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APPENDIX 1a

What is the Kennedy Analysis of the Shannon Project?

The Kennedy Analysis team has undertaken a detailed, forensic analysis of Irish Water's projection of the "need" for the Shannon project:

- The original ***Kennedy Report*** was sent to Irish Water in September 2016; it identified mathematical and data errors in Irish Water's "need" analysis and flagged various aspects that are not considered international best practice. Irish Water's response was **defensive**, failed to address the multiple specific examples of **incorrect maths**, and **avoided addressing many of the key issues** by making unrelated and irrelevant statements.
- The ***Kennedy Response*** was sent to Irish Water in December 2016. This was a detailed 30-page report with 8 appendices of supporting evidence and documentation.
- **Emma Kennedy (founder of Kennedy Analysis) met Irish Water in February 2017** ahead of Irish Water's written response to the Kennedy Response. During that meeting Emma Kennedy expressed her concern that Irish Water's **defensive** reaction to the Kennedy Analysis was not the reaction that one would expect from a body intent on ensuring the best possible use of EUR1.2billion of scarce financial resources.
- **Irish Water's formal written response to the Kennedy Response** was yet again defensive, **refused to acknowledge even the most undeniable of errors** and **BACKTRACKED ON MATTERS THAT IT HAD *CONCEDED* DURING THE MEETING.** It also ***failed* to address issues that the Irish Water team were unable to explain during the meeting and had confirmed would be dealt with in its written response**. Instead of addressing the issues raised in the Kennedy Analysis head-on, Irish Water's written response continued to make **unrelated and irrelevant statements**. Many of the points made in Irish Water's response were simply **wrong/made no sense/contained yet more basic errors**. It is clear that its formal response was not drafted with the intention of addressing the issues raised in the Kennedy Response, but rather with the intention of convincing third-party readers that the proposed Water Supply Project is indeed justified – Irish Water published its response on its Water Supply Project website (but failed to provide links to any of the Kennedy Analysis documents).
- The ***Second Kennedy Response*** was sent to Irish Water in September 2017. **It flagged the many key issues which Irish Water's latest response had still failed to address, matters contained in Irish Water's latest response that were patently incorrect, matters that Irish Water had been unable to explain during the meeting and had failed to address in its written response, and matters that Irish Water had *conceded* during the meeting on which its written response had BACKTRACKED.** It observed that Irish Water appears to have no interest in a genuinely constructive engagement regarding the Kennedy Analysis**.** Irish Water's response to the Second Kennedy Response confirmed that this observation was accurate: Irish Water simply stated "*we do not agree with your view that the project is not needed, or your analysis of our technical assessments*".

Click here for the **Kennedy Report**, the **Kennedy Response** and its **eight appendices**, the **Second Kennedy Response**, and the **Kennedy Analysis of Dublin's Leakage**. These can all be found at www.kennedyanalysis.com.

APPENDIX 1b

Who produced the Kennedy Analysis?

Kennedy Analysis was founded in 2016 by Emma Kennedy. Emma Kennedy's background is in carrying out forensic analysis of companies and projects – she was a corporate lawyer at Clifford Chance, one of London's biggest law firms, and subsequently worked in finance in London at a major global bank doing deep-level analysis of companies and corporate transactions.

The team that produced the Kennedy Analysis of the Shannon Project and the Kennedy Analysis of Dublin's Leakage have backgrounds in law, accounting, finance and business. They have all worked on an **unpaid basis** in their free time because the Shannon Project is quite simply wrong and they felt a moral obligation to challenge it.

The body of analysis produced by Kennedy Analysis in relation to the Shannon Project would have cost hundreds of millions of Euros had normal fees been charged – but it has been produced pro bono, in the public interest.

Emma Kennedy first heard about the Shannon Project because the proposed pipeline crosses her husband's family farm. She and her husband have had concerns that her involvement in challenging Irish Water's analysis for the Shannon Project might prove detrimental to them - indeed, they wrote to Irish Water some time ago requesting confirmation that it would *not* act in a punitive manner regarding the way that the proposed pipeline will impact their farm as a result of her involvement in this matter. **Notwithstanding their concerns that her involvement might prove to be detrimental to them personally, Emma Kennedy and the Kennedy Analysis team have continued to pursue this matter out of principle.**

To contact Kennedy Analysis about Irish Water's proposed Shannon project please see the "Contact us" page of the Kennedy Analysis website: www.kennedyanalysis.com or click here: www.kennedyanalysis.com/contact.

APPENDIX 2

One of Irish Water's most publicised statements about the need for this project overstated the predicted increase in Dublin's water demand by over 60%

In March 2015 Irish Water issued a very significant and misleading **false statement** that: **"*the [Project Need Report] identifies that projected demand for water in Dublin alone is expected to increase by over 50% by 2050*".**

The statement was very widely disseminated by Irish Water to **the public, the press, the Dail, ministers, senators, TDs and councillors**. The statement was extremely specific, it was the principal message contained in those letters/press releases and it was much repeated and became headline news**.** However, **it was FALSE: it over-stated the finding of Irish Water's Project Need Report by more than 60%**.

As a result of this error the press, the public and the government have been misled into believing that the predicted growth in water demand for Dublin is 61% higher than Irish Water's own analysis actually predicted it to be.

The implications of this error are significant, requiring remedial action by Irish Water. Kennedy Analysis brought the matter to Irish Water's attention in a letter dated 14 November 2016. A copy of the letter, together with the supporting evidence, is available at Appendix 5 to the Kennedy Response – **click here** or find it at www.kennedyanalysis.com.

As set out in the 14 November letter:
(a) the **public consultation** on the PNR that was based on the advertisement containing the incorrect figure is **invalid**,
(b) every **individual and entity** that received the incorrect statement should receive a **corrected statement** with an explanation of the error,
(c) every **press source** (TV, radio, printed press and online media) which published a story citing the incorrect figure should be asked to **publish a correction**, and
(d) every **politician** who made a statement citing the incorrect figure should be asked to **clarify the position to the same audience**.

Irish Water has not responded to the 14 November letter. In its latest response, Irish Water attempted to justify its false statement by creating a **fudge**. It compared apples and pears to arrive at a figure that, Irish Water says, "*is approximately 50%*" (it compared a future "requirement" to the current "WAFU" – neither of these is the same as "demand"; "demand" is a specific measure, very clearly identified in the Project Need Report as explicitly spelled out in the Kennedy Response in relation to this point).

Irish Water's refusal to acknowledge this most undeniable of errors speaks volumes about its approach to this interaction.

APPENDIX 3a

Correcting THREE of Irish Water's errors transforms its year 2050 projection of a 215Mld *DEFICIT* to a 55Mld *SURPLUS*

The Kennedy Analysis identified many analytical, data and mathematical errors in Irish Water's "need" analysis. It also identified that many of Irish Water's assumptions were extremely aggressive.

Three of Irish Water's undeniable, black and white errors have a particularly significant impact on its calculations. Correcting them and re-doing the analysis **changes Irish Water's *incorrect* conclusion that in 2050 Dublin will have a water *deficit* of 215Mld to the *corrected* conclusion that it will have a water *surplus* of 55Mld**. This calculation **uses Irish Water's selected analysis methodology and retains all of the other assumptions** in Irish Water's Project Need Report, some of which were very aggressive (for example, its assumption that by 2050 the average Dublin household will have only two occupants - Irish Water has already acknowledged that this was too aggressive). If one adjusts for more realistic assumptions on other aspects of the analysis then one arrives at an *even larger* projected 2050 water *surplus* than 55Mld. A table showing the corrected analysis is at the end of this Appendix 3a. The three errors referred to above are:

(1) Non-domestic demand data

Irish Water's analysis was informed by two sets of projections for Dublin's future water demand, produced by its two separate advisors, **Indecon and Jacobs Tobin**:
- **Indecon's analysis** for the non-domestic demand element adopted a detailed, sectoral, internationally accepted approach that **took account of the ongoing decline in industrial water intensity**.
- **Jacobs Tobin's analysis** simply projected that Dublin's non-domestic demand would grow in line with Dublin's projected population growth. This "population growth method" is an out-dated method that the Indecon report itself was highly critical of, noting that is *not* considered best practice internationally and it **takes no account of the decline in industrial water intensity**.

Irish Water repeatedly claimed in its public statements that its data on non-domestic demand took account of the decline in industrial water intensity, but in fact it used Jacobs Tobin's data on non-domestic demand which took *no account* of this and which produced a significantly higher projection for Dublin's 2050 non-domestic demand than Indecon's equivalent projection.

To observe for yourself that Irish Water adopted Jacobs Tobin's non-domestic demand data **see Appendix 3b**.

The corrected analysis in the table at page 7 uses Indecon's data for Dublin's projected 2050 non-domestic demand.

(2) Customer side leakage data

Irish Water's "need" analysis (i) assumed that base-year customer side leakage ("CSL") in Dublin was **40.8Mld**, (ii) predicted that, with very best efforts, CSL would be reduced by **a total of only 11Mld over the 39-year time frame**, and (iii) assumed that recovering water through repairing customer side leaks would cost "*in the order of* ***EUR0.75million***" per 1Mld.

The results of Irish Water's recent First Fix scheme (which uses "constant flow alarms" in water meters to identify very large customer leaks) establish that **every one of Irish Water's data assumptions/predictions above was wrong**. For full details on this, see **Appendix 3c.**

The corrected analysis in the table at page 7 uses a base CSL level of 100Mld and retains Irish Water's existing 2050 CSL target of 29.6Mld – this recovers an additional 59.2Mld of water between now and 2050.

(3) Double counting of outage

Irish Water's "need" analysis is a supply:demand equation, comparing Dublin's projected future daily water *demand* against the projected amount of water that Dublin's water treatment plants will be able to *supply* every day.

The "demand" side of Irish Water's "need" analysis in the 2015 Project Need Report ("*PNR*") - which was updated in the 2016 Final Option Appraisal Report ("*FOAR*") - included **"true" demand** (domestic and non-domestic), **"leakage" demand** (customer-side and distribution-side) plus the following **safety buffers** of extra water *over and above average demand,* which were defined in the PNR as follows:

- "**Operational usage**" (between 1% and 2%) to cover water used in the operation and maintenance of the distribution system (e.g. scouring of mains and reservoirs) and by authorised third party organisations,

- "**Peaking factor**" (of 20%, reduced to 15% in the FOAR) to reflect the fact that demand for water varies throughout the year with seasonal peaks occurring (e.g. increased water usage in summer associated with warm dry weather) - other peaks may occur as a result of sporting or cultural events occurring within the Water Supply Area,
- "**Headroom and outage**" (of 15%, increased to 20% in the FOAR) – "**headroom**" is to cater for uncertainties in the overall supply-demand balance - such uncertainties include the impact of climate change (on demand and on raw water source yields), impact of expansion in demand by very large water users, uncertainty surrounding accuracy of assumptions for output levels from new sources, and pollution of raw water sources leading to a reduction in abstraction rates, and "**outage**" is to protect against instances where the achievable output from water treatment facilities falls below normal output - this can be for a variety of reasons such as asset failures, planned maintenance, loss of service of a key element of treatment capacity or key trunk main delivering treated water to the supply network, diminished throughput due to raw water variability etc.

The analysis treated these safety buffers **cumulatively**, assuming that they will *all* be fully maxed-out *every day of the year*, i.e. that the full amount of water will be needed for "**operational usage**" (for scouring of reservoirs/mains etc), ***on the same day* that** the maximum possible amount of water will be needed due to "**peaking**" (e.g. at the height of the hottest summer imaginable), ***on the same day* that** the full "**headroom**" safety buffer is needed (e.g. because analysis data has emerged to have been significantly understated), ***on the same day* that** the full "**outage**" requirement is needed (e.g. because there has been a major failure at one or more water treatment plants). **Clearly, the likelihood of this occurring on even one single day is almost impossible to countenance**.

The PNR also introduced, **for the first time in the course of this 20-year project**, the requirement that a volume of water (5% of the "total supply requirement", amounting to **16Mld** in 2050) be provided for on the "demand" side of the equation for use by the water treatment plants ("*WTPs*") themselves in their processing.

