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## Sewage Solutions: Engineering, Politics or Sociology?

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*Over 80 per cent of wastewater is released into the environment without treatment, over 95% in some countries<sup>1</sup>, linked to 3.4 million deaths annually<sup>2,3</sup>.*

*Why is this? Could we start acting more sensibly?*

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### ***Introduction***

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Clean and effective biological methods exist for rendering sewage and other waste water harmless. Proven over decades, they have a small footprint, no smell, and provide nutrients and water for agriculture and vegetation. Implementation of these systems remains an uphill struggle, even where needs are great and alternatives costly or impractical.

Speaking with Jose-Luis Peraza<sup>6</sup>, an expert in the field of biological waste water treatment in Tenerife, it turns out the technical aspects, while complex, are simple compared to political and sociological issues. As so often when dealing with sustainability, the technical solutions are ready.

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### ***A Mini-Primer in Water Treatment***

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Simplified<sup>7</sup> we can differentiate 3 ways of dealing with sewage: "Let it Flow", "Filter, Settle and Kill", and "Biological Cleaning".

"Let It Flow" is older than the road to Rome, wherever villages and cities produce sewage volumes out of proportion with the land available. Rivers and ditches spread biohazard and smell and sometimes move it away, but degradation and making harmless are slow and haphazard. Often rivers, sometimes farms are the end-point.



"Filter, Settle and Kill" is applied in many varieties primarily to deal with the health risk of open sewage, often with some biological degradation as process stage, building on an industrial/chemical approach to problems<sup>8</sup>. To neutralise the biological threat, with epidemics like cholera vastly more lethal than terrorism, bacteriological sterility is paramount while effluent parameters such as environmental harm of residual effluent<sup>10</sup> or sterilising agents<sup>10</sup> are typically ignored.

"Biological Cleaning" has been around literally forever, with serious developments over the last decades including efforts to make harmless any manmade chemicals in the sewage, to make systems with a small physical footprint, no smell and low maintenance which recover nutrients and water for reuse. All of these issues have been resolved: in various places, with various methods. As an example Peraza's biological treatment "facility" in Masca<sup>12</sup>, Tenerife, treats the water of ~200 inhabitants, 7 restaurants and an average of 3000 tourists per day, produces clean water<sup>13</sup> and animal feed, feeds into various crops, is a lush part of the valley, has no carbon energy input, all at around 0.2 m<sup>2</sup> per person.

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### *How Are Choices Made?*

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Politicians often favour an industrial approach. On the Canary Islands this results in large smelly industrial sewage treatment sites which often operate inefficiently, are highly secretive (3 months' notice for a visit is typical), have been shown to dispose of poorly treated effluent into the environment and have little access for independent inspection and public scrutiny.

The preference for an industrial approach is partly because the bigger the bill, the more of the budget spend can be delegated<sup>14</sup>. Partly it is because the more established the company doing the work, the more established the kick-back system. Partly it is because politicians are often poorly informed, and large companies can disseminate "information" more easily than small ones or individual experts<sup>14</sup>.

But the most important reason for an "industrial" choice is a lack of connected thinking amongst decision makers which they have in common with most modern management: divide and rule, analyse and specialise, segregate and resolve<sup>19</sup>. If the problem is defined as "sewage not-up-to-specification-for-disposal", the obvious answer is to make the sewage up to disposal specification. Were the challenge described as "remove all hazard and deliver something useful" the solution could look rather different.

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### *Do Alternatives Work?*

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The Canary Islands feature a number of effective (and pretty) bio-treatment installations, many on Tenerife designed by Jose-Luis Peraza over the past 20 years. These installations are low maintenance, produce clean water and vegetation (for cattle), and it is a reluctance to make use of this cattle feed, water and humus that allows it to build up over the years, reducing oxygen ingress and thereby the efficiency of the installations.

While quietly serving the same purpose of sewage treatment -just not advertising it so prominently with stench and concrete, these installations appear so "natural" they're often left to grow wild until,





after some years, they lose effectiveness. By contrast it is accepted to employ staff in a stinking industrial plant to monitor an ineffective process.

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### *Can We Do Better?*

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Choices made for waste water treatment installations are biased towards an industrial approach while alternatives are available offering an effective and better value for environment<sup>20</sup> and people. Yet even when biological solutions are chosen, against bias of corruption, process familiarity and a single-track philosophy, long term benefits suffer from a failure to make use of the free livestock food, organic matter and clean water and so maintain the installations.

