APPENDIX A: PUBLIC OUTREACH AND PARTICIPATION SUMMARY

Public outreach and education efforts for the Integrated Water Resources Plan (IWRP) were performed to gather meaningful public input to develop a plan that is representative of Austin community values.

A.1 IWRP Public Outreach Framework

The Water Forward Public Outreach Framework was designed with the intent of providing a flexible and actionable approach to community engagement as part of the plan development process.

A.1.1 Objectives-Driven Approach

The IWRP Public Outreach Framework was based on an objectives-driven approach. This was defined as "public participation with a purpose," designed to achieve meaningful outcomes for the community and the utility.

- Objectives provide specific, achievable targets that the utility can use to solicit input in multiple formats across diverse groups
- Participants understand what input is needed and how it will be used
- Objectives provide common ground for reporting results back to the public

A.1.2 Key Objectives

At the outset of the plan development process, Austin Water staff worked with the Water Forward Task Force to develop key objectives for public outreach and education efforts undertaken as part of the plan. Three key goals were established that formed a core element of the IWRP Public Outreach Framework.

- Community Values: Identify community values that should be reflected in the IWRP
- Diverse Public Input: Seek input from the community which reflect the diversity of Austin's population and customers.
- Public Education: Inform and educate the community throughout the plan development process.

A.1.3 Targeted Participant Groups

The framework also identified several participant groups to engage as part of the plan development process. This list was not comprehensive, but was meant to serve as a starting point for further identification of groups to target as part of public outreach and education efforts.

- Austin Water customers: to include various sectors such as Single Family Residential, Multi-Family Residential, and Commercial customers.
- Diverse participant groups

- Underrepresented groups
- Groups with high-interest

- Community groups
- Regional agencies
- Policymakers

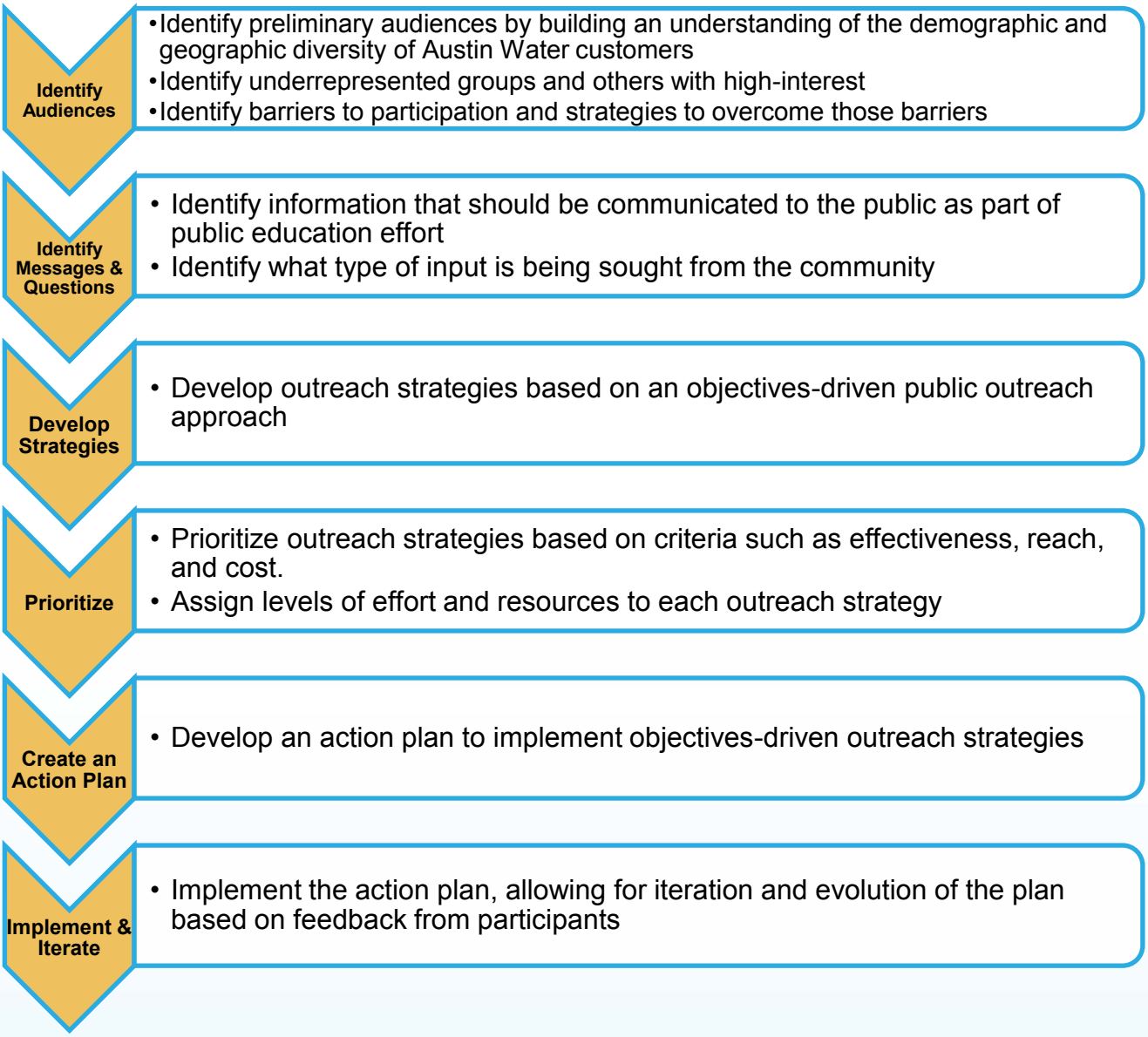
A.1.4 Potential Public Outreach Strategies

The IWRP framework identified a toolbox of potential public outreach strategies, many of which were utilized during the plan development process.

Existing Initiatives & Outlets	Public Events & Opportunities	Social Media	Print and Digital Media
• Imagine Austin and CodeNext: Sustainably Manage our Water Resources and Green Infrastructure Programs • Water use report software (DropCountr) • City of Austin Community Registry • Coordination with other department and agencies	• Public workshops • Focus groups • Conversation Corps • Neighborhood meetings • Community events • Presentations • Education panels • Festivals	• Twitter (inc. Q and A's) • Facebook • Hashtag • Flickr • Videos (ATXN, YouTube, Vine) • Pinterest • NextDoor • BloomFire	• Flyers • Bill inserts • Reports and fact sheets • Advertising • Community association newsletters • Mailing lists • Austin Water eNewsletters • Austin Water website • Austin Energy Power Plus • COA Environmental Portal Banner • ATXN Slideshow • Surveys • Neighborhood lists

A.1.5 Creating a Public Outreach Plan

The IWRP Public Outreach Framework culminated in a six-step methodology to develop objectives-driven outreach strategies as part of the IWRP Public Outreach Action Plan. The Action Plan was intended to be a living document that could help to guide the selection and implementation of outreach strategies, while remaining flexible enough to adjust based on participant feedback and progress towards achieving outreach goals.



The IWRP Public Outreach Framework culminated in a six-step methodology to develop objectives-driven outreach strategies as part of the IWRP Public Outreach Action Plan. The Action Plan was intended to be a living document that could help to guide the selection and implementation of outreach strategies, while remaining flexible enough to adjust based on participant feedback and progress towards achieving outreach goals.

A.2 Task Force Involvement

In 2014, the Austin Water Resource Planning Task Force was convened during the height of the 2008 to 2016 drought and tasked with analyzing the City's water needs and making recommendations on how to augment the City's future water supply (see Resolution No. 20140410-033). On July 10, 2014, the Austin Water Resources Planning Task Force presented their recommendations to the Austin City Council which included recommendations on demand management and water supply strategies. This IWRP was a foremost recommendation of the 2014 Austin Water Resource Planning Task Force.

The Austin Integrated Water Resources Planning Community Task Force was created to support the development of the IWRP (see Resolution No. 20141211-119).

