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The NCDOT Environmental Newsletter

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The Evolution of Roadway Design

By: Brenda Moore, PE, MBA, NCDOT State Roadway Design Engineer

View Point



The Roadway Design Unit has undergone a transformation from a large in-house plan production group to a compact operation of plan reviewers, CADD support specialists and designers. We not only review and produce roadway design plans; we also produce lighting and electrical plans for highway lighting for the entire state and

provide Computer-Aided Drafting Design (CADD) support statewide. Since the transition, we have undertaken several initiatives.

The Roadway Design Manual is being re-written with the assistance of our consultant partners and in-house staff serving as technical experts. The new manual will be written from the perspective of the 2018 Green Book which focuses on exercising more design flexibility and the inclusion of multi-modal accommodations in our designs. The update process is expected to last eighteen months.

The Roadway Design Unit is leading the effort to transition the Department to Open Roads Designer (ORD) software for the development of designs. Designs will be developed in a 3-D format and will be model based in lieu of the traditional 2-D plan

and profile views. The ORD software dynamically updates allowing design changes to be automatically updated throughout the model. An ORD Implementation Plan for the Department has been developed and we are working towards full implementation in fall 2020.

In partnership with Public Involvement, the public meeting map guidance is being updated. A workgroup has developed guidance on the various mapping products and expanded the legend. The overall goal is to improve consistency and provide products that are more easily understood by the public. The workgroup is expecting to finalize its work in the next few weeks. We are grateful to everyone that has agreed to assist us with these initiatives and hope they will be a positive addition to day to day operations in our industry.

Programmatic Approach to Aquatic Impacts

By: Marissa Cox, EAU Biological Surveys Group Leader

Project Spotlight

In anticipation of the federal listing of the Yellow Lance mussel by the US Fish & Wildlife Service (USFWS) in NC, the Biological Surveys Group (BSG) of the Environmental Analysis Unit (EAU) drafted the **Eastern North Carolina Programmatic Biological Assessment of Potential Effects on Tar River Spiny mussel, Dwarf Wedgemussel, and Yellow Lance in Association with Bridge and Culvert Replacements (PBA)**. The



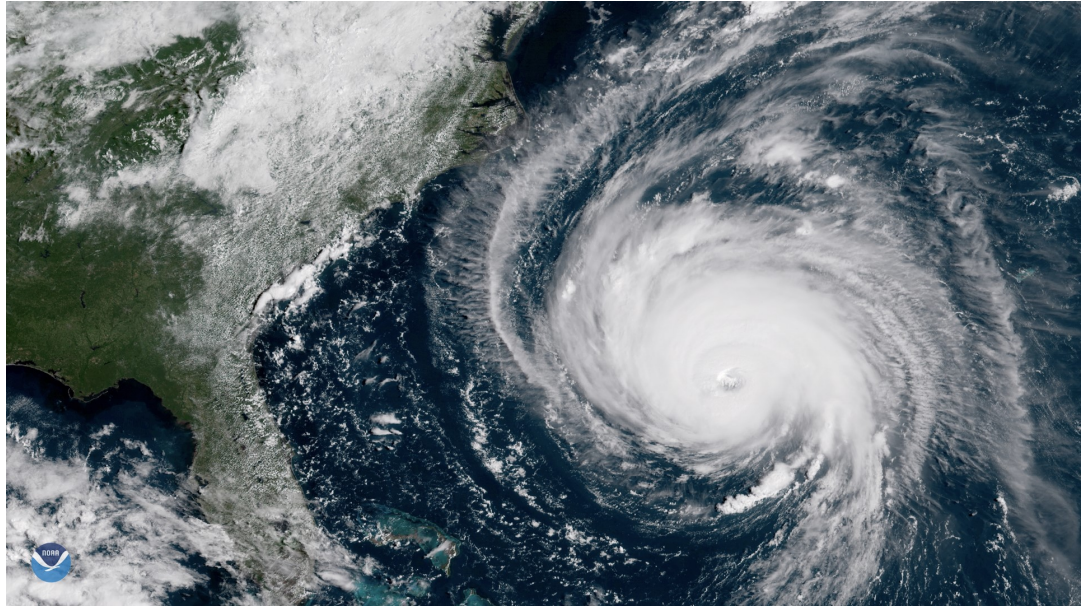
PBA was submitted to the USFWS on behalf of the Federal Highway Administration (FHWA) and the US Army Corps of Engineers (USACE) in March 2018. The PBA evaluated the potential effects of proposed North Carolina Department of Transportation (NCDOT) bridge replacements/repairs/rehabilitations, culvert replacements, and the bridge replacement/repair/rehabilitation

