Appendix E. Instream Water Needs Assessment Toolbox

HOW TO USE THIS TOOLBOX

This DRAFT "Water Needs Assessment Toolbox" contains information that groups can use to understand needs and demands for municipal, domestic, industrial, and commercial needs. The toolbox contains 1) questions that can help address the common components, 2) approaches you could use to answer the question(s), 3) available sources of data and tools, as well as 4) potential assistance. This toolbox is not meant to be read cover to cover. Click on the links below to jump to the corresponding common component or question.

DISCLAIMER

This DRAFT guidance and toolbox is intended to assist you in completing the place-based planning process as outlined in the 2015 DRAFT Guidelines. This information was compiled with the help of internal technical staff, agency partners, as well as external advisory groups with expertise in different subject matter areas for your practical use. It is up to the conveners and their support teams whether and how they use this information in their respective planning processes. The contents of this document are suggestions only and are not officially endorsed by an individual or entity. This is a DRAFT resource that will be refined and improved over time as planning groups use it and provide feedback. It can serve as a conversation starter as groups begin to think about these complex concepts, but it was not meant to be all inclusive or exhaustive. Each planning group and their planning partners will identify the questions, approaches, data, and tools that are relevant and useful to their planning effort. In terms of how work is accomplished, each partner is responsible for determining how they will contribute to the planning process and what they may be able to contribute in terms of assistance.

REQUESTING ASSISTANCE FOR PLANNING STEP 3

If you intend to request assistance from an organization identified in the tool box, please note that each organization is responsible for determining 1) whether they can provide assistance, and 2) the process by which groups can request assistance. Partners may have limited capacity to provide assistance. At this time OWRD is only able to offer planning and technical assistance to a limited number of places. Planning groups requesting technical assistance from OWRD must follow the process outlined in the Requesting Coordinated Technical Assistance Memo developed by OWRD.

FEEDBACK AND CONTINUOUS IMPROVEMENTS

If you would like to contribute a planning question, please do so by filling out this form. If you would like to provide input on an existing question, please email your thoughts or feedback to placebasedplanning@wrd.state.or.us.

IS 1. Context - Instream uses, key waterways, and water features of interest

Component	*IS 1. Context - Instream uses, key waterways, and water features of interest*
Question (1 of 1)	Q1. What are the waterways and waterbodies that your planning effort will focus on?
Rationale	Identifying the waterbodies (rivers and lakes) that are within your planning area that your group believes are important to consider during planning will allow the group to focus their instream work where it matters most. Starting with an inventory, you can then identify impaired/exceptional areas that may warrant more investigation. Some of this work may have been completed under Step 2.
Potential Approach	**Consider initiating a process for identifying and revisiting objectives and goals throughout the process, such as structured decision making (SDM).** SDM can help both with identifying specific objectives related to meeting instream needs as well as help the group members identify their priorities and figure out what data and information is more important to collect to help with decision making. This can help avoid spending time and energy on data collection and analysis that doesn't actually help with decision making and will also keep a focused conversation on the shared objectives of the group. Additionally, if the group decides that their objectives have shifted, this provides a concrete approach for adjusting those objectives. **Identify those side-boards that are likely to limit water management solutions for addressing instream needs.** For example, federally operated storage projects may have operations objectives (e.g., flood control) that are inflexible. Commitments such as treaty obligations and existing water rights are other examples of relatively inflexible systems that must be considered when developing objectives and solutions. **Understand the vulnerabilities within the instream ecosystems.** Vulnerability is the intersection of exposure, sensitivity, and adaptive capacity. Taking the time to understand which aspects of the aquatic system are likely to benefit the most from conservation and restoration will prevent the group from pursuing activities that are unlikely to realize actual protection of instream needs. **Inventory and create a map of water bodies (streams, rivers, lakes, wetlands) within the project area.** Consider both the downstream and upstream extent of your investigation, for example, you may choose to only look at 3rd order streams. Consider using the most recent version of the National Hydrograph Dataset to identify stream periodicity (intermittent versus perennial streams). Also consider adding in wetlands that may be impacted by surface or groundwater use. **Tap local experience and knowledge about past projects, prioritizations, and studies.** Watershed councils, public employees, civic volunteers, and land owners have all played important roles in habitat conservation in Oregon. Take the time to seek out citizens within your basin who have been a part of these efforts and ask them about past work. Local experts will be able to share observations about the basin not captured by state-wide data sets, including changes to stream permanence and periodicity. **Consider identifying criteria to determine waterways and waterbodies of interest where demand calculations will be focused.** Using existing information from the planning group, develop criteria for identifying waterbodies of interest that will be the focus of your study. Criteria could include issues such as existing impairments, stream

	periodicity, critical habitat, known water use conflicts, recreational use areas, areas of significant tribal cultural importance, key hydropower areas, other big picture instream issues etc. Many of the data sets described below can be used to identify these areas. Alternately, areas of interest may be identified in existing prioritization documents. As an example, the Oregon Water Resources Department (OWRD) and the Oregon Department of Fish and Wildlife (ODFW) created streamflow restoration priority maps to highlight those areas where the need for water instream was great and the opportunity to put water instream was real. This prioritization was focused on streamflow restoration, but it provides a good example of an approach you could use to focus your efforts. Finally, OWRD's Water Availability Reporting System (WARS) includes estimates of the 50 (median) and 80 percent exceedance monthly flows for hundreds of basins across the state. It also includes a calculation of how much of that water has been allocated to instream and out-of-stream uses. This may be useful for understanding the **Utilize a matrix or map to compare areas of need with areas of opportunity.** For all sub-watersheds (or whatever basin scale makes the most sense to your group) in your study area, identify criteria levels for each basin (e.g., high, med, low need) and compare this to opportunities to restore water instream (e.g., water allocation high – water allocation low). Compare these two data sets in a matrix to understand where both you have many overlapping criteria with high need and where you also may be able to address the needs with voluntary instream flow restoration. **Create a map or inventory of water bodies of interest.** Use the previous efforts to carefully map out the stream reaches/lakes/wetlands of interest. This can be done through GIS, or through annotations on existing maps. If a system was developed for identifying focus areas, include that in the mapping effort.
Data	**Waterways and Water Bodies.** The National Hydrography Dataset and Watershed Boundary Datasets are digital geospatial datasets that display surface water and watershed boundaries across the country. These are a part of the National Map, which includes lots of digital geospatial datasets. **Data sets that may be helpful for prioritization – contact ODFW District Biologist** • Species distribution data • Existing habitat designations (irreplaceable, anchor, core) **Existing Prioritization Efforts.** • **Streamflow Restoration Priority Maps.** ODFW and OWRD worked together in the late 1990's to systematically identify priority areas for stream flow restoration. These are maintained online by ODFW: Link. • **Your partners** may have other existing tables or maps that display areas of interest. You should make every effort to collect existing information regarding priority areas.
Tools	SDM resources at http://www.structureddecisionmaking.org/
Assistance	OWRD may be able to provide clipped GIS layers of the NHD data set for your area. Contact your Planning Coordinator about accessing this information.

	ODFW and OWRD can describe how streamflow restoration priorities displayed in the Streamflow Restoration Priority Maps were determined
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 2. Water rights - Voluntary agreements, legal obligations, and instream protections

Component	*IS 2. Water rights - Voluntary agreements, legal obligations, and instream protections*
Question (1 of 2)	Q1. What are the current legal instream protections within the basin?
Rationale	Legal instream protection can come through many mechanisms. Three state agencies can file for instream water rights that are held in trust by the Oregon Water Resources Department (OWRD). The Oregon Department of Fish and Wildlife (ODFW) considers flows needed to sustain fish and wildlife, the Oregon Department of Environmental Quality (DEQ) considers flows to abate pollution or preserve exceptional water quality, and the Oregon Parks and Recreation Department (OPRD) considers flows for recreation or exceptional scenic qualities. State Scenic Waterways include associated protective flows, which although are not the same as an instream water rights, do prevent the continued development of water resources in the basin.
Potential Approach	**Explore information associated with instream water rights held by OWRD**. Identify where there are existing instream water rights or Scenic Waterways to determine their priority dates, and describe how the instream water rights relate to water diversions within the basin. To identify instream water rights, consider using the Water Rights Mapping tool or asking OWRD to assist you with a query of the Water Rights Information System database. Note that in some cases, water may be legally protected instream, but instream water rights are part of the prior appropriation system, and may be junior to other uses in the basin. In other words, do not assume that because there is a legal protection that water is actually in a river or stream. **Utilize water rights transactions data to identify where water has been transferred or leased instream.** Either through a query of water rights data on OWRD's website or through a data request to OWRD, explore current instream transfers and leases that have occurred in your planning area. Consider looking back over a few decades to understand patterns of leases and transfers. **Tribal treaty rights.** Information forthcoming.
Datasets	**Water Rights** - OWRD Water Right Information System
Tools	OWRD Water Rights Mapping Tool
Assistance	OWRD staff may be able to assist with queries for specific water right types. Ask your Planning Coordinator for assistance. OWRD may be able to provide a map displaying the instream water rights and scenic waterways and can also share the shapefiles with your group.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	*IS 2. Water rights - Voluntary agreements, legal obligations, and instream protections*
Question (2 of 2)	Q2. What voluntary instream protection has occurred in the basin through third parties or local agreements?
Rationale	In addition to more permanent legal protection, some water rights may be temporarily transferred instream through the Oregon Water Resources Department (OWRD) instream lease program. Instream water rights have a priority date like out-of-stream water rights and are important to water management. In many basins around the state, conservation groups have developed long track records of incentivizing conservation or protection of water instream. Groups like the Freshwater Trust have even developed prioritization schemes for where the most benefit instream may occur.
Potential Approach	**Reach out to active conservation groups in the basin.** Additionally, talk with farmers in your basin about which conservation groups have been able to establish effective and useful incentive programs. **Analyze water rights data for patterns in voluntary instream protection.** Understanding what drives voluntary instream protection in the long and short term is important for making it a valuable option for both the leaser and aquatic ecosystems. Consider talking with local farmers about financial and land use patterns that incentivize participation.
Datasets	
Tools	None identified as of 12/11
Assistance	Reach out to conservation partners for more information, including The Freshwater Trust, National Fish and Wildlife Foundation. Deschutes River Conservancy, WestWater Research, and Watershed Councils
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation

Component	*IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation*
Question (1 of 8)	Q1. What are the species of interest in the planning area and what is known about their water needs now and in the future?
Rationale	There is a higher likelihood of there being existing instream flow studies for sensitive, threatened, or endangered species, such as salmonids. Beginning your work by identifying what studies have already been done to understand the water needs of key species will help you understand the information you have to work with and will also highlight where you may lack information.
Potential Approach	**Determine which species (invertebrates, fish, plants, amphibians, reptiles, mammals, birds) are present in your planning area**. The Oregon Department of Fish and Wildlife (ODFW) has compiled the Oregon Conservation Strategy which can be used for a multitude of activities, especially summarizing species that are present in a planning area. Additionally, ODFW operates the COMPASS tool which provides a map-based approach for identifying species and habitat types. For many species, there are also separate distribution maps which are maintained by local staff biologists. Other entities may have additional information such as the US Forest Service (USFS), US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), regional conservation groups, or local watershed councils. **Identify indicator or keystone species and important life cycle stages.** It can be difficult to plan for all species given their different water needs. The planning group should identify key species to help them focus their analyses. This might be a species listed as sensitive, threatened, or endangered or a species with cultural or economic significance in the planning area. Once species are identified, think about the life cycle stages that are critical to those species and where and when those life cycles may take place within the system. Understanding their life-cycle stages can be helpful during IS 3(b). **Document studies of water needs for key species**. In some cases, especially in places where ESA listed fish species are present, there may have been an instream flow study completed for a specific reach of a stream. Although PHABSIM studies only identify streamflow needs for habitat types identified within that reach and within the same stream morphologies, the results will help the planning group understand what types of habitat may be considered for each species within the basin. Other types of common studies are wetland inundation studies which describe the depth of water needed to maintain wetland functions for identifies wetland plants. For terrestrial species that may rely on the riparian areas around streams, consider what plants, topography, or other attributes of the riparian area are important to those species and then explore what water levels are important for maintaining those riparian attributes. **Review ODFW Basin Investigations.** The Basin Investigations completed by ODFW describe minimum flows required to support four critical life cycle stages of fish and provide a basis for filing instream water rights. **Identify if any predictions have been made about shifting species distribution within the basin due to changing climate patterns or other stressors**. Species respond to

	stressors through adapting, migrating, or extinction. Ongoing research by federal agencies and university researchers can help shed light on this topic – though this is an ongoing area of research. Reach out to ODFW district biologists and other experts on the topic of species distribution modeling to understand how species of interest to the planning group are forecasted to respond to stressors (e.g., climate change) .
Datasets	**Species Distribution and Conservation Strategies–** • Approaches for identifying and conserving habitat is documented in the Oregon Conservation Strategy, including aquatic species; • Distribution of aquatic and terrestrial species can be accessed through ODFW COMPASS **Instream Flow Studies** – Talk to ODFW or other partners that may have completed instream flow studies (e.g., PHABSIM studies). **Other Studies** – The StreamNet Regional Library is an exceptional resource for finding natural resources information. They offer an online library as well as assistance by Library Staff.
Tools	None identified as of 1/31/18
Assistance	ODFW may provide guidance and insight into local species of concern as well as guidance from technical instream flow staff who work state-wide. Contact your local ODFW district biologist. Watershed councils, tribes, and conservation groups that work in the planning area may be a great source of information and may have conducted local assessments of species distribution and water needs. The StreamNet Regional Library can help identify resources and can also help develop bibliographies on special topics. In many streams, aquatic insects are a crucial source of food for salmonids, and their abundance and composition can indicate general water quality conditions. For more information about aquatic insects, contact the Xerces society.
Notes	
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Component	***IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation***
Question (2 of 8)	Q2. What are the different flows (volume and timing) that serve current ecological functions in the basin?
Rationale	Just like with agricultural and municipal demands, an instream demand begins by identifying where and when in the river network water is needed. Instead of the water being used to grow a crop or providing drinking water, water left instream supports fish and wildlife as well as various other ecological functions that are valuable to maintaining a healthy ecosystem. An instream function is a process that occurs within an aquatic system, from the channel to the floodplain, which benefits the stream system and the communities that rely on and enjoy that stream. Identifying where and when these functions occur allows the planning group to prioritize those functions which are most important to understand, protect, and restore.
Potential Approach	**Inventory which instream functions exist in your basin - both where and when**. Start by considering the set of ecological functions that are performed in a healthy hydrologic network. For a more complete discussion of different instream functions, see the references below. Some example functions include (see possible data sets below: a. Minimum habitat needed to support viable populations of aquatic species b. Minimum habitat needed to support viable populations of terrestrial species c. Instream habitat formation for aquatic species – shaping and creating habitat d. Water temperature buffering e. Maintain conditions allowing for TMDL levels f. Nutrient transport for ecosystem function g. Inundation/recharge of floodplains and wetlands h. Distribution of plants within the riparian area during high flow events i. Control of population dynamics for key flora (e.g., black cottonwood) j. Thermal refuge k. Invasive species exclusion l. Flushing of fine sediments and pollutants m. Maintenance of sensitive habitats or ecosystems (e.g., wetlands) n. Channel and habitat formation With these functions in mind, work with biologists and natural resource experts to identify which functions occur in which of your key water bodies and at what time of year. Consider mapping out the functions as an exercise to summarize the distribution of the functions within the basin. **Use stream gage data to characterize the natural flow regime of your rivers.** Although habitat based studies (e.g., PHABSIM) are one of the most precise approaches for computing instream flow needs for aquatic organisms, there are other estimating approaches which use stream gage data to estimate instream flow needs and can be applied more quickly and broadly. Specifically, a characterization of what is called the natural flow regime can be used to explore what functions the ecosystems of rivers and streams may support. Theoretically, every river's natural flow regime is unique to that system and is a reflection of the hydro-climate, geology, and land use in the basin, and

therefor has a unique set of ecological functions that occur in the river (Petts 2009). By understanding the natural flow regime, an idea of instream need for different instream functions can be estimated.

