By email to: nwrp@water.ie

14 March 2022

KENNEDY ANALYSIS SUBMISSION

draft Regional Water Resources Plan - Eastern and Midlands Region

On 14 December 2021 Irish Water (IW) published the draft RWRP-EM for consultation. Kennedy Analysis has reviewed it and our comments are below. For definitions, see final page (Appendix 4).

KEY POINTS

Despite IW's messaging to the contrary, Ireland's problems are not due to a lack of *raw water*: they are due to its poor infrastructure and neglected water pipes

Ireland is an extremely wet country (it has 3 times as much renewable freshwater per head as France and Italy, 4 times as much as the UK and 7 times as much as Germany[1]). Every region has sufficient rainfall to meet its local water needs[2]. However, Ireland has very serious water problems:

(i) mains bursts cause **unexpected water outages** and an unreliable water supply;
(ii) **leakage** is among the highest in the world - only around 50-55% of the expensively treated water that is put into the supply system actually makes it to the taps[3]; and
(iii) the water pipes **cannot withstand cold snaps/dry spells**[4].

Ireland's water problems are due to:

(i) **ancient, decrepit water pipes** that have been neglected for decades; and
(ii) **under-invested water treatment plants** that cannot cope with the risks posed by river water[5] (note: Ireland gets more drinking water from rivers than any other EU country[6]) and that have insufficient spare treatment capacity to cover outages/routine maintenance.

Infrastructure problems have been the root cause of every major water outage/shortage in Dublin's recent history (from the harsh winter of 2010 to the drought of 2018)[7].

The policy of neglecting the pipes and pumping ever more water into the supply system is precisely how Ireland got into this situation – and IW is proposing to do the same again now

The useful life expectancy of water pipes is around 80-100 years. An appropriate proportion of the pipes should be replaced every year to ensure there is no "cliff-edge" moment (when all the pipes reach a point where they are no longer fit for purpose). Ireland has never done this. As a result,

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[1] https://www.indexmundi.com/facts/indicators/ER.H2O.INTR.PC/rankings

[2] Winter rainfall (September-March) is lower on the East coast than the West, but rainfall levels in summer (April-August, when it matters most) are very similar – see page 49: https://www.water.ie/docs/rwrp-easternmidlands/Draft-RWRP__EM-Section-2-Eastern-and-Midlands-Region.pdf

[3] Ireland's leakage is 42% excluding household leakage – once household leakage is included leakage is around 50%. A 2016 OECD study of 43 cities around the world (excluding Dublin) showed only 4 cities with leakage levels above 40% - all of them in Mexico (OECD (2016), *Water Governance in Cities*, OECD Studies on Water, OECD Publishing, Paris.)

[4] The extra pressure on the pipes (due to the ground freezing/drying out) results in thousands of new cracks and a sudden spike in leakage which Irish Water calls a spike in "demand".

[5] As was the case at the Leixlip plant, resulting in the major incident in winter 2019/2020 affecting 600,000 people.

[6] https://ehp.niehs.nih.gov/doi/pdf/10.1289/EHP4495 see Table 1: Ireland gets 82% of its water from surface water sources which is more than any other country in the EU – the EU average is 37%. Note, Dublin is particularly exposed, getting 98% of its water from rivers.

[7] The press releases issued during past water outages used to spell this out explicitly stating: "*it should be stressed that there is no problem with…storage levels of untreated/raw water*" - but Irish Water's press releases no longer acknowledge this and instead its narrative implies the *opposite*. Perhaps it realised that the former narrative undermined its case for bringing *yet more raw water* to Dublin via the Shannon pipeline while continuing to neglect the pipes.

many of its pipes are on their knees and significant pipe failures are becoming frequent. Some of Ireland's pipes are over 160 years old, yet IW replaces the pipes at a rate of just 0.3% per year[8]. At that rate, it will be another 333 years before some of Ireland's pipes are even touched.

Replacing water pipes is inconvenient and disruptive, especially in a city like Dublin: but it is a necessary evil. Dublin has a hotchpotch of pipes and they are now in very poor condition. It has Victorian-era cast iron pipes, asbestos cement pipes, low quality PVC pipes – we have even heard of the odd stretch of wooden pipes. For years, Dublin has been able to avoid addressing its increasingly decrepit and leaky pipes precisely because it has always had so much raw water available: it has simply pumped ever-increasing volumes of water into the supply system to offset the ever-increasing volumes of water being leaked into the ground. However, this short-sighted strategy had a shelf life: eventually the pipes become so unreliable that mains bursts (and water outages) become regular occurrences, no matter how much water is pumped into the system. This hampers industry and reduces the quality of life for Dublin's residents. Additionally, the wastefulness of allowing huge volumes of expensively treated water to leak into the ground has become offensive to a public that increasingly views water as a precious resource to be safeguarded.

The Shannon pipeline would not fix Dublin's problems. The only thing that can fix Dublin's problems is replacing the pipes in line with international best practice which, for Dublin, means at a rate of at least 1.2% per year just to stand still[9] (a rate higher than 1.2% would be needed to actually improve the status quo). However, Irish Water has publicly confirmed that it has no plan to do this.

A major mains replacement programme – the only thing that can sustainably fix Ireland's problems - was not even considered as a potential solution during this project

This project – tasked with sustainably addressing the water problems of the region for the long-term – *did not even consider* a major mains replacement programme as a potential solution. We flagged this in our last consultation. IW does not deny it, but stated: "*a major water mains replacement programme is not included in our unconstrained options list as it is already included as a core element of our National Leakage Reduction Programme".* This is impossible to accept. The mains replacement programme within the National Leakage Reduction Programme replaces the mains at a rate of 0.3% per year [10] - and Irish Water confirmed publicly last year that it has no plan to significantly increase this. This equates to a total replacement rate of just once every 333 years - well below the levels in the UK and Europe, where pipes are already in much better condition than those

[8] https://www.cru.ie/wp-content/uploads/2019/07/CRU19148-Irish-Water-Revenue-Control-3-Decision-Paper.pdf This is the CRU decision concluding the RC3 process. Page 7/8 shows that the 2020-2024 target for "new mains" is 424km and for "rehabilitated/lined mains" is 461km (totalling 885km out of Ireland's 65,000km of mains), i.e. 1.4% over 5 years, or 0.27% per year.

[9] A recent major project, commissioned by the UKWIR on behalf of the UK water industry and led by Servelec Technologies, undertook what was described as "*pioneering asset management research*" through a project called "*Long-term Investment in Infrastructure*". The project assessed whether current UK replacement rates are sufficient to offset the natural deterioration of the pipe system over the next 50 years. The project was high profile, generating significant industry press. Its key finding was that even though the UK pipes are currently considered to be in a "reasonable" state, the current mains replacement rate in the UK is low (at 0.6% per annum) and insufficient: unless it is increased, the pipes will begin to fail more often. It needs to be doubled to 1.2% per annum in the short term (2020-2030) and to 1.3% in the long term (from 2030-2070). It is clear, therefore, that the mains replacement rate in Ireland (where pipes are in far worse condition) needs to be well over 1.3% per annum just to offset the natural deterioration of the pipes (and Ireland can't afford to just achieve that - it needs to *improve* the state of the pipes, not just maintain the status quo). Download the presentation of the UKWIR findings here: https://ukwir.org/workshop?object=172263&daf=1

[10] See footnote 8 above.

in Ireland[11]. It is not even high enough to offset the natural rate of deterioration of the pipes. Despite Irish Water having a *multi-billion* Euro budget, it recently cut its proposed spend on mains replacement to just EUR34million per year[12].

Irish Water's failure to consider a major mains replacement programme as a solution for the water problems in the region is a glaring and wholly unacceptable error, given the state of Ireland's pipes.

This project has a long history of getting its projections for Dublin's water demand wrong

Every single set of projections that has been published for Dublin in relation to this project (in 2006, 2010, 2015 and 2016) can now be observed to have significantly over-estimated water *consumption* while citing leakage reduction plans that were not fulfilled[13].

The first set of projections for this project was published in 2006 - it projected huge increases in water consumption in Dublin. Its projections can now be observed to have been wildly over-stated. In fact, since 2005, Dublin's water *consumption* (i.e. water actually used at the tap by industry and households) has remained very much the same – the only element of "demand" that has gone *up* significantly is network leakage[14]. Similar can be said of the projections produced in each of 2010, 2015 and 2016[15]. For example, the 2010 report projected that, over the subsequent 9 years, **domestic demand** would go **up** over 9%; in fact, it went **down** 19%. It projected that **non-domestic demand** would go up 34%; in fact, it went up just 9% (and, on the basis of like-for-like data[16], it may actually have gone *down*). It projected that **leakage** would be cut: in fact, it went **up** 34%.

The projections in earlier reports turned out to be wrong because they used *incorrect data* and *inappropriate methodology*. This is also true of the projections currently being consulted upon - details of multiple errors and use of inappropriate methodology are set out in this submission.

The latest projections of Dublin's water demand contain glaring errors and will, without doubt, be proven wrong within a few years

IW's failure to account for two major upcoming water projects for Dublin, its use of 22-hour output *as well as* outage in the SDB projections, its application of "peaking" to "headroom", its sudden boosting of "safety buffers" to a level well above international best practice and a multitude of other errors (as set out below) result in a projected water deficit for Dublin that will soon prove to be significantly over-stated. Its inadequate consideration of groundwater and its failure to consider desalination purely as an *emergency back-up* (as in London) are yet more glaring errors. In a few years' time, IW's latest projections will also be shown to have been significantly over-stated - and they will have formed the basis of the hugely expensive and inappropriate Shannon pipeline project. By then, it will be too late.

Irish Water's messaging on its "21%" leakage reduction plan is misleading and disingenuous

IW knows that a huge proportion of the public considers it wrong and wasteful to pipe ever more expensively treated water into a supply system whose pipes are among the leakiest on the planet.

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[11] Mains replacement rates in the UK and on continental Europe are currently around 0.6% - see the recent UKWR project cited above – but that report notes that even the UK (where pipes are in "reasonable" condition) needs to increase to 1.3% in the long term purely to offset the natural deterioration of the pipes.

[12] See page 56: mains rehabilitation budget (2020-2024) now just EUR171m (=EUR34/ year) https://www.cru.ie/wp-content/uploads/2019/07/CRU19148c-Irish-Water-Capital-Investment-Plan-2020-2024-October-2019.pdf

[13] See Part 4.

[14] See Part 4.1.

[15] See Part 4.2.

[16] Which, despite repeated requests, Irish Water has not published.

When IW launched this consultation, one of its most high-profile claims was that the plan involved a reduction in leakage across the entire region to 21%. This sounds compelling: but one has to read well into the depths of this document to discover that IW's supply/demand balance tables do NOT reflect leakage reduction to 21% across the region. The SDBs actually assume that, for the *vast majority* of areas, leakage will remain at, or almost at, its current level (which clearly is *well* above 21%). We have raised this point with IW already: IW does not deny it is true, but tries to suggest the issue is addressed in another way (which is illogical and invalid – see below). IW implies that this is not a serious issue. This *is* a serious issue, and IW has badly misled the public on this.

Irish Water consistently makes inaccurate/misleading statements to the public, media and politicians in connection with the Shannon-to-Dublin pipeline project: its inability to be open and candid about this project should be a concern to all

Indeed, after Kennedy Analysis appeared in front of the relevant Joint Committee in 2018 alongside IW to discuss the Shannon pipeline project, we had no choice but to follow up by sending a dossier of evidence to the Joint Committee showing that the then-MD of IW had made a plethora of statements to the Joint Committee that day that were untrue. He had made those statements in an authoritative, compelling manner – yet the statements were wholly inaccurate. This is unforgiveable. The role of that Joint Committee is to hold IW to account in relation to projects like this: how can it possibly do so when key statements made to it, by the MD, are untrue? The Joint Committee has committed to investigate this serious issue.

IW's "consultation" on this project is a whitewash

IW claims that this project has been the subject of open and transparent consultation. IW claims: "*There is no question we will not answer on this scheme. There is no detail we will not stand over*". This is categorically false. Hundreds of concerns raised in previous submissions have been either (a) ignored or (b) responded to in a way that does not actually address the issue raised. Specific examples in relation to IW's last "consultation" (December 2020 – March 2021) are provided in Appendix 1 (our last submission is available at www.KennedyAnalysis.com).

The Shannon pipeline would be one of the biggest infrastructure projects in Ireland's history – yet it is being justified on the basis of incorrect analysis and is being promoted on the basis of deeply misleading messaging. If built, it will go down in history as an inappropriate and financially wasteful White Elephant that did not address Ireland's key problem: the state of its pipes. Ireland desperately need major mains replacement – indeed this is the only thing that can fix its very serious water supply issues - but a major mains replacement programme was *not even considered* as a solution for the region's water problems.

Over the past six years, Kennedy Analysis has repeatedly flagged errors in IW's calculations/ data/ methodology - and has repeatedly been proven correct. Every set of projections previously published by IW/its predecessor in relation to this project has already been proven wrong. IW's claims of transparency/accountability are untrue.

Every organisation and individual involved in approving the Shannon pipeline project should be concerned about this.

