Additional Q&A for Freshwater Science: Understanding and (Potentially) Mitigating the Impacts of Tile Drainage

Dr. Steve Lyon, Associate Director, School of Environment and Natural Resources, The Ohio State University

1. To what extent are tile currently contributing to Lake Erie cyanobacteria blooms. As opposed to other runoff, including manure, residual impacts in the lake?

No exact number here. Agricultural runoff in general is a majority contributor of the excess nutrients that lead to the HABs. Tile drainage is fairly widely used across the Western Lake Erie Basin.

2. Is the tile water influenced by surface water getting into the tile riser/inlet?

Can be for short periods of time. We are starting into some research to try and estimate the various ways water gets into the tile drainage system.

3. Would be interested to hear about the impacts of tile drainage on streamflows (peaks and volumes) during “normal” flow periods and flood flow periods.

Our work shows the higher flashiness for landscape with more tile drainage in the state. More details can be found in the publication: Miller, S.A., and S.W. Lyon, (2021) Tile drainage causes flashy streamflow response in Ohio watersheds. Hydrological Processes, 35(8), e14326.

4. Some studies, including the speaker’s, show that tile drainage increases total runoff and phosphorus export during wet years. For installed drains, what is a rough estimate of the percentage of drains that increase the flow of nutrients into streams? and the percentage with mitigation factors to reduce the flow of nutrients?

Some previous work has shown the drainage water management can reduce the nutrient loading coming from tile drainage by 25% to over 50% for dissolved phosphorus (Ross et al., 2016) (Feset et al., 2010) and 17% to 94% for nitrates (Skaggs et al., 2010).
5. Does tile drainage reduce other potential chemical run-off? Other chemicals may include trace metals, pharmaceuticals, and other emerging contaminants, especially if biosolids are used on the fields that may contain chemicals that weren’t filtered out through the wastewater treatment process. Drainage water management, where tile drainage water is held back, typically achieves load reductions by lowering total runoff (the amount of water) leaving the field through the drainage outlet. If the chemicals are long-lived in the soil and/or not potentially bioremediated, they could just be delayed in the release or leaked out of fields through other pathways.

6. Wouldn’t high level water table through controlled drainage simply increase weepage/spring-type flow like natural high groundwater into streams? Yes. And that is not inherently a bad thing as the seepage would allow more contact time between soil and water promoting remediation and uptake of nutrients. It would also slow down the hydrologic response.

7. Have you had a chance to field verify the AgTile-US data? Does it do a pretty good job of representing reality? We’ve spot checked it a couple of places and it worked. Check out the original study where the verification (ground truthing) was done: Valayamkunnath, P., Barlage, M., Chen, F., Gochis, D. J., & Franz, K. J. (2020). Mapping of 30-meter resolution tile-drained croplands using a geospatial modeling approach. Scientific Data, 7(257), 1–10. https://doi.org/10.1038/s41597-020-00596-x

8. Can these automate Drainage Water Management Systems be coupled with saturated buffers, or other edge of field practices? And are there compounding reductions expected or more additive? Yes. The impacts would at least be additive (but I’m not sure if they would be compounding).

9. Have you correlated open and/or closed tile drain runoff to surface runoff? Not exactly. We saw more flooding in general when the systems was “closed” and correlations with water tables. Check out the publications for details: Miller, S.A. J.D. Witter; S.W. Lyon (2022) The impact of automated drainage water management on groundwater, soil moisture, and tile outlet discharge following storm events. Agricultural Water Management. 272, 107828

10. Is it possible to obtain copies of the reports used as references in the presentation? Absolutely. I’ve shared these will Jill at Sea Grant and feel free to reach out to me directly at lyon.248@osu.edu

11. Do you expect that bringing up the water table while crops are on the field would have an impact on crop yield? Drainage water management has been shown to give a bump to increase yields. Combinations of more water available and nutrients held in the field.
12. Nutrient load yields — any idea how this breaks down as a loss per acre (lbs P2O5 / ac)?
Not for our study — would need to dig into some other efforts for the values.

13. Are researchers measuring how much of the nutrient load goes beyond/beneath the tile system and eventually reaches the stream through interflow seepage/groundwater? How does this compare to tile discharges?
I think this is what we are seeing in our study field here in Wooster. We see the majority of loading coming form deeper or other pathways rather than the tile drains.

14. Will the slowing down of water help the algae outbreak in the western basin of Lake Erie?
Yes, it could. Especially if we can control when water is released and stagger it across fields. Spread the peak so to speak or shift release of water/nutrients to periods when the algae are not likely as active.

15. Can you explain why there’s a flashy stream response with high % tile drainage compared to low % tile drainage? A field without tile drainage wouldn’t have the “storage” potential as a drained field. Alternatively, the surface runoff on an undrained field would get great than a drained field.
Since the tile drains lower water tables, they are effective removing the natural storage a field would have if it was not drained (not creating new storage). For the spacings and conditions we have in Ohio, the drains are efficiently translating rain into streamflow (like a storm sewer system in a city).

16. What is the greatest slope a controlled drainage system can be used on and still be effective?
Folks typically target around 1% slope or only a few feet (like 2 feet) of relief for these systems to make sense.

17. If there any regulation requiring control gates with farm tiling such as flood plan area or housing development by field to help prevent surface water flooding? to the neighboring property?
None I’m aware of but I am definitely not an expert in drainage law (which is complex). There are definitely regulations around drainage and water flow alterations.