The Council-appointed Task Force members are shown below:

Sharlene Leurig (Chair) District 4 - Council Member Casar	Lauren Ross District 5 - Council Member Kitchen
Jennifer Walker (Vice-Chair) District 9 - Mayor Pro Tem Tovo	Todd Bartee District 6 - Council Member Flannigan
Bill Moriarty Mayor Adler	Robert Mace District 7 - Council Member Pool
Clint Dawson District 1 - Council Member Houston	Marianne Dwight District 8 - Council Member Troxclair
Sarah Richards District 2 - Council Member Garza	Diane Kennedy District 10 - Council Member Alter
Perry Lorenz District 3 - Council Member Renteria	

The Task Force also included Ex Officio members from several City of Austin departments:

Austin Water Greg Meszaros, Director	**Office of Innovation** Kerry O'Connor, Chief Innovation Officer
Austin Energy Kathleen Garrett, Director of Environmental Services	**Office of Sustainability** Lucia Athens, Chief Sustainability Officer
Austin Resource Recovery Sam Angoori, Director	**Parks and Recreation** Sara Hensley, Interim Assistant City Manager
Neighborhood Housing and Community Development Josh Rudow, Planner Senior	**Watershed Protection** Chris Herrington, Supervising Engineer

The Task Force played an instrumental role in shaping the development of the Water Forward Process, providing input along the way to shape the planning process and recommendations that are included in the plan. Task Force meetings were held essentially on a monthly basis from May 2015 through [insert month year]. To view agendas, approved minutes and supporting documents, please visit: http://austintexas.gov/cityclerk/boards_commissions/meetings/132_1.htm.

A.3 Public Workshops and Meetings

Austin Water gathered meaningful public input throughout the process in order to develop a plan that is representative of the community's values. Input was gathered from community members and representatives from partner organizations through:

- Austin Integrated Water Resource Planning Community Task Force
- Targeted Stakeholder Meetings
- Water Forward Public Workshops
- Summer Series
- Community Events
- Information Sharing
- Community Group Meetings
- Seminars/Professional Events
- District Town Halls

Since 2016, Austin Water has collected input through nearly 80 outreach events including five (5) Water Forward Workshops, four (4) Targeted Stakeholder Meetings, 10 Summer Series events (one in each City Council district) and has delivered presentations and/or outreach materials to a total of 60 community events, information sharing sessions, community group meetings, seminars/professional events, and district town halls (see **Table A-1**). The input received has been incorporated into the Draft Water Forward Plan Recommendations.

A.3.1 Outreach and Publicity

All public workshops were publicized by Austin Water as described in **Table A-1**.

Table A-1. Types of Outreach and Publicity Used for Water Forward

Newsletter Lists Emailed	Groups Receiving Targeted Invitations Included	Additional Efforts
• Water Forward (495 people) • WaterWise Residential List (~15,000 people) • WaterWise Commercial List (206 people)	• Neighborhood Associations • Businesses, Developers & Professional Organizations • Environmental Advocates • Civic Leaders • Faith-Based Organizations • Education Representatives	• Outreach to City Council members • Engagement with the Water Forward Task Force • Emails were sent to staff liaisons for the following commissions: o Water Wastewater Commission o Resources Management Commission o Environmental Commission • Social Media included: o Nextdoor o Facebook o Twitter o Water Forward website

[1] Newsletter lists as of March 2018

A.3.2 Outreach Highlights

Highlights from Water Forward public outreach are included below. For a list summarizing outreach activities for Water Forward as of May 2018, please see

A.3.2.1 Imagine Austin Speaker Series: Water Forward – Planning for the Next 100 Years

As part of the Imagine Austin Speaker Series, on August 3, 2016, Austin Water Director Greg Meszaros and Austin Integrated Water Resource Plan Community Task Force Chair Sharlene Leurig shared insights on the process and importance of creating a long-term plan that will help secure Austin's water supply for future generations, shown in. Sixty-two (62) members of the community attended.

Figure A-1. Photo from the Imagine Austin Speaker Series

A.3.2.2 Austin Water IWRP Public Workshop #1

On September 7, 2016, Austin Water hosted the first of five public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). The workshop gave community members an overview of the IWRP, explained why a water plan is needed, and outlined some of the elements of a potential plan. Participants were then given a chance to offer input on the portfolio evaluation criteria for the IWRP. The workshop was held at the Waller Creek Center, located at 625 E 10th Street, Austin TX from 6:00 p.m. - 8:30 p.m. Twenty-four (24) members of the community attended.

A.3.2.3 Targeted Stakeholder Meetings

Austin Water invited a wide range of participants from various industries to three Targeted Stakeholder Meetings held on January 19th, 24th and 26th in 2017.

Targeted Stakeholder Meetings were aimed at gathering input on specifically identified options from the project team's draft list of 25 demand management options. Participants from various industries were invited to attend one or all of these meetings based on the topics most important to them.

All meetings took place at the Waller Creek Center located at 625 E. 10th St, Austin, TX 78701 from 6:00 p.m. – 8:00 p.m.

Invitees included landscape and irrigation professionals, representatives of environmental interest groups, chambers of commerce, industry representatives, business leaders, and industry professionals.

All meetings began with a presentation from Austin Water to introduce the 100-year plan to participants and explain the disaggregated demand model at a very high level. The presentation included information about public outreach and charts showing consumption by sector and end uses.

Following the Austin Water presentations, full group discussions were led regarding the following meeting topics:

- Targeted Stakeholder Meeting #1: Landscape Transformation and Irrigation Efficiency Ordinances and Incentives
- Targeted Stakeholder Meeting #2: Alternative Ordinances and Incentives (i.e. rainwater, graywater, and AC condensate)
- Targeted Stakeholder Meeting #3: Development-Focused Water Use Estimates & Benchmarking; Commercial, Industrial & Institutional & Non-Residential Ordinances; Plumbing Codes & Ordinances & Fixture Incentives; Reclaimed Water (Centralized Purple Pipe System) Ordinances & Incentives

Conversations and input gathering continued in smaller, facilitated group discussions. Austin Water staff were on hand to answer questions and offer clarifications. Participants discussed how current programs and ordinances affected them; whether they use current rebates and incentives; what barriers they run up against; and how various current programs and ordinances could be improved. Participants were also asked about new technologies being used in the field.

A.3.2.4 Austin Water IWRP Public Workshop #2

On February 8, 2017, Austin Water hosted the second of five public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). The workshop featured presentations from the project team about the plan development process, public outreach, and supply and demand modeling. After the presentation, participants were asked to give feedback on supply- and demand-management options in a brief exercise. The workshop was held at the Austin Independent School District Performing Arts Center multipurpose room, 1500 Barbara Jordan Boulevard, Austin TX from 6:00 p.m. to 8:30 p.m. 30 members of the community attended.

A.3.2.5 Austin Water IWRP Workshop #3

On April 4, 2017, Austin Water hosted the third of four public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). The workshop featured presentations from the project team about the plan development process, public outreach, and supply and demand modeling. After the presentation, participants were asked to give feedback on supply-management options in a brief exercise. The workshop was held at One Texas Center, 505 Barton Springs Road, Room 325, Austin, TX 78704, from 6:00 p.m. to 8:30p.m. 22 members of the community attended.

A.3.2.6 Summer Series

During the months of July and August 2017, Austin Water held a series of ten public meetings. These meetings were held at diverse times of the day and week and hosted at public libraries in each Council district. Meetings were advertised as child friendly and snacks were provided. The meetings focused on discussing emerging themes from stakeholder feedback, for the purpose of portfolio development. The Summer Series were designed as a lead up to Public Workshop #4.

The meetings featured a presentation from staff about the plan development process with a focus on the portfolio development process. The presentation included information about stakeholder outreach events and the themes that had emerged from ongoing outreach efforts, including the Community Values Survey. Participant's questions were answered during the presentation. A group discussion followed the presentation, where input was gathered on the emerging themes.

A.3.2.7 Austin Water IWRP Workshop #4

On August 16, 2017, Austin Water hosted the fourth of five public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). The workshop featured presentations from the project team about the plan development process including key process steps completed, public outreach conducted to date including emerging themes from public feedback, supply and demand options as well as portfolio development and evaluation. After these presentations, participants were invited to participate in two Question and Answer sessions followed by facilitated small group discussions. The workshop was held at the Canyon View Events Center (Austin Board of Realtors Building) located at 4800 Spicewood Springs Road, Austin, TX from 6:00 p.m. to 8:00 p.m. 25 members of the community attended (X participants attended in person and X participants attended via webinar).

A.3.2.8 Targeted Stakeholder Meeting #4: Update on Plan Process & Initial Portfolio Compositions

Austin Water hosted a targeted stakeholder meeting on Wednesday, November 15th, 2017 from 6:00 to 8:00 pm at the Waller Creek Center, 625 E. 10th St, Austin, TX 78701. After successful targeted stakeholder meetings in January of 2017 that focused on getting input on the demand management and supply side options, the same group of participants were invited for this meeting to update them on the project.

