

## Appendix 3C. Expert Elicitation Interview Protocols

### Elicitation Process Overview (estimated 4-5 hours total time)

- Part 1a: Interview of the expert to develop a conceptual model of ecological endpoint relationships (30 min)
- Part 1b: Training for the elicitation survey (60 min)
- Part 2: Elicitation survey (2-3 hours; independent, within 1 week)
- Part 3: Follow-up data calibration interview (30-60 min; within 2 weeks of Part 2). May want to consider the cross expert calibration.

### *Part 1a Interview of Expert Framing and Context for Linkages (30 min)*

*Preamble (10 min; 00:15)*

Thank you. I am really glad to see you virtually and talk with you about urban streams. Do you mind if we record this conversation to help in developing a summary? The recording will not be distributed, will be destroyed after we develop our synthesis, and you will be able to review our summary and make any changes that don't adequately represent your judgments.

*Quick introductions of Melissa and Hillary.*

I appreciate your willingness to participate in this study. Specifically, you are providing an "expert elicitation" where I will ask you questions that will allow us to draw connections between regularly measured water quality variables and goals identified by members of the public. The two specific goals we are eliciting are "ecosystem condition" and "murky waters". *Show goals in slide deck*

Your insights, developed through the elicitation process, about the relationships between water quality variables and these stream goals will be used, with those of a few other invited experts, to integrate water quality and economic models to quantify the value of improved stream water quality. Though this process will be a little different, the basic overall approach was published in [Van Houtven et al., 2014](#). The paper was shared with you via email when we sent you the invitation; I can send it again if you would like another copy.

The entire process is likely to take 4-5 hours total over a few weeks. There are 3 parts:

1. The 2 hour interview today to understand 1) get a quick sense of how you think about the relationship between water quality variables and the public goals, and 2) introduce the elicitation exercise in detail.
2. Independently completing the elicitation survey on your own time over the next week, which will likely take about 2 hours.
3. A follow-up 1 hour interview after you complete the survey so that we can learn a little more about how you made your judgments.

Do you have any questions before we start? Ok, we're going to go fairly rapid fire, so if I move too quickly please pause me as we go along.

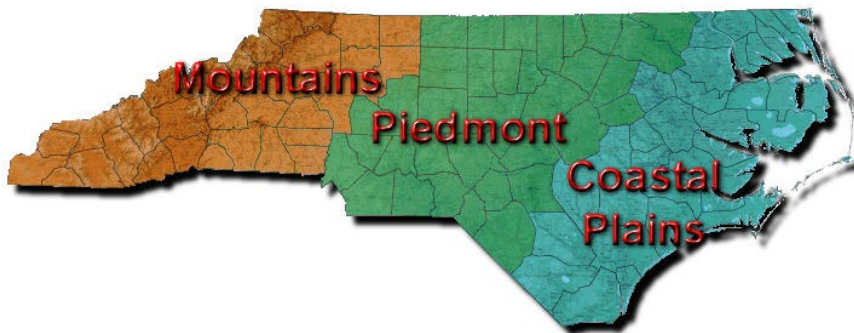
*Part 1a: Interview Questions (55 min; 01:00)*

Introduction (5 min; 00:15)

- Can you share 2 or 3 key highlights about your water resources expertise?

Location (2 min; 00:17)

For this project we have focused on wadeable streams in the Piedmont region of North Carolina (*show map in slides*). For this elicitation, I really want you to focus on the entire Piedmont region.



- Are you familiar with wadeable, urban, streams in these watersheds? Can you name or describe a stream that fits this definition in the Piedmont region?

Endpoints (10 min; ~3 min for each end point; 00:27)

In this study we conducted multiple focus groups of members of the public in these watersheds to understand and define the ecological endpoints or goals that we will focus on. For this elicitation we are focusing on two of these end points: ecosystem condition and murky waters (*show images and categories in several slides - do not include definitions, think about what image to include, may just want basic infographic and not the category infographics*).

I want you to think about wadeable, urban streams in the Piedmont of North Carolina during the growing season (~March - November). Do you want to talk about ecosystem condition or murky waters first?

- Here are our definitions of *good, fair, and poor ecosystem condition* (*see slides*)
  - Do you have any thoughts or reactions to our definition?
  - Do these definitions make sense or would you define them differently? Are you ok using these definitions to think about this endpoint?
- For **murky waters**, we are thinking about how many murky days there are over a total period of 100 days. We think that over 40 out of 100 is a *high* level of murky water days, between 20 and 40 out of 100 is a medium number of murky days, and under 20 days out of 100 would be a low number of murky days.
  - Do you have any thoughts or reactions to our definition?
  - Do these definitions make sense or would you define them differently? Are you ok using these definitions to think about this endpoint?

