Nutrient Scientific Advisory Board Meeting #18 Minutes

Friday, May 4th, 2012
TJCOG - 4307 Emperor Blvd, Durham NC, 27703
9:30 am -12:00 pm

Attendees
Members: Matt Flynn, John Cox (& Michelle Woolfolk, alt), David Phlegar, Trish D'Arconte, Bill Hunt (& Kathy Debusk, alt), Andy McDaniel, (Matt Lauffer's alt), Josh Johnson, Grady McCallie

Non-Members: Andy Sachs (facilitator), Jason Robinson (DWQ), Rich Gannon (DWQ), John Huisman (DWQ), Adugna Kebede (DWQ), Robert Patterson (DWQ), Mike Schlegel (TJCOG), Heather Saunders (TJCOG), Terry Hacket (Orange Co), Alix Matos (Cardno ENTRIX), Trevor Clement (Tetra Tech), Sally Hoyt (UNC), Sandra Wilbur (Durham), Dan McLawhorn (Raleigh), Forest Westall (UNRBA), Haywood Phthisic (LNBA)

Agenda
- **Board's Role in Model Contract**
  - Consultant Selection
  - Contract Scope of Work
  - Development of Model
- **Review "Take 3" Outline of July Annual Report**
  - Revisions per April SAB
  - Finish Other Benefits
  - Feasibility
  - Future Measures

List of Materials
- May Meeting Plan #18
- April NSAB Draft Minutes - Meeting #17
- Model Request for Qualifications - May 1, 2012 (attached)
- Second Annual NSAB Report Outline – May 3, 2012 (attached)
- Model Contract Timeline - April 24, 2012 (attached)
- Load –Reducing Practices Tables – May 3, 2012 (attached)

Convene
- Board members and guests introduced themselves.
- March minutes were approved.

Board's Role in Model Contract

Rich Gannon of DWQ gave an update on the status of the model contract and talked about how the NSAB would be involved in the selection of the consultant and development of the model by the consultant. The following points were discussed:
- The contract is in the mail, and should be executed within the next couple of weeks.

- The RFQ has been revised in accordance with comments from April's meeting. The final document was sent to the Board prior to the meeting.
- The pre-submittal meeting for potential applicants is scheduled for Wednesday, May 23rd. The Consultant Selection Panel is made up of John Cox, Andy McDaniel, Trish D'Arconte, Dr. Larry Band.
- The Panel will interview applicants at TJCOG on the morning of Wednesday, June 27th.
- The Panel will come to the July NSAB meeting with a ranked list of potential consultants. The Board will discuss the rankings and recommend a consultant to DWQ at the July meeting.
- It was proposed that the Board's August meeting be moved to the 2nd week in August in order to give the selected consultant enough time to draft a scope of work and to give the SAB and Panel that will be negotiating the scope of work a week to review the scope in order to bring comments to the meeting. Jason will send out a Doodle Poll to reschedule this meeting.
- Andy McDaniel, John Cox, Trish D'Arconte, and Grady McCallie volunteered to serve on the panel that will negotiate with the consultant on their scope of work. The members who didn't attend today's meeting also will be asked.
- The Board will interact with the consultant when the consultant has a product to present, as opposed to scheduled dates.

Second Annual Report to Secretary

Recommendations to Secretary on Improving Modeling, Analytical Tools (per SL 4b 4) – Rich pointed out the changes to the outline that were made in response to the Board's discussion at their April meeting.
Andy M. suggested adding a bullet to this list about making improvements on modeling based on available funds, in order to leave some "wiggle room". Rich explained that the report will characterize these recommendations to the Secretary as general "wants".

Next Steps

- John Cox said that the Simple Method used in the Tar-Pam Accounting tool and the newer Jordan/Falls accounting tool comes from a 1987 document by Tom Schueler, and that Schueler has come up with a revised method being used in the Chesapeake Bay which should be considered by the NSAB. Rich Gannon of DWQ said that the newer method will be noted in the report, but the report will not suggest revising the 2H regulations, which can be interpreted to require Schueler's 1987 Simple Method. This needs to be brought to the EMC's attention. Dr. Hunt mentioned that if the newer methods for calculating runoff loads are used for existing development, there will be a large push back from the development community to change the method used for new development.
- DWQ recognizes that an approval process for alternative BMPs needs to be established that is different than the approval of proprietary devices. The NSAB will be involved in this approval process.

Guidance for Affected Parties

- ***Available Measures***
  - Benefits – It was mentioned that several of the listed benefits actually fall under "Ecosystem Services". Job benefits would include both construction and regular o&m. The Board felt that these subjects are fairly standard environmental economics areas and suggested that the services of an environmental economist at NCSU or ASU be

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requested. Bill will reach out to Laurie Taylore at NCSU. The Board agreed that the results should be included in next year's report.

- Feasibility
  - It was suggested that a bullet be added for "solutions of how to overcome cost-effectiveness".
  - Trish commented that sometimes local regulations that address issues other than stormwater treatment may limit practices that can be used. An example is a greenway project
  - John added that other local requirements can limit options or make them more expensive, e.g. setback requirements, visual screening requirements, and liability insurance is often very expensive and greatly reduces cost-effectiveness.
  - Dr. Hunt mentioned that there are benefits of SCMs beyond water treatment. An example is a green roof's aesthetic benefits. He made the larger point that all practices have their strengths especially when considering other benefits.
  - It was mentioned that redevelopment that does not increase built-upon area does not have to meet any requirements, and that most local governments will not voluntarily put requirements on this type of redevelopment.
  - Board members expressed the need for buy-down options for existing development similar to those available to meet new development requirements. It was explained that these same options are available for existing development. This will be stated in the report.
  - Rich noted that while funding may not be available immediately for practices, there is no predetermined pace for implementation of existing development requirements; the local governments will negotiate this with DWQ.

- Future non-standard BMPs – Dr. Bill Hunt gave a presentation about practices that NCSU BAE Department is currently studying or has plans to study in the future. Many of these studies are gathering new research and new design criteria for BMPs already found in DWQ's BMP manual, and some build-on the standard BMPs. Dr. Hunt explained that NC is way ahead of the curve nationwide on the use of BMPs. The following practices are currently being studied:
  - Bioretention – The DRAIMOD model, which is typically used for modeling agriculture scenarios, was found to very closely predict the performance of monitored bioretention cells. Therefore, the model will be used to potentially predict the performance of up to 400 different scenarios with differing design characteristics such as differing size, soil depth, soil type, fill media, under drains, etc. The modeling should be finished sometime this year.
  - Rainwater Harvesting – There is already a model that is being used by the State that is being updated (Kathy D's PhD). The new model will allow for irrigation in the winter. The new model will provide for thousands of different design possibilities. This model should be available in the winter of 2013.
  - Level Spreader / Vegetated Filter Strips – A model is being developed that should be ready by the summer of 2012. The model isn't expected to be as accurate as the bioretention model, but it will include a factor of safety.
  - Swales – The "thin cousin "of filter strips, similar modeling is being done to predict the performance of swales. This modeling should be complete by the Summer of 213

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- Permeable Pavement – Two configurations have been looked at: Permeable pavement that captures and infiltrates stormwater and pavement that captures, detains, and slowly releases stormwater. The latter would be used in soil that does not allow for infiltration. An initial revision will be made to the BMP manual in the summer of 2012 that will allow these types of permeable pavement. Studies will continue for 100's of different design scenarios that should be complete after the Summer of 2013
- Green Roofs – A leading green-roof researcher from Australia who has published the most comprehensive document on green roofs will be visiting NCSU this fall. If 319 can provide a small amount of funds, her findings could be translated to North Carolina by July 2013.
- Other SCM accounting on the horizon that may have associated accounting after July 2013: floating wetland islands: sand filter/proprietary devices; soil amendments; and adding swales with check-damn.

Following Dr. Hunt's presentation, the Board asked Robert Patterson of DWQ how this would be incorporated into the BMP manual. Robert explained that for the Permeable Pavement chapter that will be revised soon, there will be a 60-day public comment period after the draft goes out. DWQ and NCSU will then consider any comments and make appropriate revisions, which may take an additional month or two, before the final is released. Dr. Hunt explained that sometimes changes are quickly incorporated into the BMP manual, like Bioretention cells with internal water storage. Other times it takes up to a year after he finalizes his research. Dave asked about potentially streamlining the use of proprietary devices. Dr. Hunt responded that the Chesapeake Bay is approving and using proprietary devices, and there is the potential to collaborate with them.