Summary of contents

Part	
1	Mains replacement: IW did not consider a major mains replacement programme as a solution for the water problems in the region. We flagged this in the last consultation: IW accepts it is true but tries to defend its stance in a way that is weak and illogical.
2	IW's public messaging on its leakage reduction plans is misleading and disingenuous. IW's public messaging on Dublin's water demand is also misleading and disingenuous.
3	Once again, the supply/demand balance (SDB) for the GDA contains basic mathematical errors the correction of which significantly change key findings.
4	Lessons should be learned from history: every single set of projections previously published for this project (in 2006/2010/2015/2016) can now be observed to have significantly over-estimated Dublin's future water consumption. IW's latest projections contain many errors that will, yet again, result in an over-estimation of Dublin's future water consumption.
5	The Shannon pipeline project can no longer be justified for the GDA alone - the project is now being justified by the inclusion of other regions (e.g. Mullingar). The cost analysis for those regions must reflect that.
6	Despite its claims to the contrary, IW has still not given appropriate consideration to groundwater (i.e. wells) as a solution for Dublin, which currently gets 98% of its water from rivers. In the last round of consultation, the Geological Survey Ireland (Ireland's main authority on groundwater) raised concerns, stating that IW depicts groundwater as a constrained, vulnerable and difficult to understand resource but that this is *not* the case, that groundwater represents an important, naturally good quality source of water in Ireland and that groundwater is far more reliable than surface water.
7	IW has significantly increased the "safety buffers" (headroom, peaking etc) that it says must be available to the GDA. They now amount to 55% (vs 35% in IW's 2016 report, when measured on a like-for-like basis) – this is well above international best practice. Note: IW has done this in a very opaque way that defies transparency and means that scrutiny of this major change is likely to be minimal.
8	Desalination is cheap to build but expensive to operate so London has an emergency back-up desalination plant (that cost just £250million) that it will rarely (if ever) use. IW did not consider this as an option for the GDA – it only considered desalination as a 100% operating option. This is particularly inappropriate since Dublin's projected "deficit" consists entirely of "safety buffers" that would rarely, if ever, be called upon.
9	Two major upcoming projects will significantly increase the water available to Dublin – but IW does not factor any of that extra water into its projections of Dublin's future "deficit". IW misleadingly calls them "interim solutions" (despite the fact they will be permanent). This highly significant fact is tucked well away in the depths of IW's document (at table 7.20 on page 137 and page 85 of Appendix 9).

10	In the projections for Dublin a newly introduced concept of "22-hour output" is inappropriately being used *alongside* "outage" – this is double counting, is against international best practice and has a *major* impact on the bottom line.
11	IW's economic projections assume Dublin will be "*amongst the fastest growing developed cities in the world*" and that Covid will have *zero* impact (e.g. no impact on Dublin at all from increased remote-working). We fully support optimism for Dublin's economic growth – but where IW is *already aware* of Covid implications these *must be* accounted for.
13	Irish Water claims that it is acting openly and transparently on this project: this is not true. Supporting reports and cost analysis has not been published for public scrutiny. This is a serious concern, particularly since previous supporting reports that *were* published have been shown (through the public consultation process) to contain major errors.
14	This project will go down in history as an inappropriate and financially wasteful White Elephant, like the "Kielder Project" in the UK.

Note: Irish Water is not inviting general comments on its consultation document: instead, it is inviting comments on 10 proscribed, narrow questions. The points raised in this submission all fall within the general remit of those 10 questions. Naturally, if the remit were wider, we would have raised further points.

(1) MAINS REPLACEMENT

(1.1) Irish Water did not even consider a "major mains replacement programme" as an option

Dublin has a hotchpotch of pipes and they are in a very poor state of disrepair. It has Victorian-era cast iron pipes, asbestos cement pipes, low quality PVC pipes - we have even heard of sections of wooden pipes being unearthed in Dublin. This results in high levels of leakage and bursts where pipes of different materials/ages/condition are joined. This is especially so during cold snaps and dry spells (when the ground hardens and shifts, putting extra pressure on the joints).

The useful life expectancy of water pipes is generally around 80-100 years. A proportion of pipes should be replaced every year to ensure that the whole system is replaced once every 100 years or so and there is no "cliff-edge" moment (when all of the pipes reach a point where they are not fit for purpose). Ireland has never done this and it has pipes that are over 160 years old. Many of its pipes are now on their knees and significant pipe failures will become more frequent[17].

A big problem with mixed pipe systems (like that in Dublin) is that "background leakage" (i.e. water that is lost through hundreds of thousands of tiny leaks) is very high. This type of leakage can only be addressed through mains replacement: find-and-fix only addresses large leaks. It also means that the "natural rate of rise" of leakage is high, so Irish Water has to do an awful lot of work patching up the pipes through find-and-fix just to stand still.

It is unacceptable, therefore, that a major mains replacement programme was not even considered as an option to address the water supply issues for the Dublin and the Eastern/Midlands region for the coming 25 years. We flagged this in our last submission.

(1.2) Irish Water implies that 0.3% per year equates to a "major mains replacement programme"

IW stated, in its response to submissions on its last consultation, that: "*a major water mains replacement programme is not included in our unconstrained options list as it is already included as a core element of our National Leakage Reduction Programme".* This is unsupportable. The mains replacement programme within the "National Leakage Reduction Programme" replaces the mains at a rate of 0.3% per year [18] - this equates to a total replacement rate of just once every 333 years. This is *not* a "major mains replacement programme' and to suggest otherwise is nonsensical. 0.3% per year is well below international best practice; it is well below the levels in the UK and Europe, where pipes are already in much better condition than those in Ireland[19]; it is well below the rate of mains replacement needed simply to offset the natural rate of deterioration of the pipes (which is over 1.2% for Ireland)[20].

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[17] See the recent "*Long-term Investment in Infrastructure*" project, commissioned by the UKWIR on behalf of the UK water industry and led by Servelec Technologies - download the results presentation here: https://ukwir.org/workshop?object=172263&daf=1

[18] https://www.cru.ie/wp-content/uploads/2019/07/CRU19148-Irish-Water-Revenue-Control-3-Decision-Paper.pdf This is the CRU decision concluding the RC3 process. Page 7/8 shows that the 2020-2024 target for "new mains" is 424km and for "rehabilitated/lined mains" is 461km (totalling 885km out of Ireland's 65,000km of mains), i.e. 1.4% over 5 years, or 0.27% per year.

[19] Mains replacement rates in the UK and on continental Europe are currently around 0.6% - see the recent UKWR project cited below – but need to increase to 1.2% in the short term/1.3% in the long term purely to offset the natural deterioration of the pipes.

[20] A recent major project, commissioned by the UKWIR on behalf of the UK water industry and led by Servelec Technologies, undertook what was described as "*pioneering asset management research*" through a project called "*Long-*

IW confirmed publicly, last year, that it has no plan to increase that 0.3% rate in the short- to medium- term. What is more, IW recently cut its spend on mains replacement to just EUR 34 million a year for the 2020-24 period[21] - this is a tiny fraction of the cost of the Shannon pipeline project.

(1.3) IrishWater's statements regarding mains replacement are misleading

IW, in its response to our last submission, repeatedly dismissed mains replacement on the basis that mains replacement "*standalone*" cannot address the issues; it repeatedly stated that pressure management and ALC (active leakage control, also known as "find-and-fix") are key elements of leakage reduction. *This was a red herring*: nobody with any knowledge of water supply systems would suggest otherwise. Clearly, mains replacement would never be undertaken "standalone": it would *always* be combined with pressure management and ALC. However, it is internationally recognised that ALC is generally only capable of offsetting the "natural rate of rise" of leakage and effecting small reductions beyond that (and Irish Water's record supports this)[22]. This is *not* enough for Ireland, where a step-change in leakage is needed. For significant further detail on the case for mains replacement, including its successful use elsewhere and the growing body of industrial/ academic support for its use as a sustainable long-term option, see section 2.4 (below) and Appendix 2.

Given the state of the water pipes in Ireland, a major mains replacement programme (combined with pressure management/ALC) is the most obvious solution to address the water supply problems in the region (including reliability of the supply and water quality, as well as the projected deficit). For Irish Water not to have even *contemplated* major mains replacement as an option is unfathomable.

(2) LEAKAGE

(2.1) Irish Water told the public that its plan includes cutting leakage to 21%: this was highly misleading

IW is well aware that leakage is the public's main concerns in relation to this project. When this consultation was launched (14 December 2021) IW stated that the plan involved reducing leakage across the region to 21%. At its public webinar the "*leakage*" slide was titled: "*Lose Less – By 2033 Leakage Reduced to 21% in all of the key WRZs across the entire Region*" and it showed a picture of the region with the figure "21%" splashed repeatedly and prominently across the entire region[23]. This was far from candid: it was extremely misleading.

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term Investment in Infrastructure". The project assessed whether current UK replacement rates are sufficient to offset the natural deterioration of the pipe system over the next 50 years. The project was high profile, generating significant industry press. Its key finding was that even though the UK pipes are currently considered to be in a "reasonable" state, the current mains replacement rate in the UK is low (at 0.6% per annum) and insufficient. Unless it is increased, the pipes will begin to fail more often. It needs to be doubled to 1.2% per annum in the short term (2020-2030) and to 1.3% in the long term (from 2030-2070). It is clear, therefore, that the mains replacement rate in Ireland needs to be well over 1.3% per annum just to offset the natural deterioration of the pipes (and Ireland can't afford to just achieve that - it needs to *improve* the state of the pipes, not just maintain their current state). Download the presentation of the UKWIR findings here: https://ukwir.org/workshop?object=172263&daf=1

[21] See page 56: mains rehabilitation budget (2020-2024) now just EUR171m (=EUR34/ year) https://www.cru.ie/wp-content/uploads/2019/07/CRU19148c-Irish-Water-Capital-Investment-Plan-2020-2024-October-2019.pdf

[22] See Appendix 2, below.

[23] See page 8: Preview attachment NWRP_EM Webinar_Public Consultation.pdf

One needs to spend a significant amount of time reading well into the technical detail of this 1,000+ page document to discover that the supply demand balances (SDBs) do *not* reflect a reduction in leakage to 21% across the region: they do so only for a very small minority of water resource zones (WRZs)[24]. For the vast majority of WRZs the SDBs assume that leakage will remain at, or almost at, its current level (which clearly is *well* above 21%).

We have already raised this point with Irish Water: it does not deny that it is true, but argues that the issue is addressed at the back-end of the process (i.e. *after* the Shannon pipeline project has been selected as the "preferred solution") by "re-sizing" (i.e. reducing) the volume of water that will actually be taken from the Shannon. This back-to-front suggestion misses the key point: if 21% leakage reduction were built into the regional SDBs themselves *before* the options selection process, then the projected deficits for those regions would be slashed and local options in most (if not all) cases would more than suffice to meet the deficits. For example, the SDB for study area 3 identified a deficit of 26Mld; cutting leakage to 21% would save over **13Mld** and so would cut the deficit to 13Mld (which local options could have met); but the SDB assumed that leakage would be cut by just **0.4Mld** (barely reducing the deficit at all) and the conclusion was that the region should be supplied via the Shannon pipeline. This is highly relevant since the Shannon pipeline project is now being driven to a very significant degree by these regional supplies (it cannot be justified on the basis of the GDA alone, as demonstrated in this submission).

Irish Water has gravely misled the public on this important issue.

(2.2) The fact that IW's calculations do *not* reflect a reduction in leakage to 21% across the region is tucked away deep within its document

Perhaps the most concerning angle of this point, and we cannot state this strongly enough, is the fact that it requires a very deep read of this highly technical, 1,000+ page document to understand that IW does *not* reflect a 21% leakage reduction into its regional projections. This is simply wrong and far from "transparent". The document states that the plan is to reduce leakage to 21% in the larger ex-GDA WRZs and to reduce it to SELL (which is *higher* than 21%) in all the other ex-GDA WRZs. It this did happen then leakage (and therefore the projected 2044 regional deficit) would be reduced by **57Mld**[25] - but the SDB calculations do *not* assume a reduction in leakage of 57Mld: they assume a reduction of **just 3Mld**. This highly significant fact is stated without justification and without any acknowledgement that it is at odds with IW's very high-profile "21%" statements on leakage – **and it is tucked away in section 5.2.2, at page 131 of this document**. This is wholly unacceptable.

Here is a breakdown of the approach that is being taken across the study areas of the region[26]:

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[24] i.e. for some – but not all - of the WRZs that will constitute the new "GDA Regional".

[25] See section 5.2.1, 5.2.2 and Table 5.2 https://www.water.ie/docs/rwrp-easternmidlands/Draft-RWRP__EM_Sect-on-5-Solutions-Our-Approach.pdf

[26] https://www.water.ie/docs/rwrp-easternmidlands/Draft-RWRP__EM_Sect-on-5-Solutions-Our-Approach.pdf (see part 5.2.2) *"Planned leakage reductions across the Eastern and Midlands Region (built into the SDB) include the following reductions:*

- *SA3 - 356 m³ per day through net leakage reduction in Athboy, Bailieboro, Navan Mid Meath and Trim*
- *SA4 - 251 m³ per day through net leakage reduction in Ballymahon and Mullingar Regional*
- *SA5 – 570 m³ per day through net leakage reduction in Birr, South Roscommon and Athlone*
- *SA6 - 823 m³ per day through net leakage reduction in Carlow North, Clogh- Castlecomer, Portlaoise, Portarlington and Tullamore*
- *SA8 - 978 m³ per day through net leakage reduction in Ennis, Shannon/ Sixmilebridge, and Limerick City.*
- *SA9 – 84,000 m3 per day through net leakage reduction" [Note: the GDA is SA9]*

- In **Study Area 3** (which includes Navan and Drogheda) the SDB assumes that leakage will be reduced by **less than 0.4Mld**. If IW were to reduce leakage to 21% for the large WRZs and to SELL (which is higher than 21%) for the remainder then leakage would be reduced by **13Mld**.

- In **Study Area 4** (which includes Mullingar) the SDB assumes that leakage will be reduced by **less than 0.3Mld**. If IW were to reduce leakage to 21% for the large WRZs and to SELL (which is higher than 21%) for the remainder then leakage would be reduced by **9Mld**.

- In **Study Area 5** (which includes Birr and Athlone) the SDB assumes that leakage will be reduced by **less than 0.6Mld**. If IW were to reduce leakage to 21% for the large WRZs and to SELL (which is higher than 21%) for the remainder then leakage would be reduced by **4Mld**.

- In **Study Area 6** (which includes Carlow Town, Portlaoise, Tullamore, Portarlington and Mountmellick) the SDB assumes that leakage will only be reduced by **0.8Mld**. If IW were to reduce leakage to 21% for the large WRZs and to SELL (which is higher than 21%) for the remainder then leakage would be reduced by **8Mld**.

- In Study Area 8 (which includes Limerick City, Ennis and Shannon) the SDB assumes that leakage will be reduced by **less than 1Mld**. If IW were to reduce leakage to 21% for the large WRZs and to SELL (which is higher than 21%) for the remainder then leakage would be reduced by **20Mld**.

