COMMONWEALTH of VIRGINIA

Standard Operating Procedures for Managing and Reporting Agricultural Non-Point Source Data to Virginia DEQ

Standard Operating Procedures for Soil and Manure Testing for Nutrient Management Plan Development

QUALITY ASSURANCE PROJECT PLAN

May 15, 2014

Department of Conservation and Recreation
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Virginia Department of Conservation & Recreation

Department of Conservation and Recreation
Quality Assurance Project Plan

Group A – Project Management
A1 – Title and Approval Sheet

Plan Coverage: This *Quality Assurance Project Plan: Standard Operating Procedures for Managing and Reporting Non-Point Source BMP Data to the U.S. EPA – Chesapeake Bay Program Office* in combination with the *Quality Management Plan: Virginia Nonpoint Source Pollution Management Program* (Virginia DEQ, 2013) reflects the overall Quality Assurance Program framework and management systems necessary to assure that data generated by the Virginia Department of Conservation and Recreation's Division of Soil and Water Conservation (DCR-DSWC) are of acceptable quality to meet the needs of the United States Environmental Protection Agency's Chesapeake Bay Program Office (EPA-CBPO).

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Questions or comments regarding this QAPP should be referred to Susan Hale, 804-786-9737 or susan.hale@dcr.virginia.gov.

A2 – Table of Contents

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A3 – Distribution List

This document is being provided to the following:

- Katherine Antos, EPA-CBPO, Project Officer
- Mary Ellen Ley, USGS / EPA-CBPO, Quality Assurance Coordinator
- Susan Hale, DCR-DSWC, Grant Manager (Quality Assurance Officer)
- James Beckley, DEQ-WD , Quality Assurance Officer
- William Keeling, DEQ-WD, NPS Modeling & Data Coordinator
- Larry Fender, DEQ-WD, Data Management Analyst
- Stephanie Martin, DCR-DSWC, Agricultural Cost Share Database Administrator
- Timothy Sexton, DCR-DSWC, Nutrient Management Program Manager
- Vicki Gardiakos, Geoinformatics Specialist

A4 – Project / Task Organization

Nonpoint source (NPS) pollution reduction tracking data is generated by a coordinated effort of DEQ and other agencies staff. The DCR database administrator is responsible for administration of the Agricultural Cost Share database to include computer code development and modification and quality assurance (QA) of the cost share data. The DCR regional conservation district coordinators (CDCs) provide quality assurance functions by reviewing the data generated by the SWCD's they work with and by going on spot checks of installed BMPs.

The DCR Conservation Programs Manager serves as the quality assurance officer and is in an independent unit from those generating the data. The Conservation Programs Manager and staff in the grants section of the DCR-DSWC are responsible for maintaining the official approved Quality Assurance Project Plan. Organization charts showing lines of authority and reporting responsibilities are provided in the Appendix #2.

A5 – Problem Definition and Background

The project objectives are to fulfill the reporting requirements of the EPA-CBPO for the Virginia Chesapeake Bay Implementation Grant by supplying annual NPS BMP implementation data. This data is provided to EPA-CBPO for inclusion in the annual watershed model progress evaluations as stipulated in the grant documents. The expected confidence that the BMP implementation data reported to EPA-CBPO is very high in regards to the BMPs being actually installed to specifications in the locations reported to EPA-CBPO. The EPA-CBPO requested this document for their understanding of the various sources of nonpoint source BMP data within and among jurisdictions as well as any analysis done by the jurisdictions prior to submission to EPA-CBPO.

A6 – Project / Task Description

The project includes nonpoint source data collection and compilation activities. A full description of the quality assurance activities performed annually is included in the following sections. The environmental data produced from this project is used by the EPA-CBPO to project NPS reductions of nutrients and sediment via implementation of NPS best management practices (BMPs) within the Chesapeake Bay drainage of Virginia. This project also includes the quality assurance measures relevant to samples and laboratory procedures used in the development of nutrient management plans. For NPS BMP implementation levels, the project is considered ongoing since reporting to the EPA-CBPO office is required annually. DEQ reports annual BMP implementation only once, the first year of the total lifespan of the practice. All non annual BMPs are accumulated by EPA for annual progress runs. To the extent BMPs are reported by the Virginia Department of Forestry and the Virginia Department of Health to DEQ, silviculture and

on-site septic BMP data will be included in the reporting. These BMPs are included in the BMP Crosswalk for the NEIEN mapping report in Appendix 2.

A7 – Quality Objectives and Criteria

The EPA-CBPO is responsible for the planning and design aspects of the use of the NPS data provided by DEQ in the annual progress model runs. Details regarding the systematic planning process used to plan and design the study for this data requirement should be addressed to the EPA-CBPO. Details on the quality of data provided by DCR are included in the following sections.

All BMPs completed must be certified as complete and meeting appropriate VACS and NRCS standards prior to the issuance of any state cost share or tax credits. Each year a spot check process is accomplished where five percent (5%) of the BMPs completed in the last program year and 5% of BMPs still with their lifespan are visited and assessed to assure they are being properly utilized and maintained. Any BMP found out of compliance with specifications is noted and the Soil and Water Conservation District follow the procedures in the Ag. BMP manual Spot check Procedures Overview section (Pg. I-75) and Practice Failure section (Pg. I-24) if appropriate. Participants that do not maintain practices or will not bring the practice up to specification and standards are expected to return on a pro rata share basis any cost share and tax credits authorized by the district. Analyses of spot check summary reports from Conservation District Coordinators consistently show that over ninety percent (91%) of the BMPs spot checked are found to be in compliance including some practices that may be in the tenth year of a ten year lifespan.