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From Fran to Florence – How Hurricane Response Has Changed

Marty Homan, NCDOT Communications Office

As the calendar turns to August, many people are focused on the return of football and the start to a new school year. But for the engineers in the N.C. Department of Transportation Hydraulics Unit, another season is at the front of their minds – peak hurricane season. That’s when the urgency of their work really picks up. The unit’s year-round mission is to effectively manage the interaction of water with our roadways. Its engineers make recommendations for highway construction projects to ensure water properly drains from the roadway and that the ideal size and type of structure (e.g. bridge, culvert or pipe) are used to carry water under a roadway. Much of the unit’s work, especially in re-



“Back in the ’90s with Hurricanes Fran and Floyd, primarily we would use USGS quadrangle maps,” Twisdale said. “You would have to delineate the drainage area by hand. You would trace out the drainage area on a copy of the quad map, and then you would take a planimeter and run that area and that’s how you got your drainage area.”

Technology advanced significantly by the time Hurricane Matthew brushed up the Southeast Coast and caused widespread flooding in the Carolinas in 2016. But even with information coming in by email and spreadsheets, the process still had its setbacks.

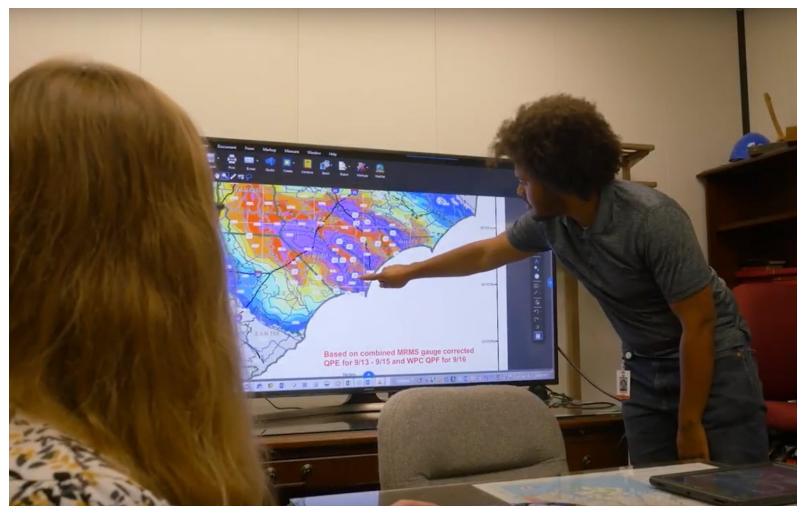
“Internally we were having to maintain our spreadsheet, and Divisions had theirs,” Twisdale said. “We had over 800 pipes to replace after Matthew. We wanted a one-stop shop where everybody could work in the same spreadsheet.”

Lessons learned during Matthew marked a turning point in

sponse to hurricanes, has changed over the past 20-plus years. Most of the change can be attributed to advances in technology.

“Twenty years ago, it was clipboards and phone calls,” said Assistant State Hydraulics Engineer Andy Jordan. “Now we’ve got apps, online spreadsheets and dashboards. We put our recommendation in, and the Division sees it automatically.”

Recently retired Assistant State Hydraulics Engineer Jay Twisdale witnessed strategies evolve over his 29 years with NCDOT. With Hurricane Fran in 1996 and again with Hurricane Floyd in 1999, Twisdale said the Hydraulics Unit relied heavily on phones to communicate time-sensitive information. Those were also the days of working on paper and calculating by hand.



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(Project Spotlight continued from page 1)

and culvert replacement portions of widening projects with a federal nexus in NCDOT Divisions 1-8. The effects evaluation focused on specific federally listed species, species proposed to be listed by USFWS, and Designated Critical Habitat that may incur adverse effects in the areas that are scheduled to be under construction during a ten-year period beginning May 2018.

In response to the proposed listing of the Yellow Lance on April 5, 2017, a working group was formed which was comprised of representatives from NCDOT, FHWA, USACE, NC Wildlife Resources Commission (NCWRC), and USFWS. This group focused discussions on developing a strategy to address the potential effects that NCDOT projects may have on the Tar River Spiny mussel, Dwarf Wedgemussel, and Yellow Lance. The goal of the working group was to advance transportation projects forward without schedule delays and to ensure federally listed mussel species protection and uplift in the most efficient way within the USFWS Raleigh Field Office work



Yellow Lance

area. The PBA was the result of a year-long intra-agency effort by this group.