- **In Study Areas 1, 2 and 7 the SDBs assume no leakage reduction at all.**
  *Note: IW's webinar slide on leakage showed a big, bold "**21%**" indicator next to the town of Nenagh: in fact, the SDB assumes that for Nenagh (and for the entirety of study area 7, in which Nenagh is located) there will be ZERO leakage reduction.*

If IW's public statements on 21% leakage *were* reflected in the SDBs for these regions then each of their 2044 deficits would be significantly reduced and in many (if not all) cases local supply options would have sufficed to meet those deficits without any need to call on the Shannon supply.

To give this some context: IW's projected 2044 deficit for this entire region (ex- the GDA) is just **84Mld**. Demand savings from cutting leakage to 21% would be over **57Mld** – but IW only reflected a reduction of **3Mld** into the SDBs. Naturally, these regions are not all connected, so it would be wrong to suggest that one could simply deduct 57Mld from 84Mld – but it is beyond question that reflecting a 21% leakage level (as per IW's statements to the public) into each of the regional SDBs themselves would have had a very profound impact on the conclusions of this project.

(2.3) Irish Water's leakage targets are not in line with international best practice

The leakage points raised in our last submission were not addressed:

(a) The leakage targets in IW's SDBs should reflect the leakage commitments of the most recent RC3 process (**25% reduction in leakage in the next 5 years**) but they do not: instead they reflect *far less ambitious leakage* reduction targets (**2% reduction in leakage in the next 5 years**).

IW recently completed its third "revenue control" process with the CRU (known as RC3). This was a long process during which Irish Water submitted a business/investment plan with its proposed leakage reduction target. The CRU considered the target (a reduction of 176Mld from the 2019 base year level of 712Mld[27]) and it was publicly consulted upon. After a complex 18-month process the CRU finally confirmed the 176Mld leakage reduction target (for the 5-year period from 2020 to 2024) in its final decision in August 2020[28]. This target was reported in the press[29]. The target set by the CRU amounted to a 25% leakage reduction over 5 years (176Mld as a percentage of 712Mld is **25%)**. This was an appropriately ambitious target given the high level of leakage in Ireland, and was in line with the targets set by the UK water regulator for under-performing UK water suppliers. However, IW did *not* reflect that 176Mld leakage reduction target in its Water Resources Management Plan. Instead, its figures assume that, by 2024, leakage will have been reduced to 698Mld[30] . This equates to a leakage reduction of just 14Mld from a 2019 baseline level of 712Mld i.e. a 5-year leakage reduction target of just 2%[31].

(b) IW's long term leakage target is SELL. We criticised this as too unambitious and not in line with international best practice. OFWAT recently stopped allowing UK water suppliers to use SELL as their leakage target because SELL is considered unambitious. **IW denied that this is true. Here is evidence that what we say is true and what IW says is not true[32]**:

- OFWAT's latest Water Resources Planning Guidelines state: "*Previously, companies have used the sustainable economic level of leakage method to determine levels of leakage. However, this is no longer acceptable for use in WRMPs"*[33].
- "*Historically, leakage targets were informed by SELL…we are concerned that this approach has not driven sufficient efficiency improvements or innovation…. SELL tends to maintain the status quo… SELL, as an approach, allows for leakage to increase when new resources are built because the value of reducing leakage decreases as more water is available*" (OFWAT, 13 December 2017).

(2.4) IW's plan to stick to "find-and-fix" will not achieve a step-change in Ireland's leakage

Ireland's water pipes are so compromised that leakage constitutes by far the biggest single element of "demand"; more treated water is lost through network leakage every day than is used by all of the households in Ireland combined; for years, the volume of water lost through leaks has been *more than double* the volume of water used by all of Ireland's industry (i.e. *twice as much* water is lost

[27] https://www.cru.ie/wp-content/uploads/2020/12/CRU20143-RC3-Financial-Incentives-Non-Domestic-billing-and-Leakage-CRU-Consultation-Paper.pdf (see page 26: "*Irish Water reported its leakage level ('Unaccounted-for-water') at 712 million litres a day in 2019. As part of its RC3 capital investment plan, Irish Water intends to reduce net leakage by 176 million litres a day by the end of 2024*").

[28] https://www.cru.ie/wp-content/uploads/2020/08/CRU20085-Update-to-Irish-Water%E2%80%99s-Revenue-Control-3-RC3.5%E2%80%93-Irish-Water%E2%80%99s-Updated-Capital-Investment-Plan.pdf (see page vii)
See also: https://www.cru.ie/wp-content/uploads/2020/12/CRU20143-RC3-Financial-Incentives-Non-Domestic-billing-and-Leakage-CRU-Consultation-Paper.pdf (see page 26: "*Irish Water reported its leakage level ('Unaccounted-for-water') at 712 million litres a day in 2019. As part of its RC3 capital investment plan, Irish Water intends to reduce net leakage by 176 million litres a day by the end of 2024*")

[29] https://www.businesspost.ie/ireland/irish-water-urged-to-cut-leakage-loss-by-176-million-litres-a-day-351fcee0

[30] https://www.water.ie/projects-plans/our-plans/nwrp/NWRP-Draft-Framework-Plan.pdf - see page 74.

[31] 14Mld as a percentage of 712Mld is **2%.**

[32] For more evidence on this see our last submission.

[33] https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline

through network leakage as is used by all of Ireland's research centres, manufacturing sites, data centres, hospitals, breweries, hospitality industry etc combined)[34].

It is increasingly acknowledged internationally that "find-and-fix" as a primary leakage reduction method is not capable of effecting significant reductions in leakage: it is capable of offsetting the "natural rate of rise" but very little beyond that[35]. Irish Water's country-wide leakage data supports this: since 2014 its leakage programme (which is primarily find-and-fix) has done little more than offset the "natural rate of rise" of leakage. Irish Water states that it has "*achieved total gross leakage savings of **233.2Mld** on the public side of the network for the 2014-2019 period*". This statement is misleading: between 2014 and 2018 (i.e. the years for which leakage data was reported on a consistent, like-for-like basis[36]), network leakage went down from around **800Mld** in 2014[37] to **782Mld** in 2018[38]). So, in those four years **leakage was cut by just 18Mld or 2%**. By using the language "*gross leakage savings*" Irish Water is referencing the water that it theoretically "saved" by offsetting what is known as the "natural rate of rise" of leakage. Offsetting the "natural rate of rise" (and achieving a very small cut in overall leakage on top of that) is *very different* to actually *cutting* leakage by a significant volume.

It is worth noting that in the UK in the '90s/'00s (when major mains replacement programmes were undertaken shortly after the privatisation of the UK water supplies and there was a strong public focus on the performance of the water supply companies) leakage was reduced by 37% in just 6 years (between 1995 and 2001) when major mains replacement programmes were undertaken[39] (and this was *net reduction* – not a reduction including the offset of the "natural rate of rise"). After those mains replacement programmes ended, the UK reverted to a primarily find-and-fix approach. Mains replacement rates reduced significantly (they are now down to around 0.6% per year). For the past decade, since find-and-fix has been the primary leakage-reduction strategy, leakage levels in the UK have plateaued with nothing like the reductions that were achieved in the '90s/'00s. This has sparked growing criticism from OFWAT and a growing body of industrial/academic opinion in support of mains replacement not only to address reliability/quality of a water supply (as was historically the case), but also as a primary leakage reduction tool.

For example, Dennis Grimshaw (technical development director of RPS Water) wrote: "*Evidence from water undertakings in England and Wales suggests that the marginal costs of active leakage control are increasing to uneconomic levels in some parts of their distribution networks as a result*

[34] https://www.cru.ie/wp-content/uploads/2020/07/CRU20073-Irish-Water-Capital-Investment-Plan-2017-to-2021-Monitoring-Report-No.-3.pdf - see chart at page 10 – N.B. the data for 2019 was "re-categorised" and is not comparable with the data for previous years.

[35] See Appendix 2.

[36] Note: Irish Water claimed (and broadcast widely) that it cut leakage significantly between 2018 and 2019: in fact, it had "re-categorised" leakage i.e. narrowed the definition, which made it look as if it had cut leakage significantly in 2019 compared to 2018 and previous years when, in reality, it had not. It is possible that, in 2019, IW achieved a small reduction in leakage although our calculations suggest that it may actually have made no reduction at all in (we have repeatedly asked Irish Water to publish like-for-like 2018 and 2019 data to establish the truth). As such, 2019 "leakage" data is not comparable to leakage data for 2018 and earlier.

[37] https://www.irishtimes.com/news/environment/almost-half-of-ireland-s-water-supply-is-lost-through-leaks-1.2102787 (note: the latest full year data at the time of this interview was 2014 data).

[38] https://www.cru.ie/wp-content/uploads/2020/08/CRU20089-Energy-and-Water-Monitoring-Report-for-2019.pdf (see page 79).

[39] https://www.gov.uk/government/publications/water-and-treated-water/water-and-treated-water "Between 1995 and 2001, there was a 37% reduction in distribution losses in England and Wales".

of asset deterioration. This has prompted a move away from purely water quality driven mains rehabilitation towards a greater focus in AMP4 on leakage savings through mains renewal"[40].

RPS stated, in 2020[41]: "*Mains renewals deliver assets that could last 160 years, reducing interruptions to supply and customer minutes lost. Historically these additional benefits rarely made it into a business case for a leakage driven scheme, but now with the pressure of AMP7 on cost, efficiency and performance, all these benefits should be fully examined. The last word: The time for preventative long-term leakage solutions is now. The AMP7 targets and the predicted AMP8 targets mean that short term fixes are no longer appropriate to be the main tool to reduce leakage,*"

RPS has also written: *"Often leakage is deemed to be a problem of operating expenditure that requires more people to find and fix leaks to improve performance. This is inefficient and supports short-term solutions to address the problem – it does not bring the benefits of addressing the root cause, as several water companies now are. Having learned that full asset renewal or extensive pressure management leads to lower leakage levels, these companies are making these strategies central to their leakage-reduction plans"*[42].

PWC stated (in a 2019 report for OFWAT[43]): *"Mains replacement, while relatively expensive in the short-term, can help deliver better value for money than reactive strategies like ALC, as a 'spend to save' initiative that reduces maintenance costs for the majority of the life of the asset and contributes to reducing leakage. The potential benefits of longer-term investment from increasing the resilience of the asset base, e.g. to extreme weather conditions, should also be taken into account. In addition, as the SMC report notes, transitioning from one steady state to another and achieving a step-change in leakage reduction will require investment in increased repairs or asset renewal activities. This shows that the choice of leakage reduction activities requires careful optimisation that strikes the right balance between maintaining cost effectiveness in the short-term, but also ensuring the longer-term sustainability of infrastructure health and impact on leakage."*

Yet IW's plan is to stick to "find-and-fix" as its principal leakage-reduction method (combined with pressure reduction and very low levels of mains replacement). Its plan is to continue with what it calls "targeted" replacement of mains – i.e. the replacement of short stretches of pipes that are "*rotten or effectively failing all the time*" (Irish Water's own words[44]). Irish Water says that it generally only replaces pipes once they are bursting 3 to 4 times a month[45]. This is *not* acceptable for Ireland, where pipes have been neglected for decades and a step-change in leakage is needed. The history of this very project supports this: *every single previous report published for the Shannon pipeline project (in 2006/2010/2015/2016) set out future leakage targets: none of those targets have been met.* This is damning – and is a reflection of Ireland's failing approach to leakage reduction.

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[40] https://www.edie.net/library/Leakage-driven-mains-renewal/3426
[41] https://www.rpsgroup.com/media/5796/wi_insights_leakage-strategy.pdf
[42] https://www.rpsgroup.com/insights/services-water/prevention-is-better-than-cure-in-tackling-uk-water-leakage-rates/ (October 2020).
[43] PWC: Funding approaches for leakage reduction, produced for OFWAT and published on 20/12/2019 https://www.ofwat.gov.uk/wp-content/uploads/2019/12/PwC-%E2%80%93-Funding-approaches-for-leakage-reduction.pdf - see page 12.
[44] https://www.oireachtas.ie/ga/debates/debate/joint_committee_on_housing_planning_and_local_government/2018-04-25/3/
[45] https://www.oireachtas.ie/ga/debates/debate/joint_committee_on_housing_planning_and_local_government/2018-04-25/3/ Mr Jerry Grant (MD of Irish Water): *"One does pipe replacement where there are repeat bursts on a regular basis. We are replacing pipes which burst three or four times a month"*

(2.5) Irish Water's messaging about water consumption in Dublin is deeply misleading

IW's public messaging is that "consumption" of water in Dublin (i.e. domestic and non-domestic demand) is going up and that leakage is going down. This messaging is the opposite of the truth: the data shows that, since 2005, "consumption" (i.e. domestic and non-domestic demand) has *plateaued* – the only element of Dublin's "demand" that has been going *up* is network leakage[46].