A8 – Special Training Certifications

Details regarding specialized training and certifications for DCR NPS programs are provided in Section IV, Personnel Qualifications and Training of the *Quality Management Plan: Virginia Nonpoint Source Pollution Management Program* (Virginia DCR, 2010). Each new program year, training sessions are held to discuss any revisions to the Agricultural BMP Cost-Share program. Any revisions to the Agricultural BMP technical specifications and program policies are reflected in the Agricultural BMP Cost-Share Tracking Program revisions each program year. Training sessions and workshops are provided on the Agricultural BMP Tracking Program application with special emphasis on any revisions or improvements to the application. These trainings help maintain data quality by ensuring that the Soil and Water Conservation District (District) personnel entering data into the application are properly trained on how to use the application, and that the input of data is uniform and correct. The trainings emphasize the importance of quality data and data reporting. The CDCs and Richmond Central Office staff also offer Agricultural BMP Cost-Share Helpdesk support to address specific questions and data concerns. This helps maintain data quality by ensuring that the Agricultural BMP technical specifications and program policies are interpreted properly. Furthermore, guidelines, policies and training aides are available for reference on the VADCR website. A specific presentation entitled "*ROLES & RESPONSIBILITIES FOR DELIVERY OF VIRGINIA AGRICULTURAL BEST MANAGEMENT PRACTICES COST SHARE PROGRAM (VACS) For District Directors & District Staff" is at* http://www.dcr.virginia.gov/soil_and_water/bmptraining.shtml. District conservation specialist personnel typically have agricultural experience or educational backgrounds and over time gain job approval authority through the United States Department of Agriculture's (USDA) Natural Resource Conservation Service (NRCS) training program. Agricultural BMPs implemented require the signature of the District conservation specialist, who

is required to have job approval authority on that agricultural BMP type, certifying that the BMPs was implemented according to the applicable technical specifications.

A9 – Documentation of Records

Each District's cost-share data is entered and maintained in a centralized enterprise database assessable via a secured web-based interface. DCR and other agency data are appended to the data tables needed to supply data to the NEIEN schemas and are the transmitted via established NEIEN protocols for inclusion in the annual progress run input deck by DEQ.

Group B – Data Generation and Acquisition

Sections B1 through B8 of this QAPP pertain to samples collected for developing Virginia nutrient management plans. Nutrient management plans are prepared to indicate how primary nutrients are to be managed on farm fields and other lands for crop production and in ways, which protect groundwater and surface water from excessive nutrient enrichment.

Laboratories approved by DCR perform soil test and manure sample analysis, and pre-sidedress soil nitrate tests are conducted as a field procedure. Soil test analysis includes information on soil fertility levels for phosphorus and potassium, and pH levels. Manure test analysis includes percentage of moisture, total nitrogen or total Kjeldahl nitrogen, *ammonium nitrogen,* total phosphorus, and total potassium. The pre-sidedress nitrate test is a procedure used to determine soil nitrate-nitrogen levels at a specific time during a corn crop and a few horticultural crops growing season. Sections B1through B8 below are completed as relevant for each of these three types of samples.

B1 – Sampling Process Design (Experimental Design)

Soil test samples. The design strategy for nutrient management soil test samples is found in Virginia's *Nutrient Management Training and Certification Regulations, 4 VAC 50-85, § 10.1 – 104.2* of the Code of Virginia (Effective: March 13,2014). Soil analysis is required for each field at least once every three years to determine the soil fertility and pH, and to update the nutrient management plan. The excerpt below is from the "Required nutrient management plan procedures" section of the regulations.

…. Soil analysis results shall be dated no more than three years prior to the beginning date of the nutrient management plan. A single composite soil sample should represent an area up to approximately 20 acres. Fields such as those common to strip cropping may be combined when soils, previous cropping history, and soil fertility are similar….

Manure samples. Manure samples are collected from specific operations in order to accurately assess the nutrient concentrations for the purpose of calculating manure application rates to supply crop nutrient needs. Manure samples are collected for laboratory analysis in order to determine the exact nutrient content. Manure analysis is recommended before field application until a baseline nutrient content is established for the specific manure type on the corresponding farm operation. After a baseline nutrient content is established, a manure analysis is recommended at least once every three years for dry or semisolid manures, and at least once every year for liquid manures. The analysis determines the appropriate rate of animal manures to apply based on the nutrient needs of various crops, soil types, and other production factors.

Soil nitrate test. The pre-sidedress soil nitrate tests involve field sampling and field analysis of soil nitrate levels found in the top 12 inches of soil. The sample is taken when corn is approximately 10 to 15 inches in height. The amount of nitrate-nitrogen in the soil sample is a representative index of the plant-available nitrogen that will mineralize from soil organic matter. Recommendations for sidedress nitrogen fertilizer rates applied to corn at the ~ 12 to 24 inch growth state can be modified depending on the level of nitrate-nitrogen found in the soil. Certified nutrient management specialists use these tests to modify top dressing or side dressing application rates of nitrogen in accordance with the *Virginia Nutrient Management Standards and Criteria (June 2014).*

The soil nitrate test is a field procedure and is not normally performed by a laboratory. Past research data used to calibrate the soil nitrate tests, for both lab tests and various field test kits, was not conclusive for readings below 21 ppm of nitrate-nitrogen in soils. Above this level, the data statistically justified that no crop responses to additional nitrogen was expected. This may limit the use of the procedure in certain instances (i.e. for readings before 21 ppm) the test is used primarily to identify fields, which need no additional nitrogen, and is a reliable predictor in this setting. Recommendations for nitrogen sidedress application rates for fields with 20 or less ppm is based the soil nitrate test results and guidance provided on page 64 of the *Virginia Nutrient Management Standards and Criteria (June 2014).* Use of the test results when soils are found to be at 21 ppm or greater does result in significant nitrogen use reductions by farmers, so targeted use of the kits is essential to Chesapeake Bay and statewide nutrient reduction efforts.

B2 – Sampling Methods

Soil test samples. The sampling method including data collection procedures to be followed for soil testing samples is found in Virginia's *Nutrient Management Training and Certification Regulations, 4 VAC 50-85, § 10.1 – 104.2* of the Code of Virginia (Effective: March 13, 2014). The excerpt below is from the "Required nutrient management plan procedures" section of the regulations.

> Representative soil sample cores shall be obtained from the soil surface to a depth of four inches (0-4") for fields that have not been tilled within the past three years, and from the soil surface to a depth of six inches (0-6") for fields, which are tilled or have been tilled within the past three years. Soil sampling of fields based on the subfield grids or management zones may be utilized….

