Water Consortium

Sponsors

Guidance Note for Issuers and Verifiers

ABSTRACT

Guidance when conducting mitigation and adaptation & resilience assessments for the Water Infrastructure Criteria of the Climate Bonds Standard

A supplementary note to the Water Infrastructure Criteria of the Climate Bonds Standard

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Prepared by John H. Matthews and Ingrid Timboe (AGWA) with assistance from Anna Creed (CBI)

1. Definitions

Climate Bonds Initiative (CBI): An investor-focused not-for-profit organisation, promoting large-scale investments that will deliver a global low carbon and climate resilient economy. The Initiative seeks to develop mechanisms to better align the interests of investors, industry and government so as to catalyse investments at a speed and scale sufficient to avoid dangerous climate change.

Climate Bond: A climate bond is a bond used to finance – or re-finance - projects needed to address climate. They range from wind farms and solar and hydropower plants, to rail transport and building sea walls in cities threatened by rising sea levels. Only a small portion of these bonds have actually been labelled as green or climate bonds by their issuers.

Certified Climate Bond: A Climate Bond that is certified by the Climate Bonds Standard Board as meeting the requirements of the Climate Bonds Standard, as attested through independent verification.

Climate Bonds Standard (CBS): A screening tool for investors and governments that allows them to identify green bonds where they can be confident that the funds are being used to deliver climate change solutions. This may be through climate mitigation impact and/ or climate adaptation or resilience. The CBS is made up of two parts: the parent standard (Climate Bonds Standard 2.1) and a suite of sector specific eligibility requirements. The parent standard covers the certification process and pre- and post-issuance requirements for all certified bonds, regardless of the nature of the capital projects. The Sector Criteria detail specific requirements for assets identified as falling under that specific sector. The latest version of the CBS is published on the Climate Bonds Initiative website

Climate Bonds Standard Board (CBSB): A board of independent members that collectively represents $34 trillion of assets under management. The CBSB is responsible for approving i) Revisions to the Climate Bond Standard, including the adoption of additional sector Criteria, ii) Approved verifiers, and iii) Applications for Certification of a bond under the Climate Bonds Standard. The CBSB is constituted, appointed and supported in line with the governance arrangements and processes as published on the Climate Bonds Initiative website.

Climate Bond Certification: allows the issuer to use the Climate Bond Certification Mark in relation to that bond. Climate Bond Certification is provided once the independent Climate Bonds Standard Board is satisfied the bond conforms with the Climate Bonds Standard.

Green Bond: A Green Bond is one in which proceeds are allocated to environmental projects. The term generally refers to bonds that have been marketed as "Green". In theory, Green Bonds proceeds could be used for a wide variety of environmental projects, but in practice they have mostly been the same as Climate Bonds, with proceeds going to climate change projects.

Technical Working Group (TWG): A group of key experts from academia, international agencies, industry and NGOs convened by the Climate Bonds Initiative. The TWG develops Sector-Specific Criteria - detailed technical criteria for the eligibility of projects and assets as well as guidance on the tracking of eligibility status during the term of the bond. Their draft recommendations are refined through engagement with finance industry experts in convened Industry Working Groups and through public consultation. Final approval of Sector Criteria is given by the CBSB.

Water Assets: Engineered, nature-based and hybrid water infrastructure for the purposes of water collection, storage, treatment or distribution, or for flood protection or drought resilience.

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2. Introduction

2.1. Purpose & use of the document

The Water Infrastructure Criteria of the Climate Bonds Standard are intended to provide transparent, verifiable, science-based Criteria for screening water infrastructure projects proposed for inclusion under a Certified Climate Bond. They enable issuers to participate in the certified green bond market, and investors to be confident that their investment is being used for climate-compatible water infrastructure projects.

The Water Infrastructure Criteria themselves are detailed in the full Water Infrastructure Criteria document. That document details the scope of water infrastructure assets and projects eligible for inclusion in a use-of-proceeds Certified Climate Bond, and the conditions of that eligibility. Those conditions may include the conduct of a Mitigation Assessment and/ or and Adaptation and Resilience Assessment. Readers are directed to that document, available at http://www.climatebonds.net/standard/water, for full information on when such Assessments are needed in respect of water infrastructure projects, and how eligibility is thereby assessed and determined.

This document is a supplementary note to the Water Infrastructure Criteria, to be read and used in conjunction with them. It provides supplementary guidance for conducting Mitigation and Adaptation & Resilience assessments under the Criteria.

2.2. Contents of this document

Applying the Water Infrastructure Criteria of the Climate Bonds Standard requires evaluating proposed projects' climate mitigation impacts, and their ability to address and contribute to aspects of climate adaptation and resilience.

The former is evaluated via a Mitigation Assessment. Section 4 includes specific guidance on this.

The latter is evaluated via an assessment of the Vulnerability Assessment and Adaptation Plan prepared by the issuer. This assessment is based on a scorecard methodology, comprising a series of binary questions. In Section 5, each of these questions are reviewed in turn, to help you better interpret what each one means and what materials are needed to evaluate compliance. A brief description of the documentation needed is given, as well as a relevant example for illustrative purposes. Many of the examples used in this guide come from a recent bond scoring the public utility the San Francisco Public Utilities Commission, and are tailored more to public utility bonds, but the Guide is intended to be applicable in a variety of contexts.

In addition, Section 5 provides general guidance applicable to conducting both Mitigation and Adaptation and Resilience Assessments.

3. General Guidance

Readers of this Guidance Note are reminded that all bonds certified under the Climate Bond Standard must also comply with the common requirements set for all certified bonds, as well as sector-specific Criteria. These common requirements are contained in the Parent Standard 2.1. See Standards webpage for this.

More specifically to water infrastructure related bonds, it is also highlighted that the CBI expects that any bond-issuing entity seeking certification under the Water Infrastructure Criteria is aware of and in compliance with acceptable guidelines or existing standards related to social and human rights and broader environmental considerations in the context of water development. Appendix 2 of the Water Infrastructure Criteria document lists key best practice guidelines in this regard.

In addition, the following clarification points apply more specifically to both the conduct of the Mitigation Assessment and the Adaptation & Resilience Assessment.

3.1.1. Building on existing references and information sources

Climate mitigation — greenhouse gas accounting — has been well understood by the finance sector for some time, and Mitigation Assessment represents a widespread and well-understood process for the finance and verifier communities, and the methodology described here should be familiar.

Terms such as Vulnerability Assessment and Adaptation Plan are much less well understood or appreciated by finance audiences, but they have been standard practice in water management, infrastructure design and planning, and reoperation and evaluations systems globally for some years. The best practice for most long-lived infrastructure investments has increasingly included evaluating climate risks (Vulnerability Assessment) and preparing contingencies to address those risks (Adaptation Plan), particularly for water-related investments. Many institutions have already switched to mandatory climate risk reports or "climate proofing" procedures, and climate adaptation and risk assessment staff are widespread and common. They are not unusual or exotic processes or types of documents to request. For instance, the City of San Francisco, California, requires climate risk assessments for all infrastructure investments and allocates support staff to this process.

Supporting documentation for the San Francisco example given includes documents produced by the California Department of Water Resources, State Water Resources Control Board, the U.S. Environmental Protection Agency, and the U.S. Geological Survey. Nearly all of the examples used in this guide were accessed electronically, and links are provided where available. And reaching out to personnel to these types of agencies (and the staff in your own organization that interacts with them) can aid immensely in the completion of this assessment.

Because the Adaptation and Resilience Assessment in particular will likely require input from multiple municipal departments, this Guidance is also aimed at connecting investors, underwriters, and auditors to their counterparts in legal, engineering, and environmental compliance – this will be essential in gathering the necessary information to complete the Assessment. In many, if not all cases, the documentation and evidence required will already exist within the issuing organization or be publicly available.

3.1.2. Project boundaries

When describing projects that are fully new, the project boundaries should be clear. But for expansions or modifications to existing facilities, the lines may be harder to define. For this, the following guidelines are given:

- If a utility is upgrading or modifying an existing facility, in general, the evaluation should be limited to the use of proceeds, rather than the whole facility being considered and scored.
- If some components for the modification to an existing facility have a longer operational lifetime than the overall facility, the latter's operational lifetime should be the standard of judgment.
- For projects that depend on other systems (e.g., electricity supplied by other institutions), the "project" should only include the investment at hand.

4. Conducting a Mitigation Assessment

The Mitigation Component of the Water Infrastructure Criteria is intended to provide transparency over the impact that the use of proceeds will have on GHG emissions, and the degree of mitigation delivered over the operational lifetime of the project or asset.

Where no emissions impact is expected, the issuer must disclose the justification for this finding and provide supporting documentation. This might include circumstances where the investment would not be expected to impact on energy usage, for example.

Where emissions impact is expected, the issuer is required to estimate the GHG mitigation impact that will be delivered over the operational lifetime of the project or asset. This impact should be defined in terms of the decreased emissions or increased sequestration relative to a business as usual baseline.

4.1. Information to be provided by the issuer

The issuer must describe:

- The calculations and assumptions used to arrive at an emissions baseline;
- Projected emissions over the life of the project and associated estimated GHG mitigation impact compared to that baseline;
- A credible, independently verifiable, method of tracking actual emissions and mitigation impact over the life of the bond.

4.2. Assessment Integrity

Both baseline and projected project emissions are theoretical constructs that contain a significant degree of uncertainty. As such, the assumptions, values and procedures used in the mitigation assessment must be conservative to ensure that the GHG emission reductions or removals are not over-estimated.

4.3. Acceptable methodologies for determining baselines and estimated performance against those baselines

The baseline proposed by the issuer may be 'business-as-usual' emissions. Or, in the case of a new asset, it may be a performance standard baseline. For example, CDM Modalities & Procedures allow for the use of performance standards to determine baselines, e.g. a baseline may be derived as "The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category" (para. 48 of the CDM Modalities & Procedures at http://www.cdmrulebook.org/337.html).

Baselines will vary depending on infrastructure type and all of the methodologies discussed in this section have infrastructure-specific guidelines for baseline emissions calculation.

Baselines can be determined using credible methodologies such as (but not limited to):

- The UNFCCC's Clean Development Mechanism (CDM),
- Climate Action Reserve,
- American Carbon Registry
- National and state / provincial approaches or any other credible, robust methodology.

Below are brief descriptions and links to four different GHG mitigation methodologies that the issuer may wish to use for the mitigation assessment.

