Climate Ready North Bay, Phase 2

Recommendations for North Bay Watershed Association

People working in North Bay watersheds are integrating climate change adaptation into their land, water, emergency, and watershed plans and policies. **Climate Ready North Bay** connects these people with the most up-to-date, actionable, customizable information to support their decisions and priorities.

Now, NBWA members and their watershed partners are familiar with carefully selected tools for answering questions about how climate and hydrology may be changing, and how to apply those answers to their work. Based on several interactive working sessions, these are the tools most useful to the NBWA community.

Background

NBWA funded this work through a grant to the North Bay Climate Adaptation Initiative, represented by Sonoma Ecology Center. The project builds on NBWA's leadership in funding, in 2010, the first report written for resource managers based on USGS' BCM down-scaled climate projections for the north bay, and on Climate Ready North Bay Phase 1, led by the Sonoma County Regional Climate Protection Authority and TBC3.

Most Useful Climate Vulnerability Assessment Tools

Climate Ready North Bay. Reports and accompanying slideshows with results of customized analyses based on climate-related watershed management questions from North Bay users. North-Bay-wide results document broad trends. There are also products specific to Marin County, Sonoma County plus Russian River, and Napa River.

Conservation Lands Network Explorer. Create, view, and download maps of your hand-drawn area within the Bay Area, with 270m x 270m resolution, of BCM variables. Choose from 4 climate futures and 5 time periods. See results compared to vegetation, conservation value, and other mapped parameters. Data is 30-year averages.

SF Bay Area Watershed Analyst. Pick a subwatershed in the Bay Area, see graphs, tables, seasonal water balance diagram. Choose any of 14 futures to graph. Download graphics and data for that subwatershed. Monthly data can be aggregated as you wish.

The Climate Commons. A searchable library of climate adaptation resources, including all of the above and more. See especially the articles introducing concepts, and the tabular comparison of tools.

Vegetation change. Bar plots showing changes in vegetation types with varying climate futures, 4-square diagrams for important vegetation types, and short report by plant ecologists, available for each North Bay Landscape Unit of the Conservation Lands Network. Detailed bar plots for each Bay Area county are also available.

30-year climate and hydrology data for California. USGS Basin Characterization Model data: maps of 30-year averages for all BCM variables for 18 climate futures for all of California (270m x 270m resolution) available as GIS downloads:

CalWeedMapper. Interactive mapping and reports for download, for invasive plant trends based on climate suitability and proximity to infestations. Results based on expert opinion, mapped observations, and limited climate suitability data. Choose Advanced mode, map an area of interest, and download the Regional Management Opportunities report.

Cal-Adapt beta. An easy tool for projecting the frequency and timing of future extreme heat days.

NBCAI's slideshow presentation for Climate Ready North Bay can be viewed here.

Questions Asked By Climate Ready North Bay (Phases 1 and 2)

Climate Ready North Bay asked what vital management questions the NBWA community is facing that are affected by climate change. The list of questions that project participants asked during the two phases of Climate Ready North Bay is highly instructive. It indicates areas of concern, where information is available to respond to those concerns, and where information is not yet available. The NBWA community still needs help accessing and making use of available information, and also is primed to explore further analyses that could inform their water and watershed management decisions. (CRNB1 below refers to Phase 1 of Climate Ready North Bay.)

Baylands

1. How are hydro & sediment from watersheds connected to effects on estuarine habits (salinity, sediment)? From: Marin.
2. Is anyone projecting levels of salinity increases in tidally influenced rivers during dry periods? From: Napa.

    Answerable with current tools? N. Refer to Baylands Goals report, recently updated to incorporate climate impacts. http://baylandsgoals.org/

Climate mitigation

3. What are the most compelling climate impacts in our area, that we can use to build motivation for climate mitigation efforts? From: Sonoma.