A.3.2.9 Austin Water Integrated Water Resources Plan Workshop #5

On March 21, 2018, Austin Water hosted the fifth of five public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). The workshop featured presentations from the project team including a recap of the plan development process, themes from public feedback, portfolio development and evaluation, and draft plan recommendations and benefits. After presentations, participants were invited to participate in two Question and Answer sessions followed by an Open House where participants were invited to view draft plan recommendation benefits and get their questions answered by project team members.

The workshop was held at the Dawson Elementary School Cafeteria located at 3001 S 1st St, Austin, TX 78704 from 6:00 p.m. to 8:00 p.m. Twenty-nine (29) members of the community attended (24 participants attended in person and five (5) participants attended via webinar).

A.4 Summary of Outreach Activities

Table A-2. Summary of Outreach Activities as of October 2, 2018

Date	Event Name	Event Category / Description	Number of Attendees (as available)
8/3/16	Imagine Austin Speaker Series: Water Forward - Planning for the Next 100 Years	Community Event	62
9/7/16	Public Workshop #1	Water Forward Event	24
9/11/16	Planning & Zoning N. Burnet Rd. Better Block Event	Community Event	
9/14/16	AustinCorps High School Program	Community Event	
9/17/16	Carver Library Tabling	Community Event	
9/28/16	Austin Hotel & Lodging Expo	Seminar/Professional Event	
9/28/16	Commercial Programs Technical Workshop	Seminar/Professional Event	
10/1/16	National Night Out Kickoff Party	Community Event	300
10/3/16	South River City Citizen's Meeting	Community Group Meeting	
10/8/16	Southeast Branch Library	Community Event	
10/22/16	25th Annual Austin Arbor Day	Community Event	12
10/27/16	Talk Green to Me - A Gray Water Overview	Community Event	7
10/27/16	UT Campus Sustainability Week Local Impact Day	Community Event	35
10/29/16	AE Community Connection Resource Fair	Community Event	1,000
11/5/16	Northwest Austin Neighborhood Association	Community Group Meeting	10
11/19/16	Grow Green Homeowner's Training	Community Event	25
11/26/16	Chuy's Children Giving to Children Parade	Community Event	
12/9/16	Gilbert Elementary College and Career Fair	Community Event	125
12/10/16	Frost Bank Home Improvement Mini-Expo	Community Event	37
12/17/16	Pleasant Valley Market	Community Event	10
1/19/17	Targeted Stakeholder Meeting #1	Water Forward Event - Demand Management Options with focus on Landscape Transformation and Irrigation Efficiency Ordinances and Incentives	23
1/24/17	Targeted Stakeholder Meeting #2	Water Forward Event - Demand Management Options with focus on Alternative Water Ordinances and Incentives that may include rainwater, gray water, and A/C condensate	15
1/26/17	Targeted Stakeholder Meeting #3	Water Forward Event - Demand Management Options with focus on Development-focused Water Use Estimates and Benchmarking; Commercial, Industrial, and Institutional and Non-residential Ordinances; Plumbing Codes and Ordinances and	12

Date	Event Name	Event Category / Description	Number of Attendees (as available)
		Fixture Incentives; and Reclaimed Water (centralized purple pipe system) Ordinances and Incentives	
1/31/17	Youth Career Fest 2017	Community Event	90
2/2/17	Central Texas Water Efficiency Network Symposium	Seminar/Professional Event	100
2/7/17	African American Heritage Network-Black History Luncheon	Community Event	150
2/8/17	Public Workshop #2	Water Forward Event - Future Water Supply Needs and Strategies to Meet Them	30
2/21/17	WaterWise Irrigation Professionals Seminar	Seminar/Professional Event	252
2/27/17	UT Graduate Class, Energy and Earth Resources program	Seminar/Professional Event	25
3/25/17	Zilker Garden Festival	Community Event	350
3/26/17	Interfaith Dialogue Event	Community Event	~50
3/26/17	Zilker Garden Festival	Community Event	250
4/4/17	Public Workshop #3	Water Forward Event - Future Water Supply Needs and Strategies to Meet Them	22
4/6/17	University of Texas City Forum	Seminar/Professional Event	~25
4/12/17	Texas Water Conference	Community Event	
4/18/17	IBM Earth Day	Community Event	125
4/20/17	TX Parks and Wildlife Earth Day Event	Community Event	75
4/20/17	IBM Earth Day	Community Event	80
4/21/17	Arboretum Plaza Earth Day	Community Event	
4/22/17	Earth Day ATX	Community Event	400
4/23/17	Sun Radio Earth Day	Community Event	100
5/4/17	Apartment Association Trade Show	Community Event	
5/5/17	Save Barton Creek Association Meeting	Community Group Meeting	~12
5/13/17	District 7 Town Hall	District Town Hall	40
5/22/17	Northwest Austin Coalition Meeting - District 6 Town Hall	District Town Hall	~15
5/25/17	El Concilio - A Coalition of Mexican American Neighborhoods	Community Group Meeting	~12
5/30/17	Montopolis Neighborhood Association Meeting	Community Group Meeting	~12
6/11/17	Cool House Tour	Community Event	
6/13/17	Austin Neighborhoods Council - East	Community Group Meeting	15
6/13/17	District 5 Town Hall	District Town Hall	40
6/19/17	District 10 Town Hall	District Town Hall - Tabling	~125
6/21/17	350.org	Community Group Meeting	5
6/22/17	UT Facilities	Information Sharing	~18
7/8/17	Summer Series - District 2	Water Forward Event - Emerging Themes from Public Input	1

Date	Event Name	Event Category / Description	Number of Attendees (as available)
7/12/17	Water and Wastewater Commission	Information Sharing	
7/14/17	NXP	Information Sharing	
7/15/17	Summer Series - District 7	Water Forward Event - Emerging Themes from Public Input	3
7/17/17	Summer Series - District 6	Water Forward Event - Emerging Themes from Public Input	3
7/19/17	Summer Series - District 9	Water Forward Event - Emerging Themes from Public Input	7
7/22/17	Summer Series - District 4	Water Forward Event - Emerging Themes from Public Input	4
7/29/17	Summer Series - District 3	Water Forward Event - Emerging Themes from Public Input	4
7/31/17	Summer Series - District 10	Water Forward Event - Emerging Themes from Public Input	6
8/5/17	Summer Series - District 8	Water Forward Event - Emerging Themes from Public Input	6
8/8/17	Summer Series - District 5	Water Forward Event - Emerging Themes from Public Input	7
8/12/17	Summer Series - District 1	Water Forward Event - Emerging Themes from Public Input	8
8/16/17	Public Workshop #4	Water Forward Event - Emerging Themes from Public Input	25
9/19/17	East Riverside Oltorf Neighborhood Association Meeting	Community Group Meeting	~20
9/28/17	Austin Board of Realtors	Community Group Meeting	6
10/4/17	AARO Energy and Water Committee		
10/19/17	L.B.J. Neighborhood Association	Community Group Meeting	7
10/19/17	TWCA	Seminar/Professional Event	
10/25/17	Friends of Riverside Neighborhood Association	Community Group Meeting	9
10/28/17	Hopefest	Community Event	100
11/15/17	Targeted Stakeholder Meeting	Water Forward Event - Update on plan process, screened option, characterized information and initial portfolio compositions	5
11/15/17	Water Utility Climate Alliance	Seminar/Professional Event	
11/27/17	Colony Park Neighborhood Association	Community Group Meeting	20
1/27/18	Georgian Acres Neighborhood Association	Community Group Meeting	12
3/12/18	Save Barton Creek Association Meeting	Community Group Meeting	7
3/21/18	Public Workshop #5	Water Forward Event – Draft Water Forward Plan Recommendations	29
3/26/18	Leader Track Focus Group #1	Community Group Event	7
3/27/18	Leader Track Focus Group #2	Community Group Event	5
4/6/18	ASCE Continuing Education Conference - Designing a more Resilient Central Texas	Seminar/Professional Event	50-60
4/22/18	Earth Day ATX	Community Event	~200
5/16/18	One Water For Texas	Seminar/Professional Event	6

Date	Event Name	Event Category / Description	Number of Attendees (as available)
6/1/18	Austin Board of Realtors	Community Group Event	~20
7/17/18	Resource Management Commission	Commission Meeting	
7/25/18	Joint Sustainability Commission	Commission Meeting	
8/1/18	Environmental Commission	Commission Meeting	
8/8/18	Water and Wastewater Commission	Commission Meeting	
8/14/18	Planning Commission	Commission Meeting	
8/22/18	AWRA webinar	Seminar/Professional Event	
8/23/18	Central Texas Water Efficiency Network	Community Group Event	~20
8/30/18	Water Forward Stakeholder Meeting	Water Forward Event	9
9/10/18	Save Barton Creek Association Meeting	Community Group Event	
9/11/18	Sierra Club Meeting	Community Group Event	
9/13/18	Water Forward Open House - North	Water Forward Event	7
9/18/18	Water Forward Open House - South	Water Forward Event	5
10/2/18	African American Resource Advisory Commission	Commission Meeting	

A.5 Demographic Summary

The charts and maps included in this section are a summary of self-reported demographic information from participants of the five public workshops, four targeted stakeholder meetings, ten summer series events, and surveys including community value survey, strategies to meet Austin's future water needs survey and demand management options feedback form survey. These do not include demographic information of participants that chose to share their input verbally, or chose to not share their demographic information.