- In the United States, the American Carbon Registry (ACR), developed by Winrock International, publishes standards, methodologies, protocols and tools for greenhouse gas (GHG) accounting, which are all based on International Standards Organization (ISO) 14064 and are routinely reviewed to ensure they reflect sound scientific practice. Proposed water climate bond projects with a wetland restoration component, for example, could use their Wetland Restoration Methodology Framework module: http://americancarbonregistry.org/carbon-accounting/standards-methodologies/restoration-of-degraded-deltaic-wetlands-of-the-mississippi-delta/wr-mf-wl_v2-0.pdf. Projects related to low-GHG emitting water purification systems could use the following methodology: http://americancarbonregistry.org/carbon-accounting/standards-methodologies/low-greenhouse-gas-emitting-safe-drinking-water-production-systems. General information about the ACR can be found here: http://americancarbonregistry.org/carbon-accounting
- In Australia, the Emissions Reduction Fund issues Australian Carbon Credit Units (ACCUs) for emissions reductions and publishes its own methodology criteria, developed by the government's Department of Environment and Energy. For information on the approved methodologies for calculating baseline emissions, see the Australian Department of Environment and Energy's sector-specific guidelines here: http://www.environment.gov.au/climate-change/emissions-reduction-fund/methods.
- In the United Kingdom, the UK Water Industry Research (UKWIR) team uses its Carbon Accounting Workbook (CAW) to provide UK water companies with a uniform and transparent approach for GHG emissions accounting that is in line with both the UK Department of Environment Food and Rural Affairs (Defra) Guidelines and Carbon Reporting Commitment (CRC) requirements. The tool itself is not publicly available, but more information for UK companies is available here: https://www.ukwir.org/reports/15-CL-01-22/129644/Workbook-for-Estimating-Operational-GHG-Emissions-Version-9.
- For countries without national mitigation standards, the UNFCCC's Clean Development Mechanism (CDM) provides an accredited system for validating, registering, and monitoring GHG mitigation projects. All potential projects must be validated by a third party agency and approved by the CDM Executive Board. All baseline methodologies currently approved by the CDM Executive Board are listed on their website: https://cdm.unfccc.int/methodologies/standard_base/index.html. Approved CDM methodologies of particular interest to the water sector include (but are not limited to):
    - Energy efficiency and fuel switching measures for industrial facilities: https://cdm.unfccc.int/methodologies/DB/M4LINVAO7Y1OZBCUWFBVZBXT3546LM
    - Methane recovery in wastewater treatment: https://cdm.unfccc.int/methodologies/DB/5JGU2EUK716KG3UAE2HBVCK16K199K
    - Switch from non-renewable biomass for thermal applications by the user: https://cdm.unfccc.int/methodologies/DB/9LFOR81TCT5FLI1AJYP46CQY8O2J79
    - Methane avoidance through separation of solids from wastewater or manure treatment systems: https://cdm.unfccc.int/methodologies/DB/694L0HKMRM81GWPI2HU0MZBHNHSXYB
    - Methane emission reduction by adjusted water management practice in rice cultivation: https://cdm.unfccc.int/methodologies/DB/D14KAKRJEW4OTHEA4YJICOHM26M6BM

Not all GHG reporting methodologies are equally robust; however, most credible GHG reporting programs stem from the World Resources Institute and World Business Council on Sustainable Development's Greenhouse Gas Protocol, which set the global standard for measuring, managing, and reporting GHG emissions. Therefore, using a methodology which is in compliance with the WRI/WBCSD GHG Protocol is strongly recommended. Information on this Protocol is available at http://www.ghgprotocol.org/about-ghgp/about-wri-and-wbcsd

5. Conducting an Adaptation & Resilience Assessment

As noted above, the Adaptation and Resilience Component of the Water Infrastructure Criteria consists of an evaluation of the efficacy and thoroughness of the issuer's Vulnerability Assessment and Adaptation Plan.

What are these documents?

- The Vulnerability Assessment is the document, or series of documents, which both describes the methods and process used to analyze vulnerability and diagnoses and itemizes any relevant climate risks and impacts that have been seen to date and that may emerge over the project's operational lifetime; and
- The Adaptation Plan is the document, or series of documents, that collectively constitute a risk management plan that refers directly to the Vulnerability Assessment, describing responses to address the climate impacts described in the Vulnerability Assessment. How will these risks be reduced or avoided? Has the project been made more robust, or will the management plan need to be reevaluated in several years?
- They are therefore paired 'documents'.

These two documents need not be long. For the purposes of evaluation under the Water Infrastructure Criteria of the Climate Bonds Standard, the issuer's Vulnerability Assessment and Adaptation Plan documents may be usefully summarized into a short document, particularly if the relevant material comes from a number of subsidiary documents. However, a summary document is not mandated by the standard.

Where will you find them?

In most cases, the issuer institution will have formal processes for evaluating and addressing climate impacts, but a communication or awareness gap may exist within institutions between finance and design or planning teams.

Within larger organisations, these documents are often prepared by technical, environmental, or engineering departments — who use them as the basis for developing designs, long-term planning, and defining operating rules. For some organizations (especially for cities), an environment department or agency may be tasked with creating urban or regional Vulnerability Assessments and Adaptation Plans. In some cases, a very specific assessment and plan may be prepared that applies directly to the use of proceeds.

The evidence used to explain or justify particular scores described below may be more complex or technical than the narrative vulnerability assessment and adaptation plan, hence it might come from a mix of sources from a mix of departments and institutions.

Who should carry out the assessment?

It is recommended that the issuer should first self-score their Vulnerability Assessment and Adaptation Plan, including gathering the supporting documentation for the scores proposed, and pass this to the verifier. The verifier will then have the relevant information to carry out their own review of the issuer's Vulnerability Assessment and Adaptation Plan and the provisional scorecard completed by the issuer.

How to carry out the assessment?

The Water Infrastructure Criteria requires the evaluation of the scope and coverage of the issuer's Vulnerability Assessment and Adaptation Plan using a scorecard methodology. The scorecard lists a series of binary questions. The overall score for each section of the scorecard determines whether the project is eligible for certification per the terms of the Adaptation and Resilience Components of the Water Infrastructure Criteria.

Further information on the scoring thresholds used to determine whether overall the completed scorecard meets the eligibility requirements of the Adaptation & Resilience component of the Water Infrastructure Criteria is given in the Water Infrastructure Criteria document available at http://www.climatebonds.net/standard/water.

What supporting evidence is required?
For each question, "evidence" of analysis / research, or "disclosure" of the relevant regulatory, governance, or legal documents is required.

For example, allocation question #3 asks, "Is there a distinction between the allocation regimes used in "normal" times and in times of "extreme/ severe" water shortage?" Evidence to document this could be an urban water plan that lays out adjusted water allocation schedules planned under a variety of climate scenarios. Disclosure might be a link to relevant regulations or statutes in the state or national water code that mandates allocation adjustments during times of extended or extreme water shortage.

Further examples are incorporated in this document for your reference.

5.1. Working through the Scorecard

The first three parts of the scorecard evaluate the issuers' Vulnerability Assessment. These three parts are: Allocation, Governance, and Diagnostic Assessment. Each part consists of a number of associated questions.

- Part 1: Allocation addresses how water is shared by users within a given basin or aquifer. With regard to the proposed bond project, this element of the scorecard concentrates on the potential impact(s) of bond proceeds on water allocation. This is important in the context of climate adaptation as future uncertainty regarding water supply may impact allocation amounts over time and it is important for any bond projects to take water allocation mechanisms into account.
- Part 2: Governance addresses how / whether the use of proceeds takes into account the ways in which water will be formally shared, negotiated, and governed. Strong water governance is important in ensuring compliance with allocation mechanisms and helps protect water resources from conflict, overuse, waste, and degradation.
- Part 3: Diagnostic Assessment addresses how / whether the use of proceeds takes into account changes to the hydrologic system over time. Is the project infrastructure and / or ecosystem resilient to current and projected climate change impacts on water resources within the basin? For this element, the use of a credible hydrologic model is essential to understanding current and future conditions within the watershed or aquifer in question.

Sections 5.1.1 to 5.1.3 go through each question in turn across these three parts respectively, providing guidance on how each question should be interpreted, and the specific nature of evidence required and potential sources for that information.

The fourth part of the Scorecard includes 5 questions to assess the Adaptation Plan (were one needed). Section 5.1.4 goes through each of these questions in turn, providing guidance on how each question should be interpreted, and the specific nature of evidence required and potential sources for that information.

5.1.1. Section I of the Scorecard: ALLOCATION Scoring Guide

The first section of the Scorecard deals with how the Vulnerability Assessment addresses water allocation and regulation within the relevant basin or aquifer. Water allocation mechanisms are usually set by the state or local water regulatory agency.

In the United States, much of this information is now available online, but reaching to agency staff may also be helpful in collecting evidence / disclosure information.

Question 1.1: Are there accountability mechanisms in place for the management of water allocation that are effective at a sub-basin and/or basin scale?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: In order to score 1 on this question, there must be water allocation verification or compliance mechanisms in place not only at the project or municipal level, but at the relevant hydrologic scale (for surface water: the river basin or sub-basin, for groundwater: the aquifer). Sustainable water resource management requires a connection between management at the project and the hydrologic scale as they influence and impact one another. Disclosure in this case could include copies of the relevant water code statutes, compliance mechanisms, or water management plans. Any verification or compliance mechanism must also have the authority and ability to apply penalties, sanctions, or another type of disciplinary action for non-compliance.

Example from San Francisco, CA: A mixture of state, federal, special commissions and agencies, and lower-level organizations manage water across the San Francisco Bay / Sacramento River Delta region. The public utility's projects must be in compliance with these regulatory institutions or they will face sanction under the State Water Code.

Relevant committees / regulatory agencies for this region include:

- Delta Protection Act / Delta Protection Committee: The Delta Protection Act of 1992 created The Delta Protection Commission, codified in the Public Resources Code (PRC) beginning with section 29700. The Act declares that, "the Delta is a natural resource of statewide, national, and international significance, containing irreplaceable resources, and that it is the policy of the State to recognize, preserve, and protect those resources of the Delta for the use and enjoyment of current and future generations, in a manner that protects and enhances the unique values of the Delta as an evolving place." PRC Section 29760-29767 further instructs that, "Not later than October 1, 1994, the commission shall prepare and adopt, by a majority vote of the membership of the commission, and thereafter review and maintain, a comprehensive long-term resource management plan for land uses within the primary zone of the delta." http://www.delta.ca.gov/Delta_Protection_Act.htm
- The State Water Resources Control Board (State Water Board) is responsible for developing and modifying the Bay-Delta Water Quality Control Plan, which establishes water quality control measures needed to provide reasonable protection of beneficial uses of water in the Bay-Delta Watershed.
    - Bay-Delta Water Quality Control Plan: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf
    - San Francisco Regional Water Quality Control Board: http://www.waterboards.ca.gov/sanfranciscobay/board_decisions/enforcement.shtml
- Delta Stewardship Council
    - Delta Management Plan (effective September 1, 2013): The Delta Reform Act of 2009, which created the Delta Stewardship Council (Council), requires that the Council adopt a legally enforceable Delta Plan to further the achievement of the coequal goals of providing a reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. http://deltacouncil.ca.gov/delta-plan-regulations
- U.S. Fish & Wildlife Service
    - Bay Delta Fish & Wildlife Office: The Bay-Delta office handles Endangered Species Act listings for the delta, and coordinates environmental monitoring and planning at the ecosystem level: https://www.fws.gov/sfbaydelta/es/endangered_species.cfm. The Fish & Wildlife Service also manages the National Wildlife Refuge System, operates fish hatcheries and fishery resource offices, enforces Federal wildlife laws, manages migratory bird populations, conserves and restores habitats

such as wetlands, and oversees a Federal Aid program that distributes hundreds of millions of dollars to State fish and wildlife agencies. https://www.fws.gov/sfbaydelta/index.cfm

- U.S. Bureau of Reclamation
    - Central Valley Project: The project was initially implemented primarily to protect the Central Valley from chronic water shortages and floods, but the CVP also improves Sacramento River navigation, supplies domestic and industrial water, generates electric power, conserves fish and wildlife, creates opportunities for recreation, and enhances water quality. The Bureau of Reclamation is in charge of water supply allocation for all CVP contractors. Relevant federal statutes are found here: http://www.usbr.gov/mp/cvpia/index.html, and disclosure of annual CVP water allocation is here: http://www.usbr.gov/mp/cvp-water/.

