

PC21 Draft Determination
NI Water Response

Annex 5.5 – Wastewater Regulation Reform
Capital Interventions

Version v3
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1. Introduction

This document forms the basis for a request to the UR for NI Water to create a new PC21 development objective as follows:

“Wastewater Regulation Reform – Capital Interventions” – To address legacy compliance issues at 51 WwTW sites that are not receiving capital investment from SP16 in the PC21 plan. The capital interventions proposed will help mitigate immediate compliance concern under Wastewater Compliance Reform and may also mitigate anticipated extant growth issues and hence ensure that the underlying development constraints in these catchments do not worsen in the short term.

The requirement for this development objective comes from response to **paragraph 6.43** of the UR’s PC21 Draft Determination – Annex I September 2020. In this paragraph the UR states:

“...we are prepared to consider this further if the company can provide a well-founded plan which clearly demonstrates that the investment will secure compliance in the longer term.”

Our plan for Wastewater Regulation Reform – Capital Interventions has been further developed with and endorsed by NIEA. NIEA recognise that the extent of compliance issues under Wastewater Compliance Reform extend to many sites not receiving upgrade proposals in the PC21 Business Plan. Additionally, planning applications already approved (extant growth) must be permitted to connect to the existing WwTW. This factor applies at WwTWs and Networks and is an additional compliance risk where no capital investment has been targeted due to prioritisation and limitations of funding.

This paper further explains that approximately 60% of this expenditure can be classified as enhancement. NIEA have provided a Letter of Support for this additional capital investment and in respect of its prioritisation with regard to other environmental enhancement spend. The letter of support is included in Appendix B.

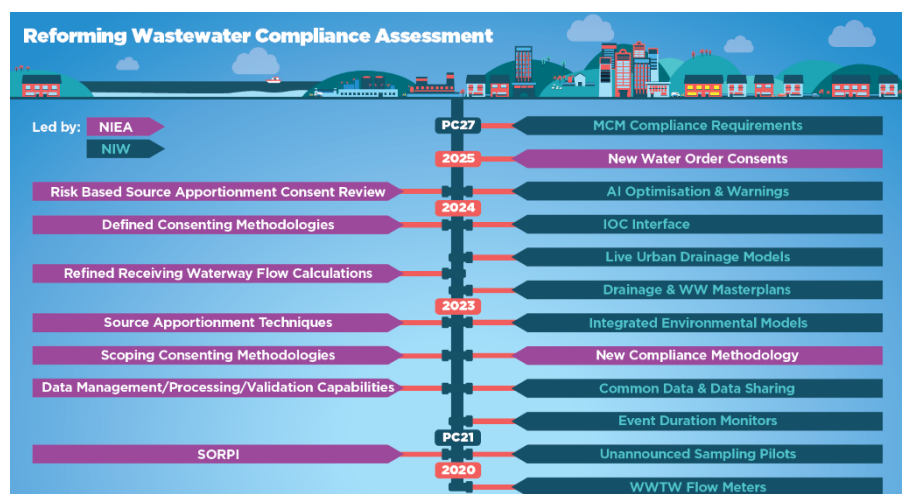
2. Wastewater Regulation Reform

2.1 Overview

NIEA have commenced a project to align the reporting of wastewater compliance at wastewater treatment works and in the sewer network with the rest of the UK. This new regime, referred to as Reforming Wastewater Compliance Assessment, will be developed during PC21 for implementation in PC27.

NIEA and NI Water are working in partnership to develop a programme of Wastewater Regulation Reform to align wastewater regulation to best practice with UK Water companies. Figure 1 is a draft illustration of the broad steps that will be investigated and introduced in PC21 in this transformation.

Figure 1 – Roadmap for Wastewater Regulation Reform



The approach will involve a series of sequential asset performance investigations to understand the scale of consequences of new regulation measures at wastewater assets. It is very likely that the new regulator targets and measures will be significantly more stringent than currently reported compliance levels.