Measurable Variables (10 min; 00:37) -- included in the interview if time permits, otherwise pivot and include as part of the elicitation training exercises

I want to switch gears and focus on measured water quality variables and how they relate to these two endpoints -- ecological condition and murky waters. Remember, we're focusing on wadeable, urban streams in the Piedmont region.

- If you had unlimited resources and were able to measure any biological, chemical, or physical variables, what is the one variable you would want to measure to determine the ecosystem condition endpoint? The murky waters endpoint?
  - Briefly, why would this variable be ideal to measure the ecological condition endpoint? murky waters endpoint?
- For this study we're focusing on these variables -- biotic index, fecal coliform, specific conductance, total nitrogen, total phosphorus, and turbidity --
  - Which ones would be the most important for the ecological condition endpoint? Can you rank variables in order of importance?
  - Which variables would be most important for the murky waters endpoint? Can you rank variables in order of importance?
  - Are there any limitations with these variables in comparison to your ideal variable?

***Part 1b: Training for the elicitation survey (60 min)***

→ Send URL to elicitation survey set up for the particular expert. Check with the expert before the end of the interview to confirm that they have received the survey and that it opens for them.

***Training Survey: <https://z.umn.edu/6loi>***

***or: [https://umn.qualtrics.com/jfe/form/SV\\_dgSTS2w046DFPbn](https://umn.qualtrics.com/jfe/form/SV_dgSTS2w046DFPbn)***

- Think about wadeable, urban streams in the Piedmont region of North Carolina. Consider the diversity of the factors (e.g., morphological, weather and climatic, land uses) within this region. Then imagine 100 streams dispersed throughout this region that you think represent the distribution of conditions that exist.
- You will be asked to think about these 100 streams in each question. You will be given a row of water quality data that includes biotic index, fecal coliform, specific conductance, total nitrogen, total phosphorus, and turbidity.
- Assume that the data row that you see represents conditions that have been measured at all 100 streams in this region.
- Using data collected at the Raleigh Durham International Airport weather station, we can predict with 95% confidence that between 40 and 71 days out of any given year's 275 day growing season there will be greater than 0.1" of measured precipitation. This equates to between 15 and 26 days out of 100 days receiving greater than 0.1" of rain in this region.

- For each data row, you will be asked to answer questions about how likely streams would be in different categories of the ecological condition endpoint and separately the murky waters endpoint.
- Does this make sense? You'll have a chance to practice it. Ok, let's move on to the what you'll be asked to do in the survey. *Go to survey*
- **For each endpoint (ecological condition and murky waters) you will be asked to select for a given data row to answer the following questions:**
  - What is the *most likely* condition of the wadeable, urban streams for the endpoint?
  - Roughly how many of the 100 streams do you think would fall into your *most likely* category?
  - Now consider the other two categories, how many of the 100 streams do you think would be in those categories?
  - Do the number of streams in all 3 categories add up to 100?
- Does this make sense? You'll have a chance to practice it. Ok, let's move on to what you'll be asked to do in the survey. *Go to survey*
  - Practice elicitation survey.
  - Things to consider as you finalize your judgment for a particular category:
    - Across all three categories do you believe the number of streams in each category reflect what you think occurs in this region? Does this look like the right distribution for this particular water quality data row?
    - Do you think any of the categories could be higher or lower than what you selected?
    - 100 random points in time
    - data point in time → WQ data (consistent with WQ model)
    - ecological endpoints → average conditions for that stream (make sure consistent with SP)

→ leave 15 minutes at the end to go through next steps (see Part 2 instructions) and answer any final questions.

## **Part 2: Elicitation survey (2-3 hours; independent, within 1 week)**

The elicitation survey link will be provided to the participant. It is a different link/survey than the training survey. You should have received this link via email, do you mind going to your email and checking to see if you got it? Can you click on the link to make sure it works for you? Don't start it now, but let me share what the elicitation includes.

- The consent form can be in the survey on the first page.
- We will ask you for your name so we can link responses and interviews.
- Throughout the survey there will be a few questions relating to the generalizability of results.
- At the end of the survey, if you would like to accept the honorarium, then we will ask you for some required information in order to process the payment.
- If we haven't gotten your response 3 days before it is due, we'll send you an email reminder just as a courtesy.