The concern and impetus to form the working group was that the Yellow Lance (newly proposed to be listed in 2017) and the Atlantic Pigtoe (which had a strong potential to be proposed for listing in the near future) would affect an above average volume of NCDOT projects. This higher anticipated project workload was due to the larger extent of the proposed species range compared to the ranges of current federally listed mussels in NC. If the Yellow Lance and Atlantic Pigtoe became listed under the Endangered Species Act (ESA), an estimated 300 bridge and culvert replacement projects over the subsequent 10 years would likely require formal ESA Section 7 consultation. At that time, BSG typically utilized the formal consul-



tation process on behalf of FHWA on 3-5 projects per year. This tenfold dramatic increase in formal consultations would have overwhelmed current staff workloads in both the transportation and resource agencies. The working group determined that a programmatic agreement was the best path forward to avoid these issues and accomplish its goals.

The potential benefits of a programmatic agreement included:

- When a **May Affect - Likely to Adversely Affect (MA-LAA)** Biological Conclusion is reached, formal ESA Section 7 consultation for the mussel species covered in the agreement would be taken off the critical path for a project. Removing the burden of formal consultation at the individual project level would eliminate the potential for project schedule delays due to the consultation process
- There would be a “built in” informal Section 7 consultation component in the agreement that includes programmatic concurrence with **May Affect - Not Likely to Adversely Affect (MA-NLAA)** Biological Conclusions which would also streamline informal consultations.
- There would be direct cost and time savings on projects requir-

ing Section 7 consultation.

- It would allow resource agencies a means to take a more holistic, strategic approach to the conservation and recovery of federally listed mussel species.
- It would promote a more manageable Section 7 consultation workload for both resource and transportation agencies.

The Yellow Lance was listed as threatened by USFWS on April 2, 2018.

Threats to the species include pollution from agriculture, logging and urban development, as well as by climate change. There are only seven remaining populations, none of which are considered highly resilient because 86 percent of the streams in the mussel's current range have low, or



Atlantic Pigtoe

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NCDOT's approach to hurricane planning and response.

"We've moved from being more reactive and static to being more proactive and dynamic," said State Hydraulics Engineer Stephen Morgan. "Historically, we've sat back and waited for a storm to approach. After it passed, we went into a reactive mode and got into recovery."

As Hurricane Florence approached the North Carolina coast last September with catastrophic potential, Transportation Secretary Jim Trogdon charged the Hydraulics Unit with a revised plan of action.

"We became more involved in preparation and response," Jordan said. "And this includes doing modeling and forecasting, predicting if a road would over-top, how long it would be inundated, and help with the detouring of the public and finding other routes." Morgan indicated that the shift was only accomplished by the brute force of a team of engineers and they would have not been as successful without the help of some very talented consultants and senior staff.

In preparation for future storms, the engineers set out to develop several programs and products to help with hurricane preparation and response. One of the programs, being developed in partnership with Emergency Management, is the Flood Inundation Mapping and Alert Network for Transportation. The FIMAN-T utilizes flood forecast models to populate a map to show the extent of the flooding.

"Now we can take a forecast model from the National Weather Service or the Southeastern Regional Forecast Center and 'slide the bar' based on what the forecast is to see how that affects the road network – how many roads are flooded," Morgan said.

The Hydraulics Unit relies heavily these days on USGS StreamStats – a considerable leap forward from the days of drawing drainage areas by hand on a quad map.

"Now, you figure out where your crossing is from coordinates provided, and you enter that in StreamStats, and it will generate the drainage area and the discharges as well," Twisdale said.

The hydraulics team also began working more closely with NCDOT Traffic Operations, ensuring critical information is shared between the two units. Morgan insisted that managing traffic was key during a significant storm event. If the Hydraulics Unit could estimate or forecast which roads may be flooded and at what time, that information could be passed over to traffic operations, which would then go into the Travel Information Management System (TIMS) network. Travel information reported in TIMS is not only available to the public at www.drivenc.gov; it is culled for

use by navigation services like Waze and Google Maps. And thanks to advances in technology, waiting on information is a thing of the past.

"Using cloud-based applications, the folks in the field can load a request and their location where everyone can see it," said Eastern Operations Engineering Supervisor Galen Cail. "It's a much quicker turnaround."