Some of the measures that are currently being investigated include:

- Unannounced Sampling;
- WwTW Flow Compliance Meters; and
- Event Duration Monitors and Key Coastal CSOs

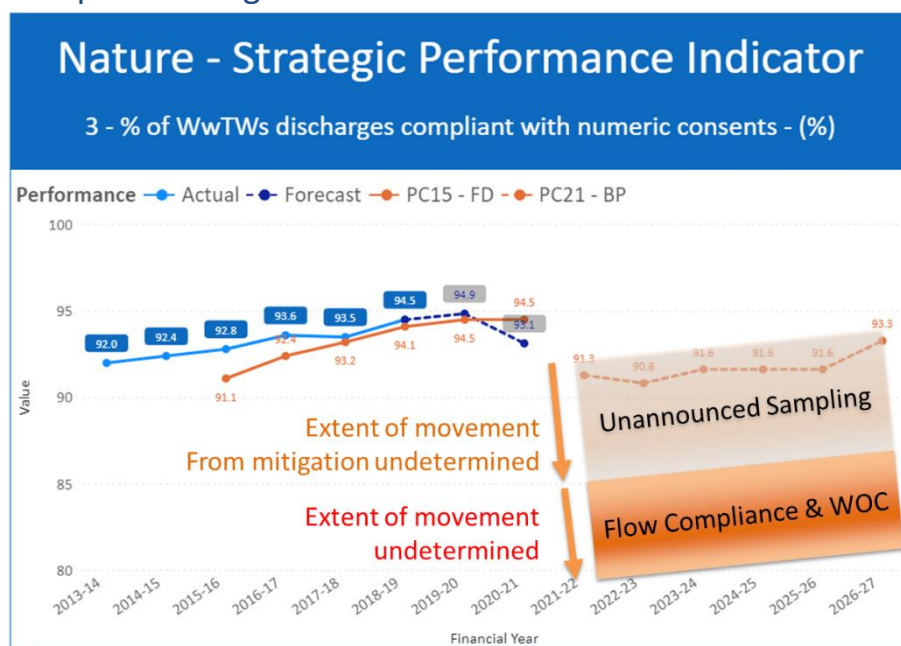
The capital interventions undertaken as part of this development objective will also enable insight that will allow us to considerably optimise future capital programmes in PC27 and beyond.

2.1 Water Regulation Reform Compliance Targets

It is unlikely that this programme will have a material impact on the current compliance targets for PC21. NIEA have confirmed that new targets associated with the above measures and others will not be in place formally until at least PC27.

Figure 2 illustrates how our performance with regard to new measures is likely to worsen without mitigation through opex and capex interventions.

Figure 2 – Impact on Performance Measurement through Wastewater Regulation Reform



The intervention projects and categories identified in the next sections will impact the movement of compliance with respect to these new targets under wastewater regulation reform. It will be very useful to undertake these projects in anticipation of very significant programmes of similar work for at least the next three price controls.

3. Capital Investment Intervention Categories

We have identified 11 capital investment intervention categories across 51 WwTWs that do not have significant planned works in PC21. High level costs have been derived from a desktop exercise to demonstrate the need for the proposed £33m included in the Business Plan. This development objective will involve working with NIEA to prioritise and refine this investment to mitigate compliance risk from Wastewater Regulation Reform.

Ref	Capex Interventions	No. of WwTW	High Level Cost £m
1	Replacement of MBR panels with high flow membranes	6	█
2	Sludge Management Improvements (only)	6	█

3	Sludge Management Improvements (plus other interventions)	5	
4	Tertiary Treatment	3	
5	Tertiary Treatment and Final Settlement Tank capacity	7	
6	Tertiary Treatment, Inlet Flow and Storm Management	1	
7	Flood Protection	4	
8	Tankered Trade Effluent (only)	4	
9	Tankered Trade Effluent (plus other interventions)	4	
10	Inlet Flow Control & Storm Management	2	
11	Innovative Pilot Projects/Tests	9	
Total		51	

Table 1: Capital Intervention Categories and High Level Costings

A full list of projects that have been identified is included in Appendix A.