Potential Future Agenda Items

- Ranking of future practices
- Continue discussion on July's Annual Report to the Secretary; feasibility.

Next Meeting

- Unless specifically rescheduled, the first Friday of each month, 9:30 – 12:00 at TJCOG.

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Request for Qualifications

Jordan Watershed Modeling for Existing Development Nutrient Loads

The Triangle J Council of Governments is seeking a qualified consultant to develop certain estimates of nutrient loading to B. Everett Jordan Reservoir from developed lands in its watershed using appropriate modeling practices. These load estimates will be suitable for allowing the NC Division of Water Quality to establish load allocations to municipalities, counties, and state and federal entities with jurisdiction in the watershed, as required by SL 2009-216 and SL 2009-484. This RFQ provides complete information on services being sought, submittal requirements, selection criteria, and timeline.

TJCOG is requesting statements of qualifications from firms interested in providing the services described herein. If interested, please submit your Statement of Qualifications meeting these requirements by US mail or email to:

Heather Saunders Benson
Triangle J Council of Governments
PO Box 12276
RTP, NC 27709
hsaunders@tjcog.org

Submittals must be received by 4:00 pm on Thursday, May 31, 2012 to qualify.

There will be a **pre-submittal meeting** for interested firms. The meeting will be held on **Wednesday, May 23, 2012 at 9:30 a.m., in the main conference room at Triangle J Council of Governments**. Division staff will present information on the project and they along with members of the NC Nutrient Scientific Advisory Board will be available to answer questions. We encourage interested firms to attend this meeting.

Interviews will be held with selected short-list firms on Wednesday, June 27, 2012, also in the main conference room at TJCOG. Interested firms should reserve this day pending notification from TJCOG staff. We expect to notify candidate firms regarding interview status during the week of June 11th, and to notify interviewed firms regarding our final selection during the second week of July.

Background

The Jordan nutrient strategy is a set of state regulations designed to reduce nutrient loading to B. Everett Jordan Reservoir to restore full designated uses to its waters. The strategy consists of Rules 15A NCAC 2B .0262 - .0272 as augmented or replaced by subsequent Session Laws 2009-216 and 2009-484. The session laws set requirements regarding existing developed lands, including a requirement for the Department of Environment and Natural Resources to assign nutrient load allocations for existing development to municipalities, counties, and state and federal entities that have jurisdiction in the Jordan Lake watershed. Allocations are to reflect application of strategy percentage reduction goals to loads representative of the baseline period, 1997 through 2001, adjusted to account for loading increases post-baseline and prior to implementation of new development programs that are scheduled to commence September 2012. Allocations are to be established in terms of annual mass loads delivered to Jordan Lake from these entities' lands in each of three subwatersheds.

Allocations thus assigned to the parties subject to this regulation will effectively serve as benchmarks they will use, in combination with recognized load-reducing practices and associated load reduction estimation methods, to design load reduction programs. The subject parties will use these programs, following approval by the NC Environmental Management Commission, to guide their implementation of nutrient load-reducing activities on a continuous basis toward the objective of meeting the allocations or until the lake's water quality is recovered, whichever comes first.

The session law establishes a Nutrient Scientific Advisory Board, or NSAB, and empowers it with the ability to recommend an appropriate method for estimating these allocations. The NSAB considers the development of a watershed model as necessary for establishing these allocations, and has outlined a set of considerations to be addressed by the consultant. These are provided in an attachment.

A nutrient loading model for Jordan Lake watershed was developed by Tetra Tech in 2003. The NSAB has reviewed that modeling approach and concluded that it was not compatible with the current regulatory purpose because the model did not retain the ability to associate specific land cover data or related loading outputs with local or other government jurisdictional boundaries. In addition they recognized certain features of the model that they felt would be important to improve upon given the current, different regulatory purpose. Key features were: representation of onsite wastewater processes, which appear to overestimate this source; limited number of instream calibration points, believed to bias load estimates upward due to

their proximal location downstream of wastewater discharges; and now-outdated delivery component coefficients.

Given the intended use of the allocations as described above, another fundamental interest is to ensure that methods developed to estimate nutrient load reductions associated with management measures and applied towards the allocations are compatible with the model as used to set allocations, and that the model adequately provides for estimation of load reductions regarding those measures for which it is determined to be the most appropriate tool. The selected consultant will be expected to address these issues as part of the project design negotiations and approval.

Interested parties are encouraged to familiarize themselves with resources that will improve their understanding of the need described here, including the following:

- Requirements of SL 2009-216 and SL 2009-484,
- Types of management measures contemplated for addressing existing development requirements: Falls Existing Development rule, 15A NCAC 2B .0278; NSAB meeting materials, http://portal.ncdenr.org/web/wq/nutrient-scientific-advisory-board,
- Various modeling interests and issues discussed by the NSAB as found in meeting minutes and materials,
- Existing Jordan watershed model reports, http://portal.ncdenr.org/web/wq/ps/mtu/tmdl/tmdls#Jordan_Lake,
- Example of a recent DWQ watershed model, for the Falls watershed, http://portal.ncdenr.org/web/wq/ps/mtu/specialstudies,

Following selection of a consultant, TJCOG and a selection panel of NSAB members and DWQ staff will engage in a series of interactive negotiations with the firm to craft a final scope of services and quality assurance plan. The negotiations will start from an initial detailed scope provided by the selected consultant. The consultant will be required to obtain Division approval, informed by consultation with the full NSAB, of this detailed scope and budget, including model performance criteria and the expectation that water quality data used in the model was collected pursuant to an approved QAPP.

The model is expected to be a “living model” that will undergo reruns and refinements in the future, and the Board and the Division want the product to be designed to accommodate future hypothesis testing, evaluation of alternative management scenarios, and reruns with updated land cover inputs as resources become available. The model may be used in the future by technically trained members of the Division, its contractors, local governments, or researchers. The model should be built to enable these future uses. The Board and the Division will seek to ground these interests with the consultant before the modeling plan is finalized.

TJCOG seeks to obtain complete model products from this project within approximately fourteen months of issuing a notice to proceed on the subcontract, and final, peer-reviewed model products within another five months. TJCOG expects to have between $200,000 and $250,000 available to fund the project through model completion. Additional funds will be secured for peer review and subsequent revisions of the model and documentation products.

Scope of Services and Deliverables

Below is an outline of the scope of requested services that will form the basis of contract negotiations with the selected consultant. Please also see the attachment for more specific Board interests regarding these requested services. We expect the consultant to submit a detailed scope based on this outline, which we then expect to modify through negotiations with the consultant as interests are reconciled with limiting factors, thus this list is not considered final.

Draft Scope of Services

- Review existing Jordan Lake watershed GWLF model, review SAB guidance, evaluate model options, and select model in consultation with DWQ and SAB panel

- Scope, review, compile and summarize existing data and information for review by DWQ and SAB panel

- Provide a watershed model built and calibrated for hydrology and water quality, constructed to account for all sources of nutrients and that includes the following outputs:
    - Estimated annual mass loads of nitrogen and phosphorus
        - generated at-source and delivered to the lake for developed lands in existence as of 2001 in the Jordan Lake watershed, and for the most recent time period feasible,
        - broken out by "jurisdiction" (county, municipality, NCDOT, other State entities, and Federal entities) and
        - broken out by subwatershed (Haw, Upper New Hope, Lower New Hope)
    - Delivery factors for smallest feasible hydrologic units, no larger than USGS 12-digit HU's, for use in allowing offsets and other trading across HU's
    - Separation of generated and delivered loads into portions produced under different flow/discharge levels, such as baseflow, NC BMP Manual water quality and quantity design storm flows, and higher flows

  - Summary table of delivered annual mass loads for different land covers, broken out by subwatershed, "jurisdiction", smallest feasible hydrologic unit and source

- Include the following model features to the extent allowed by available data:
  - Long-term simulation of generated and delivered annual mass loads of nitrogen and phosphorus for developed lands for multiple time periods including the most recent period achievable
  - Additional instream flow and concentration data beyond the 4 sites used in the original model and not directly downstream of wastewater treatment plants; use of this data in calibration and validation steps
  - Separate modeling and estimates of septic system loading from host land cover
  - Separate estimates of dry and wet weather sanitary sewer discharge loads from host land cover
  - Best available existing tools and dataset for atmospheric deposition inputs, accounting for wet and dry deposition of nitrogen in the watershed

- Investigate the extent to which the following elements can be addressed, and resolve in negotiations with the SAB and DWQ:
  - Impoundments not already included in the available hydrographic datasets
  - Functioning water quality BMPs in place as of the end of the baseline period

- Perform model assessment and Interpretation activities:
  - Sensitivity and uncertainty analyses
  - Evaluation of model performance
  - Interpretation of modeling results

- Identify future uses of the model:
  - Appropriate users and applications
  - Suitability for adaptation
  - Recommendations/requirements for remodeling of future time periods

- Define the relationship of the model to load reduction accounting methods:
  - Identification and comparative evaluation of methods for load reduction accounting associated with management measures
  - Recommendations on best practice for load reduction accounting, future revisits of watershed model, and relationship of two

- Evaluate and address comments provided during the model review stage. Revise the model and associated files and report documents as merited.

