Context for P concentrations/loads in JBW

**P concentration in tile drainage**

Observed in JBW:

|  |  |  |
| --- | --- | --- |
|  | [TP] (g/L) | [TDP] (g/L) |
| Range | 18 – 6977 | 9 – 4826 |
| Median | 150 | 59 |
| Mean1 | 140 | 63 |
| S.D.1 | 2.4 | 2.4 |
| n | 156 | 156 |

Refer to 2016 “Literature Review: Tile Drainage and Phosphorus Losses from Agricultural Land” Table 3, pp. 22-24

Phosphorus concentrations in JBW tile drainage were generally in the range reported in tile drainage from similar land uses in the LCB region and elsewhere (SEI 2016). From studies that examined seasonal or multi-event tile drainage, Benoit (1973) reported all tile drainage samples from corn silage and hay plots in Franklin, VT contained less than 20 g/L TP, the detection limit. More recently, Young (2015) reported TP concentrations of 23 – 175 g/L (mean 98 g/L) and SRP concentrations of 9 – 41 g/L (mean 11 g/L) fields on five farms in Clinton and St. Lawrence Counties, NY. In the same region, Klaiber (2015) reported mean TP concentration in tile drainage of 29 g/L; mean SRP concentration of 12 g/L in tile drainage from 7 events over a year. Note that all these data were reported from seasonal or multi-event data, not from samples collected throughout the year. Given the tremendous variability observed among individual samples of tile drainflow, it is more appropriate to compare data reported from annual studies with JBW data (see table below).

Selected annual P concentrations observed in NY and Quebec. Single values represent means; otherwise range is reported. Note that SRP is not equivalent to TDP measured in JBW.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location | Land Use | [TP] g/L | [SRP] g/L | Reference |
| NY | Corn | 110 – 9,800 |  | Goehring et al. 2001 |
| NY | Corn |  | 9 – 441 | Hergert et al. 1981 |
| Que | Corn-soybeans | 10 – 130 | 10 – 30 | Beauchemin et al. 1998 |
| Que |  | 60 – 370 |  | Enright and Madramootoo 2004 |
| Que | Corn | 200 | 40 | Simard 2005 |
| Que | Corn | 11 – 53 | 1 – 12 | Simard 2005 |
| Que | Corn, grains, grass | <1 – 2,726 |  | Goulet et al. 2006 |

TP concentrations observed in JBW tile drainage were also comparable to the range observed in Ontario (20 – 9,700 g/L), Ohio (110 – 300 g/L), and in Wisconsin (80 – 1,780 g/L) (see Table 3, SEI 2016).

Unlike the tendency for high P concentrations in tile discharge to be associated with stormflow or other high flow periods, data from the JBW did not show widespread significant associations between high tile flow and high P concentrations (see appropriate section of report). While positive flow-concentration associations were suggested in some cases (more often for TDP than for TP), relationships were generally nonsignificant, sometimes confounded by transient high concentrations such as those observed immediately following manure applications.

Although seasonal patterns of P concentration in tile flow volume have been reported in the literature (although inconsistently), there was no distinct seasonal pattern observed for either TP or TDP concentrations in tile drainage from JBW fields. Although lowest concentrations tended to occur in December and highest concentrations in October, both high and low P concentrations were observed in all months over the monitoring period.

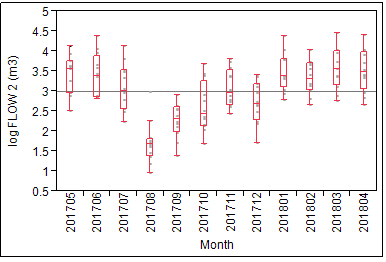
Published research has sometimes reported significant P loss in tile drainflow associated with manure applications (SEI 2016). For example, in NY, Scott et al. (1998) reported soluble P concentrations in tile drainflow that peaked at 1,170 mg/L. Similar patterns were observed in the JBW [insert example from JBW here]. Unfortunately, data from the JBW are insufficiently detailed to confirm literature reports of high P concentrations in drainflow associated with fertilizer applications, long-term manure applications, or soil test P levels.

The influence of crop type and cropping activities on tile drainflow P concentrations has been variable based on other published research; variation in land use among the twelve monitored JBW fields was insufficient to test any correlations with crop or cropping activities, although there was some evidence that some P concentrations and areal P loads were higher from row crop land compared to hayland.

**Tile Flow**

Literature reports suggest that the volume of tile flow tends to follow strong seasonal patterns.

Although tile drainflow can respond to large precipitation or snowmelt events at almost any time of year, the largest drainage volumes tend to occur from fall through spring, with tile drainflow becoming very small or entirely absent during the summer growing season.



In the JBW, tile drainflow was lowest August-September 2017 and tended to be high May – July 2017 and January – April 2018. Note that the monitoring period covered just one annual cycle and precipitation/snowmelt was not necessarily representative of long-term average [insert something about rainfall during monitoring period]

**P loads in tile drainage**

Observed in JBW

|  |  |  |
| --- | --- | --- |
|  | **Areal TPx (kg/ha/yr)** | **Areal TDPx (kg/ha/yr)** |
| Range | 0.122 – 1.124 | 0.083 – 0.556 |
| Median | 0.541 | 0.199 |
| Mean | 0.555 | 0.272 |
| 95% C.I. | 0.368 – 0.743 | 0.166 – 0.378 |

Monitored P export in tile drainflow from JBW agricultural fields was in a range comparable to that reported in the literature (SEI 2016, Table 4). Just as with P concentration, the reported P loads attributed to tile drainflow have been highly variable. In New York (within the LCB), Klaiber (2015) reported TP load of 0.13 kg/ha/yr and SRP of 0.05 kg/ha/yr in tile drainage from grass plots. Miller (1979) reported TP losses of 0.28 kg/ha/yr and PO4-P losses of 0.08 kg/ha/yr from Ontario crop fields. In the Quebec portion of the LCB, Jamieson et al. (2003) reported an estimated TP load in subsurface drainage from a corn field during snowmelt of 0.1 kg/ha, representing 37% of the total snowmelt P load from the field. Simard (2005) measured mean P loads exported from corn fields in the Missisquoi Bay watershed averaging 0.61 kg/ha/yr . Annual TP loads in tile drainage from one field varied from 0.69 to 1.23 kg/ha/yr. In northern Quebec, Goulet et al. (2006) reported average loads from plots of: TP 0.51 kg/ha/yr, TSP 0.08 kg/ha/yr, and PP 0.44 kg/ha/yr; annual TP loads from individual plots >1.0 kg/ha were observed. These TP loads in drainflow represented 95% of all TP export from the plots.

JBW areal TP loads in tile drainage were also comparable to loads reported from Iowa, Ohio, and other Midwest states. For example, King et al. (2014) reported annual TP loads of 0.28 – 0.92 kg/ha from Ohio corn/soybean fields.

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