There are two tools that can be used to describe ecological flows. First, a commonly used tool for using stream gage data to characterize the natural flow regime of a river is the software, "Indicators of Hydrologic Alteration," (IHA) developed by the Nature Conservancy in the late 1990s (link to download and learn more). This freely available tool uses stream gage data to break a river's flow regime into Environmental Flow Components (EFCs), or flow ranges, which can generally be linked to the needs of different flow functions (i.e., ecological processes). The EFCs include 34 parameters grouped into 5 types (adapted from The Nature Conservancy, 2009 – page 10-11), which includes:

a. Low flows
b. Extreme low flows
c. High-pulse flows
d. Small floods
e. Large floods

Aside from IHA, the USGS StreamStats program also provides common statistical summaries, much like IHA, of hydrologic data, though no specific gage data is required. Instead, StreamStats allows you to select any point on a stream and it will use regional regression equations relating characteristics of the geography and climate to streamflow. This can provide analysis at multiple points in the basin instead of at a single stream gage. For both approaches, interpretation of the natural flow regime by an experienced hydrologist and biologist is recommended.

Link the ecological functions to flow levels or ranges. For each of the functions identified, use research and expert opinion to identify which EFC component or StreamStats computation is most likely characteristic of the function's needs. Even if you have no stream gage data, identifying which flow level groups are most important to protect can be helpful. For example, high-pulse flows, small floods, and large floods may all play an important role in providing the function of nutrient transport for ecosystem function. Beyond just the flow level (flow magnitude), it may be helpful to also understand how often the flow occurs (frequency), when the flow tends to occur (timing), and for how long the flow event occurs (duration). All of these values are computed within the IHA software.

NOTE: The IHA tool is only as useful as the data put into it. Additionally, IHA's EFCs , which associate certain functions with certain flow ranges, is a generalized association. IHA is useful as a high-level planning tool, but the values pulled from it should be carefully examined within the context of the ecological setting of a particular site or basin. It's results are most meaningful when interpreted by a knowledgeable ecologist and are not a substitute for a more refined instream flow study.

Datasets	Watershed councils, tribes and conservation groups that work in the planning area may be a great source of information and may have conducted local assessments of ecological functions.

Ecological Functions of Flows – to identify where functions may be important to consider in your basin, consider the following resources:

- **Instream Flow Studies** – Talk to the Oregon Department of Fish and Wildlife (ODFW) or other partners that may have completed instream flow studies (e.g., PHABSIM studies). These studies may help identify where **functions a, d, h, i,** and k are important within your river networks.
- **Other Existing Studies/Assessments** – Ask your partners for other studies, including watershed assessments, limiting factors analyses, Biological Opinions from Federal projects, rule curves from reservoir operations. These types of studies can help address **all functions.**
- **DEQ Heatsource Models** may be available to understand which physical processes are driving temperature patterns within specific reaches of the basin. **Functions a, d, e, and j.**
- **Species Distribution –** Distribution of aquatic and terrestrial species can be accessed through ODFW COMPASS . This can help with identification of **functions a, b, i, and k.**
- **Riparian and Wetland Vegetation** – Many riparian plant species have life histories that are closely tied to the annual and inter-annual patterns in streamflow – identifying these species and understanding their water needs can provide a useful insight into the flow needs of the larger plant community. Surveys from local watershed councils, Soil and Water Conservation Districts (SWCDs), or other conservation groups of where key riparian and wetland areas are; helpful for identifying where on the landscape **functions d, f, g, h, i, and k.**
- **Aerial imagery**. Photos of the river and adjacent lands during different times of the year can help identify where riparian habitat may be present and where secondary channels or backwater areas are in the system. This can help identify where the **functions f, g, and h** may be found (see the Approach section for the list of functions).
- **Geomorphic studies and regional regression** – Streamflow levels and frequencies important for doing the work of forming the stream channel are often fully quantified through basin-wide geomorphic assessments (e.g., example USGS study on the Umpqua) or through reach level measurements or estimates typically captured by consultant led studies for an individual, business, or public entity whose land use or water diversion is impacted by or impacts river geomorphology. ODFW does provide a general estimating approach for quantifying effective discharge using regional regressions related to estimating peak discharge values (e.g., 2-yr flood event), or the streamflow that likely moves the most sediment within a system annually: link. Note though that geomorphology of a system is typically complex and that there are many assumptions made about a system inherent in any estimating methods. For example, to identify streamflows important for sediment movement, there must be sediment available in the system to move. Take the time to understand if these assumptions can be used reliably or recognize in your summary of work that further investigation is needed to know if the assumptions must be further investigated before further relying on the values.

	Streamflow data to use in the IHA analysis can be downloaded from: • USGS Stream Stats – includes statistical summaries of streamflow data, access to USGS stream gage data, and a useful mapping interface to identify resources • OWRD Stream Gages – includes map and tabular interface to identify stream gages and download data **References to explore for to further understand streamflow functions, IHA, and other environemental flow definitions:** • DSL. 2012. Assessing Functions and Values of Wetlands and Waterways. Flyer. http://www.oregon.gov/dsl/WW/Documents/AssessingFunctionsValues.pdf • Petts, G. E. (2009), Instream Flow Science For Sustainable River Management[1]. JAWRA Journal of the American Water Resources Association, 45: 1071–1086. Link. • Poff, N., David Allan, J., Bain, M., Karr, J., Prestegaard, K., Richter, B., Sparks, R., and Stromberg, J. 1997. The Natural Flow Regime: A Paradigm for River Conservation and Restoration. Bioscience. 47. Link. • ODSL, USACE, USEPA, and the Willamette Partnership. 2012. DRAFT Guidance for Assessing Stream Functions and Values under the Oregon Removal-Fill Program. http://www.oregon.gov/dsl/WW/Documents/Interim_Guidance_Stream_Mitigation_11212012.pdf
Tools	Indicators of Hydrologic Alteration – A tool developed by The Nature Conservancy to help identify streamflows associated with different flow functions: link.
Assistance	The Nature Conservancy. 2009. Indicators of Hydrologic Alteration – Version 7.1 User's Manual. https://www.conservationgateway.org/Documents/IHAV7.pdf Contact DEQ for information about available Heatsource models.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation***
Question (3 of 7)	Q3. What water levels are important for maintaining non-riverine water bodies (e.g., wetlands or lakes without a direct surface-water connection to a river)?
Rationale	Wetlands and lakes provide ecological functions associated with water levels instead of streamflows. Lake and wetland water levels vary over time creating different habitat opportunities as different times of the year. Knowing which species and functions occur in these waterbodies, and when these functions occur, can help the planning group determine when to protect water sources which may be influencing these water bodies.
Potential Approach	**Identify what aquatic and terrestrial species utilize the water body.** See component IS 3 Q1 for more information. **Utilize existing information about water levels for the protection of ecological functions.** Contact watershed councils, soil and water conservation districts (SWCDs), and other conservation groups about monitoring of lake and wetland water levels, as well as any information about the level of connectivity between the water body and nearby surface and groundwater resources. **Identify if any federal wildlife refuges are in the basin.** Many refuges are associated with wetland complexes and operate in cooperation with nearby agricultural communities. These groups may have established approaches for protecting sensitive wetland or lake areas, including the establishment of water level targets for different seasons related to bird migration.
Datasets	The Oregon Water Resources Department (OWRD) maintains a Historic Lake Level Database County Planning documents may have useful information about local lakes and wetlands. The Department of State Lands (DSL) maintains Local Wetlands Inventories in partnership with Cities and Counties.
Tools	USFWS National Wetlands Inventory and Wetlands Mapper Atlas of Oregon Lakes Interactive Map
Assistance	The US Fish and Wildlife Service (USFWS) may be able to provide information about wetlands in your planning area, especially where there are Wildlife Refuges. The Oregon Lakes Association may be able to provide information about lakes in your planning area. The Department of State Lands maintains information on Oregon's waterways and wetlands. The Wetlands Conservancy and The Nature Conservancy may be able to provide information on ecologically significant lakes and wetlands in your planning area.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be

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Component	***IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation***
Question (4 of 8)	Q4. How do groundwater inputs contribute to ecological functions in the planning area?
Rationale	Groundwater and surface water are not separate – groundwater contributes to ecological functions in essentially all streams, lakes, and wetlands, though the time frame over which interactions occur can vary from hours for local, hyporheic and bank exchange to decades for deep groundwater sources. **For an approachable read on how groundwater and surface water interact, consider reading:** USGS. 1998. Ground Water and Surface Water- A Single Resource. US Department of the Interior. https://pubs.usgs.gov/circ/circ1139/ . Groundwater can provide many functions for surface water or several different time periods and spatial scales, such as adding or removing nutrients from a stream, altering the chemistry of a stream, buffering water levels during lower water periods, or providing direct discharge from deep aquifers. One important example of an ecological function that groundwater plays in surface water systems is temperature mediation. In some cases, groundwater provides very important contributions during typically hot and sensitive times of the year for aquatic organisms. Identification of sensitive habitat such as these can be helpful in prioritizing important ecological attributes in the system. For a good overview of the role of groundwater in sustaining California's ecosystems, click here.
Potential Approach	**Review existing reports or summaries on this subject and consult with subject matter experts to understand where these functions occur in your basin.** The role of groundwater varies significantly from place to place. Look for groundwater investigations that have been completed in your planning area. A cooperative groundwater study by the Oregon Water Resources Department (OWRD) and the US Geological Survey (USGS) can provide a significant amount of information about groundwater and surface water interactions, but these studies have been completed in very few areas around the state. In some areas, OWRD has completed seepage runs or seepage assessments in specific stream reaches that help to identify where streams may be losing or gaining groundwater. FLIR (Forward Looking Infrared) imagery can be used to take pictures of temperature changes over a reach of river – an innovative way to identify groundwater contributions and their impacts on temperature within a river basin. These reports generally do not discuss the ecological functions supported by groundwater inflows and outflows, but work performed under previously asked questions can help you spatially understand where these impacts may be important. **Identify the role of groundwater in habitat creation, especially temperature mitigation, maintenance of instream baseflow levels, or groundwater fed ecosystems.** Groundwater and surface water interact over many different time periods (hours to years) and across many different distances (inches to miles). Late summer streamflow may be derived from groundwater sources, which may play an important role in maintaining water temperatures to support sensitive species. Furthermore, groundwater may feed important ecosystems like wetlands, springs, bogs, fens, etc.
Datasets	**Groundwater Studies** – OWRD and USGS both maintain a database of groundwater studies and publications online: OWRD Studies and USGS Studies.

	Thermal Mapping – Talk to the Department of Environmental Quality (DEQ) about any thermal mapping that has been completed in the basin. Example products and report for Grande Ronde basin. **Wetlands** – The US Fish and Wildlife Service (USFWS) maintains a National Wetlands Inventory. **Groundwater Dependent Ecosystem** – The Nature Conservancy has completed a preliminary assessment of groundwater dependent ecosystems in Oregon: LINK. **Mapping of springs** – USFS frequently maps springs, and some USGS and NHD maps show mapped springs (see IS1).
Tools	None identified as of 1/31/18
Assistance	The Nature Conservancy has conducted research on groundwater dependent ecosystems in Oregon and may have resources available to assist your planning group. Ask OWRD Regional Staff if any seepage runs/assessments have been completed in your planning area and may have local knowledge about groundwater-surface water interactions. Federal land managers like the US Forest Service, Bureau of Land Management, and US Fish and Wildlife Services conduct studies to understand the presence of groundwater fed features on federal land and may have information relevant to your planning effort.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	*IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation*
Question (5 of 8)	Q5. Where in the basin may aquatic functions be more or less resilient under future conditions?
Rationale	Continued out-of-stream water development, changing patterns of drought and rain/snow, altered behavior and population dynamics of aquatic species, and land use will likely alter how much water is needed in streams and rivers to support instream ecosystems in the future. Each of these variables plays a different role in different parts of each basin and its water resources, though they can often be difficult to tease apart.
Potential Approach	**Understand how changing climatic and land use conditions impact flow regimes of rivers and inundation periods of lakes and wetlands**. Perform a sensitivity assessment of the aforementioned functions by first identifying the possible range of changes to water supplies. This can be done through simple estimates of percent changes in streamflow magnitude based on rates of change pulled from existing literature, all the way through more complicated modeling exercises involving forecasted changes to precipitation, temperature, and land use. Focus on understanding what a shifted flow regime or inundation period may look like in the future. Consider that stream periodicity may shift – talk with local hydrologists and hydrogeologists about exploring changing stream permanence (e.g., streams that used to run every day now dry up in the summer). **Identify those instream functions most impacted by shifts to the flow regime and inundation period.** Using your understanding of relationships between instream functions and stream flow types, identify those functions that may be impacted by shifts in the flow regime. **Conserve versus mitigate**. Once the location of the at-risk functions is known, try to identify whether it is important to try to conserve the area and its current functions, or if the site is unlikely to be able to continue performing its function. If it is unable to persist, it may be important to pursue mitigation for the function in another place in the basin. Conservation strategies for specific species have been identified by the Oregon Department of Fish and Wildlife (ODFW), though less guidance exists around mitigation approaches for protecting streamflow functions. Department of State Lands (DSL) produced draft guidance for defining instream functions in 2012 (see IS3 (b)), and the Oregon Water Resources Department (OWRD) has rules about streamflow mitigation in the Deschutes Basin, though no statewide rules.
Datasets	**Climate Data**: The Climate Impacts Research Consortium CIRC hosts past gridded weather data (gridMET), forecasted seasonal climate, and projected future climate data across the US **Changing stream temperature Norwest**: The US Forest Service (USFS) researchers developed approaches for modeling current and future August stream temperatures across Oregon. **Considerations for conservation under future conditions**: The Oregon Conservation strategy provides useful information about species conservation goals that may be helpful in identifying future vulnerabilities.
Tools	**Future Streamflow**: In order to understand changes to streamflow, consider using