DRAFT

Desired Minimum Contractor Deliverables

- Watershed model plan: Initial proposal outlining modeling method through final Division-approvable and NSAB/NCDWQ-endorsable modeling plan
- A final, peer-reviewed watershed model built and calibrated for hydrology and water quality (code, executables, input files, model output files, scenario analysis files) constructed to account for all sources of nutrients and to include the following features to the extent allowed by available data:
    - Additional instream flow and concentration data beyond the 4 sites used in the original model and not directly downstream of wastewater treatment plants; use of this data in calibration and validation steps
    - Separate modeling and estimates of septic system loading from host land cover
    - Separate estimates of dry and wet weather sanitary sewer discharge loads, to the extent allowed by available data, from host land cover
    - Best available existing tools and dataset for atmospheric deposition inputs, accounting for wet and dry deposition of nitrogen in the watershed
    - Long-term simulation of generated and delivered annual mass loads of nitrogen and phosphorus for developed lands for multiple time periods including the most recent period achievable
- GIS datasets contributing to land cover and resulting model land cover input dataset
- Technical memoranda documenting development of input datasets, including providing justification for the final composition of the land cover dataset
- The following model outputs:
    - Estimated annual mass loads of nitrogen and phosphorus
        - generated at-source and delivered to the lake for developed lands in existence as of 2001 in the Jordan Lake watershed and for the most recent time period feasible,
        - broken out by "jurisdiction" (county, municipality, NCDOT, other State entities, and Federal entities) and
        - by subwatershed (Haw, Upper New Hope, Lower New Hope)
    - Delivery factors for smallest feasible hydrologic units, no larger than USGS 12-digit HU's, for use in allowing offsets and other trading across HU's
    - Separation of generated and delivered loads into portions produced under different flow/discharge levels, such as baseflow, NC BMP Manual water quality and quantity design storm flows, and higher flows
    - Summary table of delivered annual mass loads for different land covers, broken out by subwatershed, "jurisdiction", smallest feasible hydrologic unit and source
- Report addressing the following:
    - Model description, inputs, outputs
    - Model assessment and Interpretation:
        - Sensitivity and uncertainty analyses
        - Evaluation of model performance
        - Interpretation of modeling results
    - Discussion of future uses of the model:

        - Appropriate users and applications
        - Suitability for adaptation
        - Recommendations/requirements for remodeling of future time periods
    - Relationship of model to load reduction accounting methods:
        - Identification and comparative qualitative evaluation of methods for load reduction accounting associated with management measures
        - Recommendations on best practice for load reduction accounting, future revisits of watershed model, and relationship of two
    - Comments received during model review and resulting model refinements made
- Documentation – user manual or guidance - designed to allow technically trained personnel to understand and properly operate the model, including: code; executables; input data files; output data files; technical memoranda.
- Presentations to NSAB/NCDWQ at key junctures
- Onsite training to NCDWQ staff in use of the watershed model

Additional Desired Deliverables

- Modeling may also include the following elements, to be resolved in negotiations with the selected consultant:
    - Impoundments not already included in the available hydrographic datasets
    - Functioning water quality BMPs in place as of the end of the baseline period

Qualifications Submittal Requirements

Provide an original, x copies, and an electronic copy of your submittal containing the following:

1. Letter of interest - including a synopsis of the primary firm and sub-consultants, the team's qualifications, the project manager and primary contact, and the project principal representing the contractual authority of the firm.
2. Project Organization – a chart illustrating the team composition and roles. Identify key staff, their roles and expected level of commitment on the project.
3. Profile of Team – for each firm, identify capabilities and experience, number of employees, location, years in business, and scope of services for this project.
4. Resumes – for all staff with major roles, including project manager and task leaders.
5. Project Approach and Schedule – description of the proposed approach. Include a brief response to the preliminary scope, identifying key challenges and anticipated steps. A preliminary schedule with tasks, milestones and deliverables including meetings with the Division and the SAB.
6. Reference Projects – Identify recent projects performed by the team with comparable scope and complexity, at least two of which should be completed. For each project, provide references, estimated and completed budgets, and years in which the project was performed. Identify which firms and individuals contributed and the roles of each.
7. Statement of Conflict of Interest – Please certify that the team does not foresee any potential conflicts of interest with any entity involved with the project. If a conflict of interest arises, it shall be disclosed immediately to the State.

Selection Criteria

Responses will first be reviewed for completeness. The absence of required information may result in exclusion from further consideration. Acceptable responses will be evaluated based on the following criteria:

1. Project logistical and content approach, including availability – 35%
2. Experience, including area-specific – 25%
3. Team members' qualifications – 20%
4. Past performance – 15%
5. Other as determined by selection panel – 5%

Selection Process and Schedule

Following the submittal deadline, TJCOG will facilitate a selection panel involving Division modeling and nonpoint source planning staff and members of the Nutrient Scientific Advisory Board. This selection panel will evaluate all submittals, including contacting references. A short list of firms will be selected.

Interviews may be held with key personnel from the short-listed firms.

The Division will recommend a firm to TJCOG from the short list in consultation with the rest of the selection panel and after considering any recommendations made by the full SAB.

Following selection, the consultant will draft an initial detailed scope of services and budget. TJCOG, the Division and members of the selection panel will then engage in a series of interactive negotiations with the firm to craft a final scope of services, budget and quality assurance plan acceptable to all parties.

TJCOG seeks to select a consultant by July 16, 2012 and give approval to proceed with the modeling plan by September 4, 2012, and will seek delivery of complete products for peer review by November 2013 and final products by March 2014.

Attachment

Recommendations for Design of a Jordan Watershed Model

From the Nutrient Scientific Advisory Board

The Board has deliberated extensively on the best approach for assigning loading goals for developed lands to rule-affected parties and accounting for load reductions achieved by those parties' management actions. This document captures the views that have emerged from those discussions and provides recommendations on the character of and desired products from a watershed modeling contract.

We consider development of a watershed model to be necessary for establishing existing development load allocations for affected parties. A watershed model is the most appropriate tool for estimating loads at the spatial scale of local government jurisdictions.

The Board is also charged with identifying accounting methods to be used by affected parties for crediting of nutrient load reductions. Having recognized that watershed modeling is necessary for establishing initial load allocations to affected parties, the spatial scale of load-reducing activities is orders of magnitude smaller, where watershed modeling is not an effective estimator. This scale disparity issue also manifests itself in a temporal manner, in the question of whether to estimate load increases for the post-baseline, interim period using watershed modeling or a site scale tool. We understand that discrepancies will likely exist between any two tools' estimates of delivered load changes, and we seek expert input on this subject to guide our recommendations on a compatible tool at the site scale that can minimize this fundamental disparity.

Regarding the optimal time period for modeling, we seek the most robust model for estimating baseline loads and most recent loads, and we believe that this determination needs to be made through discussions with the consultant.

The following document provides the Board's recommendations on the scope of a watershed model for Jordan watershed and specific interests in its design. This is intended to provide a basis for discussions with the selected consultant.

I. Project Purpose

Primary Purpose

Output from Jordan Watershed Model for Existing Development Load Allocation will be used to allocate total nitrogen and total phosphorus loads from existing development to Jordan Lake to NCDOT, non-NCDOT State and Federal entities, and local government jurisdictions within the watershed. The model will identify and account for all point and non-point source loads that reach the Lake and will be calibrated using monitoring data. While as many nutrient sources as possible will be accounted for in the model, it will be used as a basis for allocating loads only for local, state and federal government entities.

Secondary Purposes

Output regarding nutrient loads at different flows and from different sources could be used to target the most effective existing development load reduction strategies. A model is sought that will allow future use in evaluating load reduction scenarios that could guide selection of practices and inform existing development load reduction accounting methods.

