



Cape Alliance for Pesticide Education

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Non-Toxic Strategies for a Sustainable Cape Cod

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The following comments are submitted by GreenCAPE on behalf of its membership. It has been GreenCAPE's goal for 16 years to significantly reduce the use of pesticides on Cape Cod through outreach and public education about these hazards in our air, soil, and water. There is no doubt that pesticides are harmful to human health and the Cape's vulnerable water supply. Water quality will eventually be the limiting economic factor for our fishing industry and our tourist-based economy. It has already reduced the quality of life of our residents. These brief comments on the Section 208 Cape Cod Area-Wide Water Quality Management Plan are not intended to be comprehensive or exhaustive but will briefly address our organizations specific concerns with the Plan, aspects of the public outreach process that preceded the preparation of the draft Section 208 Plan, and a suggestion for an additional mitigation technique that could augment the matrix of technologies. The successful implementation of a variety of alternatives to costly sewerage will be a key factor in making Water Quality Management Plan costs more acceptable to the residents of all income categories. We will not comment on any potential legislation or permitting relative to this Plan as a presenter at one of the meetings reported that all of that could be changed to accommodate the Plan.

The development of the information and decision support tools for organizing and analyzing the massive amount of data as well as the creation of the technology matrix is truly impressive. These have been useful in getting to the draft Plan but may be daunting when relied upon to make the case for its adoption in public venues. High tech bells and whistles may increase informed deliberation by the taxpayer but should be used judiciously.

Community engagement was disappointing. 170 stakeholders from across the Cape attended –some attending multiple watershed group meetings-and were primarily local town officials, town staff, several business interests, and a few ENGOs but attendance was very light on “interested/concerned citizens”. The Section 208 process launched during the tourist season when residents were otherwise occupied with the constant influx of visitors. The time frame was too concentrated to allow deep discussion. Meetings were poorly advertised and held on weekdays during working hours. Beyond officials and staff -which would have been paid to attend-the meetings demanded a serious time commitment--not very workable for anyone employed during the day. This was publicly noted in the beginning session but no adequate work around was offered to engage the average citizen. This lack of an informed public may create delays and difficulties with the Plan's acceptance and implementation.

Fertilizer Bylaws: The recent fertilizer bylaws adopted in a few Cape towns and which are being proposed as a model for the rest, ignore the source of a fertilizer which is extremely

relevant to these efforts. While organic production methods build a lawn's capacity to hold soil, synthetic systems weaken this ability. From a holistic soil management perspective, it becomes evident that organic management yields the optimum environmental safeguards, while nurturing healthy plants. It is unfortunate that this Plan supports half-measures that will likely not effect significant reductions in nitrogen or phosphorus loading from lawns and landscapes--primarily relying as it does on synthetic inputs. A few years ago our organization provided many organic land care programs to the public, municipal grounds crews, and to the Barnstable County Commissioners with a nationally-renowned turf expert (Chip Osborne) and we later submitted a organic land management plan that could easily be adopted by homeowners, towns, and businesses. In fact the same program has been successfully adopted as a Board of Health regulation in Marblehead MA. Several other cities and even National Parks have seen the benefits of this natural approach and the county should reconsider its adoption as the gold standard of lawn and landscape management-especially for municipalities who could then model this simple method for townspeople. In addition the overall reduction of areas planted to lawn and the replanting of native species in place of non-native ornamentals that require more fertilizer and pesticides should be formally and strongly encouraged by every town and county agency.

Pesticides on their own but also as part of a "weed and feed" lawn product can pose a threat to drinking water, and are considered contaminants of emerging concern (CECs) by the U.S. Environmental Protection Agency (EPA). According to the EPA, laboratory studies show that pesticides can cause health problems such as birth defects, nerve damage, cancer, and other effects that might occur over a long period of time, and that the effects depend on the toxicity of the pesticide and the amounts consumed. Some pesticides also pose unique health risks to children (US EPA, 2012). Often, a portion of the pesticide products applied to fields, lawns, and other areas makes its way to surface waters through stormwater runoff, to groundwater by leaching through the soil, and to other areas by volatilization into the atmosphere followed by precipitation. Once introduced into the water, pesticides are hard to detect and difficult to remove. In addition to being a potential threat to human health, pesticides can be toxic to aquatic ecosystems and can accumulate in sediments. Surrounded by water as we are on the Cape, can we sacrifice our fishing industry to the price of a perfect lawn? Stronger fertilizer bylaws are needed regardless of the objections of professional landscapers who fail to acknowledge the Cape's chemical conundrum.