	CIRC's Future Streamflow tool. This can give you projected, monthly streamflow for several different gages across Oregon under CMIP 5 modeling – though some areas have more gages than others. If you would like assistance using this tool, contact CIRC or OWRD Planning Coordinators.
Assistance	**Land-use** - Projected land use information, or the laws impacting land use, can be found through DLCD , your county's planning office through the comprehensive plan, or your city or town's planning division. **Oregon Conservation Strategy** - ODFW staff may be able to participate in planning sessions around the sensitivity of certain species to changes in instream flow for the conservation strategy.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation***
Question (6 of 8)	Q6. What are the water uses and needs for tribes in you planning area?
Rationale	Rivers and lakes throughout Oregon are socially and culturally significant to Oregon tribes. Many cultural practices include the use or harvest of animals and plants which themselves rely on rivers and streams. Salmon, wetland and riparian plants, terrestrial animals, and birds rely on habitat provided by rivers and lakes. Information provided by tribal representatives can be valuable inputs to several common components.
Potential Approach	**Determine if adjudication has occurred in your basin.** Adjudication determines the extent and validity of a pre February 24, 1909 vested water uses (water uses that existed before the state water code was enacted) and/or Federally Reserved Water Rights. Talk with tribal participants or Oregon Water Resources Department (OWRD) staff about the adjudication status of your basin. **Describe historic cultural uses and values.** Many tribes have treaties which describe their past activities– including the geographic range/extent of the tribe. Additionally, each tribe may have an idea of historic consumption rates of fish or other aquatic species, based on sources ranging from oral tradition to treaties to technical studies completed by tribal scientists. This information can be used to understand the tribe's future need for water to support aquatic life and cultural practices. Contact each tribe to learn about their specific uses and values. **Consider inviting a tribal representative to deliver a presentation on the cultural and spiritual significance of water.** When trying to understand the historic significance of water to the tribes in your planning area, it may be best to invite them to tell their stories.
Datasets	There may be local or tribally held data sets – discuss these datasets with tribal contacts. Oregon Parks and Recreation Department (OPRD) State Historic Preservation Office works with tribes throughout Oregon regarding archeological and cultural preservations.
Tools	None identified as of 1/31/18
Assistance	OWRD staff may be able to assist with inquiries to the OPRD Historic Preservation Office to identify the overlap of tribal areas of interest and the planning area as well as to help identify contacts for each tribe. Please note that many tribes have limited staff and it may take some time to identify the correct contact.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation***
Question (7 of 8)	Q7. What are the water needs for recreational interests in your planning area?
Rationale	Recreation is an increasingly important and valuable economic resource for communities around Oregon bringing business from all across the US and world. Identifying recreational opportunities may allow your community to preserve those that are most beneficial and improve access to the resource.
Potential Approach	**Identify if any State Scenic Waterways (SWW) are present within the basin and their associated streamflow values**. In Oregon, there are 22 state scenic waterways which have protective streamflow levels. These waterways were protected by Oregon Parks and Recreation Department (OPRD), in partnership with the Oregon Water Resources Department (OWRD), to protect recreational opportunities as a part of the program. Each scenic waterway is associated with a streamflow value that needs to be considered before additional water is allocated for out-of-stream uses. OWRD can assist with the identification of scenic waterway flow levels. **Identify important recreational uses within the planning area.** Work with your planning group to identify the main recreational uses of waterways in your planning area, including rivers, lakes, reservoirs, and wetlands. This may include floating/rafting, fishing, boating, camping, bird watching, etc. **Survey recreational water users about when and how they use rivers and lakes within the basin.** One of the best sources of information for recreational uses in the basin may be the recreationists themselves. Consider developing a survey or approach for querying recreationists about when they use rivers and lakes, how they recreate in those places (e.g., boating over rapids, fishing, etc), and if they have insights into what streamflow patterns and quantities are most important to their recreation. Surveys may have already been completed in some areas. **Determine water needs for identified recreational uses**. Some recreational water uses rely on a certain amount of water at a certain time of year while other recreational water uses may be more reliant on water quality. Think about how recreational opportunities may correspond with some of the ecological functions identified in Component IS1. These water needs may be best described qualitatively unless a method is determined to quantify these needs. If the floatability of a river or the height of a reservoir is important for recreation, it may be beneficial to quantify these values.
Datasets	**Recreation Studies** - Recreation studies have been completed in different parts of the state to highlight the economic impacts of recreational opportunities. OPRD may have information available on the number of site visits to state parks. State Scenic Water Ways OPRD website for maps of scenic waterways.
Tools	OWRD Water Availability Reporting System for querying for scenic waterways (SWW).
Assistance	OWRD staff may be able assist with queries for existing Scenic Water Way flow levels. OWRD may also be able to provide a map with Scenic Water Ways or a shapefile for your to use. Ask your Planning Coordinator for assistance. The Willamette Kayak and Canoe Club has documented their views on the on the best

	streamflow levels for boating various rivers across Oregon. Consider contacting them for more information about engaging boaters or estimating flows needed for water sports: http://www.wkcc.org/
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***IS 3. Water use/demands - Historic and future instream flow needs for fish and wildlife, ecological functions, culture, recreation, hydropower, and navigation***
Question (8 of 8)	Q8. What are the water needs associated with hydropower?
Rationale	Hydropower plays an important role in Oregon's energy portfolio, especially when integrated with other water diversion systems in rural parts of the state. Knowing where these systems are and how much water they require may be an important part of securing your basin's energy resources.
Potential Approach	**Identify known hydropower water rights**. Use OWRD's Water Rights Information System or the Water Rights Mapping Tool to identify hydropower water rights within the basin. Consider asking OWRD for assistance querying this information. **Quantify hydropower water rights by area (e.g., reach) and time (e.g., month) of interest.** For each water right, determine the total annual water right and maximum diversion rate for each hydropower water right. Estimate the distribution of water use for hydropower by month based on water right conditions, information from hydropower users within the system, or an even distribution of the total water right over the season of use. **Determine ownership of hydropower projects within your planning area.** Most hydropower project owners, such as the US Army Corps of Engineers and the Bureau of Reclamation, have detailed plans and important data sets related to dam operation, including inflow and outflow data, reservoir elevation data and water quality data. **Estimate future hydropower demands**. Consider future development of hydropower rights in the basin by either talking with city, municipal, or county planners and determine if there are any planned hydropower projects. Also consider engaging with local hydropower project owners and power utilities to determine if project modifications or new construction are planned or identified within your planning area.
Datasets	**Water Rights** - Water Rights Information System **Water Use** - Water Use Reporting **Hydroelectric Projects** – Federal Energy Regulatory Commission (FERC) Project Database and OWRD Hydroelectric Database
Tools	Water Rights Mapping Tool
Assistance	OWRD staff may be able to assist with queries for specific water right types. Ask your Planning Coordinator for assistance. The Federal Energy Regulatory Commission (FERC) is responsible for permitting hydropower facilitates. They may be able to provide information and assistance on permitted hydropower in your planning area. The US Army Corps of Engineers and Bureau of Reclamation may be able to provide information to the planning group on hydropower in your planning area. The International Hydropower Association maintains a hydropower database on hydropower production around the world.
Notes	

Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 4. Water quality - Water quality considerations affecting supply and availability

Component	*IS 4. Water quality - Water quality considerations affecting supply and availability*
Question (1 of 2)	Q1. What level of water quality is needed for instream uses?
Rationale	*Under development*
Potential Approach	*Under development* The Department of Environmental Quality (DEQ) water quality standards and criteria establish a baseline for the needs of instream uses, such as fish, shellfish, and wildlife propagation, recreation in and on the water, and other designated uses. Different uses are sensitive to different water quality characteristics. For example, swimming uses are sensitive to bacteria concentrations. Fish spawning is sensitive to dissolved oxygen concentrations. Each use has a unique set of water quality requirements. Some instream uses, such as some fish uses, may be designated only in certain locations or at certain times of the year. The water quality requirements of those uses only need to be met when and where those uses are designated. Identify the instream uses in your area and the water quality requirements (criteria) associated with each use. Determine when and where each water quality requirement occurs.
Data	*Under development* Link to DEQ water quality standards for recreation and aquatic life, including toxics. http://www.oregon.gov/deq/Regulations/Pages/OARDiv41.aspx Link to DEQ data on water quality instream, or map of water quality listings or integrated report database. Link to DEQ's designated use tables. DEQ's TMDL Reports The DEQ Drinking Water Protection Program has a GIS layer of the drinking water source areas for groundwater reliant public water systems here: Link. GIS groundwater drinking water source areas layer: Link. The Oregon Health Authority (OHA) Domestic Well Safety Program tracks nitrate concentrations from the real estate transaction data and has an interactive mapper that you can access here.
Tools	Link to fish use map.
Assistance	The Oregon Department of Fish and Wildlife (ODFW) may be able to help identify the timing and location of fish uses.
Data	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***IS 4. Water quality - Water quality considerations affecting supply and availability***
Question (2 of 2)	Q2. Is there sufficient water available at the quality needed for current and future instream uses?
Rationale	While water may appear to be available, if the water is not of the needed quality, or if the diversion of water out of stream impairs water quality for existing instream uses, then water is not actually available.
Potential Approach	*Under development* Consider the timing and location (reaches) of instream needs. Water quality may be sufficient for instream uses in only certain locations or only in certain times of year. Does the timing and location of need match the availability of water of sufficient quality for instream uses? As passage barriers are removed, species are reintroduced, or new scenic or recreational areas are established, the instream water quality needs will change based on the new uses in new locations. Will changing groundwater levels alter the source water quality for instream uses? Consider potential future instream water quality needs in your area.
Data	*Under development* Link to Department of Environmental Quality (DEQ) data on water quality instream, or map of water quality listings or integrated report database.
Tools	None identified as of 1/31/18
Assistance	Learn about the timing and location of instream needs by contacting the Oregon Department of Fish and Wildlife (ODFW) and DEQ. DEQ can assist in identifying the water quality requirements for waterbodies in the basin.
Data	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 5. Infrastructure - Built and natural infrastructure affecting flows and passage

Component	*IS 5. Infrastructure - Built and natural infrastructure affecting flows and passage*
Question (1 of 1)	Q1. Is there infrastructure in place that affects various instream uses and is there infrastructure in place that has a specific flow requirement?
Rationale	Infrastructure that requires certain flow levels for fish to be able to safely migrate upstream and downstream of the structure may be useful to identify as a limit on species distribution and access to habitat. Once identified, determining the bypass flows required to remove or reduce the impact of the structure can create opportunities for future projects which serve fish and the project operator.
Potential Approach	**Read about aquatic passage barriers in the Oregon Conservation Strategy.** The Oregon Conservation Strategy maintained by discusses the importance of addressing aquatic passage barriers and associated goals and actions. **Identify barriers that affect flow.** Fish passage barriers or flow modification structures may take the form of a small culvert all the way up to an on-channel dam. These structures have the potential to not only limit fish distribution within a particular stream network, but can also affect other instream uses and ecological functions identified in IS 3 Q2. Determine if any known barriers located within your basin or identified waterbodies of interest affect specific instream uses and what function(s) may be impacted. Consult with the Oregon Department of Fish and Wildlife (ODFW), watershed councils, recreational interests, and others with local knowledge of known barriers to assist the planning group identify potential instream impacts caused by these barriers. **Identify priority barriers**. One of the simplest methods to provide more habitat to anadromous species is to find a way to provide passage beyond a barrier, for example, a perched culvert which a fish cannot physically swim through. Planning groups should identify significant or priority barriers within the planning area – in particular, those barriers located on identified waterbodies of interest. These barriers may isolate available habitat within a basin or may have other local or cultural significance. ODFW, in partnership with many other local, state, and federal partners, has developed a statewide database of priority passage barriers to address. Engage with ODFW, watershed council, and/or tribal staff to assist with prioritizing barriers within your planning area. Some basins already have an inventory of barriers that can be used to assist with this process. **Identify infrastructure that has a specific flow requirement for operation.** Some built infrastructure has a design or required flow necessary for it to function properly (i.e., fish ladders, specialized fish passage projects, bypass or exclusion facilities). Identify these structures within your planning area and document the flow target necessary for proper function. Engage with ODFW and/or the facility owner to assist with the identification of particular flow needs, design limitations, and flow-specific information related to the facility.
Data	ODFW Fish Passage Barrier Inventories Oregon Conservation Strategy: Aquatic Passage
Tools	None identified as of 1/31/18

Assistance	ODFW may be able to provide guidance and insight into local species of concern as well as guidance from technical instream flow staff who work state-wide. Contact your local ODFW district biologist.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 6. Equity - Vulnerable communities and water stressors

Component	***IS 6. Equity - Vulnerable communities and water stressors***
Question (1 of 1)	Q1. What are the most vulnerable human and non-human communities relying on instream water that may be disproportionately affected by water stressors?
Rationale	*Under development*
Potential Approach	*Under development*
Datasets	*Under development*
Tools	*Under development*
Assistance	*Under development*
Data	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures

Component	*IS 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures*
Question (1 of 1)	Q1. What instream functions and systems are most vulnerable to shifts in climate, land use, or shifts to species distributions?
Rationale	*Under development*
Potential Approach	**Identify vulnerabilities to each of the instream use categories.** When identifying vulnerabilities to instream needs, consider the location and timing of needs – and what factors may cause harm to those needs. Additionally, identify whether the factor is something that the Planning Group can control or influence (e.g., climatic changes versus volume of available instream habitat. For ecological instream needs, work with the Oregon Department of Fish and Wildlife (ODFW) and other ecologists and biologists familiar with your area to identify vulnerable life history stages or habitat types for species of interest. Consider utilizing the itchyograph concept to consider how fish habitat may be impacted by streamflow and temperature changes across the basin and according to their life history phenology. For cultural instream needs, talk with tribal partners. There may be sites near and around water bodies that are at increased risk of flooding if peak flows increase in magnitude. Additionally, lower flows during the summer may threaten the usefulness of culturally important areas near rivers and streams. For recreational and hydropower instream needs, consider surveying water users about the aspects of their water use that they consider to be most vulnerable. Since both users may rely on high winter flows alterations in timing and volume of streamflow peaks may be important to understand.
Data	**References** • **How climate change may impact salmonid species:** Williams, J.E., Isaak, D., Imhof, J., Hendrickson, D.A. and McMillan, J.R., 2015. Cold-water fishes and climate change in North America. Link. • **Climate change impacts on Oregon's Fish and Wildlife:** Hixon, M.A, Gregory, S.V., and Robinson, D. 2013. Oregon's Fish and Wildlife in a Changing Climate. Oregon Department of Fish and Wildlife – Oregon Hatchery Center. Link. • **Visualizing stream temperature, streamflow, and timing of fish use of a system:** Flitcroft RL, Lewis SL, Arismendi I, LovellFord R, Santelmann MV, et al. (2016) Linking Hydroclimate to Fish Phenology and Habitat Use with Ichthyographs. PLOS ONE 11(12): e0168831. Link.
Tools	None identified as of 1/31/18
Assistance	See prior questions for contact information for ODFW, the Oregon Water Resources Department (OWRD), tribes, and recreational groups.

Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 8. Unmet needs - Current and future unmet instream needs

Component	***IS 8. Unmet needs - Current and future unmet instream needs***
Question (1 of 1)	Q1. Where are instream needs currently not being met?
Rationale	*Under development*
Potential Approach	*Under development*
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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IS 9. Prioritization - Priority areas for study, restoration, and protection

Component	*IS 9. Prioritization - Priority areas for study, restoration, and protection*
Question (1 of 1)	Q1. Where are the priority areas to study instream flows or recommend measures to restore and protect flows?
Rationale	The development of unmet needs and priorities for all demand components is an important part of preparing for discussions around meeting multiple water supply needs within the basin. Consider how this analysis may play into larger conversations within the planning effort.
Potential Approach	**Compile instream flow needs information on a map, including whether instream flow needs are satisfied or not. Consult instream experts to help assess the compiled data and identify those areas which most important for protection or streamflow restoration, including groundwater and surface water sources.** Once compiled, identify what additional studies or information needs to be completed or collected to gain a complete picture of instream need priorities. Consider a facilitated discussion about instream priorities in the basin. In many cases, the planning exercise may result in a description of additional needed studies, but the exercise will still have identified priority areas for protection and named the instream functions that the group believes are important to protect. Types of additional instream flow studies could include: • PHABSIM, Toe-width method, or other technical approach for computing minimum instream flow values for fisheries • Survey of recreational users about the amount of instream flow they prefer for recreation • Biological survey of species and timing of life-history use • Survey of hydropower efficiencies – identify systems for which upgrades may allow for more ideal water management **Consider utilizing existing analysis of priority instream protection areas.** In the mid-1990s, the Oregon Water Resources Department (OWRD) and the Oregon Department of Fish and Wildlife (ODFW) completed an exercise which overlaid basins identified by ODFW as being important for fisheries conservation with basins identified by OWRD field staff as having the potential for instream flow restoration. Where these maps overlapped, staff were able to identify "Priority Water Availability Basins (WABs)" where instream flow restoration may make the biggest impact on protecting instream needs. Consider identifying if a "Priority WAB" was identified in your basin and if instream protection opportunities (e.g., voluntary water transactions) exist in the basin. Consider updating this analysis. **Identify instream water rights that are likely not met**. Identify instream water rights that hold a very junior priority date within the basin. If they are in a priority instream protection area, consider identifying opportunities for meeting that instream need through voluntary instream water right transfers or leases. Consider engaging your watermaster to ask about regulation in favor of instream water rights or areas where the instream water right is junior. You may also be able to utilize OWRD's Water

	Availability Reporting System to determine if the basin in question is already over-allocated – possibly another risk factor associated with junior instream water rights. **Query conservation partners about approaches that have been used to identify instream flow protection opportunities.** Many groups, from ODFW to The Freshwater Trust, to local watershed councils, have been central to incentivizing the transfer of water rights instream to protect crucial instream needs. These partner groups may have identified areas that could use additional instream protection, as well as potentially have identified possible water sources. Consider partnering with these groups to utilize their existing instream prioritization work. **Update instream flow restoration opportunities maps to consider new risks and challenges.** Consider using the US Forest Service (USFS) NorWeST modeled August stream temperature projections to identify streams at risk of warming due to climate change. Use this new information to prioritize instream restoration where it is most likely to create or maintain viable instream habitat. **Use existing frameworks for decision making around how you might meet the most objectives with the fewest actions.** There are multiple tools to help understand controls on aquatic ecosystems. Though the integration of a tool may take time, it may be worthwhile to consider if the pressures on aquatic ecosystems are complex and overlapping. Structured decision making, an approach to selecting choices most in line with group values and technical information, may be helpful in prioritizing areas for protection. Modeling of ecosystem responses to impacts, such as this approach developed by the Environmental Protection Agency (EPA) through their CADISS decision support system, can be useful when attempting to prioritize which stressor to address within an aquatic system.
Data	GIS layer showing OWRD and ODFW priority WAB analysis results: Link. Water Rights Information System USFS NorWest Stream Temperatures
Tools	None identified as of 1/31/18
Assistance	For more information about the Priority WAB exercise, contact your OWRD Planning Coordinator.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Appendix F. Municipal-Industrial Water Needs Assessment Toolbox

HOW TO USE THIS TOOLBOX

This DRAFT "Water Needs Assessment Toolbox" contains information that groups can use to understand needs and demands for municipal, domestic, industrial, and commercial needs. The toolbox contains 1) questions that can help address the common components, 2) approaches you could use to answer the question(s), 3) available sources of data and tools, as well as 4) potential assistance. This toolbox is not meant to be read cover to cover. Click on the links below to jump to the corresponding common component or question.

DISCLAIMER

This DRAFT guidance and toolbox is intended to assist you in completing the place-based planning process as outlined in the 2015 DRAFT Guidelines. This information was compiled with the help of internal technical staff, agency partners, as well as external advisory groups with expertise in different subject matter areas for your practical use. It is up to the conveners and their support teams whether and how they use this information in their respective planning processes. The contents of this document are suggestions only and are not officially endorsed by an individual or entity. This is a DRAFT resource that will be refined and improved over time as planning groups use it and provide feedback. It can serve as a conversation starter as groups begin to think about these complex concepts, but it was not meant to be all inclusive or exhaustive. Each planning group and their planning partners will identify the questions, approaches, data, and tools that are relevant and useful to their planning effort. In terms of how work is accomplished, each partner is responsible for determining how they will contribute to the planning process and what they may be able to contribute in terms of assistance.

REQUESTING ASSISTANCE FOR PLANNING STEP 3

If you intend to request assistance from an organization identified in the tool box, please note that each organization is responsible for determining 1) whether they can provide assistance, and 2) the process by which groups can request assistance. Partners may have limited capacity to provide assistance. At this time OWRD is only able to offer planning and technical assistance to a limited number of places. Planning groups requesting technical assistance from OWRD must follow the process outlined in the Requesting Coordinated Technical Assistance Memo developed by OWRD.

FEEDBACK AND CONTINUOUS IMPROVEMENTS

If you would like to contribute a planning question, please do so by filling out this form. If you would like to provide input on an existing question, please email your thoughts or feedback to placebasedplanning@wrd.state.or.us.

MI 1. Context - MDIC water users, water providers, and areas served

Component	*MI 1. Context - MDIC water users , water providers, and areas served*
Question (1 of 1)	Q1. What are the MDIC water users in your planning area?
Rationale	Before beginning any analysis it can be helpful to develop a high level inventory of water users in this particular category. This can help will follow-on questions as well as with engagement strategies.
Potential Approach	**Inventory public water systems, connections, and population served.** Identify public water systems in the planning area by querying the Oregon Health Authority's (OHA) Drinking Water Services data access site which contains useful information about city water systems and others who provide potable water to the public, the number of connections they have, and the population served. **Inventory self-supplied industrial and commercial water users.** The group should inventory current industries or businesses that rely on water for their operations and their relative importance to the economy in your area. Using local knowledge and water rights information the groups should determine which of those are self-supplied versus supplied by municipalities.
Data	**Public Water Systems** – OHA maintains a database that can be used to find public water systems in your planning area: Link. **Public Water Systems** – The Environmental Protection Agency (EPA) maintains a Safe Drinking Water Information System that can be used to find public water systems in your planning area: Link.
Tools	None identified as of 1/31/18.
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 2. Water rights - MDIC water rights

Component	*MI 2. Water rights - MDIC water rights*
Question (1 of 1)	Q1. What are the water rights associated with MDIC uses?
Rationale	Understanding water rights generally answers the questions of who is legally allowed to use the water resources of the planning area, how those uses relate to each other, and the relative quantity of water permitted for each use. Allocations of water via water rights represents the maximum amount of water that can be diverted for use, but does not represent actual use at any given time since use varies based on the needs and management decisions of individual users as well as the terms of their water rights.
Potential Approach	**Query the Oregon Water Resources Department (OWRD) water rights database to determine the water rights held by those water users.** OWRD's water rights inventory system (WRIS) can be queried to identify municipal, commercial and industrial water rights in your planning area. Key information, such as the water right owner, priority date of the rights, source of the water, and diversion rate from the source is available through WRIS. Commercial and industrial water users may get water supplied by a city or they may be self-supplied with their own water rights and supply systems, or both. Compute the total volume associated with water rights within the basin by looking at the rate (cubic feet per second) and duty (acre feet) of surface water and groundwater allocated to MDIC water uses in a defined area. **Identify water users who are not required to hold water rights, such as exempt domestic wells, and the approximate number and type of use.** Many rural houses outside of cities get water for household use and landscape irrigation from "exempt wells" that are not required to have a water right permit and so will not show up in OWRD's database. However, OWRD does have a database of well logs for domestic wells that can give some information about well locations, density of wells in an area, drilled depth, static water levels, etc.
Data	**Public Water Systems** - The Oregon Health Authority (OHA) maintains a database that can be used to find public water systems in your planning area: Link. **Water Rights** - OWRD maintains all water rights in the Water Rights Information System (WRIS) and the Water Rights Mapping Tool. **Domestic Wells** - OWRD's well log database can be found here: Link.
Tools	OWRD's Water Rights Mapping Tool can be used to look at OWRD's water rights data across your planning area. You can search for water rights on a particular body of water within a geographic area. Data can be exported via excel.
Assistance	OWRD may be able to 1) assist with use of the web-based WRIS, export data for outside use, and query WRIS in more complex ways than the public web-based system, 2) send you an excel spreadsheet with water rights for each use or source category in a defined geographic area, 3) provide a map of water rights by use type and by source, and 4) provide a map of the density of domestic wells.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're

missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 3. Water use/demands - Historic and future MDIC water uses and demands (including municipal supplied and self-supplied)

Component	*MI 3. Water use/demands - Historic and future municipal, domestic, industrial, and commercial water uses and demands (including municipal supplied and self-supplied)*
Question (1 of 6)	Q1. What is the historic diversion demand of the public water providers in your area?
Rationale	Diversion demand is the amount of water that a user diverts or appropriates out of surface or groundwater – with a portion of that water being consumed by the end user and a portion of the water being returned to the system. Diversion demand is one way to estimate current and historic water use.
Potential Approach	**Inventory diversion demands (average daily demand and, if available, maximum daily demand) for each public water provider within the planning are**a. Diversion volumes will be familiar to municipalities, as these are the volumes are used to design diversion structures, treatment facilities, pipelines, and other water service infrastructure. Inventory the water providers you want to include in this analysis. Determine the time step for the analysis – day, month, and/or year. Locate the quantity of water diverted by each provider by using the datasets below. Alternately, a subset of users can be used as a proxy for determining diversion demand if they are approximately the same size. **Determine average and maximum per capita use by municipal system.** Use the average daily demand (ADD) of water suppliers within your planning area to calculate a future water demand calculation. This data can be used to calculate per capita demand (the number of gallons used by each person per day), a key data point needed to calculate future water demand. Water suppliers also generally use maximum daily demand (MDD) when calculating a future water demand for their system. System operators plan for this forecasted peak demand because their system has to be capable of supplying that quantity of water in the future. To calculate this additional demand forecast, use maximum daily demand when calculating per capita demand instead of average daily demand. The other calculations remain the same. **Compute total gallons per day for each municipal system.** To complete the current and future water demand calculation, multiply the respective population by the per capita demand (gallons per capita per day). Repeat these calculations for the number of water providers that the planning group has identified using system specific data or proxy values. Once completed, combine the individual data sets to determine municipal water use within the planning area. The planning group will decide if projections for all municipal water providers within the planning area will be calculated, or if proxy data will be used. It is recommended that, at a minimum, projections are calculated for at least 50% of the cities/towns within the planning area. **Quantify current industrial and commercial use supplied by cities.** If water is supplied by a city, then the city likely tracks use by meter size and/or through customer accounts and this information can be requested from the provider. The largest users are also identified in many municipal Water Management and Conservation Plans or Water System Master Plans.
Data	It is highly recommended that you talk to the water providers in your area since they will be an important source of information. The Oregon Water Resources Department

	(OWRD) has developed a list of questions you can ask water providers (on file at OWRD and available upon request). **Diversion Data** - Diversion data can generally be found in Water System Master Plans, Water Management Conservation Plans, or other planning documents maintained by water providers. **Water Use** - Most government entities are required to submit yearly water use to OWRD through the Water Use Reporting Database. Use is recorded by month and submitted each year. This can be used as a proxy for diversion demand. Please note that the quality of the data varies. **Historic Municipal Demand Calculation:** **Current Population** – Current populations within a service area can be found in water provider planning documents. Alternatively, current populations within a city/town or county can be found on Portland State University's Population Research Center website: Link **Average Daily Demand (ADD)** – This data may be found in a water supplier's Water Master Plan, Water Management and Conservation Plan, or other planning document. This data can also be obtained through direct communication with water suppliers. Alternatively, water use data for water suppliers within your planning area can be found on OWRD's Water Use Reporting website: Link. **Per Capita Demand (Gallons per Capita per Day or GPCD) –** The per capita demand is calculated by dividing a water supplier's ADD (in gallons) by the current population of the water supplier's service area (often a city's urban growth boundary). This will provide the planning group with an average per capita demand calculation. **[Optional] Maximum Daily Demand (MDD)** – This data may be found in a water supplier's Water Master Plan, Water Management and Conservation Plan, or other planning document. If current data is not available in a planning document, it can be obtained through direct communication with water suppliers in your planning area. **[Optional] Maximum Per Capita Demand (Gallons per Capita per Day or GPCD) –** Maximum per capita demand is calculated by dividing a water supplier's maximum daily demand (in gallons) by the current population of the water supplier's service area (often a city's urban growth boundary). This will provide the planning group with a maximum per capita demand calculation.
Tools	OWRD has developed a tool for estimating current and future municipal demands – this tool is on file at the OWRD and available upon request.
Assistance	Depending on resource availability, OWRD may be able to help you navigate the Water Use Reporting Database and can send you copies of approved Water Management Conservation Plans. The OWRD Water Management and Conservation Plan staff may be able to consult with your group to help you understand available information and how to use it.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered

	and incorporated.