    Answerable with current tools? Y. Based on numerous presentations and discussions about local climate issues over the last five years, the most compelling dangers, for most people, seem to be the health and safety impacts of extreme heat and wildfire, and the economic impacts of water shortage and wildfire.

4. How much carbon sequestration can be accomplished on vineyards and rangelands in our area, and what practices are most effective? From: Sonoma.

    Answerable with current tools? N. For rangelands, refer to the Marin Carbon Project, https://www.marincarbonproject.org/, and use the term "carbon farming" in internet research. Information on vineyards is beyond the scope of the project.

Fire Risk

5. How will climate change affect potential fire frequencies? From: All (CRNB1)

6. How are fire risks projected to impact the parks and open space portfolio? From: Sonoma County (CRNB1)

7. How do we understand the increasing risk of fire? From: Conservation Corps North Bay

Answerable with current tools? Y. Refer to CRNB1, regional tech memo and slide deck: http://climate.calcommons.org/crnb/methodology. Refer to CRNB1, Sonoma County Parks and Open Space tech memo and slide deck. http://climate.calcommons.org/crnb/scaposd-and-scrp

8. Please make a crosswalk from CWD to #days/yr when live fuel moisture falls below 15-20% From: Marin

Answerable with current tools? Partial. This question is beyond the scope of the project. However, it appears that the variables used to estimate live fuel moisture are generated by the BCM, and therefore it should be possible to create the requested crosswalk.

9. How can these findings be used to bring more balance to fire prevention activities? Creating defensible space should be done judiciously, to retain soil moisture. From: Marin

Answerable with current tools? N. This question is beyond the scope of the project.

Groundwater

10. What is the relationship of annual recharge relative to annual runoff? From Sonoma County (CRNB1).

11. What is the spatial variability of runoff and potential groundwater recharge and how might climate change impact these distributions? From Sonoma County (CRNB1).

Answerable with current tools? Y. Both these questions can be answered with the Watershed Analyst and the CLN Explorer. For another approach, refer to CRNB1, Sonoma County Parks and Open Space tech memo and slide deck. http://climate.calcommons.org/crnb/scaposd-and-scrp

12. Where are the most promising locations for climate-resilient stormwater capture/groundwater recharge projects? From: Sonoma, Napa.

Answerable with current tools? Partial. Deeper geology is complex and imperfectly known in the North Bay, yet it is the major determinant of deep aquifer recharge capacity. Results based on the BCM model are based on current geologic mapping, and need to be confirmed with field-based testing. These results also don't account for stormwater and runoff coming from a contributing area. For one approach that worked with these shortcomings, refer to CRNB1 Napa tech memo and slide deck, http://climate.calcommons.org/crnb/napa-county, using mountain front recharge combined with valley bottom recharge. Another approach would be to use the Watershed Analyst or CLN Explorer to identify locations with larger contributing areas and historic high recharge and the least change in future recharge.

13. What are the best tools to assess the localized impacts of groundwater withdrawal from a particular well? From: Napa River (CRNB1, not analyzed)

Answerable with current tools? N. This question is beyond the scope of the present tools. It calls for a groundwater model.

14. How can we estimate the impact of potentially variable groundwater recharge rates on actual aquifer levels? From: Russian River (CRNB1, not analyzed)

Answerable with current tools? N. From CRNB1: "To thoroughly assess the impacts to aquifer recharge requires the development of a coupled surface water groundwater model, as has been completed for the Santa Rosa Basin in an earlier study. This is an option to pursue for the other groundwater basins, once they have a groundwater model in place."

15. How do reservoir operations potentially influence groundwater recharge, in particular during periods of sustained high flows during the dry season that exceed unimpaired flow estimates used in this study? From: Russian River (CRNB1, not analyzed).

Answerable with current tools? N. From CRNB1: "This study [that is, CRNB1] generated recharge estimates based on estimates of unimpaired flow conditions. This might be a conservative estimate of actual recharge values for aquifers adjacent to the river due to sustained dry season flows provided by the reservoirs. A next step could be an analysis of recharge enhancement due to flow increases during the summer season due to reservoir releases."