- Total number of responses received: 783
- Number of online responses: 345
- Number of paper responses: 438

Table A-3. Comparing demographics of Water Forward respondents to demographics of Austin

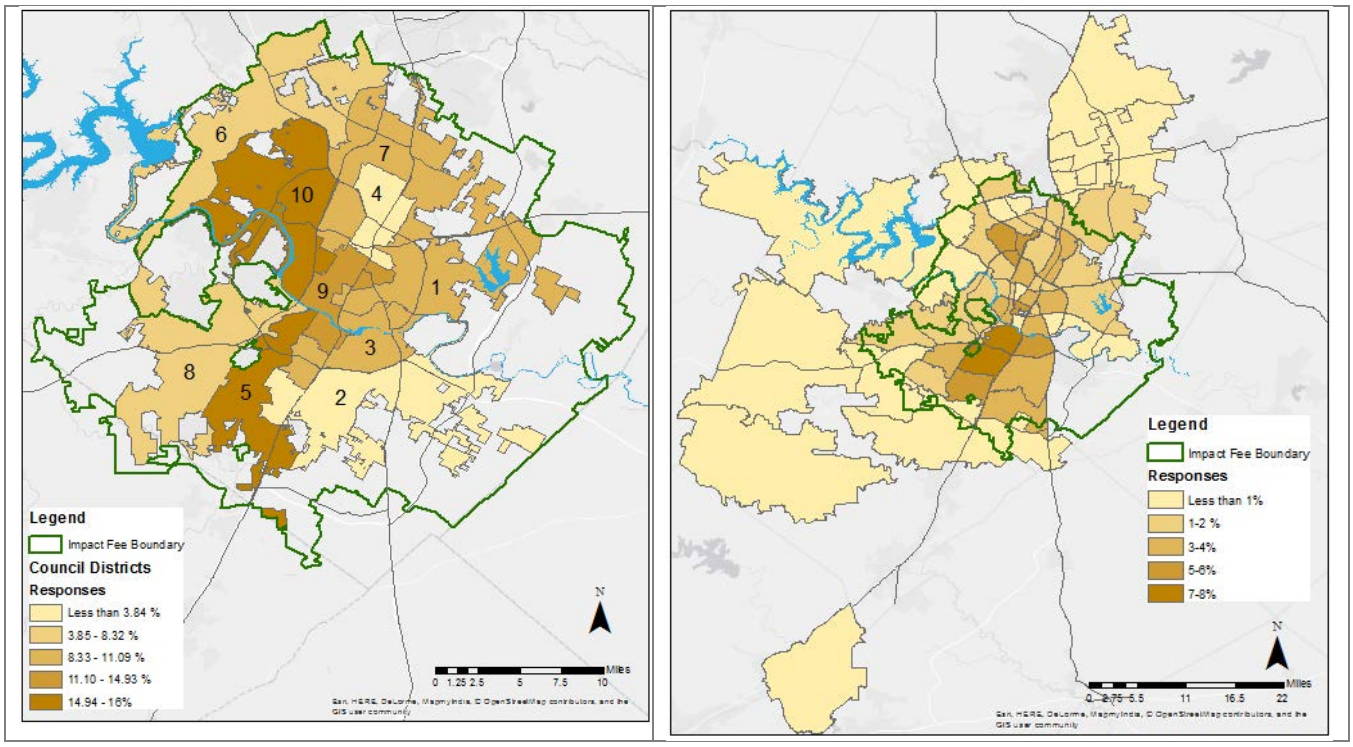
		Water Forward	Austin
Gender[1]	Male	50.6%	50.3%
	Female	49.4%	49.7%
Age[1]	Under 18	5.4%	21.9%
	18-29	16.7%	48.6%
	30-44	29.1%	
	45-64	33.1%	21.9%
	65 and over	15.7%	7.6%
	Anglo	72.4%	47.1%

Race/ Ethnicity[2]	African-American	3.2%	7.0%
	Asian-American	4.9%	6.8%
	Hispanic/Latino	14.4%	36.5%
	Other	5.2%	2.6%
Household Income[1]	Less than $24,999	11.0%	21.0%
	$25,000-$49,999	16.4%	24.1%
	$50,000-$74,999	20.9%	18.3%
	$75,000-$149,999	34.8%	25.5%
	More than $150,000	16.9%	11.1%
Type of Residence[3]	Single-family Home	79.1%	51.8%
	Duplex or Triplex	6.0%	46.70%
	Multi-family	11.8%	
	Other	3.1%	1.60%

Note: Austin city level demographics are summarized from the following sources
1. http://www.austintexas.gov/sites/default/files/files/Planning/Demographics/CoA_ACS_Profile_2013.pdf
2. http://www.austintexas.gov/sites/default/files/files/Planning/Demographics/COA_Travis_MSA_2014_Race_and_Ethnicity_estimates.pdf
3. American Community Survey 2016: Table DP04

Table A-4. Comparison of Responses by Council District and Zip code

Distribution of responses across Austin when Council District was specified Responses received: 469/783	Distribution of responses across Austin when zip code was specified Responses received: 380/783