Manure samples. It is important that representative samples are obtained. Accepted manure-sampling techniques are outlined in Chapter 9, "Manure as a Nutrient Source", in the Mid-Atlantic Regional Water Program's February 2006 publication, *The Mid-Atlantic Nutrient Management Handbook* (MAWP 06-02). Detailed sampling and handling procedures for semi-solid lot manure, liquid manure slurry, lagoon liquid, and boiler or turkey litter are provided on pages 212-213 of this publication. The DCR provides sampling bags and bottles for collection of manure samples. Samples are collected in zip-lock bags for solid samples and plastic bottles for liquid samples. Each sample is less than 1 pint.

Soil nitrate test. The pre-sidedress soil nitrate test is used on select fields where organic sources of nitrogen rates have been applied in accordance with the appropriate timing criteria to supply nitrogen to the present corn crop. Samples are taken when corn height is 10 to 15 inches tall at the whorl as it stands, not to the tallest part of the plant. The sample collection procedure involves taking 10 to 20 cores from across the field to a depth of 12 inches. Samples are taken between rows to avoid starter fertilizer bands and areas where roots have depleted nitrogen. The samples are combined, mixed, and crumbled and then a test kit is used to determine the soil nitrate-nitrogen concentration.

B3 – Sample Handling and Custody

Soil test samples. Currently the DCR approved soil test laboratories that are correlated to the Virginia Tech soil test lab using the Mehlich III procedure for phosphorus analysis include A & L Eastern Agricultural Laboratories, Brookside Laboratories, and Spectrum Analytical Laboratories, Agri Analysis Testing Laboratories, Agro Lab, Inc., Logan Labs, LLC. And

Midwest Laboratories. Waters Agricultural Laboratories uses the Mehlich I procedure and therefore the phosphorus soil test results can be interpreted the same as Virginia Tech phosphorus soil test results. Additional details on required soil test procedures that related to handling are in the sections that follow.

Manure samples. Manure storage and handling facilities and equipment results in moderate variability in both manure consistency and actual rate of material applied. Accepted manure sampling, handling and storage techniques are outlined on pages 212-213 in *The Mid-Atlantic Nutrient Management Handbook* (February 2006). Currently the DCR approved laboratory for analysis of manure samples is the Clemson University Agricultural Service Laboratory (Lab). The Lab must maintain a maximum sample turn around time of 12 working days measured from the date a sample is received by the laboratory until the complete analysis is mailed out. If unforeseen circumstances are expected to delay sample analysis beyond the 12-day time, the project manager of the DCR must be notified.

All samples submitted to the Lab by certified nutrient management planners must include a sample submission form. The Lab must log each sample with a unique lab number, adding this information to the sample submission form. One sub sample of each sample must be stored in a refrigerator at 5 degrees C and a second sub sample must be weighed, dried at 80 degrees C overnight, then weighed and ground through a Tecator Mill to pass through a 0.5 mm screen. The moisture will be determined from the weighings. The laboratory staff involved in the sample analysis and their roles includes: laboratory technician logs and grinds the samples, a lab chemist prepares and analyzes samples and lab director reviews and sends analysis reports.

The sample results are mailed to the individual listed on the form if a mailing address is included. If an email address is listed on the form, an email notification will be sent so that the

results can be viewed on the web. DCR has access to all results. The Lab must notify DCR by email to seek pre-approval if any single farm appears to have submitted more than two samples that arrive at the Lab within a day unless the samples were submitted by DCR staff.

B4 – Analytical Methods

Soil test samples. The analytical method to be followed for soil test samples is found in Virginia's *Nutrient Management Training and Certification Regulations, 4 VAC 50-85 § 10.1 – 104.2* of the Code of Virginia (Effective: March 13, 2014). Soil test analysis includes information on soil fertility levels for phosphorus and potassium, and pH levels. The excerpt below regarding the required analytical method is from the "Required nutrient management plan procedures" section of the regulations.

> …. Representative soil analysis results for fields shall be determined by using standard soil sampling and analysis methods according to *Methods of Soil Analysis, Part 3, Chemical Methods, 1996* utilizing the Mehlich I extraction procedure for phosphorus or other methods and laboratories approved by the department and correlated to Mehlich I and utilizing correlation procedures contained in Virginia Nutrient Management Standards and Criteria, revised June 2014.

Manure samples. Manure test analysis includes percentage of moisture, total nitrogen or total Kjeldahl, ammonium nitrogen, total phosphorus, total potassium, calcium, magnesium, sulfur, zinc, manganese, copper, aluminum and sodium. Manure test results must be reported on an as sampled basis in pounds per ton for dry manure and pounds per 1,000 gallons for liquid manure. Manure analysis must be performed using laboratory methods consistent with

Recommended Methods of Manure Analysis, 2003 publication # A3769 of the University of Wisconsin. Guidelines from this publication and additional analytical methods and reporting requirements are described below.

a. Results will be reported on an "as-is" basis and also calculated to lbs/ton for solid samples of lbs/1000 gallons for liquid samples.
b. Laboratory Procedure 3.2 Total Kjeldahl Nitrogen will determine TKN for liquid manure.
c. Laboratory Procedure 3.3 Total Nitrogen by Combustion will determine nitrogen for solid and semi-solid manure (greater than 15% solids).
d. Laboratory Procedure 4.1 Ammonium-N Determination by Distillation will determine ammonium nitrogen, except that KCI will be used as a reagent instead of MgO.
e. Laboratory Procedure 5.4 Nitric and Hydrochloric Acid Digestion with Peroxide will determine Phosphorus, Potassium, Calcium, Magnesium, Zinc, Copper, Manganese, Sulfur, and Sodium, and then analyzed on inductively coupled plasma (ICP).

Laboratories are required to provide a suitable report approved by DCR that utilizes the mineralization rates and ammonium nitrogen availability coefficients, which have been agreed to by the DCR as currently listed in the Virginia Nutrient Management Standards and Criteria (June 2014). The laboratory will print expected nitrogen availability based on immediate incorporation and no incorporation along with the manure analysis results on the approved report. The initials of the appropriate lab analyst must be printed on the approved report for the nitrogen, phosphorus, potassium, calcium and magnesium results as well as a brief reference to method of analysis for those parameters.