Irrigation Demand

16. How will climate change influence the frequency and intensity of heat events that trigger big upticks in demand for irrigation? From: Sonoma County (CRNB1)

Answerable with current tools? Y. Refer to CRNB1, Sonoma County Parks and Open Space tech memo and slide deck. http://climate.calcommons.org/crnb/scaposd-and-scrp

17. How might climate change influence the magnitude of landscape drought stress, estimated as climatic water deficit? Where might this effect be mitigated by present day fog distributions? From: Russian River (CRNB1).

Answerable with current tools? Y Refer to CRNB1, Russian River tech memo and slide deck: http://climate.calcommons.org/crnb/russianriverwatershed

Public health

18. Where and when will we hit thresholds related to public health: heat waves, disease vectors, etc? From: NBWA JTC

Answerable with current tools? Partial. The best tool for projecting extreme heat is at beta.cal-adapt.org/extreme-heat. It incorporates an accepted threshold that is based on the "normal" temperatures of a given location. In contrast, other public health thresholds are not well established, and therefore it is not currently known how to translate projected climate conditions into projected frequencies or intensities of exceeding important public health thresholds.

19. When and where do we need to worry about harmful algae in rivers and reservoirs, harming people & pets? From: Napa

Answerable with current tools? Partial. This is an area of active research. Refer to Naomi Feger at SFRWQCB, who is presenting on this topic at the January NBWA board meeting. The current tools can be used to project air temperatures, which can be used to project toxic algae occurrences only if a model exists that establishes a numerical relationship between air temperature and algae blooms.

20. Water quality & temperature (algal bloom in reservoirs). From: Marin

Answerable with current tools? Partial. Can be done only if there is a model connecting temperature to algal growth.

Rain and Water Supply

21. How can I get the same results [as Sonoma County Regional Parks and Agricultural Preservation & Open Space District] for the parcels I'm interested in? From: Sonoma

Answerable with current tools? Y. To find the methods used in CRNB1, refer to CRNB1, Sonoma County Parks and Open Space tech memo and slide deck. http://climate.calcommons.org/crnb/scaposd-and-scrp. A simpler approach is to use the Conservation Lands Network Explorer. You can map an area of interest and quickly view or download 30-year averages for all BCM variables.

22. How is climate change projected to impact the variability of annual rainfall relative to the historic record? From: All (CRNB1).
23. How will climate change affect precipitation quantities? From: Russian River (CRNB1)
24. How will climate change impact annual and spring precipitation variability, and in turn, winter and dry season runoff? From: Russian River (CRNB1)
25. How will climate change impact the seasonality of annual rainfall in a reservoir basin? From: Russian River (CRNB1)
26. How does rainfall variability translate to variability in watershed-wide water availability and potential delivery to reservoirs? From: Napa River (CRNB1)

Answerable with current tools? Y. Refer to CRNB1 products for the watershed asking the most relevant question for you. This information is also easily available for subwatersheds from the Watershed Analyst and in map form from the CLN Explorer. In the Watershed Analyst, you can get monthly data for subwatersheds. In the CLN Explorer, you can map an area of interest and quickly view or download 30-year averages for all BCM variables.

27. How will climate change potentially impact the seasonality of the water cycle? From: Napa River (CRNB1)

Answerable with current tools? Y. Refer to CRNB1 Napa tech memo and slide deck: http://climate.calcommons.org/crnb/napa-county. The Watershed Analyst is a good tool for this also.

28. Which parcels in the parks and open space portfolio provide key water supply benefits? Which parcels are prone to extreme drought stress? From: Sonoma County (CRNB1)

Answerable with current tools? Y. Refer to CRNB1, Sonoma County Parks and Open Space tech memo and slide deck. http://climate.calcommons.org/crnb/scaposd-and-scrp

29. What are the impacts of climate change likely to be on the watersheds outside the Napa Valley from which Napa imports water? From: Napa River (CRNB1, not analyzed)

Answerable with current tools? Y. BCM data exists for all of California. See http://climate.calcommons.org/dataset/2014-CA-BCM.