A fully integrated approach would work: coupling water cleaning with (cattle) farming, recreational area management, food production, and possibly the production of agricultural supplements. A complicated multi-discipline approach would require a coming together of design, commissioning, short term as well as long term (multi-generational) management including public land use and responsibility over regulation and controls. The sewage treatment works would become an integral part of civil society.

A "free market" alternative could also work under an integrated management contract to ensure the primary function of the installation is maintained. This would allow for water cleaning experts to design and build the installations, farmers to keep farming, park managers to manage the parks, irrigation managers to manage irrigation and supplement dealers to distribute agricultural mineral and organic supplements.

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### *How could this work?*

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The waste problem is here to stay: known solutions must therefore be made to work over multiple generations. The "free market" has shown not to excel at solving problems nor at anything of long term value<sup>21</sup>, and a multi-generational integrated project is quite a challenge.

There is a need to develop autonomous society sections, interested in the long term yet understanding of immediate needs, safeguarding multi-discipline knowledge over multiple generations, helping society feel proud of their achievements, allowing members of the society to make good decisions and perform the effort required.

Perhaps a traditional tribal leadership forum, a band of elders<sup>22</sup>, considering the 7<sup>th</sup> generation for impact<sup>20</sup>, valuing all contributions, and personally experiencing the consequences? A community?

This sounds too much like the past to be acceptable in our neo-liberal world, but perhaps a new applied/academic field called "Applied Engineering Sociology" could design *and implement* social structures which will survive and be supported over generations to come. (They might well start by learning from the past...)

All just so we can make sensible choices, and start making this world a better place, at last.

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## References & Footnotes

1. Wastewater: The Untapped Resource, The United Nations World Water Development Report 2017 [<http://unesdoc.unesco.org/images/0024/002471/247153e.pdf>]
2. UN World Water Development Report 2017 [<http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>] (842,000 deaths estimated in 2012)
3. "About 3.4 million people die each year from diseases associated with pathogens in water, like cholera, typhoid, infectious hepatitis, polio, cryptosporidiosis, ascariasis and diarrheal diseases. Many of these diseases are due to the presence of human waste in water." From UNEP - "Hundreds of Millions Face Health Risk as Water Pollution Rises Across Three Continents", 2016 [<http://www.unep.org/northamerica/news/2016/hundreds-millions-face-health-risk-water-pollution-rises-across-three-continents>]
4. Canarias Sewage Scandal 2017 - A micro-algal bloom triggered investigations, publicly exposing data on non-authorised water disposals, 69% of the island total waste streams. [<http://www.antena3.com/canarias/noticias/ciencia/medioambiente/canarias-tiene-355-vertidos-aguas-residuales-mar-2017091300930.html>]
5. BioMatrix is a company grown out of the Findhorn "life machine", a biological sewage treatment installation in use for over 25 years [<http://www.biomatrixwater.com/>]
6. Jose Luis Peraza is designer, engineer and inventor, and has been developing and designing biological waste water cleaning installations for over 20 years. [<https://www.linkedin.com/in/jos%C3%A9-luis-peraza-cano-3b5ba210b/?ppe=1>]
7. Simplified grouping of methods: The type of waste-water, stability of flow, origins, specific contaminants, and the physical flow system all make a difference. Storm drains or intermittent industrial effluents commingled with sewage place tremendous strains on system efficiencies. All of these can and must be designed out: just like plastics, paper and organic waste are separated before treatment so should categories of waste water in order to achieve effective treatment. For the sake of the political argument, however, this differentiation was deemed unnecessary.
8. "Industrial sewage treatment": Wikipedia has an adequate description of various options, dependencies, and effluents of common sewage treatment. [[https://en.wikipedia.org/wiki/Sewage\\_treatment](https://en.wikipedia.org/wiki/Sewage_treatment)].
9. harm of industrial plant effluents to environment
10. Summary of the recent (2005) EU funded APOP study on UV degradation of residual contaminants including endocrine disruptors. [[http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE03\\_ENV\\_DK\\_00056\\_LAYMAN.pdf](http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE03_ENV_DK_00056_LAYMAN.pdf)]
11. See among many examples e.g. EPA Wastewater Technology fact sheet: "Chlorine Disinfection", 1999, description of "disadvantages" [<https://www3.epa.gov/npdes/pubs/chlo.pdf>];