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Component	***MI 3. Water use/demands - Historic and future municipal, domestic, industrial, and commercial water uses and demands (including municipal supplied and self-supplied)***
Question (2 of 6)	Q2. What is the potential future demand of municipalities based on per capita demand and population trends?
Rationale	One of the simplest ways to determine current and future water demand is to use current population and water use data to develop projection estimates. The level of analysis the planning group has determined to be necessary or adequate during the scoping phase will determine how future demand forecasting is completed. For some places an annual estimate may be appropriate while other places may want to do a monthly estimate.
Potential Approach	**Use existing estimates –** **Locate and synthesize existing estimates.** Most water providers have developed estimates for potential future demand and document these estimates in Water System Master Plans and Water Management Conservation Plans. Find these estimates and summarize them. NOTE: If your partners have completed their own estimates they may not appreciate a planning group developing alternate estimates. Please consult and include municipal water providers in your planning group. **Use the estimates provided in the 2015 Statewide Demand Forecast.** The 2015 Statewide Demand Forecast includes estimates for municipal and industrial use in each county. **Develop your own estimates –** 1. **Determine population projections of planning area within municipal systems.** Future population projections are generally calculated by using a projected annual growth rate. If an annual growth rate is not available, using historic growth rates is a suitable alternative. To accomplish this, look back at population numbers for the past 10 years (or longer) and calculate an annual population growth over that time period. Apply this historic growth rate to the current population and calculate population growth over the established planning horizon. 2. **Compute total gallons per day for each municipal system.** To complete the current and future water demand calculation, multiply the respective population by the per capita demand (gallons per capita per day). This calculation can be made for multiple projections (10 years, 20 years, etc.), though the projections are likely less accurate as the planning horizon lengthens. Repeat these calculations for the number of water providers that the planning group has identified using system specific data or proxy values. Once completed, combine the individual data sets to determine municipal water use within the planning area. The planning group will decide if projections for all municipal water providers within the planning area will be calculated, or if proxy data will be used. It is recommended that, at a minimum, projections are calculated for at least 50% of the cities/towns within the planning area. 3. **Estimate future needs for municipal supplied commercial and industrial water users**. It can be difficult to estimate future industrial/commercial demands, but they often grow in relative proportion as a city grows. A city may have plans to

	serve industrial water to a currently-undeveloped zone within the urban growth boundary. Major industry within a city may also have known plans for expansion and estimated water needs for that expansion. The group can qualitatively describe where they see opportunities for future industrial/commercial development, locations of that development, and the water demands of likely development including timing of use. NOTE: If municipal demand is a big driver of water use in your planning area, you may want to consider a more advanced analysis. Consult with OWRD about more advanced approaches that you could use.
Data	**Future Municipal Demand Calculation -** **Future Population Projections** – This data may be found in a water supplier's Water Master Plan, Water Management and Conservation Plan, or other planning document. It is generally calculated using a projected annual growth rate. If an annual growth rate is not available, using historic growth rates is a suitable alternative. To accomplish this, look back at population numbers for the past 10 years (or longer) and calculate an annual population growth over that period. Apply this growth rate to the current population and calculate population growth over the desired planning horizon. Projected future populations within a city/town or county can also be found on the State of Oregon's Office of Economic Analysis website: Link **Future Water Demand Projections -** This data may be found in a water supplier's Water Master Plan, Water Management and Conservation Plan, or other planning document. It is generally calculated by multiplying the current per capita demand and the projected future population (Ex. 150 gpcd (2017 per capita demand) x 14500 (2027 population projection) = 2.2 mgd (2027 demand projection). **[Optional] Maximum Future Water Demand Projections -** This data may be found in a water supplier's Water Master Plan, Water Management and Conservation Plan, or other planning document. It is generally calculated by multiplying the maximum per capita demand and the projected future population. **Future Industrial and Commercial Water Use -** **Industrial and Commercial Water Use (Supplied by a Water Provider)** – Water providers may keep records of the water provided to different sectors and may supply that information upon request. **Economic and Employment Data –** The Oregon Employment Department maintains information on employment data across the state that can help you assess the relative importance of different sectors to the economy: Link. **Water Use by Industry** – The Pacific Institute has assembled information of water use by major industries that can be used as a proxy for current and future needs: Link. **Municipal Billing Data –** The billing software used by many municipal water users has the ability to differentiate water users (residential, commercial, demand, etc.) and the quantity of water used by each sector.
Tools	The Oregon Water Resources Department (OWRD) has developed a tool for estimating current and future municipal demands – this tool is on file at the OWRD and available

	upon request. OWRD has developed an interview guide with questions that you can ask municipal water providers – this interview guide is on file at the OWRD and available upon request.
Assistance	Many water providers have done these calculations in the past and are a great source of information and assistance. Be sure to reach out to them and include them in your planning process. The OWRD Water Management and Conservation Plan staff may be able to consult with your group to help you understand available information and how to use it.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 3. Water use/demands - Historic and future municipal, domestic, industrial, and commercial water uses and demands (including municipal supplied and self-supplied)***
Question (3 of 6)	Q3. What is the current diversion demand of self-supplied industrial and commercial water users?
Rationale	Industrial and commercial water users have unique water needs that are important to understand given their importance to the overall economic vitality of the planning area. In some communities most industrial and commercial users are supplied by municipal water providers, if that is the case, make sure they are included in MI 3 Q1. Self-supplied industrial and commercial users may be a small or large part of the overall water use in your planning area and your analysis should be tailored accordingly.
Potential Approach	**Use existing estimates –** **Use the estimates provided in the 2015 Statewide Demand Forecast.** The 2015 Statewide Demand Forecast includes estimates for municipal and industrial use in each county. **Determine your own estimates –** **Estimate current self-supplied industrial and commercial water use.** If the water user is "self-supplied" beyond the limits of an exempt well, they will have a water right in Oregon Water Resources Department (OWRD) Water Rights Information System (WRIS) database. The water right information found in the database provides rates of diversion, but industrial and commercial users do not typically use the full rate every hour of the year, are often not required to report water use to OWRD, and some may be simply out of business or operating only periodically due to business and economic conditions. One approach is to sort the water right list down to the most significant subset based on diversion rate, and then estimate actual use of the major users through local knowledge in the planning group, or through direct inquiry with the industries. In some cases they will have water use reporting requirements and their reports can be reviewed through OWRD's on-line database. For the statewide water demand forecast, OWRD estimated self-supplied industrial use by assuming industries, on average, operate at one-half the diversion rate for 16 hours a day, 365 days a year.
Data	The most reliable data for self-supplied industrial and commercial users will generally come from the users themselves if they are willing to share that information with you. **Water Use (Self-Supplied)** – Some industrial and commercial users report their water use to OWRD through the Water Use Reporting Database. Use is recorded by month and submitted each year. This can be used as a proxy for diversion demand. Please note that the quality of the data varies. **Water Use by Industry** – The Pacific Institute has assembled information of water use by major industries that can be used as a proxy for current and future needs: Link.
Tools	EPA has assembled materials, including Water Assessment Worksheets, to help commercial and industrial facilities conduct a self-assessment: Link.
Assistance	The Chamber(s) of Commerce, Economic Development Association(s), Council of Governments, County Planning Departments, or Regional Solutions Team in your planning area may be able to assist in understanding and articulating water needs for

	industrial and commercial water users in your planning area.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 3. Water use/demands - Historic and future municipal, domestic, industrial, and commercial water uses and demands (including municipal supplied and self-supplied)***
Question (4 of 6)	Q4. What is the potential future demand for self-supplied industrial and commercial water use?
Rationale	Industrial and commercial water users have unique water needs that are important to understand given their importance to the overall economic vitality of the planning area. In some communities most industrial and commercial users are supplied by municipal water providers, if that is the case, make sure they are included in MI 3 Q1. Self-supplied industrial and commercial users may be a small or large part of the overall water use in your planning area and your analysis should be tailored accordingly. Estimating future water needs of industrial and commercial water users may be difficult given uncertainties about economic growth, land use development, consumer demands, and market considerations. In some instances, self-supplied industrial and commercial water use may decrease over time as new industrial and commercial needs are served by municipal water providers.
Potential Approach	**Use existing estimates –** **Use the estimates provided in the 2015 Statewide Demand Forecast.** The 2015 Statewide Demand Forecast includes estimates for municipal and industrial use in each county. **Develop your own estimates –** **Estimate the future need for self-supplied industrial and commercial water users.** Once an estimate of self-supplied industrial and commercial use is made (see MI 3 Q3), at least a qualitative estimate of future demand can be made. The county planning department may have information about industrial parks or other plans for attracting industry in the future. They may have insight into how those future industrial uses would be supplied and how much water they may require. Self-supplied users currently operating below the capacity of their water rights can be assumed to expand to their capacity in the future.
Data	**Economic and Employment Data –** The Oregon Employment Department maintains information on employment data across the state that can help you assess the relative importance of different sectors to the economy: Link. **Water Use by Industry** – The Pacific Institute has assembled information of water use by major industries that can be used as a proxy for current and future needs: Link.
Tools	None identified as of 1/31/18.
Assistance	The Chamber(s) of Commerce, Economic Development Association(s), Council of Governments, County Planning Departments, or Regional Solutions Team may be able to help you understand water needs for future economic development.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 3. Water use/demands - Historic and future municipal, domestic, industrial, and commercial water uses and demands (including municipal supplied and self-supplied)***
Question (5 of 6)	Q5. What is the current water demand for rural domestic water use?
Rationale	Domestic, self-supplied water users are likely to face different issues than domestic water users served by municipal providers. Although self-supplied rural domestic water use is a small portion of the overall water budget, it is important to understand their water needs, especially if a large portion of the population lives outside of an area supplied by a municipal water provider. Rural domestic water needs can be difficult to estimate given that many rural water users rely on exempt wells that do not require a water right and do not record or report their water use.
Potential Approach	**Use existing estimates –** **Use the estimates provided in the 2015 Statewide Demand Forecast.** Estimates for water use outside of the Urban Growth Boundaries were included in the 2015 Statewide Demand Forecast and can be used by your planning group. **Develop your own estimates –** 1. **Determine the number of self-supplied rural domestic water users.** There are many ways to estimate the population not served by municipal water providers or public water systems. One method is to take overall population for the planning area, subtract the estimated number of people served by water providers to arrive at the population of rural residents. County Planning departments may have information on occupied dwellings outside of the Urban Growth Boundary. 2. **Estimate a per capita use value for the population**. Develop an estimate for gallons per person per day for rural water users and document your assumptions. Multiply the "unincorporated" population by a per capita demand number, which could be derived from the average of the municipal per capita demands in the planning area. You may also consider using a per-capita value from a smaller utility in a neighboring community. Alternately, these needs can be described qualitatively. 3. **Calculate current demand using population and per-capita use.** Calculating current water demand for this particular demographic can be accomplished by multiplying the estimated number of self-supplied rural domestic water users by a per capita use value. This can be represented as gallons per day as well as acre feet per year.
Data	**Statewide Demand Forecast** - Data used to calculate self-supplied rural domestic water use can be found online: Link. **Water Rights** - Surface water rights for domestic use are tracked in the Water Rights Information System and the Water Rights Mapping Tool – these are typically connected to a second use type (e.g., irrigation). **Current Population** - Current populations within a county or city/town can be found on Portland State University's Population Research Center website: Link. **Domestic Wells** - The Oregon Water Resources Department (OWRD) Well Log Database can be used to see when and where wells were drilled for domestic purposes.
Tools	None identified as of 1/31/18.
Assistance	Depending on staff capacity OWRD may be able to provide a map of well density and

	well yield in your planning area, which can help you assess where wells are currently concentrated and where future development may occur. OWRD may also be able to help you use the well log database to see where wells have recently been drilled or deepened. OWRD may be able to help your group access and understand data used to develop the Statewide Demand Forecast. The County Planning Department may be able to provide information on the number and location of occupied dwellings outside of the Urban Growth Boundary.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 3. Water use/demands - Historic and future municipal, domestic, industrial, and commercial water uses and demands (including municipal supplied and self-supplied)***
Question (6 of 6)	Q6. What is the potential future water demand for self-supplied rural domestic water use?
Rationale	Domestic, self-supplied water users are likely to face different issues than domestic water users served by municipal providers. Although self-supplied rural domestic water use is a small portion of the overall water budget, it is important to understand their water needs, especially if a large portion of the population lives outside of an area supplied by a municipal water provider. Rural domestic water needs can be difficult to estimate given that many rural water users rely on exempt wells that do not require a water right and do not record or report their water use.
Potential Approach	**Use existing estimates –** **Use the estimates provided in the 2015 Statewide Demand Forecast.** Estimates for water use outside of the Urban Growth Boundaries were included in the 2015 Statewide Demand Forecast and can be used by your planning group. **Develop your own estimate –** 1. **Estimate how many people will be served by rural domestic systems in the future**. For purposes of planning, it is recommended that the groups determine whether population growth will predominantly occur in rural or urban areas. If growth is likely to occur in urban areas, you may assume this number does not change significantly. If growth is likely to occur in rural areas, determine a method to estimate that growth or describe it qualitatively. 2. **Estimate a per capita use value for the population**. This may be the same amount documented for MI 3 Q5 or an alternate value. For most of the country, per capita use has decreased over time as appliances have become more efficient and consumers have adopted conservation measures. Be sure to document your assumptions about future per capita use. 3. **Calculate future demand using population and per-capita use.** You can calculate a future demand projection by multiplying the current per capita demand by the projected future rural population at the desired planning horizon. This will likely be a very small portion of overall water use in your planning area, but can still be an important consideration depending on how many residents supply their own water.
Data	**Statewide Demand Forecast** - Data used to calculate self-supplied rural domestic water use can be found online: Link. **Future Population** - OWRD's Demand Forecast Appendix B contains forecasted population values statewide from both Portland State University's Population Research Center (from 2014) as well as the Office of Economic Analysis (OEA) and the 2010 Census: Link.
Tools	None identified as of 1/31/18.
Assistance	The County Planning Department(s) in your planning area may be able to help you assess rural population growth and the associated challenges to meeting the future water and wastewater needs of these users.

Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 4. Water quality - Water quality considerations affecting water supply and availability

Component	***MI 4. Water quality - Water quality considerations affecting water supply and availability***
Question (1 of 2)	Q1. What level of water quality is needed for MDIC uses?
Rationale	MDIC users require water to be of a sufficient quality in order to process it into usable water for domestic, commercial and industrial uses. The quality of source water needed depends in part on infrastructure, the technology used by the treatment facility, and the water quality standards that apply.
Potential Approach	*Under development* Infrastructure can react chemically with the water and introduce contaminants that were not present in the source water. To prevent this, the source water must be of a certain quality. For example, using source water that is low in salts can help reduce corrosivity which reduces lead contamination. Determine the type of infrastructure in your area and the water quality needed to ensure a healthy functioning system. Treatment facilities vary in the type of treatment technology and strength of treatment. Treatment methods may include filtering out particles of a certain size, disinfecting using UV radiation, adding chlorination, etc. The cleaner the water, the less treatment it needs. Determine if the source water in your area is of sufficient quality to provide quality drinking water given the existing treatment systems. Contact treatment plan staff to determine source water limitations. Water that is used for domestic purposes such as drinking, showering, washing, must meet drinking water standards. Drinking water standards describe the acceptable level of pollutants in tap water. They are defined by the Environmental Protection Agency (EPA) and adopted in Oregon law. Determine which water quality standards and criteria apply to MDIC uses in your area. Municipal and smaller public domestic users are required to frequently test treated drinking water. Check out the quality of treated MDIC water in your area on the Oregon Health Authority (OHA) municipal water quality database. Private domestic sources are only required to test water quality at the time of sale, for a limited number of parameters. Review OHA's real estate transaction data to identify water quality limited areas for groundwater. The Department of Environmental Quality (DEQ) has conducted several groundwater quality studies that may inform groundwater quality limitations for domestic wells. Contact DEQ to determine if a groundwater quality study has been completed in your area. Industrial and commercial uses, which are not connected to the municipal water supply, should also be surveyed to identify water quality limitations of source water and if pollution reduction is needed to meet the needs of the user group.
Data	*Under development* Link to Municipal surface or groundwater source water testing

	Link to Oregon Drinking Water Standards and surface water standards Link to OHA Well Testing and Regulations Link to OHA municipal water quality data
Tools	
Assistance	Contact local water treatment facilities and/or your city water planning department to understand the water quality needs of municipal infrastructure and treatment facilities. Contact OHA for information from OHA's real estate transaction database. Learn about your well system infrastructure and treatment options from OHA. DEQ and OHA developed a Groundwater Resource Guide to understand and address groundwater quality concerns for drinking water. A companion Surface Water Resource Guide will be completed and available in early 2018. DEQ may also be able to provide maps of source water areas and additional technical assistance: Link. Oregon State University (OSU) Extension maintains a well water program with information for well owners: Link. OHA's Domestic Well Program provides resources for private well owners: Link.
Notes	None identified as of 1/31/2018.
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 4. Water quality - Water quality considerations affecting water supply and availability***
Question (2 of 2)	Q2. Is there sufficient water available at the quality needed for current and future MDIC uses?
Rationale	While water may appear to be available, if the water is not of the needed quality, or if the diversion of water out of stream impairs water quality for existing MDIC uses, then water is not actually available.
Potential Approach	*Under development* Consider the timing and location (diversions or wells) of MDIC needs. Water quality may be sufficient for MDIC uses in only certain locations or only in certain times of year. Does the timing and location of need match the availability of water of sufficient quality for MDIC uses? Consider potential future MDIC water quality needs in your area. As new regulations are developed, new infrastructure is installed, or new treatment technology is used, the water quality needs for MDIC source water may change. Will changing groundwater levels alter the source water quality for MDIC uses?
Data	*Under development* Link to the Oregon Health Authority (OHA) data on water quality from municipal systems. Link to the Department of Environmental Quality (DEQ) map of water quality listings or integrated report database.
Tools	None identified as of 1/31/2018.
Assistance	DEQ may be able to assist your group with determining the impacts of out-of-stream uses on instream water quality. Learn about the timing and location of withdrawals for MDIC uses by contacting City and County staff.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 5. Infrastructure - Built and natural infrastructure needs affecting MDIC water supply and availability

Component	*MI 5. Infrastructure - Built and natural infrastructure affecting water supply and availability*
Question (1 of 3)	Q1. What is the status of built (grey) infrastructure used by water providers to meet their water needs?
Rationale	The condition of diversion, storage, treatment, and delivery infrastructure can help to understand where there may be potential water and energy savings and where there may be the opportunity for cooperation between cities facing similar issues. Infrastructure issues may be connected to water quality and/or quantity issues. Infrastructure can be a source of vulnerability as well as a source of resiliency.
Potential Approach	**Infrastructure of municipal water providers.** Consider inventorying and generally assessing diversion, storage, treatment, and delivery infrastructure within your planning area. In many cases water providers have invested in studies to better understand their current infrastructure and define infrastructure improvement goals (e.g. Capital Improvement Plans or Water System Master Plans). Consider drafting a survey or interview guide that will provide a common set of answers across users. The survey results could highlight opportunities for effective cooperation between cities and bring awareness to the broader community through the place-based planning process. **Document the replacement and repair needs of key infrastructure if they limit efficient water supply**. Consider aging infrastructure and the impacts of growth and development on existing water systems.
Data	The best source of information will generally be from your partners and water users themselves. You can get a high-level sense of the status of infrastructure by talking to the people that are responsible for maintaining the infrastructure. Some may have a lack of developed infrastructure, while others are grappling with aging infrastructure. Their Water System Master Plans or Water Management and Conservation Plans are public documents though water system security concerns may limit access to certain portions. **Infrastructure Survey** - The League of Oregon Cities conducts surveys on infrastructure needs for cities: Link. **Dam Inventory** - The Oregon Water Resources Department (OWRD) maintains a Dam Inventory that can be used to look at the dams in your area and their hazard ratings: Link. **Water Management Conservation Plans** - OWRD has an inventory of cities that have submitted Water Management and Conservation Plans and can provide a copy of those plans upon formal request.
Tools	None identified as of 1/30/18.
Assistance	County Planners and Emergency Managers may be good sources of information for understanding infrastructure issues that affect residents that live outside city boundaries (septic systems and wells).

	Depending on staff capacity OWRD can consult with your group to discuss the dams in your planning area.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 5. Infrastructure - Built and natural infrastructure affecting water supply and availability***
Question (2 of 3)	Q2. What is the status of built (grey) infrastructure used by rural water users to meet their water needs?
Rationale	Self-supplied rural domestic users face different water challenges since they are ultimately in charge of their own infrastructure to treat, store, and distribute water to their homes. These users can also be more vulnerable since they may lack knowledge about their water systems, the money for needed investments, or connections to resources that can help.
Potential Approach	**Describe the status of infrastructure for self-supplied rural water users.** Rural water users generally rely on wells and septic tanks for water and wastewater. Well drillers or well inspectors may be able to describe the status of wells in the planning area. County planners may be able to describe the status of septic systems. This is a very complex topic that varies greatly from place-to-place and should be described at a high-level only if it is important to your planning efforts.
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 5. Infrastructure - Built and natural infrastructure affecting water supply and availability***
Question (3 of 3)	Q3. What is the status of natural (green) infrastructure used by water providers to meet their water needs?
Rationale	*Under development*
Potential Approach	*Under development*
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 6. Equity - Vulnerable communities and water stressors

Component	***MI 6. Equity - Vulnerable communities and water stressors***
Question (1 of 1)	Q1. What vulnerable communities in your planning area may be disproportionately affected by water stressors?
Rationale	*Under development*
Potential Approach	*Under development*
Data	The US Water Alliance developed a National Briefing Paper on how to ensure an equitable water future.
Tools	The Oregon Rural Communities Explorer can be used to better understand local demographics and potential vulnerable communities. EPA maintains a tool called EJ Screen, which is an environmental justice screening and mapping tool that provides reports on vulnerable communities and the environmental risks they may face.
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures

Component	*MI 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures*
Question (1 of 3)	Q1. What extreme events affect the ability of MDIC users to meet their water needs?
Rationale	Identification of vulnerabilities in the MDIC systems can help determine priorities for solution development. This will likely be a qualitative description of the vulnerabilities that MDIC water users face.
Potential Approach	**Determine which natural hazards may impact MDIC systems and which are most likely to occur.** List the hazards that have the potential to affect water supply and availability for MDIC uses. Consider the likelihood of different hazards, such as droughts and floods as well as other natural disasters (e.g. earthquakes, landslides, wildfires). Some communities already have natural hazard plans that describe these events and their likely impacts.
Data	Partners will be the best source of information. Consider developing a consistent approach to assess vulnerabilities and resilience across users. **Statewide Geohazards Viewer** - The Oregon Department of Geology and Mineral Industries (DOGAMI) maintains a statewide map that can help you identify hazards in your planning area: Link. **Natural Hazards Plans and Maps** - The Department of Land Conservation and Development (DLCD) has summarized natural hazards in different regions of Oregon that is maintained online: Link. **Floods** - DLCD maintains a Risk Map that outlines floodplains and flood risk: Link. **Floods/High Flow Events** – The Oregon Water Resources Department (OWRD) maintains a Peak Flow Estimation database that can be used to assess peak flows and potential impacts to infrastructure: Link. **Droughts** - The National Integrated Drought Information System provides an online database of past drought events as well as a future outlook for drought potential: Link. **Landslides** - DOGAMI maintains an interactive map of potential landslides: Link. **Forest Fires** – The Oregon Department of Forestry (ODF) maintains a database of forest fires: Link. **Earthquakes** - DOGAMI maintains earthquake hazard maps: Link.
Tools	**Vulnerability Assessment** - The Environmental Protection Agency (EPA) has developed a Vulnerability Self-Assessment Tool (VSAT): Link. **Hazards Explorer Tool** - Oregon Explorer includes a Hazards Explorer Tool: Link.
Assistance	Your County Planning Department likely has information and resources about natural hazards in your area that the planning group could reference. DLCD and DOGAMI may be able to provide insight into the hazards timing and intensity

	of hazards in your planning area.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures***
Question (2 of 3)	Q2. How will climate change affect the ability for MDIC users to meet their water needs?
Rationale	In many areas, climate change is likely to increase water demand while shrinking water supplies. This shifting balance would challenge water managers to simultaneously meet the needs of growing communities, sensitive ecosystems, farmers, ranchers, energy producers, and manufacturers. In some areas, water shortages will be less of a problem than increases in runoff, flooding, or sea level rise. These effects can reduce the quality of water and can damage the infrastructure that we use to transport and deliver water. It is important to think about how climate change will affect water users in your area.
Potential Approach	**Qualitatively assess impacts to MDIC uses considering the amount and timing of supply, changes in demand, water quality, and infrastructure.** Climate change impacts on MDIC water needs will vary greatly depending on the type of users and their ability to both plan for and respond to hazards. This will likely be a qualitative description of potential impacts to water systems and users resulting from climate change. Similar to vulnerabilities, consider increased frequency of droughts and floods and the impacts of those events. Consider how changes in streamflow may affect the amount and timing of water availability. Water quality may be impacted as a result of natural hazards or as weather patterns and precipitation patterns change over time. Also, think about the impacts to human health under different climate scenarios as it relates to water needs and demands. There may be some partners that have conducted some of these analyses in your area.
Data	**Climate Change Adaptation Framework** - The Department of Land Conservation and Development (DLCD) has developed a Climate Change Adaptation Framework that summarizes the likely impacts of climate change and how Oregon communities can prepare and adapt to these impacts: Link. **Climate Assessment Reports** - The Oregon Climate Change Research Institute (OCCRI) assembles Climate Assessment Reports that summarizes the likely impacts of climate change and how Oregon communities can prepare and adapt to these impacts: Link. **Climate Change Impacts Overview** – The Environmental Protection Agency (EPA) maintains a website on climate impacts to water resources: Link. **Climate Change Indicators** – The EPA maintains a website with climate change indicators as well as report cards that track climate change impacts over time: Link.
Tools	The Environmental Protection Agency (EPA) has developed a Climate Resilience Evaluation and Awareness Tool (CREAT): Link.
Assistance	The Oregon Climate Change Research Institute may be available to assist you in assessing climate change impacts to MDIC users in your area. Consider contacting county emergency managers about areas prone to flooding and drought.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're

missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***MI 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures***
Question (3 of 3)	Q3. What are MDIC water users doing to be more resilient in their operations?
Rationale	*Under development*
Potential Approach	*Under development*
Datasets	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 8. Unmet needs - Current and future unmet MDIC needs

Component	*MI 8. Unmet needs - Current and future unmet MDIC needs*
Question (1 of 1)	Q1. What are current and potential future unmet MDIC water needs in your planning area?
Rationale	The identification of unmet needs and priority areas can help create the backbone for the identification of solutions. Unmet needs can be described quantitatively as a supply-demand comparison, or can be described qualitatively as visual depictions of areas where water needs may not be met by current supplies, and specific conditions which may create unmet needs (e.g., drought).
Potential Approach	**Define types of unmet need and identify the timing and location of those needs**. Needs may be for different volumes of water, different timing of available water, or for infrastructure improvements to more efficiently use available water. Maximum water use is typically used as a planning target for municipal water suppliers. During droughts, unmet needs may be evidenced by water providers using curtailment plans, entering a state of emergency, or seeking emergency back-up supplies. During floods, failed infrastructure points to a need to develop improved or redundant diversion facilities. If needs cannot be met due to water quality issues, this should also be described. Consider using standard lines of questioning and a consistent methodology to determine unmet needs and priority areas for different users. Utilize facilitation skills of the group facilitator or project manager. Consider mapping out where the diversions are within the basin and representing needs visually. **Prioritize which unmet needs are most important to address**. Consider developing evaluation criteria or a prioritization matrix to help the group determine the highest priorities.
Data	The best source of information will likely be from your partners. Talk to water providers about whether they have concerns about meeting their current and future water needs with available supply. Consider hosting a community forum for rural water users to share their needs and concerns. Watermasters may be able to provide information about when and where MDIC users have been regulated off of the surface or groundwater system based on the priority date of their water rights. **Water Delivery** - You may call water trucks to see if there are places that they regularly have to deliver water during times of the year to rural water users. **Deepened Wells** – The Oregon Water Resources Department (OWRD) Well Log Database can be used to assess where wells have been deepened: Link.
Tools	None identified as of 1/31/2018.
Assistance	Depending on staff capacity OWRD may be able to provide a map showing where domestic wells have been deepened. Watermasters may be able to provide information about MDIC users that do not receive their water rights due to senior calls made on the water.
Notes	

Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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MI 9. Prioritization - MDIC water needs and priorities for planning

Component	*MI 9. Prioritization - MDIC water needs and priorities for planning*
Question (1 of 1)	Q1. How can MDIC water needs be prioritized for planning purposes?
Rationale	*Under development*
Potential Approach	*Under development*
Datasets	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Appendix G. Agricultural Water Needs Assessment Toolbox

HOW TO USE THIS TOOLBOX

This DRAFT "Water Needs Assessment Toolbox" contains information that groups can use to understand needs and demands for municipal, domestic, industrial, and commercial needs. The toolbox contains 1) questions that can help address the common components, 2) approaches you could use to answer the question(s), 3) available sources of data and tools, as well as 4) potential assistance. This toolbox is not meant to be read cover to cover. Click on the links below to jump to the corresponding common component or question.

DISCLAIMER

This DRAFT guidance and toolbox is intended to assist you in completing the place-based planning process as outlined in the 2015 DRAFT Guidelines. This information was compiled with the help of internal technical staff, agency partners, as well as external advisory groups with expertise in different subject matter areas for your practical use. It is up to the conveners and their support teams whether and how they use this information in their respective planning processes. The contents of this document are suggestions only and are not officially endorsed by an individual or entity. This is a DRAFT resource that will be refined and improved over time as planning groups use it and provide feedback. It can serve as a conversation starter as groups begin to think about these complex concepts, but it was not meant to be all inclusive or exhaustive. Each planning group and their planning partners will identify the questions, approaches, data, and tools that are relevant and useful to their planning effort. In terms of how work is accomplished, each partner is responsible for determining how they will contribute to the planning process and what they may be able to contribute in terms of assistance.