Question 1.2: Are the following factors taken into account in the definition of the available resource pool?

1. Non-consumptive uses (e.g., navigation, hydroelectricity)
2. Environmental flow requirements
3. Dry season minimum flow requirements
4. Return flows
5. Inter-annual and inter-seasonal variability
6. Connectivity with other water bodies
7. Climate change impacts

Scoring: 1 point each for yes, maximum of 7 points, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Evidence of these criteria, expanded upon below, should be included in the relevant water management plan. What each of these factors mean:

1. Non-consumptive use refers to water uses that do not diminish the amount of water moving through the hydrologic system or significantly alter its quality for other uses. During non-consumptive use, water is either left instream or, if it is diverted, is returned immediately to the source following its use in the same quantity and quality as when it was diverted.
2. For surface water, are there requirements in place for instream flow levels necessary to maintain the ecological function of the water resource and its ecosystem?
3. Most free-flowing waters experience seasonal fluctuations in water levels. For the waterway in question, are there minimum flow requirements in place during dry/low-flow periods?
4. While return flows are notoriously hard to quantify, are measurements being taken or models employed to estimate the amount of water that is returned to the resource pool once it has been used?
5. As previously mentioned, most surface and some groundwater resources experience flow variability over different timescales, due in part to seasonal changes in precipitation, temperature, the consumptive use rate, land cover / land use change, and interannual climate patterns such as the El Niño Southern Oscillation (ENSO). Do the resource availability reports take these fluctuations into account?
6. Availability reports should also note whether or not the water resource in question is hydrologically connected to other water resources such as an aquifer, lake, or a larger stream network or basin, as use of the resource in one area could have a wider impact on these interconnected systems.
7. Does the availability report mention climate change and any predicted impacts climate could have on the resource's availability over time?

Example from San Francisco, CA: These factors are governed at the state level by the CA State Water Board, as well as a variety of specialty groups, such as the San Francisco Public Utilities Commission (PUC), federal and state navigation standards, SWB and US EPA environmental flow requirements, and CA energy governance committee.

Evidence/ disclosure information requirements sourced from CA State Water Resources Control Board Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem document: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf.

Question 1.3: Is there a distinction between the allocation regimes used in "normal" times and in times of "extreme/severe" water shortage?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Within the relevant water resource management plan(s), is there an arrangement in place for modifying water deliveries (measured as either volume or percentage, or both) during times of extended or extreme drought? Evidence of this would be a section of the water management plan addressing current / potential water shortages and how allocation is / will be modified during those times.

Examples from San Francisco, CA: The SFPUC's Urban Water Management Plan differentiates between allocation under normal conditions and both short-term (1 year) and longer-term (2-4) year drought conditions. The reduced allocations during water shortage years are based on a percentage of the total volume delivered under normal conditions. For example, during a 1 critical dry year, allocation is cut by 10% system-wide; for years 2-4, system-wide allocation is cut by 22%. These shortage allocations are further divided between retail public utility customers and wholesale users. The 2015 Urban Water Management Plan could be used as Evidence for this question: http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=8838. The U.S. Bureau of Reclamation also adjusts its annual CVP water allocation plans based on drought conditions. The most recent example from 2016 is available here: http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/tucp/docs/febnov_2016plan.pdf, and could be supplied as Evidence.

Question 1.4: What arrangements are in place, if any, to accommodate the potentially adverse impacts of climate change on the resource pool?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Are there plans in place to monitor the status of the water resource in question over time and, if necessary, revise existing laws and regulations should the water be negatively affected by future climate change? In order to score a 1 in this category, the relevant water management plan(s) should employ the best available science to monitor the resource and formulate a plan for addressing negative climate impacts.

Example from San Francisco, CA: The SFPUC's 2010 and 2015 Urban Water Management Plans both outline impacts to date and alternative plans for handling crisis periods: http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=8838. Additionally, the CA Department of Water Resources published a detailed Climate Change Handbook for Regional Water Planning in 2011 that addresses anticipated climate impacts to regional water supplies, as well as response protocols. Available here: http://www.water.ca.gov/climatechange/CCHandbook.cfm. In 2015, the State Water Board adopted new drought emergency regulations to deal with extended water shortages: http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/emergency_regulations.shtml. Any of these examples could be used as Evidence in this scoring exercise.

Question 1.5: Are there plans to define "exceptional" circumstances, such as an extended drought, that influence the allocation regime? (E.g., triggers water use restrictions, reduction in allocations according to pre-defined priority uses, suspension of the regime plan, etc.)

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Increasing variability in flow can necessitate flexibility in water allocation by the relevant government agency or public utility. Do extended or extreme drought conditions currently trigger changes by the government agency or public utility to the allocation regime? Examples that could be used as Evidence include water use restrictions or reduction in allocation authorized / mandated by the state water code.

Example from San Francisco, CA: The California Water Code's Urban Water Management Planning statute mandates an urban water shortage contingency analysis for water providers that includes, "Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply, and an outline of specific water supply conditions that are applicable to each stage." As mentioned in question #3, the SFPUC's 2015 Urban Water Management Plan has outlined a water shortage contingency plan with single and multiple dry year allocation reductions, which could be supplied of Evidence: http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=8838.

Question 1.6: For international / transboundary basins, is there a legal mechanism in place to define and enforce water basin allocation agreements?

Scoring: 1 if yes, 0 if no, or N/A if the basin is not shared by two or more countries
Evidence or Disclosure: Disclosure

What this means: If two or more countries share the river basin or aquifer in question, is there a treaty or other bi/multilateral agreement in place to A) Allocate water between the basin countries and, B) Enforce those allocations? For the purposes of this scoring exercise, the existence of a shared use treaty or agreement between the riparian countries constitutes Disclosure.

Example from the United States and Canada: The International Joint Commission (IJC), authorized by the 1909 Boundary Waters Treaty resolves all transboundary water-related disputes between the United States and Canada and constitutes Disclosure for this question. These rulings are legally binding for all parties. From the IJC's website:

> "The International Joint Commission prevents and resolves disputes between the United States of America and Canada under the 1909 Boundary Waters Treaty and pursues the common good of both countries as an independent and objective advisor to the two governments.
>
> In particular, the Commission rules upon applications for approval of projects affecting boundary or transboundary waters and may regulate the operation of these projects; it assists the two countries in the protection of the transboundary environment, including the implementation of the Great Lakes Water Quality Agreement and the improvement of transboundary air quality; and it alerts the governments to emerging issues along the boundary that may give rise to bilateral disputes."
> http://www.ijc.org/en_/IJC_Mandates

Question 1.7: Are water delivery agreements defined on the basis of actual in situ seasonal/annual availability instead of volumetric or otherwise inflexible mechanisms?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Water delivery amounts can be based on a discrete volume, such as 200 mgd (million gallons per day) or as a percentage of the total resource block available at any given time. In the latter case, the actual volume delivered may fluctuate depending on the season or annual/decadal precipitation patterns that impact the total resource pool. Percentage-based water delivery agreements that take these fluctuations into account are preferable because they are better able to respond and adjust in times of shortage. Evidence for the type of water delivery mechanisms being used in the basin will most likely be found in the relevant water delivery agreement or regulatory statute.

Example from San Francisco, CA: Water delivery to Central Valley Project customers are based on in situ conditions. According to the U.S. Bureau of Reclamation, CVP water delivery amounts are made annually and based on "factors that include hydrology, changing river and Delta conditions, storage in CVP reservoirs, regulatory requirements, court decisions, biological opinions, environmental considerations, operational limitations and input from other agencies and organizations." More information here: http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=52228

Question 1.8: Has a formal environmental flows (e-flows)/sustainable diversion limits or other environmental allocation been defined for the relevant sub-basin or basin? If preexisting, has the environmental flows program been updated to account for the new project?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Environmental (also called 'instream') flow refer to the quantity, quality, and timing of water moving through the hydrologic system required to maintain basic ecological function of the ecosystem, as well as meet the needs of the aquatic and terrestrial communities dependent upon it. Environmental flows are left instream and cannot be used for a non-ecosystem purpose. These can be a volumetric amount, i.e., 30 cfs (cubic feet per second), or a percentage of total flow. Evidence of environmental flow allocation will be most likely found it the relevant water management plan.

Example from San Francisco, CA: An interagency group has developed a Bay-Delta watershed management plan, which includes city, country, state, and federal entities. The plan allocates environmental flow targets and is regularly updated. Referencing this Program would count as evidence for this question: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/final_rpt.shtml. Similarly, for the Tuolumne River, a detailed SFPUC instream flow plan has been prepared and could also be used for Evidence purposes: , http://utrep.blogspot.com/2014/04/draft-oshaughnessy-dam-instream-flow.html.

Example from the Potomac River basin, USA: Evidence of environmental flow criteria can be found in the 2013 Middle Potomac River Watershed Assessment: Potomac River Sustainable Flow and Water Resources Analysis, produced by the United States Army Corps of Engineers, Baltimore District, The Nature Conservancy, and the Interstate Commission on the Potomac River Basin. Available here: https://www.potomacriver.org/wp-content/uploads/2015/09/MPRWA_FinalReport_April20141.pdf

Question 1.9: Have designated environmental flows / allocation programs been assured / implemented?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Either

What this means: If there are regulatory environmental or instream flow requirements in place, are there monitoring or other verification mechanisms to ensure that these requirements are being met? Disclosure of the relevant statute or Evidence of an instream flows monitoring program could be used to satisfy verification requirements for this question.

Example from San Francisco, CA: Instream flow criteria, as mandated under the Bay-Delta Plan, are monitored by the State Water Resources Control Board as well as the Delta Independent Science Board, and is now being implemented: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/

Question 1.10: Has a mechanism been defined to update the environmental flows plan periodically (e.g., every 5 to 10 years) in order to account for changes in allocation, water timing, and water availability?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: To ensure that environmental flow requirements reflect conditions in the stream or aquifer, as well as the best available science, allocation plans should have mechanisms for periodic review built-in to allow changes to flows based on (potentially) changing environmental requirements. Evidence would be documentation in the water management plan that outlines periodic review processes.

Example from the Trinity River basin, California, USA: Environmental flow requirements are managed by the multi-agency Trinity River Restoration Program, monitored, and updated periodically as part of their Adaptive Environmental Assessment and Management (AEAM) program. More information about the Trinity River environmental flow program is available here: http://www.trrp.net/restore/flows/.

Example from San Francisco, CA: The SFPUC's Urban Water Management Plans also require an update every 5 years to ensure they reflect current conditions and the best available science. From the State Water Code's Urban Water Management Planning section: "10621. (a) Each urban water supplier shall update its plan at least once every five years on or before December 31, in years ending in five and zero."
http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=8838

Question 1.11: Is the amount of water available for consumptive use in the resource pool linked to a public planning document? (E.g., a river basin management plan)

A. Yes, the limit is linked to a river basin management plan
B. Yes, the limit is linked to another planning document, please indicate:
C. No, the limit is not linked to any planning document

Scoring: If A or B, 1; if C, 0
Evidence or Disclosure: Evidence

What this means: Consumptive use refers to any water use that removes available water from the system without returning it (e.g., domestic consumption, crop irrigation, or industrial manufacturing). Is the total volume or percentage dedicated for consumptive uses tied to a broader river basin management plan that takes both consumptive and non-consumptive uses into consideration? The relevant planning document constitutes Evidence for this question.