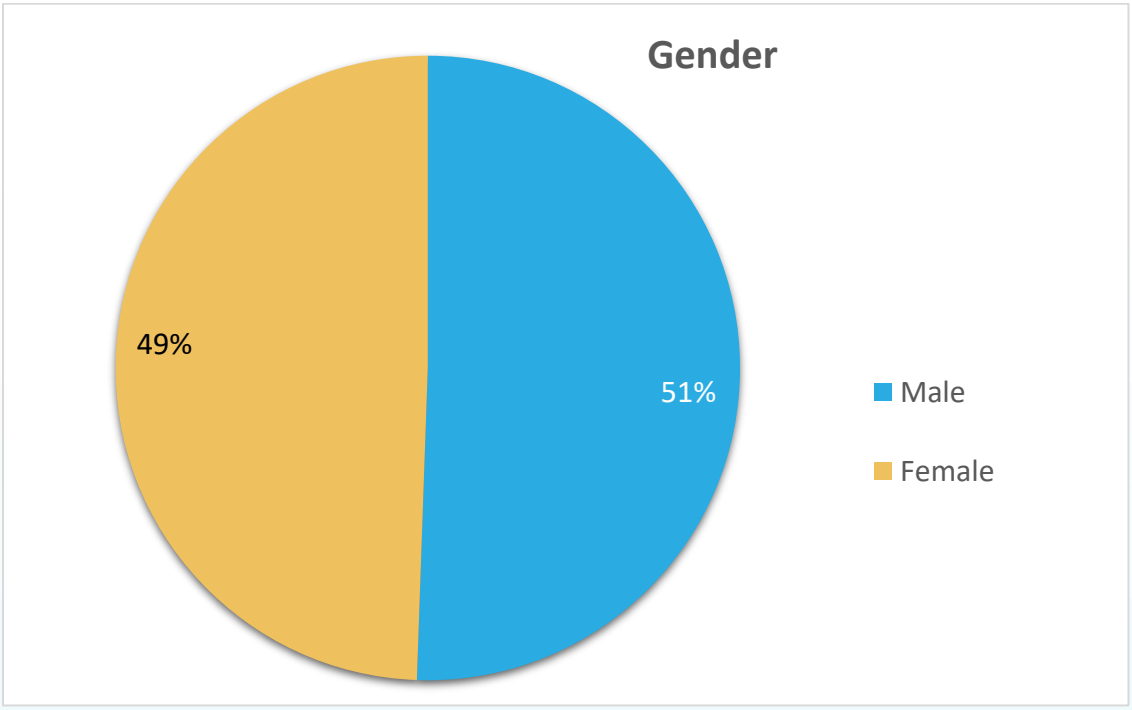


Figure A-2. Distribution of responses across gender, Responses received: 718/783

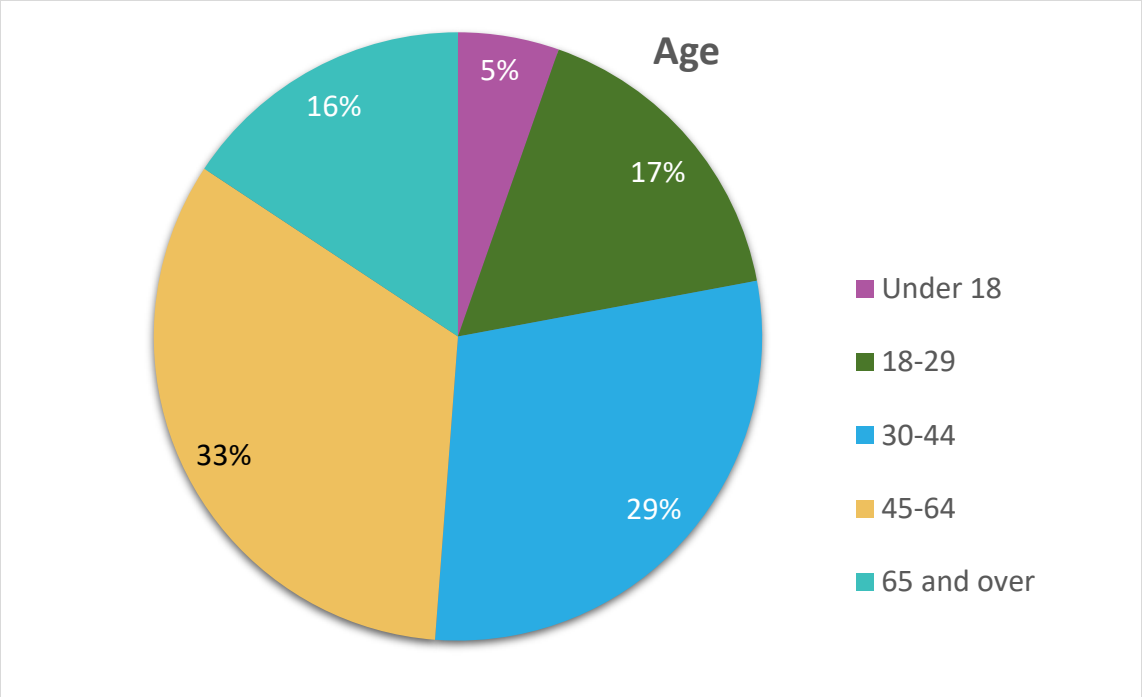


Figure A-3. Distribution of responses across age groups, Responses received: 707/783

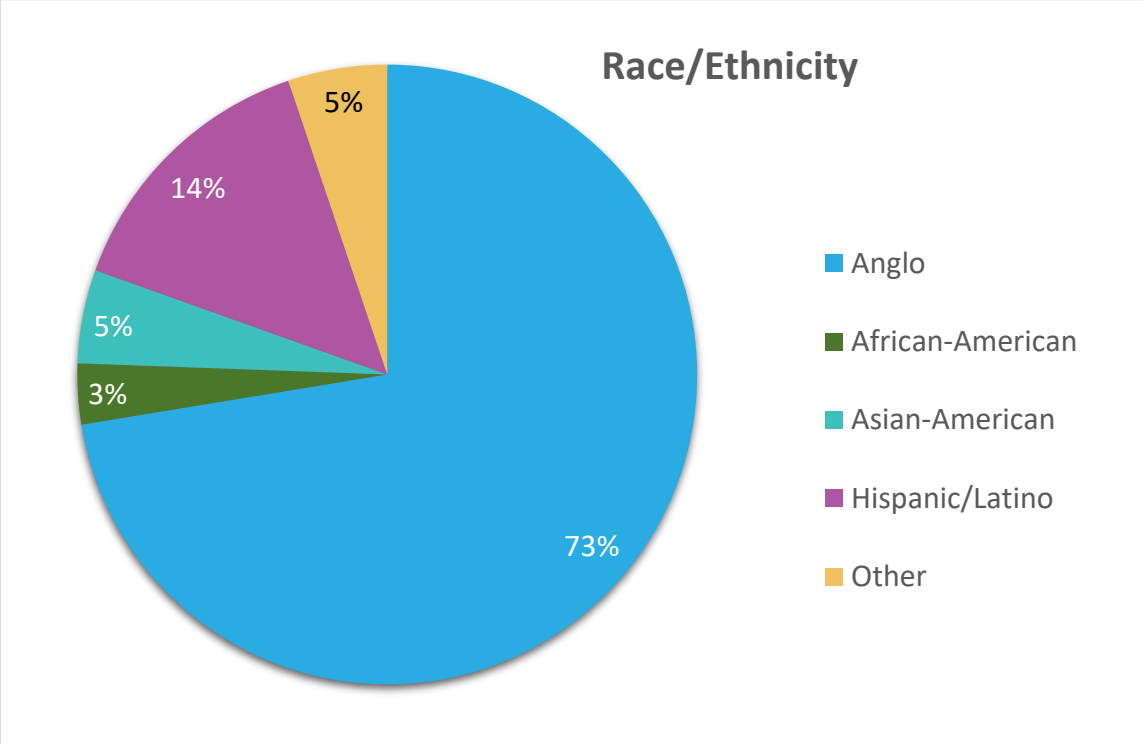


Figure A-4. Distribution of responses across race, Responses received: 696/783

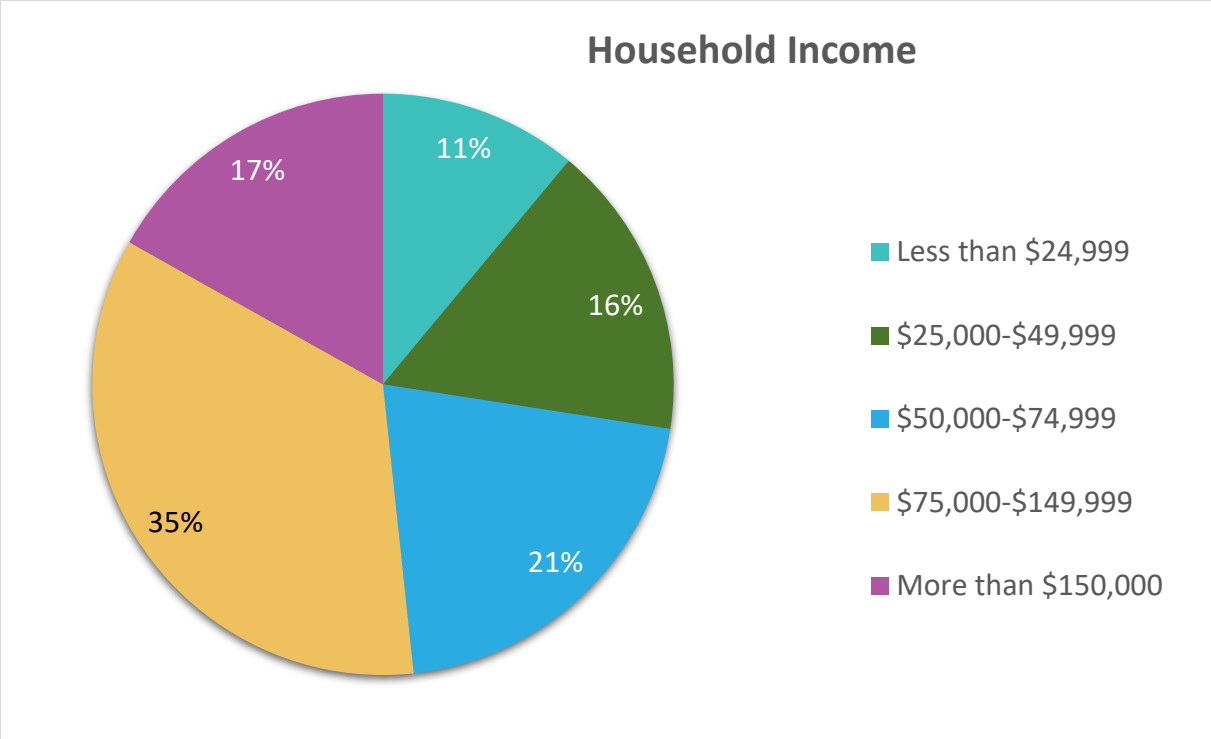


Figure A-5 Distribution of responses across household income, Responses received: 652/783