MBR – High Flow Membranes

NI Water has 15 flat plate and 2 hollow fibre Membrane Bioreactor (MBR) process WwTWs. These were commissioned between 2003 and 2008. It has subsequently been evidenced that the operational costs, particularly energy and treatment capacity, are not as anticipated at the time of installation to the extent that a number of these sites are at risk of compliance failure. Typical improvements would include:

- MBR conversion to Moving Bed Biofilm Reactor (MBBR) pilot, followed by Reed bed polishing; and
- Replacement of flow membranes with high flow membranes.

Sludge Management Improvements

Some WwTWs have a higher risk of compliance failure due to restrictions with the rate at which they manage the solids or sludge within the process. If the mixed liquors and sludge cannot be removed from the process as required this has a detrimental effect on the biological process eventually leading to breaches in the numerical standards. The type of interventions to temporarily address these issues in the short term can typically be a combination of the following:

- SAS or RAS pump upgrades and pipework upgrades including SAS and RAS pumping station improvements;
- Automatic desludging within the process;
- Increased sludge holding tank capacity with decant facility; and
- Additions or improvement to sludge thickening ability.

Tertiary Treatment

NI Water uses tertiary treatment to further clean the effluent to meet tighter numerical consent standards at a WwTW or if a plant is struggling to be compliant a tertiary filter may be able to be retrofitted. There are a range of different forms on the market and they provide a way of filtering the effluent. They can be mechanical or biological filters. A typical installation comprises a disc filter with a cloth membrane. The final effluent passes into the centre of the filter and the disc continually rotates to ensure uniform filtration. A pressure head differential between the inside and outside of the disc allows the effluent to filter through the cloth. There is a need for a backwash system to keep the cloth from blinding and control sensors to identify that the system is operating as it should. The tertiary filters reduce BOD & SS and help to mitigate against spikes in these parameters also.

Flood Protection

Some additional WwTWs not included in SP16 of the PC21 business plan were identified as having flooding issues. Typical remedial work includes:

- Providing flood defense walls at part of the site;

- Including non-return valves on outfall pipework where possible;
- Raising susceptible equipment above the flood level or relocating to another part of the site; and
- Providing additional inlet balancing tank and associated equipment and inlet works modification or replacement.

Tankered Trade Effluent Improvements

Upgrading more WwTWs to have the ability to accept tankered trade effluent will help to utilize some of the headroom present and not currently being used at some WwTWs. This will take biological pressure of some WwTWs that are currently accepting tanker trade effluent as the volume can be shared with more WwTWs. A typical installation requires:

- Tanker unloading facility with required EMS protection;
- Bauer coupler and tanker logging station;
- Loading tank, pump forward facility and storage tank; and
- Forward feed control system including actuated valve and control system.

Inlet Flow Controls

A number of WwTWs have inlet works that do not correctly deal with the flows hydraulically. During storm conditions this results in flows greater than the WwTW can process being passed forward causing “washout” to the process affecting compliance and or spillage in areas around the site. Typical installations require:

- A new inlet works with the correct size screens, storm overflow weirs and controls;
- Inlet balancing tank with modulating penstocks may be included; and
- Inlet pumping stations may require to be modified or installed if not already present.

4. Innovation and Pilot Projects

NI Water are currently constructing the PC15 nominated output at Ballykelly WwTW. As part of this project a pilot test bed is being retained so that WwTW innovations can be piloted in natural wastewater flow, where the final effluent is returned to the main site process so as not to compromise compliance. This will provide a new facility for NI Water to test these products which has not been available before.