Given that the "demand" side of the analysis provided protection against all these risks, and equated to **the maximum amount of water that could feasibly be required in a very extreme (non-sustained) one-day scenario**, it is vital that the "supply" side of the equation must *not* simultaneously provide protection against these same risks – the "supply" side must equate to the **maximum amount of water that could feasibly be put into the supply system on any one day**. The "supply" side data must assume that everything is working optimally: it must make *no deductions* for the risk of outages at the treatment plants/problems with the raw water supply/the impact of climate change/deployment limitations or pipework problems/water that is used by the treatment plants themselves during production etc – all of these risks are already provided for on the "demand" side and **to *add* an amount of water in to the *demand* side of the equation to cover outage/deployment limitations etc while simultaneously *deducting* an amount of water from the *supply* side of the equation to cover outage/deployment limitations etc would be DOUBLE COUNTING. However, this is exactly what Irish Water's analysis did**: instead of accounting for the full ("peak") treatment capacity of Dublin's water treatment plants its "supply" data was the "*sustainable*" (not the "peak") capacity of Dublin's water treatment plants *minus, in some instances, a "haircut" for outage, deployment and various other factors*.

It is a matter of fact that WTPs have a "peak" capacity above their "sustainable" capacity – the 2010 Report (produced earlier in the life of the Shannon Project, before Irish Water assumed control) made this distinction particularly clear – when calculating the demand/supply balance the 2010 Report explicitly compared (a) "**sustainable**" supply against "**average**" demand, and (b) "**peak**" ("non sustainable") supply with "**peak**" demand. **Ballymore Eustace** has a *peak* capacity of **400Mld** and a *sustainable* capacity of **318Mld** – however, the "supply" figure used in the PNR was only **310Mld.** The explanation given for this in the PNR was "*BME has recently been upgraded to nominal 318Mld maximum treatment capacity however the **deployable output** to the Dublin area is currently limited to 310Mld*". Not only did the analysis not use the "peak" capacity but it made a deduction to the "sustainable" capacity due to ***deployment issues*** – this should not have happened, since deployment limitations were provided for on the "demand" side of the analysis. Irish Water's documents repeatedly betray the fact that the "supply" side data used in its analysis is at best the "*sustainable*" (not the "*peak*") data and is frequently subject to a "haircut" for outage situations/ deployment/ other limitations (see pages 15/16/17 of the Kennedy Response for specific examples): **this is DOUBLE COUNTING**.

Irish Water's documents betray what appears to be either (i) a miscommunication between those individuals at Irish Water providing the data and those individuals who were actually carrying out the analysis for the Shannon Project, or (ii) a misunderstanding of basic maths: adding a protection buffer in on the *demand* side of the equation while simultaneously deducting it from the *supply* side is DOUBLE COUNTING and mathematically invalid.

In the past few years almost all of Dublin's water treatment plants have been upgraded and considerable additional treatment capacity is now available *over and above* the production limit at those plants (the production limit is driven, in most cases, by raw water abstraction limits). Irish Water's responses show that Dublin's water treatment plants have/will have **158.5Mld per day of treatment capacity *over and above* their permitted output.** For the purposes of our corrected analysis below, we consider only the 122Mld of extra treatment capacity at Dublin's two largest water

treatment plants, **Ballymore Eustace and Leixlip**. That "extra" treatment capacity is not used on a day-to-day basis but **it would be called upon in an outage** (e.g. a failure within another treatment module at the plant). **As noted above, on the "demand" side of its analysis Irish Water *added in* an additional 20% of water as a "*headroom and outage*" safety buffer - but on the "supply" side, the analysis took no account of this extra 122Mld of water treatment capacity *which exists explicitly to provide protection against an outage or mechanical failure at the Ballymore Eustace/Leixlip plants*. THIS IS DOUBLE COUNTING.**

As noted in this Kennedy Analysis Overview with reference to the position taken in London, there is also a strong case to be made that (contrary to the approach taken in Irish Water's "need" analysis) Dublin's extra treatment capacity should also be made available to treat water from Dublin's raw water reservoirs to cover short-term, non-sustainable "peaking"[1].

The corrected analysis in the table below *includes* this extra 122Mld of capacity at Ballymore Eustace and Leixlip on the "supply" side of the equation, which is *mathematically essential* given that the "demand" side of the equation already provides for a safety buffer against "outage".

Table showing Irish Water's incorrect 2050 projections (as per its Project Need Report) and corrected 2050 projections as calculated by Kennedy Analysis, accounting for the three errors set out above:

Component	**2050 Projections (Mld) as per the Project Need Report**	**Corrected 2050 projections (Mld)**
Domestic demand	260.7	260.7
Non domestic demand	181.1	238.2
Adjustment for strategic industrial allowance	100.0	0[2]
Customer side leakage	29.6	29.6
Additional water to be recovered through addressing CSL[3]	0	(59.2)
Distribution side leakage	130.0	130
Operational water	4.7	4.7
Average demand	**706.1**	**604.0**
Average demand minus leakage and 100Mld strategic allowance	476.1[4]	344.4
Peaking allowance (20%) - not applied to leakage or to the strategic allowance, as stated in the PNR	95.2	68.9
Headroom and outage (15%) - not applied to leakage or the strategic allowance, as stated in the PNR	71.4	51.7
Production requirement (average demand plus peaking, headroom and outage)	**872.7**	**724.6**
Less existing sources **accounting for the additional 122Mld capacity at BE and Leixlip**	(658.0)	(780)
Water deficit/surplus	**215 DEFICIT**	**55 *SURPLUS***

[1] See the Part B(6) of the Kennedy Response for more detail on this.
[2] The Indecon analysis incorporated this into the 238.2Mld.
[3] Assuming Irish Water's current CSL target of 29.6Mld but using a corrected base-year level of 100Mld.
[4] The PNR failed to deduct CSL from this figure, despite stating that it had deducted leakage.

APPENDIX 3b

Non-domestic demand: Irish Water's analysis used the wrong data

Irish Water commissioned (i) its project engineering advisers (**Jacobs Tobin)**, and (ii) it's independent economic adviser (**Indecon**) to prepare separate analysis of projected water demand from 2011 to 2050. Various elements fed into the projections including population growth, number of households, per capita consumption, domestic demand, non-domestic demand and leakage. **The Indecon "*base case*" scenario and the Jacobs Tobin "*most likely growth*" scenario produced *identical* 2050 projections for *all* of the key components of Dublin's future water demand *except for non-domestic demand*.**

Indecon and Jacobs Tobin approached their **non-domestic demand** analysis in very different ways:

(1) **Jacobs Tobin** simply assumed that Dublin's non-domestic demand would grow **in line with Dublin's population growth** and added in a separate, additional, "strategic allowance" (100Mld at 2050).

(2) Indecon was *highly critical* of the "population growth" method which it noted is *not* considered best practice internationally and is a particularly inappropriate method for a city like Dublin that relies heavily on international trade (so its own population has a limited bearing on the need for water in its industrial sector) – Indecon undertook **detailed, sectoral econometric modelling** which *took account of the reduction of industrial water intensity* as well as the anticipated growth in high-water-using industry.

The Indecon report stated *repeatedly* that the population-growth method is it *not* an appropriate method to adopt for Dublin[5]. Irish Water has stated repeatedly that it adopted the econometric modelling approach (i.e. Indecon's data)[6]. Irish Water even went so far as to state *explicitly* that it had *not* adopted the population-growth method[7]. **THIS IS A FALSEHOOD: as can be observed from the table below, Irish Water adopted Jacobs Tobin's data *not* Indecon's data.**

Table showing projected non-domestic water demand to 2050 (in Mld) as stated in the Project Need Report:

Year	Indecon "base case" scenario [8]	Jacobs Tobin "most likely growth" scenario[9]	Data used by Irish Water[10]
2011	126.5	126.5 plus 0 (strategic allowance "*SA*") **TOTAL: 126.5**	126.5 plus 0 (strategic allowance "SA") **TOTAL: 126.5**
2016	136.9	-	-
2021	155.9	138.3 plus 34 (SA) **TOTAL: 172.3**	138.3 plus 34 (SA) **TOTAL: 172.3**
2026	164.8	146.2 plus 50 (SA) **TOTAL: 196.2**	146.2 plus 50 (SA) **TOTAL: 196.2**
2031	176.0	154.8 plus 75 (SA) **TOTAL: 229.8**	154.8 plus 75 (SA) **TOTAL: 229.8**
2041	205.2	168.7 plus 100 (SA) **TOTAL: 268.7**	168.7 plus 100 (SA) **TOTAL: 268.7**
2046	222.6	175.3 plus 100 (SA) **TOTAL: 275.3**	175.3 plus 100 (SA) **TOTAL: 275.3**
2050	238.2	181.1 plus 100 (SA) **TOTAL: 281.1**	181.1 plus 100 (SA) **TOTAL: 281.1**

During our February 2017 meeting Mick Garrick of Jacobs Tobin eventually conceded that Irish Water had indeed adopted Jacobs Tobin's data and *not* Indecon's data for non-domestic demand, yet Irish Water's written response stated: "*Irish Water do not accept this observation. The two methods used in the 2015 PNR to project Non Domestic Demand have always been presented as independent, and there is not an "accidental" adopting of one over the other. There is a recognition that both define a range of potential outcomes*". **This is highly misleading and disingenuous.**

[5] Indecon stated: "*previous reports have simply assumed that non-residential water demand will grow in line with population growth based on the **inappropriate assumption** that population growth will drive non-residential water demand on a one to one basis…. Indecon Economists believe **this was a flaw in previous analysis**…. It takes no account of marked variance in water intensity between sectors or the trend towards water efficiency within the non-residential sectors"…"It is **not prudent** to assume a one to one relationship between population growth and change in demand for water by the non-residential sector. **This point is taken into account in best practice modelling of water demand in other countries but had not been reflected in previous Irish work**. This is particularly relevant given the significant amount of FDI and internationally traded services in the region*". The use of bold font for emphasis is ours, not Indecon's.

[6] For example, it stated "*econometric modelling of industrial water requirements has been used for the first time and declining intensities of industrial water usage have been identified and incorporated in projections*" (source: Project Need Report, page 12).

[7] It stated: "*the traditional approach to estimation of non-domestic demand linked growth to corresponding population growth is outlined (solely for comparison purposes) in the Water Demand Review*" (source: project Need Report, page 13).

[8] *Source: Project Need Report, Appendix B, page 52.*

[9] *Source: Project Need Report, Appendix C, page 35.*

[10] *Source: Project Need Report, page 26 and Final Options Appraisal Report, page 31.*

APPENDIX 3c

The recent First Fix Free results establish that the leakage data used in Irish Water's "need" analysis for the Shannon Project was WRONG

Customer side leakage ("CSL") is the leakage on the customer side of the water supply network. Leakage on the mains side of the network is known as distribution leakage or unaccounted for water ("UFW") and is an estimate calculated by deducting "accounted for water" (which includes CSL) from the total amount of water being put into the water supply system. Irish Water's "need" analysis made assumptions about the **base year** (2011) levels for its various elements of water demand (the key elements were domestic demand, non-domestic demand, CSL and UFW) and then **projected how these elements would increase or decrease up to 2050.**

The Project Need Report analysis (i) assumed that **base-year CSL in Dublin was 40.8Mld**, (ii) predicted that, with very best efforts, CSL would be reduced from 40.8Mld to a low of 21.8Mld in 2031 **(a saving of 19Mld of water)** and that thereafter CSL would increase again to a level of 29.6Mld in 2050 **- a total reduction of only 11Mld over the 39-year time frame**, and (iii) assumed that recovering water through repairing customer side leaks was extremely expensive and would cost "*in the order of **EUR0.75million***" per 1Mld.