Soil nitrate tests. Merckoquant 10020 Nitrachek meters are utilized to read color metric test strips which are exposed to soil solutions extracted with 0.025 molar aluminum sulfate-solution. The test meters are standardized daily using a 10 ppm nitrate-nitrogen standard solution. The extracted soil solution is analyzed at least two times to ensure consistent results.

B5 – Quality Control

Manure samples. The DCR requires that the laboratory used for manure samples hold a Manure Testing Laboratory Certification by the Minnesota Department of Agriculture. The laboratory is also requested to participate in sample exchange programs including: North American Proficiency Testing Program, Manure Analysis Program, National Forage Testing Association, and Association of American Feed Control Officials, Inc. All analysis reports of results must include the initials of the lab analyst that performed the analysis for percent moisture, total nitrogen, ammonium nitrogen, total phosphorus, calcium, and magnesium. The laboratories are required to provide DCR with quarterly and annual reports including a summary of the total manure samples analyzed, and average test values for all parameters analyzed each quarter for each category of manure type.

B6 – Instrument / Equipment Testing, Inspection, and Maintenance

The individual laboratories performing soil test and manure analysis are responsible for meeting appropriate operating standards for equipment testing, inspection, and maintenance.

Soil nitrate tests. Merckoquant Nitrate Test, test strips are used for the detection and semi-quantitative determination of nitrate ions. Unopened Merckoquant Nitrate Test packs are stored in a refrigerator. After opening, the kits are stored in a dry and cool area, but not in a

refrigerator to avoid too much atmospheric moisture condensation in the tube. Test strips are dipped into the solution for 1 second to allow the reaction zones to be fully wetted. The test strip is removed and excess liquid shaken off. After 1 minute has passed the test strip is compared to the reaction zones on the color scale provided on the test kit tube / container. All field nitrate test kits are carefully maintained in order to obtain reliable results. The test meters are checked daily during the use season, using a 10-ppm nitrate-nitrogen standard solution, and standardizing the results with the fixed color strip to ensure proper functioning of the meter.

B7 – Instrument / Equipment Calibration and Frequency

Manure samples. The LECO combustion units used by the DCR approved laboratory must be calibrated with certified EDTA and checked with NIST peach or orchard leaf reference materials. The inductively coupled plasma (ICP) is standardized with standards made in house from stock solutions purchased from High Purity. The ICP standardization is checked with the NIST peach reference material. The reference materials for the LECO combustion unit and standard for the ICP are to be rechecked by the laboratories after every 15 samples.

B8 – Inspection / Acceptance of Supplies and Consumables

This section does not apply to this QAPP.

B9 – Non-direct Measurements

Internal NPS data. DCR obtains NPS tracking data from internal sources. The primary internal source of data is the Agricultural BMP Tracking Program. Other data provided internally is for nutrient management planning acreage.

Agricultural BMPs. Data in the Agricultural Cost Share database originates from the 47 Soil and Water Conservation Districts and reflects the implementation of Agricultural and Conservation Reserve Enhancement Program (CREP) Best Management Practices installed and funded through cost-share, state tax credits, and CREP incentive programs. Specifications for all DCR approved BMPs are in the *Virginia Agricultural BMP Manual.* Each District has Internet access to a secured server to access the Agricultural BMP Tracking Program. The DCR central office staff maintains and updates the program data reporting for each program year. The Agricultural BMP Tracking Program is used to track and report data associated with BMP implementation. The tracking program application and database are stored on remote servers accessed through the Internet to allow for all information associated with BMP implementation to be entered and maintained in an enterprise database. The database web application provides printable contract forms to obtain participant signatures. These paper files are archived by the District and retained for three years beyond the lifespan of the practice.

Nutrient management. Agricultural nutrient management plan implementation and urban nutrient management acres are supplied by the DCR nutrient management staff, which includes plans developed by certified private nutrient management planners as well as DCR's certified nutrient management specialists. As required in Virginia's *Nutrient Management Training and Certification Regulations* all certified nutrient management planners must submit an annual activity report including number of nutrient management plans completed; acreage covered by

plans and planned acreage by county and state watershed codes; breakdown of planned acreage by cropland, hay, pasture, specialty crops, and turf/landscape by county and watershed code; and other information indicating number of practices facilitated by the planner such as manure testing and use of the pre-sidedress nitrate test.

B10.1 – Data Management: Agricultural BMP Cost-Share Data

Automated quality assurance. Beginning July 1, 2009 at the start of the 2010 state fiscal year, the Agricultural BMP tracking program was redesigned and implemented as a web-based application using MS SQL Server. Highly relational database schema and application logic, coded in ASP.NET, allows very strict control of data entry to ensure data quality. At the start of each program year, the database is setup to restrict entries to allowable practices for allowable funding sources in specific geographic areas. BMP installations cannot be marked as completed and paid without a minimum set of fields entered. A mapping component, utilizing ArcGIS Server, incorporates recent high resolution aerial imagery that helps ensure the quality of spatial attributes as well.

Regional review. Data in the agricultural cost-share database originates from the 47 Soil and Water Conservation Districts. Data entries from Districts are initially screened by a DCR regional office conservation district coordinator (CDC) for a local knowledge review.
After the end of each quarter, District's records are reviewed by the assigned CDC for completeness and accuracy of financial reporting. Any irregularities are brought to the attention of the appropriate District staff for corrections.

B10.2 – Data Management: Nutrient Management Data

Nutrient management implementation and urban nutrient management acres are not derived from the agricultural cost share database. This data is supplied separately by the DCR nutrient management staff and is reported to the data management staff using MS Excel spreadsheets, and MS Access database files. The data is at the 12-digit hydrologic unit spatial scale for agricultural nutrient management and at the county or jurisdiction scale for urban nutrient management. The nutrient management data is provided to DEQ and mapped to the established NEIEN XML schemas and reported via established NEIEN protocols to CBPO.

B10.3 – Data Management: External Data

This section does not apply to this QAPP.

B10.4 – Data Management: Reporting to EPA-CBPO

This section does not apply to this QAPP.