On 24 April 2018 Mr Jerry Grant (the former MD of Irish Water) gave an interview on the "Morning Ireland" radio show in which he said "*we are frankly running out of water. We've seen a 7% to 8% growth in demand in this region [the GDA] in the last 4 years that reflects clearly the recovery in the economy and the growing population*". This statement was highly misleading: at that point in time average "demand" had been virtually flat for an entire decade – and "consumption" (which he referred to, by citing the economy and population growth) had actually gone *down*. The table below shows average demand in the GDA going back a full decade, extracted from reports published by Irish Water. Full year 2017 average demand (i.e. the latest full-year data that would have been available to Mr Grant at the time of this interview) was **557Mld**; in 2007 average demand was **542Mld** - so between 2007 and 2017 average demand in the GDA went up by just 15Mld which equates to less than 3%. However, the only reason "demand" had increased at all was due to an increase in ***network leakage***: *consumption* of water (i.e. water used at the tap by householders and by industry) had actually gone *down* [47]. Had it not been for an increase in network leakage then "demand" would have been *down* in 2017 compared with 2007. **Irish Water's messaging in the media about "demand" in Dublin is unacceptably misleading.**

Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Average demand (Mld)	542	539	539	550	539	532	540	539	540	547	557

(3) YET AGAIN, THE SDB TABLES CONTAIN BASIC ERRORS

(3.1) "Peaking" is being applied to "headroom"

In Irish Water's projections, peaking (of 13%, for the GDA "dry year critical period" scenario) is being inappropriately applied to "total demand" (which *includes headroom*). This means that "peaking" is being applied to "headroom" i.e. it results in an inappropriately inflated headroom provision – indeed it **increases headroom by 7Mld**[48] which is a very significant volume in the context of this project. **This is, of course, entirely inappropriate and we trust that it was an error and not done deliberately.**

Both Kennedy Analysis and the CRU flagged this issue in their submissions on the last consultation for this project. IW's response document did not address the point in any detail, but rather it simply stated: "*Headroom is applied to total demand*" with no further detail given. That statement from Irish Water is entirely inadequate: not only because it fails to address the very specific (and mathematically demonstrated) issue raised, but also because it directly contradicts the statements/ methodologies set out in the original consultation document itself. The consultation document stated explicitly that "headroom" *forms part of* "total demand", and that "*headroom factors are applied to*

[46] See table at part 4.1, below.
[47] See part 4.4 below.
[48] 2044 headroom for the GDA is **51Mld**; peaking for the GDA for the DYCP is **13%**: 13% of 51Mld = **7Mld**.

the SDB for each Weather Event Planning Scenarios described in section 2.3.2 in order to derive the total demand" and later "*total demand is the sum of the components of water use plus headroom".*

If we (and the CRU) have indeed misunderstood this then IW should not dodge the issue (as it did in its last response): it should address it head-on and show the line-by-line calculations to prove that it is *not* doing what its consultation document states that it is doing (which would be entirely inappropriate and contra to best practice).

(3.2) The Supply/Demand balance tables contain basic errors that invalidate key findings

There are mathematical and data errors in the SDB tables. "Total" fields do not in fact reflect the total of the cells that they purport to add up. Fields that should contain identical figures do *not* contain identical figures. Rows are inadvertently repeated. Each of these errors has an impact on the findings of the analysis.

However, one error has particularly serious implications:

- When one compares the SDB table for the "GDA" with the SDB table for the new "GDA Regional", it can be observed that the "demand" projections in the SDB for the GDA Regional are considerably higher than those in the SDB for the GDA (this is as it should be – the GDA Regional is a wider region than the original GDA so the demands are, of course, higher);
- The "supply" projections for the GDA Regional should also be considerably higher than those for the GDA (since there are 9 additional WTPs within the GDA Regional that were *not* within the GDA[49]). However, it is clear that something has gone wrong in IW's processing because the water available for use (WAFU) cited for the "normal year annual average" (NYAA) and for the "dry year critical period" (DYCP) scenarios for each of the years *other than* 2044 (i.e. for the years 2019/2025/2030/2035/2040) are *identical* to the equivalent figures for the original (non-expanded) "GDA";
- This results in incorrect (i.e. significantly overstated) projected deficits for the years 2019 – 2040 for the NYAA and the DYCP for "GDA Regional", which have also been reflected (incorrectly) in the "Supply Demand Balance" table.

These projected deficits for the GDA Regional are among the most significant data in this entire document – the fact that they are incorrect is a serious issue. They imply that the GDA Regional is currently operating with a far greater "deficit" than it actually is, and the same applies to every year up to 2040. *We trust that this major error was an accidental oversight and was not deliberate.* However, there are many other basic mathematical and data errors in the SDB Tables. This is unacceptable: the SDB Tables are at the very heart of this project.

(3.3) The SDB tables for the GDA/GDA Regional are opaque and incomplete

We flagged this in our last submission. SDB tables should contain a line for each of: distribution input; domestic demand; non-domestic demand; leakage; PCC and show how each of these elements grows or reduces, at 5-year intervals. **This is vital in order to allow for proper public/independent scrutiny of IW's calculations**. The UK guidance on SDB tables (which IW claims to be following) spells this out[50]. IW's previous SDB tables in its 2015/2016 reports contained this breakdown. Its

[49] This can be observed from the table labelled "*WAFU Available for use in 2044 (DYCP)*" for the "GDA Regional" which sets out 9 WTPs whose WAFU should have been added to the WAFU for the "GDA" to create the WAFU for the GDA Regional.

[50] https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline see Part 6

latest SDB tables fail to do so. **This makes proper scrutiny impossible, which is neither transparent nor accountable. The errors identified above highlight the importance of proper public scrutiny of the SDB tables as they can already be observed to contain errors.**

In the SDB table for the GDA the figures for WAFU/outage are not provided. There is no excuse for this: the WAFU/outage figures are key to the SDB analysis and should be subject to public scrutiny. IW's excuse for failing to publish the WAFU/outage figures a year ago was invalid: it claimed that, because WAFU was generated using a complex model called "Aquator", it could not publish the figures. But we are not asking to see the method by which the WAFU figures are *calculated*, we are simply asking IW to publish the figures that their modelling ultimately *produced* (i.e. the ones that were used for the purposes of calculating the deficit). **Failure to publish WAFU/outage data is a failure of transparency and accountability – it suggests that IW is afraid of proper scrutiny of this data.**

(4) LESSONS MUST BE LEARNED FROM HISTORY

Note: We make reference in this section to the lack of "like-for-like data" for the year 2019. This is a reference to the fact that, in 2019, Irish Water changed the way that it reported the various elements of water demand[51]. Water losses that were previously reported as part of "network leakage" (UFW) were re-categorised as "domestic demand"/"non-domestic demand". To put this another way, in 2019 Irish Water narrowed the definition of "network leakage" (UFW) and broadened the definitions of "domestic demand" and "non-domestic demand". This resulted in an artificial inflation of "domestic demand" and "non-domestic demand" for 2019 (compared to previous years) and it made it look as if "network leakage" (UFW) had been reduced significantly in 2019 (compared to 2018) when, on the basis of like-for-like data, this was *not* the case. Despite our repeated requests, IW has not published like-for-like data for 2019.

(4.1) Dublin's total water consumption is the same now as it was in 2005: the only part of "demand" that has gone up is network leakage

Since 2005 (the base-year data used in the first SDB for this project) Dublin's water *consumption* (from industry and households) has *not* gone up significantly (as was projected): in some years it has been slightly higher than it was in 2005 and in others slightly lower, but overall it has remained flat. The only element of "demand" that has gone *up* significantly is leakage.

	2005 (as per the 2006 SDB)	**2020** (as published by IW)	**Trend**
Domestic demand	229 Mld	227 Mld	*Flat*
Non-domestic demand	117 Mld	121 Mld	*Flat*
"Consumption" (non-domestic demand plus domestic demand)	346 Mld	348 Mld	*Flat*
Leakage (UFW)	169 Mld	212 Mld	*Increasing*

[51] This can be observed in multiple CRU reports - for example, see page 10 of the "Irish Water Capital Investment plan 2017 to 2021 Monitoring Report No 3" which states: "*For 2019, Irish Water has made some changes to how it is reporting water losses to the CRU. An estimate of the water used by Irish Water in its own buildings and treatment plants has been included in the non-domestic demand figures. An estimate of the water used by fire services, other unbilled use and water used at connections that are not recorded on Irish Water's system have been removed from unaccounted-for-water and are now reported as unrecorded use. Under-recorded use at homes and businesses, resulting from old and broken meters and data errors, has also been removed from unaccounted-for-water and is now included in the domestic and non-domestic demand figures, respectively".*

(4.2) Every single set of projections of Dublin's water demand published in relation to the Shannon pipeline project has since been proven significantly wrong

Every single set of projections of Dublin's future water demand that has been published in relation to the Shannon pipeline project (in 2006, 2010, 2015 and 2016) can now be observed to have significantly over-estimated future water *consumption* (while making claims about leakage reduction plans that were not fulfilled).

Projections from the SDBs produced for the GDA in **2006 and 2010** can now be verified as a significant amount of time has passed. They each made projections of how large the various elements of "demand" would be in 2019.

In 2010, **domestic demand** was reported to be **255Mld**. The 2010 report projected that, by 2019, "domestic demand" would increase to **279Mld**. In fact, by 2019, "domestic demand" had gone down (not up) and was **207Mld**. To put that another way: it projected that, over the subsequent 9 years, domestic demand would go **up 24Mld** (i.e. over 9%); in fact, it went **down 48Mld** (19%).

In 2010, **non-domestic demand** was reported to be **127Mld**. The 2010 report projected that, by 2019, "non-domestic demand" would increase to **170Mld**. In fact, by 2019, "non-domestic demand" was **139Mld**. To put that another way: it projected that, over the subsequent 9 years, non-domestic demand would go up 43Mld (**34%**); in fact, it increased just **9%** (indeed, if like-for-like data were available – which IW has not published - it may actually have gone *down*).

In 2010, **network leakage** ("unaccounted for water") was reported to be 161Mld. The 2010 report committed to reduce leakage by 2019. In fact, by 2019, leakage had increased to **215 Mld.** To put that another way: it projected that, over the subsequent 9 years, network leakage would go down; in fact, it went up **34%.**

The **2015 and 2016** SDBs used base-year data from 2011. Only five/six years have passed since the 2015/2016 SDBs were published but already their projections can be observed to have been wrong. The fact that the short-term projections have already been proven wrong is significant: the short-term projections are the ones for which IW should have had the most accurate data and the greatest confidence in their accuracy.

(4.3) The latest (2021) SDB compared with the 2010 SDB

Given the fact that the 2010 SDB is now known to have *wildly* over-estimated Dublin's future growth, it is helpful to compare the **longer-term** projections of the 2010 SDB with those in IW's new 2021 SDB (the one currently being consulted upon). The 2010 SDB made projections as far as 2040; the latest 2021 SDB only gives projection data for the year 2044 (except for non-domestic demand, for which it only gives data for 2050). See Table 4.3 below.

As can be seen in Table 4.3, the long-term projections in the 2021 SDB for "non-domestic demand" and "domestic demand" are reduced compared to those in the 2010 SDB (although not as much as one would expect, given the degree to which the 2010 SDB can now be seen to have over-estimated 2019 demand). However, the total "production requirements" are almost identical. This is because the 2021 SDB adopted hugely increased "safety buffers". **Safety buffers in the 2010 SDB added 79 Mld to projected demand: the safety buffers in the 2021 SDB add 249 Mld.** We discuss this in detail in part 9 below.

The result is that, despite the fact that previous SDBs can now be seen to have been very wrong in terms of demand projections, Irish Water has simply moved the goal posts in a way that still enables it to claim that there is a case to be made for the Shannon pipeline project.

Table 4.3

	2010 SDB prediction for 2040	**2021** SDB prediction for 2044 (except NDD, which is for 2050)
Non-domestic demand (NDD)	270 Mld	241 Mld
Domestic demand (including CSL)	377 Mld	249 Mld (approx.) [52]
Network leakage (UFW)	160 Mld	130 Mld
Safety buffers	**79 Mld**	**249Mld**
Peak production requirement	**879 Mld**	**881 Mld**

This Kennedy Analysis submission shows many data and methodology errors in IW's latest 2021 SDB for the GDA. There is a very high chance that IW's latest SDB will prove to have significantly over-estimated Dublin's future water consumption, and one of the biggest infrastructure project in the history of the state will have been undertaken on the basis of incorrect analysis.

(5) THIS PROJECT IS NOW ALSO BEING DRIVEN BY REGIONS OTHER THAN THE GDA – THE COST ANALYSIS MUST CORRECTLY REFLECT THIS

When this project began (back in 1997) the proposal was to build the Shannon pipeline to supply the Dublin region alone. Water demand projections were produced, and predicted that there would be enormous growth in Dublin's water consumption. Those predictions turned out to be wrong. In the intervening 25 years it has become clear that, provided leakage in the GDA is addressed, the future water needs of the GDA alone will not be enough to justify the building of the Shannon pipeline.

In 2015 and 2016 Irish Water suggested that towns/areas besides Dublin might also take water from a potential Shannon pipeline. Early work on this concept was extremely poor quality – analysis was full of errors and inconsistencies – and the concept kept changing. The latest report proposes that Dublin become, in IW's words, the "parent supply" (i.e. it takes water from the Shannon pipeline and then feeds that water along, via the GDA water supply system, to adjacent regions). It also suggests that certain towns/regions receive water from the Shannon pipeline directly. Conceptually this has its merits – but only if correct analysis concludes that it is cheaper/better to:

(i) undertake the Shannon pipeline project (with all of the costs and risks that that entails), plus

[52] 249Mld is calculated by deducting NDD, UFW, operational use (1%/6Mld) and apparent losses (1%/6Mld) from 2044 average demand of 632Mld – it is, unfortunately, an estimate because IW has provided such opaque and limited data in its latest SDB.

(ii) build the additional infrastructure required to pipe water from the Shannon pipeline to those particular regions,

than simply upgrading/consolidating local WTPs and using good, resilient local raw water supplies. However, this analysis has *not* been done meaningfully, transparently or correctly.

We noted above that 21% leakage targets were not factored in to the regional SDBs. Another key issue is that the cost analysis of the newly-included towns/regions should reflect the fact that the Shannon pipeline project could not be justified if the concept of supplying additional regions (beyond the GDA) had not been built into the latest plan. For example, IW proposes that the Shannon pipeline will deliver **37Mld** (out of **278Mld**) to the Mullingar region, i.e. **13.3%** of the water from the Shannon pipeline proposal is for the purposes of Mullingar. An appropriate proportion of the costs of the Shannon pipeline project itself must therefore be ascribed to the Shannon option for the Mullingar region. It is clear that IW has not done this.

(6) GROUNDWATER

(6.1) Lack of transparency and a failure to account for the advantages of groundwater

IW claims that it is no longer relying on a groundwater report previously produced for this project (the 2008 report by Eugene Daly & Associates, commissioned by Dublin City Council (the "EDA Report")) – but it has *not* published the groundwater report that it *is* now relying on. This is of serious concern given that every groundwater report/review that has previously been published in relation to the Shannon pipeline project (including the EDA Report) has been proven to contain major errors - see Appendix 3.