The results of the recent First Fix scheme have established that **ALL OF IRISH WATER'S DATA POINTS ABOVE WERE WRONG:**

- **far more water will be recovered through addressing CSL than the 19Mld (reducing to 11Mld) that Irish Water factored into it analysis: the First Fix scheme alone recovered at least 38Mld in its first 18 months of operation, despite having only repaired a fraction of the "major" leaks that the scheme targets;**
- **it is impossible that the base year CSL was only 40.8Mld – it must almost certainly have been at least 100Mld (see below). This error has significant implications for the analysis – in meeting its own 2050 CSL target of 29.6Mld, Irish Water will recover an additional 59.2Mld of water over and above that assumed in its analysis;**
- **recovering water through repairing CSL is far cheaper than Irish Water factored into its analysis: recovering 1Mld of water through the First Fix scheme cost an average of only EUR212,000 – this is 1/3 of the amount that Irish Water's analysis assumed and just 5% of the predicted cost of obtaining 1Mld through the Shannon project.**

Irish Water's "*First Fix Free*" or "*First Fix*" scheme was introduced to tackle Dublin's high levels of CSL. The scheme uses the recently installed water meters to identify particularly large leaks in customers' properties. A "*constant flow alarm*" is triggered by a constant flow of *at least 6 litres of water per hour over a 48-hour period* which flags that there is a major leak at that property. According to Irish Water data, properties that are triggering their constant flow alarm are using, on average, **over six times the normal consumption for a typical household**. These are truly major leaks and Irish Water writes to the property owner offering to carry out a leak investigation which can result in an offer of a free leak repair.

The First Fix scheme received CER approval in August 2015. After 18 months **38Mld** of water had already been recovered through the scheme - **this is *three times as much water* as Irish Water's analysis predicted would be recovered over the course of *39 years,* through repairing ALL types of customer leaks (large and small).** That 38Mld figure will increase as those Q1 2017 results did not *take full account of water savings from the previous two quarters' customer repairs* and the scheme is ongoing so cumulative water savings are still increasing.

The First Fix results *prove* that significantly more water will be recovered through repairing customer side leakage than Irish Water factored into its "need" analysis and that Irish Water's base year data was *wrong*.

This recovery of 38Mld in only 18 months is enormously significant: bear in mind that Irish Water's "need" analysis had assumed that the *total* amount of water being lost through *all* customer side leaks was only 40.8Mld. The First Fix scheme targets **only very large leaks** (not the hundreds of thousands of smaller leaks that contribute significantly to Dublin's total customer side leakage) and only in those homes with an **operating water meter**. Also bear in mind that **only a fraction of the leaks that the First Fix scheme has identified have so far been repaired**: as at Q3 2016 (the latest set of published data that takes full account of customer repairs) **of the 34,510 major leaks (i.e. leaks that were triggering a "constant flow alarm") that the First Fix scheme had identified in the Dublin water supply area only 40% had been repaired**.

Provided that the First Fix scheme continues (whether on its existing terms, under which the customer receives no incentive to repair leaks falling within the dwelling itself, or whether it shifts to a "subsidy" model as is used in the UK and as contemplated in Irish Water's 01/04/15 submission to the CER) then, **taking into account the trajectory of the issuance of "constant flow alarm" letters and the trajectory of the volume of water recovered per leak repaired, the scheme has the potential to recover upwards of 65Mld.** Once (i) water being lost through the hundreds of thousands of *smaller* leaks (i.e. leaks that are not large enough to trigger a "constant flow alarm") is also factored in, together with (ii) water being lost through leaks in homes without an operational water meter, and (iii) taking account of Irish Water's own assumption that the base-year volume of CSL was *more than double* the volume of water that would be recovered through leakage repairs over 35-years, **it is almost certain that the base year level of CSL was at least 100Mld**.

The First Fix scheme has shown that recovering water through fixing customer side leakage is far easier and cheaper than Irish Water accounted for in its analysis. The table below shows the volumes of water that were recovered for the Greater Dublin Water Supply Area ("*GDWSA*") *in each quarter* (i.e. in *every three-month window*) of the operation of First Fix, up to the latest published results.

Period	**Mld recovered in GDWSA in period**[11]	**Mld recovered in GDWSA (cumulative)**
Q2 2015 (using cumulative data as at Q1 2016 report)	5.5	5.5
Q3 2015 (using Q2 2016 report data)	6.9	12.4
Q4 2015 (using Q3 2016 report data)	6.7	19.1
Q1 2016 (using Q4 2016 report data)	5.4	24.5
Q2 2016 (using Q1 2017 report data)	5.2	29.7
Q3 2016 (using Q1 2017 report data)	4.1	33.8
Q4 2016 (using Q1 2017 report data) *Data incomplete – the volume of recovered water will increase - need to wait one more quarter for water savings through customer repairs to be fully accounted for.*	*Data incomplete*	36.6 (will increase)
Q1 2017 (using Q1 2017 report data) *Data incomplete – the volume of recovered water will increase - need to wait two more quarters for water savings through customer repairs to be fully accounted for.*	*Data incomplete*	*37.6(will increase)*

- *Note: the Q1 2017 report was published in October 2017. The scheme was put on a "hiatus" while the First Fix scheme becomes part of the wider "Water Network Programme" and as at the date of this Kennedy Analysis Overview no further results reports had been published. No "constant flow alarm" notifications had been issued for a period, including Q1 2017.*

In every quarter, the amount of water recovered through the First Fix scheme was approximately DOUBLE the production of *the entire Bog of the Ring wellfield*. The Bog of the Ring wellfield produces 2.5-3Mld of water – the First Fix scheme has so far recovered a *cumulative* total of over 38Mld. That huge volume of "new" water is now available at Dubliners' taps every day instead of pouring into the ground.

Recovering water by repairing customer leaks is equivalent to adding approximately two new, additional Bog of the Ring wellfields to Dublin's water supply *every three months* - but far, far less expensive.

11 *As per Irish Water's published guidance, these figures assume that 80% of water recovered in the "East and Midlands" region fall within the Dublin water supply area.*

APPENDIX 4

This project has a history of significantly over-estimating future water demand, yet Irish Water's latest methodology is even more aggressive than those used in the past

This project was conceived in 1996 under the remit of Dublin City Council. This culminated in the publication of a report in **2006** (the "*2006 Report*") that included detailed projections of future water demand for Dublin as far as 2031. Subsequently, in **2010**, DCC published updated water demand projections (in the "*2010 Report*"), this time as far as 2040. **In 2006 and again in 2010 the conclusion was that water demand was set to increase hugely and a huge new water source was needed as a matter of urgency. It has since emerged that the projections of future water demand in the 2006/2010 Reports were *significantly overstated*.** Average day demand in 2006 was 540Mld and **the 2006 Report predicted that, by 2015, average demand would be 665Mld.** Four years later (at the time of the fresh 2010 report) average day demand *was still only 545Mld.* The 2010 Report made fresh projections of future water demand - these were informed by (i) the then-current recession, (ii) knowledge that demand had already plateaued for four consecutive years and (iii) the awareness of the likely introduction of water charging – and the 2010 report proclaimed its projections to be very conservative, incorporating "*extremely challenging demand side efficiency targets which entail significant risk of achievement*". **The 2010 report predicted that, by 2015, average demand would be 573Mld: in fact, by 2015 average demand was still only 540Mld[12]. This was the 9th year running that average demand had remained around 540Mld** (see page 2 of Appendix 1 to the Kennedy Response)**.**

Predicting water demand out to a 35-year horizon is extremely challenging - unexpected events might occur and errors are to be expected, hence the inclusion of a significant "headroom" buffer. However, **such a significant error over such a short prediction window suggests that something was fundamentally wrong in the assumptions of the 2006 and 2010 Reports. It turns out that this was indeed the case:** the PCC used in the 2006/2010 Reports has been found (using metering data) to have been too high and its "zoning" methodology for projecting non-domestic demand ("NDD") has been strongly discredited[13].

The project passed into Irish Water's remit in 2014 and a fresh set of water demand projections was produced in the Project Need Report ("*PNR*") in 2015. In those projections, **Irish Water adopted a methodology even more aggressive than either of the methodologies adopted by the 2006 and 2010 Reports to predict, yet again, enormous increases in water demand for the next three and a half decades.** The new 2015 "need" analysis had the benefit of corrected PCC data (obtained from meter readings) and discarded the "zoning" approach for calculating future NDD – as a result, the long-term *average* demand predictions of the PNR were significantly lower than those of the 2006/2010 Reports which is entirely appropriate given how overstated we now know the 2006/2010 projections to have been. However, **the PNR then offset some of that reduction by introducing the following new additional elements to the calculation for the predicted 2050 *total* water requirement (i.e. over and above the "average" demand) that had *not* been required by the 2006/2010 Reports**:

(a) a higher requirement for "peaking": the PNR **increased peaking from 12.5% (in the 2010 Report) to 20%,**

(b) a higher requirement for "headroom and outage": the PNR **increased "headroom and outage" from 6.25% (in the 2010 Report) to 17.5% (tapering to 15%)**,

(c) a requirement of **an additional amount of water (equating to 5% of total production)** for use by the WTP itself during the treatment process (no equivalent had been incorporated in the projections of the 2006/2010 Reports), and

(d) a "strategic allowance" of 100Mld for potential future major water using industry **- this 100Mld is *cumulative* to the projected *organic growth* in water demand from Dublin's already-existing industrial users** (note: *total* industrial demand for water is currently only 110Mld).

All of the above supports the statement made in the Kennedy Report that: *"despite its predecessors having hugely overestimated future water demand… Irish Water is now taking an even more aggressive approach to calculating future water demand – only time will tell how wrong their current predictions will be"*. Irish Water's response refuted this statement (with reference to the Celtic Tiger economy and to figures that were not, in fact, demand figures) and countered it by stating: "*If … new demographic or consumption information, and a strong commitment to conservation and leakage reduction, permits the downward estimation of water demand….then Irish Water are happy to recognise this evolving situation and any reductions in demand which may arise. Irish Water has stated and continues to state that it will constantly be reviewing and updating demand projections in light of more detailed and recent information as and when it becomes available. That means that demand projections may continue to change to allow for this more up-to-date information*". **This is highly misleading: the Shannon project is ALL-OR-NOTHING. Not a single drop of water can be supplied until the entire EUR1.2billion mega-project has been completed. If, in the meantime Dublin's demand grows at a slower rate than Irish Water's analysis assumed then, *contrary to its inferences*, there is very little that Irish Water can do by way of response**.

The investment costs of the Shannon project are heavily front-ended: there is almost no scope for phasing of investment expenditure or bringing the project online in increments. The project will cost the best part of EUR1.2billion regardless of whether, in the end, it needs to supply Dublin with the full 215Mld (which is the PNR's predicted 2050 Dublin deficit) or 50Mld or indeed no water at all (which is identified by the Kennedy Analysis as the most likely scenario).

12 See page 6 of Appendix 1 to the Kennedy Response.

13 See page 11 of Appendix 1 to the Kennedy Response.

APPENDIX 5
<u>This project has outlived its need</u>

20 years ago, when this project first began, there was indeed serious cause for concern about Dublin's future water supply and as recently as 2010 talk of Dublin's water supply being on a "knife edge" was justified. In 2010 Dublin's **average water demand was 546Mld and its sustainable water treatment capacity was only 560Mld – there was only 2.5% spare capacity**. Indeed, its peak demand was actually above its peak water treatment capacity[14]. This lack of sufficient treatment capacity at its water treatment plants resulted in Dublin's water crises of 2010/2013. *Even at the time of its water crises,* ***Dublin had plenty of raw water*** *– but it was operating with ancient, under-invested water treatment plants with* ***insufficient treatment capacity and with little/no spare capacity over their licenced extraction limits to cover "outage" situations****.*

Since the 2010/2013 crises hundreds of millions of Euros have been invested upgrading almost all of Dublin's water treatment plants and Dublin's water treatment capacity has been increased by 202Mld:

- The new River Barrow/Srowland abstraction and treatment plant was officially opened in October 2013 at a cost of EUR25million. This added **40Mld of entirely new water treatment capacity**. Although the plant has been completed this full treatment capacity is not yet being fully utilised and will be brought online over time.
- An **additional 80Mld** of treatment capacity has been added at Leixlip (a brand new, "state of the art" stand-alone facility was completed in June 2014 at a cost of EUR30million).
- An **additional 82Mld** of treatment capacity has been added at Ballymore Eustace (through new plant construction and refurbishment of the existing plant).
- Irish Water received planning permission in November 2016 for a EUR200million upgrade at Vartry/Roundwood including a **brand new water treatment plant** – the existing plant cannot cope with Vartry's frequent "algal bloom".