Group C – Assessment and Oversight

C1 – Assessments and Response Actions

BMP spot checks. A primary form of QA of the BMP data occurs during the spot check process, where records are randomly pulled from the database and the practices described are visited to assure that the BMPs that were recorded have actually been installed and are in compliance with the BMP's specifications.

Number of BMPs. It is important to note that the Agricultural Cost Share Tracking Program can track voluntary BMP installations if the District personnel are willing to verify the BMP meets specifications and report on the installations. However, at this time there are only 202 of over 71,000 records of voluntary BMP installations. This figure does not adequately

reflect the actual level of voluntary agricultural BMP installations. Therefore, the BMPs reported to any EPA program based on the Agricultural Cost Share Tracking Program are conservative overall estimates of agricultural BMP implementation in the Commonwealth of Virginia.

A Virginia Polytechnic Institute & State University report, *Factors Influencing Implementation of Best Management Practices in Virginia's Chesapeake Bay Drainage Basin,* confirmed that 81% of farmers in the Chesapeake Bay watershed implemented BMPs, 31% implemented BMPs using cost-share funds, and 75% implemented BMPs without cost-share assistance. The overlapping 6% is associated with farmers reporting both cost-share and voluntary implementation of BMPs. This report also showed that on an average, each farmer adopted four non-cost-share BMPs for every cost-share BMP implemented in the basin (Mostaghimi, Lowery, Gupta, McClellan, 1996). A follow-up report, *An Assessment of the Quality of Agricultural Best Management Practices Implemented in the James River Basin of Virginia,* shows that there is no statistically significant difference between the quality of cost-share and non cost-share practices. This report concludes "non cost-share practices should be treated equally when accounting for NPS pollution reductions due to BMPs in watershed management and computer modeling" (Cunningham, 2003).

Assessment responsibility. In early spring of each year, after the 4th quarter (program year) data is processed for the previous program year (July 1 through June 30), the Agricultural BMP implementation records of the practices funded through the Virginia Agricultural BMP cost-share incentives program (VACS) and Conservation Reserve Enhancement Program (CREP)are randomly selected for spot check during the following summer and fall. The District and CDC typically schedule the spot check visits during the parts of the year when the producers are not so busy. Mostly structural agricultural BMPs are eligible for spot checks. CREP

installations are also spot checked by USDA-NRCS staff under guidelines developed and followed by USDA NRCS and FSA personnel.

Frequency and type of assessment. At least five percent of the practices installed during the previous program year are spot-checked, as well as another five percent of all practices within their lifespan. Eligible BMPs are randomly selected for spot check. A spot check data table is generated and a spot check form printed for each practice selected. The District conservation specialist and the DCR CDC cannot remove BMPs from the spot check table. However, based on local knowledge they can, and frequently do, add additional BMPs or sites to the spot check table. The CDC and the District conservation specialist (sometimes accompanied by District directors or Richmond Central office staff) notify the producers of the spot check visits and then go to the respective agricultural BMP implementation sites and inspect the installation. The staff then fills out the spot check form for that BMP and sends a copy to the DCR Richmond Central office in the late fall.

Spot check status and actions. The spot check BMP statuses are: *OK*, *Not Maintained Properly*, *Not Functioning Properly*, and *Practice Destroyed*. A status of *OK* indicates the BMP was in technical compliance with the specific standard(s) for that BMP at the time of the spot check. A status of *Not Maintained Properly* indicates that the BMP at the time of the spot check had one or more technical defects needing to be addressed by the producer for the BMP to be fully in compliance with the specific BMP standard(s). For these status BMPs the SWCD staff issue a letter to the producer detailing the specific action(s) needed to bring the BMP installation into full compliance. If the participant is unwilling to bring the practice into compliance a request is made to refund a pro rata share of the cost-share funds received by the producer for that specific BMP installation. This provides a financial incentive for the producer to correct any

defects found during the spot check process. When the participant completes the maintenance required to bring the practice into compliance, the site is revisited to confirm compliance. Participants that refuse to bring the practice into compliance or return cost-share funds are referred to the Office of the Attorney General for legal action to recover the cost-share funds.

A status of *Not Functioning Properly* indicates that the BMP was not working as designed at the time of the spot check. There are many reasons that this status might be assigned such as a spring that was developed to supply water for an off-stream watering system and due to drought the spring has stopped flowing. These practices also receive follow up site visits to verify compliance when the reason for the *Not Functioning Properly* designation has been resolved. A status of *Practice Destroyed* are typically instances where the property has been sold and the new owner has removed the practice not knowing the linkage of the BMP to the property and the agricultural cost share program. The SWCD follows a written procedure for requesting the return of a pro rated share of the cost share funds. This calculation is based upon the number of months that the practice was functioning before receiving a Not Function Properly status when the program participant is unwilling to return the calculated pro rated cost-share amount. Participants may have a maximum grace period of 6 months to restore the BMP to its intended function of repay the pro-rated cost share amount. After sixty additional days the delinquency is turned over the Office of the Attorney General for assistance in reclaiming the state funds.

A spot check summary of the PY 2010 program year is included as an appendix to this report.

C2 – Reports to Management

Compiling results. A spot check report is entered into the Agricultural BMP Tracking Program by district staff for each BMP installation visited. This information can be used to filter data extraction. Of the 70 BMPs tracked in the Agricultural BMP Cost-Share Tracking Program database 55 or 79% are considered spot check eligible. Of the 70 BMPs tracked in the Agricultural BMP Cost-Share database 30 or 43% are recognized and modeled by EPA-CBPO. Of these 30 EPA-CBPO recognized BMPs 23 or 77% are spot check eligible.

Group D – Data Validation and Usability

D1 – Data Review, Verification, and Validation

Acceptance criteria. Criteria for accepting or rejecting agricultural BMP cost-share practices for the resulting data can be found under the individual practices in the most recent version of the *Virginia Agricultural BMP Manual.* Districts are responsible for the verification of all installations paid for through the Agricultural Cost Share incentive program. For example even though cover crops are not considered a spot check eligible BMP before a participant can receive funds for this practice the District conservation specialist verifies planting dates at or near the time of planting and verifies crop plant density at time of crop kill dates. These verification inspections insure that the farmer is planting the crop in a timely manner and that the crop was of sufficient density to provide the desired water quality benefit. This is a recent modification in the tracking of this BMP and will allow DCR to report to EPA-CBPO acreage of cover crops as early or late planted. Additional details regarding the verification and validation criteria for individual BMPs can be found under the previous section C1 – Assessments and Response Actions.