Example from San Francisco, CA: The State Water Board implements the Basin Plan. All designated beneficial uses, including all consumptive uses, are tied to the Basin Plan:

"By law, the Water Board is required to develop, adopt (after public hearing), and implement a Basin Plan for the Region. The Basin Plan is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the Region. The plan must include:

- A statement of beneficial water uses that the Water Board will protect;
- The water quality objectives needed to protect the designated beneficial water uses; and
- The strategies and time schedules for achieving the water quality objectives."

http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/bp_ch1.shtml#1.4.

Question 1.12: If present, is the river basin plan a statutory instrument that must be followed rather than a guiding document?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Either

What this means: Does the planning document referenced in question 11 have legally binding compliance mechanisms in place? Most likely this will require Disclosure of the relevant statute, but Evidence of compliance mechanisms within the basin plan is also acceptable.

Example from San Francisco, CA: The Bay-Delta Plan is required and authorized under California Water Code Section 85000 (The Delta Reform Act of 2009):
http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200920107SB1&search_keywords.
As such, it is a statutory document, requiring compliance with the criteria developed by the plan. More information is available here: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/.

5.1.2. Section II of the Scorecard: GOVERNANCE Scoring Guide

The section of the Scorecard includes the following questions relating to how the Vulnerability Assessment addresses the policy and governance mechanisms in place to manage and ensure user compliance with relevant water regulations.

Question 2.1: How are water entitlements defined?

A. Purpose that water may be used for
B. Maximum area that may be irrigated
C. Maximum volume that may be taken in a nominated period
D. Proportion of any water allocated to a defined resource pool
E. No formal definition exists

Scoring: A - D = 1; E = 0; n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Water can be allocated in a variety of ways – by usage type, maximum volume, etc. In many places, multiple criteria are used. The most common allocation methods are included (A-D) in this question. While answers A-D all achieve a score of 1, from an adaptive water governance perspective, answer D is preferable. Water allocation should be proportional to the amount available within the resource pool to give flexibility during times of shortage and ensure enough water remains instream to ensure proper ecosystem function.

This question requires Disclosure in the form of the legal statute or document that defines how water entitlements are measured. In the United States, this is often found in the state water code.

Example from San Francisco, CA: Both A and D. California, like many U.S. states, has a list of approved "beneficial uses" to which water can be allocated. Beneficial uses include things like navigation, human consumption, irrigation, industrial use, and ecosystem services (i.e., "environmental flows"). According to the state water code, water cannot be allocated for use in any way that is not covered by the list. Disclosure from the state water code:

> Article 4. Beneficial Use [1240. - 1244.] (Article 4 enacted by Stats. 1943, Ch. 368.) § 1240. The appropriation must be for some useful or beneficial purpose, and when the appropriator or his successor in interest ceases to use it for such a purpose the right ceases. (Enacted by Stats. 1943, Ch. 368.) http://www.waterboards.ca.gov/laws_regulations/docs/wrlaws.pdf.

California also allocates water proportionally based on maximum volume available. This comes into play primarily during times of drought, when the State Water Resources Department can adjust the percentage of water deliveries made to State Water Project (SWP) permittees, and Water Code section 1058.5 mandates that the State Water Resources Control Board must curtail water diversions when sufficient flows in a watershed are not available because the water is needed to satisfy senior rights or provide a correlative share of equally senior rights (i.e., riparian rights), or is needed to meet public trust and water quality requirements. Disclosure: http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=01001-02000&file=1050-1060.

Question 2.2: Is the surface water system currently considered to be:

A. Over-allocated
B. Over-used
C. Neither over-allocated nor over-used

Scoring: A = 0.5, B = 0, C = 1, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: A. Over-allocation means that the current usage rate is within sustainable limits but there would be a problem if all legally approved entitlements to abstract water were used at their full allotment. Over-used refers to a situation where existing abstractions exceed the estimated proportion of the resource that can be taken on a sustainable basis. Evidence of either of these conditions could be in the form of a basin report or water resources management plan that shows allocation and withdrawal percentages for the given waterway or aquifer.

Example from San Francisco, CA: The Sacramento-San Joaquin basin is currently over-allocated, meaning that there is not enough water in the system to sustainably supply existing allocation agreements and water rights, while leaving enough water instream to provide ecosystem services. This has led to chronic shortages and considerable water stress, particularly during the current drought, which began in 2012. This water rights allocation report, completed by scientists at the University of California – Davis, shows high levels of over allocation for the Sacramento, Tuolumne, and San Joaquin rivers: https://watershed.ucdavis.edu/files/biblio/WaterRights_UCDavis_study.pdf.

Question 2.3: If monitored and the investment uses groundwater, is the groundwater water system currently considered to be:

A. Over-allocated
B. Over-used
C. Neither over-allocated nor over-used

Scoring: A = 0.5, B = 0, C = 1, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Similar to the previous question, except referring to groundwater withdrawals. Only relevant if groundwater is being used by the proposed bond project. Evidence of this would be an aquifer study or monitoring report that shows current allocation and aquifer withdrawals.

Example from Australia: Groundwater in the Australian states of South Australia and Victoria are cooperatively managed and monitored under the 1985 Victoria-South Australia Groundwater Agreement. According to the Border Groundwaters Agreement Review Committee (BGARC), several of the shared aquifers are over-used meaning they are being withdrawn faster than they can be sustainably replenished. Thus, if the potential bond project planned to withdraw water from one of these over-used aquifers, they would receive a score of 0 on this question. The most recent annual report from the BGARC is available here: http://www.parliament.sa.gov.au/HOUSEOFASSEMBLY/BUSINESSOFTHEASSEMBLY/RECORDSANDPAPERS/TABLEDPAPERSANDPETITIONS/Pages/TabledPapersandPetitions.aspx?TPLoadDoc=true&TPDocType=0&TPP=53&TPS=2&TPItemID=536&TPDocName=SA%2BVic%2BGroundwaterARC%2BThirtieth%2BAnnual%2Breport_final.pdf.

More information on the 1985 Victoria-South Australia Groundwater Agreement here: http://archive.nwc.gov.au/home/water-governancearrangements-in-australia/cross-boundary-arrangements/victoria-south-australia-border-groundwater-area

Question 2.4: How are limits on the amount/rate of abstraction defined?

A. There is a limit in the volume of water that can be abstracted
B. There is a limit to the proportion (e.g. percentage) of water that can be abstracted
C. There are restrictions on who can abstract the water (but no limit on how much water can be abstracted)
D. There is no explicit limit on water abstraction

Scoring: A = 0.5, B = 1, C = 0.5, D = 0, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Within the relevant water management plan, have the upper limits of water withdrawal been defined? If so, how are they defined? The ideal limitations are proportional to the in situ amount of water available in the pool, since water levels can and do fluctuate. If the withdrawal limits are based on a total volume, during times of low flow, it may mean that the water withdrawn either reduces the resource pool to the point of ecosystem impairment, or fully depletes the resource. Degraded habitat can lead to degraded water quality and quantity, further reducing the amount of water available. On the other hand, if withdrawal limits are proportional, when water levels drop, so too does the amount withdrawn, ensuring that more is left instream for ecosystem use.

Example from the United Kingdom: The UK Environment Agency sets abstraction limits using the percentage of the total resource pool. More information on water abstraction limits can be found in this document, which also serves as Evidence for this question: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297309/LIT_4892_20f775.pdf

Question 2.5: Are governance arrangements in place for dealing with exceptional circumstances (such as drought, floods, or severe pollution events), especially around coordinated infrastructure operations?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Are there laws, policies, statutes, or management regulations in place to manage water infrastructure during emergency situations? This is relevant for all water infrastructure, but particularly important for combined systems such as stormwater, wastewater, and drinking water treatment facilities. Disclosure might include the relevant statutes or laws governing emergency circumstances.

Example from San Francisco, CA: Yes, there are explicit plans for extreme events including drought, flooding, and severe pollution, crossing a number of institutional levels. The most relevant for this issuance are described in the Urban Water Management Plan:

Also, emergency water rights curtailments are allowed under Water Code section 1058.5, which mandates that the State Water Resources Control Board must curtail water diversions when sufficient flows in a watershed are not available because the water is needed to satisfy senior rights or provide a correlative share of equally senior rights (i.e., riparian rights), or is needed to meet public trust and water quality requirements. Disclosure: http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=01001-02000&file=1050-1060.

Example from Potomac River: Yes, the ICPRB holds annual drought exercises and manages reservoir operations during times of drought; they also coordinate emergency spill operations. More information is available on their website here: https://www.potomacriver.org/focus-areas/water-resources-and-drinking-water/

They are also tasked with completing the Comprehensive Management Plan for the Potomac River, which is currently being finalized. More information about the comprehensive plan is available here: https://www.potomacriver.org/focus-areas/water-resources-and-drinking-water/water-resources/planning/basin-wide-comprehensive-plan/

Question 2.6: Is there a process for re-evaluating recent decadal trends in seasonal precipitation and flow OR recharge regime, in order to evaluate "normal" baseline conditions?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Baseline conditions refer to the recorded "status-quo" surface water levels or aquifer (groundwater) recharge rate at any given time during the year. Climate change and other factors such as land use and withdrawal rates can alter these baselines over time, reducing their accuracy and usefulness in planning and allocating water from the resource pool. As such, it is important that periodic review is undertaken by the relevant water resources management division to determine if the baseline conditions are in fact changing and if a change in withdrawal rates / volume is thus warranted. In order to score a 1 on this question, there must be a sanctioned review process in place within the water management plan to monitor baseline conditions over time and update the plan if and when necessary. Disclosure would be the management plan itself.

Example from San Francisco, CA: Yes. The Urban Water Management Plan is a periodic review document, based on recent trends in water usage and flows. In accordance with the Urban Water Management Planning Act (California Water Code Division 6, Part 2.6, Sections 10610 through 10656), the plan is updated every 5 years. Disclosure: http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=8839

Question 2.7: Is there a formal process for dealing with new entrants?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: When there are prospective water users desiring to use the resource pool, are there formal permitting processes in place to determine if there is enough water to allocate to the new user(s), what uses are allowed, how much they can withdraw, from which point, at what rate, etc.? This will most likely be found in the state or national water code; Disclosure consists of the relevant statue or law regarding the water permitting process.

Example from San Francisco, CA: In the western United States, each state has its own water permitting process based on the doctrine of prior appropriation, also known as first-in-time, first-in-right. In California, the State Water Board defines and regulates the water rights permitting application process. Detailed information on this process can be found here: http://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.shtml; the Water Rights Commission Act of 1914, which established the water permitting system, is available here: http://repository.uchastings.edu/cgi/viewcontent.cgi?article=1061&context=ca_ballot_props

Example from Potomac River: New entrants are managed at the state level. In Maryland, for example, there is an extensive permitting process, outlined here: http://www.dsd.state.md.us/comar/SubtitleSearch.aspx?search=26.17.06.*

Question 2.8: For existing entitlements, is there a formal process for increasing, varying, or adjusting use(s)?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Water rights permits typically define the total volume or percentage of the resource pool that can be withdrawn, the rate of withdrawal, season of use, point of diversion, and type of use. If the permit holder wants to change any of these criteria, is there a formal process for them to do so? Like the previous question, Disclosure is likely found in the relevant water rights permitting statute or law.