Resilience applications

30. How do we use this information in Hazard Mitigation Plans? From: RCPA CC

Answerable with current tools? Y. The frequency and intensity of several events covered in Hazard Mitigation Plans, such as drought, heat waves, wildfires, and floods, can be projected with these tools, and their frequency and intensity can be compared with past patterns. This analysis can provide both boundary conditions within which to plan, and a guide for how past prioritization of effort may need to shift, to cope with future hazard conditions.

31. How do we use this information in adaptation plans, e.g. Graton Rancheria and Kashaya Pomo? From: RCPA CC

Answerable with current tools? Y. The frequency and intensity of several phenomena relevant to adaptation plans, such as drought, heat waves, wildfires, vegetation change, and streamflow, can be projected with these tools, and their frequency and intensity can be compared with past patterns. This analysis can provide both boundary conditions within which to plan, and a guide for how past prioritization of effort and investment may need to shift, to cope with future conditions.

32. How can we use this dataset to reduce imperviousness, whether by influencing land use policy or by informing designers and engineers? From: Marin

Answerable with current tools? Partial. This would require running the BCM, after changing recharge to zero wherever surface is impervious. Good future project!

33. How can these findings be used to build and maintain climate-smart public works projects, such as flood protection, drainage, water supply, roads, levees, culverts, etc? Related to safety factor that is already used. From: Napa, RCPA CC

34. How can a City water supply planner use this information? From: RCPA CC

Answerable with current tools? Partial. The future conditions projected by these tools show what our infrastructure will need to withstand over the course of its useful life. But the process of designing future conditions into planning, construction, and maintenance is a larger task, beyond the scope of this project. See Next Steps.

35. How can project permitting help make projects more climate-resilient, for example by promoting infiltration, choosing a climate-smart planting palette, and protecting recharge sites? From: CDFW

Answerable with current tools? N. These datasets emphasize the importance of built projects being designed to enhance infiltration and absorption, moderate temperatures by promoting and re-establishing thick drought-resistant vegetation, reduce fire risk, minimize water use, and avoid contributing to climate change. Permitters can require such characteristics and create accountability mechanisms to ensure they are incorporated.

Salmonids

36. How will climate change potentially impact the hydrology of high value main stem reaches and tributaries for fish? From: Napa River (CRNB1)

Answerable with current tools? Y. Refer to CRNB1 Napa tech memo and slide deck: http://climate.calcommons.org/crnb/napa-county

37. What will the impact of climate change be on stream temperatures that in turn will impact fisheries habitat value? From: Russian River (CRNB1, not analyzed), Marin

Answerable with current tools? N. The present set of tools can produce projected air temperature, which influences water temperature, which influences salmonid health. However, volume of streamflow may be a stronger factor in determining water temp than air temp, and with higher temps you'll usually have lower flows. So a result based only on air temperature could be an underestimate of the warming effect on salmonids. Agrawal et al. 2005 states that coho salmonwere very rarely reported as present in watersheds where the lowest mean August air temperature in the basin exceeded 21.5◦C, but we are not aware of similar thresholds for central California coast steelhead.

Showing we know

38. How can we use this data to show that we are climate-informed and in fact, ahead of most places? We want to show our responsiveness to funders, to IRWM region, DWR, etc. How is BCM being used at the state level, as mandate rolls out for counties to plan around climate? From: Marin

Answerable with current tools? Partial. Providing graphs and statements derived from any of these tools conveys that we are considering future conditions as we plan projects, policies, and programs. The reports downloadable from the Watershed Analyst and CLN Explorer, narrative sentences can be used directly from the CRNB1 tech memos, and the excellent graphs from all the tools are compelling. On the second point, there is no single standard for downscaled projections. While some agencies may not be familiar with BCM, it is well respected. Other modeling approaches may differ in their construction, but may result in quite similar findings.