BMP verification and validation. Agricultural BMPs implemented require the signature of the producer and the District conservation specialist (who is required to have job approval authority on that Agricultural BMP type), certifying that the BMPs were implemented according to the applicable technical specifications. The signature form is a legal document that, for structural BMPs, typically requires maintenance and proper usage of the implemented BMPs during the design life spans. These are also typically the types of Agricultural BMPs that are later eligible for spot checks during the design life span time window.

Tracking program QA. The specific types of QA conducted on the Agricultural Cost Share Tracking Program and resulting cost-share BMP data include:

- BMP location coordinate pair and other spatially determined fields are populated using a web-based mapping application. District personnel locate BMP installation using a variety of base maps including; USGS 7.5 minute quads, recent high resolution aerial imagery and high resolution road centerlines.
- Many fields of data are populated from drop down lists so that those items are uniformly entered (for example, County names, Agricultural BMP Practice codes, Funding Source Types [Program Types], Practice status, Animal Type [on applicable Agricultural BMPs], etc.).
- Each District personnel login is associated with a particular District and data entry is limited to funding sources, practices and other variables approved for each District.
- The cost-share payment amount approved by the District board cannot be greater than the estimated cost-share payment.
- The cost-share payment amount cannot be greater than the approved cost-share payment amount (which in turn, can not be greater than the estimated cost-share payment).

D2 – Verification and Validation Methods

General content regarding data verification and validation is provided in section C1, Assessments and Response Actions. Information pertaining to the validation of data based on the tracking program is provided above in section D1, Data Review, Verification, and Validation.

These sections identify who is responsible for verifying and validating the different components of the cost-share data.

Report of Spot Check Results. At any time, DCR can generate a report of the spot check results for a specific time period. Table 2 in Appendix 1 details the analysis of the 2010 spot check records. Based on this analysis DCR infers that over 91% of all BMPs installed via the Virginia Agricultural Cost-Share Program whether reported to EPA-CBPO or not are fully meeting design and maintenance specifications for the period July 1, 2009 through June 30, 2010.

D3 – Reconciliation with User Requirements

There are various factors related to possible uncertainty during the collection of historic NPS BMP implementation data from the 47 SWCDs and historically the majority of data quality issues have been data input errors with these errors primarily being the entering of invalid data in the tracking program. The redesigned tracking program, implemented July 2009, has a great number of features to ensure the quality of data entered and avoid common types of data entry errors that the previous tracking application could not address.

Another source of potential uncertainty in the historic data is in the field collection of the data. An example of this type of uncertainty is variable interpretations on where to collect representative location coordinates. This arises in part due to the type of BMP(s) being installed on various farms. Cover crops may have coordinates taken at a representative point near or in the field(s) where the crops are planted such as the middle of the farm or middle of the individual fields. Stream exclusion fencing may have these coordinates collated at a central point along a linear feature (the fence) near the stream or could be collected in the upland pasture if rotational

grazing of the upland acres benefiting from the exclusion/rotational grazing system BMP is installed. These types of collection uncertainty are significant if very fine scale modeling is of concern since they could induce error of plus or minus tens to hundreds of meters between the BMPs actual location coordinates and that of those reported. These types of inaccuracies cannot be programmed away with any soft ware type fixes.

It is possible that a conservation specialist with a SWCD picks a point of convenience for collecting the data (the center of the farm, near the front gate, at the farmhouse) that is not actually reflective of the individual BMP installation point. For a practice such as stream exclusion without rotational grazing a SWCD conservation specialist according to the BMP manual is required to report linear feet of streambank excluded not the linear feet of fencing installed. However, it is possible that the fence is what is measured and reported. These types of collection uncertainty are significant if medium scale modeling is of concern since they could induce errors of plus or minus hundreds to thousands of meters between the BMPs actual location coordinates and that of those reported.

For all data collected for program years 2009 and forward utilizing the location selection associated with the mapping function of the new tracking program will significantly reduce locational inaccuracies. For the EPA-CBPO phase 5.x watershed model the level of uncertainty described above should be acceptable since the confidence that the data exists within a given watershed model segment is very high due to the very large scale of the models segmentation and the very high probability that the reported coordinates are valid for the topographic quadrangle reported and that those quadrangles are in a given hydrologic unit or county contained within a model segment. Additionally, DCR provides training on correct data collection and input in order to minimize this type of uncertainty. The previous sections provide

details on the multiple quality assurance measures that DCR undergoes to develop, track, and report quality BMP implementation data to the citizens of Virginia, Executive and Legislative branches of state government, and to the EPA.

References

Code of Virginia. (2006, January 11). *§ 10.1-104.2 Nutrient Management Training and Certification Regulations.* 4 VAC 5-15. Commonwealth of Virginia: Virginia Department of Conservation and Recreation. These regulations are available on the DCR website, http://www.dcr.virginia.gov/documents/nmtraincertregs.pdf

Cunningham, J. (2003, August). *An Assessment of the Quality of Agricultural Best Management Practices in the James River Basin of Virginia.* Blacksburg, VA: Virginia Polytechnic Institute and State University's Biological Systems Engineering Department.

Haering, K. C., Evanylo, G. K. (2006, February). *The Mid-Atlantic Nutrient Management Handbook.* MAWP 06-02. Mid-Atlantic Regional Water Program: A Partnership of USDA CSREES & Land Grant Colleges and Universities.

Mostaghimi, S., Lowery IV, J., Gupta, R., McClellan, P. (1997). *Factors Influencing Implementation of Best Management Practices in Virginia's Chesapeake Bay Drainage Basin.* Report No. CS0896. Blacksburg, VA: Virginia Polytechnic Institute and State University's Biological Systems Engineering Department. Submitted to Virginia Department of Conservation and Recreation, Richmond, VA.