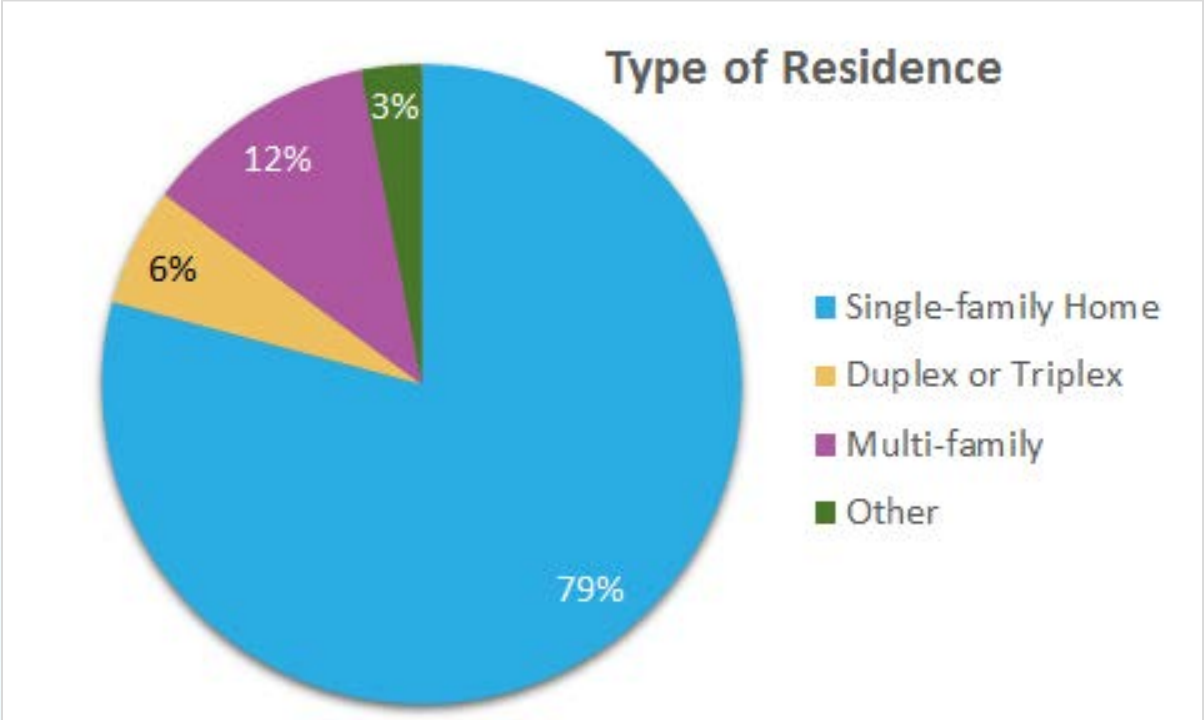


Figure A-6. Distribution of responses across types of residence, Responses received: 719/783

Austin WATER | WATER FORWARD
INTEGRATED WATER RESOURCE PLAN

Memorandum

To: *Teresa Lutes, Austin Water*

From: *Megan Klein, Rifeline*

Copied: *Marisa Flores Gonzalez, Austin Water*

Date: *September 22, 2016*

Subject: *Austin Water Integrated Water Resources Plan Workshop 1 Summary Report*
Task 1 – Public Outreach
CDM P/N: 0590-114879

On September 7, 2016, Austin Water hosted the first of four public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). This 100-year water plan will evaluate mid- to long-term water supply and demand management options for the City of Austin. The IWRP planning process will provide a holistic and inclusive approach to water resource planning.

The workshop gave stakeholders an overview of the IWRP, explained why a water plan is needed and outlined some of the elements of a potential plan. Stakeholders were then given a chance to offer input on the portfolio evaluation criteria for the IWRP. The workshop was held at the Waller Creek Center, located at 625 E 10th Street, Austin TX from 6:00 pm to 8:30 pm. Twenty-four members of the community attended and signed in (see sign in sheet in appendix).

Outreach and Publicity

The event was publicized by Austin Water in the following ways:

- Austin Water emailed the following eNewsletter lists a notice about the workshop (see appendix for invitation):
  - Water Forward (225 stakeholders)
  - WaterWise Residential List (16,792)
  - WaterWise Commercial List (145)
- Austin Water emailed invitations to groups and individuals on the Water Forward stakeholder list, including:

  - Neighborhood associations
  - Businesses, developers, and professional organizations
  - Environmental advocates
  - Civic Leaders
  - Faith-based organizations
  - Education representatives
- Austin Water reached out to City Council members and engaged the IWRP Task Force.
- Austin Water emailed the staff liaisons for the Water Wastewater Commission, Resource Management Commission (RMC), and the Environmental Commission.
- Posted information to Next Door and Facebook and Twitter (see Appendix).
- Posted information to the Water Forward website, http://austintexas.gov/waterforward.

Presentation

Austin Water staff provided an overview of the background of Austin Water, the Integrated Water Resource Plan and the planning process, as well as future public outreach activities. The presentation highlighted:

- Austin Water's demand and population
- History, purpose and goals of the plan
- IWRP development process and public outreach opportunities

The Consultant team outlined the guiding principles of the planning process and discussed the Objectives, Purpose and Desired Outcomes of the plan on which the stakeholders would give feedback. A copy of the full PowerPoint presentation is available in the Appendix.

Stakeholder Feedback

Stakeholders were asked to give their feedback at five stations, one for each of five Objectives including: water supply benefits; economic benefits; societal benefits; implementation benefits; and environmental benefits. At each station, a member of the project team facilitated a discussion to

discover what stakeholders liked about the Objectives, Purpose and Desired Outcomes, what the stakeholders didn't like about the sub-objectives, and if they thought anything needed to be added. A scribe captured their comments on flipcharts and the compiled comments for each Objective are included in the appendix (see appendix). Stakeholders were also given a survey that they could use to write comments that were specific to each Objective and Purpose and Desired Outcomes (see scans of surveys received in the appendix as well as a scan of one comment form received). The following sections provide a summary of the feedback received, categorized by Objective.

Objective: Water Supply Benefits

Purpose: Sustain Austin's water supply reliability, providing resiliency for future population growth and climate change

Desired Outcomes:

- Minimize the number, duration and size of water shortages
- Maximize the certainty that the water supply will be available to Austin when needed
- With emphasis on local sources, enhance the diversification of water supply

Feedback summary:
The drought of the last several years was a major topic of discussion with regard to water supply. Discussion ranged from defining local sources to how we put a monetary value on water. The main recurring theme was the desire to plan for future shortages now. Stakeholders value infrastructure investment with an eye on conservation, safety, and water quality.

Other key feedback themes for this Objective include:

- Need for clarity of technical language (e.g., how do you define a shortage and over what period; what is meant by diversification)
- Climate change should be explicitly addressed
- Need for adaptability to address planning uncertainties like climate change

Objective: Economic Benefits

Purpose: Develop water reliability solutions that are cost-effective for the Austin community

Desired Outcomes:

- Seek cost-effective solutions for improving water supply reliability

- Maximize advantageous external funding for recommended projects/programs

Feedback summary:
The majority of the discussion groups' feedback centered around two themes: affordability and how to plan for a 100-year time period. Affordability concerns included making sure rates stay affordable for families over time, with emphasis on low-income families. Stakeholders highlighted that cost-effectiveness can be viewed from multiple perspectives, including from the perspective of the ratepayer and the perspective of the utility, and costs should be communicated in a way that acknowledges this distinction. In terms of planning 100 years out, stakeholders suggested addressing cost uncertainties by incorporating future evaluations for re-assessing cost-effectiveness. During the discussion on all objectives, stakeholders mentioned maintaining flexibility, as technology and circumstances are expected to change over the 100-year time frame.

Other key feedback themes for this Objective include:

- Clarity around how cost-effectiveness is defined (over what time period, etc.) and how our community values water
- Interest in partnerships and potential funding sources
- Considering regional impacts and benefits upstream and downstream
- Clarity around the plan in general (what's the end product, how concrete will the plan be)

Objective: Environmental Benefits

Purpose: Protect and sustain the local environment for the benefit of the Austin community

Desired Outcome:

- Sustain local watersheds and ecosystem health
- Seek lower energy-intensive solutions for improving water supply reliability
- Increase water use efficiency to reduce demands on potable water supplies

Feedback summary:
There were a few terms stakeholders agreed needed to be defined more clearly - "watershed" and "ecosystem health." Several stakeholders mentioned the idea of conservation and that in order for a plan to be successful, everyone in the community needs to know how they can conserve and how

water use and energy go hand in hand. There were also quite a few ideas about how water can be conserved, such as using native landscaping; capturing air conditioning condensate for reuse; expanding grey water use; and changes to irrigation systems.