REQUESTING ASSISTANCE FOR PLANNING STEP 3

If you intend to request assistance from an organization identified in the tool box, please note that each organization is responsible for determining 1) whether they can provide assistance, and 2) the process by which groups can request assistance. Partners may have limited capacity to provide assistance. At this time OWRD is only able to offer planning and technical assistance to a limited number of places. Planning groups requesting technical assistance from OWRD must follow the process outlined in the Requesting Coordinated Technical Assistance Memo developed by OWRD.

FEEDBACK AND CONTINUOUS IMPROVEMENTS

If you would like to contribute a planning question, please do so by filling out this form. If you would like to provide input on an existing question, please email your thoughts or feedback to placebasedplanning@wrd.state.or.us.

AG 1. Agricultural products, acres in agricultural production, irrigated acres, and irrigation districts

Component	***AG 1. Agricultural products, acres in agricultural production, irrigated acres, and irrigation districts***
Question (1 of 5)	Q1. What agricultural activities require water and what are their general water needs (e.g., amount, distribution, timing)?
Rationale	Understanding what agricultural products require water can provide a basis for estimating water needs/demands. Consider all agricultural activities that require water (e.g., stockgrowing, nursery operations, etc) since each agricultural activity has its own unique water needs both in terms of amount, distribution, and timing.
Potential Approach	*Under development*
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 1. Agricultural products, acres in agricultural production, irrigated acres, and irrigation districts***
Question (2 of 5)	Q2. What crops are currently grown and what acreage do they cover?
Rationale	Understanding what types of crops are grown and where they are grown will provide a snapshot of agriculture in your planning area and help to provide a basis for analyzing water needs. Water needs will vary depending on the types of crops grown and the growing conditions in your planning area. Each agricultural activity has its own unique water needs both in terms of amount, distribution, and timing.
Potential Approach	**Utilize existing data sets to determine crop types and distribution.** The US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) conducts a detailed census of US farms and ranches at the state and county level every five years. The results describe the distribution of crops within each county as well as the number of self-reported irrigated acres by county. The USDA NASS also releases a GIS coverage of crops called the Cropland Data Layer (CDL). This remotely sensed (i.e. satellite derived) data set, produced from 1997 through today, provides a gridded map of what crops are grown where. There are important caveats to understand about these data sets if they is used; see the Assistance section of this table for more information.
Data	**Crop Types and Distribution** - Census of Agriculture County-level Data (2012) **Overview of Crops and Irrigated Acres** – NRCS Hydrologic Unit Profiles
Tools	**Crop Types and Distribution** – CropScape - Cropland Data Layer **Crop Types and Distribution** – Climate Engine Application
Assistance	NRCS may be able to help planning groups access the Census database, identify relevant datasets, and understand the data. If CDL data is used, please consider methods to bias correct the data: Link. Overlaying land use zoning and soil types on the CDL helps improve accuracy by limiting the acreage to that which is agricultural, and not a meadow mistaken for grass/pasture or something.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 1. Agricultural products, acres in agricultural production, irrigated acres, and irrigation districts***
Question (3 of 5)	Q3. What crops are irrigated and where are they located?
Rationale	*Under development*
Potential Approach	**Determine the amount and location of irrigated land.** There are multiple sources of information to estimate irrigated land: • The US Geological Survey (USGS) Oregon Water Use Compilation estimates total irrigated land by county using the US Department of Agriculture (USDA) Census of Agriculture data as an input. Planning groups can use data from the Census and USGS Compilation to determine total acreage of various crops in their county and the proportion of that acreage with or without irrigation. • The Natural Resources Conservation Service (NRCS) compiled this information in profiles of hydrologic units across Oregon that were completed in the early 2000s. • Another option for determining irrigated acres, is to use the Oregon Water Resources Department (OWRD) water rights Place of Use layer overlain on the Cropland Data Layer to identify those specific crops and lands which have the legal right to irrigate. If the group is interested in using the OWRD Water Rights Place of Use GIS Data Layer, they should consult with OWRD to determine how best to use this information given that this data has location specific considerations. • Finally, Farm Services Agency (FSA) data and identifies irrigated and dryland acreage. Data is limited to farmers who participate in the program and the data are confidential, so to use them would require consent of the landowners participating in FSA. • Local/regional OSU Extension and NRCS may have refined, more recent and/or more accurate data; maybe just for some crops or areas, but it is worth checking.
Data	**Overview of Crops and Irrigated Acres** – NRCS Hydrologic Unit Profiles **Irrigated Acres** - USGS Oregon Water Use Compilation (2010) **Irrigated Acres** - OWRD Water Rights Place of Use GIS Data Layer* *Please consult the Oregon Water Resource Department if you choose to use this data set so they can help you figure out how best to use and interpret the data given location specific considerations.
Tools	**Crop Types and Distribution, and Irrigation** – Climate Engine Application
Assistance	NRCS and OSU Extension may be able to help planning groups access information about irrigated acreage. USGS may be able to help groups clarify any questions about the Water Use Compilation data set. OWRD may be able provide guidance on how to use the Water Rights Place of Use GIS Data Layer to determine irrigated lands.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 1. Agricultural products, acres in agricultural production, irrigated acres, and irrigation districts***
Question (4 of 5)	Q4. What are historic trends in crop types, distribution, and irrigated acres?
Rationale	*Under development*
Potential Approach	**Determine historic trends in crop types and irrigated acres over time using published datasets.** The US Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) conducts a detailed census of US farms and ranches at the state and county level every five years. Past publications are publically available. Groups can use crop type coverage data by county dating back decades to understand agricultural trends over time. **Discuss trends over time with agricultural producers, including factors that are likely to affect future trends.** Agricultural producers are the best source of information about the factors that have affected past trends and factors that are likely to affect future trends in terms of what crops are grown their growing requirements.
Data	*Under development*
Tools	None identified as of 1/31/18
Assistance	NRCS may be able to help planning groups access the Census database, identify relevant datasets, and understand the data.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 1. Context - Agricultural products, acres in agricultural production, irrigated acres, and irrigation districts***
Question (5 of 5)	Q5. What agricultural users are served by irrigation or water districts?
Rationale	Farms may have their own independent surface or groundwater supplies or may receive water as part of an irrigation district or irrigation company. If water is primarily managed by irrigation districts, it will likely be easier to estimate water based on diversion demand because districts measure their diversions. If most agricultural producers are self-supplied, many assumptions may need to be made since most producers are not required to report the amount of water they divert.
Potential Approach	*Under development*
Data	*Under development*
Tools	None identified as of 1/31/18
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 2. Agricultural water rights

Component	*AG 2. Water rights - Agricultural water rights*
Question (1 of 1)	Q1. What are the water rights for agricultural water users?
Rationale	Understanding water rights generally answers the questions of who is legally allowed to use the water resources of the planning area, how those uses relate to each other, and the relative quantity of water permitted for each use. Allocation of water via water rights represents the maximum amount of water that can be diverted for use, but does not represent actual use at any given time since use varies based on the needs and management decisions of individual users as well as the terms of their water rights.
Potential Approach	**Identify agricultural water rights within the basin and quantify total agricultural water rights.** A query of OWRD's Water Rights Information System (WRIS) can produce all agricultural water rights within a basin. Compute the total volume associated with water rights within the basin by looking at the rate (cubic feet per second) and duty (acre feet) of surface water and groundwater allocated to agricultural water use in a defined area. For storage rights, there is an associated volume of stored water (acre-feet) instead of a rate of water diversion. It is important to consider all of the permitted uses as well as the permitted season of use. Some rights may be restricted to a certain time of year while others are permitted year round. Water rights can be described in cumulative numbers, in graphs showing water rights over time, or in maps showing spatial distribution of water rights. Some water rights account for conveyance losses, which can be an important consideration in areas where significant seepage occurs (see AG 3). **Identify the types and distribution of agricultural water right uses.** Agricultural water rights, though predominantly used for irrigation, have many other beneficial uses that you will find distinguished within the WRIS system. These uses include: Agriculture (AG) Frost protection (FR) Nursery uses (NU) Dairy barn (DB) Irrigation (IR) Temperature control (TC) Greenhouse (GH) Livestock (LV) Mint still (MS) Knowing which agricultural uses exist in the basin will help groups understand different water supply needs. For example, if nurseries make up a large percentage of water use, their consumptive uses follow a different pattern from row crop irrigation, and they may require a water source with year-round reliability. To gain an understanding of how water is used for agriculture within the basin, begin by inventorying water rights by different use categories using the online databases maintained by the Oregon Water Resources Department (OWRD) specifically the Place of Use (POU) and Point of Diversion (POD) summary reports. Consider analyzing this information spatially to get a sense of which types of agricultural water use are occurring where within the basin. **Identify the sources of supply for agricultural water rights.** Knowing which agricultural water uses come from which source will help the group to understand how water use impacts supply from each source. To understand which agricultural water use is coming from groundwater, surface water, or storage, use tabular data and sum water rights when sorted by water right type (groundwater, surface water, storage) instead of use or location. To understand how this use is distributed spatially, you can sort tabular data by Township, Range, Section, Quarter Quarter (TRSQQ) or stream tributary, or you can use GIS data to display and summarize water rights by other sub-basins.
Data	**Water Rights** - OWRD's Water Rights Information System can provide a tabular view of

	all water rights within any of OWRD's administrative basins. Water rights can be searched for by file name, location, associated legal names of holders, or by stream reaches. A good place to get a full list of applicable water rights is from the "Summary Reports" tool on OWRD's website. When performing "Summary Reports" for either POU or POD in WRIS, note that a POU may have multiple associated PODs. Also, note that the Rate Sum (cfs) and Area Sum (acre feet) are the sum of two different columns of data, though some represent the same data. It is important to take the time to go through the data set to understand which numbers are being double-counted (show up in both columns) and which only show up in a single column. **Water Rights** - OWRD's Water Rights Mapping Tool can be used to look at OWRD's water rights data across your planning area. You can search for water rights on a particular body of water within a geographic area. Data can be exported via excel. **Water Rights** - OWRD's Water Rights Spatial Data includes GIS layers with water rights information that can be used with other spatial data to perform analyses.
Tools	**Geographic Distribution of Water Rights** - OWRD's Water Rights Mapping Tool
Assistance	OWRD may be able to send you an excel spreadsheet with water rights for each use category in a defined geographic area and may be able to help you interpret the information. OWRD may also provide a GIS layer or map of water rights by use and water rights by type (source). Watermasters may be able to help to you understand the typical water rights and water rights conditions in your planning area.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 3. Water use/demands - Historic agricultural water use and future water demands

Component	*AG 3. Water use/demands - Historic agricultural water use and future water demands*
Question (1 of 2)	Q1. What are the historic water uses of agriculture based on water diverted?
Rationale	Diversion demand is the volume of water that must be diverted from surface water systems (or extracted from groundwater) in order to meet full applied water demand for all of the farms in a given distribution network. Diversion demand is larger in volume than applied water demand, since many of the canals that supply irrigation water experience conveyance losses, such as seepage to groundwater through unlined portions of the network, aging infrastructure, as well as losses to evaporation. Historic diversions are helpful to understand past water use, but may not be good indicators for future supply needs.
Potential Approach	**Use water rights to compute maximum diversion demand.** Using the values computed as described in Component AG 2, use water rights data to describe maximum amount of water that could be diverted by law. This is generally completed by multiplying the average duty (measured in acre feet) by the number of legally permitted acres. **Use existing demand calculations to understand county-wide diversion demands.** The 2008 and 2015 State-wide Demand Forecasts developed by the Oregon Water Resources Department (OWRD) estimate current and future diversion demands county wide for agricultural uses. The US Geological Survey (USGS) Water Use Compilation also has an estimate of water diverted to meet irrigation demand. These values are generally a good starting point, but the planning groups should strive to improve upon and refine these estimates whenever possible. **Use reported water use to estimate diversion demand and variability in demand.** Users with significant points of diversion (those diverting 5% or more of median monthly flow) are required to measure their water use. Some water users also have permit conditions that require them to measure their water use. Only 17% of water rights in Oregon require the user to measure and report water use. Water use is measured each month and reported to OWRD on an annual basis. Some water users voluntarily measure and report their water use even though they're not required to. Many water users who do not report to the state may keep their own records of water use for their own management purposes. Gather available water use data and see if you can identify any trends regarding water use during different years or different times of year that you can apply more generally to the planning area. **Compute diversion demand by multiplying the consumptive demand by an efficiency coefficient**. If you are planning to compute the consumptive crop demand for irrigated lands (Component A4), you can multiply the resulting consumptive values by an efficiency coefficient to determine diversion demand. This number can be derived empirically based on past studies and applied evenly across the entire basin, derived from conversations with agricultural users about conveyance and system efficiency (see Component A3), or some combination of the two approaches. For an example of this approach see the 2008 and 2015 State-wide Demand Forecasts.
Data	**Water Rights** - OWRD Water Rights Mapping Tool **Statewide Water Demands** – OWRD has compiled information on agriculatural water demands in the 2008 Statewide Water Demand and the 2015 Statewide Water Demand

