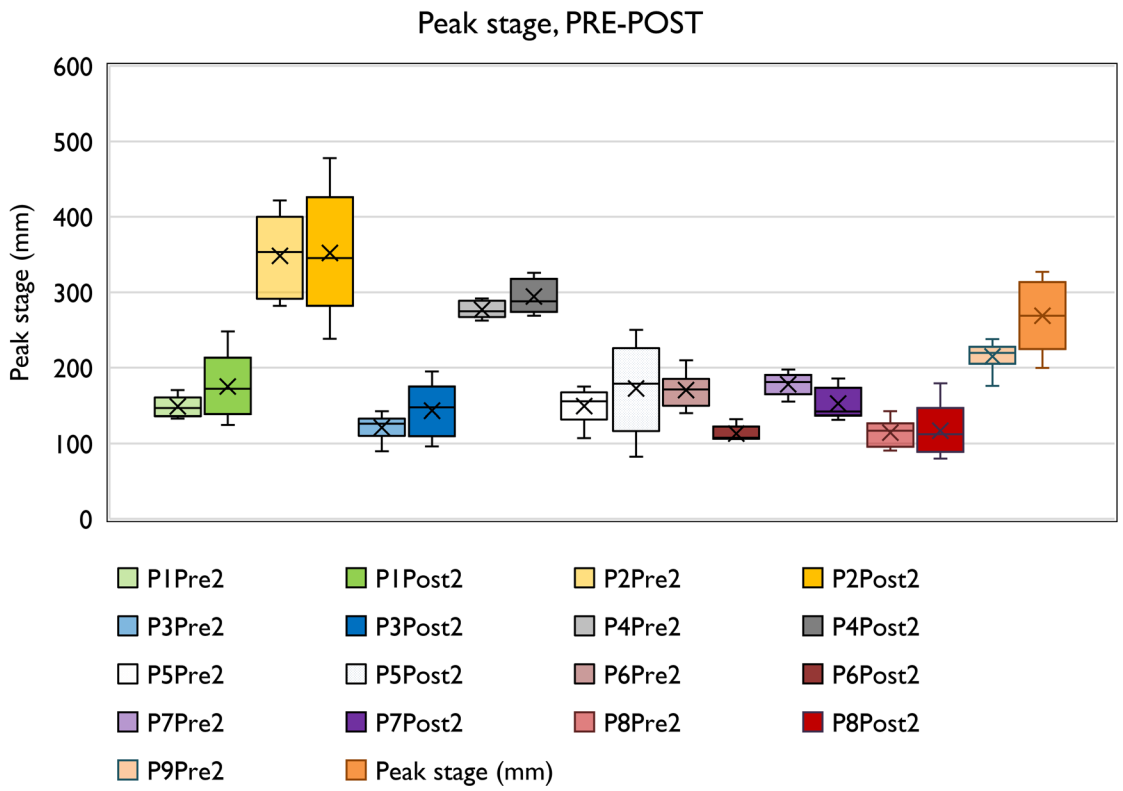

Peak stage, Pre1-Post1
Peak stage (mm)
300
250
200
150
100
50
0
ConPre1
ConPost1
TreatPre1
Peak stage (mm)

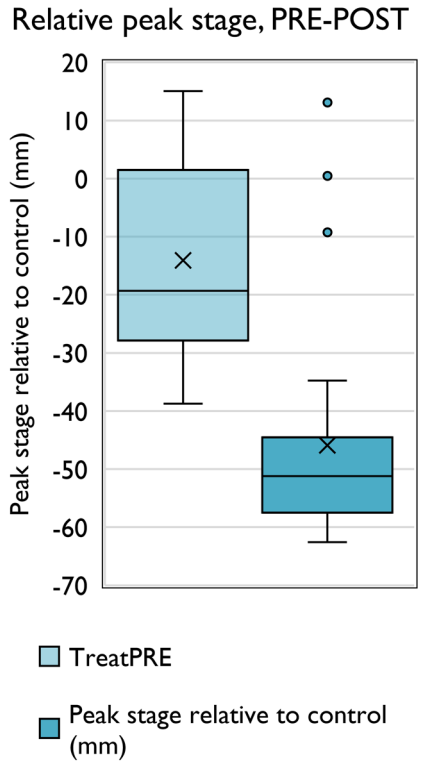

Relative peak stage, Pre1-Post1
Peak stage relative to control (mm)
20
10
0
-10
-20
-30
-40
-50
-60
-70
TreatPre1
Peak stage relative to control (mm)