See Appendix 4 of the Kennedy Response for evidence of the above.

Meanwhile Dublin's average water *demand* has not increased but rather, according to Irish Water's data, **for an entire decade since 2007 Dublin's water demand has oscillated at around 540Mld[15]:**

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
541Mld	539Mld	539Mld	550Mld	539Mld	532Mld	540Mld	539Mld	540Mld	547Mld	557Mld

Plateauing/declining demand for water is in no way uncommon – the same is being observed in many cities across the world. One of the key factors that ordinarily contributes to this decline is the recovery of water that was being lost through leakage: "leakage" demand is considered part of a city's overall "demand", so as leakage is reduced the overall "demand" figure (being "leakage" demand *plus* "true" demand) is also reduced. However, this reduction in "leakage" demand is often accompanied by a reduction in "true" demand: for example, leakage in Paris has been reduced consistently over the past 25 years (down to a leakage level of around 5%) and Paris has seen an accompanying reduction in its "true" demand (i.e. the actual consumption by its domestic and business consumers): "***like many urban metropolises, Paris has seen its water consumption decrease by nearly 30% in the last twenty-five years. This good news for water conservation can be explained by changes in the Parisian business fabric (service industries require less water), the efforts from the business community to reduce its consumption and also the efforts from private citizens to better control their domestic usage. This consumption decrease continues at an average rate of 2% per year***"[16].

Leakage reduction in Dublin over the past decade has been tiny, making a far smaller contribution than it should have done. However, **major changes have taken place that *have* contributed to the plateau in Dublin's water demand**: **(1) consumers are more aware of the value of water and the need for conservation (the threat of water charges has changed the way that the man on the street perceives water), (2) regulations have ensured that new-builds and household appliances are far more water efficient, and (3) industry has been forced to reduce the intensity of its water usage**. The Indecon Report concluded that industrial and commercial water intensity has reduced globally since the mid 1990s and "*similarly, when looking at water intensity in Ireland we observe a similar downward trend*". See page 3 of Appendix 1 to the Kennedy Response which shows the downward trend in average water intensity for Ireland since 1995. The same conclusion was reached by Thames Water (London's water supplier) in its Water Resources Management Plan 2015-2040. It predicted that London's non-domestic demand will actually *decrease* between now and 2040[17], stating: "*increases in water use from service industries (e.g. offices, call centres) are being offset by reductions in demand from non-service industries (e.g. industrial sites, breweries)*". Naturally the profile for London is different to the profile for Dublin, however it is notable that **between now and 2040 London's non-domestic demand is predicted to DECLINE whereas, due to its adoption of the incorrect set of data for its analysis, Irish Water's analysis projects that Dublin's non-domestic demand will MORE THAN DOUBLE over the same time-frame[18]**.

14 See page 1 of Appendix 1 to the Kennedy Response for the relevant page of the 2010 Report.
15 See page 2 of Appendix 1 to the Kennedy Response – the 2016 data comes from page 14 of the Irish Water response to the Kennedy Response.
16 "*Water in Paris. A public service*" http://www.eaudeparis.fr/uploads/tx_edpevents/Brochure_institutionnelle_ENG_2013.pdf
17 See page 4 of Appendix 1 to the Kennedy Response.
18 See page 5 of Appendix 1 to the Kennedy Response.

APPENDIX 6
Groundwater

The Kennedy Response spelled out in significant technical detail (over *11 pages*) the mathematical and logical errors contained in the original groundwater report and in the review of the original groundwater report that Irish Water undertook when it took control of this project. **Irish Water's response to the Kennedy Response yet again failed to address these errors.**

- When Irish Water took this project on from Dublin City Council it changed the nature of the project significantly by introducing the concept of the "benefit corridor". This had a major impact on the option of groundwater as a potential water source due to the significantly increased supply area in parts of the country with far higher rainfall and more available groundwater than that on the East coast. However **Irish Water's review took *no account* of this major change**.
- Irish Water's review failed to take account of the fact that the original groundwater report had been premised on the need to identify **a *single* water source** capable of providing **350Mld** of water – by the time of Irish Water's review **it was *known* that the 350Mld figure was wrong** (Dublin's needs at the time of the review were considered to be only **215Mld**) and logic should have dictated that multiple water sources offered *better* security of supply than a single source - yet **Irish Water's review took *no account* of this major change**.
- Rather than undertaking a fresh groundwater report Irish Water simply undertook a *desk-based* review of the original *desk-based* report, and Irish Water *failed* to account for (i) the newly expanded supply area, (ii) the reduced water need, and (iii) the nonsensical and flawed notion that only a one-source solution was acceptable. 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.
- Irish Water's review **incorrectly summarised the original report** – for example, 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 indicated 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***".
- The **"resource and distance threshold" test** set out in the original report was **applied incorrectly**, resulting in the **incorrect conclusion** that only 6 out of 19 aquifers satisfied the test – **had Irish water done its review correctly, taking account of the now-expanded proposed supply area, it would have realised that 11 out of the 19 aquifers now satisfied the test**.
- Irish Water's response to the Kennedy Response **still fails to address** the fact that, during consultations, the Geological Survey of Ireland (Ireland's main authority on groundwater) "*strongly suggested that the use of groundwater should not be overlooked, because it is an important natural resource that has a number of advantages over the use of surface water. It is a viable and widely available resource that would be relatively inexpensive to develop at a local level*".
- Irish Water's response to the Kennedy Response **fails to address** the point that, even on its constrained and self-proclaimed **conservative** analysis, the groundwater report found that there are significant groundwater resources in the region. It identified two aquifers alone that are likely to yield 87Mld if developed – more than enough to safeguard Dublin's future water supply and offering *diversification* away from *exclusively* surface-water sources. Further, one of these aquifers is perfectly located to avail of the brand new Srowland water treatment plant, minimising OPEX and CAPEX costs.
- Irish Water's response to the Kennedy Response **fails to address** the point that the groundwater analysis repeatedly proclaimed itself to be "conservative" which is not appropriate – it should have been *realistic*. That "conservative" approach may have contributed to the **nonsensical finding** that **18 units of water *were already being extracted*** from an aquifer that the groundwater analysis had concluded **only contained 11.3 units of water** in the first place – see part B(9) of the Kennedy Response for details.
- Irish Water's response to the Kennedy Response **yet again fails to address** the **illogical concept** of the 80km-radius study area being centred on *downtown Dublin*. Any layman knows that you are not going to drill a bore-hold in downtown Dublin so its inclusion in the study zone is a nonsense. What is more, as Irish Water itself stated, "*aquifer recharge in the east of the country is lower than in the west due to significantly lower annual rainfall and low permeability*" yet, rather than take account of the newly expanded supply area, the bizarre study zone that it selected *included more land directly on the East coast than on any other meridian* - this resulted in a study area of which, according to the groundwater report, *over 75% was underlain by ground unsuitable for groundwater extraction*. Had the study area been located in a more logical location (for example, within an 80km range of Dublin's existing water treatment plants or an 80km margin around the *periphery* of the newly expanded water supply area) then significantly more groundwater would almost certainly have been identified.

APPENDIX 7a
Benefit Corridor Submission

The original "benefit corridor" analysis (which formed part of the 2015 Project Need Report) was flawed on a multitude of levels, as identified in the Kennedy Report. The "benefit corridor" concept was changed significantly in the 2016 Final Options Appraisal Report: treatment plants in Tipperary were removed from the "benefit corridor" concept and water treatment plants in Wicklow, Louth, Westmeath, Laois and Meath were included on the basis that they are ***close to the existing Dublin network so could easily be linked in***. Public details of the new "benefit corridor" concept are scant but it appears, yet again, to contain fundamental errors. See below a submission sent by Emma Kennedy to Irish Water in this regard. **Irish Water has provided no response to this submission**.

10 February 2017

Dear Mr Geoghegan,

The Final Options Appraisal Report ("FOAR") and the "Interim Midlands and GDA Water Resource Plan" (Appendix A to the FOAR) introduce an entirely new concept of "benefit corridor" from that which has been on the table throughout this project to date.

Very little detail is given on the facts and the maths underlying the new concept, and little attention is drawn to the fact that there has been a fundamental change to the "benefit corridor" concept. It is not clear how this new benefit corridor concept, which is one of consolidation of existing water treatment plants ("WTPs") will be funded: will it be funded by the Water Supply Project?

As I understand it (I reiterate that the details are very difficult to draw out and analyse) the geographical concept of a "Benefit Corridor" has been abandoned. It now consists of an explanation that 105 WTPs (including, for the first time, WTPs in Wicklow and Clare but NO LONGER including any WTPs in Tipperary) are going to be consolidated into 28.

The new inclusion of Wicklow and the continued inclusion of Louth/Westmeath/Laois (and of Meath - which incidentally is not mentioned in the report but is included in the list of the 105 WTPs) is on the basis that they are close to the existing Dublin network so could easily be linked in. This brings the repeated justification of the Shannon pipeline over desalination by the fact that it can "*supply communities in a "benefitting corridor" along the route from the Parteen Basin to Dublin*" into even further disrepute. This justification was always very weak given that the vast majority of the residents within the old "benefit corridor" were within supply networks that could have easily been connected into the Dublin water supply network (within which the proposed desalination plant would have been situated) and as such the vast majority of the old "benefiting corridor" population could have been served using a fraction of the length of pipeline than that used for the Shannon project. Under the previous "benefit corridor" concept only a handful of people along the pipeline route between around Tullamore and Parteen (i.e. along the course of 50% of the pipeline's length) were slated as potential beneficiaries of Shannon water.

Under the new incarnation of the "benefit corridor" this distinction between "water for Dublin and its surrounds" vs "water for the rest of the country" is even more stark: the Shannon pipeline would provide water for the Greater Dublin Area (which includes most of Kildare), as well as 6 other counties ***surrounding Dublin*** (being Meath, Louth, Wicklow, Laois, Offaly and Westmeath) - **along with *just 4,000 people in Clare*.** This constitutes ***just 0.009% of the State population***, in the context of a project that is justifying itself on the basis that it will serve over 40% of the state. The idea, therefore, that a Shannon source is better placed to serve those people than a source lying at the heart of it (i.e. desalination, lying just off the coast of North Dublin) is difficult to support – and the fact that this project is repeatedly justified on the basis that it brings a benefit to the communities along the entire length of the *pipeline* is disingenuous.

However, my more specific questions on the new benefit corridor are regarding the details and the numbers:

Can you clarify how these 105 WTPs were identified? They don't appear to be *all* of the WTPs within the geography of the new "Benefitting Area" so how were they chosen, and why have you now decided to leave Tipperary WTPs out?