The following is a short summary of the known technologies NI Water wish to test in the near future:

- 1 **Bio Augmentation** is the practice of enhancing the performance of microbial populations, by adding bacterial strains with specific degradative abilities, and/or addition of missing nutrients. There are a large number of suppliers that provide these types of products for use at both WwTWs and within the networks. We propose to investigate a number of these to see if the capacity and or quality of our existing works can be increased.
- 2 **Green Sword** - This company provides a number of products including one that consists of selected naturally occurring microbe organisms that clean soil, water and other materials which have been contaminated by hydrocarbons eg oil spills. They also provide Bio augmentation products.
- 3 **Membrane Technology** has opened up a number of opportunities that we would like to explore, two of these are:
 - **Integrated Fixed-Film Activated Sludge system (IFAS)** combines conventional activated sludge and biofilm technologies in one reactor. This process involves adding an attached growth media to an activated sludge tank to facilitate biomass growth and strengthen the treatment process. This process can be retrofitted to existing assets.

- **The Bio-Settler** is a membrane aerated biofilm reactor (MABR) process that NI Water have worked on in collaboration with Queen's University and a local company for a number of years.
- 4 **Bio-Blok** is a structured filter media, the surface of which acts as a substrate for specialized bacteria. It can be used in trickling filters. It is claimed that the application of the BIO-BLOK® elements could increase efficiency by up to four times compared to traditional activated sludge treatment plants.
 - 5 **Aero-fac** is a high-process-rate, modular wastewater treatment system that is a completely biological aerated facultative treatment process that automatically adjusts to handle extreme variations in flows and loadings. It uses little energy, requires exceptionally simple operator skills, almost no maintenance, and yet claims to produce excellent effluent quality.
 - 6 **Telemetry** based optimization systems that help us control how we operate our WwTW more efficiently using all available data including effluent quality, process parameters, rainfall and influent composition. An example of a system we would like to explore is provided by Kando. It aims to identify problem discharges within our wastewater networks allowing us to potentially react before they impact on our WwTW.

5. Base/Enhancement Allocation

We estimate that 60% of the capital investment allocation for this wastewater reform development objective will be enhancement funding. It is felt that this programme is higher priority than projects to further alleviation of development constraints and compliance risk. This is mainly due to the insight we will gain with regard to successful interventions for new wastewater regulations reform targets for PC27 and beyond. Plus the understanding of these new regulations with regard to the direct impact on further development constraints in the future. The estimate for enhancement/base spend is further described in Appendix A.

6. Interplay with OPEX

There are many situations where compliance at WwTWs can be improved with additional opex such as tankering, chemicals and cleaning. NI Water has been working with NIEA, who have been overseeing the delivery of unannounced sampling pilots and agreeing the technological requirements for flow assessment.

NIEA have commenced a project to align the reporting of wastewater compliance at wastewater treatment works and in the sewer network with the rest of the UK. This new regime will be developed during PC21 for implementation in PC27. The opex included in the PC21 Business Plan and provisionally allowed in the Draft Determination targets opex interventions to improve the normal operation of wastewater treatment works and support the work of NIEA in developing the new regime. As a result of insight gained from the initial pilots of unannounced sampling, NI Water sought additional opex of circa £2m per annum, in the Business Plan, to target opex interventions to improve the normal operation of wastewater treatment works and support the work of NIEA in developing the new compliance regime.

All projects recommended from within this development objective will ensure that the optimum blend of Opex and Capex (both base and enhancement) interventions will be recommended.

7. Conclusion

NIEA plans to implement a Wastewater Regulation Reform model which will align the reporting of wastewater compliance at treatment works and the sewer network with the rest of the UK. This paper seeks

the reinstatement of the £33m sought in the PC21 Business Plan for the delivery of Capex interventions to mitigate against the impacts of wastewater regulation reform.

Although the £33m was portrayed in the Business Plan as base maintenance investment, it is now recognised that a mixture of Base and Enhancement investment, and a blend of Capex and Opex will be required. The intervention projects and categories identified are unlikely to move our current regulated targets however they will significantly impact the movement of compliance with respect to new wastewater regulatory targets under wastewater regulation reform. It will be very useful to undertake these projects in anticipation of very significant programmes of similar work for at least the next three price controls.

It is to be noted that the anticipated Water Order Consents Refresh, Flow Compliance and Network Compliance elements of the Wastewater Regulation Reform will not be fully addressed by this £33m.