As we have observed in recent decades coastal and inland waters are increasingly imperiled on Cape Cod from various agents, including agricultural and industrial discharges, nutrient loading (nitrogen and phosphorus), biological agents such as pathogens, and chemical agents such as pesticides and other contaminants of emerging concern (CECs). According to the USGS pesticides discharged into our nation's rivers, lakes and streams can harm or kill fish and amphibians. These toxicants have the potential to accumulate in the fish we eat and the water we drink. Previous USGS [reports](#) have documented pesticides and fertilizers in U.S. streams and [drinking water](#). As pesticide use escalates <http://www.usgs.gov/newsroom/article.asp?ID=3594> and the drinking water/wastewater cycle becomes increasingly polluted with unregulated contaminants like pesticides and other toxicants, low-cost and natural alternatives for restoring water are desperately needed. It's never too soon to protect the water supply so we are encouraged that a local process has finally been initiated that addresses excess nitrogen entering Cape Cod embayments and phosphorus loading of inland water bodies primarily –but not entirely-sourced from septic systems. In general GreenCAPE supports sustainable

wastewater mitigation technologies including eco-toilets, with sewerage as a last resort. However we are concerned that the Plan does not commit to more definitive action regarding other pollutants shown to be in our water. “Adaptive management” does not rise to the level of a commitment. Acknowledging that regulation is far behind the current science in this area, the entire process to develop this Water Quality Management Plan has been promoted as forward-thinking but it is still lacking in the area of contaminants of emerging concern (CECs). Will additional structures or treatments for these CECs need to be designed and constructed after the current Plan is already in place? And would that demand yet another prohibitively expensive “CEC Management Plan” in the next decades? More thorough investigation and incorporation of CEC-eliminating technologies should be added to the final draft of the Section 208 regardless of the lack of current regulatory coverage. Regulations cannot be used as an excuse for avoiding treatment of known pollution in the water/wastewater cycle.

Ocean Outfall: GreenCAPE is strongly opposed to ocean outfalls for treated sewage effluent as a means of eliminating the end products of wastewater treatment. Any consideration of the land application of biosolids should be abandoned immediately. The common occurrence of chemical mixtures in effluent and sewage sludge from a Waste Water Treatment Plant (WWTP) means that the total combined toxicity may be greater than that of any single contaminant present. This finding punctuates the need for continued research before committing time and treasure to the construction of any outfall pipe because the additive or synergistic effects on human health of mixtures of synthetic chemicals at low levels are not well understood or regulated. Land application of sludge is equally unacceptable especially on porous soils above an aquifer. The end-products of any Waste Water Treatment Plant should not be considered for use as fertilizer but rather a potential biohazard that would eventually find its way into groundwater and the food chain. This will be a disposal challenge but land application should never be an option. Many so-called organic fertilizers actually consist of sewage sludge (aka biosolids) and are prohibited for organic food production and organic land care programs. Biosolids/sewage sludge contain a complex array of biological pathogens, chemical contaminants, pharmaceuticals, hormones, and emerging contaminants that are not completely eliminated by waste water treatment plants. “Class B biosolids” have been found to contain pesticides, detergents, estrogenic hormones, dioxins, PCBs, and heavy metals - all of which can leach into groundwater or be taken up into plants. They can also contribute to antibiotic resistance in bacteria on fields that have had biosolid fertilizer applications. Moreover, a 2002 study revealed a high prevalence of *Staphylococcus aureus* infections in residents that lived within close proximity to biosolid treated agricultural fields due to exposure from blowing winds.

Ignoring the local and international evidence of the existence and impacts of unregulated CECs in water and on wildlife/humans is shortsighted. Waiting 20 years for state/federal governments to catch up to the science is not an option here because of the quickly percolating sand. The Cape Cod Commission will be nationally recognized if they acknowledge and attack the problem of CECs in water and wastewater with the same energy they have brought to bear on the 208 Plan. On the upstream side, both the Sierra Club and Massachusetts Breast Cancer Coalition have developed CEC fact sheets to help the public reduce the use -and presumably the exposure—to unregulated chemicals in their homes which lends itself to a reduction of these chemicals on the downstream side. In addition broad local campaigns stressing the connection can be developed in the interim before regulations are developed. The pharmaceutical components cannot be as readily

controlled so the focus would need to be on filtering them out or capturing them from the effluent or sludge. Ignoring this serious issue is not an option. In a recent article in *The Guardian* some graphic results of ignoring pharmaceutical contamination of the environment were reported:

Potent pharmaceuticals and hormones flushed into the environment via human and animal sewage could be a hidden cause of the global wildlife crisis, according to new research. The scientists warn that worldwide use of the drugs, which are designed to be biologically active at low concentrations, is rising rapidly but that too little is currently known about their effect on the natural world.

Studies of the effect of pharmaceutical contamination on wildlife are rare but new work published on Monday reveals that an anti-depressant reduces feeding in starlings and that a contraceptive drug slashes fish populations in lakes.

“With thousands of pharmaceuticals in use globally, they have the potential to have potent effects on wildlife and ecosystems,” said Kathryn Arnold, at the University of York, who edited a [special issue of the journal Philosophical Transactions of the Royal Society B](#). “Given the many benefits of pharmaceuticals, there is a need for science to deliver better estimates of the environmental risks they pose.”

[She said](#): “Given that populations of many species living in human-altered landscapes are declining for reasons that cannot be fully explained, we believe that it is time to explore emerging challenges,” such as pharmaceutical pollution.

Research published in September revealed [half of the planet’s wild animals had been wiped out](#) in the last 40 years. In freshwater habitats, where drug residues are most commonly found, the research found 75% of fish and amphibians had been lost.