Example from San Francisco, CA: This process is also defined by the State Water Board. From the Board's website: "Any change in purpose, place of use, or point of diversion requires Board approval. The proposed change cannot initiate a new right or injure any other legal user of water." More information is available here: http://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.shtml#process

Question 2.9: Is there policy coherence across sectors (agriculture, energy, environment, urban) that affect water resources allocation, such as a regional, national, or basin-wide Integrated Water Resources Management (IWRM) plan?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Are water-related policies across sectors and governance scales (local, state, regional, national) consistent with one another? This question returns to the concept of basin-scale planning. If there is a basin or sub-basin management plan in place, does it include inter-agency policy planning guidelines or mechanisms to ensure coherent policies across sectors and scales? Without such provisions in place, laws and regulations can (and do!) contradict or impair one another. Evidence of policy coherence would be the existence of interagency task forces or working groups, or an integrated water management policy or plan.

Example from San Francisco, CA: Inter-agency coherence is managed through several mechanisms. There are interagency processes at the state level, such as the interagency drought task force:

https://www.gov.ca.gov/docs/12.17.13_Drought_Task_Force.pdf, http://drought.ca.gov/; as well as the aforementioned environmental flows work, both of which could be used as evidence of policy coherence across sectors. More information about integrated water management in California can be found here: http://www.water.ca.gov/irwm/resources/ncro.cfm

Question 2.10: Are obligations for return flows and discharges specified and enforced?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Are there expected to be return flows (i.e., water returning to the resource pool following its removal, primarily through sub-surface infiltration or surface runoff) associated with the proposed bond project? Are those flows quantified and, if so, is there monitoring in place to ensure that the water being returned to the source meets applicable water quality requirements?

Example from San Francisco, CA: In California, there is a network of state, local and federal agencies involved in the monitoring of return flows as part of their overall water monitoring programs in the Sacramento – San Joaquin delta.

- The USGS-CA monitoring program is detailed in this brochure: http://pubs.usgs.gov/fs/2015/3061/fs20153061.pdf
- More information is also available through the California Department of Water Resources Data Exchange Center: http://www.cdec.water.ca.gov/

Question 2.11: Is there a mechanism to address impacts from users who are not required to hold a water entitlement but can still take water from the resource pool?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Many water uses with a relatively small withdrawal volume or percentage, such as household use, lawn care, stock watering, etc. are routinely exempt from official entitlement processes, such as permitting requirements. Taken together, however, these withdrawals can make a significant dent in the resource pool. In order to score a 1 on this question, these unregulated withdrawals must be addressed by the water management plan or regulatory framework.

In the case of California, these uses are handled very explicitly, with robust regulatory mechanisms in place. Most of the details are described in relation to the state's Water Boards: http://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.shtml. Relevant text there includes:

- A riparian right entitles the landowner to use a correlative share of the water flowing past his or her property. Riparian rights do not require permits, licenses, or government approval, but they apply only to the water which would naturally flow in the stream. Riparian rights do not entitle a water use to divert water to storage in a reservoir for use in the dry season or to use water on land outside of the watershed. Riparian rights remain with the property when it changes hands, although parcels severed from the adjacent water source generally lose their right to the water….

- The Water Commission Act of 1914 established today's permit process. The Act created the agency that later evolved into the State Board and granted it the authority to administer permits and licenses for California's surface water. The act was the predecessor to today's water Code provisions governing appropriation….

- Permittees run the gamut from water districts and electric utilities to farmers and ranchers. Besides riparian right holders and ground water users, permits are not required of users of purchased water or those who use

water from springs or standing pools lacking natural outlets on the land where they are located. However, unauthorized appropriation of water is against the law and can result in court action and fines.

Other options are possible too. For instance, in an OECD report on water allocation, water users without an explicit (i.e., permitted) entitlement may use quite different systems:

- In Alberta, Canada, in the case of collective entitlements, allocation of water among individual users within a group of users is based on a bargaining process and informal trading. In the Yellow River Basin, China, collective entitlements are assigned to an institution representing water users. Irrigation districts and public water companies access water to consume by paying a fee. In some irrigation districts, authorities assign water abstraction rights to clients under a permit system. For Costa Rica, in the case of collective entitlements, the Ministry of Energy and Environment grants a concession to each Society of Water Users according to the Water Law. These societies have the authority to decide internally the form of water distribution amongst their members through agreements of the general assembly of members, or through their own regulations. In Spain, there are both individual and collective entitlements. Collective entitlements may be granted to Water Users Associations or Irrigators Communities, for instance. Finally, in the case of France, the recently created Single Collective Management Bodies (OUGC) provide a structure and incentives for irrigators to devise their own rules to allocate a set volume of water among themselves at the catchment level. These rules are subject to approval by the Ministry of Ecology, Sustainable Development and Energy. (p. 73, OECD 2015)

Question 2.12: Is there a pre-defined set of priority uses within the resource pool? (E.g., according to or in addition to an allocation regime)

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Many states maintain a list of approved or priority uses for their water resources. These "beneficial" uses often include activities like irrigation, navigation, domestic consumption, energy production, industrial use, recreation, and environmental flows. In order to receive a water permit or right, the applicant must demonstrate that they will use the water for one or more of these sanctioned purposes. Often times, once the permit is granted, the water must go to that designated use and cannot be used for other purposes without a formal change to the permit (this was addressed in question #8). Designated priority uses may also come into play during times of shortage when decisions must be made about which uses continue to receive their full allotment.

Example from San Francisco, CA: Priority usage is clearly defined at the state level.

From the state Water Code
http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/bp_ch2.shtml:

- "The specific beneficial uses for inland streams include municipal and domestic supply (MUN), agricultural supply (AGR),commercial and sport fishing (COMM), freshwater replenishment (FRESH), industrial process supply (PRO), groundwater recharge (GWR), preservation of rare and endangered species (RARE), water contact recreation (REC1), noncontact water recreation (REC2), wildlife habitat (WILD), cold freshwater habitat (COLD), warm freshwater habitat (WARM), fish migration (MIGR), and fish spawning (SPWN). The San Francisco Bay Estuary supports estuarine habitat (EST), industrial service supply (IND), and navigation (NAV) in addition to COMM, RARE, REC1, REC2, WILD, MIGR, and SPWN.
- Coastal waters' beneficial uses include water contact recreation (REC1); noncontact water recreation (REC2); industrial service supply (IND); navigation (NAV); marine habitat (MAR); shellfish harvesting (SHELL); commercial and sport fishing (COMM); wildlife habitat (WILD), fish migration (MIGR), fish spawning (SPWN), and preservation of rare and endangered species (RARE).

- Existing and potential beneficial uses applicable to groundwater in the Region include municipal and domestic water supply (MUN), industrial water supply (IND), industrial process supply (PRO), agricultural water supply (AGR), groundwater recharge (GWR), and freshwater replenishment to surface waters (FRESH). "

Beneficial uses are protected under the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Chapter II): http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/wq_control_plans/2006wqcp/docs/2006_plan_final.pdf.

Question 2.13: If there are new entrants and/if entitlement holders want to increase the volume of water they use in the resource pool, can new entitlements be issued or existing entitlements be augmented?

A. Yes, no restrictions
B. No, catchment is closed
C. Yes, if conditional on:
    - Assessment of third party impacts
    - Environmental impact assessment (EIA)
    - Existing user(s) forgoing use

Scoring: A = 0, B = 1, C = 1 (if conditions include one or more of 1-3, n/a if not applicable
Evidence or Disclosure: Disclosure

What this means: Has the resource pool been fully allocated, meaning that no new permits can be issued? If so, the catchment (basin) is closed. If not, can new permits be issued or existing water permits be enlarged? If so, are there conditions set on the new / revised permits based on potential injury to other users, potential environmental impacts, or the forfeit of usage by current permit holders? For example, in the U.S. state of California, existing water rights can be altered only if they do not cause injury to other permitted users in the basin, including the environment. Disclosure consists of the relevant rules and regulations related to water permitting alterations.

Example from San Francisco, CA: Permits are managed by the State Water Resources Control Board. Changes to permits and the issuance of new permits is allowed, but with restrictions. Permitting regulations are available here: http://www.swrcb.ca.gov/waterrights/water_issues/programs/applications/#permitting.

Question 2.14: Are withdrawals monitored, with clear and legally robust sanctions?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: To score 1 on this question, there must be a verification mechanism in place to monitor withdrawal amounts and ensure compliance with all applicable state and federal water regulations. The public utility, irrigation district, or other monitoring entity must be legally able to apply penalties or sanctions for non-compliance.

Example from San Francisco, CA: Sanctions for illegal water withdrawals are clear, legally binding, and subject to civil and criminal actions. Evidence from the state Water Code: "The State Board also is responsible for investigating possible illegal, wasteful or unreasonable uses of water, either in response to a complaint or on the State Board's own initiative. If the State Board's staff investigation determines that a misuse of water is occurring, the Board generally notifies the affected persons and allows a reasonable period of time to terminate the misuse. The State Board may also hold a hearing to determine if a misuse of water has occurred or is occurring. Water users who do not terminate a misuse of water are subject to various administrative enforcement measures including possible fines and revocation of a permit or license. In appropriate cases, the State Board may also seek judicial relief in the courts."

As of 2015, the State has also adopted even more stringent monitoring and reporting guidelines for water withdrawal infractions, excerpted here:

(D)Upon receipt of information that indicates actual or threatened waste, unreasonable use, unreasonable method of diversion, or unlawful diversions of water by any water right holder, diverter or user. (2) The Deputy Director may issue an order under this article requiring a water right holder, diverter or user to provide additional information related to a diversion or use described in (c)(1), including the claim of right; property patent date; the date of initial appropriation; diversions made or anticipated during the current drought year; basis or right and amount of water transfer not subject to approval of the Board or Department of Water Resources; or any other information relevant to authenticating the right or forecasting use and supplies in the current drought year. (3) Any party receiving an order under this subdivision shall provide the requested information within thirty (30) days. The Deputy Director may grant additional time for submission of information supporting the claim of right upon substantial compliance with the 30-day deadline and a showing of good cause. (4) The failure to provide the information requested within 30 days or any additional time extension granted is a violation subject to civil liability of up to $500 per day for each day the violation continues pursuant to Water Code section 1846.

http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/infomational_order/frm400.pdf.

Question 2.15: Are there conflict resolution mechanisms in place?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Either

What this means: When dealing with water rights, conflicts between users, government officials, and non-governmental organizations are quite common. In order to score 1 on this question, there must be a legally binding dispute resolution mechanism or process in place to deal with these issues when they arise. Disclosure would be the existence of a dispute resolution mechanism, Evidence could be a less formal, i.e., non-statutory, process for addressing and resolving disputes within the water management plan.

Example from the Danube River Protection Convention: This legally binding river management convention includes an Article addressing dispute resolution, which counts as Disclosure for the purposes of this scoring exercise. The two mechanisms they sanction are settlement through the International Court of Justice or through the use of their own arbitration mechanism, outlined in the text.

Article 24

Settlement of disputes

(1) If a dispute arises between two or more Contracting Parties about the interpretation or application of this Convention, they shall seek a solution by negotiation or by any other means of dispute settlement acceptable to the parties to the dispute, if appropriate with assistance by the International Commission. (2)(a) If the parties to the dispute are not able to settle the dispute in accordance with paragraph 1 of this Article within a reasonable time, but not more than twelve months after the International Commission has been notified about the dispute by a party to the dispute, the dispute shall be submitted for compulsory decision to one of the following means of peaceful settlement:

- the International Court of Justice;
- arbitration in accordance with Annex V to this Convention.

