

## ***Interactive comment on “Sources and Transformations of Anthropogenic Nitrogen along an Urban River-Estuarine Continuum” by Michael J. Pennino et al.***

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bg-2016-264 Title: Sources and Transformations of Anthropogenic Nitrogen along an Urban River-Estuarine Continuum Authors: M.J. Pennino et al.

This is an interesting paper that answers a number of important research questions, covering the attribution of sources, transformations of nitrogen, and the impact of the hydrological conditions over the Potomac river-estuary continuum of 150 km. Isotope and mass balance approaches are combined to track nitrogen sources and transformations along this distance. The results of this work can be very helpful in designing strategies to manage the water quality of this densely populated river basin.

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The paper is well structured, and reads easily. I have a few concerns and a number of minor comments and suggestions.

Lines 290-304: the reasoning why the 14 down-stream WWTPs have little effect is completely unclear to me. Particularly 301-304 is not clear.

With all the uncertainties associated with the mixing model (line 204-206, line 214-216) and the caution (use for illustrative purposes only), I wonder if it makes sense to present it at all, since I do not know what the meaning is of “illustrative purposes” if I do not know the uncertainty. The attribution of sources in the text looks pretty certain (no word about the illustrative purpose), and the uncertainty ranges are very small. That is surprising to me, and I wonder how these ranges are obtained? Is it the same error propagation method discussed in lines 267-274?

The range for the contribution of denitrification to the TN decline of 23-27% (Line 478; Line 543) suggests it is an uncertainty, but is simply is two different estimates, a direct and indirect one. It is possible to provide a real uncertainty here? The Burial rate presented by Boynton et al. is an average for upper and lower Potomac estuary, and it is not clear if this calculation was done by the original paper or in this study, but it is probably quite and uncertain number. Similar question about the average denitrification rate.

In various places the authors indicate that a statement or reason for a phenomenon is described “below”: e.g. line 292, 311, 318, 434, 514, 529, 547,597, 633. For readers this is awkward, because they start looking where this could be, because they want the explanation for something they read. Now either the word below can be avoided by placing the discussion referred to directly after the statement, or the explanation comes first, and then the concluding statement.

#### Minor comments

-I am not sure if present and past tense is consistently used correctly in the results and

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discussion sections. Please check.

-I do not know how many times the words "additionally", "suggest" and "suggesting" are used, but it is a lot. Please try to vary.

-Line 126 and line 134: confusion between current concentration of 2.3 mg/L and 2001-2008 concentration of 4.1 mg/L. What is current? Has it gone down further, or what is the reason of the difference?

-Line 187: atmospheric deposition.

-It is not clear to me if the sampling locations in Figure 2 correspond to those in Figure 1. For example, the first point at about -17 km is not in Figure 1.

-Line 232: insert that after indicate.

-What is at distance zero in Figure 2? Is that the WWTP?

-Lines 267-274: I assume that the errors are expressed as standard deviations? If so, please mention.

-Line 295-296: The isotope signal for the Blue Plains has been mentioned previously. These references provide numbers for the 14 down-stream WWTPs, I assume, but it suggests that they are for Blue Plains.

-Line 362: what is directly down-estuary?

-Line 385: up-estuary? Line 386: 2km down-estuary? Is it possible to attach a code to sampling locations, show that in Figure 1 (and 2) and refer to those codes instead of these up and down indicators of locations?

-Line 506: it is not clear if there is a long-term warming or increasing warming; are temperatures warming?

-Line 528: What is the unit "mgd".

-Line 546: is it AND assimilation?

-Lines 565 and 671: shorter times instead of lower.

-Lines 547-551: remineralization leads to addition of TN, so I'd attribute a decrease in TN to uptake and subsequent deposition.

-The header 4.2 and 4.3 read like a conclusion, not a section header. In addition, it looks like in 4.2 a few words are missing (indicate that) and dominate (two processes dominate); If this is actually the intention, then please be consistent, and change 4.1 in a similar way.

-Line 634: may suggest→suggest or indicate? Otherwise 2x suggest

-Line 638: caused.

-Line 644: is supported.

-Line 674: nitrate produced by nitrification.

-Line 681: delete “the” and change the order of the sentence: there is more conservative behavior when flows are larger.

-Line 695: dominant.

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