N:P Exchange Options
WQGIT Meeting August 8, 2011

BACKGROUND

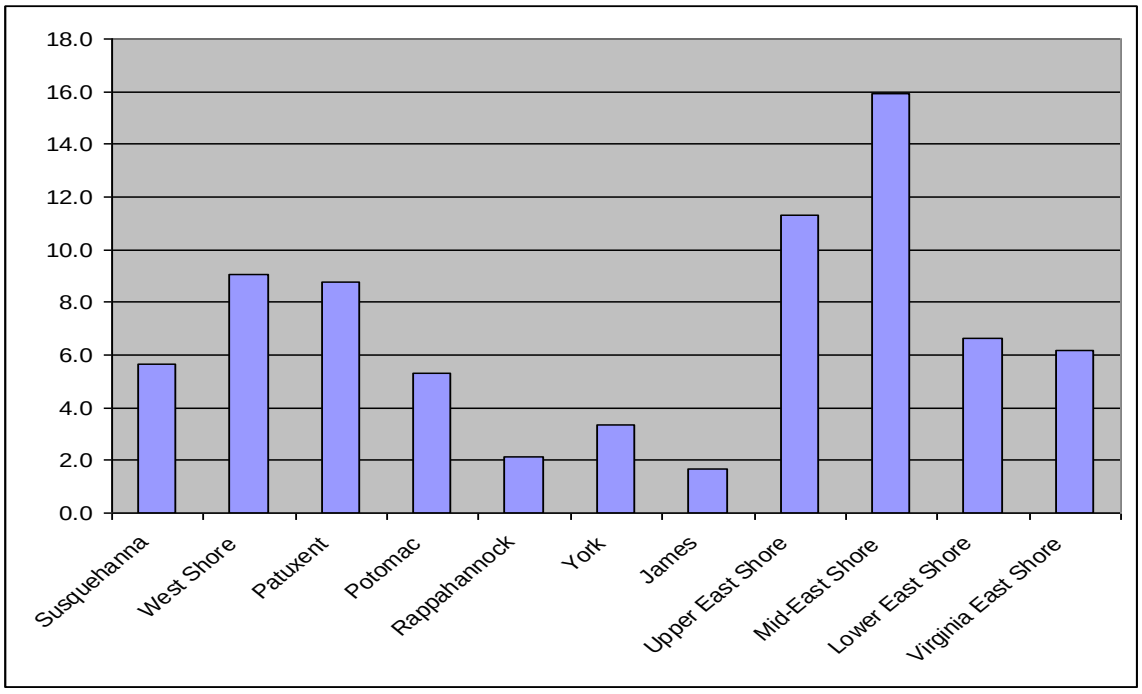
The N:P exchanges used in the Phase I WIP process were set asymmetrically at 5:1 and 15:1 because of conservative assumptions which were based on the range of response documented in the peer-reviewed literature. For the Phase II WIPs an extensive analysis of 37 model runs were used to develop three N:P exchange options. EPA requests the recommendations and guidance of the WQGIT on these three options before resolving which approach to take for Phase II WIP development.

In evaluating the N:P exchange options the following four principles have particular weight:

1) The N:P exchange approach should be relatively simple and easy to communicate.
2) The N:P exchange should include sufficient safety factors to ensure water quality standard achievement.
3) The N:P exchange should be equitable and applied consistently throughout the watershed.
4) The N:P exchange should respect exchanges that have already occurred in Phase I WIP development and any new approach, such as Options 2 or 3, should minimize disruption to previous exchanges.

CURRENT STATUS – RECENT CHANGES

The revised N:P ratios by major river basin are shown below. To simplify the approach the above and below fall line regions of the western tributaries from the Patuxent to the James have been combined using a load weighted average, resulting in a total of 11 separate regions with unique N:P exchange rates. In addition, in Option 2 the buffers have been reduced to 10% based on additional analysis of the N:P exchange uncertainty.



Documentation of the N:P exchange analysis, particularly the estimated transport and nutrient limitation in the estuary that is the primary driver in the N:P exchange estimates, will be completed by late-September.

FINDINGS

1. Generally, the 5:1 phosphorus to nitrogen exchange and 15:1 nitrogen to phosphorus exchange ratios used by the CBP partners during development of the Phase I WIPs were reasonable bounds and were environmentally protective. Notably though, Virginia's major western river basins of the Rappahannock, York, and James were outside the 5:1 to 15:1 bounds and consistently have a lower ratio than 5:1 in the current calculated estimates.

2. There are significant spatial distinctions.
    a. P is relatively more important, i.e., generates more nitrogen exchange, in northern river basins.
    b. N is relatively more important in southern river basins, resulting in relatively less nitrogen mass in exchange for phosphorus.

OPTIONS

Option 1: There is a wide range of exchange ratios in the watershed and 15:1 and 5:1 are reasonable, conservative bounds. Option 1 keeps the same WIP I N:P exchange ratios moving forward.

Pros: - Existing Phase I WIP exchange ratios are most conservative.
- No change is needed from the 2010 Bay TMDL and Phase I WIPs.

Cons: - Partners have specifically requested that the existing exchange ratios be updated to reflect the best scientific understanding.
- Existing fixed exchange ratios limit jurisdictional flexibility.

Option 2: There are significant geographic differences in the ratios and this information should be used to inform the Phase II WIP development process. Option 2 maintains some of the conservative nature of the asymmetric trading ratios by putting 10% bounds around the calculated N:P exchanges. For example, the Susquehanna with a calculated N:P exchange rate of 5.7 to 1 with a 10% buffer would be a 5.1 to 1 exchange rate for exchanging phosphorus for nitrogen and a 6.2 to 1 exchange rate for exchanging nitrogen for phosphorus. Under Option 2, if a significant nutrient exchange is proposed confirmation model runs will be needed to ensure water quality standards are still being met..

Pros: - Still provides for a conservative assumption.
- Allows for more jurisdictional flexibility based on geography.

Con: - Less conservative than the Phase I WIP exchanges.

Table of N:P exchanges under Option 2.

Basin	Exchange of P for N w/ 10% Buffer	Exchange of N for P w/ 10% Buffer
Susquehanna	**5.1**	**6.2**
West Shore	**8.2**	**10.0**
Patuxent	**7.9**	**9.6**
Potomac	**4.8**	**5.8**
Rappahannock	**1.9**	**2.4**
York	**3.0**	**3.7**
James	**1.5**	**1.8**
Upper East Shore	**10.2**	**12.5**
Mid-East Shore	**14.3**	**17.5**
Lower East Shore	**6.0**	**7.3**
Virginia East Shore	**5.6**	**6.8**

Option 3: Use the ratios exactly as calculated, and ensure water quality standards are being met with confirmation model runs if significant exchanges are proposed beyond the small scale "trim" adjustments made at the end of the WIP process used to balance implementation overshoot of a particular nutrient.

Pro: - Allows maximum jurisdictional flexibility.

Con: - Less conservative than options 1 or 2, but still sufficiently protective if confirmation model runs are made to ensure water quality standards are being met.

Table of N:P exchanges under Option 3.

Basin	Ratio
Susquehanna	**5.7**
West Shore	**9.1**
Patuxent	**8.8**
Potomac	**5.3**
Rappahannock	**2.2**
York	**3.3**
James	**1.6**
Upper East Shore	**11.3**
Mid-East Shore	**15.9**
Lower East Shore	**6.7**
Virginia East Shore	**6.2**