Greater organization and efficiency are critical in a state expected to grow by about 1 million people per decade through 2050. North Carolina has also felt unprecedented effects of severe weather in the past couple years. NCDOT's response is a heightened emphasis on resiliency

– larger pipes and bridges and infrastructure designed to last longer.

"I think that effort will be more extensive the next time we are faced with another hurricane," Twisdale said. "The Department has taken huge steps in becoming more proactive. It's a unique thing about NCDOT; whenever asked, NCDOT always steps up, looking for better ways to accomplish what's needed at the moment."



very low, water quality. In North Carolina the Yellow Lance is found in the Chowan, Neuse and Tar River watersheds. The population in the Tar River in North Carolina is the healthiest remaining population and is estimated to have moderate resiliency. In Virginia, the Yellow Lance is found in the James and Rappahannock River basins, and in Maryland it's found in the Chesapeake River basin. Geographically, the species has declined by 70 percent in the Coastal Plain region and by approximately 50 percent in both the Piedmont and the Mountain regions.

On June 13, 2018, the USFWS Raleigh Field Office issued a **Programmatic Biological Opinion for Bridge and Culvert Replacements/Repairs/Rehabilitations in Eastern North Carolina, NCDOT Divisions 1-8 (PBO)**. Use of the PBO by project managers is not required, but it provides an option in-lieu of standard protocols and procedures on projects within the range of these three aquatic mussel species. The PBO provides the following: 1) a step-by-step Biological Conclusion determination process, 2) advance Service concurrence with MA-NLAA conclusions that are consistent with the protocols as defined in the PBO and 3) pre-determined project-specific requirements, conservation measures, and monitoring and reporting requirements for MA-LAA determinations.

Examples of conservation measures in the PBO included:

- An in-lieu fee program established to allow the option for NCDOT to remit payment per bridge/culvert project that is likely to adversely affect one or more listed mussel species. Payments are made to the NCWRC

N.C. Nongame Aquatic Species Fund.

- Sedimentation and erosion control measures.
- Bridge demolition and removal measures.



As suspected, the Atlantic Pigtoe was proposed for listing on October 11, 2018 by the USFWS. Atlantic Pigtoe (*Fusconaia masoni*) is a freshwater mussel now only found in Virginia and North Carolina in the following river basins: Tar, Neuse, James, Chowan, Roanoke, Cape Fear, and Yadkin-Pee Dee. The Service states that the Atlantic Pigtoe “currently has reduced adaptive potential due to limited representation (compared with historical repre-

sentation) in seven river basins and three physiographic regions” (83 FR 51570,51573;October 11, 2018). The proposed rule indicates the most significant threat to the species is habitat degradation. Per the Service’s

strict rulemaking procedures, a listing proposal is published in the Federal Register followed by a 12-month period. During this time, the Service will review, analyze, and respond to public comments and either publish a final listing rule, withdraw the proposal, or extend the proposal for 6 months at which time a decision is required.

In order to avoid delaying any NCDOT projects, an addendum to include Atlantic Pigtoe in the PBA was submitted to USFWS on June 3, 2019. The BSG,

FHWA and USACE are currently reviewing the **Revised Programmatic Biological/Conference Opinion for Bridge and Culvert Replacements/Repairs/Rehabilitations in Eastern North Carolina, NCDOT Divisions 1-8 (Revised PBO)**. Once this Revised PBO is finalized, NCDOT will have a conference opinion for Atlantic Pigtoe which will be converted to a Biological Opinion when the species is listed.



The use of programmatic agreements for endangered species is a useful tool to accomplish ESA compliance while achieving cost and time savings by streamlining the Section 7 consultation process. The BSG is currently developing more of these agreements with USFWS statewide in an effort to collaboratively solve conservation challenges while avoiding transportation project delays, as well as create opportunities for resource agencies to recover the ecosystems and remaining populations of listed species in NC.

How Much Is A Picture Worth?

By: Jamille Robbins & David Hinnant, EAU PICSviz Group

Technical Article

Technology is affording us new ways to engage the public in our various projects, plans and studies. Integration of virtual tools into the overall public involvement strategy is known as Virtual Public Involvement (VPI). One of the tools in the VPI toolkit is project visualizations.

Project visualization techniques include photo simulations, 3D images, videos, aerial footage, augmented reality or virtual reality. Project visualizations are a critical component of modern public outreach. They complement and enhance in-person engagement and other virtual public involvement techniques. They provide us a way to immediately translate the appearance and location of designs and concepts with the purpose of promoting a better understanding of transportation projects and impacts. We will rely on the use of visualization more and more to help convey to the public the purpose, need, and technical features of upcoming planning and design projects.