Other key feedback themes for this Objective include:

- Taking a regional view (consider downstream impacts, good neighbor policy)
- Evaluation of net environmental impacts (including water consumption and waste generation impacts on base flow, aquifers, aquatic plant and animal health, etc.)

Objective: Societal Benefits

Purpose: Provide societal benefits from improving water supply reliability for the Austin community

Desired Outcomes:

- Enhance livability and recreation through multi-beneficial water infrastructure/programs
- Protect and improve local economic vitality
- Seek social equity and environmental justice, with emphasis on underserved communities

Feedback summary:
Clarity and prioritizing environmental justice were recurring themes at the Societal Benefits table. For many stakeholders, the language was too vague or too technical. Some said the concepts of local economic vitality and underserved communities should be defined, for example. In addition, stakeholders noted the social benefits of the project should be more specific.

Other key feedback themes for this Objective include:

- Water quality should be included as a social benefit
- Societal impacts should stand alone from economic impacts
- Public health and safety are social benefits

Objective: Implementation Benefits

Purpose: Reduce potential implementation challenges thereby increasing likelihood of success for projects/programs

Desired Outcomes:

- Achieve public acceptance and permitting/regulatory success, and reduce potential legal/institutional barriers
- Emphasize the scalability of projects/programs to better meet needs over time
- Seek projects/programs that have proven or tested technologies

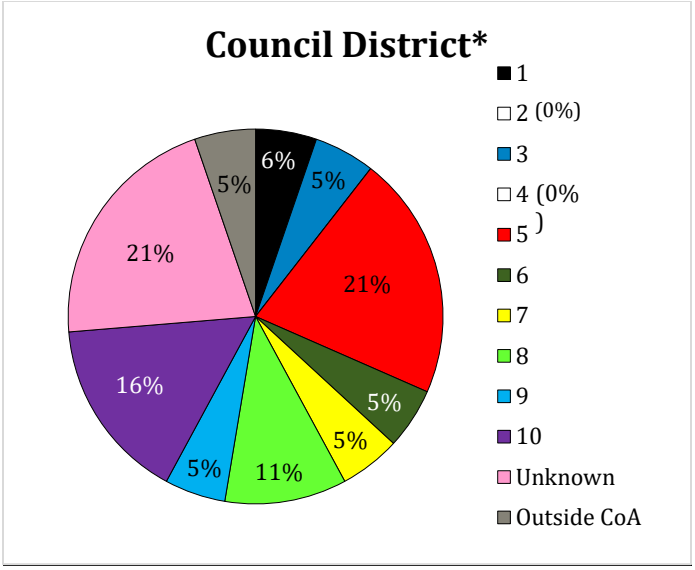
Feedback summary:
Stakeholders agreed that the implementation of the project should be innovative and raise the bar for other cities. Stakeholders felt the project should account for and embrace emerging technologies, especially in light of uncertainties inherent in planning a century in advance. Outreach and education were seen as key to the process of implementation.

Other key feedback themes for this Objective include:

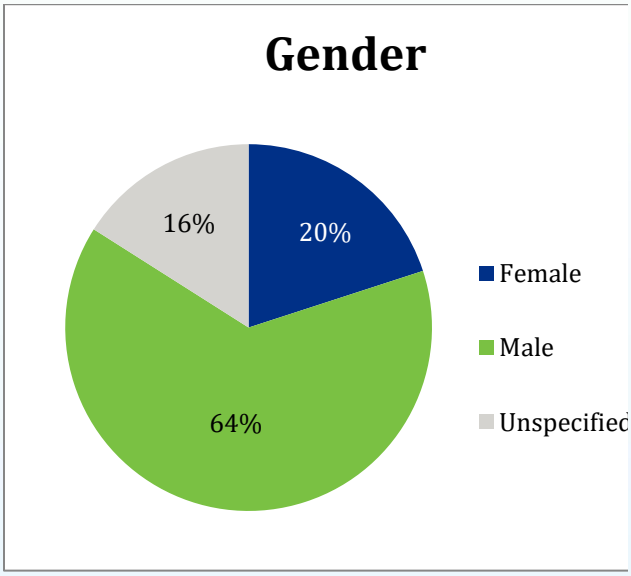
- Clarify impacts and benefits to surrounding communities
- Minimizing public and private property impacts
- Recognize that regulatory and institutional frameworks have the potential to change over the 100-year planning horizon
- Transparency

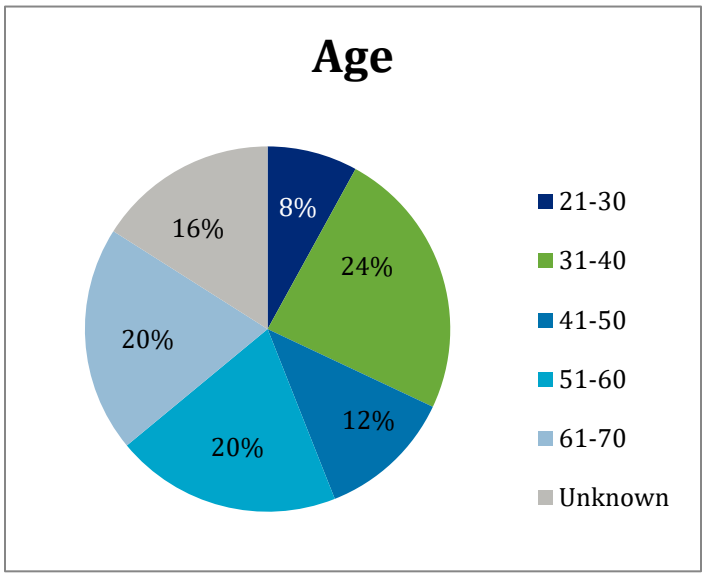
Demographic Breakdown

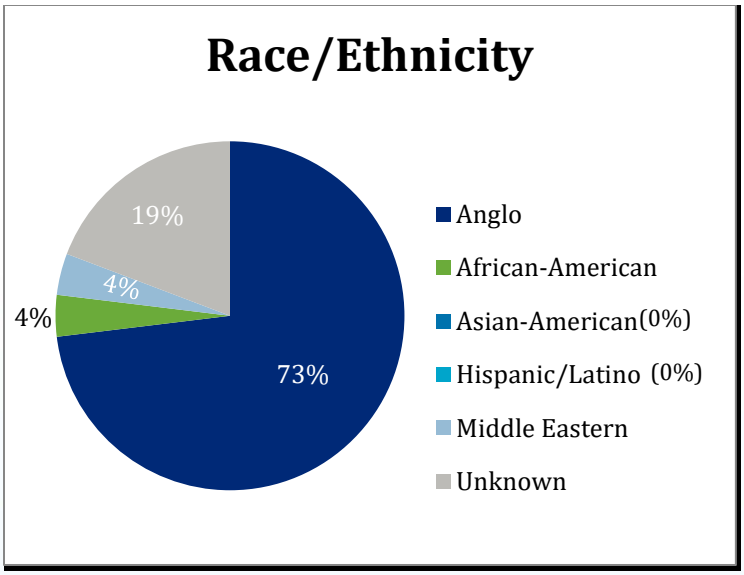
Of the 25 surveys collected, the following demographic information was self-reported (note that demographic information was not provided on all 25 surveys submitted – see survey forms in appendix):