12. An overview video of the Masca plant may be seen on Youtube "Depuradora de Masca"  
[\[https://youtu.be/HfXCuKNMRok\]](https://youtu.be/HfXCuKNMRok)
13. Due to regulations this may not be officially certified as drinking water, but having seen the analysis and drunk it without immediate harm, I suggest it's fine!
14. Stiglitz, "Globalisation and its Discontents", 2002, which details the preference of organisations like the World Bank for large projects like dams.
15. 2015, Transparency International, "Accountable influence - Bringing lobbying out of the shadows " finds UK Members of Parliament spend ~50% of their meetings with corporate interests, with 80% of their "most frequent visitors" from FTSE100 companies. [\[http://www.transparency.org.uk\]](http://www.transparency.org.uk). The UK government found in 2009 in "Lobbying: Access and influence in Whitehall " a large potential for corruption towards large corporate/financial interests. [\[https://publications.parliament.uk/pa/cm200809/cmselect/cmpublicadm/36/36i.pdf\]](https://publications.parliament.uk/pa/cm200809/cmselect/cmpublicadm/36/36i.pdf)
16. "2017 sewage and waste water census shows hundreds of unauthorized discharges into the sea"  
[\[https://www.janetanscombe.com/news/sewage-wastewater-discharges-tenerife-coast.html\]](https://www.janetanscombe.com/news/sewage-wastewater-discharges-tenerife-coast.html) / Un estudio contradice al Gobierno los vertidos fecales [\[http://www.laopinion.es/tenerife/2017/08/13/estudio-contradice-gobierno-canario-vertidos/800794.html\]](http://www.laopinion.es/tenerife/2017/08/13/estudio-contradice-gobierno-canario-vertidos/800794.html) / El argumento sobre la aparición de las microalgas no convence a los ecologistas [\[http://cadenaser.com/emisora/2017/08/09/radio\\_club\\_tenerife/1502276982\\_296434.html\]](http://cadenaser.com/emisora/2017/08/09/radio_club_tenerife/1502276982_296434.html)
17. It's not just the Canaries: South Africa looked at three plants here:" The effectiveness of sewage treatment processes to remove faecal pathogens and antibiotic residues", R.Hendricks & E.J. Pool, 2011,  
[\[https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293510/pdf/lesa47\\_289.pdf\]](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293510/pdf/lesa47_289.pdf)
18. The scandal –excessive Boron in desalinated drinking water- happened early 2009, yet many people in 2017 still do not drink tapwater in Las Palmas because of this fear. From the immediate aftermath, 2009 " ¿Por qué es tóxico el boro?" [\[http://www.elmundo.es/elmundosalud/2009/04/21/medicina/1240310173.html\]](http://www.elmundo.es/elmundosalud/2009/04/21/medicina/1240310173.html) :
19. An illustrative example of this "decompose the problem" method is the (very adequate) Wikipedia entry on Industrial Wastewater Treatment, which discusses contaminants individually, separating, treating and disposing to account for specific "tolerances" and specifications.  
[\[https://en.wikipedia.org/wiki/Industrial\\_wastewater\\_treatment\]](https://en.wikipedia.org/wiki/Industrial_wastewater_treatment).
20. "Multi-Generational Economics" is a surprisingly little-used phrase. The field of economics uses specific methods for transferring value from the future to today, "discounting" future value – saying that what we do now has more value than what people would do in the future – yet there is no way of transferring externalities from the future which keeps their full impact. The Saudi Arabia resource economics model – no discount applied – would be a start, possibly adding parameters including number of persons affected integrated over unlimited future years, or perhaps restricted to 7 generations (7x30=210years), would go a long way in highlighting if not preventing today's environmental pillage. This would immediately alter overfishing, climate change emissions, plastic pollution and production, consumer electronics design, etc. Some general information can be found under 7<sup>th</sup> generation economics: Economics for the Seventh Generation – Part I  
[\[http://rsfsocialfinance.org/2013/10/30/economics-seventh-generation-part/\]](http://rsfsocialfinance.org/2013/10/30/economics-seventh-generation-part/)
21. ECONOMIST: The rolling over of obligations is a natural pyramid scheme, with attendant risks" Title: How burdens are passed on to the next generation, Sept 2017, [\[https://www.economist.com/news/economics-brief/21727877-final-brief-our-series-big-economic-ideas-looks-costs-and-benefits\]](https://www.economist.com/news/economics-brief/21727877-final-brief-our-series-big-economic-ideas-looks-costs-and-benefits)
22. "The Elders" are an independent group of global leaders working together for peace and human rights; representing an independent voice, not bound by the interests of any nation, government or institution, they are committed to promoting the shared interests of humanity, and the universal human rights we all share.  
[\[http://www.theelders.org/\]](http://www.theelders.org/) While this is a specific group with a specific mission, the principle of respect-based influence is powerful, and the idea that leaders look to resolve humanitarian issues is helpful.