Visualizations can explain a project to anyone regardless of background or prior knowledge. The improved communication provided through these tools plays an important role in reducing project delays as the public has a better understanding of how they may be affected by a project. For transportation professionals, better understanding leads to better dialogue which leads to better projects.

Visualizations can easily be shared via social media channels, streaming sites, and project websites. Choosing the right visualization product for the appropriate phase of outreach is important. A 3-D “fly-through” animation is not always needed or may not be needed at the early stages of outreach. Static renderings giving the public an idea of design concepts being pro-

posed may be best at that time.

Creating visualizations requires specialized training and expertise in the use of key software packages and tools. At NCDOT we are fortunate to have this skillset in-house. The Visualization Team, led by David Hinnant, possesses a skillset that does not exist anywhere else within the Department or State of NC agencies.

The products produced by the Visualization Team have evolved from simple static graphics and photo composites of small localized areas to highly complex 4D animation and video projects that encompass entire highway projects. Many consist of descriptive animated videos requiring video and audio overlays. Early visualization projects were individualized and required only Computer-Aided Design and Drafting and image editing software. New technologies being incorporated into visualization projects include the use of drones, real time envi-



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ronments and virtual reality. Two of the team members are licensed unmanned aircraft system (drone) pilots.

Visualizations represent the future of how projects will be presented to the public. Two-dimensional plans sheets will go the way of the dinosaur. Three-dimensional and 4-D models/animations will become the standard communication tool to convey project design concepts and impacts to the general public.



For more information about the current visualization product offerings or for consultation on the appropriate tools for your project, contact David Hinnant via email at dbhinnant@ncdot.gov.

To learn more about the VPI, please visit the Federal Highway Administration's webpage at: https://www.fhwa.dot.gov/planning/public_involvement/vpi/

Congratulations Shane!!!

Earlier this year, Shane Petersen was recognized for his successful graduation of the Legacy Leadership Program. Specifically, Shane completed the program in Leading at the Executive Level. Congratulations Shane on this great accomplishment!!!



USACE Commanders Award Presented to FHWA's Donna Dancausse

At the June Interagency Meeting, a special moment was set aside to present the United States Army Corps of Engineers (USACE) Commanders Award to Ms. Donna Dancausse with the Federal Highway Administration (FHWA). Donna is commended for her significant efforts while working at FHWA and specifically in her capacity as a valued and trusted partner of the Wilmington District, USACE. Her ability to forge strong relationships with interagency partners promotes a strong sense of teamwork that reflects positively on her leadership abilities and facilitation skills. As a direct result of her efforts, groups such as the Interagency Leadership Team, the Merger Management Team, and many others function at a level much higher than anticipated. In addition, Donna has facilitated countless process improvement efforts including those that enhance project scoping, streamline the Merger Process, and ensure the proper evaluation of complex proposals all for the benefit of delivering transportation projects in a timely manner. Many of the state and federal agencies involved in transportation projects owe their strong bonds and solid relationships to the time and effort that Donna places on each and every interaction. Her positive attitude and

tireless efforts have resulted in a consistently high level of customer service that reflects the highest credit upon herself, the FHWA and the Wilmington District, USACE.



Employee Spotlight

Wesley Cartner, EAU Mitigation & Modeling Group

Many people are familiar with the adage of “advancement through adversity,” but what about through adverse... weather? In the same week that Category 4 Hurricane Florence was set to make landfall over Wilmington, NC, I had also accepted an opportunity of a lifetime to come and work with the NCDOT office in Raleigh. So after a few days of displacement, followed by a few more weeks of replacement, I managed to float the rest of my belongings back up I-40 for the start of a new career in the Photogrammetry Department.



An NC native from Wilkes County, this Appalachian mountain man turned Wilmington beach bum with the help of University of North Carolina Wilmington (UNCW). After arriving in Wilmington in 2009, I attended UNCW and obtained a Bachelor of Arts in Applied Geography that lead to an Masters of Science in Geosciences with a Graduate Geographic Information System (GIS) Certification. These experiences cultivated not only a strong passion for working with all types of imagery and the derived data communicable through intricate mapping, but also the unique coastal wetland environments

that were the center of analysis. After semesters of listening, learning, lecturing, and in turn teaching others about the various types of wetlands, it was only fitting for my puppy's name, Pocosin, to be a product of our environment. Although heavily based with a background in GIS and remote sensing techniques using satellite imagery, I still maintain a great affinity for terrain analysis through topo maps.