II. Background

Why this Model is Needed

Session Laws 2009-216 and 2009-484 require the Department to assign nutrient load allocations for existing development to affected jurisdictions in the Jordan watershed, which include municipalities, counties, and state and federal entities. Allocations are to reflect application of strategy percentage goals to loads representative of the baseline period, 1997 through 2001, adjusted to account for loading increases post-baseline and prior to implementation of new development programs that are scheduled to commence around September 2012.

The NSAB considers development of a watershed model necessary for these purposes. The legislation specifies use of the Tar-Pamlico method for this purpose, with the option to use an alternative acceptable to the Department and recommended by the NSAB. The Tar-Pamlico method, like the Jordan Lake accounting tool, is designed for site-scale nutrient surface runoff load calculation, not watershed-scale loading. Furthermore, required load allocations are for loads delivered to the lake. The site-scale methods do not themselves include any means of translating a calculated nutrient load to an equivalent load delivered to the lake. For these reasons, we consider use of such site-scale load calculations for the determination of load allocations to be unsatisfactory.

We have evaluated whether the existing Watershed Model developed by Tetra Tech in 2003 could be used to calculate load allocations, and concluded that it was not compatible with the current regulatory purpose. The model did not retain the ability to associate specific land cover data or related loading outputs with local or other government jurisdictional boundaries.

Relationship to Existing-Development Load Reduction Accounting Method (EDLRAM)

A method to account for load reductions from existing development (EDLRAM) is to be developed separately from this watershed remodeling effort. However, the new watershed model will inform the EDLRAM where possible. Output from the watershed remodel may be used to inform the selection of input variables in a separate EDLRAM. For example, the watershed model might be used to inform the following potential parameters within the EDLRAM:

- the land use/land cover loading rates
- load reduction rates for specific practices including septic and sanitary sewer modifications
- load reduction rates that vary by location (e.g. watershed, jurisdiction) and drainage area characteristics
- transport/delivery factors to the lake

III. Modeling Plan Development Process

Selection of a modeling plan will be a three-step process: 1) interested firms will submit statements of qualifications to TJCOG; 2) the Division in consultation with the NSAB will select a consultant; and 3) the consultant will draft an initial detailed scope and budget, after which the parties will collaboratively develop a quality assurance design that will best meet the interests of the participants within the various limitations faced by the process.

This section addresses step 3 of the process, following selection of the consultant. To facilitate QAP development discussion, we recommend that the consultant first review available data including:

- Monitoring data for the baseline period (1997-2001) from DWQ, USGS, Durham City, UCFRBA, and other data collection programs with quality control procedures that meet the Division of Water Quality's QA requirements, available at http://portal.ncdenr.org/web/wq/ps/mtu/assessment#4
- Monitoring data for the post-baseline period (post-2001) from DWQ, USGS, Durham City, UCFRBA, and other data collection programs with quality control procedures that meet the Division of Water Quality's QA requirements, available at http://portal.ncdenr.org/web/wq/ps/mtu/assessment#4
- Existing Watershed Model (Tetra Tech, 2003)
- GIS land cover and land use data
- Jurisdiction-specific data that may be provided by the affected local governments, NCDOT, and non-NCDOT State and Federal entities
- Most recent local, regional, and national data for input parameters such as event mean concentrations, atmospheric deposition rates, septic system performance characteristics, etc.
- The consultant may suggest other data sources, to be reviewed by the Division of Water Quality

We will ask the consultant to develop and detailed scope of services and budget, including proposing a method to address each of the following needs:

- Model or models to be used. Any modeling method will be based on credible methods that are peer-reviewed, public-domain, and tested.
- Method for addressing each "Proposed Model Element" below.
- Address whether questions posed for "Future Model Use" below can be answered by the model you propose to build, whether your proposal anticipates including answers in your results or leaving this work to future researchers, and what additional data may be required to answer these questions.
- Time period(s) to be used for calibration and validation, including pros and cons of using more recent data than the baseline period. If recommended, explain how baseline loading will be derived.
- Targets for evaluating model performance regarding error.
- Method to address non-detects in the evaluation of load calculations.

IV. About the Model

In addition to basic required model outputs identified in the RFQ Scope of Services, the Board seeks a model that can address a range of questions to improve rule-affected parties' ability to cost-effectively reduce loads from existing development. We first provide a series of questions on potential future model uses, followed by specific model elements sought in the belief that these will help address our questions.

Future Model Use

The NSAB recognizes that there are a variety of questions that may greatly enhance nutrient reduction strategies if answered, however available resources may limit the set of questions that the consultant would be charged with answering. Nevertheless, as this model is expected to be a "living model" that will undergo reruns and refinements in the future, we want the product of this modeling effort to be designed to accommodate future hypothesis testing and evaluation of alternative management scenarios as resources become available. The model may be used in the future by technically trained individuals with DWQ, its contractors, local governments, or researchers. The model should be built to enable these future uses to the extent feasible. The consultant should be prepared to describe not only whether a model can address a given need but whether data and scientific knowledge will allow a model to meaningfully and reasonably address that need, or to characterize the relative uncertainties of a potential model component. Interests include the following:

1. How do different flow levels/discharges affect N and P generation or delivery to the lake? Does this effect of discharge differ between land uses?

2. Are meaningfully different delivery factors feasible for different flow levels?

3. At which flows/discharges (base flow, structural-BMP-managed flow, beyond BMP-managed flow) are more of/most of the N and P being washed off or generated? Does this suggest the use of different BMPs or BMP methods to reduce loading? Does this suggest we need to capture or treat higher flows than we currently do?

4. Can the watershed be broken down into smaller spatial subsets than were used for the 2003 watershed model to more closely approximate the benefits of extra nutrient treatment/credits in any given area?

5. Are there seasonal patterns in generation of N/P from different land uses? Are there seasonal patterns in nutrient delivery/attenuation to the lake? Are there "temporal hotspots"? Do these patterns interact with BMP seasonal performance?

6. What are the differences between the land use loading rates from the remodel and those of the Jordan Lake Tool? Are they significant enough to potentially interfere with trading between new development (overtreatment credit) and existing development, agriculture, or point source discharges?

7. What are the differences in loads delivered to the lake using additional sites for model calibration that are upstream of the 4 previously used sites in comparison to those calculated using the old model?

8. What is the sensitivity of N/P generation/loading to various septic system failure rates? How do various maintenance practices for septic systems affect N/P generation/loading? What kinds of septic system improvement – density, failure rate, performance, local conditions, type – can change N/P generated loads?

9. What is the feasibility to model the potential contributions of sanitary sewer system leaks (not overflows) to N and P loads, generated and delivered to the lake?

10. How much of the generated load is derived from local-source wet/dry N atmospheric deposition vs. non-local? How much of the delivered load?

11. Are there seasonal patterns of wet/dry atmospheric deposition that may interact with BMP seasonal performance, seasonal trends in nutrient generation from different land uses, or seasonal trends in nutrient delivery to the lake?

12. What types of atmospheric N sources contribute more/less to our area? Which are increasing over time? Decreasing? N species?

13. What types of regulatory scenarios might reduce atmospheric deposition – local vs. non-local?

14. What are the effects of existing waterfowl impoundment areas? Do they act as stormwater wetlands and attenuate nutrients, do they serve as concentrated sources of nutrients considering bird waste inputs, or both? If both, what is the net effect, are there seasonal patterns of interest, and are there implications for adjusting their management for water quality purposes?

15. Which parameters in the remodel are most sensitive? Do these suggest any potential changes in or more effective BMPs, management methods, etc.?

16. Can the consultant make recommendations for improved monitoring efforts based on how well such monitoring data would improve a future revision or rerun of the revised model? Which data collection efforts/changes would improve/reduce uncertainties in a future rerun or revision the most?

Proposed Model Elements

The NSAB wishes to include a number of specific elements in the model to the extent feasible. There will be multiple methods and levels of complexity possible for each element, and the NSAB looks for the consultant to propose, and provide supporting rationale for, methods to best meet the intended purposes identified in this scope based on their knowledge of modeling options and available data, time and funds.

