Agricultural Modeling Team (AMT)
Meeting Minutes: Day 1
November 1st, 2022
09:00 AM - 02:00 PM
[Day 1 Materials](#)

Summary of Actions and Decisions (Day 1 & Day 2)

Action: VOTING MEMBERS ONLY: Please complete the following poll **by COB Wednesday, November 23rd** to determine the prioritization of topics for the AMT: **https://www.surveymonkey.com/r/6NMTRYV**. *Please note: This will be used as an initial "temperature check" to determine the AMT's general timeline and schedule, however, this is not a comprehensive list of topics that the group will be discussing.*
Action: Please complete the following poll by **COB Tuesday, November 15th** to determine a monthly meeting time for the AMT (two-hour meetings/month): **https://forms.gle/rtu3xHHHnKiexYne9**.

Meeting Minutes

Introduction – 09:00 - 09:15a (15 min). Tom Butler, EPA.
The group introduced themselves and Tom set the stage for what the group will be doing.

Group Structure and Decision-making – 09:15 - 09:45a (30 min). Tom Butler, EPA.
Tom reviewed how the group is organized and will make decisions.

Discussion
Alisha Mulkey: Are we making recommendations or are we making decisions ourselves?
Tom Butler: We are making decisions ourselves. But groups above us, such as the AgWG, can overturn our decisions if they reach consensus on doing so.
Ken Staver: Do we have to all endorse something on the consensus continuum for an item to pass?
Tom Butler: As long as there are no "stops" or "holds", then the item will move forward.
Chris Brosch: How does the accountability of this group work?
Tom Butler: The AMT falls under WQGIT and AgWG so it does sit within the hierarchy of the Bay Program. If the AgWG wants to overturn something that we decide on, they can vote by consensus to do so.
Gary Shenk: Also, 2026 will be a year of review for the Phase 7 model so if a group wants to comment on a decision they have a dedicated year to do so.
Alex Soroka: Are we required to have all 12 members to vote?
Tom Butler: Yes.
Chris Brosch: So this group doesn't need subsequent approvals for the decisions we make?
Tom Butler: Correct. The AgWG approved the decision-making process/structure for this group.
Dave Montali: The AMT makes a decision by consensus, then presented to the higher bodies, they have to reach consensus to overturn the decisions?
Tom Butler: Yes, similar to how other groups within the bay program make decisions.
Jeremy Hanson: The structure was intentional so we have the ability to make decisions where the expertise exists.

Introduction of Topics – 09:45-10:30a (45 min). Tom Butler, EPA.
Tom provided an initial list of topics that have been raised for the group to examine and rank. Ranking of topics will be revisited on Day 2 after discussion of the context in which the topics interact. [*Reminder: rankings may be more relevant to states who engage in Bay Program activities than academics in the group so the state perspective of what's important could be given more weight.*]

Discussion
Alisha Mulkey: Does the animal size refer to animal counts or the nutrients from a particular animal type generated?
Tom Butler: The size/weight of the animal.
Chris Brosch: DAF comes from poultry processing waste, not poultry houses. Also, will there be an opportunity to add items to this list of topics so that we're making informed decisions when we rank things?
Tom Butler: These topics have been provided to us by the partnership and have been reviewed by the AgWG as being important. Any additional topics that come up can be addressed but we want to do an original ranking of these topics beforehand.
Chris Brosch: I'd like to be able to discuss those topics with the membership in advance of the ranking process.
Tom Butler: We will discuss these in more depth during Day 2 after we talk about the model today. You will also have two full weeks to complete the ranking survey.
Alex Soroka: Are we voting on all 24 as one group?
Tom Butler: Yes, you will rank all 24 based on relevance.
Dave Montali: Is this list of topics comprehensive? Or is it just to see what we are going to address first and we can add more topics as needed?
Gary Shenk: This input is only to gauge the group to develop a timeline, it is not meant to limit the group.
Tom Butler: Yeah we can shift things as we go along if we need to. The idea is that we have a timeline to line up our experts that need to be at each meeting baked on the topic.
Candiss Williams: Did the partners rank these based on importance?
Tom Butler: No, they are listed at random.

Introduction to the Chesapeake Assessment Scenario Tool (CAST) PART 1 – 10:35 - 11:15a (40 min). Olivia Devereux, Devereux Consulting.
Olivia gave an introduction to CAST, including what CAST is, how it is used by partners, as well as how it is used to evaluate progress and develop Watershed Implementation Plans (WIPs). CAST Website.

Discussion
Scott Heidel: With the high impact BMP opportunity area mapping, has there been any communication with the Healthy Watershed GIT to restore some of the antidegradation watersheds that are currently listed as impaired that could also have high priority for N, P, and sediment reductions with ag implementation?
Olivia Devereux: There is communication internal to the Bay Program office, but there is definitely room for improvement. Definitely looking to integrate it more closely.
Scott Heidel: The reason I ask is because PA is trying to meet local restoration of impaired stream segments. Communication between the two could help target and prioritize where those efforts take place.

Introduction to the Chesapeake Assessment Scenario Tool (CAST) PART 2 – 11:15 - 11:55a (40 min).
Gary Shenk, USGS.
Gary reviewed how CAST operates from a technical perspective in addition to the tool's sensitivities to inputs. He also presented on the relationships between CAST and other Bay Program models and tools.

> **Discussion**
> Ken Staver: Didn't the ag modeling subcommittee (AMS) work on average loads last time around?
> Gary Shenk: Yes. But Modeling WG determined average load for cropland and pasture, and within that, the ag land use loading rate subgroup (subgroup of the AMS) determined the relative loading rates within that.
> Chris Brosch: Why is the WQGIT shown as being responsible for acres?
> Gary Shenk: Because the Land Use Workgroup falls under the WQGIT and they approve the land use data.
> Lisa Duriancik: The AMT does not have any input on the BMP piece?
> Gary Shenk: This is referring to the percent reduction of the BMPs, which are determined by expert panels. Those get approved by the WQGIT.
> Chris Brosch: Some of the inputs that the AMT adjusts could affect the BMPs, though.
> Gary Shenk: Correct. Good point.
> Alisha Mulkey: Are the land use categories staying the same for Phase 7?
> Gary Shenk: They are up for discussion so they could change. In Phase 2-4, we had high-till and low-till crop land, and now we have more crop lands. The more land uses we have, the more we have to figure out how to divide crops across them. This group will go into what the "sweet spot" is for the number of land uses. The level of complexity will increase based on the number of land uses.
> Dave Montali: The change we made on the modeling side was a simplification, but we have very complicated inputs that make things more difficult to understand as we use the model.
> Alex Echols (in chat): Does the model assess things like specific crop genetics, yield, etc?
> Gary Shenk: Yes, the crop genetics are represented through the crop yield.
> Chris Brosch: We don't assess them, we just capture the data. So we don't assess yields for crops but we assess other inputs.
> Gary Shenk: We do have crop uptake from the Ag Census as one of the inputs.
> Chris Brosch: The yield data we capture from the Ag Census inadvertently hits drought years. We didn't assess the data to give respect to that.
> Gary Shenk: Right, if we can think of these things as estimates we may be able to come up with a different way of doing things down the road.
> Alex Echols (in chat): So offtake is not calculated or is it?
> Gary Shenk: We have crop removal and uptake as two different numbers and a formula to translate between the two. It's based on the yield.
> Ken Staver: But that relationship is open to review because it's on our charge?
> Gary Shenk: Correct.
> Ken Staver: Prior to this update, soil P was not considered in the model?
> Gary Shenk: It sort of was but not in a satisfactory way.
> Ken Staver: Need to have soil P in the model. Shift to reduced tillage and carbon sequestration leaves manure and fertilizer in a vulnerable position to be lost.
> Lisa Duriancik: I second that comment. APLE is one of the models USDA is working on for legacy P assessments, so may be more information with that in the future. Also, with USDA's major nutrient management initiative, placement of fertilizer sources is a big part of what we're going

to be emphasizing. Might be useful to consider how manure and fertilizer is accounted for in Phase 7.

Chris Brosch (in chat): Good point Ken on soil P. We need to revisit and discuss.

Gary Shenk: Agreed. The first time around the thinking was that it is either affecting soil P or it's affecting water extractable P. But you're saying there's a difference if the soil P concentration is on the surface or if it's further down. So thank you for that.

Olivia Devereux: That's easy to determine if we look at the collinearity, assuming we have the data.

Alex Echols (in chat): In the past we did not consider ortho P as a significant item. How has that evolved in the model?

Ken Staver: In the Clearfield county case, how do you deal with the imbalances of distributing nutrients if older data is used and might be less accurate but used for consistency sake?

Gary Shenk: We want to have both accuracy and consistency, but it's a balance between the two. It's harder to deal with the lack of consistency than the lack of accuracy, but they both present problems. The land use data itself doesn't have that big of an effect on the model and outputs and loads. Modeling WG produced a paper on that a few years ago.

Lisa Duriancik: Do you have a process in place for validating the land use data? The time point and collection of that data would make it temporally sensitive.

Gary Shenk: Peter Claggett could better answer that question. We can have him present at a future meeting about the land use data if needed.

Lisa Duriancik: The scale of CAST for Phase 7 - I'm wondering how the edge-of-field water quality data work into what the WQGIT does relative to in-stream water quality data?

Gary Shenk: The model is calibrated to in-stream data, not edge-of-field data. Not enough edge of field data to do that. The edge-of-field data are used in smaller scale modeling studies and we do a literature review of those studies.

Lisa Duriancik: The scale for Phase 7 has not yet been determined?

Gary Shenk: Yes, to be determined. The WQGIT is in disagreement on the final scale of the model, whether it's NHD scale or land river segment. We'll make that decision in 2025.

Animal Categories – 12:30 - 01:10p (40 min). Sucharith Ravi, UMCES.
Sucharith discussed the animal types used in CAST as well as how population data are determined.

Discussion

Alex Soroka: Are you happy with how the survey data agreed with the modeled prediction after 2017?

Sucharith Ravi: We assumed 2017 was never reported, and then used 82 to 2012 to predict the 2017 data, and then compared that to the actual 2017 data. The double exponential smoothing was more accurately predicting the data compared to other methods we used. We can revisit that once we get the 2022 information or more recent survey data.

Scott Heidel: Question about animal numbers for counties that border the watershed? Can we extrapolate based on the percentage of agricultural land within the state inside the watershed and then apply that to the animal numbers?

Sucharith Ravi: Yes, I think we can look into that. The land use data can differentiate between inside and outside the watershed, so once we establish the lb per acre nutrient value we already do that in a way.

Dave Montali: Can this group address the number of animals we have but also the way we process the data, especially poultry? Complex step of taking animal numbers, assigning average weight per bird, determining amount of dry litter per bird per weight, and then nutrient

concentrations with the dry litter. Disconnect between those poultry types and pullets/layers. There's also an issue of dry litter generation as it varies between management styles.

Tom Butler: I don't think we have anything specifically geared towards that, but Mark Dubin might have some insight about that.

Mark Dubin: I can give a presentation about that at a later date if the group is interested.

Crops and Land Use Data – 01:10 - 01:50p (40 min). Jess Rigelman, J7 Consulting/Olivia Devereux, Devereux Consulting.
Jess and Olivia reviewed the crop types and the categorization of crops into land use groups within CAST.

Discussion
Chris Brosch: Double cropping has historically been the most difficult logic problem that we've had to deal with. There's a balance between getting the output right vs having the input match the real world as closely as possible.

Ken Staver: If you plant wheat after corn or soybean harvest in the Fall in that calendar year is that considered a double crop acre?

Jess Rigelman: We only have the table of data so the rotations are not defined. We only know the acres of planted crops exceeds the area of total harvested crop land in the ag census. From there we assume those acres are double cropped. States define what crops are double cropped.

Alex Soroka: Are these reported acres harvested or planted?

Alisha Mulkey: Harvested acres are reported to NASS.

Ken Staver: I think we should understand this better as a group.

Jess Rigelman: Agreed. We haven't identified a better way of doing it, but if we can think of one we could implement it.

Ken Staver: This should be clarified before we start speaking about winter forage.

Ken Staver: Do we have a system for accounting for how to move manure around for counties that don't have animal units?

Jess Rigelman: Yes, counties without animals can have manure applied if they have crops that are manure eligible. But this process could be improved upon if this group decides to do so.

Alex Soroka: Sq foot for broilers is really small, why is that?

Chris Brosch: I don't think we know anymore.

Chris Brosch: The reason for that is because of splitting counties?

Jess Rigelman: Yes, all of the processing of manure and fertilizer inputs is done at the county scale. We just make sure we know that the feedspace acres are appropriately in and out of the watershed based on state input.

Scott Heidel (in chat): Is there a method to account for manure applications used during the reclamation of abandoned mines lands?

Jess Rigelman: No, not yet.

Scott Heidel: But abandoned mine reclamation is a BMP right?

Jess Rigelman: Yes but it's not an agricultural BMP, it turns mixed open into forest.

Tamie Veith: What about applying biosolids to ag land areas? Are we tracking that?

Jess Rigelman: We definitely apply biosolids. Tom will review it tomorrow. When I say manure, I mean biosolids or manure, so any land use eligible for manure can also be eligible for biosolid application. We collect biosolid data through the point source app, which the Wastewater Treatment Workgroup is in charge of.

Concluding Remarks – 01:50 - 02:00p [10 min].
Meeting Adjourned – 02:00

Meeting Chat

from Kate Bresaw, PA DEP to everyone: 9:33 AM
If there will be future in-person meetings, please communicate the dates more than 30 days in advance. PA needs at least 30 days to seek approval for out-of-state travel. Thank you!
from Jackie Pickford, CRC (she/her) to everyone: 9:36 AM
Will do, Kate
from Scott Heidel to everyone: 11:34 AM
sounds great! I'm at scheidel@pa.gov
from Alex Echols to everyone: 11:36 AM
in the past we did not consider ortho P as a significant item. How has that evolved in the model?
from Brosch, Chris DDA to everyone: 11:37 AM
Good point Ken on soil P. We need to revisit and discuss.
from Olivia Devereux to everyone: 11:51 AM
https://www.chesapeakebay.net/what/programs/modeling/phase-7-model-development

Day 1 Participants

Jackie Pickford, CRC	Helen Golimowski, Devereux Consulting
Tom Butler, EPA-CBPO	James Martin, VA DCR
Olivia Devereux, Devereux Consulting	Jennifer Walls, DNREC
Jess Rigelman, J7 LLC	Robert Waring, VA DCR
Gary Shenk, USGS	Frank Schneider, PA SCC
Sucharith Ravi, UMCES	Holly Walker, DNREC
Chris Brosch, DDA	Jeremy Daubert, AgWG Chair
Zach Easton, VT	Mark Dubin, UME/CBPO
Jeremy Hanson, CRC	Alex Echols, Keith Campbell Foundation for Environment
Alisha Mulkey, MDA	
Cassie Davis, NYSDEC	Clare Gooch, DNREC
Emily Dekar, USC	Karl Blankenship, Bay Journal
Scott Heidel, PADEP	Isabella B, Modeling WG
Kate Bresaw, PA DEP	Elizabeth Hoffman, MD
Robert Shoemaker, VA DCR	Kate Bresaw, PA DEP
Becky Barlow, VA DCR	Paul Bredwell, Us Poultry and Egg
Dave Montali, WV Tetra Tech	Grant Gulibon, PA Farm Bureau
Kristen Bisom, WVCA	Amanda Barber, NY
Jeff Sweeney, EPA-CBPO	Ruth Cassilly, UMD-CBPO
Ken Staver, UMD	Seth Mullins, VA DCR
Candiss Williams, USDA ARS	Dean Hively, USGS
Lisa Duriancik, USDA NRCS	Clint Gill, DDA
Alex Soroka, USGS	Tamie Veith, USDA

Agricultural Modeling Team (AMT)
Meeting Minutes: Day 2
November 2nd, 2022
09:00 AM - 02:00 PM
[Day 2 Materials](#)

Meeting Minutes

Introduction/Recap – 09:00 - 09:15a (15 min). Tom Butler, EPA.
Tom gave a recap of day one and went over the order of day 2.

Manure Data and Biosolids – 09:15 - 09:55a (40 min). Tom Butler, EPA.
Tom discussed the process of calculating manure and biosolid inputs for CAST.

Discussion

Alex Soroka: what scale are the non-nutrient management multipliers enacted at?

Tom Butler: They are enacted on the land use itself, across the entire watershed.

Olivia Devereux: It depends on how people report the BMP of nutrient management. For non-nutrient management, it's applied to as many acres that do not have the BMP applied.

Alisha Mulkey: What if we don't specify the land use?

Olivia Devereux: Then it will get broken up proportionally across the ag land uses.

Alex Echols (in chat): Just to make sure I understand your intent, you exclude management actions - so for example injection reduces nutrient loss - compared to surface application - but that is not built into this calculation?

Tom Butler: That's correct. This is only for the nutrient management plan. If there is a nutrient management plan then that will affect how these will get applied.

Olivia Devereux: Injection is a different BMP.

Alex Echols (in chat): So as I understand there is a layering system that would calculate load?

Chris Brosch: Great fundamental question about how BMPs stack. Injections are applied as filter BMPs, it will affect the back end of the model sequence. Nutrient management is a type of BMP that affects the application of nutrients that go towards future calculations of loads. Sequentially nutrient management is applied before management actions like injection.

Alex Soroka: So this would impact everything else in the modeling system. Can we have a ballpark of the percentage of land by state that is reported with nutrient management plans?

Jess Rigelman (in chat): State nutrient management % as reported to the Bay Program in 2021

DE	72.70%
MD	72.70%
NY	14.90%
PA	18.10%
VA	25.90%
WV	23.90%

Tamie Veith: PA is a lot lower than other states. Can we look into if the nutrient management percentage reflects what is on the ground?

Olivia Devereux: I think the amount for PA is mostly just NRCS data. PA doesn't have reporting capacity for nutrient management, which might be why it looks low.

Kate Bresaw: It includes ag 38 nutrient management plans and manure management plans, but we have room to grow.

Lisa Duriancik-NRCS (in chat): So you don't treat injection as part of nutrient management, the placement part of the 4Rs of nutrient management? You treat injection/subsurface placement as a filtering practice?

Tom Butler: Yes I believe that is the case.

Olivia Devereux (in chat): @Lisa, yes, the manure injection is a separate BMP from nutrient management plans. You can have a nutrient management plan and manure injection.

Tamie Veith: This is for land that does not have a nutrient management plan applied?

Tom Butler: Yes.

Olivia Devereux: Difficult to determine how land is managed when there is no nutrient management plan because we don't know what they're doing if they're not following one. Because it is so variable, we decided to add a multiplier to assume more nutrients are being applied. Lots of components to a nutrient management plan but many of these components are actually separate BMPs from a model perspective and can be added as separate BMPs.

Alisha Mulkey: Anything that exceeds regulatory requirements gets stacked as a separate BMP.

Tamie Veith: The injection is part of the plan, however. This is essentially just nutrient application.

Olivia Devereux: We have an ongoing issue with clarity about this across the Bay Program. Leon Tillman, NRCS, can speak to his work at the Bay Program trying to clarify that more.

Chris Brosh: The approach was designed to mimic the way nutrient management plans have been written through time across generations. Challenge in comparing nutrient management plans from the 1990s in comparison to plans in 2017, for example. Stacking BMPs allows for easier comparison.

Lisa Duriancik: What was your basis for the rates?

Chris Brosh: The Expert Panel put together recommendations based on best professional judgment.

Lisa Duriancik: When was the last time it was updated?

Chris Brosh: The EP report has been updated around 4 times. The last nutrient management expert panel was in 2016.

Clint Gill (in chat): Nutrient Management EP Report

Gary Shenk: These rates are not the same that is applied in the model. These are just the starting rate for a calculation that we will go through later.

Mark Dubin: The 2016 expert panel report doesn't say it has to be a plan, they just have to implement nutrient management actions.

Ken Staver: This is about the effect on the load that you discussed yesterday with the equation?

Gary Shenk: If you're applying more to non nutrient management land, you get more load off by about 20% of the additional application.

Ken Staver: Average amount applied vs amount applied in each segment - these multipliers go into that fraction?

Gary Shenk: They go into calculating the amount applied in that segment.

Chris Brosch (in chat): I'm not sure the conversation between Gary and Ken is accurate. The multipliers are "goals" for nutrient assignments to an acre. The actual application is further adjusted by the nutrient supply and the load is calculated on the actual application, not the goal - taking into account supply issues where surpluses can exist. A non-nm Dre can have more manure and fertilizer applied than 1.2, 2 or even 3x the "goal".

Olivia Devereux: Correct, there's a difference between the goal and what actually happens.

Mark Dubin: There's a nuance here about the pasture land use on the multiplier table. I have information/data on application rate on pasture that I can present at a later date if needed.
Dave Montali: If you start looking at the curves in the data, that application to pasture does happen in the model if counties have an excess. More about applying that manure for disposal reasons rather than agronomic.
Ken Staver: In terms of loads, is the only place the nutrient management comes into play is how the fertilizer bucket gets spread around the watershed?
Gary Shenk: Essentially, yes.
Ken Staver: The nutrient management effect is on inorganic nutrients being spread around the watershed out of that big fertilizer sales bucket.
Gary Shenk: It's also manure on land uses within the county.
Olivia Devereux: If there are not enough animals producing enough manure and the fertilizer sales aren't showing enough, you can apply less than the crop goal in some places, or you could apply more than the crop goal as Chris explained in the chat previously. Only have data for certain years though. Direct deposit is also not a part of this.
Chris Brosh: Imagine the entire watershed is like a waterbed. Where nutrient management is applied, it is as if you sit on one part of the waterbed - it reduces the amount of nutrients that can be applied in those areas. But the nutrients (manure and fertilizer) must go somewhere, so other parts of the waterbed will increase in height.
Dave Montali: I think we'd benefit from discussion of core nutrient management versus supplemental nutrient management BMPs.
Jeff Sweeney: This whole discussion is about core nutrient management. You get additional benefits for applying at the rate, timing, and placement on top of the multiplier, which is supplemental nutrient management.
Lisa Duriancik (in chat): Are the multipliers ever re-evaluated based on the fertilizer sales data? Or based on price for fertilizer? so your "core nutrient management" is just rate? Not really a 4R nutrient management approach? Just so we understand.
Olivia Devereux (in chat): @Lisa, no regarding re-evaluating multipliers. @Lisa, yes, regarding Core nutrient management, not rate, placement or timing.

Fertilizer Data – 09:55 - 10:30a (35 min). Tom Butler, EPA.
Tom discussed the current fertilizer data and how these data are used across the Chesapeake Bay watershed.

Discussion
Ken Staver: The crop yield is NASS, application goals are not?
Tom Butler: Correct.
Ken Staver: When do the non nutrient management multipliers come in?
Gary Shenk: We take the crop yield, multiply it by a yield to application goal ratio, then you modify the application goal based on whether or not there is nutrient management. Amount of nutrient management in the county affects the amount of fertilizer that it receives.
Jess Rigelman: The fertilizer bucket when applied absent of manure, you never get 100% of your goal. It's possible but it never happens. There is a watershed wide goal that is met with biosolids and manure and then we apply fertilizer, there's not enough fertilizer to 100% meet that goal. It doesn't mena application isn't greater than 100% though.
Lisa Duriancik: Watershed wide scale there is underapplication consistently based on yield goals?
Olivia Devereux: Yes, but in individual locations for individual land uses it could be greater.

Brosch, Chris DDA (in chat): Load is not attributed in this step. That word should be application.
Alex Soroka (in chat): Is that an underapplication of fertilizer compared to the whole nutrient budget? Or, underapplication of Manure+fertilizer.
Jess Rigelman: Both. Watershed-wide.
Gary Shenk: It's not an under-application compared to recommendation, it's compared to what our assumption is plus the nutrient management multipliers for those areas.
Chris Brosch: If there was 100% coverage of nutrient management for every acre in the model, the nutrient deficit would be much smaller or disappear. The deficit exists because of the multiplier of non nutrient management or because the demand on those acres is artificially higher to simulate the non-BMP condition.
Tamie Veith: Doesn't that indicate that the rate might be too high?
Chris Brosch: Non-nutrient management rate works through all of time in the model as a goal for non BMP condition. It's supposed to be higher.
Tamie Veith: Right, but that deficit wouldn't exist if everyone was applying based on the management rate. Confusion between baseline setup/calibration?
Chris Brosch: Confusion is discussing mass balance at CB wide scale versus county wide scale (simulation scale). There are many counties that have a surplus in the mass balance when you account for fertilizer and manure that is applied. Some entire counties are in deficit. Because of the penalty goal, the CBW will always be in a mass balance deficit the way the model is now.
Gary Shenk: Deficit could be attributed to underreporting of nutrient management or because the multipliers are too high.
Ken Staver: Also we're assuming that fertilizer sales number is correct. The bucket approach sort of constrains those ratios because they are constrained by the amount of N and P are available?
Gary Shenk: They come into play with how the fertilizer bucket is distributed.
Chris Brosch: The national data set for fertilizer sales is not consistent. States have own fertilizer laws which generate that data and they don't have QAPPs like we do for BMP data so it's impossible for it to be consistent.
Tom Butler: We have an investigation going on right now about the differences in how the states report so that we can potentially provide a more consistent template across jurisdictions.

Existing Fertilizer Data Investigation – 10:30 - 10:40a (10 min). Tom Butler, EPA.
Tom discussed an existing fertilizer investigation that will directly inform the AMT's examination of inorganic fertilizer data.

Discussion
Alex Soroka: Are the states using similar base data to provide these estimates? Are their methods similar?
Tom Butler: Every state is a little different. Their database is not necessarily "apples to apples" but we're looking at ways to make it more comparable.
Alisha Mulkey: Prioritization of topics - how does this group play into that?
Tom Butler: It will take time with the other group to talk with the states so I wouldn't suggest starting with this topic.
Alex Soroka: This team is doing this investigation. It will take time. In terms of our planning, how far along are we in this process? Results in 2023 or 2024?
Tom Butler: We're developing a tentative timeline, but it is contingent upon when we can meet with people which has been difficult to coordinate.
Alisha Mulkey: So this group is a separate entity that will decide about a better/improved dataset, then it comes to the AMT to decide what to do with it?

Tom Butler: The fertilizer expert team will start as an independent group, but I'm hoping in time we can bring in experts from that group to help inform the dialogue in the AMT. They won't make the decision independently, but they will be able to provide input and information for AMT to make the decision.

Mark Dubin: AAPFCO has a standardized process, but not sure whether or not the states use the template. There is some attempt to standardize it, though I know states might be working under separate regulations.

Ruth Cassilly: All the states are not still reporting to AAPFCO as of 2016 - NY doesn't report anymore. So our 2017 dataset would not include one state. Just making folks aware of that. Could be a motivation to find a standardized reporting of the data from the states to the Bay Program.

Soil Data: Revised Universal Soil Loss Equation (RUSLE) and Soil Phosphorus data – 10:45 - 11:25a (40 min). Tom Butler, EPA.
Tom discussed the use of RUSLE and the focus on cover factors (C factors) across the Chesapeake Bay watershed. He also reviewed soil P data sources utilized by the model.

Discussion
Lisa Duriancik-NRCS (in chat): For everyone who missed our webinar last week on nutrient management, or wants to access those slides, a recording (now available) and citations, please see: https://www.nrcs.usda.gov/conservation-outcomes-webinar

Alex Soroka: Are the values for soil data coming from the county?

Tom Butler: Not necessarily county-specific, some are a set of counties or larger areas.

Olivia Devereux: We get the soil data from private and public testing labs, some by county and some by zip code. From there they are generalized. Geographic spatial methods are applied to generalize it across a three county range for any samples from the location where we had the data.

Ken Staver: What other data goes into APLE?

Gary Shenk: APLE is based on inputs and outputs. It is an annual mass balance model. We interpret it as an estimate of the trend more than the absolute value. The uncertainty of the soil data and APLE were discussed in the previous AMS group.

Olivia Devereux in chat): These are the inputs to APLE in addition to the soil P data. Manure split into solid and liquid
> Biosolids
> Fert
> Uptake
> Fixation

Ken Staver: The sensitivity factors for water extractable phosphorus (WEP) - where do those numbers matter?

Gary Shenk: Total P that's applied is represented in change of soil P. The WEP is particularly susceptible to runoff so there is that sensitivity to it. If you have a greater WEP fraction it creates more of a load than just increasing the soil P. Greater percentage of WEP in the total P will result in a greater runoff amount.

Ken Staver: Is there anything done related to the application method here? It really comes into play when it's applied.

Alisha Mulkey: When you initialize it, there is a surface and subsurface that you can distinguish but I forget about application. New generation might have different variables.

Here is more information on APLE, from our USDA P Modeling/Legacy P Workshop last December. Scroll down to Phosphorus Modeling Documents: https://www.nrcs.usda.gov/ceap/publications#:~:text=Annual%20P%20Loss,(175%20MB) Annual P Loss Estimator (APLE) Slides part 2, 2021 (0.6 MB) Annual P Loss Estimator (APLE) Video, 2021 (175 MB)

Revisit: Prioritization of Topics - 11:30a - 12:00p (30 min). Tom Butler, EPA.
Tom reviewed the focus topics for the AMT that were presented during Day 1 and described how we plan to create a work plan for the AMT via ranking topics. To repeat: rankings may be more relevant to states who engage in Bay Program activities than academics in the group so the state perspective of what's important could be given more weight.

Discussion
Category: Manure
Topic: DAF
Alisha Mulkey: DAF is poultry processing plants, not poultry house. When animals go to the processing plant, DAF is the technology that will separate the wastewater fluids portion and the semi-solid portion that can be land applied as a nutrient source. D
Alex Echols (in chat): DAF - Dissolved Air Flotation. It picks up fats, small solids and particles and floats them to the surface for stripping out
Dave Montali: So it is the process to put flocculant into the water that facilitates the flotation of the solides up top where they can be collected and removed from the waste stream? And then that's a solid waste that needs to be disposed of or can be land applied?
Alisha Mulkey: I'm thinking of the semi-solid waste as the nutrient source.
Clint Gill (in chat): https://www.denaliwater.com/news/posts/2020/july-2020/demystifying-daf-sludge/
Alex Echols (in chat): There are proposals to use DAF materials for other processing purposes - ie resource recovery
Gary Shenk: Can it be estimated or is there data available?
Alisha Mulkey: Brokers handle that for the integrator. The waste stream is collected by a third party and it could go lots of places. From an industry perspective, we don't know where or how far it's traveling or whether or not it stays in the watershed. This isn't different from other nutrient sources that would be crop applied, so not sure why this was on the list and others were not included.
Tom Butler: This was something suggested from the partnership, but we can add other components to this topic if we feel it's necessary.
Jennifer Walls (in chat): Is DAF covered by a poultry plant NPDES permit?
Olivia Devereux: Right now we have biosolids, manure, and fertilizer. What other nutrient sources are we missing? DAF, others?
Alex Soroka: Depends if this is a process that we think is widespread.
Jennifer Walls: DAF also being used as material for compost and energy operations. It's more than just land application. I don't know who is tracking and accounting for that or if it gets covered in an NPDES permit.
Cassie Davis, NYS DEC (in chat): would food processing waste fall under biosolids?
Dave Montali: Probably needs to be looked at into the future.
Alisha Mulkey: For Phase 6 we don't currently quantify them.
Dave Montali: I think there's an existing way to quantify that.
Olivia Devereux: Jess could dig into that.

Tom Butler: I'll change the topic to include a broader category than just DAF and look into whether or not we see the value of including them.

Category: Crop
Topic: Crop Nutrient Application
Ken Staver: language of "so we can move away from real life practices"?
Tom Butler: I can remove that language. Trying to state the balance between generalized vs more detailed modeling.
Dave Montali: Question is can we simplify and increase transparency vs the way it's written as very complex in contrast to a simplified model approach.
Gary Shenk: Hard to fully discuss that without going into crop application curves which we will have to do at a later time. Complexity is getting in the way of transparency, so the question is can we understand what it's doing and predict what it is going to do.
Olivia Devereux: Timing of application also adds complexity.

Category: Crop
Topic: Plant Categories
Tom Butler: I'll eliminate urban turf grass in the wording since we are only focusing on ag.
Dave Montali: I think we should make a decision about what our land uses are before we talk about plant categories or crop nutrient application.
Ken Staver: I'd consider hay to be a crop.
Tamie Veith: How much can we change the land use distinctions without messing up the historical trend so that it's consistent?
Gary Shenk: We can change them but we have to change them back through time. We could absolutely do that.
Tom Butler: I'll change it to "reevaluate plant categories".
Robert Shoemaker (in chat): In Virginia 65%, more or less, of the active agricultural land base is in hay and pasture so we need to understand a certain segment of this is well managed.
Mark Dubin: We need to look at the source of data as well to see if they are categorizing these as commercial crops.

Category: Crop
Topic: Timing of crop nutrient applications
Ken Staver: If you don't have core nutrient management you aren't eligible for timing or placement BMPs. Is that correct?
Mark Dubin: Yes that's correct. Manure incorporation or injection could be applied separately.
Olivia Devereux: That is how the expert panel is written. The timing of nutrient applications causes unexpected illogical effects which is why this category is listed as a topic.
Lisa Duriancik: Other aspects of timing are not considered?
Olivia Devereux: Nutrients are recorded using the last frost date. We don't model putting nutrients down during winter.
Lisa Duriancik: So you don't model the benefit from that then?
Olivia Devereux: Right, because it's not modeled in the first place. We would have to model it happening before we gave anyone benefits for it not happening.
Gary Shenk: We could incorporate it but not just by describing the inputs, we'd have to describe the effect as well.
Tom Butler: I'll reword to say "reevaluate current application strategy for CAST".

Category: Crop
Topic: Double cropping
Alisha Mulkey: Lets address land use before we start discussing double cropping.
Chris Brosch: Double cropping sequence is important in stakeholders' minds because crop rotations are a BMP in the real world.
Ken Staver: Interested in the winter cereal forage issue and how that fits into the double cropping definition.

Category: Crop
Topic: Climate Change and crop types
Gary Shenk: This is about forecasting for future scenarios. The WIPs made in 2018 were made on 2025 land use and do we forecast a change due to climate change.
Robert Shoemaker (in chat): Due to climate change it appears we are getting warmer with more rainfall so under this category should we include impact on crop yield?
Chris Brosch: In the real world, this is linked to increased demand for installing irrigation systems.
Zach Easton (in chat): and drainage.
Robert Shoemaker (in chat): Also does increase atmospheric co2 increase photosynthetic rate that leads to improve crop yields?
Lisa Duriancik-NRCS (in chat): Yes, drainage also. Changes in runoff and discharge. Are these accounted for or is this not the model to evaluate that?
Ken Staver: Suggestion to simplify and not focus on climate because it's being addressed in other places.
Chris Brosch: But opportunity exists to be responsive to the partnership. Maybe we can rank this but just identify where the topic can be picked up by another group in the future.
Gary Shenk: This won't be needed until 2027. Not necessary to evaluate for calibration of the model. Chris, I like that idea - numerating these things and then setting it aside for future consideration.
Alisha Mulkey: Is the high resolution land use also considering ag land coming out of production for sea level rise, marsh migration, any of those factors?
Tom Butler: Need land use workgroup to answer that question.
Ken Staver: Irrigation - with or without climate change - is worth including. And drainage as well.

Category: Crop
Topic: Crop uptake vs removal
Brosch, Chris DDA (in chat): Two-part comment. Fixation needs revisiting and uptake should be connected on legumes.

Category: Animal
Topic: Reevaluate animal types
Dave Montali: Horses are disconnected from the rest of the animals. Might be better to keep it the way that it is.
Chris Brosch: Should refer to the BMP expert panel. Only have reports on three animal types. Want to prioritize the animal types that we don't have yet.

Category: Animal
Topic: Feeding Operations

Alisha Mulkey: Imagery is limited to permitted AFOs and CAFOs or just any barnyard areas?

Tom Butler: I have to consult the Land Use Workgroup to get that answer.

Alex Echols (in chat): Need to include information on feed use efficiency in calculating animal impact.

Olivia Devereux: Yes, concentration of nutrients in manure is lower in precision feeding. But we don't quantify the amount of nutrients it takes to feed an animal.

Chris Brosch: similar issues but not the same. recommendation from the poultry litter subcommittee report. Precision feeding and feed use efficiency are two different issues. Conversion that Alex is referring to is indirectly captured in the manure generation data from the poultry litter subcommittee report.

Tom Butler: So we need to reevaluate elements of both size and feeding?

Gary Shenk: Maybe we just need to capture all of the factors that go into production of manure nutrients rather than focus on size.

Alex Soroka: So this suggests that for the same amount of animal unit it might be assumed as producing lower amount of nutrients in the manure?

Gary Shenk: Correct, but we're going to reevaluate that.

Dave Montali: want to look at the way manure nutrients are simulated or inputted for broilers and turkeys. Current assumptions in the model of nutrient content for litter may be different now.

Mark Dubin: Reports approved in 2016 for swine. Need to consider using updated information.

Robert Shoemaker (in chat): Regarding size and amount of feed is it important to differentiate between feed that is grown within the Bay watershed and what is being shipped in from outside the Bay watershed? ie some is being recycled within the system, some is being added to the system.

Alex Echols (in chat): The change in clean out may change again as the sector moves to miscanthus. That could also affect the value of litter as a fertilizer.

Gary Shenk: Not a net anthropogenic input model. Instead we are tracking what is coming out of waste treatment plants, what's in the manure generated through animals, and what leaves the field in terms of crop removal and we don't have the connections between crop removal and where it ends up in import, export, feed and food. We don't track that in this model.

Olivia Devereux: We track manure and concentration of nutrients in manure, but we don't track food products.

Olivia Devereux (in chat): Manure transport is tracked and reported by the states

Alex Echols (in chat): What is subsidized is tracked.

Category: Manure
Topic: Manure storage

Mark Dubin: Expert Panel has reviewed this for Phase 6 model. Includes housing along with storage.

Olivia Devereux: Can you add field volatilization as well?

Tom Butler: Sure.

Lisa Duriancik: From a water loss perspective, literature exists that covers nutrient losses from barnyards, for example, to capture the storage and housing aspects. Do you limit it to volatilization or do you plan to include other nutrient from wash off from actual barnyard manure storage area?

Tom Butler: That will be included in the category "storage and handling losses".

Mark Dubin (in chat): Manure transport may also be tracked by federal and state permit oversight, not just incentive based.

Alex Echols (in chat): Agree - but it only captures a portion.

Category: Animal
Topic: Mineralization
Olivia Devereux: It will also depend in part on how the crops are categorized into land uses.

Category: Animal
Topic: Transport
Alisha Mulkey: If transport is not reported in cost share program but it's leaving the state, but we don't know the destination, can we report that now?
Olivia Devereux: Yes, you can always report manure transport out of the watershed.
Tamie Veith: Needs to include the weight.
Olivia Devereux: It's reported by tons of wet manure.
Dave Montali: We don't have the data for dry but there's a default conversion from wet to dry that could be reevaluated.
Olivia Devereux (in chat): Wet to dry manure conversions are on CAST:
https://cast.chesapeakebay.net/Documentation#EditScenarioManureBMPs
Dave Montali: Also manure transport goals are hard to meet because there is less actual manure available due to housing management. links to the quality of the litter and if there is less it might be more concentrated.
Mark Dubin: Modeling tools automatically distribute across acres for manure application, at least within the county scale. The primary concern is outside of the county.
Alex Echols (in chat): Over the past year there has been a shortage of litter - in part because of the price of synthetics and in part because of Av Flu.
Robert Shoemaker (in chat): the free market is moving a bunch of litter.
Dave Montali: The issue is how states track that. If it's private industry, it's harder to account for.
Mark Dubin: VA is developing an online tool for producers to report litter transports back to the agency to obtain better data.
Chris Brosch (in chat): We estimate a 50/50 split in DE.
Robert Shoemaker (in chat): Virginia poultry growers are now required to keep records of manure sold and that is part of the inspection process by DEQ
Seth Mullins (in chat): To add to Mark and Robert's comments - The majority of poultry operations in VA are permitted and those permits now include transfer reporting. That regulation also includes mandatory reporting requirements for litter end-users.
Kate Bresaw, PA DEP (in chat): Same for PA. All CAOs and CAFOs are required to report transport.

Category: Inorganic fertilizer
Topic: Fertilizer Breakdown
Dave Montali: Can you make the description more vague and just say that we want to look at the scale of it? Or take recommendations from the state chemists.

Category: Inorganic Fertilizer
Topic: Revisiting AAPFCO NH4 to NO3
Gary Shenk: Currently in CAST it doesn't make any difference, but it could be built into the Phase 7 CAST. It is if that ratio is changing and what it means to export.
Alisha Mulkey: We're not using that information at all?

Gary Shenk: Not using any speciation for any of the inputs right now. Group could investigate if adding in speciation is worth it.

Category: Inorganic Fertilizer
Topic: Biologicals
Alex Echols (in chat): On biologicals, these are already in the field on a large scale. We do not know the water quality implications - could be very good if they fix N directly into to the plant - if however they are used with continued application of fertilizers at traditional rates could increase load. There is very little data on water quality impact to date - but research is underway.
Chris Brosch: Need to add input from fertilizer experts. These products as result of not being labeled fertilizers, they don't require nutrient analysis.
Tom Butler: Need fertilizer experts to confirm they don't know what is in it?
Chris Brosch: Yes. Need to document that.
Dave Montali: Need to talk to manufacturers about this. Maybe as a technical advisory role.
Alex Echols (in chat): On the microbial - not much direct content of N or P but can produce or make plant available. Application rate may be in the ounces per acre - and some claim 45+ pounds N per acre - next generation to be released shortly
Lisa Duriancik-NRCS (in chat): How do you avoid double counting this with mineralization?
Mark Dubin (in chat): The Phase 6 nutrient management EP considered the 4th "R" as a potential Supplemental nutrient management BMP, but chose intentionally not to include fertilizer or enhancement products as a BMP.

Category: Modeling
Topic: All
Dave Montali: Land use needs to be broader than that. Land use can be evaluated based on transparency and use of the model and the other inputs like NASS data or ag census data. Keep the same land uses as in Phase 6 or modify them.
Alisha Mulkey: Cover factor to feed the RUSLE equation or soil phosphorus data to feed APLE?
Tom Butler: The P data would be more for APLE and the cover factors just for RUSLE. Potentially looking into new sources of data at the watershed scale.
Olivia Devereux: The watershed model used for calibration also looks at land available to be eroded to have detached sediment.
Chris Brosch: Don't decrease complexity at the expense of specificity. Matching the real world is important to the farming community. Striking a balance is what we should be focusing on, rather than decreasing complexity.

In General
Alisha Mulkey: Can we be shown when in the sequence in the model that these topics come into play for a given land use?
Jess Rigelman: I can prepare the data for any scenario.
Gary Shenk: We could work through an example of a county step by step to show you. Or we could do sensitivity tests.
Olivia Devereux: Jess has tested some of these ideas such as the timing. It didn't have a large impact. Would be nice to test them and then revisit them to make sure they jive.
Chris Brosch: I would like to capture new topics before we rank these.
Brosch, Chris DDA (in chat): Dave and others, did we capture new topics through the discussion? Other than those enumerated on the slides?

Mark Dubin (in chat): The ranking should also consider the timing of when data will be available for consideration; e.g. fertilizer sales data.
Robert Shoemaker: More important for VA is adding to the list, calendar schedule for when these new items will be due for dates and timelines.
Tom Butler: Year of testing will be 2026 but I will figure out dates between now and then as interim deadlines.

Action: VOTING MEMBERS ONLY: Please complete the following poll **by COB Wednesday, November 23rd** to determine the prioritization of topics for the AMT:
https://www.surveymonkey.com/r/6NMTRYV. *Please note: This will be used as an initial "temperature check" to determine the AMT's general timeline and schedule, however, this is not a comprehensive list of topics that the group will be discussing.*

Recap of Action Items for the Group - 01:00-01:15 (15 min). Tom Butler, EPA.

Action: Please complete the following poll by **COB Tuesday, November 15th** to determine a monthly meeting time for the AMT (two-hour meetings/month): **https://forms.gle/rtu3xHHHnKiexYne9.**

Closing Remarks - 01:15 - 01:20p (5 min). Tom Butler, EPA.
Meeting Adjourned – 01:20p

Day 2 Participants

Jackie Pickford, CRC
Tom Butler, EPA-CBPO
Olivia Devereux, Devereux Consulting
Jess Rigelman, J7 LLC
Gary Shenk, USGS
Sucharith Ravi, UMCES
Chris Brosch, DDA
Zach Easton, VT
Alisha Mulkey, MDA
Cassie Davis, NYSDEC
Emily Dekar, USC
Scott Heidel, PADEP
Kate Bresaw, PA DEP
Robert Shoemaker, VA DCR
Becky Barlow, VA DCR
Dave Montali, WV Tetra Tech
Kristen Bisom, WVCA
Jeff Sweeney, EPA
Ken Staver, UMD
Candiss Williams, USDA ARS
Lisa Duriancik, USDA NRCS
Alex Soroka, USGS
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Seth Mullins, VA DCR
Leon Tillman, NRCS
Isabella B, Modeling WG
Tamie Veith
Tad Williams
Alex Echols
ShoreRivers
Joel Blanco-Gonzalez
Clint Gill, DE

Acronym List
APLE: Annual phosphorus loading estimator
AMT: Agricultural Modeling Team (Phase 7)
AMS: Agricultural Modeling Subcommittee (Phase 6)
BMP: Best Management Practice
LUWG: Land Use Workgroup
RUSLE: Revised Universal Soil Loss Equation
GIT: Goal Implementation Team
LRseg: Land river segment
NHD: National hydrography dataset
WEP - water extractable phosphorus
DEQ – department of environmental quality