8. Recommendation

It is recommended that the UR allow a development objective value £33m (60% Enhancement):

“Wastewater Regulation Reform – Capital Interventions” – To address legacy compliance issues at 51 WwTW sites that are not receiving capital investment through SP16 in the PC21 plan. The capital interventions proposed will help mitigate immediate compliance concern under wastewater compliance reform and may also mitigate anticipated extant growth issues and hence ensure that any underlying development constraints in these catchments do not worsen in the short term.

Appendix A – Preliminary Capital Interventions

Ref	Area	WwTW	CAR ID	AIR20 Design PE	AIR20 Actual PE	Potential Capex Intervention	Relieve High Profile	% Enhancement	Reduce Compliance Risk	Capital Cost Est. £k
1	South	Ardglass	S00268	7600	2895	Sludge storage and thickening		100	With TE control may maintain steady state	■
2	West	Blackwatertown	S02552	354	754	Tertiary Treatment		100	Reduce	■
3	North	Armoy	S01172	745	818	Upgrade inlet works	Yes	50	Reduce	■
4	West	Castlederg	S03042	4750	3902	Improved storm buffer tank. Tertiary treat. Sludge storage, sludge thickening plant.		70	Reduce	■
5	West	Claudy	S03054	3409	2722	Sludge management improvement and FST improvement, Auto desludge, defog system and descum, flow balancing between FSTs		70	Reduce	■
6	West	Coalisland	S02828	14511	10003	Upgrade screens. TTE reception facilities.		50	Reduce	■
7	West	Derrygonnelly	S03074	1202	907	Sludge management improvement		70	Reduce	■
8	West	Donnybrewer	S03080	7888	5246	Overall upgrade of controls. Move final discharge point (2 miles - FE PS) for relaxed standard		50	Reduce	■
9	West	Drumquin	S03098	438	893	Sludge management improvement - autodesludging. Tertiary treatment.		70	Reduce	■
10	West	Greencastle (Tyrone)	S03132	500	328	Sludge management improvement - autodesludging. Tertiary treatment.		70	Maintain Stable State	■
11	West	Irvinestown	S03137	3549	2679	Replacement of MBR panels with high flow membranes		0	Reduce wrt flow compliance	■

Ref	Area	WwTW	CAR ID	AIR20 Design PE	AIR20 Actual PE	Potential Capex Intervention	Relieve High Profile	% Enhance- ment	Reduce Compliance Risk	Capital Cost Est. £k
12	West	Kesh	S03140	3000	2679	Storm buffer tank and tertiary treatment. Sludge storage and sludge thickening. May need additional land		100	Reduce	■
13	West	Maghery	S02414	410	363	Protection from flooding - not included in SP16z project		100	Reduce	■
14	West	Newmills	S02852	846	722	Inlet flow control and storm management		70	Reduce	■
15	West	Omagh (Mountjoy)	S03999	47000	34060	Tertiary Treatment. Sludge management improvement (sludge holding and thickening facilities). TTE reception facilities (holding tank)		100	Maintain Stable State	■
16	West	Seskinore	S03217	120	297	Inlet flow management		60	Stabilise	■
17	West	Tamnaherin.	S03226	470	393	Tertiary treatment, inlet flow and storm management		80	Reduce	■
18	North	Bonnaboigh	S03031	400	272	Screen and inlet flow control		50	Reduce	■
19	East	Kircubbin	S04881	3000	1360	Replacement of MBR panels with high flow membranes		0	Reduce	■
20	East	Lower Ballinderry	S02410	1200	1097	Tertiary treatment and FST capacity		100	Maintain Stable State	■
21	West	Carrickmore	S03039	2500	1286	Auto desludging and sludge holding facilities		80	Reduce	■
22	East	Moneyreagh	S00337	2150	2386	Replacement of MBR panels with high flow membranes		0	Reduce	■
23	East	Portaferry	S05200	5287	3802	Upgrade tertiary filter from cloth to		60	Reduce	■