1. Model septic systems separately from land use

- Description: Septic systems will be modeled separately from land use (in contrast to the previous watershed model where septic system loads were approximated by altering land use loadings where they occurred).
- Considerations: The previous model only accounted for septic systems in areas without sewer service. However, many municipalities have old septic systems within sewered areas. The selected consultant is encouraged to consult with the NC Division of Public Health and local universities to ensure this element of the model reasonably represents septic system contributions in the various conditions found in the watershed.
- Purpose: Improve understanding of septic system contributions and estimate their load contribution. Allow possible future scenario testing for different failure rates than are assumed for this model, different maintenance practices, and different onsite treatment technologies. Also, municipalities may wish to claim nutrient reductions for improvements to systems or connecting homes to sanitary sewer service.
- Data Sources: 1990 Census quantifies septic density by census block. County Health Departments are delegated to maintain records of septic system permits. Some, but not all, jurisdictions will be able to provide data on septic locations, and which ones were in existence as of 2001. The consultant will weigh this information when proposing a method, and may propose a method that estimates or approximates septic locations.
- Priority: This is a required element.

2. Model Sanitary Sewer Discharges – Dry and Wet Weather

- Description: Account for the loading from sanitary sewer infrastructure during dry weather (illicit connections, leaking pipes, overflows) and wet weather overflows to the extent that available data allows.
- Considerations:
- Purpose: Since 2001, communities have implemented or planned programs and infrastructure improvements to reduce sanitary sewer discharges. Communities are interested in receiving nutrient reduction credit when these post-2001 or future reductions can be quantified.
- Data Sources: Major wastewater dischargers in the watershed have mapped their sanitary sewer collection networks and may be able to determine which lines were in existence as of 2001. Some agencies may have information on the frequency and magnitude of sewer discharges. The consultant may propose a method that estimates density, magnitude, type, and

frequency of discharge events. Major wastewater dischargers include City of Durham, Durham County(?), City of Greensboro, Orange Water and Sewer Authority, (others???).

- Priority: This is a required element.

3. Additional Monitoring Sites for Model Calibration and Validation

- Description: Include measured data from additional monitoring sites in the estimate loads used to calibrate and validate the model. In particular, include sites that are not downstream of major WWTPs in addition to the 4 previously used sites downstream of WWTPs.
- Considerations:
- Purpose: Allows model calibration to sites not directly receiving WWTP discharges and removes potential source of error from plant inflow/outflow and concentration measurements.
- Data Sources: The US Geological Survey maintains a network of rain gauges, discharge monitoring stations, and water chemistry monitoring stations in the watershed. The Division of Water Quality, the City of Durham, and the Upper Cape Fear River Basin Association also conduct water chemistry monitoring using a DWQ-approved Quality Assurance Program Plan. Other agencies may have conducted water chemistry monitoring in the watershed. Their use for calibration and validation should be reviewed with DWQ.
- Priority: This is a required element.

4. **Model nutrient generation and delivery at multiple flows/discharges**

- Description: Model nutrient load export and delivery to the lake at multiple flow/discharge levels, such as at baseflow, at flows generated by water quality and quantity design storms specified in the NC BMP Manual, and at flows higher than those currently designated for treatment or attenuation. The goal is to understand when more/less of the nutrients are moving through the system, and how instream transformation might change depending on flow levels.
- Considerations: The consultant is expected to propose the method for modeling different flows including the flows, modeling method, time step, and delivery to the lake method. An example method would be the construction of "nutrient duration" curves similar to "flow duration" curves.
- Purpose: Identifying the relative nutrient loads at different flow regimes is expected to help guide selection of the most effective nutrient load reduction techniques.
- Data Sources: The US Geological Survey maintains a network of rain gauges, discharge monitoring stations, and water chemistry monitoring stations in the watershed. Other agencies may have conducted flow monitoring in the watershed. Their use for model development should be reviewed with DWQ.
- Priority: This is a required element.

5. Include atmospheric deposition as a model input

- Description: Using the best available existing tools and dataset for atmospheric deposition inputs, account for wet and dry deposition of nutrients in the watershed.
- Considerations:

- Purpose: Including all major sources of nutrients in the model allows for a better understanding of sources, testing of alternative management scenarios, and helps guide selection of the most effective nutrient load reduction techniques.
- Data Sources: The model needs to use monitoring data and output from the US EPA atmospheric deposition tools, e.g. EPA's Watershed Deposition Tool. In addition, models designed by UNC-CH include a variety of nitrogen species.
- Priority: This is a required element.

6. Address Other Major Storage Impoundments

- Description: Include, to the extent of the consultant's best professional judgement, impoundments not already included in the available hydrographic datasets.
- Considerations:
- Purpose: Improve the extent to which the model represents and factors in effects of these existing aquatic features in the watershed toward a more accurate attribution of instream losses and delivered loads.
- Data Sources:
- Priority: This is an optional element.

7. Include stormwater BMPs existing at time of baseline period

- Description: Account for the load reductions due to BMPs existing in 2001.
- Considerations: The SAB has discussed multiple methods for accounting for BMPs during the baseline period. Possible methods include different loading rates for land areas based on age relative to the implementation date of stormwater practices; neighborhood or parcel-scale identification of treated areas; and inclusion of specific BMPs and BMP drainage areas. The consultant will propose the method.
- Purpose: Accounting for pre-2001 BMPs may provide a fairer allocation of loads to jurisdictions because some communities had many BMPs in place in 2001 while other communities had none. Also, selecting a model that can account for BMPs is expected to be useful if future model use evaluates scenarios.
- Data Sources:
- Priority: This is an optional element.

V. NSAB Recommendations on Consultant Tasks

A more detailed statement of tasks will be included in the final scope of services issued by TJCOG for the project. The Board provides the following recommendations to address interests we have identified. To better understand Board interests, the consultant is encouraged to review the most recent version of the following two documents initially discussed by the NSAB at its December 2011 meeting:

- Division clarifications on the definition/character of existing development in the document *Interpretive Guidance on Assigning Existing Development Nutrient Loads*
- *Draft Summary of GIS Subcommittee Meetings*

Draft Milestones and Timeframes

Task #	Months Allotted	Consultant Tasks
1	1	Review existing GWLF model & SAB guidance, develop detailed scope and budget
2	1	Negotiate, agree on model design and final scope and budget with SAB panel
3	5	Input data: scope, review, compile, summarize
4	7	Model: set up, calibrate, validate vs. performance targets, do scenarios & sensitivity
5	2	Results: analyze, interpret, put in context, develop reporting
6	5	Peer review of model products, revise model and reporting accordingly, provide onsite training

Milestone Task Flow

The following is an outline of suggested task flow to address major milestones listed above. Tasks and milestones will be set out in the 319 contract and further defined in the final scope of services issued by TJCOG:

- Review existing Jordan Lake watershed GWLF model, review SAB guidance, evaluate model options, select model in consultation with DWQ and SAB modeling panel, develop detailed scope and budget and agree on final scope and budget with DWQ/SAB (Task 1 & 2)
- Identify (scope and review) existing data and informational sources, including where and how to retrieve these data and information (Task 3)
- Put these data in a form (review, compile, summarize, and transmit) that is easily transmitted to NCDWQ and the SAB panel for timely review (Task 3)
- Provide Technical memoranda for each step of the modeling process. Include responses to comments made by DWQ/SAB (All major tasks)
- Participate in model related update conference calls or meetings with DWQ and SAB (All tasks)
- Develop model and calibrate to all available data (Task 4)
- Analyze, interpret, put in context (This includes load allocations by source, HU, and jurisdiction) (Task 5)
- Provide watershed model products to DWQ, SAB and other identified parties for review (Task 6)
- Evaluate and address comments made during the peer review period, revise model and associated documentation as merited (Task 6)
- Develop a watershed modeling report (Draft & Final) detailing sources of data, assumptions made in the calibration, calibration time series graphs and any sensitivity and uncertainty

analysis that is done, and load allocations and load reduction needs by source, HUC, and jurisdiction (Task 5)

- Deliver Final Calibrated Model (Models and Input Files; reports, documentation (code, executables, input and output files, technical memoranda and data analysis files)) (Task 6)
- Provide onsite training to DWQ and interested local government staff in the use of the watershed model (Task 6)

Task: Develop Representative Land Cover by Jurisdiction and Subwatershed

The consultant will create a GIS-based land cover dataset for model input that is most representative of the time period being modeled for the purpose of estimating loads for the baseline period. The consultant may also utilize current or more recent land cover data in the model development or application process to support loading estimates for a later time period. The data will be broken into polygons or pixels that retain the following minimum attributes:

- Land cover categories, including various developed, agriculture, forest, and other – developed lands are broken apart as needed for calculating nutrient export, agricultural lands are separated into cropland, pasture, and other
- Jurisdiction (NCDOT, non-NCDOT State or Federal entity, or local government)
- Sub-watershed (Haw, Upper New Hope, Lower New Hope)
- Hydrologic units used for delivery to the lake

The Board would like the consultant to address the following questions and concerns during the model plan negotiations:

- Are E-911 address points a workable and useful option for locating rural residences to improve rural residential land cover estimates?
- The Board believes that rural residences and their driveways can contribute significantly to the developed cover of county lands, thus resolution needs to be sufficient to identify them.
- If NLCD is used, the Board feels that nationally-based individual cover specifications should be adjusted to reflect conditions in North Carolina specifically for tree cover.
- How will the model quantify the case of tree canopy over impervious; will it credit the interception and somehow capture the fact of impervious land cover underneath?
- Will the model distinguish intensively managed pervious, specifically golf course and ball field covers and associated loading characteristics?
- What is the potential to use an enhancement approach on standard NLCD, e.g. the approach used for recent modeling of High Rock Lake watershed, followed by use of high-resolution aerial photography on some sampling of areas in order to establish a statistical relationship that can be used to adjust/improve the land cover proportions of the enhanced dataset, or to at least better characterize uncertainties or inaccuracies associated with it?

