Central Sands Lakes Study Technical Presentations – Methodology
Response to Comments
December 17, 2020

On October 5, 2020 the Wisconsin Department of Natural Resources (DNR) released a series of technical presentations related to the methodology applied to the Central Sands Lakes Study (CSLS). DNR held a 30-day public comment period that accompanied the release of these presentations. The DNR has summarized the questions and comments received as part of the comment period and provided our responses below in blue.

1. Was there any statutory/administrative rule definition or legal precedent of "significant" in another relevant context (e.g., the definition of a "significant adverse environmental impact" in NR 820) when developing your approach to defining what a "significant reduction" was? The presentations highlighted how this term was not defined, but did not provide any background on how the team went about developing its own definition.

   We acknowledge the definition of "significant adverse environmental impact" meaning "the alteration of groundwater levels, groundwater discharge, surface water levels, groundwater temperature, surface water temperature, groundwater chemistry, surface water chemistry, or other factors to the extent such alterations cause significant degradation of environmental quality including biological and ecological aspects of the affected water resource." (See NR 820.12 (19), Wis. Admin. Code). This definition provides a starting point, but it is not specific to lakes and does not quantify the significance of lake level change or any corresponding ecological impacts due to changes in lake levels. This is one of the challenges of this study. We address "significant impact" in our Lake Resource Evaluation presentations at the following time stamps: water chemistry (24:55-27:20), plants (36:00-42:13) and fish (51:10-56:45). We also outline how we will synthesize all possible significant impacts at the conclusion of the presentation (1:01:15-1:03:03). With that said, the definition of significance to the study lakes is on-going and will be made publicly available when the Decision Report is released, which we anticipate will be in the first quarter of 2021.

2. When coming up with the approach that DNR is using to define "significant impact", did the team rely on any existing standard for a "significant reduction", such as a similar statutory definition elsewhere for an analysis another DNR program already utilizes in a different context? Are there other existing analyses to rely on that are relevant to defining the "significant impact" term for this study, or is this study based on the team's expert opinions about how water levels could affect the lake's ecology and human value?

   The goal of this study is to define "significant reductions" in water levels in Plainfield, Pleasant and Long Lakes due to groundwater withdrawals. In the absence of a statutory definition of significant impact that fulfills the requirement of this study, the study team has turned to existing literature (including the fields of limnology, stream ecology, hydroecology and wetland science), field data, and professional opinions of experts across these various fields.

3. There are numerous soil borings and monitoring wells installed around the three lakes in question. Are the boring logs and well construction details for the soil borings and monitoring wells advanced and sampled by the WDNR around the three lakes available for review? Based on the cross-sections, there are limited boring logs shown that encountered bedrock. How was the depth of the bedrock surface determined around these lakes? Is the WDNR collecting additional data to confirm the bedrock surface around Plainfield and Long lakes?

   Boring logs and well construction reports are now included as appendices to the Draft Central Sands Lakes Study Technical Report: Data Collection and Hydrostratigraphy ("Hydrostratigraphy Report"), available on the DNR's website. Depth to bedrock was estimated from available logs, two rotosonic cores completed near Long and Plainfield Lakes during the project period (see Hydrostratigraphy Report pp. 34-41), and passive seismic data (Hydrostratigraphy Report pp. 19-22). Additional information about data and methods used to create bedrock surfaces for the groundwater model can be found on pp. 77-81 of the Hydrostratigraphy Report.

4. In the video presentations, there is a reference to stable isotopic analysis that was completed during the study but there was not a presentation of results from the study. In a poster presentation on the AWRA website earlier this year, there is a conclusion that an isotopic signal was not observed in downgradient wells during the high-water

levels of 2019 for Plainfield and Long Lakes. There is a hypothesis in the poster presentation that groundwater flow paths were "pushed deeper, below the shallow monitoring well network". Is the WDNR or WGNHS conducting additional data collection and evaluation to determine if this hypothesis is correct or to resolve this issue? Does the WDNR feel this needs to be confirmed prior to issuing a report of findings?