(b) When ratifying, accepting, approving or acceding to this Convention or at any time thereafter a Contracting Party may declare in writing to the Depositary that, for a dispute not resolved in accordance with paragraph 1 of this Article, it accepts one or both means of dispute settlement referred to in subpara (a) of this paragraph. (c) If the parties to the dispute have accepted both means of dispute settlement referred to in

subpara(a) of this paragraph the dispute shall be submitted to the International Court of Justice, unless the parties agree otherwise. (d) If the parties to the dispute have not accepted the same means of dispute settlement referred to in subpara (a) of this paragraph, the dispute shall be submitted to the arbitration. (e) A Contracting Party which has not made a declaration in accordance with subpara (b) of this paragraph or whose declaration is no longer in force is considered to have accepted the arbitration.

http://www.icpdr.org/main/icpdr/danube-river-protection-convention.

5.1.3. Section III of the Scorecard: DIAGNOSTIC ASSESSMENT Scoring Guide

This is the final section of the Scorecard that assesses the Vulnerability Assessment. It deals with the technical components of water management and planning, including hydrologic models, historical climate data, and future uncertainty. In order to score well in this section, robust hydrologic models of the water resource in question should be employed by the issuer to ensure that the bond proceeds go towards investments that are robust to future climate scenarios. A good place to start tracking down this information is with your environmental planning or water resources department. Civil engineering may also be a useful resource. For example, in the United States, the U.S. Army Corps of Engineers manages hydrological analysis and climate change preparedness as it relates to U.S. water infrastructure. Reaching out to technical leads within these departments is recommended, as some of the data may not be publicly available or difficult to track down / verify independently.

Question 3.1: Does a water resources model of the proposed investment and ecosystem (or proposed modifications to existing investment and ecosystem) exist? Specify model types, such as WEAP, SWAT, RIBASIM, USACE applications). Scale should be at least sub-basin.

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Hydrological models such as the Water Evaluation and Planning (WEAP) system are computer programs that use mathematical equations to represent relevant processes in the hydrologic cycle. These decision support tools (DSTs) are used by planners to simulate water demand, supply, cycling, instream flow requirements, ground and surface water storage capacity, climate change, and more within a given basin or sub-basin. These can be open-source, like WEAP, or proprietary systems. Hydrological models can be used to simulate the impact of a new project or the modification of existing infrastructure or management regimes on the relevant hydrologic system over time, under a variety of conditions. In order to score 1 on this question, a hydrological model must be used to determine the potential hydrological impacts of the proposed bond project. Evidence is the hydrologic model itself.

Example from the Potomac basin: For basin planning and e-flow modeling, the Interstate Commission on the Potomac River Basin (ICPRB) uses the USGS Hydrological Simulation Program—Fortran (HSPF) model: http://water.usgs.gov/software/HSPF/. Every five years, the ICPRB also uses a long-term water-planning tool called the Potomac River and Reservoir Simulation Model (PRRISM) to evaluate whether future water demands can be met by the current WMA water supply system under a variety of future climate change scenarios. More information about this tool and the Commission's climate forecasting for the Potomac River is covered in this report: https://www.potomacriver.org/wp-content/uploads/2014/12/ICPRB13-071.pdf

Example from San Francisco, CA: California uses the HFAM II model, which is a continuous simulation model designed for both historical and forecast analysis. More information about this model is available here: http://www.hydrocomp.com/HfamSoftware/Hfam%20II%20Description.htm.

Question 3.2: Can the system model the response of the managed water system to varied hydrologic inputs and varied climate conditions?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Using a model that can be adjusted to simulate a variety of hydrologic and climatic conditions over different time scales is potentially important in determining the proposed bond project's impact on the water resource over time. Because there is a considerable level of uncertainty around climate change impacts at the local or basin scale, it is important to model multiple scenarios to better prepare for a range of future conditions. Independent of climate change, the managed water system can be altered by a variety of inputs such as population growth or land use management, and those should be accounted for as well. Evidence for this is the ability of the model to be adjusted to multiple climate and hydrologic conditions.

Example from San Francisco, CA: The HFAM II model referenced in Question 1 of this section is a comprehensive modeling system that simulates hydrologic processes (runoff from rainfall and snowmelt, channel flow) and the operation of existing or planned water resource facilities (reservoirs, hydro plants, irrigation systems). It can be adjusted to simulate a wide variety of historical, current, and future scenarios. It has been used for design or operations analysis for many large irrigation, water supply and hydroelectric projects. http://www.hydrocomp.com/HfamSoftware/Hfam%20II%20Description.htm

Question 3.3: Are environmental performance limits (ecosystem, species, ecological community) and/or ecosystem services specified?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Questions 3-7 in this section deal with environmental performance limits and their application to the hydrologic model. "Environmental performance limits" is a term of art that refers to the ecological and hydrological variables that can be monitored and evaluated to define the limits of environmental tolerance. These performance limits can be variously defined, such as in relation to environmental water quality, flow rates, ecosystem services such as water purification, habitat qualities or population levels for endangered or significant species, or the presence / absence of groups of species composing particular ecological communities. Performance limits are the indicators of progress, success, or failure of environmental variables. In many cases, these environmental performance limits will have some regulatory or legal component. Environmental performance limits should be specific, clear, and operational. They are probably monitored by environmental or natural resource staff. In some cases, they may also include terrestrial systems, such as forests that support water quality services. For credit here, these should be incorporated into the monitoring and evaluation process — ideally represented through the modeling software but they may also be defined in more qualitative or non-model based regulatory guidelines or strictures and/or explicit boundaries defined internally or by external groups.

Example from San Francisco, CA: Ecosystem performance limits are taken into account in the HFAM II model and are defined and monitored / evaluated by the California Climate Change Technical Advisory Group, which include flow regime and snowpack timing and levels.

Question 3.4: Can these performance limits be defined and quantified using the water resources model?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Can the hydrologic model incorporate the relevant environmental performance limits? Evidence of this includes the ability to calibrate the model to simulate environmental performance under a variety of current and future climate conditions.

Example from San Francisco, CA: This memo on the Upper Tuolumne River provides a good example and can be used as Evidence to show what the HFAM II model can simulate in terms of quantified environmental performance limits for precipitation and runoff in a variety of future climatic scenarios: https://infrastructure.sfwater.org/fds/fds.aspx?lib=SFPUC&doc=751346&data=289268210. The full report is available here: http://utrep.blogspot.com/2012/12/tuolumne-climate-change-sensitivity.html.

Question 3.5: Have these limits been defined based on expert knowledge and/or scientific analysis?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Environmental performance limits should not be arbitrarily set; they should be based on scientific analysis. Evidence could be a description of how the environmental performance limits were calculated – either by a hydrologic / climate model or through another form of rigorous scientific analysis.

Example from San Francisco, CA: In the case of the Upper Tuolumne River basin, yes, the environmental performance limits of the hydrologic system are defined based on the HFAM II model outputs (i.e., scientific analysis).

Question 3.6: Are these performance limits linked to infrastructure operating parameters?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

Example from San Francisco, CA: HFAM II can specify infrastructure operating rules, in this case for the San Pedro dam on the Tuolumne River. This allows the modeler to simulate changes to dam operations and climate scenarios on stream flow and Hetch Hetchy Reservoir levels. http://utrep.blogspot.com/2012/12/tuolumne-climate-change-sensitivity.html.

Question 3.7: Are these limits linked to an environmental flows regime?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: An environmental flows regime refers to the flow regime required in a river to achieve desired ecological objectives. Understanding the environmental performance limits of these ecological objectives can help determine the flow level required to maintain overall eco and hydrological function.

Example from San Francisco, CA: The Upper Tuolumne River Ecosystem Program manages the environmental flow regime for the Tuolumne River. Their 2012 report, using modeled data from HFAM II, documents potential changes to environmental performance of the hydrologic system, including environmental flow levels, under a range of future climate and water resource management scenarios. The report can be found here: http://utrep.blogspot.com/2012/12/tuolumne-climate-change-sensitivity.html.

Question 3.8: For new projects, is there an ecological baseline evaluation describing the pre-impact state?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Evaluating current (pre-project) ecological conditions ("baselines") provide a reference that helps managers understand, track, and quantify project impacts (if any) over time.
In order to score 1 on this question, an ecological evaluation must be done prior to project approval and commencement. In this case, Evidence would be the baseline evaluation.

Example from San Francisco, CA: One of the primary goals of the Upper Tuolumne River Ecosystem Program is to "describe historical and present day upper Tuolumne River ecosystem conditions and assess the relationship of historical and present day conditions to Hetch Hetchy Project operations." Baseline conditions for the river can be found in the Upper Tuolumne River: Description of River Ecosystem and Recommended Monitoring Actions report, accessed here: http://utrep.blogspot.com/p/reports-and-publications.html. This report could be used as Evidence of a baseline assessment.

Question 3.9: For rehabilitation / reoperation projects, is there an ecological baseline evaluation available before the projects was developed?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: In order to score 1 on this question an ecological evaluation of the resource pool would need to have been completed prior to the original project's commencement. The evaluation does not have to have been completed by the issuer, but the issuer needs to have access to it.

Example from San Francisco, CA: Environmental conditions have been monitored in the Sacramento – San Joaquin delta under the Environmental Monitoring Program (EMP) since 1971. The program is carried out jointly by the United States Bureau of Reclamation (USBR) and the California Department of Water Resources (DWR), with assistance from the California Department of Fish and Game (CDFG) and the United States Geological Survey (USGS). The primary purpose of the EMP is to provide necessary information for compliance with flow-related water quality standards specified in the water right permits. In addition, the EMP also provides information on a wide range of chemical, physical and biological baseline variables. All of this data can be submitted as Evidence. More information is available here: http://www.water.ca.gov/iep/activities/emp.cfm

Question 3.10: Has there been an analysis that details impacts related to infrastructure construction and operation that has been provided?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: The construction process can have a significant environmental impact, as can the ongoing operations and management of the project / investment itself. Have both aspects been formally evaluated? Evidence could be an environmental impact assessment or statement documenting projected impacts from construction and operation of the project.

Example from Duluth, Minnesota, USA: In 2015, St. Louis County submitted an Environmental Assessment Worksheet (EAW) to the state pollution control agency for an aquatic habitat restoration project that would use dredge material from the St. Louis River navigation channel to recreate the optimal water depth and flow conditions needed to support benthic habitat in the river's estuary. Even though this is a restoration project, there can still be impacts to the waterway, particularly during the construction phase. As part of the assessment, the project proposer is required to address impacts from placing dredged material in the project area, and identify best management practices (BMPs) to mitigate any adverse impacts. According to the EAW, these impacts include:

> …short-term turbidity impacts in the water column where the dredged material is placed and also downstream of this area… To help offset impacts to the fishery, the work will not occur during spawning periods as required in all state and federal agency permit requirements… the Proposer does not anticipate the Project will create long-term contaminant releases.
> Furthermore, the ecological risk assessment does not expect significant adverse long-terms changes from background levels for either contaminants or pathogenic organisms.

More information about this project is available here: https://www.pca.state.mn.us/sites/default/files/p-ear2-92.pdf.

Example from San Francisco, CA: The Hetch Hetchy Restoration Project has an entire Annex dedicated to impacts of the project, including construction and operation. See Appendix D, here: http://www.water.ca.gov/pubs/environment/hetch_hetchy_restoration_study/hetch_hetchy_restoration_study_appendices.pdf.