Ref	Area	WwTW	CAR ID	AIR20 Design PE	AIR20 Actual PE	Potential Capex Intervention	Relieve High Profile	% Enhancement	Reduce Compliance Risk	Capital Cost Est. £k
						panel based system				
24	East	Ravernet	S00319	638	609	Auto desludging and sludge holding facilities		80	Reduce	■
25	South	Darkley FLT	S02569	433	438	Tertiary Treatment and FST capacity increase		100	Reduce	■
26	North	Antrim (Milltown)	S01422	80624	66342	TTE reception facilities (improvement to reception)		90	Maintain Stable State	■
27	South	Derryhale	S02570	1297	1165	Inlet flow control and storm management		50	Reduce	■
28	North	Ballycarry	S00267	2048	1753	Tertiary Treatment and FST capacity		100	Reduce	■
29	North	Dervock	S01102	579	969	Tertiary Treatment and FST capacity increase	Yes	100	Reduce	■
30	North	Ballymena	S01456	2E+05	68092	TTE reception facilities - new at this site	Yes	100	Reduce compliance risk at other WwTWs	■
31	North	Ballymoney	S01109	40650	20998	TTE reception facilities - new		100	Reduce compliance risk at other WwTWs	■
32	South	Dromara	S00316	1800	1386	Sludge Management improvement		80	Reduce	■
33	North	Dernaflaw	S03072	224	394	Tertiary treatment and FST capacity		100	Reduce	■
34	North	Dungiven	S03101	5742	4744	Inlet flow control and flood protection		70	Reduce	■
35	North	Dunloy	S01108	1630	1424	Replacement of MBR panels with high flow membranes		0	Reduce	■
36	East	Edenderry	S00343	481	458	Flood protection		100	Reduce	■
37	North	Loughguile	S01115	1353	854	Replacement of MBR panels with high flow membranes		0	Reduce	■

Ref	Area	WwTW	CAR ID	AIR20 Design PE	AIR20 Actual PE	Potential Capex Intervention	Relieve High Profile	% Enhancement	Reduce Compliance Risk	Capital Cost Est. £k
38	West	Galbally	S02844	530	383	Tertiary Treatment		100	Reduce	■
39	North	Magilligan Point	S05593	8696	5674	Upgrade UV plant		80	Reduce	■
40	North	Moorfields	S01446	214	273	Power required, inlet flow control		50	Reduce	■
41	North	North Coast	S04150	1E+05	77105	TTE facilities (need holding capacity at Riversdale PS), FST capacity at North Coast (identified under TTE review)		100	Maintain Stable State	■
42	South	Aghalee MBR	S02394	2000	1111	Replacement of MBR panels with high flow membranes		0	Reduce	■
43	South	Banbridge CSBR	S02102	40000	20705	TTE Facilities - new facility needed		100	Maintain Stable State	■
44	South	Belleek FLT	S02253	605	472	Flow control and balancing to works		70	Reduce	■
45	North	Liscolman	S01191	400	265	Adjustment of process to deal with variation in flow and load (impact of school on catchment)		70	Reduce	■
46	South	Gilford FLT	S02162	3262	2447	Tertiary treatment and FST capacity		100	Reduce	■
47	South	Jonesborough FLT	S02272	1002	599	Tertiary treatment		100	Reduce	■
48	South	Killyleagh	S00273	20000	7225	Upgrade of sludge treatment. TTE reception facilities		70	Reduce	■
49	South	Maghera RBC	S00305	375	340	Flood protection		100	Reduce	■

Ref	Area	WwTW	CAR ID	AIR20 Design PE	AIR20 Actual PE	Potential Capex Intervention	Relieve High Profile	% Enhance- ment	Reduce Compliance Risk	Capital Cost Est. £k
50	South	Middletown RBC	S02592	800	557	Fix automatic desludging and SHT capacity		60	Reduce	■
51	South	Mountnorris FLT	S02248	905	893	Tertiary treatment and FST capacity		100	Reduce	■
TOTAL										■

Appendix B – Letter of Support from NIEA