My understanding is that you propose to consolidate these 105 WTPs down to 28 bigger WTPs which will serve bigger populations. **Can you please confirm the locations of these proposed remaining 28 WTPs?**

You state that the 105 WTPs in the new benefit corridor currently supply "over" 157Ml/d to their water supply zones, and that by 2050 the demand in the benefit corridor is estimated to reach 181Ml.d – i.e. only 24Mld more than it is today. This is a tiny number and certainly not one on which to justify a EUR1.2billion project if the Dublin water supply issues can be resolved without recourse to the Shannon. **Can you tell me where the calculations for these 157Ml/d and 181Ml/d figures can be found?**

You then go on to state that "*the midland water resource zone requires an additional "backbone" supply of at least 56Ml/d by 2050*". I am confused by this 56Ml/d figure: deducting today's supply from predicted 2050 demand (181Mld – 157Mld) leaves a 2050 supply deficit of **24Ml/d (not 56Ml/d).**

Your calculations seem to be predicated on the assumption that, as demand in the new "benefit corridor" grows (admittedly not very much from looking at your figures) between now and 2050, the 28 new bigger WTPs will *not* take advantage of existing good local water sources over and above those that are currently being used, which seems strange – **why would you not use local good water sources for future "benefit corridor" need if they are available?** I assume that at least some of the 28 remaining WTPs have the benefit of a plentiful supply of raw water and so are able to cover their own projected increased demand themselves? **Which of the 28 do *not* have a sufficient raw water supply from their current source to cover their projected 2050 demand? Which of the 28 would you propose piping water to from the Shannon pipeline?**

In the FOAR at page 37 you include a table titled "benefit corridor water demand" with a figure for 2026 of 26.97Ml/d increasing to 56.0Ml/d in 2050 – again, **I don't understand where these figures are coming from, could you explain?**

Appendix A makes reference to "the GDWSA Supply/Demand and Resilience Strategy Report" – **could you please provide me with a copy of this?**

Appendix A states at page 10 "*Current leakage on our networks is approximately 204.7Mld … This figure incorporates the most up to date domestic meter readings and uses a consumption per property figure of 365litres/day…*" This implies that the 204.7Mld is the *total* leakage (distribution side and customer side) which is *wrong*. The 204.7Mld is just the unaccounted for water ("UFW" i.e. distribution-side leakage) - it does not include customer side leakage, as the statement in appendix A suggests. **Can you please confirm what levels of customer side leakage (additional to the 204.7Mld of UFW) are in fact currently being assumed in your analysis?**

Regarding the soundbite that 40% of the state will benefit from the Shannon pipeline: the 40% figure as used in relation to the previous benefit corridor notion was *factually incorrect* - it included the *total* populations of the *entire* counties in which some supply schemes might benefit as opposed to the number of people within those counties who would *actually* benefit. **Please can you explain the** maths **underlying your latest 40% claim?**

The notion of consolidation of WTPs, as conceived by the Water Services Strategic Plan, is a much more logical one that that proposed in the previous incarnation of "benefit corridor". However, quite why the Water Supply Project has a bearing on whether consolidation of existing disparate WTPs can take place is not clear. The concepts appear to be wholly independent of one another. **Can you explain why the contemplated consolidation could not happen in the absence of the Water Supply Project?**

Thank you in advance

Emma Kennedy

APPENDIX 7b
Final Options Appraisal Report Submission

Irish Water's November 2016 Final Options Appraisal Report contained **yet more errors and use of incorrect data**. See below a submission sent by Emma Kennedy to Irish Water in this regard on 25 November 2016. **Irish Water has provided no response to this submission**.

25 November 2016

Dear Mr Geoghegan,

In the recently released Final Options Appraisal Report ("*FOAR*") you discard the previous method for calculating predicted domestic demand (as used in the 2015 Project Need Report ("*PNR*")) and instead adopt a new approach. You state that your new approach to domestic demand is based on interim changes that need to be taken into account, which naturally makes sense. However, notwithstanding that domestic demand is the most significant proportion of your predicted 2050 demand, the details of your new analysis in the FOAR are scant to non-existent. They should be comparable at least to the level of detail provided in the Need Report for the previous approach. One thing that is, however, clear is that you have *not* taken account of the facts made clear by the recent results of the First Fix scheme ("*FF*"): that current (i.e. 2011) CSL water loss is much higher than stated in the PNR and that reducing it is much easier and cheaper than predicted in the PNR. Future water recovered for Dubliners' use through addressing CSL will be much higher than the PNR predicted. Full details on this are below.

The only significant methodology changes on domestic demand that you have spelled out in the FOAR are (1) you now use a "per connection" consumption figure which includes customer side leakage ("*CSL*") as opposed to the previously used "per capita consumption" ("*PCC*") with CSL being accounted for separately, and (2) your predicted occupancy rate has been increased from 2.00 to 2.20. However, additional changes to your approach beyond these two must have been adopted, as the 2050 demand prediction is otherwise anomalous.

The new FOAR approach predicts a 2050 domestic demand **23mld higher** than was predicted in the Need Report and I can not understand how this can reflect reality given (1) the FOAR base case 2011 figure for domestic demand is **15mld below** the PNR base case 2011 domestic demand figure, (2) the FOAR domestic demand prediction is based on *fewer* predicted 2050 households than were predicted in the PNR - this should bring the new predicted 2050 domestic demand down, not push it up, (3) even the PCC figure of 125.5 litres/day that you were using in the PNR was already well above the true average of PCC as found in your own meter collection data studies, and (4) FF is already showing far better results at recovering water through fixing CSL than the Need Report had predicted and it shows that future CSL savings will be considerably higher than the PNR assumed which should also push the new predicted domestic demand (which now incorporates CSL) down and not up.

All of the above would suggest that your 2050 prediction for domestic demand (as updated for interim developments) should have gone *down*, and yet it has gone *up*. I do not understand how this is possible, so I need to understand the components behind it.

Please respond to the following specific questions – it would be helpful if you would respond to them with reference to the question number:
1. Using your new FOAR approach (as opposed to the PNR approach) the FOAR current (2011) domestic demand figure is 15ml/d *below* the PNR equivalent, but when extrapolated forward to 2050 the new FOAR domestic demand figures at some point overtake the PNR figures and by 2050 the FOAR domestic demand is 23ml/d *above* the PNR equivalent. **How is this possible given the points I make above - what assumptions are you using that are so different to those that were used in the PNR? The FOAR suggests (see below) that you are not assuming any further CSL water recovery beyond that shown in the Q1 2016 FF results – is this correct? What impacts of conservation, introduction of metering, declining occupancy rates and new housing stock are you assuming? Please provide the detail.**

2. **How did you calculate the predicted 2050 number of households?** Dividing your predicted population of 2,154,252 by your predicted occupancy rate of 2.20 produces a predicted total of 979,205 which is 48,960 below your total household number – you say that this "includes properties not permanently occupied" – **how many of these are there? How does this fit with the "consumption per connection" figure – did that also include non-permanently occupied properties (see above)?**

3. **What are you basing this 365 l/d "per connection" consumption figure on?** The detail is not provided in the FOAR – in particular,

(a) in your submission to the CER on First Fix in 2015 Irish Water stated "*based on meter consumption data, IW estimates average household consumption at **300** litres per day*". Now you state that it is 65l/d higher than that, at **365** litres per day. What has changed since your submission to the CER which you stated was based on meter consumption data?
(b) how did your meter consumption data deal with apartment blocks - was a block of apartments treated as one "connection" or multiple?
(c) how did you deal with houses that are not permanently occupied – are they included in or excluded from the data?
(d) in terms of CSL, how is this new data different from the previous data (as used in the PNR) which was also received from newly installed meters – presumably the previous data received from meters at that point also included CSL but you did some sort of calculation to estimate it and carve it out, or am I missing something here?

4. **How did you calculate the new predicted 2.20 occupancy rate?** I had significant reservations about your previous 2050 prediction of 2.00 (as used in the Need Report) – I was also not comfortable with your comparison in the PNR of Ireland to Germany and Denmark (when, at the time, Ireland had the second *highest* occupancy rate of the EU states compared to Germany and Denmark who were the *lowest and the second lowest*). Please provide the details of this latest occupancy rate analysis.

5. **On customer side leakage**: in the FOAR you refer to the results of the First Fix scheme ("*FF*") which have indeed been extraordinarily impressive. In the FOAR you have taken account of FF results up to Q1 2016; the Q2 2016 results are also now available and I refer to these below.

You state, correctly, that ***in just over 1 year the First Fix scheme recovered more water through addressing CSL than Irish Water predicted would take almost 20 years of very best efforts to achieve***. You state that by Q1 2016 20.7Mld of water had been recovered through the scheme; by Q2 2016 this had increased yet further to 27.4Mld.

The FF results to date establish beyond question that base case (i.e. 2011) CSL was much higher than the PNR had stated: the PNR stated that total CSL in Dublin at 2011 was 40.8Mld. In just 18 months (as per the Q2 2016 FF results) FF saved 27.4Mld in Dublin – 67% of what the PNR (incorrectly) purported to be Dublin's *total* CSL.

This huge water recovery was in spite of customer response to the FF scheme being much lower than expected – only 39% of customers have responded to the "constant flow advice letter" that they received (this letter informed them that a "constant flow alarm" linked to their meter indicated that there was a major leak on their property). It is also in spite of the fact that, contra to expectations, it emerged that almost 80% of the leaks that Irish Water were invited to investigate were within the dwellings themselves and as such did not qualify for a free repair under the current terms of the scheme.

As a result of the above factors, **Irish Water has so far only repaired 6% of the major leaks that they now know are out there** (customers have fixed some internal leaks themselves, even though the scheme on its current terms does not incentivise them to do so) – and yet they have already recovered **27.4Mld** of water in Dublin alone. Extrapolating this makes it clear that the amount of water that was being lost through CSL pre-First Fix (i.e. the figure used by Irish Water as their base case 2011 figure in their water demand calculations) must have been significantly above the **40.8Mld** that they used. It is naturally difficult to be completely precise, but **extrapolating this data certainly suggests that 2011 CSL was over 100Mld**.

However, you imply in the FOAR that you do not expect to see much more in the way of CSL water recovery beyond the 20.7Mld recovered at the time of the Q1 2016 report. You state at page 33 of the FOAR: "*the future returns from the scheme will diminish since the larger leaks are prioritized and are resolved earliest, but Irish Water will continue to work with customers to help them to conserve water*" suggesting that from the point of the Q1 2016 results you were assuming very little further water recovery through addressing CSL beyond the 20.7Mld referred to in the FOAR.

This position taken in the FOAR simply does not reflect the new reality as proven by the FF scheme. It ignores the further savings now seen since the Q1 2016 results and, more importantly, it ignores the huge potential for further water recovery through addressing CSL in the next few years. If FF continues on its current trajectory (without an improvement in the rate of customer responses and without any changes to its terms) it looks set to taper off at a savings level of between 35Mld and 40Mld for the Dublin area (see the chart at Figure A below). This notwithstanding (a) the unexpectedly low customer response rates to FF and (b) the fact that, on its current terms, only 22% of the identified leaks qualified for a free repair.

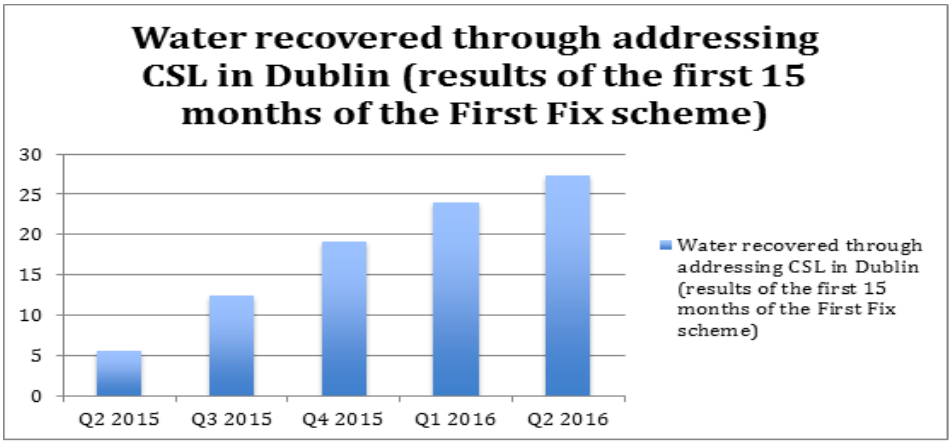


Figure A

Irish Water stated in the FF Q2 2016 results that they are working to improve customer awareness of the scheme through SMS/phone call/media campaigns and that "*it is anticipated that as more members of the public become familiar with the scheme and develop an understanding of their water consumption, these response rates will increase*". This may improve customer response rates and result in an acceleration of water recovery under the existing scheme, but in any event there is a very strong case for a new incarnation of the First Fix scheme. The conditions to qualify for a free repair need to be re-assessed in light of the results, perhaps more incentives need to be introduced to encourage customers to participate in the scheme or to repair leaks identified within dwellings themselves, and perhaps the marketing needs to be changed. **However, now that we know as a matter of fact that far larger volumes of water are going into the ground on the customer side of the Dublin water network than ever believed, and that recovering that water is much less expensive than thought it is vital that a sharp focus is put on the best methods to recover as much of this water as possible for Dubliners' use.**

Irish Water had predicted (in their submission to the CER in 2015) that by Q2 2016 they would have repaired 27% of the major leaks identified through FF - in fact, as mentioned above: **Irish Water have so far only repaired 6% of the major leaks identified through the First Fix scheme. They know exactly where a lot of major leaks are, and a huge proportion of them have NOT so far been fixed, so there should still be extremely significant water savings available.**

First Fix has also demonstrated that reducing CSL is far cheaper than predicted. It is running at around 1/3 of predicted budget – the scheme was forecast to have cost EUR40m to this point but in fact has only cost EUR16m for country-wide savings of 65Mld - so saving water through fixing CSL is proving to be extremely inexpensive.

