Chapter 7: Pause — For Thought and For Action

We set out in this *Sustainability Concepts Paper* to be deliberately contrarian: *not* to contribute to any further "operational", "quantifiable" definition of sustainability. We wanted to suggest that meaningful forward momentum could still be achieved in the absence of such, in the presence of vagueness. Yet in the so very many pages it has taken for this, doubtless I have been self-contradictory — effortlessly, of course, without trying. In the end, much of this hefty volume of text can be distilled down to an essence — Table 4 — printable on a single page. And that essence looks suspiciously like (yet) another set of criteria or indicators; it is guilty, arguably, of being just another product from the "indicators industry" derided in our opening statements. But is it? Figure 18, from Boulanger's (2008) discussion of sustainable development indicators, would suggest that this *Paper* has been all about "conceptual analysis", with Table 4 edging up towards "identification and selection of variables", but falling well short of the heartland of the indicators industry.

Given the space too, sufficient statements have no doubt been included for every reader to disagree with something, perhaps very strongly so. That is the point, however: to harness contestation — including disputing the fact of our having elaborated a multiplicity of competing schools of engineering thought.

There has been an undeclared theme to this *Concepts Paper*: that of the fluctuating image (if not fortunes) of Engineering for sustainable development, beginning with its descent (as opposed to the image of Ecology, say) in the great sustainability debate of the 1990s. Recounted across Chapter 2, this descent came with an awakening: that environmental engineers working with the water-based paradigm of wastewater infrastructure in cities of the Global North might *not* self-evidently be doing good by the Environment. Yet in the course of Chapters 3.3 and 3.4, in building a response to the challenge and vision of Chapter 2.4 — of cities as forces for good in the environment — we find ourselves at the beginning of Chapter 4 ready to question whether what some perceive as comprehensively a "broken" paradigm, is truly all that "broken".

From this has come the re-ascent of environmental engineering, rehabilitation of its image, and restoration of self-confidence in those who practise it. If they are not self-evidently doing good by the environment, they are at least doing "less bad". Things could be yet better, in fact. For Chapters 3.3 and 3.4 have broadened our horizons, away from the sole motivation of eco-efficiency symbolized in reducing the ecological footprint of the city (and doing ever "less bad" thereby), towards the joint motivations of eco-efficiency *and* eco-effectiveness: doing "good" as well, as in acting as a force for good.

This strategic cycle of descent, re-ascent, and so on, is echoed on a smaller scale, in the inner spaces of some of our discussion. For example, in matters of {economic feasibility} in the Triple Bottom Line (in Chapter 3.2) the reader is deliberately projected up to the heights of grand social programs and equally grand concept — economist Solow's "bequests to future generations" — only to be thrust immediately back down to the blunt depths of pragmatism — engineer Mara's notional, poverty-stricken Indian villager, who is confronted with choosing today between an ecosan toilet and a single-pit pour-flush toilet. These are the intellectual gymnastics of Systems Thinking, as we now well appreciate. They enable the switching, connecting, and creativity in the tension of the close juxtaposition of the expanse of the "global" and the intense intimacy of the "local" and very personal.

We began with a metaphor from Ecology: the large animal (of the city) grazing in its pasture (of the watershed), as announced already in the Introduction (of Chapter 1). The metaphor itself assumed more specific forms, becoming an unappealing "bull" in a "china shop" (Chapter 2.4), slipping into a speeding athlete (across Chapter 3.3), but re-emerging in Chapter 3.4 (and Box 3) as an intelligent bull gifted with deft movement — to epitomize a climax in the unfolding and burgeoning prospects for re-engineering the city's water- and nutrient-return infrastructures. Engineering has much to learn from Ecology, and the Biomedical Sciences as well. How now shall the most basic and deep concepts of sustainability be enlightened by the perspective of Engineering? Box 3 is one engineer's upward riposte to the ecological and