Peters, J. (2003). *Recommended Methods of Manure Analysis.* A3769. Madison, WI: University of Wisconsin - Madison.

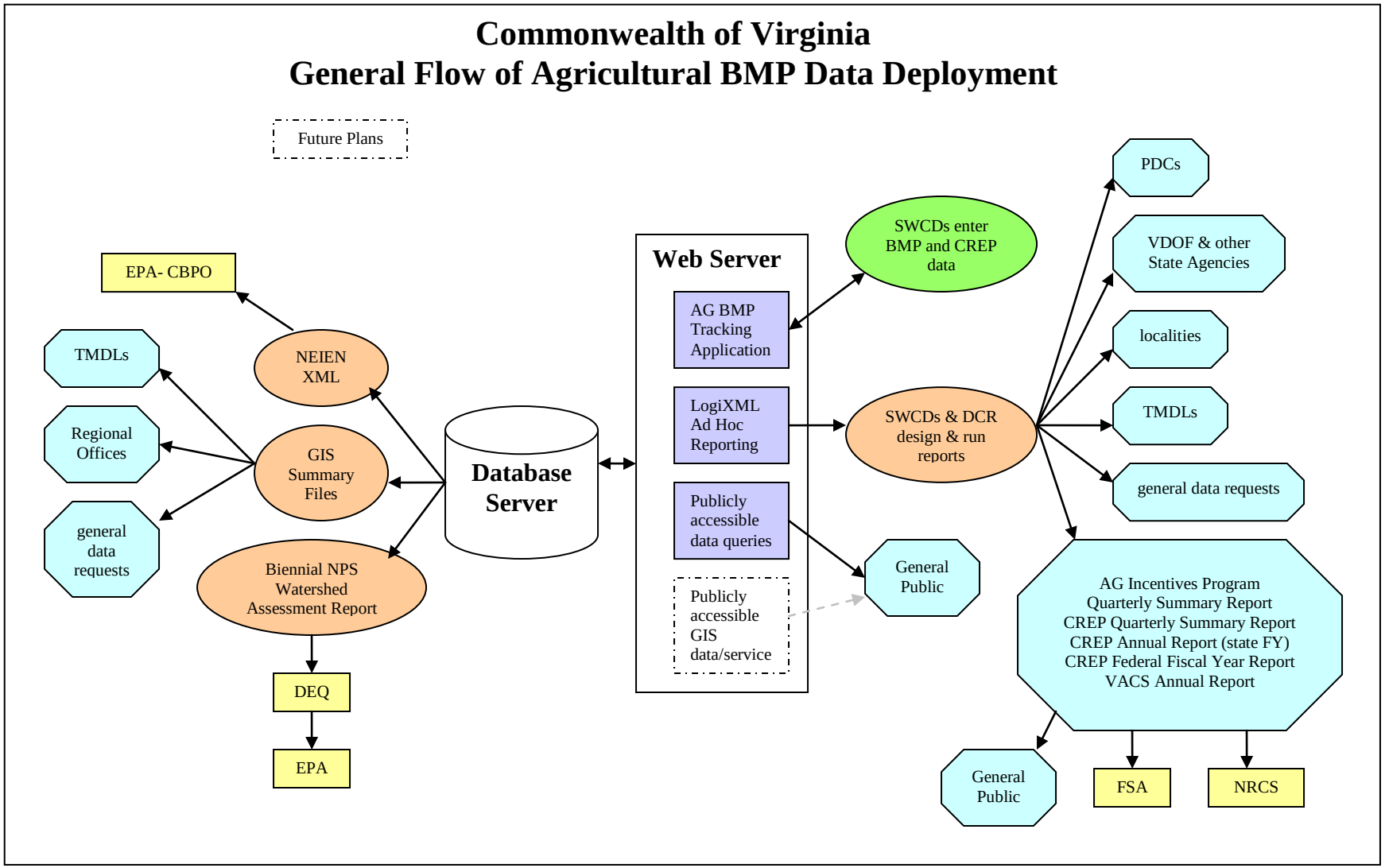
Virginia Department of Conservation and Recreation (2010 – Program Year 2011). *Virginia Agricultural BMP Manual.* Richmond, VA. [This manual is updated annually.] This manual is available on the DCR website, http://www.dcr.virginia.gov/stormwater_management/costshar.shtml.

Virginia Department of Conservation and Recreation, *SWCD Employee's Guide to Navigating the DCR Website.* http://www.dcr.virginia.gov/stormwater_management/documents/cswebnav.pdf

Virginia Department of Conservation and Recreation (2010, August 31). *Quality Management Plan: Virginia Nonpoint Source Pollution Management Program.* Richmond, VA.

Virginia Department of Conservation and Recreation (2005, October). *Virginia Nutrient Management Standards and Criteria.* Richmond, VA. This document is available on the DCR website, http://www.dcr.virginia.gov/documents/StandardsandCriteria.pdf