In summary: before meters were installed it was very difficult to know the true leakage rates in Dublin. The Q2 2016 results of the First Fix scheme show us that much more water was being lost through leakage on the customer side of the network than was ever imagined, and certainly much more than Irish Water have assumed in their calculations for this project. This is actually excellent news because First Fix has shown that recovering this CSL water is easy and cheap (and certainly much easier than addressing leakage on the distribution side of the network, which we now know must be much lower than previously thought as a corollary to CSL being higher). This all tells us that, provided Irish Water continue to focus on recovering water currently being lost through CSL (for example by extending the duration of, and broadening the terms of, the First Fix scheme), then within the next few years the absolute volume of treated water that will flow to the taps in Dublin, rather than into the ground, is a significant proportion of the predicted 2050 water deficit.

Bearing in mind my points above, and the implication in the FOAR that Irish Water's latest analysis does not assume any further CSL recovery through First Fix or any other incarnation of it beyond Q1 2016, **please confirm that you will now (a) significantly increase your 2011 base case CSL assumption (as stated above, it is difficult to see how this could be below 100Mld), (2) reduce "unaccounted for water" ("UFW") as a corollary, (3) reduce your forward-looking CSL predictions by the additional 6.7Mld of water that we already know has been recovered through FF (as per the Q2 2016 results), and (4) further significantly reduce your forward-looking predictions of water lost through CSL by an appropriate amount, taking into account the enormous success of FF and the anticipated future water recovery through addressing CSL going forward.**

6. As a corollary to the fact that current CSL is much higher than the Need Report was assuming, the assumed current unaccounted for water ("*UFW*") (i.e. leakage on the distribution side of the network, which is calculated simply as the balance between the water that is put into the system and "accounted for water") will obviously need to be reduced. This is obviously excellent news since UFW is more complicated and more expensive to recover than CSL due to the need to close roads etc.

Thank you in advance for your responses to these points.

APPENDIX 8

Dublin's third-world leakage rates and Irish Water's unambitious leakage reduction targets

For full details on the below click here for the Kennedy Analysis on Dublin's Leakage or find it at www.kennedyanalysis.com

(A) Dublin's problem is not a lack of water: Dublin's problem is that most of the water put into its supply system pours straight through holes in its ancient, corroded pipes into the ground and never reaches Dubliners' taps

The Project Need Report assumed leakage in Dublin of 33%: it has since emerged that Dublin's total leakage is almost certainly at least 57%. So ***more than half* of the precious *treated* water put into Dublin's water supply system pours through holes in its ancient, corroding pipes straight into the ground and never reaches the taps**. Dublin's water pipes are so full of holes that when water pressure is low there is a danger of *contaminated* groundwater leaking from the water-logged ground around the pipes back *into* the pipes carrying "*clean*" water to Dubliners' taps. This requires extra disinfection before it is put *into* the supply system to counteract the **risk to public health**. Further, the state of Dublin's water pipes is such that **major water outages and flooding incidents caused by burst water mains are inevitable** as pressure is normalised**.**

Dublin's 57% leakage levels are far from normal or acceptable. The OECD carried out a study in 2016 observing leakage levels in cities across the world. **Only 4 cities had leakage levels over 40%: all of them were in Mexico** (Dublin did not take part in the study). Earlier in the life of the Shannon project Dublin City Council presented water analysis for 6 comparable countries/cities including their leakage rates. They found that the leakage levels for the countries that they selected were:

Country/city	**Approximate leakage rate**
Denmark	**6%**
The Netherlands	**6%**
Germany	**7%**
Sydney, Australia	**8.5%**
Lithuania	**15%** (in 2000)
United Kingdom	**23%**

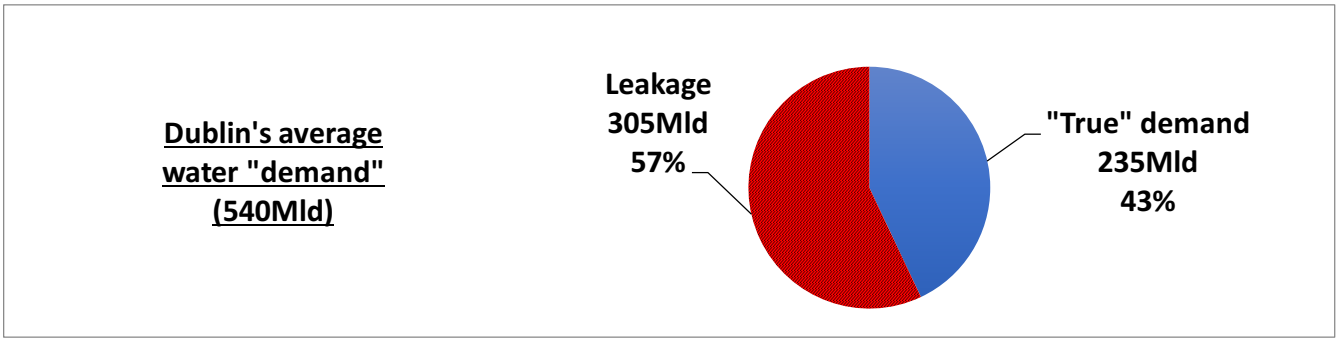
Irish Water's default comparison city when it comes to leakage tends to be London. It is important to observe that *London is one of the worst leakage performers among developed world cities* – indeed **Thames Water (London's water provider) was fined by its regulator yet again in July 2017 for "*unacceptable*" leaks**. Leakage levels in the UK in 2012 ranged **from 14% to 27%** depending on the region **- well under half of that in Dublin**.

It is neither normal nor acceptable or a developed world city that is attempting to attract inward investment to have an ancient, corroded water pipe network with such high leakage levels and such a high risk of mains bursts and water outages.

(B) Leakage in Dublin is so extreme that it makes up by far the biggest portion of Dublin's "demand"

"Demand" (as the term is used by Irish Water) includes **"true" demand** (i.e. water actually *used* by domestic and business consumers) and **"leakage" demand** (i.e. water that is put into the supply system but leaks out of the pipes into the ground before it reaches the taps).

Dublin's "true" demand amounts to well under 50% of what Irish Water terms "demand". **Dubliners only actually use around 43% of the water put into the water supply system every day, as can be seen in the following chart.**



(C) Irish Water's leakage reduction targets are unambitious and inadequate

Irish Water continues to propagate the false claim that its leakage targets are "ambitious". It claims that it is targeting a reduction in leakage from 38% to 20% which target is, it claims, "*in line with those set for the majority of water utilities in the UK….. for the past 25 years UK water companies have been targeting a 20% leakage rate and are only now beginning to see leakage rates in the low to mid 20%*". **This statement does indeed make its leakage targets appear ambitious: however, the statement is wholly invalid and highly misleading.**

Leakage within a water supply network is split into (i) **distribution side leakage** (also known as unaccounted for water, UFW) and (ii) **customer side leakage**. Leakage in the UK is reported as **"total leakage"** being distribution side leakage ***plus*** *"supply pipe losses from consumers' pipes"*[19]. By contrast, the figures that Irish Water cites for Dublin are **distribution side leakage figures *only*** – they do not include any of the water pouring into the ground on the *customer side* of the network. Dublin's distribution side leakage was **38%** but its customer side leakage was almost certainly at least **19%** - its **TOTAL leakage is therefore almost certainly at least 57% - not 38%. Irish Water is comparing London's "total" leakage with Dublin's distribution-side-leakage alone, which is mathematically and logically invalid.**

What is more, its 20% target for distribution side leakage is itself *highly misleading*. This 20% "target" is the targeted volume of distribution side leakage ***expressed as a percentage of Irish Water's predicted 2050 average demand*** **(which figure is highly uncertain and is already *known* to have been *overstated* due to Irish Water's accidental use of the wrong data on non-domestic demand)**. Naturally, when expressing leakage *as a percentage* of predicted demand, the *bigger* that predicted demand figure is then the *smaller* leakage appears *as a percentage of it*. When that predicted demand figure is extremely *uncertain* (as is the case here) and is *already known to be overstated* (as is the case here) then expressing a predicted figure for leakage as a percentage of that predicted figure for demand is **valueless**. The only measure of Irish Water's target leakage reduction that is *not* impacted by the uncertainty of predicted data 33 years into the future is a measure of the targeted **reduction of the absolute volume of water being lost through leaks***,* i.e. *comparing the absolute volume of water (in Mld) being lost from the system today with the absolute volume of water (in Mld) that Irish Water target will be lost from the system in 2050*. **On this measure, Irish Water's targets are extremely unambitious when compared with recent leakage reduction achievements in the UK and elsewhere.**

Irish Water aims to reduce Dublin's *absolute volume of leakage* from 245.5Mld in 2011 to 170.4Mld in 2050 - i.e. a reduction in the absolute volume of leakage of 75.1Mld. To put this in percentage terms, in order to compare with reductions elsewhere, **Irish Water aims to reduce Dublin's leakage by 31% in 39 years**. This target is far from "ambitious" when compared with recent reductions in leakage achieved in the UK (*Sources: Thames Water and Scottish Water*) and across the EU (as cited in the 2015 EU Reference Document "*Good Practices on Leakage Management*"):

- London's leakage was reduced by **30% in only 6 years**
- Scotland's leakage was reduced by **55% in only 10 years**
- Lisbon's (Portugal's capital city) leakage was reduced by **64% in only 8 years**
- Leakage in the Reggio Emilia province in Italy was reduced by **50% in 8 years**
- Malta's leakage was reduced by over **83% in under 20 years**.

The leakage reductions in the UK are even more significant given the fact that they were starting from a base level of leakage *significantly* below that in Dublin. The law of diminishing returns makes clear that **leakage recovery in Dublin should be significantly easier given the very high base from which it is starting** – indeed Irish Water has stated "*It should be noted that finding and repairing leaks is very expensive with ever lower leakage reductions being achieved (for the same expenditure) over time as the situation improves*". On this basis, recovery of water through addressing leaks in Dublin should be significantly cheaper and easier than has been the case in recent efforts in the UK.

It is also worth noting that the analysis for this project has already been **proven** to have contained **very unambitious customer side leakage targets**: see **Appendix 3c** above - the analysis assumed that **only 11Mld of water would have been recovered after 39 years** of repairing customer side leakage **-** this has already been **proven** by the First Fix results to have been **significantly underestimated**: **at least 38Mld of water was recovered in the *first 18 months alone*.**

(D) Short-sighted failure to repair and replace water mains has led to burst mains and major water outage/flooding incidents

Irish Water's own press releases show that even after a "major" mains replacement project was launched in 2007 **only 140km of Dublin's mains were replaced in 6 years**. By contrast, Thames Water replaced **1,868km of mains in 4 years in London alone**. This was an average mains replacement of 467km per year in London versus 23km per year in Dublin (where the leakage

[19] "*In England and Wales, leakage is treated water lost from the distribution system. It includes water lost from the companies' distribution networks and supply pipe losses from consumers' pipes.*" (Source: OFWAT)

problem was far more extreme). **London replaced its mains at a rate 2,000% faster than that in Dublin** despite the fact that London's leakage rates were *less than half* those in Dublin.