Task: Sensitivity and Uncertainty Analysis

The consultant will propose approaches/methods to conduct sensitivity and uncertainty analysis to determine the relative sensitivity of model parameters and inputs, identify different sources of uncertainty (model, data, parameter etc), and to provide qualitative and/or quantitative assessment of uncertainty if possible.

The report on sensitivity and uncertainty analysis may include:

- Approaches/methods used for sensitivity and uncertainty analysis
- Relative sensitivity of model parameters
- Sources of uncertainty
- Quantitative (e.g. 95% confidence intervals for N and P loading) and/ or qualitative assessment of uncertainty

Task: Model Performance Evaluation

The consultant will propose model performance criteria relevant to the modeling objectives. It is expected that the model performance measures will include more than one measure/statistic. The measures/statistics should be selected to reflect the intended use of the model and should be outlined before the model calibration step.

Task: Interpretation of Modeling Results

The interpretation will at a minimum address the following:

- Additional monitoring sites that should be added for the future?
- Model and data limitations that should be considered to interpret the results
- Clearly stated assumptions used during the modeling process and/or for scenario analysis that should be considered when interpreting results.
- Characterize the relative uncertainties associated with modeling of septic and sanitary sewer loading for the purpose of informing the EDLRAM with regard to septic and sanitary sewer upgrades and modifications, as well as any potential safeguards we may need for such accounting
- Recommendations on credit tool options to minimize fundamental limitations of the current credit tool, which estimates only surface runoff.
- Scenario analysis to test various alternatives

Task: Final Report and Submittal

The final submittal will include a report and electronic deliverables. All deliverables will be made publicly available by DWQ.

The final report will document the modeling process. It will address at least the following and may include content from previous technical memos:

- GIS Data development
- Lb/ac/yr by land cover and hydrologic unit
- Delivery factors by hydrologic unit
- Compare land cover loading rates to the JLAT
- Results for different flows

DRAFT

Second Annual Report of the Nutrient Scientific Advisory Board
To the Secretary, NC Department of Environment and Natural Resources
July 1, 2012

Summary

During the last year, the SAB:

- Developed the attached guidance for affected parties and others per 4b of SL
    - Available measures with associated accounting methods, feasibility, costs, benefits
    - Prioritized potential measures with associated needs
- Refined Jordan watershed model interests, shaped contract, selected consultant
- Developed recommendations to the Department on modeling, analytical tool improvement needs for nutrient strategies
- Identified Jordan SL implementation issues, obtained certain interpretive guidance from DWQ

Background

- SAB charged with SL 4b 1-4 + option to recommend other method for setting Jordan allocations
- Timing context: Jordan and Falls Existing Development implementation timelines

Highlights

- Attached measures guidance to affected parties
- **Recommendations to Secretary on Improving Modeling, Analytical Tools (per SL 4b 4)**
    - Watershed modeling improvements for ED management
        - Septic characterization
        - Load contributions by flow level
        - Sorting load by jurisdiction
        - Higher resolution/more/better data
            - Instream data
            - Land cover
            - Impoundments
            - Existing BMPs
            - Atmospheric inputs
    - Other needs
        - Gross solids – currently under the radar
        - Runoff/instream data collection strategies/infrastructure to build knowledge base, support better modeling
        - Improved tools for assessing ED project feasibility
        - Regulatory: reconsider restrictions on permitting instream measures

- Method for Jordan ED allocations:
    - Determined alternative method required
    - Took Jordan watershed model as top priority, focused heavily on
    - Developed RFP, RFQ, guided contract, selected modeling consultant

Next Steps

- For July 2013 model Jordan, Falls ED programs:
    - Assist development of Falls ED allocations
    - Complete selected non-standard conventional BMPs criteria & credit
    - Further develop cost, benefit, feasibility guidance
    - Assist DWQ to establish alternative measures approval process
    - Map course beyond model approval:
        - Specify needs for other priority potential measures
        - Identify improvements to current stormwater BMP credit tool
        - Identify studies needed
- Guide Jordan watershed model completion by early 2014

Guidance for Affected Parties (per SL 4b 1-3)

Introduction – Currently available measures, improvements targeted for July 2013, improvements beyond 2013, modeling and analytical needs

Available Measures

- Table 1 BMPs
- Table 1 Accounting – J/F tool (+ DF in Jordan) - current best tool
- Costs and Benefits
    - Costs – Hunt, Hatch and DeBusk, 2011, …
    - Benefits –
        - J/F Tool load reduction ranges across land uses
        - Other benefits:
            - Ecosystem services
            - Jobs
            - Recharge
            - Stream recovery
            - Amenity
    - Load reduction cost-effectiveness
- Feasibility of Measures – Depends on objective. Objectives considered here, narrow to broad, and associated feasibility are:
    - Individual measure feasibility
        - Site-neutral, textbook cost-effectiveness
        - Site factors influence suitability, cost-effectiveness
            - Physical: utilities, space constraints, slope, bedrock, catchment size, depth to stormwater system, outfall suitablility, etc
            - Logistical: scale economy, serial inefficiency, maintainability,
            - Temporal: future changes to drainage area,
            - Social: landowner willingness, public acceptance
            - Regulatory: permit hurdles,
        - All measures have strengths, some prove more useful more often
    - Catchment-scale feasibility
        - Prevalence of opportunities depends on land use patterns, changes to land use with time (redevelopment potential)
    - Meeting SL percent goals – depends on:
        - Diminishing returns with current BMPs and current land use

        - Measures will expand, land use will evolve
        - Fund flow limited short-term, but implementation pace not set
    - Studies tend to show given sufficient time, funds ≥ 5 – 10% N, P reduction feasible using cost-effective current measures (Hunt, Hatch and DeBusk, 2011; CDM, 2012; Brown and Caldwell, 2010, …)

Measures by July 2013

- Permeable Pavement Goes Statewide
- Certain Table 2 practices - non-standard conventional BMPs
- DWQ Approval Process for Additional Measures
    - Applicability of data – climatic, physiographic, loading source character
    - Depth of data
    - Quality of data
    - Similarity to quantified measures – process elements
    - Measure specifications
    - Approval tiers by uncertainty, risk level?

Additional Measures Beyond 2013

- Additional Table 2 non-standard conventional measures (Dr. Hunt)
- Priority Table 2 Other Measures
- Active, Planned and Needed Studies
    - Active: House Creek Retrofit Costs, Water Quality Benefits
    - Planned?
    - Needed?