Appendix 1
Table 1

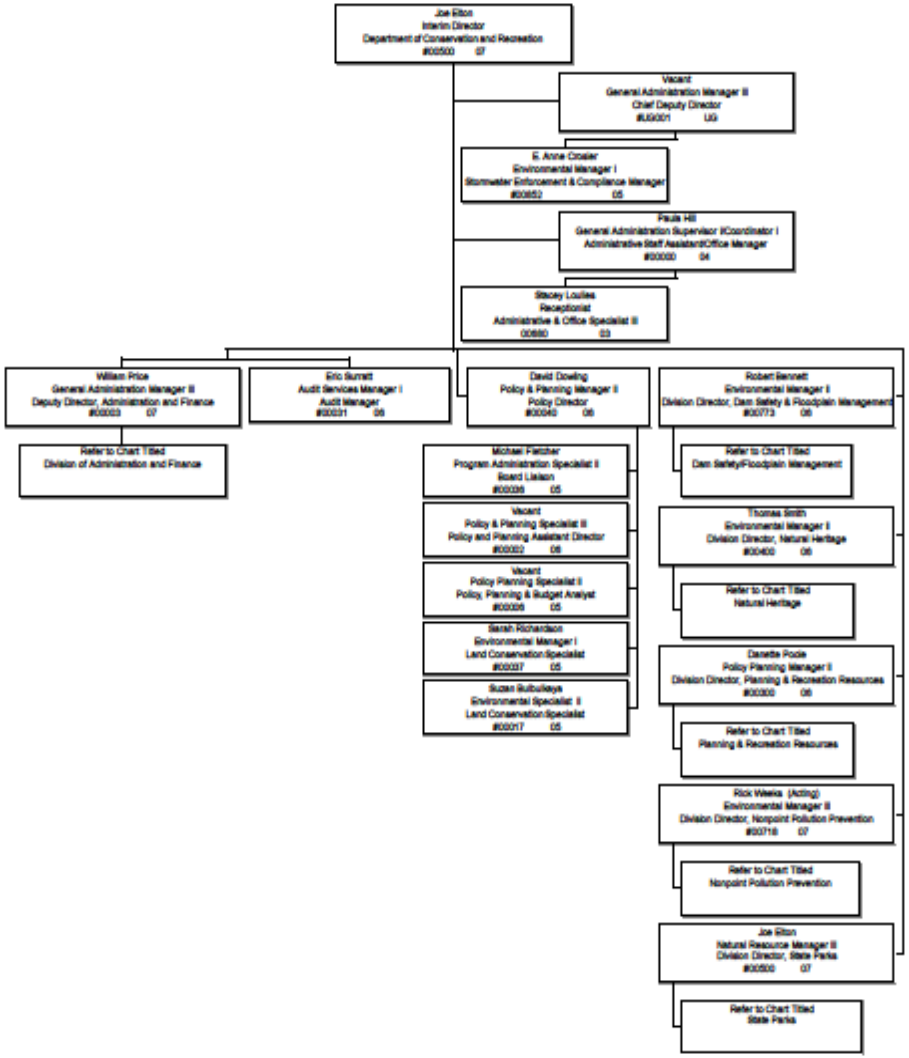


Appendix 2 – DCR Organizational Charts

VA Department of Conservation and Recreation

Director's Office

January 2014

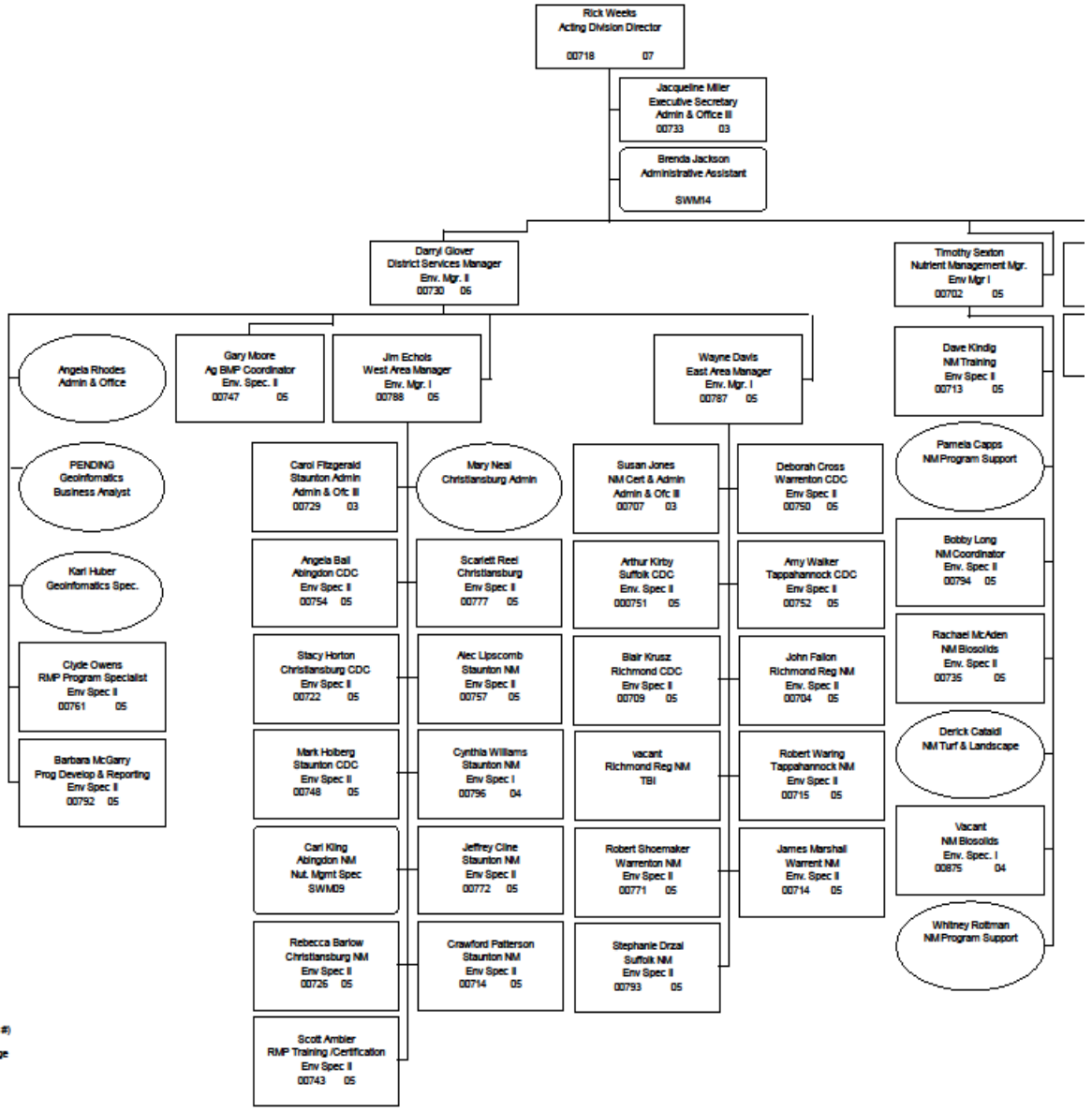


Last Modified 3/17/2014

VA Department of Conservation and Recreation

Division of Soil and Water Conservation

September, 2013



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