Irish Water has confirmed that over the past ten years only around EUR100million has been spent on addressing leaks *NATIONALLY*. This is an average spend of **only EUR 10million per year on fixing leaks for the entire country (not for Dublin alone)** which is a shockingly low figure given the scale of the problem - it equates to **only 0.8% of the projected EUR1.2billion cost of the Shannon project.** Irish Water's press releases reveal the inadequate mains replacement programmes that Irish Water has undertaken in towns and cities across the country in the past couple of years, spending comparably tiny amounts of money on a problem that demands a truly significant financial investment: only **EUR 6.6million** for the "mains rehabilitation" programme in Limerick City, **EUR 4.1million** for Tullamore Town, **EUR 2.86million** for Mullingar, **EUR 15.8million** for Cork City – **compare these figures to EUR 1.2*billion* (twelve thousand million Euros) that will be spent on the Shannon pipeline – a pipeline that would not be needed at all if an appropriate proportion of water mains were replaced**.

The state of the water pipes in Dublin (along with the rest of the country) means that **major water outages and flooding incidents caused by burst water mains are a certainty** as pressure in the water supply system is normalised. What is more, the extreme extent of the corrosion to the pipes means that **repairing those bursts is extra complicated and takes far longer than it should** - after the recent mains burst in Louth/Meath Irish Water's own press release stated: ***"three attempts to fix the 50 year old pipe failed over last weekend as the corrosion and warping of the pipe meant that any available standard fittings were not sufficient. A bespoke piece of pipe and fittings were manufactured in Belfast".***

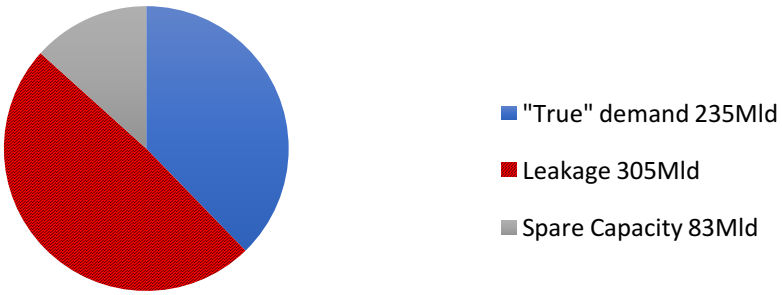
Allowing Ireland's water pipes to have reached such an extreme state of disrepair is a shocking failure which Irish Water remains unwilling to appropriately address.

(E) Dublin's spare capacity is not constrained by insufficient water but rather by Dublin's leakage levels

Spare capacity is the difference between the amount of water *available* for supply at Dublin's water treatment plants and the amount of water that those plants actually put into the supply system every day. As leakage is reduced within a water supply system so "spare capacity" is increased. For example, Paris is often cited as a city with a very large spare capacity in its water supply, but it is vital to note that Paris has very low leakage rates of around 5%: **if Dublin's leakage rates in 2015 had been 5% (as in Paris) it would have had 152% spare capacity. Even if Dublin's leakage in 2015 had been 20% (which is *well above* that in other comparable EU cities – and even in the UK, the "total leakage" rate for water suppliers in 2012 ranged from 14% to 27% with an average of 20%[20]) then Dublin would have had 112% spare capacity which is ABSOLUTELY ENORMOUS.**

The chart below shows the amount of water that was *available* for supply in Dublin in 2015 (623Mld) and how that available water was split between **"true" demand** (i.e. water actually *used* by domestic and commercial consumers on the average day), **leakage** (i.e. the amount of water that *poured out of the pipes into the ground* on the average day) and **spare capacity** (i.e. the amount of "spare" water that was available at the water treatment plants) – it is easy to see that as leakage decreases spare capacity increases.

Dublin's water available for supply, 2015: 623Mld
(source: Project Need Report)



[20] Source: Irish Water Final Options Appraisal Report Appendix J, "*Preliminary Options Appraisal - Consultation Submissions Report*", page 35.

Irish Water's messaging about Dublin's spare capacity is inaccurate and highly inconsistent:
(1) According to the data in the Project Need Report (**March 2015**) Dublin had **over 15% spare capacity**[21].

(2) Four months later, a **10 July 2015** press release cited Jerry Grant as follows: "*Currently in Dublin, water supply is operating with spare capacity of **around 10%***".

(3) Irish Water's business plan published **three months later** in **October 2015** stated: "*there is **less than 2%** spare drinking water capacity in Dublin*". This was unquestionably FALSE.

(4) Seven months later Minister Simon Coveney stated in a Dail debate on **24 May 2016**: " *Since Irish Water became the national water utility in January 2014, it has made significant progress in addressing some of the problems... **Dublin's spare water capacity has increased from 1%-4% to 10%** which is a welcome move towards the 15% target of Irish Water*."

(5) In a presentation to the Joint Oireachtas Committee on **12 January 2017** Jerry Grant, together with the Group CEO and Group FD of Ervia, stated that the spare capacity in Dublin at the end of 2016 was **10%**.

(6) **One month later**, on **15 February 2017**, Jerry Grant told a Joint Committee meeting that Dublin's spare capacity was "**about 8%**". He did not mention that Dublin's water supply was already set to increase by a further 6% (from 623Mld (2015) to 658Mld (2026)) through *ongoing* projects.

(7) A **July 2017** Irish Times article citing "*a slew of statistics from Irish Water seen by the Irish Times*" was *still* incorrectly reporting that Dublin has a spare capacity of **only 2%**, reflecting Irish Water's false and inconsistent statements on this "headline issue".

Each of these highly inconsistent statements about Dublin's spare capacity avoids the key point: the single key issue limiting Dublin's spare capacity and undermining Dublin's water supply system is the fact that most of the water put into Dublin's water supply system flows through holes in its ancient, corroded pipes directly into the ground instead of reaching Dubliners' taps. If Dublin had "normal" leakage levels it would have an absolutely enormous spare capacity and a highly resilient water supply system relying only on its existing raw water sources.

[21] Being 83Mld (the spare water available over average demand of 540Mld) expressed as a percentage of the average distribution input/average demand, amounting to 15.4%.

APPENDIX 9a

Irish Water's written response backtracked on matters that it had conceded during our meeting on 16 February 2017

(1) Non-domestic demand data

During our meeting we discussed the data used in Irish Water's non-domestic demand analysis. Mick Garrick of Jacobs Tobin eventually **confirmed** that the data adopted for non-domestic demand was indeed Jacobs Tobin's data and *not* Indecon's data. **This took place in front of 8 other attendees at the meeting**, yet Irish Water's response stated "*Irish Water do not accept this observation…. There is not an 'accidental' adopting of one over the other*". It is demonstrably and indisputably the case that Irish Water adopted the wrong set of data for non-domestic demand: **see Appendix 3b** which sets out (i) Indecon's data for NDD, (ii) Jacobs Tobin's data for NDD, and (iii) the data adopted by Irish Water for NDD. **Anyone can easily observe that Irish Water adopted Jacobs Tobin's data for NDD in *direct contradiction* to Irish Water's repeated claims.**

This unsubstantiated statement in Irish Water's response is a denial of the most undeniable of errors. Unless one assumes that it *deliberately* adopted the wrong set of data (as opposed to doing so accidentally) then **Irish Water's position on this is simply untrue which raises questions about its approach to this engagement.**

(2) Irish Water's false claim that previous water outages in Dublin cost the economy EUR78million per day

Another key point discussed in our meeting that **Irish Water failed to address in its response** is in relation to its **ongoing false statement that past outages in Dublin have cost the economy an average of EUR78million per day**. During our meeting Alan Gray of Indecon **confirmed** that Indecon's report had *not even purported to make any analysis of the cost of past water outages* – Irish Water is citing the Indecon analysis and this wholly inappropriate figure out of context.

Alan Gray's confirmation is at odds with Irish Water's repeated public statements. More shockingly, **Irish Water's public statements *SINCE OUR MEETING* continue to propagate THE SAME FALSE MESSAGE even though IT WAS CONFIRMED TO IRISH WATER IN EMMA KENNEDY'S PRESENCE THAT IT IS INCORRECT.** Irish Water must stop deliberately misleading the public and politicians by using that figure out of its correct context to attempt to justify this project.

If Irish Water's EUR78million statement were true (which it is not) then **the Louth/Meath water mains burst that occurred in July of this year would have cost the Irish economy over half a *billion* Euros (EUR 546,000,000).** Clearly, that mains burst was very disruptive and the length of time that it took to repair it was unacceptable in a developed world city, but **its cost to the Irish economy was certainly nothing of the magnitude of half a billion Euros.**

(3) Irish Water's inexplicable adoption of a non-standard 35-year projection window

It is international best practice to adopt a **25-year time frame** for the projection of future water demand. The projection window originally adopted for this project under the remit of Dublin City Council was 25 years, and Irish Water's other strategic state-wide water projects (e.g. its major "25-year Strategic Plan") use a 25-year time frame. The 35-year timeframe that Irish Water has adopted for the Shannon Project analysis produces highly uncertain results and, due to its very aggressive assumptions, it **produces a much larger projected "water deficit" for 2050 than it does for 2040** (2040 would have been the end date of the analysis had Irish Water used a standard 25-year time frame). **At our meeting, Irish Water was unable to explain the reason that it had adopted a 35-year time frame for its latest analysis: the project team said that it would address this point in its response, but it has not done so.**

(4) False statement about Dublin's future water demand

During our meeting, **the Irish Water team remained unable to validly defend the statement** that was very widely disseminated by Irish Water in 2015 that **"*the [Project Need Report] identifies that projected demand for water in Dublin alone is expected to increase by over 50% by 2050*"**. The statement was extremely specific, it was the principal message contained in those letters/press releases and it became headline news. However, **it was FALSE: it over-stated the predicted increase in Dublin's water demand (as calculated in Irish Water's own report) by more than 60%**. For details of this, see **Appendix 2**.

Irish Water's attempt to justify this statement in its latest response is, yet again, a fudge. It compares apples and pears to arrive at a figure that, Irish Water says, "*is approximately 50%"* (it compares a future "requirement" to the current "WAFU" – neither of these is the same as "demand"; "demand" is a specific measure that is clearly identified in the Project Need Report, as explicitly spelled out in the Kennedy Response in relation to this point). **Yet again, this refusal to acknowledge even the most undeniable of errors speaks volumes about Irish Water's approach to any challenge regarding the need for this project.**

(5) Irish Water's own First Fix results prove that the leakage data used in its analysis for the Shannon Project was WRONG

Irish Water's own First Fix results *prove* that the customer side leakage data used in its analysis for the Shannon project was wrong, yet **Irish Water still refuses to concede this indisputable point** and **Irish Water's response did not even attempt to address the maths set out in the Kennedy Analysis.** For details of the First Fix results, see **Appendix 3c**.

APPENDIX 9b

Irish Water's written response failed to address key points made in the Kennedy Analysis

(1) Irish Water's analysis accounted for outage on both sides of the supply:demand equation: this is double counting

The Kennedy Response spelled this out in considerable detail with reference to Irish Water's documents. Irish Water's response: it "*does not accept the observation*" and states that it has used "*established methods/"best practice*". **Irish Water gives itself a clean bill of health without addressing a single one of the issues that the Kennedy Response spelled out.** Instead, Irish Water simply stated: "*the methodology used by Irish Water is in line with international best practice for water resource planning. Irish Water confirms that headroom, peaking and outage allowances are used appropriately in accordance with this methodology*". **This response is wholly inadequate: stating "*we do not accept this observation*" does not change the fact that the observation is accurate; simply stating that its own analysis is correct does not make it so.**

(2) Irish Water's response entirely avoids the case made in the Kennedy Response for a discussion to take place with ESB to seek the flexibility to occasionally call on small volumes of water from the Pollaphuca reservoir to meet peaks in demand – this **reflects the approach adopted in London**, where "peaking" is not added to the "demand" calculation because "*peak demands in London can be met through the relatively large volume of surface storage (reservoirs). The ability to meet peak demands is therefore not a resource availability issue….but dictated by treatment and transmission capabilities"* (source: Thames Water). A short term, occasional over-drawing at Pollaphuca to meet "peaking" would be offset by under-drawings in the subsequent window of time, thus having **no impact on the ongoing water levels at Pollaphuca or on the amount of water being extracted from the Liffey**. Irish Water has previously stated that ESB's consent to this "*is not considered likely*", however the Kennedy Response pointed out that Irish Water's own adviser has stated that "*ESB now effectively manage the resource in response to the requirements of water supply, generating power opportunistically as they do so*". **The case for a discussion with ESB is extremely strong given the enormous cost of proceeding with this project, a major justification for which is the newly adopted 35% safety buffer that will almost certainly *never* be fully called upon**.