A few dramatic examples of wildlife harmed by drug contamination have been discovered previously, including male fish being feminised by the synthetic hormones used in birth-control pills and vultures in India being virtually wiped out by an anti-inflammatory drug given to the cattle on whose carcasses they feed. Inter-sex frogs have also recently been found in urban ponds contaminated with wastewater.

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But because the pharmaceuticals are not designed to kill – unlike pesticides – the damage caused to wildlife can be more subtle.

In one of the new studies, Tom Bean at the University of York and colleagues, showed that the common [antidepressant fluoxetine, at the low levels expected in the environment, led starlings to feed less often](#) during the key foraging times of sunrise and sunset.

“Importantly, fluoxetine is not the only pharmaceutical, or indeed the only antidepressant, to be detected in the environment,” he said. “Mixtures of pharmaceuticals could potentially be more potent.”

Another new study, led by Karen Kidd at the University of New Brunswick, showed [synthetic oestrogen used in the birth control pill not only wiped out fathead minnows in lakes used for experiments in Ontario](#), but also seriously disrupted the whole ecosystem. The lakes’ top predator – trout – declined by 23-42%, due to the loss of the minnow and other prey, while insects increased as they were no longer being eaten by the minnows.

Amphibians are suffering the hardest in the global biodiversity decline and Cecilia Berg, at Uppsala University, and colleagues reported that a [number of hormonally active](#)

[pharmaceuticals harm reproduction in amphibians](#) at concentrations that occur in natural waters.

The [most environmentally dangerous drugs are identified in a paper](#) by Anette Küster and Nicole Adler, both at Germany's Federal Environment Agency. "For human medicinal products, hormones, antibiotics, [painkillers], antidepressants and [anti-cancer drugs] indicated an environmental risk," they said. For veterinary drugs, hormones, antibiotics and parasiticides were highlighted.

Pharmaceuticals can contaminate the environment through discharges from drug factories, as well as through sewage. Professor Joakim Larsson, at the University of Gothenburg, found that [drug levels in effluents can even exceed those found in the blood](#) of people taking medication.

Larsson cited antibiotic pollution coming from factories in China, India, Pakistan, Korea, Denmark, Norway and Croatia. "Although pollution from manufacturing is less widespread, discharges that promote the development of [drug-resistant microorganisms can still have global consequences](#)." He also documented antidepressant pollution from factories in Switzerland, Israel and Spain and "narcotic opioid" pollution in the US.

The use of pharmaceuticals is rising with increases in the human population and the livestock it keeps. Environmental exposure is also rising as sewage is increasingly used to irrigate or fertilise farmland. In the US, for example, about 4m tonnes of dry sewage biosolids are applied to land each year.

Sally Gaw, at the University of Canterbury, and colleagues warned that [even less is known about the effect of pharmaceutical pollution in the oceans](#). "This is a critical knowledge gap given the significant increase in coastal human populations around the globe and the growth of coastal megacities, together with the increasing importance of coastal [fisheries] around the world."

Addition to the Tech Matrix: MYCORESTORATION/MYCOREMEDIATION employs materials and methods that were overlooked in the technology matrix but have been utilized in other areas of the U.S. and have received research funding from USEPA and Department of Defense. Pioneered by Paul Stamets, mycorestoration draws on the natural properties of mushroom-bearing fungi to fight human-made pollution. Oyster mushrooms, for example, can digest the complex hydrocarbons in wood, so they can also be used to break down petroleum and pesticides. Other fungi use their mycelia to trap and digest bacteria, so they can filter *E. coli* from agricultural runoff. Field experiments have shown that these applications work. Stamets has conducted pilot projects with the EPA and designed a mycofiltration system for managing storm water runoff. Since the Cape has a resident mycologist who has studied with Stamets, similar mycorestoration projects should be investigated for the Cape's challenged watersheds. Simpler projects have been conducted by volunteers on the Willamette River with the Ocean Blue Project, placing mushroom spawn and a mixture of coffee grounds and straw in burlap bags and then placing the bags so that water entering storm drains will filter through them.

http://www.gazettetimes.com/news/local/mushrooms-used-to-clean-up-urban-streams/article_cebc14d8-817b-11e3-a2a8-0019bb2963f4.html. The technique is attempting to take advantage of the natural ability of mycelium to break down toxins like oil and pesticides and metabolize harmful bacteria like *E. coli*. An additional benefit--many mushroom species are able to remove and absorb heavy metals, including radioactive isotopes, from soil. The technique could potentially be a low-cost way to use biologic processes to reduce pollution in waterways and even WWTP sludge or effluent.

Clearly nitrogen and phosphorus are only two of several water/wastewater problems that need solving to ensure a drinkable water supply and swimmable/fishable waters well into the Cape's future. Massive financial outlays that only manage a portion of the problem will not get buy-in from an already cash-strapped public-- many on fixed incomes, others already living below poverty. Even IF there could be partial state or federal funding to ease the pain, residents will want a guarantee of clean water at the end of the rainbow--not just water that has less nitrogen and ponds that are not quite as polluted. For the amounts of money guesstimated for the Plan, the residents should have every expectation of truly CLEAN WATER.

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