Question 3.11: Are lost species and/or lost or modified ecosystem functions specified for restoration in the environmental evaluation?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: In regions that have experienced the loss of native species and/or normal ("baseline") ecosystem function, does the bond project include a plan to address these losses through habitat restoration, reintroduction, improved environmental flows, etc.? If so, the plan can be used as Evidence for this question.

Example from San Francisco, CA: Restoration activities are explicitly laid out in the 2010 flow criteria development document, beginning on page 43, available here: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf

Question 3.12: Have regional protected areas / nature reserves been included in the analysis for impacts from the investment asset and future climate impacts?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Protected areas or reserves refer to legally-designated areas that are off-limits to resource extraction such as logging, fishing, or, mining, and may have limits on non-extractive human activities within the reserve such as boating or hiking. While your proposed bond project is likely located outside of these areas, it may still impact these reserves. To score 1 on this question, protected areas and the potential impacts to them must be taken into account in the environmental assessment.

Example from San Francisco, CA: For a good example, refer to the Upper Tuolumne River Ecosystem Program, which is led by the SFPUC and includes operation of the San Pedro dam, Hetch Hetchy Reservoir. The Upper Tuolumne also flows through Yosemite National Park. The park is taken into water resource management decisions and conditions within the park are monitored to ensure that river operations are not having a detrimental impact on the protected area. Monitoring reports from the park could be used as Evidence for this question. http://utrep.blogspot.com/p/reports-and-publications.html

Question 3.13: Does the model include analysis of regression relationships between climate parameters and flow conditions using time series of historical climate and streamflow data?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Historical climate and streamflow data is often used to model future hydrologic conditions under a range of climate scenarios. Evidence for this question will likely come from the model itself. If you're unsure, check with the hydrologic model developers.

Example from San Francisco, CA: The HFAM II uses regression analysis to estimate the relationship between streamflow and climate change over time. Evidence from the Upper Tuolumne River basin study:
The current Tuolumne HFAM model system includes: HFAM program, version 2.3 watershed input files that describe the physical characteristics of the watershed (topography, soils, vegetation, channel reaches) and the operations of reservoir spillways and outlets, diversions, tunnels and power houses

a historical meteorological database of precipitation, temperature, evaporation, wind movement and solar radiation data management software and spreadsheets

http://utrep.blogspot.com/2012/12/tuolumne-climate-change-sensitivity.html.

Question 3.14: Does the model include climate information from a multi-modal ensemble of climate projections (e.g., from the Climate Wizard or the World Bank's Climate Portal) to assess the likelihood of climate risks for the specified investment horizon(s)?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Climate risks may vary over time, so it is important to understand and plan for these potential risks over the expected lifetime of the project. This is particularly important for projects involving water infrastructure that may be in place for 50+ years. Most hydrologic models, such as WEAP, use climate projections from the Intergovernmental Panel on Climate Change (IPCC) to model future climate risks such as droughts or flooding over a variety of timescales (usually 10-100 years). If you're unsure where the climate data used by your hydrologic model comes from, check with the model developer.

Example from San Francisco, CA: The HFAM II uses IPCC climate projections to model climate risks at the basin scale over multiple time scales. More information can be found here: http://www.hydrocomp.com/applications/Climate%20Change.htm

Question 3.15: Are changes in the frequency and severity of rare weather events such as droughts and floods included?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Changes to the frequency, timing, and severity of extreme hydrologic events are predicted under most of the IPCC's future climate scenarios. A robust hydrologic model should be able to model these changes.

Example from San Francisco, CA: According to the San Francisco Public Utilities Commission's 2012 report on the sensitivity of the upper Tuolumne River to climate change, the HFAM II model predicts that in critically dry years, reductions in annual runoff into the Hetch Hetchy Reservoir would be significantly greater, with runoff decreasing up to 46.5% from present day conditions by 2100. These predictions can be used as Evidence for this question. Report is available here: http://utrep.blogspot.com/p/reports-and-publications.html.

Question 3.16: Are sub-annual changes in precipitation seasonality included?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Similar to the previous question, climate change may induce changes to seasonal precipitation patterns. In the Pacific Northwest of the United States, for example, it is predicted that summer rainfall may decrease by up to 30% over the next century, with rain accumulating primarily in heavy, infrequent downpours. The hydrologic model used for the adaptation plan should be able to simulate these changes.

Example from Alaska, USA: Scientists at Texas A&M University employed the widely-used Soil and Water Assessment Tool (SWAT) to model monthly stream flow under different climate scenarios in the Cook Inlet watershed of south-central Alaska. Like the C2VSim model, SWAT is a physically based, continuous time watershed model that is used to predict the impacts of land management practices on water and sediment in complex watersheds over a ranges of scales over an extended period of time. Its time-steps can be adjusted for annual, seasonal, and monthly changes. The data provided by the model can help inform future adaptation planning and response efforts in south-central Alaska, and beyond. More information about the Cook Inlet project can be found in a 2015 paper published

by Deb, Butcher, and Srinivasan here: http://link.springer.com/article/10.1007/s11269-014-0887-5, more information about the SWAT model that could be used as Evidence for this question can be found here: www.swat.tamu.edu.

Question 3.17: Is GCM climate data complemented with an analysis of glacial melt water and sea level rise risks, where appropriate (e.g., high or coastal elevation sites)?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: In addition to climate change, rapid glacial melting and rising sea levels may significantly impact many regions around the world. Increasing flood events in alpine areas near existing glaciers and along low-lying coasts are widely predicted over the next 10-100 years. If the proposed bond project is located in or near a region that may be affected by glacial melt or sea level rise, does the hydrologic model take these factors into account?

Example from San Francisco, CA: Because San Francisco is located in a low-lying coastal delta, even a small amount of sea level rise is predicted to impact its freshwater supplies. Sea level rise is addressed in many places, including the following coastal planning document: http://onesanfrancisco.org/wp-content/uploads/Guidance-for-Incorporating-Sea-Level-Rise-into-Capital-Planning1.pdf, which could be submitted as Evidence.

Question 3.18: Is paleo-climatic data (e.g., between 10,000 and >1000 years before present) included?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Paleo-climatic data refers to historical climate data from past geological ages, such as the Pleistocene. This data comes from a wide variety of sources including tree-rings, ice cores, and lake sediment and helps scientists understand past instances of rapid climate change as well as the consequences for biotic communities living at that time. Reports detailing paleo-climatic data and its use in the hydrologic model constitute Evidence for this question.

Example from San Francisco, CA: Not currently included in the model, but is planned using this document: http://www.water.ca.gov/waterconditions/docs/tree_ring_report_for_web.pdf.

Question 3.19: Is the number of model runs and duration of model runs disclosed?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Various data sets should be explored through the hydrologic-climate model through multiple simulations and runs, essentially testing hypotheses, system sensitivity, and alternate conditions. For Evidence purposes, you can confirm the simulation model type with the developer.

Example from San Francisco, CA: The HFAM II software is a continuous simulation model, which runs every hour, tracking interactions between meteorological data and streamflow over time. Described here: http://www.hydrocomp.com/HfamSoftware/Hfam%20II%20Description.htm and here: www.wucaonline.org/assets/pdf/puma_presentation_sanfran.pdf.

The California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) is another dynamic hydrologic model used to simulate water movement through land surface, groundwater, and surface water flow systems in Sacramento River basin. It is used to simulate the historical response of the basin's groundwater and surface water flow system to historical stresses, which can be used to simulate the response to projected future stress. More information about the C2VSim model is available here: www.baydeltaoffice.water.ca.gov/modeling/hydrology/C2VSim/index_C2VSIM.cfm.

Question 3.20: Has a sensitivity analysis been performed to understand how the asset performance and environmental impacts may evolve under shifting future flow conditions?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: A sensitivity analysis in this context refers to the degree to which a given system or component of a system is affected by changes to future water conditions. The change can be direct: for example, the sensitivity of a given fish species to a 2C rise in water temperature. It can also be indirect: for example, damages caused by coastal flooding due to sea level rise. The sensitivity analysis itself is the Evidence for this question.

Example from San Francisco, CA: The San Francisco Public Utilities Commission's Sewer System Improvement Program (SSIP) is addressing the sensitivity of its wastewater / stormwater infrastructure to changing climate and sea level rise. More information about this program can be found here: http://www.sfwater.org/index.aspx?page=116

Question 3.21: Is directly measured climate data available for more than 30 years and incorporated into the VA?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: Historical climate data (30 years or more) for the basin or sub-basin in question should always be incorporated into a vulnerability assessment when it is available because the longer period of record gives a clearer picture of the typical climatic cycles (seasonal, annual, decadal) that may impact the basin's hydrologic cycle. Data from a shorter time period may miss these longer-term cycles and will be less useful for accurate vulnerability analysis and future planning. The historical climate data can be provided as Evidence for this question.

Example from San Francisco, CA: Directly measured climate data dating to 1976 was included in the Public Utilities Commission's vulnerability assessment and 2015 Urban Water Management Plan, referenced throughout this document. This data was used to develop a design drought sequence more severe than the worst drought on record, and rationed allocation amounts for multiple dry years.

In the Upper Tuolumne River basin, directly measured climate data dating to 1922 has been used by University of California – Davis and Environmental Defense to model future stream flow. Data from these models were also incorporated into the 2006 Hetch Hetchy Restoration Study, available here: http://www.water.ca.gov/pubs/environment/hetch_hetchy_restoration_study/hetch_hetchy_restoration_study_report.pdf.

Question 3.22: Does the VA show that climate change has already had an impact on operations and environmental targets? Are these impacts specified and, to the extent possible, quantified?

Scoring: 1 if yes, 0 if no. If yes, an adaptation plan is needed.
Evidence or Disclosure: Evidence

What this means: Climate change and sea level rise are already impacting infrastructure and the environment in many places around the world. Quantifying these impacts is notoriously difficult, but efforts to do so are becoming more common. If the vulnerability assessment demonstrates that climate change and/or sea level rise is already occurring, an adaptation plan that addresses these changes and how the utility plans to adjust is needed. Adaptation plans are discussed further in Section 4.1.6.

Example from San Francisco, CA: The San Francisco Sea Level Rise strategy document addresses both the vulnerability of the system and the city's adaptation plan. More information can be found here: http://onesanfrancisco.org/wp-content/uploads/Guidance-for-Incorporating-Sea-Level-Rise-into-Capital-Planning1.pdf

Question 3.23: Does the VA show that climate change will have an impact on operations and environmental targets over the operational lifespan? Are these impacts specified and, to the extent possible, quantified?

Scoring: 1 if yes, 0 if no. If yes, an adaptation plan is needed.

What this means: Similar to the previous question, if the vulnerability report indicates a future impact from climate change or sea level rise, an adaptation plan is also needed.

Example from San Francisco, CA: In the same planning document, the text states: "As a consequence of rising sea level, San Francisco will experience more frequent and severe coastal flooding than in the past. Areas that currently experience infrequent flooding will be inundated more often and more areas along our shorelines will be exposed to periodic flooding than in the past or today. Sea level rise, therefore, poses a pervasive and increasing threat along San Francisco's shorelines." Using data from the National Research Council (2012), it goes onto quantify the potential amount of sea level rise over the next 100 years (See Table X.)