(3) This twenty-year project has a proven history of significantly over-estimating water demand – yet Irish Water's latest method for projecting Dublin's future water demand is *even more aggressive* than those used in the past

Full details of this are spelled out in part B(2) of the Kennedy Response and a summary is contained at **Appendix 4** to this Kennedy Analysis Overview. **Irish Water's latest response failed to address any of the facts** spelled out in the Kennedy Response to establish the point. Instead, Irish Water's response simply stated "*Irish Water do not accept the observation*" and stated that the issue was covered in section 4 of its response, **which it was not** (no further mention was made of the issue).

(4) Irish Water's response fails yet again to address the black and white errors made in Irish Water's groundwater analysis

The Kennedy Response spelled out in significant technical detail (over *11 pages*) the mathematical and logical errors contained in the original 2008 groundwater report and in Irish Water's 2015 review of it. **See Appendix 6** for a brief overview of those many errors, which **Irish Water's response yet again failed to address**.

(5) Irish Water's response failed to address any of the errors identified in our submission regarding the newly conceived "benefit corridor"

Irish Water's Final Options Appraisal Report introduced an entirely new concept for the "benefit corridor" but provided almost no detail or underlying analysis. We sent a detailed submission to Irish Water in this regard on 10 February 2017. Among our concerns was yet more apparently **incorrect maths**. Irish Water committed to respond to the points raised in that submission, yet **Irish Water's response still does not address a single one of our points**. Our 10 February 2017 submission is attached to this Kennedy Analysis Overview at **Appendix 7a**.

(6) Irish Water's response failed to address any of the errors identified in our "Final Options Appraisal Report" submission

Irish Water's November 2016 Final Options Appraisal Report contained **yet more errors and use of incorrect data**. We sent a detailed submission to Irish Water in this regard on 25 November 2016. Irish Water committed to respond to the points raised in that submission, yet **Irish Water's response still does not address a single one of our points**. Our 25 November 2016 submission is attached to this Kennedy Analysis Overview at **Appendix 7b**.

(7) On population growth

The Kennedy Analysis has never purported to make any predictions about Dublin's population growth. Rather, it points out that **Eurostat (which is a highly reputable statistics body) projects considerably slower population growth than that assumed in Irish Water's analysis**. It is impossible to know whether Irish Water's projections or Eurostat's projections will be closer to the truth but the significant difference in their projections underlines, yet again, the **aggressive nature of Irish Water's assumptions** and the **significant risk that this presents in an "all of nothing" project like the Shannon Project**. The Shannon Project will cost the best part of EUR1.2billion regardless of whether, in the end, it needs to supply Dublin with 215Mld of water, 50Mld of water or indeed no water at all. There is almost no scope for phasing of investment expenditure or bringing the project online in increments. A combination of smaller alternatives that could be brought online incrementally if and when "need" is actually demonstrated is a far more logical solution - but one that Irish Water did not properly consider in its analysis.

APPENDIX 9c

Many of the points made in Irish Water's written response are simply wrong, make no sense or contain yet more basic errors

(1) The First Fix results prove that:
(a) far more water was being lost through customer side leakage than Irish Water's analysis assumed, so **far more water can be *recovered* through *fixing* customer side leakage** (and will become available at Dubliners' taps instead of disappearing into the ground) than Irish Water accounted for in its "need" analysis, and
(b) recovering water through leakage repair is **far cheaper** than Irish Water had factored into its analysis.

Irish Water's response attempts to **dismiss** the fact that First Fix has recovered these huge volumes of water by stating that these savings have not resulted in a reduction in Irish Water's *distribution input* (i.e. the volume of water that the water treatment plants need to put into the water supply system every day). Irish Water suggests that Dublin's extreme levels of leakage and abnormally low water pressure means that these CSL savings are somehow being "lost" in the system. For example, Irish Water points out that CSL savings increase the water pressure in the supply system and, as a result, (i) *even more* water pours *out* of the holes in the distribution pipes than was pouring out when the water pressure in the supply system was lower, and (ii) "true" demand increases because water comes out of customer taps at a faster rate. **On this basis, Irish Water suggests that its analysis should take *no account at all* of the huge, proven water savings achieved through the First Fix scheme.**

This is invalid. For the purposes of the *analysis* it is *irrelevant* if the customer side leakage savings are not being translated into a reduction of distribution input. If, as a matter of fact, customer side leakage has been or will be reduced then *the data in the analysis needs to reflect that somewhere – it cannot simply be ignored*. If, as a corollary, this *reduction* in customer side leakage also causes a knock-on *increase* in distribution side leakage (known as unaccounted for water or UFW) then naturally the *UFW* data must also reflect that. Similarly, if it causes a knock-on increase in "true" demand then, again, that should be reflected in the *domestic demand* data in the analysis. However, **failing to account for it *at all* is invalid**.

Irish Water's suggestion that the enormous reduction in CSL should not be accounted for in its analysis is invalid and, yet again, betrays what appears to be a disconnect between those working at the coal-face (who are having to provide data for the analysis) and those actually *producing* the analysis. It also highlights the folly of pumping more and more water into one end of a supply system that is cripplingly compromised due to ancient, corroded water pipes.

(2) The Kennedy Response identified that Irish Water had used out-dated, over-inflated figures in its analysis of the cost of fixing leaks: Irish Water's response confirmed that *it had indeed* used cost data from *prior to* the installation of meters across the network, at a time when fixing leaks was far more complicated and expensive. **This is wholly inappropriate: fixing leaks (on both the customer-side and the distribution-side of the network) is far less complicated and far cheaper now that meters have been installed**. Before meters were installed it was almost impossible to know where a distribution-side leak was unless water was actually pouring out of the ground: meters allow leaks to be easily pin-pointed simply by observing the difference in water pressure between two meter points.

Irish Water's analysis assumed that recovering 1Mld of water on the customer-side of the network would cost "***in the order of EUR 0.75million***", but the results of the First Fix Free scheme show that **saving water by fixing customer side leaks has cost an average of just EUR212,000 per 1Mld – this is one third of the amount that Irish Water's analysis assumed and just 5% of the predicted cost of delivering the same volume of water through the Shannon project**.

Irish Water's response suggests that the customer side leakage costs as presented in its First Fix results are not an appropriate reference point because (a) Irish Water has, it states, "*prioritised the notifications, leak investigations and repairs*", and (b) some of the CSL savings have been achieved through *customer* repairs. On (a), its prioritisation system will have had a limited impact given that, at the time of the Q2 2016 First Fix results, **Irish Water itself had only repaired 6% of the major leaks that the scheme had identified** due to a combination of low customer response rates and most identified leaks falling outside the scope of the scheme. On (b), yet again, **the point Irish Water makes in its response is invalid**: clearly leaks *within the dwellings themselves* have been carried out by customers at their own expense because *they are not covered* by the First Fix scheme. **This is normal: water providers generally expect customers to cover the cost of repairing leaks within their own homes.** This does nothing to detract from the fact that the First Fix scheme made the customers *aware* of major leaks in their homes and that those repairs resulted in *real water savings* for Dublin at *no cost* to Irish Water – and *they will continue to do so* as long as an appropriate notification scheme is in place.

(3) Irish Water's response still suggests that Dublin's recent water crises of 2010-2013 were caused by insufficient *raw water* and the state of the *currently existing* infrastructure, which is wholly untrue.
Dublin's water crises were *not* caused by insufficient *raw water* but rather by the fact that its ancient, under-invested water treatment plants had insufficient treatment capacity to *treat* the plentiful raw water that was available. The press releases

issued at the time of those crises stated explicitly that raw water was *not* the cause. Had sufficient treatment capacity been available at the time, relying only on Dublin's then-existing raw water supply, Dublin's water crises would not have occurred.

At the time of the major 2010 water crisis the sustainable water treatment capacity of all of Dublin's water treatment plants was **560Mld** against average demand of **546Mld** – supply was indeed on a knife edge. **Since then, due to massive investments of hundreds of millions of Euros in Dublin's water treatment plants, Dublin's water treatment capacity has been increased by 202Mld** – but Dublin's average water demand has **remained at around 540Mld**. Dublin is in a **very different position today** to that which existed in 2010 yet Irish Water continues to refer to the *existing* infrastructure as the cause of the *past* crises. What is more, the ancient treatment plant at Vartry, which is unable to cope with Vartry's frequent algal blooms, has now received planning permission for a long-overdue upgrade.

Irish Water's response to the Kennedy Analysis even **denies the hard fact** that the water treatment capacity of Dublin's water treatment plants has increased significantly since the 2013 crises. In its latest response, Irish Water responds to this with its standard: "*Irish Water do not accept this observation*" yet this is an undeniable fact as per its own press releases over recent years - indeed elsewhere in the response itself Irish Water makes reference to "*incremental expansions and improvements at existing WTPs over the past 10 years*", contradicting its own earlier denial.

APPENDIX 10

Parallels between the 1970s Kielder project in the UK and the proposed Shannon Project

The following are extracts from *"Spending Money like Water"* by William Charlton, The Spectator, 22 May 1982:

"Wednesday next week the Queen will take part in an opening ceremony for the Kielder Reservoir scheme. 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 Kielder White Elephant, as a recent article in New Scientist called it, is not just a huge artificial lake in the forests of north-west Northumberland. That is only the body of the animal. The trunk, in the form of a gigantic tunnel capable of squirting out water at the rate of 250 million gallons a day, stretches from the Tyne to the Tees****. It is this tunnel-aqueduct, with its attendant pumping stations and pipes, which accounts for the greater part of the £167 million the scheme is admitted to have cost so far****…****In 1967 the authority said Teesside would be out of water by 1974; the chemical and steel industries were going to grind to a halt****. Today there is still a surplus of 20 per cent on Teesside, and no prospect of a shortage anywhere else. The White Elephant will bring resources up to just about double present requirements****….***

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, but mainly on reported verbal assurances by unnamed Teesside employees of ICI and BSC. ICI, though it was to use nearly half of Kielder's water, never appeared at the inquiries, and the witness from BSC, allegedly the next biggest user, did not stay to be cross-questioned, perhaps because the plans on which he based his estimates had not been (and never were) approved by London. Despite the dubious nature of this evidence, neither the inspectors nor the department ever questioned the scale of the need.***

The authority saw the importance of ***public relations*** *from the start. Its first act after deciding on Kielder was to engage the services of a major local advertising agency' The agency did well: its glossy broadsheets distributed free around the North Tye, helped to stifle local opposition, and It always had a director breathing down the necks of the young reporters covering the inquiries for the local press….. The authority bombarded MPs with documents urging them to save Teesside from drought…. The contracts were not let until 1976, nine Years after Mr Cunningham's meetings with ICI.* ***In the interval there had been an oil crisis and a recession, and demand had grown at only a tenth of the rate predicted. Nevertheless there was no way of getting the scheme reconsidered. In the spring of 1976 prominent residents in the North Tyne valley wrote to every MP and council in the North-East, pointing out the lack of need and the likely expense****….".*

Those responsible for approving or rubber-stamping the Shannon project are on notice: the parallels with the Kielder project are stark and alarming. If the Shannon project proceeds and does indeed turn out to be an unnecessary White Elephant, as the Kennedy Analysis indicates is almost certain to be the case, then they must be held to account given the very clear evidence contained in the Kennedy Analysis.