LINE ITEM	TBL_{now}	STEPPING OUT IN PRACTICE ($TBL_{frontier}$)	TBL_{future}
(T0) ORGANIZATIONAL LEARNING		Yarra Valley Water seeks change through organizational learning	"Always Learning, Never Getting It Right"; in pursuit of the self-transforming mind, which "leads to learn"; entertaining self-contradiction, including abandoning a line item, even "sustainability" itself
(T1) Personal Aspirations	Health and hygiene	Sulabh Sanitation & Social Reform Movement elevates women scavengers to the fashion catwalk at UN Headquarters	Towards a well-being sufficient for self-reflexive apprehension of the "big picture"
(T2) Citizen Participation	Individuals empowered to acquire and employ expertise and "know-how"	San Francisco Public Utilities Commission (SFPUC) is accountable to stakeholders from "cradle-to-cradle" in its planning processes	Deliberative democracy
(T3) Social Bonds	"Cultural acceptance", as in adoption of a given style of device or technology	Clean Water Services, Ostara, and the Clean Water Institute have evolved a tripartite, institutional synergy amongst public-, private-, not-for-profit sectors	Benefitting from multiple (four) wisdoms on how to live with one another and nature
(T4) Quality in Governance	Presence of institutional-regulatory framework *per se*	Nepal Water Conservation Foundation is pursuing a clumsy institutional process for restoring the Kathmandu-Bagmati system	Refurbished pluralist democracy of Dahl; adaptive community learning
(T5) Ethics and Equity		Sydney Water employs inter-generational equity as a matter of routine in screening projects	Variety of standpoints on the consequences of inappropriate behavior in man-to-man, man-to-nature, individual-to-group, present-to-future generation, seller-to-buyer, and other relationships
(T6) Valuation	Engineering economics; user/service fees/revenues	Over 300 Water Health Centers signal private-sector business-model success for Water Health International	Plurality of what counts economically; bequests to the future ("final environmental wills and testaments")
(T7) Environment Within the Language of Business	Biodiversity		Natural capital, ecosystem services, and service providers; risks to "business as usual" through loss of biodiversity
(T8) Supply-Value Chains	None beyond "factory (treatment plant) fence-line"	50 cities committed to UN Global Compact; CH2MHill, Halcrow and other water businesses are signatories of Global Compact's CEO Water Mandate	Exercise of power ever further along ever more extended and intricately interwoven chains of commercial relationships
(T9) Commercial Sectors	Water ... alone	Veolia Water UK as "Multi-utility Services Company" (MUSCO)	Water sector ... and nutrient and energy sectors ... and more
(T10) Space	IUWM or IWRM; rarely both	DHV Group (Consulting Engineers) re-engineers Soerendonk Sewage Treatment Plant to blur distinction between sewage treatment and river habitat	From Earth Systems Analysis to individual agency (e.g., dietary preferences)
(T11) Life Cycle and Time	Expenditures and revenue streams over time	The Natural Step has worked with Yarra Valley Water on Life Cycle Analyses	From cradle to cradle analyses
(T12) Function	Adaptability; durability; robustness-vulnerability; reliability	Within IBM's Smarter Planet and Smarter City portfolio, Galway, Ireland is acquiring a SmartBay	Ecological resilience and biomedical self-repair
(T13) Gauging Environmental Benignity	Environmental degradation: pollution syndromes; eco-efficiency	DHV's re-engineering of Soerendonk Sewage Treatment Plant generates rhythmic flow variations to enhance watershed ecosystem services	Biomimicry: appetite; metabolism; pulse
(T14) Cycling of Materials	Man's appropriation/consumption of resources (water, nutrients, energy, and land area)	Severn Trent plc acknowledges water-cycle and carbon-cycle policy antagonisms; Resources Centres on Urban Agriculture & Food Security (RUAF) promote Sustainable Urban Nutrient Management	Natural nutrient cycles and technical nutrient cycles; dematerialization; eco-effectiveness

Table 4 Tables 1, 2, and 3 assembled as a whole.

political thrusts of the great sustainability debate of the 1990s.

Arise then the self-confident Engineer — or the water professional as "public leader" (Termeer, 2009)! If the "global water crisis" is a crisis of governance, we envision Engineering interventions as those tailored to resolving the crisis. But let us not be over-bearing. Thus has this intention been expressed in Box 2, as just a mere "aside" to the principal business of Chapter 3.1 on {social legitimacy}.