39. Can this dataset provide guidance to help funders choose climate-smart projects? From: Marin

Answerable with current tools? N. However, if you are familiar with tools like these, you'll have an easier time recognizing when a project proponent should consider future weather and hydrological conditions, and whether they have used an appropriate approach for accounting for those conditions.

Streamflow and flooding

40. What are the implications of more variable hydrology on site-specific flood infrastructure requirements? From: Napa River (CRNB1, not analyzed)

Answerable with current tools? Partial. The future conditions projected by these tools show what our infrastructure will need to withstand over the course of its useful life. But the process of designing future conditions into planning, construction, and maintenance is a larger task, beyond the scope of this project. See Next Steps.

41. What are the potential impacts of climate change on flooding and the streamflow regime? From: Napa River (CRNB1), Russian River (CRNB1)

Answerable with current tools? Partial. Flooding is a phenomenon that occurs on the timescale of hours or days, whereas most of the available downscaled tools operate on the timescale of months. There is daily BCM data for the Russian River watershed and Sonoma County. For watersheds in that area, refer to the methods used for this question in CRNB1, Russian River tech memo and slide deck: http://climate.calcommons.org/crnb/russianriverwatershed. For watersheds outside that area, refer for methods to the CRNB1 Napa River tech memo and slide deck: http://climate.calcommons.org/crnb/napa-county.

42. What about the relationship between flooding in streams and sea level rise? From: NBWA JTC

Answerable with current tools? N. This is an active area of research. At this point there are not easily accessible tools for assessing how riverine flooding and sea level rise interact.

43. Are direct dischargers at risk of hardly ever meeting their permit conditions? From: Napa

Answerable with current tools? N. This question is beyond the scope of the project. However, Bay Area Clean Water Agencies is working on it. A related information resource is this summary by the Association of Metropolitan Water Agencies: http://www.amwa.net/galleries/climate-change/AMWA_Climate_Change_Paper_12.13.07.pdf

44. How will changes to winter flows affect water rights permits? How do we get the regulatory system to adapt? From: Napa

Answerable with current tools? N. This question is beyond the scope of the project.

45. What to do with "100-year flood"? BCDC is using sea level plus, but what about in watersheds? From: Napa

Answerable with current tools? N. This question is beyond the scope of the project.

Using tools

46. How to aggregate sub-watersheds in the Watershed Analyst to get whole watershed (e.g.) Petaluma River? From: Marin

Answerable with current tools? N. This functionality will be available in future versions of Watershed Analyst. CLN Explorer can be used to answer many of these questions. You can upload your watershed outline, or any polygon, and get maps and data for that area.

Vegetation Change

47. Which plant communities are most likely to suffer from a mismatch between future climate and vegetation suitability, in which locations? From: NBWA JTC

48. What will be the impact of climate change on important upland vegetation types, and can we identify potentially stable vegetation communities? From: Napa River, Sonoma County (CRNB1)

49. What kind of transitions in native vegetation may occur on parks and open space lands? From: Sonoma County (CRNB1)

50. What species are appropriate to plant after fire?

Answerable with current tools? Y. Refer to UC Berkeley vegetation reports (Ackerly et al. 2016) to learn about "winners" and "losers" among native plant species and communities, and concise findings on vegetation transition by plant ecologists: http://www.pepperwoodpreserve.org/tbc3/our-work/climate-ready/ and http://www.pepperwoodpreserve.org/tbc3/our-work/vegetation-modeling/. The table below is a summary of North Bay vegetation projections from these studies. "Vulnerable" plant communities are likely to be in decline, or mismatched to their climate over time. "Stable, expanding, or uncertain" plant communities are a better bet for planting after fire, or using in reforestation or ecological enhancement.