	Water Use - OWRD Water Use Reporting Database **Water Use** - USGS Oregon Water Use Compilation (2010)
Tools	OWRD Water Rights Mapping Tool
Assistance	Irrigation Districts in your planning area may be able to help you understand the timing and amount of water diverted for agricultural uses within district boundaries. Watermasters may be able to help you understand the significant points of diversion in your area and how to interpret water from the water use reporting database. OWRD may be able to provide a map and excel spreadsheet of significant points of diversion in your area. OWRD may be able to help you understand calculations from past Water Demands. Diversion demands by county calculated for the 2015 Statewide Demand Forecast are available upon request from OWRD.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	*AG 3. Water use/demands - Historic agricultural water use and future water demands*
Question (2 of 2)	Q2. What are the current and future water demands of agriculture based on consumptive demands of crops?
Rationale	Crop consumptive water needs describe the total water used by a crop based on climatic variables as measured through evapotranspiration (ET). This is the amount of water needed for the crop itself, not the water that needs to be diverted to meet the water needs of the crop. Generally the crop consumptive demand is assumed to be the potential ET under well-watered conditions and does not take supply limitations into account. Climate variability and change; markets and crops raised, water availability, irrigation efficiency and water management practices are among factors influencing future water use and will not be represented in crop consumptive demand estimates. Furthermore, this will not necessarily account for the impact of available supply on overall demand.
Potential Approach	Three variables are used to compute crop consumptive demand, whether computing past, current, or future crop consumptive demands: 1) acreages of irrigated agricultural land use; 2) distribution of crop types; and 3) crop and irrigation water demands. The first two terms, acres of irrigated land and distribution of crop types, are addressed in component A1 (pg 5). How to determine crop and irrigation water demands is addressed below. **Computing current and future crop and irrigation water demands – existing computations.** For the 2015 Statewide Water Demand Forecast, OWRD used the Bureau of Reclamation's West-wide Climate Risk Assessment (WWCRA), Oregon State University's (OSU) Oregon Crop Water Use and Irrigation Requirements, and PRISM precipitation data to estimate historic and future crop consumptive demands and irrigation demands. The Oregon Water Resources Department (OWRD) also compiled crop consumptive water needs by primary crop types using ET calculations. County-wide estimates of current and future crop consumptive demand and irrigation demand were computed using the two datasets described above, multiplied by the number of acres of irrigated crops within a county (Appendix D). An important assumption of these estimates was that crop types and acres of crops would be held constant in future scenarios. **IF YOU ARE CONSIDERING COMPLETING YOUR OWN COMPUTATIONS:** Computing a crop consumptive demand, though more costly in terms of time and effort, may be important if your planning group would like to discuss crop types, irrigation application practices, or planning for future development of irrigated agriculture within specific areas of the planning basin. This is the only approach that can provide annual calculations of crop water use and quantify the variability in water use across the landscape. Consider using this approach if agriculture is the dominant use within your basin. Be aware that unless you are willing and able to use already computed water demands, the cost of developing those values yourself will be significant in time and money – though it may be important to do so. It is recommended that the planning group consult with technical experts if you plan to complete their own computations. **Computing current crop and irrigation water demands – complete your own computations.** The planning group may decide to determine the crop consumptive demand themselves. For example, the 2015 Statewide Demand Forecast uses a base period of 1950-1999, but the group may want to choose a more recent time period given possible shifts in weather patterns. The 2015 Statewide Demand Forecast values

	also utilize a mean value for the base period. The group may want to explore variability in recent crop consumptive demand for the base period to explore the range of values that may be used by agriculture during the period. There are several ways in which crop-specific ET can be computed. Real-time monitoring of ET at Bureau of Reclamation Agrimet sites can provide calculations of reference ET at a daily time-step at stations across Oregon based on the Penman-Montieth equation. You may also be able to compute ET at points across your agricultural areas using modeled temperature data from PRISM for individual years and the Blaney-Criddle equation, as well as crop water use coefficients (Kc values) for selected crops. Finally, you could also try to build your own models for crop-consumptive uses and irrigation demands of ET. All of these approaches require expertise in computing agricultural demands and should include careful consultation with your planning partners when selecting parameters. **Computing future crop and irrigation water demands – complete your own computations.** Future water demand for agriculture will likely depend on water conservation, land use change, market forces, and climate change. These variables may affect the acreage in cropland, the types of crops, and the consumptive demand of crops. The group will have determined what variables they consider in a future demand and what their assumptions are.
Data	**Acres of Irrigated Agriculture** – see AG 1. **Distribution of Crop Types** – see AG 1. **Crop and Irrigation Water Demands** – There are two sources of information that can be useful: 1) Oregon 2015 Statewide Long-Term Water Demand Forecast – Appendix G : Database of Current and Future Crop Consumption and Irrigation Water Requirements, Appendix A: Calculations for Current and Future Agricultural Water Demands; Appendix C: Current and Projected Future Irrigation Water Requirements for Oregon; and 2) Oregon Crop Water Use and Irrigation Requirements **Water Use** - USGS Water Use Compilation
Tools	None identified as of 1/31/18
Assistance	OWRD may be able to help planning groups access the Crop Consumptive Use database, identify relevant datasets, and understand the data. Consumptive demands by county calculated for the 2015 Statewide Water Demand are available upon request. OWRD may also be able to talk to the planning groups about innovative tools that other states use to estimate crop water needs.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 4. Water quality - Water quality considerations for agricultural water supply and availability

Component	***AG 4. Water quality - Water quality considerations for agricultural water supply and availability***
Question (1 of 2)	Q1. What level of water quality is needed for agricultural uses?
Rationale	*Under development* Each agricultural use has a unique set of water quality needs. For example, stock watering requires low concentrations of algal toxins. Each crop type varies in its ability to tolerate dissolved salts. Determine the water quality needs of each agricultural use in your area. Technology can also affect the water quality needed for agricultural uses. For example, flood irrigation water needs to be low in bacteria concentrations to avoid contamination of crops. Sprinkler irrigation water needs to be low in sediment to avoid clogging sprinkler heads. Consider the technological water quality needs for agricultural uses in your area.
Potential Approach	*Under development* **Identify water quality needs of crops.** Think about the water quality that crops or other agricultural products in your planning area need. Some crops may have very specific water quality needs, while others crops can handle variable water quality.
Data	None identified as of 1/31/2018
Tools	None identified as of 1/31/2018
Assistance	NRCS and OSU Extension may be able to help the group identify areas where water quality has a negative impact on crop health due to mineral content, salinity, or other considerations.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 4. Water quality - Water quality considerations for agricultural water supply and availability***
Question 2 of 2	Q2. Is there sufficient water is available at the quality needed for current and future agricultural uses?
Rationale	*Under development* Water may appear to be available, but if the water is not at the needed quality, then water is not actually available.
Potential Approach	*Under development* Consider the timing and location of agricultural needs. Water quality may be sufficient for agricultural uses in certain locations or in certain times of year. Water quality during spring high flows may be too high in sediment for agricultural uses. Groundwater quality is late summer may be too high in nitrate concentrations. Does the timing and location of need match the availability of water of sufficient quality for agricultural uses? Stored water is susceptible to contamination from high temperatures, nutrient and bacteria inputs, and toxins. Consider the changing quality of stored water over the course of the season of use. Consider potential future agricultural water quality needs in your area. Will climate change lead to higher concentrations of salts or bacteria or toxic algae in agricultural source water? Will changing upstream uses or upland management affect downstream agricultural source water quality? Will changing climate or changing markets influence the types of crops planted in your area? Will changing agricultural technology change the water quality requirements for agricultural uses in your area? Will changing groundwater levels alter the source water quality for agricultural uses?
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 5. Infrastructure - Built and natural infrastructure affecting water supply and availability

Component	*AG 5. Infrastructure - Built and natural infrastructure affecting water supply and availability*
Question (1 of 2)	Q1. What is the status of built (grey) infrastructure that helps agricultural water users meet their water needs?
Rationale	Understanding how water is moved throughout the basin in agricultural distribution systems may be helpful for discerning where improvements to systems could improve water supply conditions for other instream and out-of-stream water users. Knowing the condition of the infrastructure can help identify where there are needs within the agricultural community and may point to areas for potential water and energy savings.
Potential Approach	**Complete a high-level inventory of infrastructure for agricultural water use.** Conduct a high-level inventory of existing infrastructure, its expected useful life, and known needed upgrades or repairs. For this approach, think about the different types of infrastructure, including: diversion infrastructure (e.g., headgates, pumps, fishscreens, etc.), storage infrastructure (e.g., dams, reservoirs, storage tanks), conveyance infrastructure (e.g., canals, pipes), and on-farm delivery infrastructure (e.g., hand lines, wheel lines, pivots). The information that you need to complete this census is likely distributed across water users. In some instances an irrigation district or water district may have this information contained in a planning document. **Consider infrastructure-related water losses or energy inefficiencies.** Irrigation districts or water districts may have invested in studies to better understand their current infrastructure and examine infrastructure needs. In some areas across the state, the Farmer's Conservation Alliance (FCA) has completed a System Improvement Plan that describes current systems and opportunities for improvements. Agricultural Water Management Conservation Plans may also contain some of this information, though few of these plans have been completed.
Data	The best source of information will likely be from your partners and water users themselves. You can get a high-level status of infrastructure by talking to the people responsible for maintaining the infrastructure. Do not just focus on water users that already have infrastructure, since some may lack infrastructure. **Conservation Plans** – Oregon Water Resources Department (OWRD) has Agricultural Water Management Conservation Plans on file that describe current agricultural infrastructure. Check with the Department to see if any have been completed in your planning area. **Dam Inventory** - OWRD maintains a Dam Inventory that can be used to look at the dams in your area and their hazard ratings: Link.
Tools	None identified as of 1/31/18
Assistance	The Natural Resources Conservation Service (NRCS) may be able to help planning groups understand irrigation infrastructure in the planning area, including a general assessment of conditions and opportunities. OWRD may be able to consult with your group to discuss the condition of dams in your area. Irrigation districts or water districts may have completed System Improvement Plans or other planning documents that can provide information on infrastructure.
Notes	

Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 5. Infrastructure - Built and natural infrastructure affecting water supply and availability***
Question (2 of 2)	Q2. What is the status of natural (green) infrastructure that helps agricultural water users meet their water needs?
Rationale	*Under development*
Potential Approach	*Under development*
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 6. Vulnerable communities and water stressors

Component	***AG 6. Equity -Vulnerable communities and water stressors***
Question (1 of 1)	Q1. Are there portions of the agricultural community that may be disproportionately vulnerable to water stressors?
Rationale	*Under development*
Potential Approach	*Under development*
Data	**Social Vulnerability and Climate Change Report** – Link
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures

Component	*AG 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures*
Question (1 of 3)	Q1. What vulnerabilities (e.g. extreme events/natural hazards) affect the ability of agricultural users to meet their water needs?
Rationale	Identifying vulnerabilities in the agricultural systems can help determine priorities for generating solutions. This will likely be a qualitative description of the vulnerabilities that agricultural water users face, including vulnerabilities in their current systems as well as vulnerabilities that result from climate variability and natural hazards.
Potential Approach	**Determine which natural hazards currently impact agricultural systems.** Consider the likelihood of different hazards, such as droughts and floods as well as other natural disasters (e.g. earthquakes, landslides, wildfires) and their impact on agricultural water users. Some communities already have natural hazard plans that describe these events and the likely impacts. **Document the replacement and repair needs of key infrastructure if they limit efficient water supply**. Consider aging infrastructure and the impacts of that infrastructure on the ability to meet current agricultural water needs.
Data	Partners will be the best source of information. Consider developing a consistent approach to assess vulnerabilities and resilience across users. **Statewide Geohazards Viewer –** DOGAMI maintains a statewide map that can help you identify hazards in your planning area: Link. **Natural Hazards Plans and Maps** - DLCD has summarized natural hazards in different regions of Oregon that is maintained online: Link. **Floods** - DLCD maintains a Risk Map that outlines floodplains and flood risk: Link. **Floods/High Flow Events** - OWRD maintains a Peak Flow Estimation database that can be used to assess peak flows and potential impacts to infrastructure: Link. **Droughts** - The National Drought Institute maintains a database of past drought events: Link. **Landslides** - DOGAMI maintains an interactive map of potential landslides: Link. **Forest Fires** - ODF maintains a database of forest fires: Link. **Earthquakes** - DOGAMI maintains earthquake hazard maps: Link.
Tools	None identified as of 1/31/2018
Assistance	The County Planning Department may have information and resources about natural hazards in your area that the planning group could reference.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures***
Question (2 of 3)	Q2. How will climate variability affect the ability of agricultural users to meet their needs?
Rationale	*Under development*
Potential Approach	**Describe impacts of climate variability on agricultural water use.** Climate change impacts on agricultural water needs will vary greatly depending on the type of users and their ability to both plan for and respond to hazards. This will likely be a qualitative description of potential impacts to water systems resulting from climate change. Similar to vulnerabilities, consider increased frequency of droughts and floods and the impacts of those events. The planning group should consider the projected evapotranspiration (ET) under projected climate conditions in A4. Consider how changes in streamflow may affect the amount and timing of water availability. Also think about how precipitation trends and the consumptive needs of crops are likely to change over time. Crops may have a higher consumptive demand with less of that demand met by rainfall. In addition, the growing season of crops may begin earlier in the season or last longer.
Data	**Climate Change Adaptation Framework** – The Department of Land Conservation and Development (DLCD) has developed a Climate Change Adaptation Framework that summarizes the likely impacts of climate change and how Oregon communities can prepare and adapt to these impacts: Link. **Climate Assessments/Reports** - The Oregon Climate Change Research Institute assembles Climate Assessment Reports that summarize the likely impacts of climate change and how Oregon communities can prepare and adapt to these impacts: Link. The US Forest Service has conducted a literature that discusses the potential effects of climate change on rural communities: Link. The National Climate Assessment has useful tools for understanding the potential impacts of climate change on different sectors: Link.
Tools	The Climate Engine Application (developed by the Desert Research Institute, University of Idaho, and Google) is an online tool can be used to quickly process and visualize satellite earth observations and gridded weather data for environmental monitoring and to improve early warning of drought, wildfire, and crop-failure risk.
Assistance	The Oregon Climate Change Research Institute (OCCRI) is a network of over 150 researchers at Oregon State University, the University of Oregon, Portland State University, Southern Oregon University, and affiliated federal and state labs. OCCRI or its affiliates may be available to assist you in assessing climate change impacts to agricultural users in your area.
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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Component	***AG 7. Vulnerabilities - Vulnerabilities and resilience in the face of extreme events and coming pressures***
Question (3 of 3)	What are agricultural water users doing to be more resilient in meeting their water needs?
Rationale	*Under development*
Potential Approach	*Under development*
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 8. Unmet needs - Current and future unmet agricultural water needs

Component	*AG 8. Unmet needs - Current and future unmet agricultural water needs*
Question (1 of 1)	Q1. When and where are agricultural water needs unmet?
Rationale	The identification of unmet needs and priority areas may help identify needed solutions. Unmet needs can be described quantitatively as a supply-demand comparison, or can be described qualitatively as visual depictions of areas where water needs may not be met by current supplies, timing of supplies, and specific conditions which may create unmet needs (e.g., drought).
Potential Approach	**Define types of unmet need and identify the timing and location of those needs.** Needs may be for different volumes of water, different timing of available water, or for infrastructure improvements to more efficiently use available water. During droughts, unmet needs may be evidenced by water rights holders being regulated off of the system or by crops lost due to drought stress. During floods, unmet needs may be evidenced by failed infrastructure. If needs cannot be met due to water quality issues, this should also be noted. Priority areas may be areas with high agricultural potential but limited or no water available for irrigation. Consider using standard lines of questioning and a consistent methodology to determine unmet needs and priority areas for different users. Utilize facilitation skills of the group facilitator or project manager. Consider mapping out where the diversions are within the basin and representing needs visually. **Prioritize which unmet needs are most important to address**. Consider developing evaluation criteria or a prioritization matrix to help the group determine the highest priorities.
Data	**Overview of Resource Needs** – NRCS Hydrologic Unit Profiles summarize resource concerns and also show where agricultural development is limited due to land capability class.
Tools	None identified as of 1/31/2018
Assistance	The best source of information will likely be from your partners. Talk to agricultural producers about whether they have concerns about meeting their current and future water needs with available supply. NRCS and local industry groups may be able to help the planning group identify unmet needs and priority areas. OWRD may be able to provide information on past regulation of water rights (e.g., number of acres, priority date, and stream).
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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AG 9. Prioritization - Agricultural water needs and priorities for planning

Component	*AG 9. Prioritization - Agricultural water needs and priorities for planning*
Question (1 of 1)	Q1. How can agricultural water needs be prioritized for planning purposes?
Rationale	*Under development*
Potential Approach	*Under development*
Data	*Under development*
Tools	*Under development*
Assistance	*Under development*
Notes	
Contributions	Do you have any feedback on the approach outlined above? Any data or tools that we're missing? Please send feedback to placebasedplanning@wrd.state.or.us to be considered and incorporated.

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