Stable isotope data were collected in order to develop a water budget for the study lakes. This approach, modified from Krabbenhoft (Krabbenhoft, D. P., Bowser, C. J., Anderson, M. P., and Valley, J. W. (1990), Estimating groundwater exchange with lakes: 1. The stable isotope mass balance method, Water Resources. Res., 26(10), 2445– 2453) does not require the use of isotopic data from downgradient wells, since the groundwater outflow term of the water budget equation is not an input. Rather groundwater outflow is calculated from the other input terms, with stable isotope data used to calculate groundwater inflow, as stated on the poster (Eq 1).

Also noted on the poster is that samples from deeper downgradient piezometers do show a lake water signal and support the hypothesis. This result is similar to responses noted by Krabbenhoft and others and is not unexpected in an area near a groundwater divide. As such, DNR does not intend to collect additional stable isotope data or evaluate the hypothesis presented in the poster.

5. The video presentations included a lengthy discussion of the chemical characteristics of the lakes and presented the results for some individual compounds with an interpretation. Is the water quality data available for review from the groundwater samples collected from the wells installed near the lakes?

   The water quality data will be made publicly available when the Decision Report is released, which we anticipate will be in the first quarter of 2021.

6. The groundwater model was calibrated using data from the 2012 through 2018. This period is characterized by dry conditions in 2012 and increasingly wet conditions throughout the period. Based on climatic and groundwater elevation data, it is assumed that 2019 was one of the wettest periods across the Midwest, which may have manifested in record lake and groundwater levels. Is it possible for the transient model to include the 2019 climatic data? Or has the base model been run using the 2019 climatic data to determine if it accurately represents the observed conditions?

   The model was calibrated using data from 2012 through 2018 as that time period represented the best available data. At the time when we started building the model, not all 2019 data necessary for the model was available – climatic data had not been released and water use data had not been fully reported and processed. Due to the statutory time restrictions imposed with this study, there are no plans to extend the model time period to 2019. Note that 2018 was also one of the wettest on record, so the model calibration period does cover both ends of the spectrum – dry periods in 2012 and wet periods in 2018.

7. The calibration of the base model is largely complete, and it is assumed that the USGS and WDNR will be running this model using simulations to predict the lake elevations during the simulations. Are the model calibration runs available for review?

   Calibration runs are not available as they are still preliminary at this time. The datasets for the parent and inset models will be released at the time of publication of the Decision Report which we anticipate will be in the first quarter of 2021.

8. The scope of the study was to determine the impact of high capacity well pumping on the lake elevations and to determine if these are significant impacts. How will the WDNR determine the impact that the high capacity well pumping has on the lake elevations?

   A calibrated model will be developed to simulate conditions from 2012-2018. We will use the calibrated model to simulate the groundwater system using current irrigated agricultural extents over a variety of climate patterns experienced in the past several decades, and then rerun the model with the irrigation wells turned off and the associated irrigated parcels changed to reflect non-irrigated land use. Differences in lake levels and groundwater

flow to the lakes between these two runs will be the initial assessment of impacts from high capacity well pumping.

9. Using the base model, has the WDNR already performed a preliminary evaluation of the impact of high capacity well pumping on the lake elevations for the data used from 2012 to 2018? If so, were the results used to develop the predictive simulation and what are the results of this evaluation?

   These analyses are still on-going, and results are not available at this time. The DNR will release the results at the time of the Decision Report, which we anticipate will be in the first quarter of 2021.

10. Can you provide a summary of the predictive simulations that the WDNR will being running to evaluate lake elevations and the influence that high capacity well pumping has on the lake elevations?

    How we use the model is partially dependent on the results of the initial impacts modeling scenarios, so a comprehensive list of simulations is not available. We may ask the model to include things such as: how important is distance from the lake and what sort of lag or other timing issues can we identify with respect to irrigation well impacts on the lake? Additional scenarios may be analyzed depending on results from any of these scenarios.

11. Can you provide a summary of the predictive model simulations scenarios that are already completed and a summary of the results?

    The DNR and USGS are still conducting these analyses. The DNR will release the results at the time of the Decision Report, which we anticipate will be in the first quarter of 2021.