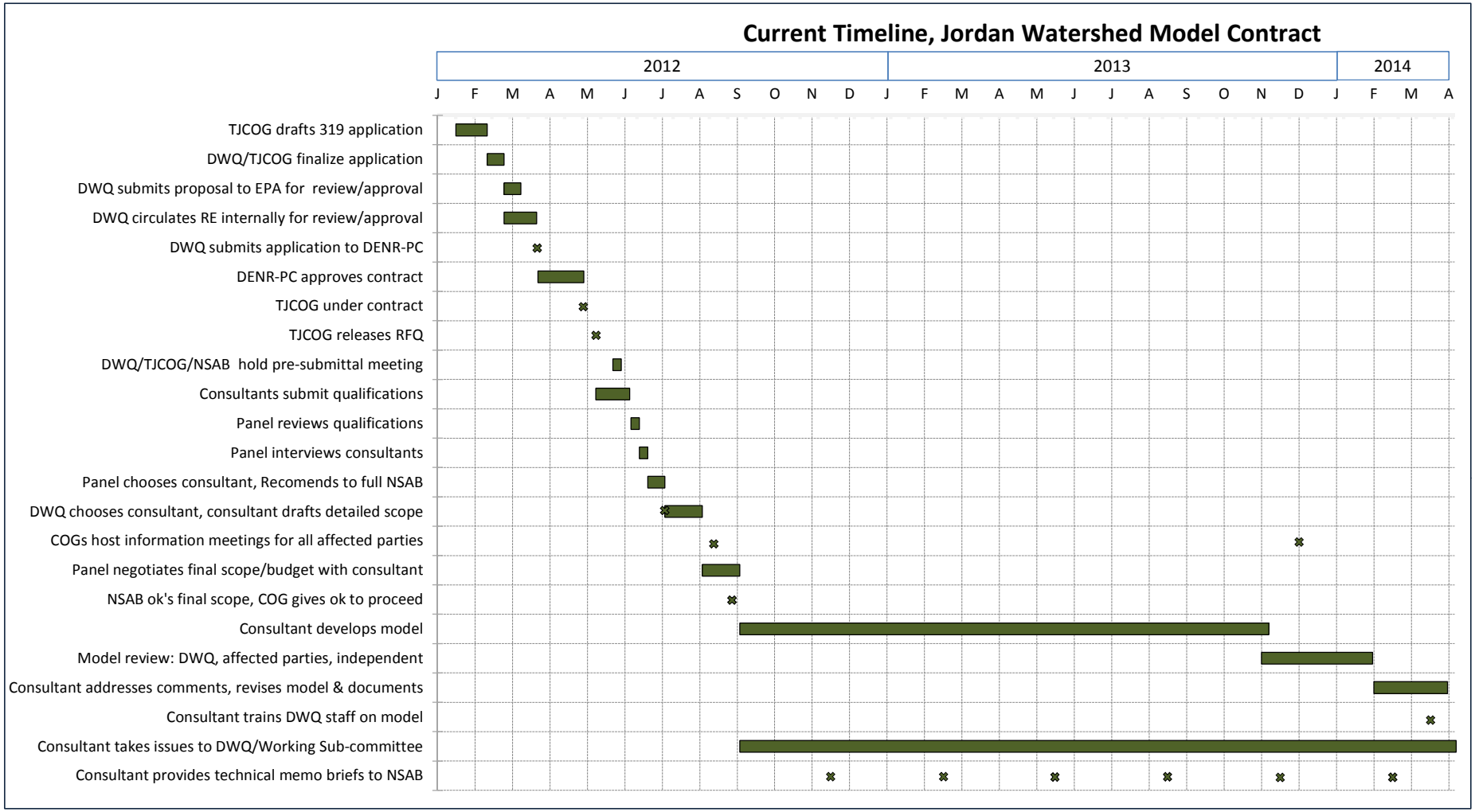
Current Timeline, Jordan Watershed Model Contract
2012
2013
2014
J F M A M J J A S O N D J F M A M J J A S O N D J F M A
TJCOG drafts 319 application
DWQ/TJCOG finalize application
DWQ submits proposal to EPA for review/approval
DWQ circulates RE internally for review/approval
DWQ submits application to DENR-PC
DENR-PC approves contract
TJCOG under contract
TJCOG releases RFQ
DWQ/TJCOG/NSAB hold pre-submittal meeting
Consultants submit qualifications
Panel reviews qualifications
Panel interviews consultants
Panel chooses consultant, Recomends to full NSAB
DWQ chooses consultant, consultant drafts detailed scope
COGs host information meetings for all affected parties
Panel negotiates final scope/budget with consultant
NSAB ok's final scope, COG gives ok to proceed
Consultant develops model
Model review: DWQ, affected parties, independent
Consultant addresses comments, revises model & documents
Consultant trains DWQ staff on model
Consultant takes issues to DWQ/Working Sub-committee
Consultant provides technical memo briefs to NSAB

Table 1. Load-Reducing Practices w/ DWQ-Approved Accounting

Practice[1]	Accounting Method	Removal Efficiency	Description
Stormwater Wetland	Jordan/Falls Tool[2] + DF[3]	TN = 32 - 56% TP = 61 - 86%	• Runoff routed to BMP, treated • Fixed effluent concentration • Volume reduction via ET, infiltration
Bioretention w/ IWS **Bioretention w/o IWS**	Jordan/Falls Tool[2] + DF[3]	TN = 61-73% TP = 61 - 84% TN = 48 - 66% TP = 49 - 80%	• " • " • " • Internal Water Storage improves N removal
Wet Detention Basin	Jordan/Falls Tool[2] + DF[3]	TN = 28 - 52% TP = 34 -76%	• " • " • "
Sand Filter	Jordan/Falls Tool[2] + DF[3]	TN = 30 - 55% TP = 17 - 75%	• " • " • "
Level Spreader + Filter Strip	Jordan/Falls Tool[2] + DF[3]	TN = 48 - 66% TP = 43 - 88%	• " • " • "
Dry Extended Detention Basin	Jordan/Falls Tool[2] + DF[3]	TN = 8 - 41% TP = -21 - 75%	• " • " • Volume reduction via ET, infiltration in Coastal Plain/Sandhills
Grassed Swale	Jordan/Falls Tool[2] + DF[3]	TN = 8 - 50% TP = -59 – 78%	• " • " • Volume reduc via ET, infiltration CP/Sandhills
Green Roof	Jordan/Falls Tool[2] + DF[3]	TN = 50 - 51% TP = 48 – 76%	• Direct precipitation to BMP • No nutrient treatment - fixed effluent concentration equal to roof EMC • Volume reduction via ET • Can be routed to stormwater system (see Rainwater Harvesting)
Permeable Pavement - CP/Sandhills	Jordan/Falls Tool[2] + DF[3]	TN = -10 – 35% TP = -82% - 65%	• Direct precipitation, option of routed runoff • Currently case-by-case approval, soil infiltration > 0.52 in/hr - Coastal Plain/Sandhills • No nutrient treatment - fixed effluent concentration equal to parking lot EMC • Volume reduction via infiltration CP/Sandhills

[1] To qualify, practices shall meet design specifications in current version of DWQ Stormwater BMP Manual except as noted.

[2] *Jordan/Falls Lake Stormwater Nutrient Load Accounting Tool*, approved by NC EMC March 2011 for load compliance accounting under Jordan & Falls New Development rules. Uses the Simple Method, does not account for stormwater routing. Recommended only for catchments $\leq$ 1mi^2 (640 acres).

[3] For Jordan watershed applications only, nonpoint source N, P delivery factors translating 14-digit HU loads to lake-delivered loads. Estimated with SPARROW-based Stream Network Delivery Model by Tetra Tech, Inc. for DWQ. Approved by NC EMC 11/03. Delivery factors available at http://portal.ncdenr.org/web/jordanlake/home.

Table 1. Load-Reducing Practices w/ DWQ-Approved Accounting (continued)

Practice[1]	Accounting Method	Description
(Rooftop) Rainwater Harvesting (See also Table 2a)	Jordan/Falls Tool[2] + DF[3]	***DWQ Technical Guidance Memo:*** • Runoff routed to storage, then to dedicated use • Case-by-case approval, incl. dedicated end use • No nutrient reduction by roof - fixed effluent concentration equal to roof EMC • Treatment/volume reduction are use-specific • If stormwater BMP used, storage reduces size • Dedicated use may not be vegetated area
Require Treatment of New Development Where DWQ Does Not	Jordan/Falls Tool[2] + DF[3]	Require treatment on new development that DWQ New D rule does not require, i.e. not above loading rate targets or land disturbance thresholds, or vested
Overtreatment of New Development	Jordan/Falls Tool[2] + DF[3]	Require development to meet loading rate targets below New Development Rule requirements.
Load Reduction on Redevelopment	Jordan/Falls Tool[2] + DF[3]	1. Quantify net load reduction credit on redevelopment that increases BUA and is thus required to treat under New Development Rule. 2. Require treatment on redevelopment that is not otherwise required to treat under New Development rule - no increase in BUA or below land disturbance thresholds.
Removal of impervious surface	Jordan/Falls Tool[2] + DF[3]	Replace impervious with pervious cover, increasing infiltration and decreasing runoff.
Restoration of Riparian Buffer (See Also Table 2b)	DWQ Credit Yield Calculation[4] + DF[3]	• Diffuse inflow required, e.g. level spreader • Load reduction via up to 3 mechanisms: 1. Treatment of catchment drainage 2. Treatment of overbank flooding 3. Land conversion of buffer footprint • Mitigation under Buffer Rule not eligible. • Buffer required on New Development ineligible.
Upland Reforestation on Developed Land (See also Table 2b)	Jordan/Falls Tool[2] + DF[3]	Requires conservation easement or other protective covenant.
Payment to EEP or Private Bank	DWQ Credit Yield Calculation[4] or Jordan/Falls Tool[2]	Calculation method dependent on practice. See above.