Example from Potomac River: Yes, as mentioned in question 1 of this section, there is a climate change planning document detailing potential climate impacts for the region, which indicates that there are several https://www.potomacriver.org/wp-content/uploads/2014/12/ICPRB13-071.pdf

Question 3.24: Is there a discussion of the uncertainties associated with projected climate impacts on both operations and environmental impacts?

Scoring: 1 if yes, 0 if no, n/a if not applicable
Evidence or Disclosure: Evidence

What this means: There is a great deal of uncertainty about the specific impacts of climate change, particularly at the basin scale. The best available science now informs us that there are likely to be a variety of impacts related to precipitation patterns and the timing and frequency of extreme weather events, wildfire, and drought. Thus, multiple projections are used to simulate a range of future scenarios. Vulnerability assessment and resource planning should acknowledge this uncertainty and address how uncertainty and risk will be dealt with.

Example from San Francisco, CA: Uncertainty is thoroughly addressed in the CA Water Resources Department's Climate Change Handbook for Regional Water Planning. Planning is based on the projected "worst case scenarios" for both drought and sea level rise. This document could be submitted as Evidence for this scoring question: http://www.water.ca.gov/climatechange/docs/Section%207%20Planning%20Under%20Uncertainty-Final.pdf.

Example from Potomac River basin: Uncertainty is built into the ICPRB's planning documents, including the 2010 Washington Metropolitan Area Water Supply Reliability Study Part 2: Potential Impacts of Climate Change report, excerpted here:

> Limitations and Uncertainties
> Projections of future climate are subject to considerable uncertainty, since global climate models cannot capture the full complexity of the earth's inter-related land, water, and atmospheric systems. Thought it is predicted that precipitation will increase on a global scale, in many areas, including the Potomac River basin, models differ on whether precipitation will increase or decrease. Watershed models are used to simulate the effect of a changing climate on stream flows, adding additional uncertainty.
>
> Finally, though it's believed that as the earth warms, the variability of climate is likely to increase, with extreme weather events becoming more frequent and more intense, this change is not well represented by most currently available global model output. This study uses the historical variability in temperature and precipitation from a relatively short period to represent potential future variability. This historical period includes a moderate drought, but does not capture the full range of conditions that could be experienced in

2040 under an altered climate, such as the occurrence of severe long-term drought similar to the drought of 1930.

The full report is available on the ICPRB website and could also be used as Evidence: https://www.potomacriver.org/focus-areas/water-resources-and-drinking-water/cooperative-water-supply-operations-on-the-potomac/long-term-planning/.

5.1.4. Section IV of the Scorecard: Adaptation Plan scoring guide (if applicable)

If the issuers' Vulnerability Assessment states that there are realized and/or potential climate impacts, the issuer will need to prepare and provide for assessment their associated adaptation plan. In that circumstance, the fourth section of the Scorecard is used to evaluate that Adaptation Plan.

There are 5 questions in this fourth section, which are explained below.

Question AP.1: Is there a plan to restore or secure lost / modified ecosystem functions / species? Confer Vulnerability Assessment

Scoring: 1 if yes, 0 if no
Evidence or Disclosure: Evidence

What this means: A primary function of the adaptation plan should be to address existing and potential changes to the ecosystem function of the water resource, meaning changes to the quantity, quality, location, and timing of water in the system. Such changes can have a negative effect on the biogeochemical processes required for native plant and animal survival, as well as on the ecosystem services that nourish and fulfill human life. Specific steps to both arrest current and/or future degradation and improve ecosystem function under a changing climate should be included in the plan. Examples could include riparian corridor restoration to improve stream bank stabilization and off channel habitat for aquatic and riparian-dependent species, or an aquifer recharge project intended to replenish depleted groundwater reserves and reduce land subsidence.

Example from San Francisco, CA: The Tuolumne River environmental flows management plan addresses ecosystem services as well as species loss. The Upper Tuolumne River Ecosystem Program (UTREP) has been implemented to conduct long-term, collaborative, science-based investigations designed to (1) describe historical and present day upper Tuolumne River ecosystem conditions, (2) assess their relationship to Hetch Hetchy Project reservoir operations, and (3) develop projects and plans for improving ecosystem conditions on a long-term, adaptively managed basis. Under the umbrella of UTREP, many projects to monitor and address ecosystem function and biodiversity have been undertaken. Here are links to a few of these projects:

- The Looking Downstream Project: This project is designed to better understand the physical and ecological processes of the Tuolumne River. A primary goal of the project is to "provide information that water managers can use to manage environmental water releases from O'Shaughnessy Dam in ways that will more closely replicate natural physical processes and benefit water-dependent ecosystems downstream of the dam." More information is available here: https://drive.google.com/file/d/0ByXbtqrXtQ1LX3U5Q0ZsckRJU28/view
- O'Shaughnessy Dam Instream Flow Management Plan: The purpose of this project is to "describe the development and implementation of a new instream flow regime for O'Shaughnessy Dam that is designed to mimic natural hydrology and provide broad support for physical processes, habitats, and native species within the Hetch Hetchy Reach of the upper Tuolumne River." This plan is currently in Phase II and more

information is available here:
https://sfpuc.sharefile.com/share?cmd=d&id=s0892606d1b949d1a#/view/s0892606d1b949d1a

Question AP.2: Is the adaptation plan for environmental targets / infrastructure robust across specified observed / recent climate conditions? Confer Vulnerability Assessment.

Scoring: 1 if yes, 0 if no
Evidence or Disclosure: Evidence

What this means: The goals of the adaptation plan should be tied to specific, verifiable, current climate conditions. In the case of San Francisco, changes in the timing of spring runoff have already led to lower summer soil moisture as reduced winter snowpack and earlier spring runoff have decreased summer stream and base flows. These alterations to the hydrologic cycle have widespread implications for ecosystem function and biodiversity in the region, water supply for San Francisco and San Joaquin Valley farmers, and power generation at the O'Shaughnessy and La Grange dams. Thus, the Public Utilities Commission's environmental targets should specifically address the issues of water timing and storage in the adaptation plan.

Example from San Francisco, CA: As mentioned, the observed impacts of both climate change and sea level rise have already been significant in the Sacramento – San Joaquin watershed. The Sewer System Improvement Project (SSIP) is designed to be robust to current impacts, including excess stormwater / wastewater discharge, flooding, and saltwater intrusion. More information is available here: http://sfwater.org/index.aspx?page=607.

Question AP.3: Is the adaptation plan for environmental targets / infrastructure robust across specified projected climate conditions? Confer Vulnerability Assessment.

Scoring: 1 if yes, 0 if no
Evidence or Disclosure: Evidence

What this means: Similar to the previous question, but addressing future conditions. Predicting the future trajectory of climate change and its associated impacts at the watershed level is a challenging task and there is a great deal of uncertainty involved. However, based on current impacts and downscaled climate models, climate scientists have been able to identify a range of projected scenarios that can be anticipated and planned for with confidence. For example, in many low-lying coastal areas sea level is predicted to rise anywhere from 1 – 4 feet (0.3-1.4 meters) over the next 75 years. Adaptation plans for these regions should address how project managers will ensure the resilience of project infrastructure and / or ecosystem function under multiple elevated water conditions.

Example from San Francisco, CA: The SSIP has extensive plans for changes in a range of outcomes for sea level rise and climate variability. For example, in 2010, a design standard was drafted to incorporate the infrastructure impacts of projected sea level rise in the planning, design, construction, operation, and maintenance of facilities directly or indirectly related to the wastewater system, coastal erosion, overflow structure protection, and flooding, using tidal projections based on a 1.4 m (55 in.) sea level rise by 2100. IPCC future warming scenarios project sea level rise of 0.5-1.4 m above 1990 levels and the design standard uses the most severe scenario for its planning guidelines. Combining historical data and future projections based on the 1.4 m benchmark, Figure X demonstrates the vulnerability of San Francisco's existing combined sewer infrastructure to overflow during high tides. This information can then be used in the SSIP decision-making process.

More recently, a Sea Level Rise Coordinating Committee was formed by the San Francisco Planning Department and is overseeing the development of a city-wide Sea Level Adaptation Plan, due to be completed in 2018. More information can be found on the committee's website, here: http://sf-planning.org/sea-level-rise-action-plan .

The San Francisco Public Utilities Commission is also a co-founder of the Water Utility Climate Alliance (WUCA), a partnership between 10 of the largest water providers in the United States. The Alliance works to assess and adapt to the potential effects of climate change through collaborative action, and to improve water management decision

making in the face of climate uncertainty. Recent publications include Embracing Uncertainty: A Case Study Examination of How Climate Change is Shifting Water Utility Planning and Changes in Water Use Under Regional Climate Change Scenarios. Both are available on the WUCA website: www.wucaonline.org.

Question AP.4: Is there a monitoring plan designed to track ongoing progress and impacts to inform future decisions?

Scoring: 1 if yes, 0 if no
Evidence or Disclosure: Evidence

What this means: Because there is an inherent level of uncertainty about future climate conditions, the adaptation plan should include monitoring mechanisms and review processes in order to ensure project effectiveness and, if necessary, to make adjustments. For example, if riparian habitat restoration is undertaken along a stream corridor to improve ecosystem function, there should be monitoring before, during, and after the restoration activity takes place in order to gauge its effectiveness in achieving the outcomes it was designed for, both now and in the future. Monitoring data can also be fed into larger stream monitoring networks that track climate change over time.

Example from San Francisco, CA: The Urban Water Management Plan for San Francisco is updated every 5 years and documents ongoing efforts to reduce urban water demand and comply with the California Urban Water Conservation Council. One such effort is the city-wide upgrade to San Francisco's water metering system. The new meters are helping to improve reliable water use monitoring and track compliance with water efficiency targets over time. Detailed discussion is available in Section 9 of the report, found here: http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=8839

Question AP.5: Is there a plan to reconsider on a periodic basis the VA for operational parameters, governance and allocation shifts, and environmental performance targets?

Scoring: 1 if yes, 0 if no
Evidence or Disclosure: Evidence

What this means: Adaptation planning is about precisely that: adapting. An adaptation plan must be able to adjust to novel conditions over time because climate change is a dynamic series of processes interacting with changing conditions on the ground and it is impossible to predict precisely how future interactions will play out.

As such, it is important to periodically review the vulnerability assessment to ensure that the information is still accurate and relevant to the adaptation plan, to conditions on the ground, and the best available science. Evidence of this could be a management plan that includes a program review timeline and process.

Example from San Francisco, CA: As mentioned in the previous example, the Urban Water Management Plan is updated every 5 years. The most recent report was produced in 2015. The Sea Level Rise Action Plan also employs a cyclical review process for its sea level rise adaptation planning, outlined here: http://default.sfplanning.org/plans-and-programs/planning-for-the-city/sea-level-rise/160309_SLRAP_Final_ED.pdf.

Vulnerability assessment feeds into adaptation planning and implementation, monitoring of implementation feeds back into vulnerability assessment and future adaptation planning. More information about this process can be found in the project's executive summary, available here: http://default.sfplanning.org/plans-and-programs/planning-for-the-city/sea-level-rise/160309_SLRAP_Executive_Summary_EDreduced.pdf

Example from the Danube River: The Danube River Basin Management Plan operates on a 6-year cycle to ensure that its management objectives and activities reflect best practices and any changes to current or future climate projections. The current plan, covering the period of 2016-2021 is available from the International Commission for the Protection of the Danube River: www.icpdr.org/main/management-plans-danube-river-basin-published.

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