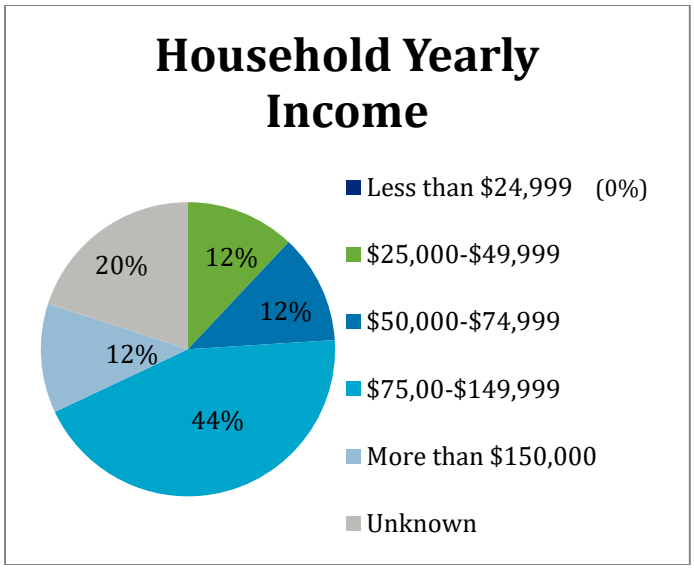


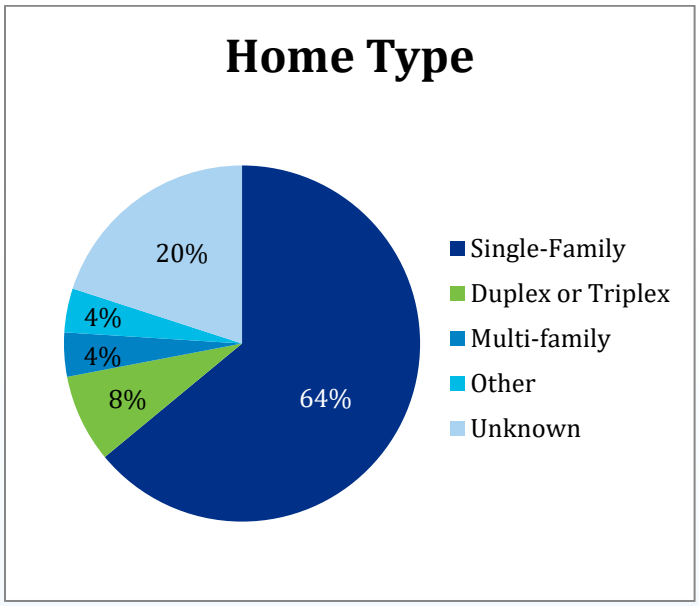
- * Five respondents did not know their district and so provided the list of ZIP codes below:
  - 78702 (1)
  - 78744 (1)
  - 78751 (1)
  - 78757 (1)
  - 78759 (2)

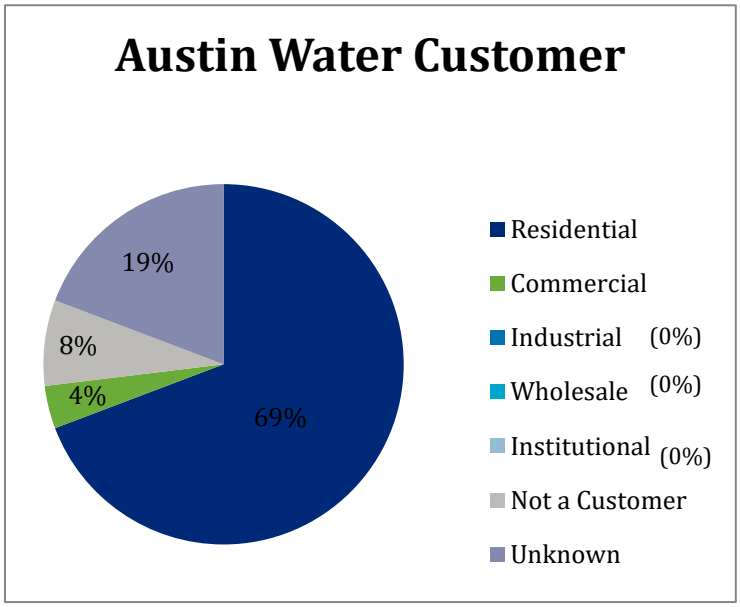



Age
8%
24%
12%
20%
20%
16%
21-30
31-40
41-50
51-60
61-70
Unknown


Race/Ethnicity
73%
4%
4%
19%
Anglo
African-American
Asian-American(0%)
Hispanic/Latino (0%)
Middle Eastern
Unknown


Household Yearly Income
12%
12%
12%
44%
20%
Less than $24,999 (0%)
$25,000-$49,999
$50,000-$74,999
$75,00-$149,999
More than $150,000
Unknown


Home Type
64%
8%
4%
4%
20%
Single-Family
Duplex or Triplex
Multi-family
Other
Unknown



Next Steps

The next Workshop is tentatively set for February of 2017. In the meantime, Austin Water and the project team will strive to incorporate stakeholder feedback and find more avenues to collect feedback.

Appendix

Due to the large number of additional pages, the appendix section is available upon request from Austin Water.

Austin WATER | WATER FORWARD
INTEGRATED WATER RESOURCE PLAN

Memorandum

To: *Marisa Flores Gonzalez, Austin Water*
Teresa Lutes, Austin Water

From: *Megan Klein, Rifeline*

Copied: *Tina Petersen, CDM Smith*
Dan Rodrigo, CDM Smith
Linda Rife, Rifeline

Date: *February 9, 2017*

Subject: *Austin Water Integrated Water Resources Plan Workshop 2 Summary Report*
Task 1 - Public Outreach
CDM P/N: 0590-114879

On February 8, 2017, Austin Water hosted the second of four public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). This 100-year water plan will evaluate mid- to long-term water supply and demand management options for the City of Austin. The IWRP planning process will provide a holistic and inclusive approach to water resource planning.

The workshop featured presentations from the project team about the plan development process, stakeholder outreach, and supply and demand modeling. After the presentations, stakeholders were asked to give feedback on supply- and demand-management options in a brief exercise. The workshop was held at the Austin Independent School District Performing Arts Center multipurpose room, 1500 Barbara Jordan Boulevard, Austin, Texas from 6:00 pm to 8:30 pm. approximately 30 members of the community attended. Copies of sign in sheets are attached in Appendix.

Outreach and Publicity

Austin Water publicized the event in the following ways:

- Austin Water emailed a notice about the workshop to the following eNewsletter lists (see Appendix for a copy of the invitation):
  - Water Forward (339 stakeholders)
  - WaterWise Residential List (Mailing list of 15,738 people)

  - WaterWise Commercial List (Mailing list of 128 people)

- Austin Water emailed invitations to groups and individuals on the Water Forward stakeholder list, including:
  - Neighborhood associations
  - Businesses, developers, and professional organizations
  - Environmental advocates
  - Civic Leaders
  - Faith-based organizations
  - Education representatives
- Austin Water distributed 562 invitation flyers in English and Spanish in the Mountain Ranch (City Council District 3), Village at Collinwood (District 1) and Santoras Villas (District 3) apartment complexes. Emails were sent to an additional 2,709 residents through the apartment management associations. One complex without the ability to email residents posted a flyer on a bulletin board in the common area.
- Austin Water reached out to City Council members and engaged the Water Forward Task Force.
- Austin Water emailed the staff liaisons for the Water Wastewater Commission, Resource Management Commission (RMC), and the Environmental Commission. Due to scheduling limitations, the Water Forward Workshop #2 occurred on the same evening as the February Water and Wastewater Commission Meeting.
- Austin Water invited attendees of past stakeholder outreach meetings.
- Austin Water posted information to Next Door, Facebook and Twitter.
- Austin Water posted information to the Water Forward website, http://austintexas.gov/waterforward.
- Notice of the Workshop was distributed through various local media outlets and was published in the Austin American Statesman and The Monitor.

Presentation

Austin Water staff provided an overview of the background of Austin Water, the Integrated Water Resource Plan and the planning process, as well as past and future public outreach activities. The presentation highlighted:

- Austin Water's demand and population
- History, drivers, objectives and goals of the plan
- IWRP plan development process and public outreach activities

The Consultant team outlined past stakeholder activities including workshop #1 and three targeted stakeholder meetings with industry experts. The presentation highlighted some of the feedback stakeholders have given and how public input will be incorporated in the plan.

Austin Water presented an overview of the water demand forecast. The presentation highlighted:

- Historical and future population figures
- Water use types
- Forecast assumptions
- Impact of weather
- Historical and future demand

Austin Water presented the results of the preliminary water needs analysis and projected supply and demand at several planning horizons. A copy of the full PowerPoint presentation is available in Appendix.

The project team held a brief question and answer session following the first set of presentations. Question and comments included:

- Current and Future Water Supply
  - Does the supply include the Edwards Aquifer?
    - *No, Austin's water supply comes from the Colorado River system. The Colorado River System Water Availability Model (WAM) does not directly take into account water from the Edwards Aquifer.*
  - How many aquifers along Colorado River are fed by the Colorado River and have you measured those effects on supply?

- *Interaction effects between the river and aquifers are not specifically modeled. However, the Water Availability Model (WAM), used in the river system analyses, includes inflows of water to the river and lakes system based on measured flows through the basin's streams and rivers so in that way the model takes interaction effects into account to the extent of the historical interactions.*

- We're asked to ration water. