EASTERN VIRGINIA GROUNDWATER MANAGEMENT ADVISORY COMMITTEE AND THE DEPARTMENT OF ENVIRONMENTAL QUALITY

Patrick Henry Building – East Reading Room (Room 1035)
1111 East Broad Street, Richmond, VA 23219

April 23, 2024
10:30 AM/11:00 A.M.

FINAL MEETING MINUTES

Committee Members Present	
Ethan Betterton – Chamber of Commerce	Robert Pickett – Northen Neck Soil and Water Conservation District (NN SWCD)
Andrew Clark – Home Builders Association of Virginia	Doug Powell – James City County Service Authority
Jason Early - Stantec	Paul Retel – City of Suffolk & Western Tidewater Water Authority
Dan Holloway – Hampton Roads Sanitation District (HRSD)	Kellen Singleton – Accomack-Northampton PDC
David Jurgens – City of Chesapeake	Jake Tabor – Virginia Farm Bureau
Whitney Katchmark – Hampton Roads Planning District Commission (HRPDC)	

Committee Members' Alternates Present	
Patrick Fanning (Alternate for Chris Moore)	Chesapeake Bay Foundation
Doug Meyer (Alternate for Mark Bennett)	USGS
Chris Pomeroy (Alternate for Paul Retel)	City of Suffolk & Western Tidewater Water Authority
Shannon Varner (Alternate for Andrea Wortzel)	Mission H2O

The following committee members were absent from the meeting: Chief Steve Adkins – Chickahominy Tribe; John Aulbach – Aqua Virginia; Mark Bennett – USGS; Nina-Mary Butler – WestRock; Hope Cupit - Southeast Rural Community Assistance Project, Inc. (SERCAP); Stewart Leeth – Smithfield Foods; John Loftus – VA Economic Development Partnership/VDOT; Dr. Kevin McGuire – VA Water Resources Center; Chris Moore – Chesapeake Bay Foundation; John O'Dell – VA Well Drillers Association; Mike Rolband – DEQ; Dr. Karen Shelton – VDH; Kurt Stephenson – Virginia Tech; Nathan Thomson – James River Association; Robert Wayland – Citizen-at-Large; Mark A. Widdowson – Virginia Tech – Department of Civil and Environmental Engineering; Andrea Wortzel – Mission H2O; & Bruce Young – VA Department of Wildlife Resources.

Technical Support Staff Present	
Scott Bruce - DEQ	Gouri Mahadwar - DEQ
Brandon Bull - DEQ	Liz McKercher - DEQ
Brian Cambell - DEQ	Scott Morris - DEQ
Weedon Cloe - DEQ	Bryan Mountjoy - Stantec
Allison Dorsey - DEQ	Bill Norris - DEQ
Heather Esposito - DEQ	Eric Seavey - DEQ
Sam Jasinski - DEQ	Dallin Walker - DEQ

Interested Parties	
CBF – Van Park	RES – Charlie Westbrook
HRPDC – Ivy Ozmon	Tauxemont Community Association - Glenda Booth
HRSD – Jamie Mitchell	Tauxemont Community Association – Robert J. Surovell
KBJW – Ken Bannister	Virginia Agribusiness Council – Brad Copenhaver

Meeting Notes

Welcome and Introductions:

Mr. Weedon Cloe, Manager of the DEQ Office of Water Supply, informed the gathered group that the Patrick Henry Building had a Fire Drill scheduled for 10:30 so the start of the meeting was going to be delayed until the completion of the drill. He convened the meeting at approximately 11:00 AM. He welcomed members to the third meeting of the Eastern Virginia Groundwater Management Advisory Committee for FY2024. He thanked everyone for attending today's meeting. He identified the available handouts for today's meeting.

Handouts:

- Agenda,
- Draft Minutes/Notes for the February 29, 2024, EVGWMAC Meeting,
- Presentation - Jason Early, P.G. (Stantec) & Bryant Mountjoy, P.G., PMP (Stantec) – *"Aquifer Recharge in the Coastal Plain: Considerations for Groundwater Trading"*

He went over some housekeeping items, including location of facilities and emergency evacuation procedures.

Meeting Agenda:

Mr. Cloe went over the planned meeting agenda outline.

1. Welcome and Introductions

2. Review and Approval of 04/23/2024 Agenda.
3. Review and Approval of the 02/29/2024 Meeting Minutes
4. Presentation – Jason Early, P.G. (Stantec) & Bryant Mountjoy, P.G., PMP (Stantec) – *"Aquifer Recharge in the Coastal Plain: Considerations for Groundwater Trading*
5. Round Table Discussion on Groundwater Trading
6. New Business – Updates and/or Topics of Interest from Committee Members
7. Public Input Forum
8. Next Meeting
9. Wrap Up

Approvals:

- **Agenda:** The committee approved the tentative agenda as presented.
- **Meeting Minutes – 02/29/2024:** The committee approved the minutes as presented.

ACTION ITEM: DEQ staff will finalize the meeting minutes and post them as "Final" to Town Hall.

Mr. Cloe introduced Mr. Bill Norris to the group and invited him to the podium for a few words. Mr. Norris provided the following information to the group:

> "I would like to add my welcome to Weedon's to the group. Thank you all for your interest and participation. As most of you know I am Bill Norris. I am the Regulatory Analyst Team Lead for the DEQ Water Division, and I am your main point of contact for activities related to the Eastern Virginia Groundwater Management Advisory Committee. I also develop the meeting minutes for each of the meetings. I do need to let you know that I do record the meeting to use as a tool in developing the meeting minutes, but that that recording is deleted once the draft minutes have been prepared.
>
> Thorough Chapter 805 (SB 679) of the 2020 Virginia Acts of Assembly the General Assembly directed DEQ to establish the Eastern Virginia Groundwater Management Advisory Committee as an advisory committee to assist the State Water Commission and the Department of Environmental Quality in the management of groundwater in the Eastern Virginia Groundwater Management Area and identified the categories of members to be included.
> Pursuant to § 62.1-256.2 of the Code of Virginia in September 2020, the DEQ Director appointed individuals and organization representatives to serve on the committee.
>
> The purpose of the advisory group is to "assist the State Water Commission and the Department in the management of groundwater in the Eastern Virginia Groundwater Management Area." The Committee may develop specific statutory, budgetary, and regulatory recommendations, as necessary, to enhance the effectiveness of groundwater management in the Eastern Virginia Groundwater Management Area.
>
> Members of the advisory group include:
> - Representatives of Industrial and Municipal Water Users,
> - Representatives of Public and Private Water Providers,

- Developers and Representatives from the Economic Development Community,
- Representatives of Agricultural, Conservation, and Environmental Organizations,
- State and Federal Agency Officials,
- University Faculty and Citizens with Expertise in Water Resources-Related Issues.

Due to changes in personnel and representation on certain stakeholder groups since that the inception of the original advisory committee, we are looking to affirm and reaffirm the representation of these groups on the committee and to identify alternates for each member so that we can ensure that the specified categories of members are adequately represented.

We have heard back from a number of the current members regarding their interest in continuing to participate and or their identification of another individual to serve in their place. We have also gotten a number of recommendations for alternates that could represent those categories if the member is unavailable to attend.

We thank all of you have responded to our request and ask that if you have not identified an alternate that you provide that name at your earliest convenience so that we can officially affirm and reaffirm the members of the group. Thank you for your time and your willingness to participate."

Presentation: Jason Early, P.G. (Stantec) & Bryant Mountjoy, P.G., PMP (Stantec) – *"Aquifer Recharge in the Coastal Plain: Considerations for Groundwater Trading"*

Weedon Cloe introduced Jason Early and Bryant Mountjoy from Stantec who will be giving the presentation today.

Jason Early is a Senior Hydrogeologist with Stantec in the Ashland, Virginia office. He has over 26 years of experience in groundwater and environmental consulting and routinely works on groundwater supply projects including well siting and construction management, yield and aquifer testing, groundwater modeling, water supply planning, and water withdrawal permitting. He has worked extensively on Groundwater Withdrawal Permits across the Eastern Virginia Groundwater Management Area, providing consulting services to municipalities, industry and manufacturing, water utilities, and agricultural businesses. Jason was trained to use DEQ's Virginia Coastal Plain groundwater model in 2014 and frequently runs model simulations to help current and prospective groundwater withdrawers assess the feasibility of obtaining Groundwater Withdrawal Permits. He was a member of the Alternate Sources Workgroup working under the Eastern Virginia Groundwater Advisory Committee and gave several presentations to the Groundwater Trading Workgroup. Jason holds a BS in Geology from the College of William and Mary and a MS in Geology from West Virginia University. Additionally, he maintains Professional Geologist certifications and licenses in Virginia, Pennsylvania, and North Carolina.

Bryant Mountjoy is a Project Hydrogeologist in Stantec's Ashland, Virginia office. He has eight years of research and consulting experience primarily related to groundwater supply development, permitting, and management. Bryant regularly manages and supports projects

involving groundwater modeling, water-well drilling and construction, aquifer testing, water withdrawal permitting, and groundwater resource and sustainability evaluations. In Virginia, Bryant has supported public and private entities with dozens of Groundwater Withdrawal Permit applications and post-permit issuance regulatory compliance activities. Bryant received a BS in Geology from Western Carolina University and a MS in Geology from West Virginia University. He is a certified Professional Geologist in Virginia and Texas, and a Project Management Professional.

Stantec Presentation:

Slide 1: Aquifer Recharge in the Coastal Plain: Considerations for Groundwater trading:

Discussions: Mr. Early thanked everyone for their attendance and noted that there was evidently a great level of interest in the concept of groundwater trading in eastern Virginia. He noted that they were slightly involved with the initial groundwater trading concepts that were being discussed especially with the Groundwater Trading Workgroup and their activities back in 2018 timeframe. That started an evaluation about what were the hydrogeologic complexities that are related to implementing a groundwater trading program in the Eastern Virginia Groundwater Management Area. A similar presentation on these findings related to that evaluation were presented at the Water Jam Conference in September of 2020.

Slide 2: Agenda for Presentation:

1. Introduction & Background
2. Model-Simulated Recharge: Recovery Zone
3. Model-Simulated Recharge: Recovery Zone AND Available Withdrawal Rate Menu
4. Model-Simulated Potomac Aquifer Benefits After 50 Years
5. Theoretical Trading Example
6. Conclusions, Considerations, and Concepts

Discussions: Mr. Early provided an overview of the topic areas that would be covered during the presentation. He noted that the concept of environmental trading or credits is nothing new. Nutrient credit trading has been occurring successfully for a number of years in Virginia and it provides financial incentives for multiple parties while essentially reducing nutrient loading to the Chesapeake Bay. Today's discussions will be about some of those hydrogeologic concepts that can complicate a groundwater trading program in Virginia's Coastal Plain region and why these factors should be considered. This analysis was developed four years ago, so some of the maps that are included in the presentation have critical cells from that time frame. The idea is to provide some food for thought as the group looks at this concept and to make sure that we are looking at the technical issues involved in the process. He noted that what is being presented today, is not the answer, but are simply ideas for thought. There are many ways to do a trading program, but any trading program should be based on sound and rigorous science.

Slides 3 & 4: Groundwater Movement – Darcey's Law:

Discussions: The Potomac aquifer and most of the aquifers in the Eastern Virginia Groundwater Management Area are confined aquifers, meaning that they are under pressure and as such they act just like pressurized water pipes in your home. Except that they are not pipe shaped, they are more like irregular shaped boxes, wedge shaped boxes that are filled with sand and groundwater. Mr. Early provided an overview of Darcey's Law – the underlying theorem of groundwater flow. It is basically the first principle of groundwater flow. When we talk about groundwater levels in the Potomac aquifer, we are not really talking about levels but rather pressure, the hydraulic head or head. He noted the following: (i) hydraulic conductivity is a measure of how permeable the aquifer material is – how easily groundwater moves through it; (ii) transmissivity (can be estimated from an aquifer test) is a measure of the aquifer's ability to transmit groundwater; (iii) hydraulic head is a measure of the pressure (that is what we are really talking about when are saying groundwater levels and (iv) an important concept to remember is that a change in flow creates a rapid pressure change – this is directly analogous to what happens in the Coastal Plain Aquifer system. This explains why in some of the modeling or during real world aquifer tests you see head increases from recharge or injection projects and head decreases from pumping that occur very quickly and they propagate over large distances very quickly. They also spread out over a fairly large area. The Potomac aquifer is the largest and thickest and most widely used aquifer in the region. It exhibits high transmissivity – it is able to transmit large quantities of groundwater. For high transmissivity aquifers like the Potomac, when you pump groundwater out of a confined aquifer you develop what is known as a "cone of depression" or "draw-down". Conversely, when you inject water through a recharge project you develop a "cone of impression" or "mounding" or "draw-up". For a relatively Higher-Transmissivity Aquifer (100,000 gpd/ft) you would have a very shallow draw-down that has an impact spread out over a very large area. Whereas for a relatively Lower-Transmissivity Aquifer (10,000 gpd/ft) you have a much steeper and deeper cone of depression with an impact spread out laterally over a much smaller area. Why is this important? Going back to 2018 and that time frame, during the discussions on Groundwater Trading and Aquifer Storage Recovery and Aquifer Recharge there were some questions on the ability of a recharge project to create a long-term "bubble" of head or a "mound". The "head" change may be slight and almost immeasurable. That doesn't mean that you are not putting water back into the aquifer. Also, it is likely to not look like a "bubble", it will probably look more like an inverted cone for a recharge project (a "draw-up"). A recharge project can create wide-spread benefit to the aquifer system even with relatively small amounts of head increase.

Going back a few years, the concept of groundwater trading came about as part of the Eastern Virginia Groundwater Advisory Committee which was formed to address at that time some recent hydrogeologic and groundwater modeling findings indicating that significant areas of the region could become critical in less than 50-years. The Advisory Committee created 5 sub-groups/working groups, two of which were the Alternate Sources Group and the Groundwater Trading Work Group.

Slide 5: Virginia Groundwater Withdrawal Permitting Program:

- Potomac Aquifer Critical Cells 2020

Discussions: Mr. Early presented an overview of the Potomac Aquifer Groundwater Withdrawal Permitting Program. The map shows the critical cells based on January 2020 data. The squares identified on this map and the following maps represent groundwater modeling cells, which are 1 mile in dimension in each direction horizontally. Orange cells are where the model predicted that the aquifer would become critical after 50 years at a total permitted withdrawal,

Slide 6: HRSD – SWIFT:

- SWIFT to the Rescue?
- 6 Plants – Up to 100 MGD
- Recharge increases aquifer pressure, reducing saltwater intrusion and land subsidence.

Discussions: Mr. Early noted that the HRSD's SWIFT Project came into existence concurrently with the creation of the Advisory Committee. This project is expected to have multiple benefits; not only replenishing heads in the aquifer but also reducing the number of critical cells; to help counter-balance salt-water intrusion; and possibly mitigate some of the land-subsidence effects. If successful SWIFT and other long-term aquifer recharge projects could effectively reopen the entire Coastal Plain Region for groundwater development and water supply planning and development and growth by eliminating the currently modeled critical cells.

Recharge projects are expensive – there are significant costs associated with the development of a recharge project like SWIFT. There are the permitting costs; there are design costs; construction costs; and O&M costs. We are also still "learning" to do recharge properly in the Potomac aquifer.

The concept is that a trading program could help incentivize a wastewater treatment plant to construct a recharge project that they could receive credit for the recharge.

Mr. Early reviewed the history of the Groundwater Trading Program and the initial concepts proposed by the Groundwater Trading Work Group. The discussions of the group at that time (2018) centered around the concept of a "recovery zone" or an "extended recovery zone" – that "bubble concept" where a recharge project creates a "mound" or a "cone of impression" where other entities can withdraw groundwater. This concept is kind of analogous to what DEQ does with groundwater withdrawals, where you have an area of impact based on one (1) foot of draw-down. Reverse that and there may be a localized one foot of head increase or draw-up – maybe even something more than a foot as the result of the recharge project. Trading may not be limited to recharge projects, there may be other ways to benefit the aquifer system, such as water conservation, voluntary permit reductions, etc.

Mr. Bryant Mountjoy provided an overview of the history of the Groundwater Trading effort and gave examples of what a recharge project and effort might look like for different amounts in different areas over time on a theoretical basis.

Slide 7: Virginia – Groundwater Trading Program

- **Virginia House Bill 1036 – March 23, 2018,**

- § 1. "That a groundwater trading work group is established for the purpose of serving as a resource to the Department of Environmental Quality (the Department) … that an aquifer storage and recovery banking system be developed."
- **Initial Concepts Proposed by Groundwater Trading Work Group**
    - Recovery Zone – spatial area within which injected water is authorized to be recovered.
    - Short Term Storage – injected water that may be recovered within 36 months of the date of injection.
    - Long Term Storage - injected water that may be withdrawn more than 36 months of the date of injection.
    - Groundwater Storage Credit – quantity of injected water that is authorized to be recovered.
- **Concepts above are complicated by time and aquifer heterogeneity.**

Discussions: One of the concepts that has been discussed related to Groundwater Trading is the idea of a "recovery zone" which is a specific area in which a theoretical trading partner could benefit from a recharge project and how that could be defined. There are "short-term" and "long-term" storage concepts where after a certain period of time a volume of water equal to a percentage amount of injected water could be taken out of the recovery zone. Then there is the concept of credit which is the measure that could be authorized to be traded. That could be a volume; gallons of recharge; gallons of withdrawal; or a head increase - this is the "currency" of the trading program. These concepts are complicated by the aquifer system itself. The aquifer is not constant from one area to another; there are changes in thickness and materials in various areas of the aquifer; there are changes in hydraulic conductivity; etc.

Mr. Mountjoy noted that a lot of their modeling work has focused on the idea of the recovery zone. How can it be defined? Is there a specific way that it can be defined so that a trade could occur without undoing the benefits of a recharge project? There are a lot of ways to look at this. It could be a specific distance or an area of influence over a period of time, etc. What these modeling examples look at is a recovery zone based on a "draw-up" contour, a head increase contour. These examples are all based on the VA-Hydro – the regional groundwater model for the Eastern Virginia Groundwater Management Area and they are all 50-year simulations. He reviewed the model simulations and animations with the group.

Slide 8: Model-Simulated Recharge: Recovery Zone:

- Simulated Injection of 1 MGD in Eastern Hanover County (50-Year):
    - "Extended Recovery Zone" drawn as the 5-ft draw-up contour.
    - Does not answer question of "How much water can be withdrawn from a specific location?

Slides 9-10: Model-Simulated Recharge: Recovery Zone & Available Withdrawal Rate:

- Simulated Injection of 1 MGD in Eastern Hanover County (2-Years – 50-Years Simulation):

- Additional groundwater that can be withdrawn from a VA Hydro-CPM model cell estimated using the Cooper-Jacob (1946) approximation to the Theis (1935) equation.
- Represents "menu" of options for a single theoretical trade.

Slides 11-12: Model-Simulated Recharge: Recovery Zone & Available Withdrawal Rate:

- Simulated Injection of 10 MGD in Eastern Hanover County (2-Years – 50-Years Simulation):
  - Additional groundwater that can be withdrawn from a VA Hydro-CPM model cell estimated using the Cooper-Jacob (1946) approximation to the Theis (1935) equation.
  - Represents "menu" of options for a single theoretical trade.

Slides 13-14: Model-Simulated Recharge: Recovery Zone & Available Withdrawal Rate:

- Simulated Injection of 1 MGD in Suffolk (2-Years – 50-Years Simulation):

Slides 15-16: Model-Simulated Recharge: Recovery Zone & Available Withdrawal Rate:

- Simulated Injection of 10 MGD in Suffolk (2-Years – 50-Years Simulation):

Slides 17-18: Model-Simulated Recharge: Recovery Zone & Available Withdrawal Rate:

- 1 million gallons per day injection
- 10 million gallons per day injection

Discussions: Mr. Mountjoy noted that in the simulations/animations that after the first few years the area of influence really did not expand very far. This is a result of the aquifer being very transmissive. Large amounts of draw-up or head increase tend to stabilize relatively quickly. What these simulations do not answer is how much water can be withdrawn from a specific point. If you were to use this concept for a contour to delineate your recovery zone, it does not tell you how much water could be withdrawn from a specific location in that zone or outside of that zone and still result in a net-benefit or net head increase in the aquifer.

Due to the transmissivity of the aquifer and other aquifer parameters, relatively small amounts of head increase, in specific locations can correspond to large amounts of water that could be withdrawn.

The further east you go in the Coastal Plain the thicker the aquifer becomes and the more transmissive it becomes. What this means is that less amounts of head increase correspond to more water being available.

David Jurgens noted: A real-world application of this process might be that Chesapeake started injecting back in 1989 and they tried to model the injection to see what had been done and the model didn't show any impact. When the City was renegotiating their

permit, the state didn't want to give any credit for the injection, because the model did not show any increase in head or any area of influence. But there was a net of 3.7 billion gallons of water that was injected over what was withdrawn. The current model appears to explain why that occurred. They would likely want to get credit back for those 3.7 billion gallons of water.

If you were to permit a trade, you do not want to allow a withdrawal that causes more draw-down at that project site than was there originally that you benefited from; otherwise, we are not having the net benefit at the project site. In terms of volume, sure you are injecting 10 million gallons per day but only pulling out a quarter million gallons, the water balance works but it doesn't work on a site-by-site basis. If you are pulling a quarter million gallons per day out of a location that only got the benefit in terms of head of only 100 thousand gallons per day you are still going to be causing draw-down in the immediate area more than the benefits from the recharge project. There are local scale problems that have to be taken into consideration with assuming that 10 million gallons a day injected in one location can immediately be withdrawn in another. The amount that can be withdrawn across spatially is going to decrease the further and further you get from that recharge area.

In the modeling scenario, a number of cells are shown where a withdrawal might occur, that does not mean that amount of water is available across the entire area indicated. Once a withdrawal occurs at one of these points then the entire scenario changes and would need to be reevaluated. The simulations only show the impacts of a recharge there are no new withdrawal scenarios built into the models at this point.

Mr. Mountjoy presented a comparison of the aquifer benefits of the various scenarios.

Slide 19: Model-Simulated Potomac Aquifer Benefits After 50-Years

SCENARIO	GALLONS RECHARGED	CRITICAL CELLS ELIMINATED	AVERAGE HEAD INCREASE (FT)
Hanover County 1-MGD	18.3 Billion	29	0.5
Hanover County 10-MGD	183 Billion	88	5
Suffolk 1-MGD	18.3 Billion	19	0.5
Suffolk 10-MGD	183 Billion	109	5

Critical Cell = model cell where aquifer head is predicted to be below the surface representing 80% of the distance between land surface and the aquifer top after 50 years

Discussions: Mr. Mountjoy noted that the location of the injection/recharge matters, the benefits are not the same across the entire aquifer. The benefits have to be looked at on a site-by-site basis. The important factor to consider is the modeled impact on existing critical areas. The critical cell concept is used in the groundwater permitting program to essentially limit the development of new groundwater resources in any areas where the heads are simulated to be too

low after a 50-year period. By reducing the number of critical cells, you do open up some of these areas that were previously un-permittable to being able to get a groundwater withdrawal permit. Location matters. The benefits are not the same from one location to another.

Mr. Mountjoy presented a series of slides on a theoretical groundwater trading scenario.

Slide 20: Groundwater Trading Scenario I: Theoretical Groundwater Trade – Simulated Withdrawal:

- Proposed facility near Franklin has a projected water demand of 0.25 MGD, or ~91 MGY.
- Cannot obtain GWP – simulated AOI intersects numerous critical cells.
- Maximum withdrawal rate without AOI intersecting critical cells is 0.187 MGD, or ~68 MGY.

Slide 21: Groundwater Trading Scenario I: Theoretical Groundwater Trade – Simulated Injection:

- Aquifer recharge project near Suffolk injects 1 MGD, or 365 MGY.
- Simulated area of mounding covers the majority of the Coastal Plain, including the proposed Franklin facility.
- Simulated Draw-up is relatively small.

Slide 22: Groundwater Trading Scenario I: Theoretical Groundwater Trade – Simulated Net Head Change:

- Combined, the Area of Impact of the Franklin facility is eliminated, and overall net benefit to aquifer heads.
- Proposed Franklin facility can obtain GWP.
- Now-reduced mound accessible for other trades, or to remain as benefit to aquifer heads.

Mr. Early provided a wrap-up and presented a summary of the conclusions and concepts from their presentation and some topics for discussion for consideration by the Advisory Committee. He provided contact information for any further questions regarding the presentation.

Slide 23: Conclusions and Concepts:

- BENEFITS: Aquifer recharge and groundwater trading may improve access to and availability of groundwater in areas where aquifer heads are currently critical but also relatively small head increase leads to relatively large volumes of newly available withdrawals in specific areas.
- LOCATION, LOCATION, LOCATION:
    - Geologic heterogeneity complicates a potential groundwater trading program – 1 MGD injected “here” does not necessarily equal 1 MGD withdrawn “there”.
    - Recovery zone that doesn’t account for hydrogeologic variability will result in inaccurate groundwater trading accounting.

    - Areas and current/prospective groundwater users that will benefit most from recharge projects may not be near the recharge project but rather tens of miles away generally to the west in or near critical cells.
- Timing:
    - Recharge projects can take years-to-decades for heads to stabilize.
- Uncertainty:
    - All analyses to-date in theoretical "model world" need to be verified by long-term site-specific testing.
    - Model accuracy predicting draw-up caused by recharge wells is unknown.
    - Model is the best tool we have for GW Management, but it needs improvement and frequent updates and recalibration.

Slide 24: Topics for Discussion:

- Trading vs. Banking? What's the best approach?
    - Overlapping recharge mounds.
- How is Participation Incentivized?
    - Non-participants also benefit from head increases.
    - Include voluntary GWP limit reductions? (vs. only recharge projects)
- How are "Recovery Zones" (or other term) defined and regulated?
    - Modeling (existing model with updates), new model(s), local-scale model(s), multiple models
    - Aquifer testing, BUT…. Long enough to observe effects?
    - Long-term head monitoring, BUT…. Where? When and how frequent? Can mounding observations clearly be attributed to a recharge project miles away?
- Program Management?
    - Confidence in groundwater model(s) to determine benefits and water balance.
    - Model updates and calibration.
    - A withdrawal permit for one entity buying credits is contingent upon another entity injecting recharge water simultaneously (what happens if the recharge project goes away?)
- What are the Credits?
    - Head? (modeled or observed?)
    - Flow?
    - Critical Cells Eliminated?
    - Safety Factors (50%, 75%, 80%)?

Slide 25: Contact Information:

    - Jason Early, PG – Jason.Early@stantec.com;
    - Bryant Mountjoy, PG, PMP – Bryant.mountjoy@stantec.com

ACTION ITEM: The department will post the Stantec Presentation on the DEQ Website.

Questions from Committee Members/Round Table Discussions:

Weedon Cloe opened the floor up to the members of the Advisory Committee for questions and any discussion items:

- Based on the current modeling effort is there any lingering effects from the injection process when the injection stops?
    - The model did not simulate the cut off of the injection process in the model to see if the head declined after the injection stopped. In theory there would be a lingering effect that would decline over time.
- What is the source of the recharge water?
    - The models are theoretical and do not take into account any particular source of recharge water. For the SWIFT project the source is wastewater treated to beyond potable standards.
- What is the potential for this to really happen? This option was not available when a number of the permits were negotiated. The models used at that time did not have the capability to analyze this type of recharge activity. What is the potential that this could lead to something?
    - A saying in the modeling world is that "All models are wrong, but some are useful". How do we know that the Groundwater Flow Model is useful in considering withdrawals? We know that because we have decades of high-quality groundwater data that has been laboriously collected from a network of groundwater monitoring/observation wells, that demonstrate the relationship between water levels and withdrawals. The math works in both directions, so it can account for both withdrawals and injections. Without the decades of high-quality groundwater monitoring data, this would be simply a hypothesis. The decades of data allow us to test the hypothetical and theoretical models with real world data.
    - The concept of transient changes in elastic storage resulting from aquifer compression (from pumping) and expansion (from recharge/injection) is not accounted for in the current modeling effort.
- Are there other areas of the Country that are doing recharge and modeling the effects of injection? Maybe there are other examples of use of recharge and injection that could be looked at?
    - The current modeling effort did not have a chance to look at any other areas of the Country for any similar efforts.
    - When looking at other areas and other modeling strategies it is important to consider whether the geology in the area is representative of Virginia's geology and particularly the Virginia Coastal Plain Aquifer system.
- How does the water that is injected move within the aquifer? How does it interact with the existing water? Does it commingle or does it push the existing water in front of it?

    - This model does not take that into consideration. It ends up being a situation that has to take into consideration the hydraulic pressure in the aquifer. A pressure wave can propagate very quickly but a particle of a pollutant does not move very quickly through an aquifer. The injected water can be dispersed throughout the aquifer, or it could take on the aspects of a plume moving through the aquifer.
    - This type of movement is already being modeled in the region because of BOD and PFAS. The VA Hydro-GW Coastal Plain Model does not really show the plume of movement but is actually a representation of the pressure within the system. Water does not migrate very far from the injection source, but it creates pressure within the system which can be demonstrated through the modeling efforts.
- The discussions today have revolved around modeling efforts focused on the Eastern Virginia Groundwater Management Area. Are there any current considerations for conducting similar modeling efforts for the Eastern Shore?
    - The same type of analysis could be done on the Eastern Shore. There are smaller model cells for that area, but it could be done in the same manner. Similar modeling efforts can be done for the Eastern Shore.

Questions from the Interested Public:

- What are the theoretical options for recharge water?
    - The source could be treated wastewater; potable water; surface water; storm water, etc.

New Business – Updates and/or Topics of Interest from Committee Members: Mr. Cloe went around the room and asked if there were any updates or topics of interest that the Committee Members wanted to inform the group of. No updates were presented.

MOTION: April 23, 2024: Eastern Virginia Groundwater Management Advisory Committee Meeting: MOTION by David Jurgens and Seconded by Shannon Varner:

"To reenergize the conversations about the possibility of Groundwater Trading using as a basis the modeling that was presented today that has more capability than models that were available previously because it appears that there may be some scientific supportable mechanism at some point to support the concept of trading."

VOTE:

Voting to support the motion were: Andrew Clark; Patrick Fanning; Shannon Varner; David Jurgens; Dan Holloway; Paul Retel; Doug Powell & Kellen Singleton

Abstaining was Robert Pickett

REQUEST OF ADVISORY COMMITTEE MEMBERS: Please confirm your vote and position on the motion made by David Jurgens.

Public Input Forum: Weedon Cloe asked if there was any public input. No input was offered.

Next Committee Meeting:

Weedon Cloe noted that the next meeting of the advisory committee will be last week of June. DEQ will send out a Doodle -Poll in the near future to set the date and location for the meeting.

Adjournment:

Weedon Cloe thanked all of the members of the committee and the interested public and the STANTEC representatives for their presentation and closed the meeting. The meeting was adjourned at approximately 12:35 P.M.