GSI (the Geological Survey Ireland, the main expert body on groundwater in Ireland) has been consistently critical of IW's approach to groundwater. In the last round of consultation GSI commented that IW depicts groundwater as a constrained, vulnerable and difficult to understand resource – GSI notes that this is *not* the case, and that groundwater represents an important, naturally good quality and resilient source of water in Ireland and that groundwater is a far more reliable resource when compared to surface water. GSI was critical of the methodology used by IW to assess groundwater. In a damning statement, GSI said: "*GSI consider it necessary for Irish Water to meaningfully engage with GSI on groundwater issues to avoid significant supply, environmental and financial consequences*".

(6.2) IW's statements about groundwater are very misleading

One thing that can be deduced from the limited information provided is that, in terms of potential new groundwater solutions to supply the GDA, IW has still only investigated aquifers within 80km of downtown Dublin despite it being known that (i) there is virtually no viable groundwater within 25km of downtown Dublin, and (ii) the region around Dublin has significantly lower annual rainfall and low permeability compared to elsewhere in the country.

It claims that "*the supply options to provide a long term sustainable treated drinking water supply for the GDA considered as part of the options development are unconstrained by distance from the GDA".* Yet it betrays (elsewhere in the document) that **this is not accurate**: it actually only considered groundwater options for the GDA to the East of Tullamore. IW's statement in this regard is also misleading: it states that IW considered groundwater for the GDA "*across the region, extending as far as supplies in Tullamore and Carlow*". It is broadly accepted that aquifers/groundwater sources are low in the immediate vicinity of the GDA and increase as you

move West across the country. A reasonable observer might well therefore assume, given the "*across the region"* part of that statement, that IW had investigated groundwater supplies across the larger part of the new Eastern and Midlands region that lies to the *West* of Tullamore. But IW did the precise opposite: it only investigated groundwater supplies to the *East* of Tullamore.

(6.3) IW conclusions on groundwater for the GDA differ significantly from its own 2015 report

Even within the compromised and limited region that IW did consider, it appears to have significantly understated the groundwater available: its latest conclusions conflict considerably with the findings of its own 2015 review (see table 6.3 below).

The EDA Report only considered groundwater within 80km of downtown Dublin (at that time the plan was to supply water to Dublin alone – there was no plan to supply water to an entire region). Even on its self-proclaimed conservative, and geographically-limited, analysis it identified 125Mld of "developable resources" within 80km of the GDA. In 2015, Irish Water published its own update/review of the 2008 EDA report (to take account of the Water Framework Directive ("WFD"), including the WFD Quantitative Objectives and the updated EPAWFD Risk Assessments) and, applying the "*WFD quantitative objectives methodology*" it came to broadly the same conclusion as the EDA Report itself. For some aquifers it concluded that the developable resources were higher, for others lower, but overall the conclusion was similar. It stated that the general approach of the EDA report had been "*reasonable and valid*" and that its rationale/filtering process was "*robust*".

Yet multiple findings in IW's latest document conflict significantly with the findings of its own 2015 report. The table below shows the volumes that Irish Water now states are available at certain aquifers close to Dublin, vs the volumes stated in its 2015 report.

Table 6.3

Aquifer (as cited in the dRWRP-EM)	**Water available (as per IW's latest document)**	**Developable resources (as per IW's 2015 report)[53]**
Lucan	**4 Mld**	**68 Mld** Two Lucan aquifers are mentioned in the 2015 report – Lucan (Trim) and Lucan (Dublin) – with developable resources of 52Mld + 16Mld
Ballyadams-Millford	**3 Mld**	**17 Mld**
Curragh Camp in Mid Kildare / Clownings in Mid Kildare	**8 Mld**	**44 Mld** IW's 2015 report stated that two Mid-Kildare aquifers had developable resources of 32Mld and 12Mld
TOTAL	**15 Mld**	**129 Mld**

[53] https://www.water.ie/projects/national-projects/water-supply-project-east-1/publications/150525WSP1_AppendixBSource_A011.pdf See "Table 3-2" at page 12 in Appendix B-1 "Review of EDA Groundwater Report 2008".

These very different conclusions are notable because, as IW itself has pointed out in the past, what lies deep under the ground does not change much within a few years, or even a few decades. Naturally, extraction/environmental regulations change, but IW's 2015 report already took account of the WFD. **IW has reached a significantly different conclusion today to that which it reached just 7 years ago. This must be subject to proper scrutiny: Irish Water's latest analysis of groundwater *must* be published.**

(6.4) IW's analysis does not factor in the advantages of groundwater over surface water

Dublin gets 98% of its water from the most vulnerable category of water (rivers) *Note: this figure used to be 99% but the WTP figures in IW's latest document differ slightly from those in earlier reports.* Some of this is category S3 i.e. water that is extracted not at the source (where water is pure) but rather at the mouth of the river, downstream of sewage treatment plants/industrial areas/agricultural areas – i.e. the point at which water has the highest chance of being polluted by raw sewage/ giardia/ cryptosporidium/ pesticides/ chemicals. IW does not flag, in its consideration of new raw water sources for the region, that (according to the EPA) the quality of Ireland's rivers is poor (and declining) whereas the quality of Ireland's groundwater is good (and improving). It also does not flag that the proposed extraction point for the Shannon pipeline means that the Shannon river water it proposes to deliver to Dublin would be S3 water.

IW's analysis methodology did not account for the risks associated with S3 water and the fact that it needs to go through a huge number of treatment processes just to make it safe for human consumption (and if something goes wrong in those processes, as happened at Leixlip in the winter of 2019/20, there is a serious risk to public health). Its methodology did not give any 'priority' to water from well-protected deep wells - which is generally very clean and needs hardly any treatment at all to make it safe to drink. If an error at a WTP results in failure at one or more stages of the treatment process (which, with the best will in the world, will always be a possibility – as we have seen repeatedly in recent years with alarms at treatment plants being accidentally ignored) then the risk to public health is far lower if the raw water is coming from deep, well-protected wells than it is if the water is S3 river water. This is a significant oversight within IW's methodology, particularly given the GDA's exceptionally high (98%) reliance on river water.

(7) "SAFETY BUFFERS" HAVE BEEN INCREASED (IN A VERY OPAQUE MANNER) TO A LEVEL WELL ABOVE INTERNATIONAL BEST PRACTICE

(7.1) The projected 2044 "deficit" for Dublin is entirely due to the inclusion of "safety buffers"

Based on its existing water supplies alone, by the year 2044 Dublin will have more than enough water to meet its projected "average demand". Indeed, it will have a surplus of **55Mld** over and above its projected "average demand". This amounts to a headroom/"safety buffer" of **12%** of "accounted for water" (AFW). The projected "deficit" that IW cites for Dublin consists entirely of extra levels of "safety buffers" over and above the 12% that it would have based on its existing water sources. IW is now demanding **249Mld** of "safety buffers" for the year 2044 – this is well above international best practice and is the sole reason that Dublin has a 2044 projected deficit of **194Mld**[54]

[54] 249Mld safety buffers minus the 55Mld of safety buffers that Dublin will already have (based on its existing water sources) equals 194Mld of additional water that is required for Dublin in order for it to have the level of "safety buffers" that IW is now incorporating into its projections.

While we are fully supportive of the GDA having a "safety buffer"/spare capacity that is at the top end of international best practice (and, clearly, it must be *higher than 12%)* it is vital that IW is not permitted to demand a spare capacity that is *inappropriately* high. To do so would result in the Shannon pipeline being built unnecessarily when better (and less expensive) solutions are available. It is important to remember: any major infrastructure investment has economic costs as well as benefits, and Ireland's scarce economic resources must be efficiently and appropriately allocated.

(7.2) IW has increased the required "safety buffers" enormously

The first reports for the Shannon pipeline project (produced in 2006/2010) projected a huge long-term water deficit for Dublin. These projections calculated "average demand" and then added in "safety buffers (for headroom/peaking/outage) that were deemed, at the time, to be appropriately conservative. The 2006/2010 projections had used incorrect data and inappropriate methodologies for their projections and it soon emerged that they had significantly over-estimated Dublin's future "average demand"[55].

In 2015/2016 IW produced updated reports for the Shannon pipeline project. They corrected some of the errors of the 2006/2010 reports (although they introduced new errors of their own). The latest IW projections have addressed one of the major errors of the 2015/2016 reports (the use of outdated methodology for non-domestic demand) and have adopted slightly more ambitious long-term leakage targets. As a result, Dublin's projected 2044 "average demand" in IW's latest SDB is significantly lower than the projections in earlier reports. Indeed, projected 2044 average demand is now so low that Dublin will have enough water available every day (above and beyond "average demand") to provide a "safety buffer" of 55Mld (12% of "accounted for water"). **However, IW counteracted that by introducing new/larger "safety buffers"**. Consequently, even though the projected "average demand" is now lower than it was in 2006/2010, the overall "water requirement" (i.e. the projected long-term deficit) is almost identical[56]. In the 2010 SDB, the safety buffers amounted to **79Mld** (for 2040). In the 2016 SDB, the "safety buffers" (which provided for climate change risks, peaking, outages and headroom) amounted to 35% of "accounted for water" or, in absolute terms, **165Mld** (for 2046). This was right at the very top of international ranges. The "safety buffers" that IW now demands in its latest SDB amount to 55% of "accounted for water" or, in absolute terms, **249Mld**.

This enormous hike in the level of "safety buffers" is not mentioned or justified by IW (indeed it is introduced in an extremely opaque way – see below) but is hugely significant. It is well above the top of the range that IW itself has stated to be international best practice. **If IW's latest SDB for the GDA had adopted 35% "safety buffers" (in line with what IW described as international best practice, in its last report in 2016) then the safety buffers would amount to 158Mld and the projected 2044 deficit for the GDA would be just 103Mld (instead of 194Mld).**

(7.3) IW has introduced these new "safety buffers" in a very opaque way

IW has changed the way that it presents the data in the SDB and has made it very challenging to extract data from the SDBs - it requires detailed analysis (and a good knowledge of the SDBs produced for the previous reports) to identify how big the latest safety buffers actually are, and to be able to identify that IW has significantly increased them. For example, IW presents the safety buffers as a percentage figure, but it does not make clear **what they are a percentage *of***. It does not

[55] See part 4.2 above.
[56] See table 4.3 above.

mention that, in previous reports, they were a percentage of "accounted for water" alone (i.e. *excluding* leakage and *excluding* the strategic industrial allowance), whereas now (one can discover only after doing a significant amount of work) they are a percentage of "accounted for water" *plus* leakage *plus* the strategic industrial allowance of 50Mld (or, in the case of the "outage" provision, the equivalent of this volume of water on the "supply" side which is known as "deployable output") – naturally, this significantly increases the safety buffers.

IW has introduced additional (hidden) "safety buffers" for the GDA without flagging this to be the case e.g. the new 22-hour output concept[57] and the two "interim solutions"[58]. It has also introduced an *additional* climate change provision without providing details (climate change risks used to be provided for through the "headroom" provision alone; they are now apparently provided for through both "headroom" on the demand side *and* through *at least* one new provision on the supply side, but the scale and details of this new provision on the supply side are not provided).

(7.4) IW has failed to take account of the "spare" treatment capacity at Dublin's WTPs

The SDB lists the following WTPs for the GDA: Ballymore Eustace, Leixlip, Vartry, Srowland, Ballyboden, Rathangan Wellfields, Monasterevin, Bog of the Ring, Cronroe, Roundwood Well and Glenealy. The total 24-hour output of these WTPs is (according to the SDB) **687Mld.** However, this 687Mld is not the *total treatment capacity* of these WTPs – multiple WTPs have (or will soon have) treatment capacity *considerably higher* than the figures set out in the SDB.

Ballymore Eustace, for example, has treatment capacity of **400Mld** but only **312Mld** is referenced in the SDB. 312Mld represents the level of water that can be sustainably produced in the DYCP due to abstraction limitations – so it is correct to say that *in the summer (i.e. the dry year critical period scenario, or DYCP)* only 312Mld can be treated - but that is not to say that the other 88Mld of treatment capacity should be ignored altogether. This 88Mld spare capacity should offset the "outage" provision at Ballymore Eustace, and it certainly negates IW's proposal to assume 22-hour output[59] *based on 312Mld*. Clearly, if one treatment module at Ballymore Eustace is taken out of supply (whether for an outage or for routine maintenance), then some or all of this spare 88Mld treatment capacity would be called upon.

Further, in the winter (i.e. the winter critical peak scenario or WCP), raw water availability is not a constraint – so, in an emergency situation during the WCP, the full 400Mld treatment capacity of WTPs could be called upon. This should clearly be reflected in the projections for the WCP – but, even for the WCP scenario, the SDB states that Ballymore Eustace only has 312Mld treatment capacity.

(7.5) Lack of clarity as to whether WAFU for the GDA is reduced for "deployment" issues

Deployment problems within the GDA water supply have historically been a major contributing factor to Dublin's water shortages (including not only the major winter storms, but also during the 2018 drought). The infrastructure issues that limit deployment in the GDA are all, according to IW, being addressed. As such, no haircut for "deployment issues" should be applied in the GDA for the purposes of calculating WAFU. **It would be entirely inappropriate for infrastructure issues to drive a 2044 deficit. Infrastructure issues must be addressed first and foremost: they should never contribute to the need for the development of a new raw water source.** However, it

[57] See part 10.
[58] See part 9.
[59] See part 10.

appears that infrastructure problems and deployment limitations *are* still being factored into the WAFU for the GDA. If so, this is entirely inappropriate and must be addressed.