In the presence of the defining quantitative, codified turn of mind of Engineering, not to mention that of the accountancy of the Triple Bottom Line, the descent of Engineering into more subtly troubled waters was epitomized by the caricature of a mathematical program (***M***) for generating sustainable decisions in Chapter 2.5. There is a fine line separating that which should be included in ***M*** and that which should be left out, for due process of public debate and democracy. The resurgence of Engineering, perhaps paradoxically, was capped off in Chapter 4 by deliberate use of the mathematical, engineering metaphor — a model ***M*** and some basic notions of control engineering — to provide the tightest of specificity and clarity in how we might engineer our way out of a technological and socio-cultural lock-in, in the face of *vagueness*. Is this self-contradictory?

As for the *long view* — in general, too frequently conspicuous by it absence — this is surely present in the challenge and vision of Chapter 2.4, and again in our response to them, constructed across Chapters 3.3 and 3.4. Under this long view it seems inappropriate to entitle as "Conclusions" this closing chapter. We have chosen not to do so. The unrelenting pursuit of the long view, throughout this entire *Concepts Paper,* may nevertheless have blinded us to the nearness of tomorrow's first, practical step. We all have blind spots. For as long as *water* professionals, many from *water* utilities, meet to discuss *water* issues, under the *aegis* of *water* associations, issues of the nutrient metabolism of cities — the daily bread inextricably coupled with the

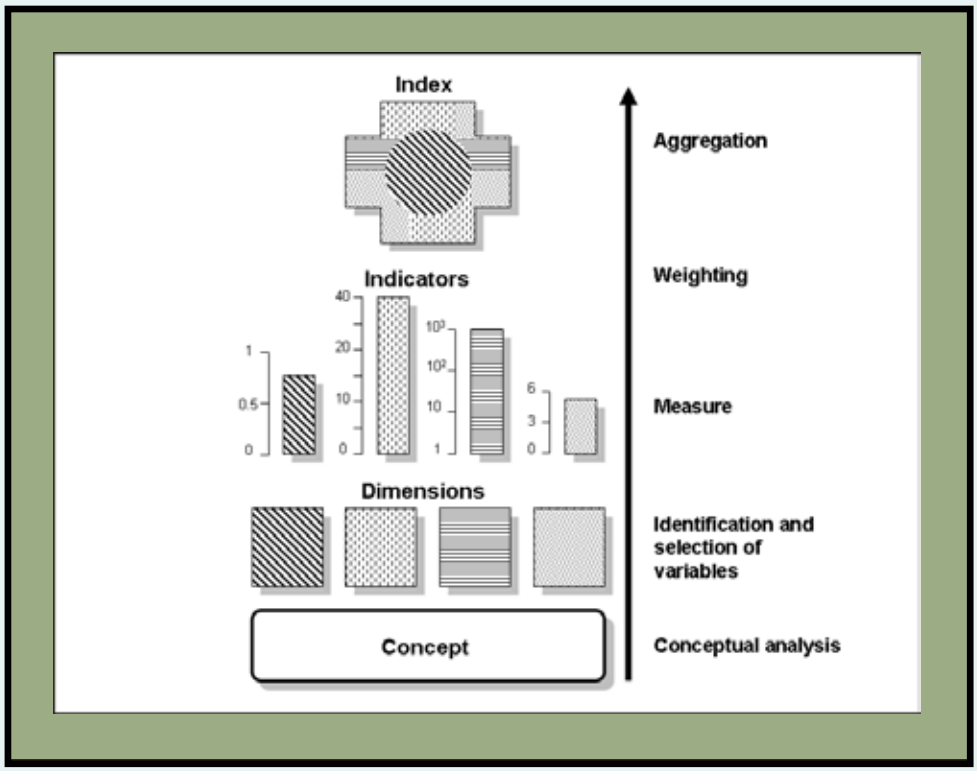

Figure 18
Boulanger's pictorial representation of Lazarsfeld's progression "from concept to indices" (reproduced with permission from Boulanger, 2008).

daily water of our very existence — will struggle to be adequately addressed. There is no IU*Nutrient*M within I*Nutrient*RM to accompany IUWM within IWRM. There are no City Nutrient Departments, as far as we know, nor any Soilshed Agency. To establish them, however, might be to head in the wrong direction of ever more compartmentalization.

If our *Paper* has succeeded in being thus contrarian, self-contradictory, and/or disagreeable, may it provoke actions and thoughts on how to make something better of it, to suit the very local circumstances of you, the reader.