After UNCW I went to work for a geotechnical firm, Engineering Consulting Services doing structural and foundation inspections. I had the opportunity to work on various projects such as the FedEx Distribution and FedEx Freight Centers, River Road Re-alignment, Live Oak Bank Airport Hangar at Wilmington International Airport, MARSOC installation additions, and UNCW's dining addition, The Hub. I was able to contribute to inspections on everything from deep foundation piles for parking decks, to reinforced concrete for 40-ft deep pump stations, and all the soils found in between.

Albeit a brief stint in the Photogrammetry Department before departing for the Environmental Analysis Unit (EAU), it still afforded me the ability to follow a passion for imagery that I would be able to cut teeth on through compiling planimetric and terrain features from stereoscopic imagery of roadway projects. Presently working within the EAU Mitigation and Modeling team under Leilani Paugh and Morgan Weatherford has poised me for close involvement on Project ATLAS, as it pertains to GIS and incorporating



various discipline's data into the framework. I will also be fortunate to pursue greater passions while dabbling in various unmanned aircraft system applications for environmental analysis, as well as applications aimed at producing survey grade geospatial products for NCDOT preconstruction and construction projects.

I am very fortunate for the experiences and wonderful colleagues I've already acquired in such a short time, and am excited to see what new ones are on the horizon.



RIBBON CUTTINGS



Please join me in welcoming to the Environmental Analysis Unit (EAU) Jamie Lancaster, Cheryl Knepp, Lucious McEachin, and Wesley Cartner.



Jamie will serve as the EAU Assistant Manager and the Cultural Resources Group Leader. He is a long time NCDOT employee, previously working with the Natural Environment Mitigation Engineering Group, the Priority Projects

Unit, the Roadside Environmental Unit and the Contracts, Standards & Development Unit. Please join me in welcoming back Jamie into his new role.

Cheryl has also returned to the EAU as she recently joined the Biological Surveys Group having come from the Department of Agriculture. Cheryl brings a vast knowledge of biological expertise and specializes in database management. Welcome back Cheryl!!!



Lucious McEachin recently joined the EAU Noise & Air Group after getting extensive training while on the Transportation Engineer Associate (TEA) Program. Lucious received a civil engineering degree from NC A&T. We are so happy to have you!!!

As mentioned in our Employee Spotlight article, Wesley Cartner has recently joined the EAU Mitigation & Modelling Group. He is a UNC Wilmington graduate and brings a large Geographic Information System expertise to his new job.



A big WELCOME to these folks and we look forward to working with you all!!!

EAU Employee Appreciation Picnic

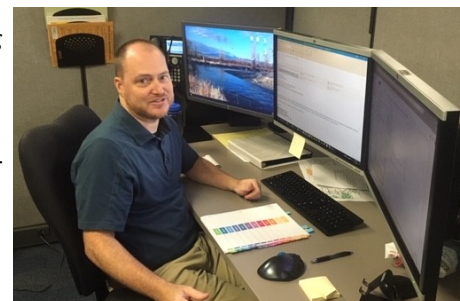
The Environmental Analysis Unit held its annual employee appreciation picnic earlier this summer. Individuals who had reached career milestones were awarded "Years of Service" certificates and much fellowship and great food was enjoyed.

Our "team" is made up of internal NCDOT staff, embedded consultants and consultant contractors, and we are grateful and appreciative for all the hard work and experience that they put in to their jobs everyday.



Congratulation to Michael Turchy, Tyler Stanton, and David Johnson for their recent promotions within the Unit.

Michael has been a long standing member of the Environmental Coordination and Permitting (ECAP) Group and was recently promoted to Western Team Leader. Michael brings with him a vast amount of experience in both traditional let and design-build project coordination.



David Johnson has recently moved from the Mitigation & Modelling Group into an Engineering I position within the Monitoring & Stewardship Group. David has a large skill set that includes GIS/CADD and mitigation details and specifications.

Tyler Stanton was recently promoted to the Terrestrial Team Lead within the Biological Surveys Group. Tyler has previous experience in the ECAP Group and he specializes in submerged aquatic vegetation and

Red-cockaded Woodpecker investigations and is a technology "go to" person..

Congratulations to all three as they expand their experience and contribute to the Department in new ways!