(7.6) Lack of transparency on provisions for "outage" and climate change

In previous SDBs for the GDA the "outage" provision was reported (within the "demand" projections) in a transparent manner, with the exact size of the outage provision (in Mld) stated for every year within the projection table. IW now provides for "outage" on the supply side (it is deducted from WAFU) but *nowhere* in the SDB for the GDA does IW state how large the outage provision actually is, in absolute terms (i.e. in Mld). **This is unacceptable. The "outage" provision is a key figure. To redact it is opaque, and does not allow for proper scrutiny.**

Similarly for climate change: in previous SDBs for the GDA the "headroom" provision was deemed to cover all implications of climate change (i.e. the risk of increased demand for water plus the risks of reduced water being available at raw water sources). However, in IW's latest SDB for the GDA it states that, *as well as* providing for climate change through the "headroom" provision, it is making an *additional provision* for climate change by making a deduction to "WAFU", and it appears that it may also make *another additional provision* for climate change through the "1/50yr yield" provision. However, the SDB table does not state what deduction is actually made (in Mld) to "WAFU" for climate change and details about the "1/50yr yield" provision in the SDB are almost non-existent. **This is opaque, and does not allow for scrutiny. The full extent of the "climate change" provisions for the GDA must be published.**

(8) DESALINATION AS AN EMERGENCY BACK-UP (AS IN LONDON) WAS NOT CONSIDERED

London has a desalination plant that it never uses. It cost just £250million to build (a tiny fraction of the proposed Shannon pipeline) and is there to cover short-term water needed in the event of an emergency. It has never, to our knowledge, actually been used for water supply.[60]

Desalination plants are comparatively cheap to build (low CAPEX) but comparatively expensive to run while actually operating (high OPEX). The logic of having one in place to cover an element (e.g. 100Mld) of the projected deficit (all of which, one must remember, consists of the "safety buffers", so would only be needed occasionally, if ever) is therefore extremely valid: it would rarely (if ever) be operating so the total cost (TOTEX) would be comparatively low.

IW has identified several potential locations for desalination plants – but it has clearly priced them on the basis that they would be producing the entire identified volume of water every single day of the year. Given the fact that desalination can be turned on and off (and used in an emergency only) this is inappropriate. It will have a particularly high impact on the costs analysis of the desalination options because of the high OPEX costs of desalination. The desalination options should be priced on the basis that they would only operate on a very occasional basis to meet short-term peaking/outage etc.

This is where desalination has a clear advantage over options that involve development of new surface water sources (for which the majority of costs are incurred up-front). The cost profile of desalination is the precise opposite and it should be costed on that basis.

[60] https://londonist.com/2015/10/london-s-desalination-plant

(9) "INTERIM SOLUTIONS"

(9.1) Two upcoming projects that will significantly increase/improve Dublin's water supply are not accounted for

Groups challenging the Shannon pipeline have long pointed that, by optimising storage at Poulaphouca, the water that would be cheaply, safely and resiliently available for the GDA at Ballymore Eustace could be considerably increased. Deep within IW's document (and not mentioned in the main conclusions or in the "non-technical summary") IW notes that this is indeed true.

IW plans to significantly increase the water available to the GDA through two major projects in the coming few years – Plan 1 will add **an additional 50Mld** of treatment capacity at Leixlip WTP. This will be available in outage situations and in the winter (when raw water constraints are not a limiting factor). Plan 2 will provide the GDA with **an additional 70Mld/ 100Mld** (the figure varies within IW's document) of raw water by "optimising storage" at Poulaphouca/ lowering the level of the abstraction inlet/ building a new trunk main from Ballymore Eustace to Saggart. This additional water will seemingly be available year round – and if this is not the case it will certainly be available during the winter planning scenario, or the "WCP".

However, IW misleadingly refers to these two projects as "interim solutions" (despite the fact that its document makes clear that this new infrastructure - and the additional water that it will provide - will be permanent[61]) and **IW takes no account of this additional 120Mld – 150Mld of water in its calculation of the future water deficit for the GDA**. This is unfathomable and wholly unacceptable. It serves to artificially elevate the projected 2044 deficit for the GDA (and, as such, serves to artificially justify the case for the Shannon pipeline) enormously. If these two new projects are accounted for in the SDB for the GDA on the basis that the full 120-150Mld is available during the winter (i.e. the "winter critical period" scenario, or "WCP") and only 70-100Mld is available during the summer (the "dry year critifcal peak" scenario, or "DYCP") then the projected 2044 GDA deficit would be reduced from 166Mld to just 16Mld-46Mld (for the WCP) and from 194Mld to 94Mld-124Mld (for the DYCP). To view that more clearly:

	As per IW's document (which does *not* take account of these two new projects)	Adjusted to take account of these two new projects
Projected 2044 deficit (summer - DYCP)	194 Mld	94 Mld – 124 Mld
Projected 2044 deficit (winter - WCP)	166 Mld	16 Mld – 46 Mld

IW's report contains the following sentence: "*while the requirement for additional supply provided by these options is temporary, the infrastructure required will increase long term security and reliability of the entire supply*". This makes clear that IW proposes to use these two new water sources as an additional "safety buffer" for the GDA in the long term – but that it is *not* accounting for them in any of the figures, and is *not* offsetting them against the "outage"/"peaking" allowances in the SDB.

[61] See page 85 *https://www.water.ie/docs/rwrp-easternmidlands/Draft-RWRP-EM-Appendix-9-Study-Area-9-Technical-Report.pdf*

This is entirely inappropriate and invalidates the findings of the SDBs. It seems to betray an intention to build the Shannon pipeline at all costs – and certainly at the cost of correct analysis. Yet again, the very existence of these two significant projects is tucked well away in the depths of IW's 1,000+ page document (at table 7.20 on page 237 and page 85 of Appendix 9), they are misleadingly termed "interim solutions" (despite the fact that they will be permanent), and they are not accounted for in the SDB calculations at all.

(10) "22-HOUR" OUTPUT

Water treatment plants (WTPs) ideally do not operate at 24-hour output all of the time, but they are perfectly capable of doing so when needed (as IW has repeatedly stated in the past). To assume that WTPs are capable of operating at 24-hour output for the purposes of this type of water projection is *entirely appropriate for the purposes of the SDB and in line with international best practice*. Indeed, in all previous projections for the Shannon pipeline project, 24-hour output was used to calculate water available for use (WAFU).

The need for treatment modules to be taken out of commission (for maintenance etc) and the risk of failure at WTPs is provided for through the "outage" provision. That is the norm for water resource plans and, again, is what was done in previous projections for the Shannon pipeline project.

However, the WAFU calculation in IW's latest projections for the GDA assume that (in the dry year critical period scenario, or DYCP) Dublin's WTPs will operate at just 22-hour output. **The effect of using "22-hour" output is to introduce an *additional* 8% "outage" provision by the back door (2hrs / 24hrs = 8%).** IW already includes a significant "outage" provision in its SDB Projections. To include an outage provision *and also* assume that WTPs will *never* (even in the event of a short term emergency like a drought or an outage scenario at another treatment plant) operate at greater than 22-hour output during the DYCP is simply not realistic and it amounts to double counting of outage. **This inappropriately inflates the projected 2044 water deficit for the GDA by over 57Mld[62].**

IW's use of 22-hour output as well as an outage provision is inappropriate, not in line with international best practice and must be addressed. IW's projected 2044 deficit for the GDA is **194Mld**: if this double-counting error *alone* is corrected then the 2044 deficit is reduced to **137Mld**.

(11) INDUSTRIAL PROJECTIONS FOR DUBLIN MUST ACCOUNT FOR COVID

IW's latest projections rely on a fresh non-domestic demand (NDD) report produced by Ernst & Young. Unlike the previous NDD reports it is *not* published in full – only a short summary is published. This is of concern, given that Kennedy Analysis previously identified a major anomaly between the 2015/2016 projections and the underlying NDD report that those 2015/2016 projections were based upon[63].

Despite being dated September 2020, the E&Y report highlights that it relies on pre-Covid data and takes no account of the potential impacts of Covid. The E&Y report produced several NDD projections – including one based on the "Oxford Economics" macroeconomic forecast modelling,

[62] 24-hour 2044 output for the GDA WTPs is 686.9Mld; 22-hour output is 629.7Mld – the difference is 57.2Mld – see the GDA SDB at the final page of Appendix L https://www.water.ie/projects/strategic-plans/national-water-resources/NWRP_FP-Appendix-L-Merged-final.pdf

[63] See part 12.2 below.

an E&Y "base case" and various scenarios assuming accelerated growth combined with additional allowances (of 50Mld) for "contracted demand".

The table below compares 2050 NDD projections for the GDA as per the E&Y report. The projection that has been selected as the basis of the SDB for the GDA is the one highlighted in red – note that this results in a 2050 NDD projection that is nearly *double* that produced using the "Oxford Economics" model. It is based on what E&Y calls an "*accelerated growth*" scenario, which looks at a growth trajectory that **"*would put [Dublin] amongst the fastest growing developed cities in the world*".** It also includes an allowance of 50Mld for "contracted demand" (as notified to E&Y by Ervia).

Projection model name	**Projected 2050 non-domestic demand**
Oxford Economics	128 Mld
EY base case	158 Mld
EY Accelerated 1	241 Mld

Given the scale of the "contracted demand" provision and the fact that the E&Y report did *not* take any account of the likely long-term impacts of Covid on the fabric of industry in Dublin, it is vital that Ervia/Irish Water themselves verify whether any of the previously notified "contracted demand" is already known to be reduced as a result of Covid.

(12) COST ASSUMPTIONS AND KEY SUPPORTING REPORTS MUST BE PUBLISHED

(12.1) Correct cost analysis must be published

IW states that the Shannon pipeline would be the least expensive of the three solutions that it considered for the GDA – however, it did not publish the basis for this. It has not even stated how much the Shannon pipeline is currently anticipated to cost. This is entirely inappropriate and must be addressed because:

(i) the projected costs of the Shannon pipeline project have spiralled since it first began (in 2011 it was reported that it would cost **EUR 720 million** but by 2018 IW said it would cost **EUR 1.3 billion**) - it is important to understand the scale and the basis of the latest cost assumptions;

(ii) at the time of the 2016 FOAR Irish Water used OPEX cost data for desalination that was out-of-date and likely to be over-inflated (it actually acknowledged at the time that the OPEX cost figures it was using were out-of-date and likely to be overstated - but it used that cost data regardless).

In the interests of transparency and scrutiny, the cost assumptions of the three final "combinations" considered for the GDA should be published in full.

(12.2) Key supporting reports must be published

At the time of the 2015 PNR Irish Water published the various reports that fed into its projections in relation to **non-domestic demand, customer side leakage, groundwater, desalination, per capita consumption** etc. This time it has published no reports for any of these elements except for non-domestic demand (for which it has published a short, high-level summary only, and not the full report).

This is against the principles of transparency and does not allow for proper independent scrutiny. **Publication of those underlying reports in 2015/2016 allowed Kennedy Analysis to identify major errors within IW's analysis**. For example, Kennedy Analysis' review of the non-domestic demand (NDD) reports produced by (i) Jacobs Tobin and (ii) Indecon revealed that the method for calculating projected NDD used by Jacobs Tobin was the outdated "population-growth" method. This method has been roundly discredited and (as noted by Indecon in its own report at the time) is particularly inappropriate for use for a city like Dublin. Jacobs Tobin's method produced a projected 2050 NDD for the GDA of **281.1Mld**. Indecon used sectoral, econometric analysis and produced a projected 2050 NDD of **238.2Mld**. IW's own report at the time (which contained its projections) explicitly stated that it was using the Indecon data (and that it was *not* using the Jacobs Tobin data) - but the SDB tables themselves proved otherwise: the SDB tables used a projected 2050 NDD for the GDA of **281.1Mld** (i.e. Jacobs Tobin's figure). Kennedy Analysis has repeatedly flagged this as one of the key errors in the 2015/2016 projections for the Shannon pipeline project. Kennedy Analysis would not have been able to identify this error in the previous projections if it had not been the case that the previous two industrial demand reports were *published in full*. This demonstrates the benefit of public scrutiny in projects of this scale. **All underlying reports should be published in full to allow for proper public scrutiny.**

(13) THIS PROJECT WILL GO DOWN IN HISTORY AS AN INAPPROPRIATE AND FINANCIALLY DISASTROUS WHITE ELEPHANT

The parallels between the proposed Shannon pipeline project and the "Kielder" reservoir/pipeline project (that was built in the UK the 1970s and was subsequently widely criticised as having been an **unnecessary White Elephant)** are ominous.

Here are extracts from a damning report[64] of the Kielder project at the time it was opened:
"It will be a great day for the small group of men, elected by no one and responsible to no one…They decided on the scheme 15 years ago. Since then there have been embarrassments. Their estimates of growth in demand for water turned out to be five times too high…..Shrugging all this off they have pressed forward to build the biggest man-made reservoir in Europe. In the process …their annual turnover has risen from £0.4 million to £84 million, and the number of people they employ from 150 to 2,300. They have built an empire…The authority testified that the whole of the new supply would be used by 2005. This forecast was based partly on figures for past consumption which objectors managed to prove false…The authority saw the importance of public relations from the start…. It always had a director breathing down the necks of reporters…."

A 2006 review of the Kielder project[65] was highly critical. Its synopsis referred to "*the politics of promotion of megaprojects and the problems of their subsequent assessment and accountability*". It noted that the analysis for the Kielder project had used inappropriate data, including the incorrect assumption that non-domestic demand would continue to grow rapidly when, in fact (much like in Dublin): *"the industry it was planned to supply was already reducing its water requirements before construction started"*. The study noted that those who supported the scheme proclaimed: "*the scheme is a bold and imaginative one: the largest single water conservation scheme yet undertaken in this country*" - however, it stated, "*unfortunately, engineering accomplishments were often marred by economic miscalculation.* ***The resulting mismatch between vastly increased water supply at a time of diminishing rise in demand, together with huge debts incurred at a time of rapid inflation and high interest rates, had lasting effects on the state's management of water resources***".

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[64] *"Spending Money like Water*", William Charlton, The Spectator, 22 May 1982.
[65] *"The Kielder Water Scheme: the last of its kind?"* CS MCCULLOCH, University of Oxford, UK (2006) https://britishdams.org/2006conf/papers/Paper%2010%20Mcculloch.PDF

APPENDIX 1
The last consultation process was a whitewash

IW's suggestion that all responses to consultations were responded to within its consultation report "in a fair and transparent manner", is categorically false. Countless concerns raised in submissions to the last consultation were either (a) ignored, (b) *noted* in IW's consultation report, but not *responded to* at all, or (c) responded to in a way that did not actually address the issue raised.