Landscape Unit	Vulnerable	Stable, expanding, or uncertain
Marin Coast	Grassland	Chamise chaparral

	Redwood forest Canyon oak	Coastal sage scrub – Artemisia California bay laurel Coast live oak Douglas-fir
Coastal Grassland	Grassland Redwood forest	Coast live oak Douglas-fir Baccharis
Sonoma Mountain	Oregon oak Grassland buckbrush	Coast live oak Douglas-fir Baccharis Chamise chaparral
Sonoma Valley	Redwood forest Grassland	Chamise chaparral
Southern Mayacamas	Oregon oak Douglas-fir	Chamise chaparral Knobcone pine Baccharis
Napa Valley	Grassland Valley oak forest, woodland	Chamise chaparral
Vaca Mountains West	Oregon oak Canyon live oak	Chamise chaparral Blue oak Interior live oak

Also see CRNB1, Sonoma County Parks and Open Space tech memo and slide deck. http://climate.calcommons.org/crnb/scaposd-and-scrp, and CRNB1 Napa tech memo and slide deck: http://climate.calcommons.org/crnb/napa-county.

51. What invasive species should we worry about? From: Marin

Answerable with current tools? Y. Refer to CalWeedMapper: http://cwm-mapper.cal-ipc.org. It projects (http://cwm-mapper.cal-ipc.org/tmp/7dcfbd856a53ee44b72a39e45dd310b5/ManagementOpportunitiesReport_San_Pablo_Bay_Watershed.pdf) significant increases (>40% btw 2010-2050) in the San Pablo Bay watersheds for cheatgrass, tree tobacco, crimson fountaingrass. For the Marin-Sonoma Weed Management Area, it projects (report: http://cwm-mapper.cal-ipc.org/tmp/bec2ebfdb263c1adb9c3deb70e192810/ManagementOpportunitiesReport_Marin_Sonoma_WMA.pdf) a significant decrease for pepperweed, and significant increase for tocalote. The Napa WMA report (http://cwm-mapper.cal-ipc.org/tmp/40946c66d0b424c4624ab41e9e192a55/ManagementOpportunitiesReport_Napa_WMA.pdf) projects these same changes, plus significant decrease for rush skeletonweed, and significant increase for oblong spurge.

52. Effects on freshwater wetlands: meadows, vernal pools, seeps/springs. From: Marin

Answerable with current tools? N. The site-specific hydrology of these features makes the current tools inappropriate for this question. If a correlation can be established between past hot or dry years and impacts to these wetlands, then the current tools could be used to project future frequencies of problematic years.

53. What are the implications of climate change for site-specific riparian vegetation and restoration projects? From: Napa River (CRNB1, not analyzed)

54. How do we know that a broader restoration planting palette is successful? From: EPA

Answerable with current tools? N. We urge people conducting ecological restoration in the NBWA area to use Point Blue's Climate Smart Restoration Toolkit http://www.pointblue.org/our-science-and-services/conservation-science/habitat-restoration/climate-smart-restorationtoolkit/. An evaluation of whether the Toolkit, or a similar approach, is successful is beyond the scope of this project.

Viticulture

55. How will agricultural lands be potentially impacted by climate change in terms of irrigation demand? From Napa River (CRNB1)

Answerable with current tools? Y. Refer to CRNB1 Napa tech memo and slide deck: http://climate.calcommons.org/crnb/napa-county

56. What will be the impact of climate change on the determination of suitable growing regions in the Napa Valley? From: Napa River (CRNB1, not analyzed)

Answerable with current tools? Partial. If there is a model correlating suitability with one or more of the BCM variables, then the current set of tools can be used to produce proxy projections of suitability. Stu Weiss, at Creekside Center for Earth Observations, may be a resource.

Wind and fog

57. How will wind change as the climate changes? From: Marin

Answerable with current tools? N. In a preliminary search, no information was found on projected changes in wind for our area of California.