***Part 3: Follow-up data calibration interview (30-60 min; within 2 weeks of Part 2).***

- Identify 3 data rows that are the same, check for consistency.
- Given analysis of the data, identify responses that seem like outliers.
- May want to consider the cross-expert calibration.

Location - Scaleability

Finally, given what we've discussed I want to see if what you are sharing has relevance to other watersheds beyond the Upper Neuse and Haw wadeable, urban streams. *(show images of the watersheds and have a map ready of the larger eastern US)*

- Given the characteristics of this watershed, what other areas would you expect the relationships to be similar to the upper Neuse and Haw watersheds?
  - Can you draw a rough circle around these areas?
  - Why would you expect the relationships to be the same?
  - Are you using the same definitions of urban and wadeable?

Anything Else?

- Is there anything else that you would like to share with us that we didn't ask?
- Anything that you want us to know or take away from this conversation?

**Water Quality Data Rows and Survey Development**

The elicitation survey will be developed in Qualtrics. A few method notes:

- Most Likely selection - easier cognitive task, easier calibration (required)
- add box in survey so people can describe reason (optional response)
- randomize the order of the 100 rows so that there is no ordering effect
- include consent form at the beginning, ask to select yes
- include the ability to have data shared back to the expert, if they wish
- create ability for an expert to start and return to the exercise

In the practice and calibration exercises, experts will be asked to explain a sample of their assessments and will be asked about their judgments, allowing the elicitors to check for consistency and biases. This check will ensure that experts have a chance to modify their judgments or provide a justification, assuring that the experts' assessments accurately represent their knowledge.

The water quality variables to be used are

- biotic index,

- fecal coliform,
- specific conductance,
- total nitrogen,
- total phosphorus, and
- turbidity.

A link to the method for processing water quality data and generating data rows for the expert elicitation can be found [here](#), and a generated sample data set can be found [here](#).

## Elicitation Invitation Email

Dear [expert],

I hope you are doing well, especially during these odd pandemic times.

I'm writing to you based on [insert recommender's] recommendation, and your expertise in [insert expert's specific expertise that led them to be chosen]. I am part of a project led by [Dr. Melissa Kenney](#), to understand how wadeable, urban stream water quality and improvements are valued by the general public. For this study, we are focused on the Piedmont region of North Carolina.

**Specifically, I would like to invite you to participate in an 'expert elicitation' where we are drawing connections between regularly measured water quality variables and goals identified by members of the public. The two specific goals we are eliciting are "murky waters" and "ecosystem condition".**

If you are willing to virtually participate in the elicitation, you can be **paid an honorarium of \$500** (\$100-125 per hour) for your time. You may, of course, decline the honorarium (particularly if your job requires you to for things like this).

The entire process is estimated to take 4-5 hours total over the next several weeks. The process would consist of three parts:

- Part 1: (1.5-2 hrs) Teleconference (zoom, skype) interview with Institute on the Environment researchers followed by a short training for the elicitation survey. **We are hoping the first interview will take place sometime during the last week of January.**
- Part 2: (1.5-3 hrs) Online elicitation survey to be taken independently; task is to categorize streams based on given biophysical measures (within 1 week of Part 1) **We are hoping the elicitation survey will be completed in the week following the initial interview.**
- Part 3: (0.5-1 hr) Follow-up data calibration interview (scheduled within 2 weeks of Part 2).

**We are hoping the follow up interview will take place the second week of February.**

Your insights about the relationships between water quality variables and these stream goals will be used, with those of a few other invited experts, to integrate water quality and economic models to quantify the value of improved stream water quality. Though this process will be a

little different, the basic overall approach was published in [Van Houtven et al., 2014](#) ([attached here](#)). Also attached is a screenshot of a typical elicitation question - please don't worry if you are unsure of how we are defining things or what we mean by 100 streams, we'll go over that in a short training.

I hope you are willing to participate in our study because we would enjoy working with you and value your insights. If you would like to participate, let us know so that I can schedule you for a time that works with your schedule.

I've included project lead Dr. Melissa Kenney on this email. If you have any questions, we would be happy to talk with you over email (Melissa: [makenney@umn.edu](mailto:makenney@umn.edu); Hillary: [wate0119@umn.edu](mailto:wate0119@umn.edu)) or schedule a time to talk on the phone.

Please let us know if you'd like to participate and we can move forward with scheduling.

Best wishes,

Drs. Melissa Kenney and Hillary Waters