[1] To qualify, practices shall meet design specifications in current version of DWQ Stormwater BMP Manual except as noted.

[2] *Jordan/Falls Lake Stormwater Nutrient Load Accounting Tool*, approved by NC EMC March 2011 for load compliance accounting under Jordan & Falls New Development rules. Uses the Simple Method, does not account for stormwater routing. Recommended only for catchments $\leq$ 1mi^2 (640 acres).

[3] For Jordan watershed applications only, nonpoint source N, P delivery factors translating 14-digit HU loads to lake-delivered loads. Estimated with SPARROW-based Stream Network Delivery Model by Tetra Tech, Inc. for DWQ. Approved by NC EMC 11/03. Delivery factors available at http://portal.ncdenr.org/web/jordanlake/home.

[4] N and P load reduction estimate for riparian buffer restoration, developed by DWQ and NCWRP, 1998. Used as credit value in setting of EEP and private bank nutrient offset rates for buffer restoration under stormwater rules for Neuse, Tar-Pamlico, Jordan and Falls watersheds. Available at http://portal.ncdenr.org/web/wq/nutrient-offset-practices.

Table 2. Potentially Creditable Nutrient Load-Reducing Practices
Table 2a: Potential Stormwater Practices

Practice	Potential Accounting Method	Description
Permeable Pavement (See also Table 1)	Modify Jordan/Falls Tool[2]	Statewide infiltration credit, soil-specific
Table 1 BMP Modifications: • **Rainwater Harvest** • **LS/Filter Strip** • **Bioretention** • **Green Roof** • **Permeable Pavement** • **Grass Swales**	Jordan/Falls Tool[2]& DF[3]	Various research efforts in progress - Dr. Hunt: • Credit updates based on additional research • Design modifications for improved removal • Undersize/oversize treatment effects
Retrofit Stormwater Ponds: • **BMP Manual Designs** • **Floating Wetlands**	Jordan/Falls Tool[2]	Improve volume control ponds for nutrient removal
Infiltration Devices, including Infiltration Basins	Modify Jordan/Falls Tool[2]	• SW routed to BMP, fully infiltrated • Data needed: effluent concentrations, volume reduction • Consider using BMP manual specs
Rainwater Harvesting (See also Table 1)	Modify Jordan/Falls Tool[2]?	Expand dedicated uses to allow for directing SW to vegetated area for infiltration
Divert Impervious Runoff to Pervious Areas	Modify Jordan/Falls Tool[2]	Develop criteria, e.g.: o Area & dimensional ratios o Soil and slope variables
Soil Amendments	Calculation based on literature findings	Reduce runoff volume via improved infiltration
Repairing Failing BMPs or Updating Design Standards	Jordan/Falls Tool[2]	• Investigate potential with DWQ SPU • Would require evidence of failure during baseline
Off-line Regional Treatment	Jordan/Falls Tool[2]	Route large catchment to treatment with ponding retrofit practice
Proprietary Devices	Depends	• DWQ has process for evaluating and approving • Credit BMP-specific o Tree boxes, hydraulic vortex units….
Peak Flow Control	Watershed Remodel?	• Study load benefits instream • Flow Modification • Prevent Erosion

Abbreviations:

- BMP = Best Management Practice
- BUA = Built-upon area
- DF = Delivery Factors
- EMC = Event Mean Concentration
- ET = Evapotranspiration
- IWS = Internal Water Storage
- PP = Permeable Pavement
- SW = Stormwater
- WW = Wastewater

Table 2b: Potential Ecosystem Restoration Practices

Practice	Potential Accounting Method	Description
Riparian Buffer Restoration, Variable Width	DWQ Draft Method & DF[3]	• DWQ Draft Method o Diminishing credit with increased width o Site-specific elements
Repairing/Enhancement of Existing Riparian Buffers	Watershed Model or separate calculation (additional data required)	• Literature review, research • Potential Activities o Hydrologic restoration including diffuse flow o Removal of invasive species • Credit will depend on type of improvement
Stream restoration	Calculation based on literature findings	• Reduce erosion of stream bank soils • Restore stream assimilation functions
Flood Plain Restoration	DWQ Draft Credit Yield Method?	• Increase floodplain storage; encourage stream to overflow in larger storms; increase infiltration; remove structures; add grade-control structures, etc.
Increase Tree Canopy	Calculation based on literature findings or WS Remodel	• Reduce runoff via interception – potential volume/load reduction • Requires means of tracking and assurance of long-term maintenance
Land/Forest Protection		

Abbreviations:

- BMP = Best Management Practice
- BUA = Built-upon area
- DF = Delivery Factors
- EMC = Event Mean Concentration
- ET = Evapotranspiration
- IWS = Internal Water Storage
- PP = Permeable Pavement
- SW = Stormwater
- WW = Wastewater

Table 2c: Potential Agriculture Practices

Practice	Potential Accounting Method	Description
Agriculture BMPs w/ Credit Method Available • **Cropland Conversion to Trees/Grass** • **Buffer Restoration** • **Exclusion** • **Excluded Buffers**	• Calculation • DWQ Credit Yield Method • Calculation • Calculation	• Literature-based export coefficient comparison • Revisions currently being drafted • Pasture Point System Method with export coefficients • Pasture Point System Method with export coefficients and DWQ Draft Buffer Credit Yield
Other Ag BMPs • **Managed Grazing** • **Water Control Structures** • **Cover Crops** • **Conservation Tillage**	Calculation based on literature findings or WS Remodel	Have BMP efficiencies, but need load reductions in-stream
Potential Ag BMPs • **Pond creation** • **Pond renovation**	Calculation based on literature findings or WS Remodel	Work with agriculture community to develop specifications

Table 2d: Potential Programmatic Practices

Practice	Potential Accounting Method	Description
Improved street sweeping	Calculation based on literature findings or WS Remodel	Decrease organic matter entrained in runoff to surface water
Source control, such as pet waste and fertilizer ordinances	Calculation based on literature findings or WS Remodel	Decrease "fertilizer rates" to landscape areas
Emission Reduction (Atmospheric Deposition)	Watershed Remodel?	• Correlate emission reductions to deposition reduction to impervious surfaces, effect on event mean concentrations
Improved Biosolids Management	Calculation based on literature findings or WS Remodel	• Reduce application rates blow Fertilizer Management Rule requirements • Sampling design to determine reduction in loading to surface

Table 2e: Potential Wastewater Practices

Practice	Potential Accounting Method	Description
Overtreatment of WW	Calculation of annual mass load difference between existing and new treatment of discharge volume	Long-term dedication of unused allocation
Improvement/ Regionalization of WW facilities	Calculation of annual mass load difference between existing and new treatment of discharge volume	Redirecting discharge not treated for nutrients into larger system that does, or adding nutrient removal to an existing system
Improvement of discharging sand filter	Calculation of annual mass load discharge difference between existing and proposed	Connect to central sewer or replace with non-discharge alternatives
Repair Malfunctioning Septic System	Calculation based on literature findings or WS Remodel	• Restore nutrient removal functions • Connect to central sewer, improve treatment, or replace with non-discharge alternatives • Sampling of discharge and calculation of annual mass load discharge difference between existing and proposed
Improvement of functioning Septic System	Calculation based on literature findings or WS Remodel	• Increase nutrient removal efficiency • Account for different flows • Account for rising groundwater table
Removal of Illegal Discharges	Calculation of specific discharges	Decrease illegal discharges making their way into surface waters
Improvement of Wastewater Collection Systems	Calculation of annual mass load discharge difference between existing and proposed	Increase nutrient removal efficiency

Abbreviations:

- BMP = Best Management Practice
- BUA = Built-upon area
- DF = Delivery Factors
- EMC = Event Mean Concentration
- ET = Evapotranspiration
- IWS = Internal Water Storage
- PP = Permeable Pavement
- SW = Stormwater
- WW = Wastewater