12. There are historic records indicating that some or all of these lakes had low water levels similar to the recent low lake levels prior to the use or increase in high capacity wells from the 1960s through today. It is understood that there may be limited available lake elevation data from historic periods but is the WDNR considering using the climatic data from these periods to confirm the low lake elevations observed prior to the permitted use of high-capacity wells?

    The historic water level timeseries dataset that DNR developed to gain understanding of the range and dynamics of water levels in the study lakes, was constructed using known observations and historic precipitation data (among other things). This approach allows us to estimate the full range of water level variation, including under extremely wet or dry conditions, as well as the frequency of highs and lows. We then use water level metrics such as magnitude and frequency to relate water levels to ecology and human use in order to determine significance.

    While we are confident that this approach allows us to meet the legislatively mandated goals of the study, it is not intended nor appropriate to attempt to re-create or "confirm" specific elevations from specific dates.

13. The video presentation provided a framework for how the model results will be used to evaluate if the reduction causes a significant impact. There are several factors presented, but not all factors are relevant to each of the lakes due to the specific lake characteristics. Has there been any consideration of creating a hierarchy of conditions for each lake or ranking the possible conditions (e.g., solute and nutrient budgets, stratification changes, and/or use or biological changes) in the evaluation of significant impacts? In the evaluation of "significant" impact, does the WDNR envision that a "significant" impact could be determined based on one of the factors or are multiple factors necessary to demonstrate a "significant" impact?

    Yes. Each lake will be evaluated for a number of factors, and the most sensitive factor will be considered the limiting factor and the associated threshold for the most sensitive factor will be the one that determines what constitutes a significant impact.

14. In the video presentation there is reference to a social survey that was sent to the lake community for comment. Can you please provide some background for the purpose of this survey while the study is being performed? Are the questions in this survey and results of the social survey available for review? Agriculture in this area is a

significant part of the economy and business conducted. If the impact to the lake community is important, has the WDNR also considered a similar survey for the agricultural community in the area of the lakes that could be impacted to determine the impact it could have on their businesses? As you know, the WPVGA is an advocate and financial supporter of the study, and many of these businesses in the areas surrounding the lakes are members of this organization.

The social survey was designed to gain insight about how the study lakes are used, how those human uses are valued and perceived impacts on the lakes. As with all other data from the study, results will be available when the study concludes in 2021.

As for a similar survey for the agricultural community, if the DNR recommends special measures to prevent or remedy significant impacts to the lakes, then DNR would be required to conduct an economic impact study to determine if agricultural and other economic sectors would be impacted by those special measures. As we do not know if there will be special measures at this time, DNR cannot say if we will be conducting an economic impact study.

15. Based on our understanding of the lake study, the pump test that was planned was not completed due to financial and logistical matters. Is the WDNR considering performing this pump test to confirm the model predictions, as originally proposed?

    In the early stages of the study we had proposed conducting a large-scale pumping test to verify the hydrologic connection between the groundwater and the lakes and the causal relationship between pumping and potential significant reduction of water levels in the study lakes. Several factors led us to cancel this test: 1) The connection between groundwater and the lakes is readily apparent from much of the other data collected from piezometer, lake and groundwater water quality composition and seepage meters. With the evident connection between groundwater and lake levels, it follows logically that there is at least a potential for a reduction of lake levels from pumping; 2) The study budget was held up at a crucial time at the beginning of the second biennium of the project, thus making it unclear as to whether we would have the funds to complete the test as originally proposed in the first biennium; and 3) the test would have cost about $250,000 which is a large fraction of the study budget and seems unnecessary due to factor #1.

16. The understanding of the existing lake characteristics was completed during survey work completed in 2018-2019, under above-normal lake levels and precipitation events. How will the characteristics of the lakes be confirmed under lower lake levels and near-normal precipitation events? Are you aware of lake characteristic studies completed over the period from 2010-2012?

    The study is statutorily required to be completed by June 3, 2021. So far there have not been low lake level conditions during that period. While we are not aware of lake characteristic studies completed over the period from 2010-2012, the study team has referenced other resources including relevant literature, and older fish surveys to understand lake characteristics in drier periods. In addition, we are confident that our historical water level time series, as described in response to question #6 above, provides insight into the full range of lake levels, including low and median levels.