58. What do we know about future fog patterns? When will we know more? From: Marin, NPS

Answerable with current tools? N. This is an active area of research. Fog levels appear to have been declining along the California coast. See https://geography.wr.usgs.gov/fog/ and http://www.pepperwoodpreserve.org/tbc3/our-work/fog/

Good Practices for Staying Climate-Ready

- Be an informed, not overwhelmed, user and consumer of the multiple, wide-ranging climate and hydrology projections.
    - Remember that many climate models--all those used in the tools presented by Climate Ready North Bay--are equally likely.
    - Do not average across climate futures. Instead, aim for conclusions and decisions that work across most or all of the projected futures. Look for your conclusions to be supported by a preponderance of the projections. In some cases, you may want to aim for being prepared for all futures.
    - Omit “unrealistic” futures--those with a lower global emissions trajectory--in your planning and analysis. Or don’t, if you wish to emphasize the lower climate risks to be gained by dramatic emissions reductions.

    - Focus on your worst case scenario. For example, focus on wetter futures if you are a flood manager, and on hotter futures if you are concerned with water supply or groundwater.
    - Compare the climatic conditions surrounding past important events (such as floods, droughts, or heat waves) with the projected future frequency of those conditions repeating. Or, compare past frequencies of important events with projected future frequencies.
    - Support real-time empirical monitoring, to refine and validate climate models over time.
- Keep up to date. Sign up for newsletters. Ask your professional association for any climate adaptation guidance of issues summaries they may have.
    - For further exploration, please see:
    - NBCAI's fact sheets on climate adaptation in the North Bay
    - A Roadmap for Climate Resilience in Sonoma County
    - Climate Readiness Institute - bay area scale, excellent newsletter
    - Bay Area Ecosystem Climate Change Collaborative – excellent newsletter
    - TBC3 – climate, hydrology, vegetation, and fog research
    - California Landscape Conservation Collaborative
- Talk about climate across silos: with other departments in your agency, with other organizations that have a similar mandate or mission, with elected officials, with people working on public issues that are outside of natural resources. Seek common ground in terms of climate threats and resilience solutions.
- Get in the habit of using projected or estimated future conditions and frequencies instead of or along with past patterns.

Moving Ahead

Many management challenges facing north bay water and watershed workers can be informed by the available information products. However, several management questions can be not answered because of incomplete knowledge about the local thresholds at which a changing climate variable might tip the scales into an undesirable condition. For example, what weather conditions could produce toxic algae in the Napa River? What climate threshold would push steelhead out of the warmer North Bay streams? The NBWA community has powerful new tools at its disposal, and is primed to apply additional climate knowledge as it evolves, for a more climate ready North Bay.

Next steps

Based on feedback from participants, several next phases of Climate Ready North Bay would be helpful to the NBWA community:

- A 90-minute webinar, comprising video of slideshow presentation and real-time interactive demo of tools with audio recording of slideshow presenter
- Workshop showcasing local case studies of people applying future conditions to today's decisions, segmented by project type. Invited: electeds, public works heads. Example speakers: someone on the PUC development checklist, SCWA on using climate projections to plan for managing Santa Rosa stormwater, Marin County Planning Division and/or Sonoma County PRMD on coastal plan, potentially Brett McIntyre of Sonoma County Transportation & Public

Works on sizing road crossings. (Conversation about this idea started in Sonoma County; clearly people from Napa, and more from Marin, would need to be involved.)

- Separate tools demo for each of: farmer organizations such as Sonoma County Farm Bureau and North Bay Ag Alliance, waste management agencies, advisory committees of transportation departments, and climate staff at larger cities. These will be most successful if they are organized by, and attendees invited by, someone seen as part of the attendees' culture, e.g. an engineer inviting engineers, a road person inviting road people.
- NBWA staff may want to consider any uses for the 20-50 email addresses, different from those already on NBWA's lists, collected by the project, of people likely to use climate vulnerability assessment tools

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For North Bay Watershed Association by
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