(i) One example is the new "22-hour" output concept (see part 10 above) that both the CRU and Kennedy Analysis flagged in their submissions. IW's report noted that Kennedy Analysis/the CRU had raised concerns about it but it did not even attempt to address the concerns, and gave no explanation/ justification for its use within the SDB calculation of the 2044 DYCP for the GDA.

(ii) Another example is the fact that "**peaking**" is being inappropriately applied to "**headroom**". Peaking (of 13%, for the GDA "dry year critical period" scenario) is inappropriately applied to "total demand" (which, on the basis of IW's methodology, *includes headroom*). This results in an inappropriately inflated headroom provision – indeed it **increases headroom by 7Mld**[66] which is a very significant volume in the context of this project. **This is, of course, entirely inappropriate and we can only assume it was an error.** The CRU submission also raised concerns in this regard. IW did not address the point and the very specific mathematical concerns directly, but rather it simply stated: "Headroom is applied to total demand" with no further detail given. This statement is entirely inadequate, not least because it directly contradicts multiple statements/ methodologies set out in the consultation document itself. The consultation document stated explicitly that "headroom" *forms part of* "total demand". The document stated: "*headroom factors are applied to the SDB for each Weather Event Planning Scenarios described in section 2.3.2 in order to derive the total demand"* and later "*total demand is the sum of the components of water use plus headroom".* If we are indeed wrong on this then IW should not dodge the issue (as it did in its response): it should address it head on and show the line-by-line calculations to prove that it is *not* doing what its consultation document states that it is doing (which would be entirely inappropriate and contra to best practice).

(iii) Another example relates to short-term leakage targets. The submissions from Kennedy Analysis and the EPA (IW's environmental regulator) both flagged that during the recent RC3 process with the CRU (IW's economic regulator) IW committed to deliver a 25% leakage reduction over the next 5 years. This 5-year leakage target should be reflected in the NWRP (this is basic common sense, and it is also stated explicitly in the UK water resource planning guidelines, that IW claims to be following). However, instead, the NWRP adopted a far lower 5-year leakage reduction target (2%, as demonstrated in the Kennedy Analysis submission). The concerns were broadly referenced in IW's report, but IW did not even attempt to address them. This extremely important point was essentially ignored.

(iv) Another example relates to the long-term leakage targets adopted in the NWRP as detailed in the "SELL Appendix" to IW's consultation document. Kennedy Analysis submitted 5 pages of detailed, technical analysis demonstrating concerns with the data, methodology and underlying drivers adopted for IW's calculation of SELL. Among other concerns, the SELL Appendix contained alarming comments that those calculating SELL for the GDA were cognisant that the level of SELL adopted for the GDA "*is one of the key inputs when making strategic decisions in relation to long-term projects for the supply demand balance"* and stated that: *"In the interests of making "no regrets" investment decisions at this time….. taking a prudent view of SELL is advised*". It seems

[66] 2044 headroom for the GDA is **51Mld**; peaking for the GDA for the DYCP is **13%**: 13% of 51Mld = **7Mld**.

reasonable to assume that there is a possibility that the "*strategic decisions in relation to long-term projects*" for the GDA referred, at least in part, to the Shannon pipeline project. A "*prudent*" view, in this instance, meant adopting a *less ambitious* (i.e. *higher) SELL* leakage target than the level of SELL that had been referenced, repeatedly, in the Appendix. Adopting this higher level of SELL generates a significantly larger projected 2044 deficit for the GDA – i.e. it makes the Shannon pipeline project easier to justify. **These comments are deeply concerning: they suggest that a less ambitious approach to leakage may have been adopted specifically in order to generate a higher deficit for the GDA and help justify the Shannon pipeline project.** IW did not mention these concerns in its report and did not address *any* of the detailed and specific concerns that we flagged in relation to the SELL Appendix.

(v) Another example is IW's new SDB methodology whereby it adds "headroom"/"peaking" allowances not to "accounted for water" *excluding* any strategic industrial allowance within non-domestic demand and *excluding* leakage (as was the case in previous SDBs in 2015/2016) but rather to (i) "accounted for water", *plus* (ii) the strategic industrial allowance, *plus* (iii) leakage. It now applies "outage" on the supply side (in the 2015/2015 SDBs it applied outage to the "demand" side and only to AFW) – and, again, it applies it to a volume of water that is considerably larger than the equivalent of "accounted for water". **Not only is this new approach *inconsistent* with earlier IW SDBs: what is more, earlier SDBs *explicitly stated*, that it is *not appropriate* (and *not international best practice*) to apply "headroom"/"peaking"/"outage" to *leakage* or to any *strategic industrial allowance*.** Doing so, as IW has done in its latest SDB methodology, results in a considerably higher allowance for headroom/peaking/outage than would result if they were applied to "accounted for water" alone, in line with what IW acknowledged *itself* in the past was international best practice. Kennedy Analysis flagged this anomaly in its submission: IW's purported attempt to address it in its response was an incoherent fudge that failed to address the very specific issue as raised by Kennedy Analysis: see pages 93, 191 and 192 of the IW response report. IW appears to have copied a particular paragraph (in which incoherently attempts to address "peaking" concerns) and then pasted that same paragraph into the sections relating to "headroom" and "outage" where it makes no sense at all.

(vi) Another example relates to mains replacement. Kennedy Analysis flagged that an aggressive mains replacement programme was not even considered as a potential solution for the GDA's water problems. IW did respond to this (albeit inadequately - see part 1 above for details) but in so doing it made a multitude of misleading and inaccurate statements, for example IW's response stated:

- "*Irish Water's review of approaches implemented in other jurisdictions confirms that mains replacement on its own is not a method to deliver leakage reduction"* [Our response: nobody with any knowledge of water supply systems would suggest that mains replacement *on its own* should be used to deliver leakage reduction – and we certainly did not do so in our submission – mains replacement would clearly always be combined with ALC/pressure management].
- *"Demand interventions alone do not address the multitude of other issues with our existing supplies, including sustainability of our sources, climate change impacts, drought impacts, resilience, and drinking water quality"* [Our response: this statement is simply not true. Reducing leakage is the equivalent of developing a new water source *and* building a new water treatment plant. It reduces abstraction demands at existing raw water sources, reduces treatment demands at WTPs and would help address all of the issues mentioned here apart from "drinking water quality", which is a separate issue and is one that IW must address independently of projects to increase water supply].
- "*As set out in the European Commission's EU Reference document Good Practices on Leakage Management WFD CIS WG PoM Case Study, there are no records of countries or*

jurisdictions that use largescale watermains replacement programmes as a stand-alone method to reduce leakage. Instead, the primary methods for leakage reduction in comparator jurisdictions are pressure management and active leakage control, coupled with speed and quality of repairs. Mains renewal is an ancillary process that is usually driven by the need to reduce interruptions to supply where mains have a high burst frequency (however this can also be improved via pressure management) or where water quality is deteriorating in the distribution network." [Our response: of course no countries adopt mains replacement as "a stand-alone method to reduce leakage" - to suggest otherwise would be absurd and is certainly not what Kennedy Analysis suggested. Pressure management and ALC are vital elements of leakage reduction that would always be implemented alongside a mains replacement programme – but pressure management/ALC alone cannot deliver anything close to the level of leakage reductions that can be delivered if they are combined with a major mains replacement. This has been extensively reported on in the UK[67]. We also do not dispute that the primary purpose of major mains replacements programmes has generally been to improve water quality/increase reliability by reducing bursts (both of which are badly needed for the water supply system in Ireland) but, as a side-benefit, they also deliver extremely high levels of leakage reduction as can be observed in the UK[68]. We do note, however, a growing body of recent research[69] that makes the case for mains replacement as the more sustainable long-term solution for leakage reduction].

We could provide many further examples and would be happy to do so. Kennedy Analysis' February 2021 submission is available at www.KennedyAnalysis.com. It was a 37-page, fully-referenced submission: IW essentially ignored it. **This is not transparency or accountability: it is a whitewash**.

[67] See Appendix 2.
[68] See Appendix 2.
[69] See Appendix 2.

APPENDIX 2
The Case for Mains Replacement

(i) The value of mains replacement programmes

It is increasingly recognised internationally that, in countries where the pipes are in poor condition, mains replacement programmes (MRPs) are the most sustainable long-term solution for water supplies[70]. It is widely accepted that find-and-fix generally cannot achieve a step-change in leakage levels. If a step-change in leakage is required (as is the case in Ireland) a MRP should be considered.

The key benefits of mains replacement are (i) offsetting asset deterioration and improved reliability (i.e. the pipes are less prone to bursts), (ii) improved water quality, and (iii) leakage reduction. However, the benefits of MRPs are much wider. For example, they allow for redress of "mixed pipe systems" like that in Ireland where the pipe system has developed organically over hundreds of years, resulting in pipes of different materials joining directly to one another – for example, cast iron Victorian-era pipes joining to poor quality PVC pipes joining to asbestos cement pipes, all of which are deteriorating at different rates and respond differently to external pressures such as frost heave. This means that bursts and cracks at the joints is a real problem – Irish Water itself has said "*leakage is endemic in mixed pipe systems"*. Ireland also has a particular problem with connection pipes, as historically many of these were laid at very shallow depths so are prone to frost damage. The only way to address the root of this problem is to undertake a wholesale replacement of the pipes, one DMA at a time, and replace them all with pipes of one material.

(ii) Mains replacement programmes in the UK

In the UK in the '90s/'00s (shortly after privatisation of the UK water supplies, when public eyes were sharply focused on water supplier performance) major MRPs were undertaken. The UK MRPs were undertaken primarily to address (i) "serviceability" (i.e. to reduce pipe bursts/failures due to old and deteriorating pipes) and (ii) water quality. They improved the reliability of the pipes and reduced their average age. Naturally, the MRPs also had a huge impact on leakage levels - leakage in England and Wales dropped by 37% in 6 years (from 1995 to 2001)[71].

During its MRP London replaced up to 3% of its water pipes per year (note: when we appeared in front of the relevant Joint Committee alongside Irish Water in April 2018 to discuss the proposed Shannon-to-Dublin pipeline project, Irish Water told the Joint Committee that London had never replaced more than 1.3% of its pipes in one year – this was wrong and we have sent the evidence to prove it to the Joint Committee[72]). It did this by replacing all of the pipes in one entire DMA (district metered area) at a time - to get a sense for the scale of a DMA, there are 749 DMAs in Dublin. This allowed it to localise disruption, realise economies of scale (the cost per meter of replacing 500m of pipes is significantly lower than replacing 5m due to fixed-cost overheads), rationalise the layout of the pipe network (and reduce its overall length - the overall length of pipes was cut by an average of 20% per DMA) thus reducing future maintenance costs, and eliminate the "mixed pipe" problem by replacing the entire DMA with pipes of one material of the same age that responds to external pressures in the same way.

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[70] For example, https://www.rpsgroup.com/insights/water/prevention-is-better-than-cure-in-tackling-uk-water-leakage-rates/

[71] https://www.gov.uk/government/publications/water-and-treated-water/water-and-treated-water "Between 1995 and 2001, there was a 37% reduction in distribution losses in England and Wales".

[72] In summary: Thames Water operates 31,411km of pipes, of which 56% (17,600km) are in London; in the year 2007/8 Thames Water replaced 631km across its entire network including 527km in London – this amounts to 3% in that year alone.

The London MRP achieved its purpose. Again, Irish Water suggested to the Joint Committee in April 2018 that the London MRP had been a failure - this was not the case, as can be observed from reading the Independent Review of the London mains replacement programme[73] which concluded that the programme had been the right course of action for addressing the issues it set out to address and that, following the MRP, Thames Water (i) recovered its position on watermains deterioration to "stable", and (ii) not only *met* its leakage targets: it outperformed them.

Commentary on the impacts of the MRPs in England and Wales is clear: while leakage reduction was generally not the primary purpose of the programmes, they effected a step-change in leakage in England and Wales which simply could not have been achieved through find-and-fix and which has not been replicated since the programmes ended. The Independent Review noted that it is very difficult to effect large reductions in leakage through find-and-fix: "*Typically [find-and-fix] is used to manage the Natural Rate of Rise. Increasing [find-and-fix] activity can marginally reduce leakage levels, but generally will not deliver large reductions cost effectively".*

After the MRPs ended the UK reverted to a primarily find-and-fix approach. Mains replacement rates reduced significantly (they are now down to around 0.6% per annum). For the past decade, since find-and-fix has been the primary leakage-reduction strategy, leakage levels in the UK have plateaued with nothing like the reductions that were achieve in the '90s/'00s. This has sparked growing criticism from OFWAT and a growing body of industrial/academic opinion in support of mains replacement not only to address reliability/quality of a water supply (as was historically the case), but also as a primary leakage reduction tool[74].

It is important to bear in mind that the water supplies in England and Wales were privatised in 1989 and naturally the interests of shareholders (whose investment timeframes can be short/medium term)

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[73] *"Thames Water Mains Replacement Programme Independent Review - Findings and Recommendations Report*" (02 July 2012) produced by Black & Veatch for Thames Water and OFWAT.