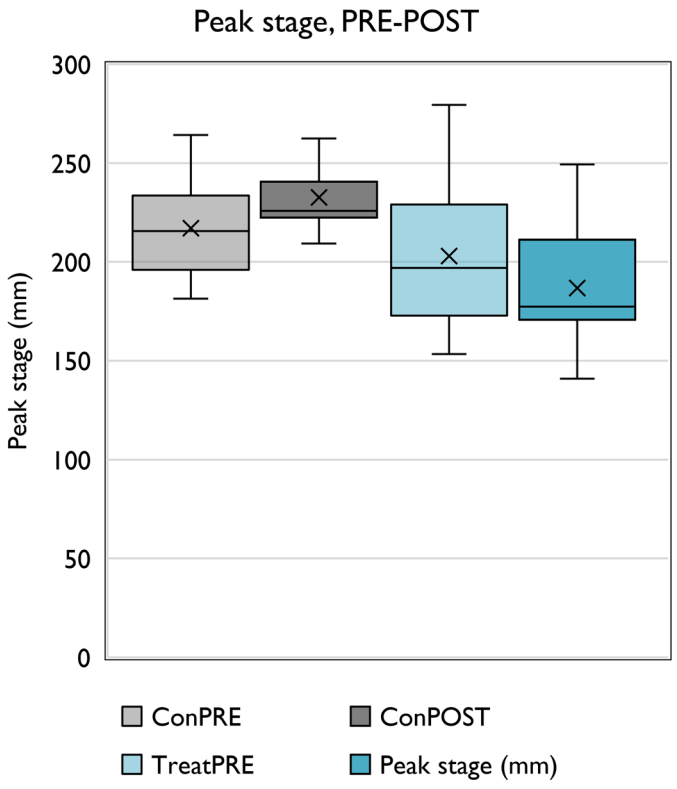

Peak stage, Pre2-Post2
Peak stage (mm)
600
500
400
300
200
100
0
P1Pre2
P1Post2
P2Pre2
P2Post2
P3Pre2
P3Post2
P4Pre2
P4Post2
P5Pre2
P5Post2
P6Pre2
P6Post2
P7Pre2
P7Post2
P8Pre2
P8Post2
P9Pre2
Peak stage (mm)


Relative peak stage, Pre2-Post2
Peak stage relative to control (mm)
20
10
0
-10
-20
-30
-40
-50
-60
-70
TreatPre2
Peak stage relative to control (mm)


Peak stage, Pre2-Post2
Peak stage (mm)
300
250
200
150
100
50
0
ConPre2
ConPost2
TreatPre2
Peak stage (mm)


Peak stage, PRE-POST
Peak stage (mm)
600
500
400
300
200
100
0
P1Pre2
P1Post2
P2Pre2
P2Post2
P3Pre2
P3Post2
P4Pre2
P4Post2
P5Pre2
P5Post2
P6Pre2
P6Post2
P7Pre2
P7Post2
P8Pre2
P8Post2
P9Pre2
Peak stage (mm)


Relative peak stage, PRE-POST
Peak stage relative to control (mm)
20
10
0
-10
-20
-30
-40
-50
-60
-70
TreatPRE
Peak stage relative to control (mm)


Peak stage, PRE-POST
Peak stage (mm)
300
250
200
150
100
50
0
ConPRE
ConPOST
TreatPRE
Peak stage (mm)

6. Dissolved Organic Carbon (DOC) concentrations (mg l^{-1})

Table 10. Descriptive statistics for DOC concentration in the different comparison periods

	Pre1	Post1	Pre2	Post2	PRE	POST
Treatment						
Mean	33.22	39.41	35.83	28.53	34.53	34.93
StDev	7.03	12.72	8.86	7.28	7.87	11.89
N	9	10	9	7	18	17
Minimum	22.69	16.35	25.44	21.14	22.69	16.35
1st Quartile	28.19	32.04	26.16	21.16	27.41	25.44
Median	30.39	36.24	37.10	29.93	35.20	33.38
3rd Quartile	38.77	50.06	42.73	32.50	40.02	44.69
Maximum	44.80	57.93	50.66	40.82	50.66	57.93
Control						
Mean	33.94	38.68	37.87	27.83	35.90	34.21
StDev	7.85	12.63	9.48	6.42	8.68	11.64
N	9	10	9	7	18	17
Minimum	21.19	15.12	27.30	21.60	21.19	15.12
1st Quartile	27.58	31.35	27.82	23.39	27.83	23.95
Median	34.23	37.21	36.93	24.20	34.60	35.60
3rd Quartile	42.54	50.57	46.12	36.36	43.53	42.20
Maximum	43.31	55.80	51.98	37.05	51.98	55.80
Relative						
Mean	-0.71	0.74	-2.04	0.70	-1.37	0.72
StDev	3.22	3.26	2.77	3.99	2.99	3.46
N	9	10	9	7	18	17
Minimum	-5.35	-3.00	-8.03	-4.55	-8.03	-4.55
1st Quartile	-3.93	-2.21	-3.49	-2.23	-3.73	-2.20
Median	-1.12	0.28	-1.32	-0.46	-1.22	-0.46
3rd Quartile	2.58	3.23	0.05	4.46	0.92	3.33
Maximum	2.85	7.12	0.72	7.09	2.85	7.12

Table 11. Change in relative DOC concentration (mg l^{-1}) after blocking

Period	Change overall	Change at individual pipes						
		P1	P2	P3	P6	P7	P8	P9
Pre1-Post1	1.39	-3.36	-3.93	-0.17	7.58***	-0.71	-0.61	0.37
Pre2-Post2	0.86	-2.04	-7.27	1.97*	1.15	3.06***	1.55	2.40**
PRE-POST	0.75	-3.75	-7.65	0.10	6.87***	1.65**	0.10	1.58**

*Note Cell contents are the observed median change from a temporal sequence of relative DOC concentration measurements averaged over all control pipes subtracted from the equivalent set of measurements from treatment (blocked) pipes. Probabilities are denoted by asterisks: * (P < 0.1), ** (P< 0.05), *** (P < 0.01), **** (P < 0.001).*

Table 12. Correlation statistics between pipe characteristics and change in DOC concentration

Pipe characteristic	**Pre1-Post1**		**Pre2-Post2**		**PRE-POST**	
	R^2	P-value	R^2	P-value	R^2	P-value
No. of blocks	-0.59	0.05	-0.52	0.07	-0.70	0.02
No. of peat blocks	0.19	0.33	0.05	0.63	0.13	0.42
No. of stone blocks	-0.32	0.19	-0.43	0.11	-0.47	0.09
No. of bale blocks	-0.17	0.36	0.00	0.94	-0.17	0.36
Water storage	0.52	0.07	0.08	0.53	0.34	0.17
Diameter	0.38	0.20	0.01	0.87	0.13	0.48

Note R^2 = Coefficient of regression for fitted line plot. P = probability that the factor has no correlation with change in median relative DOC concentration. Median lag time changes were used for the correlations

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