[74] For example, Dennis Grimshaw (technical development director of RPS Water) wrote: "*Evidence from water undertakings in England and Wales suggests that the marginal costs of active leakage control are increasing to uneconomic levels in some parts of their distribution networks as a result of asset deterioration. This has prompted a move away from purely water quality driven mains rehabilitation towards a greater focus in AMP4 on leakage savings through mains renewal*" (https://www.edie.net/library/Leakage-driven-mains-renewal/3426). PWC stated (PWC: Funding approaches for leakage reduction, produced for OFWAT and published on 20/12/2019 https://www.ofwat.gov.uk/wp-content/uploads/2019/12/PwC-%E2%80%93-Funding-approaches-for-leakage-reduction.pdf - see page 12): *"Mains replacement, while relatively expensive in the short-term, can help deliver better value for money than reactive strategies like ALC, as a 'spend to save' initiative that reduces maintenance costs for the majority of the life of the asset and contributes to reducing leakage. The potential benefits of longer-term investment from increasing the resilience of the asset base, e.g. to extreme weather conditions, should also be taken into account. In addition, as the SMC report notes, transitioning from one steady state to another and achieving a step-change in leakage reduction will require investment in increased repairs or asset renewal activities. This shows that the choice of leakage reduction activities requires careful optimisation that strikes the right balance between maintaining cost effectiveness in the short-term, but also ensuring the longer-term sustainability of infrastructure health and impact on leakage."* RPS stated, in 2020 (https://www.rpsgroup.com/media/5796/wi_insights_leakage-strategy.pdf): "*Mains renewals deliver assets that could last 160 years, reducing interruptions to supply and customer minutes lost. Historically these additional benefits rarely made it into a business case for a leakage driven scheme, but now with the pressure of AMP7 on cost, efficiency and performance, all these benefits should be fully examined. The last word: The time for preventative long-term leakage solutions is now. The AMP7 targets and the predicted AMP8 targets mean that short term fixes are no longer appropriate to be the main tool to reduce leakage,*" RPS has also written: *"Often leakage is deemed to be a problem of operating expenditure that requires more people to find and fix leaks to improve performance. This is inefficient and supports short-term solutions to address the problem – it does not bring the benefits of addressing the root cause, as several water companies now are. Having learned that full asset renewal or extensive pressure management leads to lower leakage levels, these companies are making these strategies central to their leakage-reduction plans"* (https://www.rpsgroup.com/insights/services-water/prevention-is-better-than-cure-in-tackling-uk-water-leakage-rates/ October 2020).

are not always aligned with the interests of the supply system (investment in which provides long-term benefits). OFWAT sets limits on the amount of investment in new pipes that can be charged to customers through bills - it expects the shareholders to shoulder some of the burden. This conflict is often raised in the UK press, calling for higher levels of investment in the pipes, and this broad issue was flagged in the important 2018 EFRA committee report[75], which ultimately called for an independent review of the way the UK water industry is regulated. Clearly, this is not the situation in Ireland – and we should capitalise on the fact that Irish Water has the freedom to address the pipes in a manner that is the best interests of Dublin for the medium to long term.

(iii) Ireland's need for a mains replacement programme

The most obvious indicator of the state of Ireland's pipes is the very high leakage levels. However, pipes as poor as this also create serious issues for water quality, with high background leakage (through countless tiny cracks that are impractical to address through find-and-fix), a high "natural rate of rise" of leakage, and a high vulnerability to sudden new cracks/bursts when the pipes comes under pressure from shifting ground during a cold snap/dry spell (often resulting in water shortages and outages as water treatment plants struggle to keep up with the surge in leakage).

It is a decade since Engineers Ireland stated in its "State of Ireland 2011" report that "*renewal of water pipe infrastructure is vital*" and that it should be a "*national imperative*" that Ireland upgrade "*at least 1%, or more*" of the water pipes every year[76]. However, Ireland's pipes have never been replaced at a rate even close to 1% and Irish Water's plan (for the period 2020-2024) is to continue replacing pipes at a rate of just 0.3% per annum[77]. This equates to a total replacement rate of just once every 333 years. This is entirely inadequate for Ireland, where some pipes are already 160 years old.

A recent major project, commissioned by the UKWIR on behalf of the UK water industry and led by Servelec Technologies, undertook what was described as "*pioneering asset management research*" through a project called "*Long-term Investment in Infrastructure*". The project assessed whether current UK replacement rates are sufficient to offset the natural deterioration of the pipe system over the next 50 years. The project was high profile, generating significant industry press. Its key finding was that even though the UK pipes are currently considered to be in a "reasonable" state, the current mains replacement rate in the UK is low (at 0.6% per annum) and insufficient: unless it is increased, the pipes will begin to fail more often. It needs to be doubled to 1.2% per annum in the short term (2020-2030) and to 1.3% in the long term (from 2030-2070). It flagged that the current UK replacement rate is similar to rates in Europe, despite parts of Europe having much younger pipes[78]. *Note*: The average age of pipes in the UK is currently around 55 years - the EU average is around 36 years. This would suggest that the mains replacement rate in Ireland needs to be well over 1.3% per annum just to offset the natural deterioration of the pipes (and Ireland can't afford to just achieve that - it needs to *improve* the state of the pipes, not just maintain the status quo).

It is hard to see how Irish Water's current approach of sticking with find-and-fix as its primary leakage reduction method and not undertaking any major mains replacement programmes will not

[75] "*Regulation of the Water Industry*" (8 October 2018) a report from the EFRA committee (the committee of DEFRA, the relevant UK government department).
[76] https://www.engineersireland.ie/LinkClick.aspx?fileticket=XIOWhReG3xs%3d&portalid=0&resourceView=1
[77] https://www.cru.ie/wp-content/uploads/2019/07/CRU19148-Irish-Water-Revenue-Control-3-Decision-Paper.pdf This is the CRU decision concluding the RC3 process. Page 7/8 shows that the target for "new mains" is 424km and for "rehabilitated/lined mains" is 461km, totalling 885km out of Ireland's 65,000km of mains, i.e. 1.4% over the next 5 years (2020-2024) or 0.27% per year.
[78] Download the presentation here: https://ukwir.org/workshop?object=172263&daf=1

have serious implications for Ireland's water pipes. There is an ever-growing risk of major outages/floods caused by large mains bursts and pipe failures. Additionally, as identified in the UKWIR project referenced above, a stitch in time saves nine: ***delaying*** **the necessary mains renewal and allowing the situation to deteriorate yet further will make it *even more expensive* to recover the position in the future, compared to addressing it now**.

Ireland needs to do what the UK did 20 years ago: undertake an ambitious mains replacement programme to effect a step-change in the water supply system. Yet it appears that, for an unfathomable reason, Irish Water is not supportive of major mains replacement programmes (MRPs). Its comments to the Joint Committee in 2018 (when it was attempting to justify its proposed Shannon pipeline project) downplayed the value of mains replacement – yet much of the data that it cited was incorrect/extremely misleading. Irish Water points to the disruption (to traffic etc) of a MRP – yet it is widely acknowledged that the opposite is true: undertaking a wholesale replacement of all of the pipes in one DMA at a time localises disruption to one region and *reduces* disruption in the medium- and long- term. *Replacing* pipes (rather than simply patching them up through find-and-fix) means that they need less maintenance and are less likely to burst in the future i.e. less drilling up the same stretch of tarmac to do repairs (and consequently less social disruption/diverting of traffic/noise/pollution etc) - remember, Irish Water says that "*pipe replacement is about the replacement of pipes that are rotten or effectively failing all the time*" and that it generally waits until a pipe is bursting "*three to four times a month*" before it replaces it (these were Irish Water's own words to the Joint Committee in April 2018[79]). Drilling up the same stretch of tarmac three or four times in a month is highly disruptive.

If Ireland undertook a major mains replacement programme then, as can be observed from the remainder of this submission, there would be no need for the Shannon pipeline project at all. Once a major mains replacement programme (and the correction of double-counting and other errors within the latest SDB for the GDA) is accounted for, the projected 2044 deficit (if any) would be very small and would be easily addressed through local water options. Dublin's pipes need to be replaced as a matter of increasing urgency, regardless. No amount of water pumped into the system from the Shannon can change that and no amount of water from the Shannon can address the increasing lack or reliability of the supply system. A major mains replacement programme should be undertaken as a matter of urgency to ensure that Dublin has a reliable, high quality water supply as soon as possible – and to avoid wasting scarce public funds on the unnecessary Shannon pipeline project.

[79] *https://data.oireachtas.ie/ie/oireachtas/debateRecord/joint_committee_on_housing_planning_and_local_government/2018-04-25/debate/mul@/main.pdf*

APPENDIX 3
Groundwater

Kennedy Analysis has read every groundwater report/review published by Irish Water (IW) and its predecessor, Dublin City Council (DCC) in relation to the proposed Shannon pipeline project. The key report was produced by Eugene Daly & Associates for Dublin City Council in 2008 (the EDA report). The EDA report was the principal report that IW relied on until now – it now claims it is no longer relying on the EDA report, but it has failed to publish (or provide any detail about) the report on which it *is* now relying.

In previous submissions in relation to the Shannon pipeline project Kennedy Analysis spelled out (in significant technical detail extending to well over ten pages pages) many errors contained in the EDA report, and in the flawed review of the EDA report that IW undertook in 2015. IW has not addressed any of the points we have previously raised regarding groundwater. Below are some of those points:

(i) The 2008 EDA report was a "*desk based study*". The author was forced to rely on studies/data that were not directly relevant: "*the studies and data reviewed for this report have been collected by many individuals/organisations for a variety of purposes and therefore will be variable in depth and strict relevance to the main focus of this report. Nevertheless, this is considered to be acceptable for the type and general nature of this report*". When IW took on this project, rather than undertaking a fresh groundwater report Irish Water simply undertook a *desk-based* review of the original *desk-based* report. This notwithstanding that Irish Water's own review (i) identified errors in the original report, and (ii) was so high-level that it was not able to identify the geographical boundaries that the original report had used to delineate one of the key aquifers under consideration – rather than doing deeper analysis to come to an accurate conclusion the review created a "*crude comparison*" (in its own words) to deal with the lack of information.

(ii) When IW took this project on from DCC it reviewed the 2008 EDA report – but it failed to notice that interim events (among other things) had resulted in the EDA report's original conclusion being factually incorrect. A "resource and distance threshold" test set out in the EDA report (to assess whether an aquifer was sufficiently large/local to provide water to the supply area) was applied incorrectly: one of the limbs of the test required calculation of the distance from the aquifers to the "source of demand" or "point of distribution/use"– i.e. the distance from the aquifer to the supply area/distribution network. Instead, in doing the calculations for that limb of the test, the EDA report accidentally measured the distance from the aquifers to the centre of Dublin. So aquifers that were close to (and even within) the proposed supply area were incorrectly dismissed because they were not close enough to downtown Dublin. Indeed, one "regionally important" aquifer that actually lay within the supply area and pipe network (close to Kildare) was dismissed after incorrect application of the "resource and distance threshold test" partly as a result of being 53km from central Dublin. This error led to the conclusion that only 6 aquifers were appropriately positioned to be used for the supply area - those aquifers could produce 125Ml/d worth of water. If IW had done its review correctly (*taking account of the then-expanded proposed supply area – note, the supply area has now been expanded far more than it had been at that stage*) it would have found that 11 out of the 19 aquifers satisfied the "resource and distance threshold test" taking the "developable resources" from 125Ml/d to 166Ml/d (an extra 33%). Instead, it reiterated the conclusion that only 125Ml/d was available and groundwater was dismissed on this factually incorrect basis.

(iii) The EDA report repeatedly proclaimed itself to have been "*conservative*" in its estimations of groundwater availability. One example of the conservative approach taken in the 2008 GW Report is

seen at page 39: *"Owing to the type of study being undertaken it is necessary to make conservative estimates for some parameters such as recharge, but overestimates of others such as the number and abstraction rates of [existing] high yielding wells*". This means that the report assumed on the one hand only *conservative* amounts of water availability in the aquifers while simultaneously *overestimating* the amount of water that was currently being drawn from those aquifers for use elsewhere (e.g. for other wells already drawing upon them). The reference here to "recharge" was to both "rejected recharge" and "indirect/induced recharge" which are both processes which result in more water being available from wellfields than is otherwise indicated by their throughput. The report went on to state (at page 40) "*experience would indicate that both types of recharge would contribute at least 10% of the water abstracted annually from wellfields benefitting from such recharge. In the calculations described below, a conservative approach is taken and both types of recharge are ignored*".

(iv) The conservative approach adopted by the EDA report contributed to the bizarre and anomalous situation set out at page 45 of the report. The report identified the direct recharge /throughput for each aquifer, from which it deducted the "existing demands" on those aquifers (e.g. for other wells already drawing upon them or for water deemed necessary to maintain baseflow in nearby rivers) to result in the "potential resources available" i.e. the amount of water left in the aquifer that could be available as a resource for the Dublin water supply. For the aquifer named "Waulsortian/Allenwood (Portlaoise-Portarlington)" the report identified a "direct recharge" (which is the total estimated amount of water available from the aquifer per year) of 11.3 units – however it calculated that the "existing demands" on that aquifer were already over 18 units per year i.e. it found that significantly more water was already being extracted from that aquifer than (according to its conservative methodology) could have been available in the aquifer in the first place. This certainly calls into question the EDA report's methodology.

(v) Irish Water's review of the EDA report incorrectly interpreted the original report. It stated that the original report "*takes account of recharge*" which is the exact opposite of what the original report had done: the original report had identified that there are two types of recharge ("*rejected recharge*" and "*induced recharge*") and that "*experience would indicate that both types of recharge would contribute at least 10% of the water abstracted annually*" but the original report stated "*owing to the type of study being undertaken it is necessary to make conservative estimates for some parameters such as recharge*" and concluded that "*a conservative approach is taken and both types of recharge are ignored*".

APPENDIX 4
Definitions

AFW	Accounted for Water
CRU	Commission for Regulation of Utilities (Irish Water's economic regulator)
DMA	District metered area
DYCP	Dry year critical period
FOAR	"Final Options Appraisal Report" (2016) – an earlier report produced by Irish Water attempting to justify the Shannon pipeline project
GDA	Greater Dublin water supply area
IBP	international best practice
IW	Irish Water
KA	Kennedy Analysis
Mld	million litres per day
MRP	Mains replacement programme
NWRP	The "National Water Resources Plan", the last document produced in relation to this project and consulted upon a year ago, from December 2020-March 2021
PNR	"Project Needs Report" (2015) – an earlier report produced by Irish Water attempting to justify the Shannon pipeline project
RC3	Revenue Control 3
RWRP-EM	the draft Regional Water Resources Plan – Eastern and Midlands Region
SDB	supply/demand balance
SELL	sustainable economic level of leakage
WAFU	water available for use
WRZ	water resource zone
WTP	water treatment plan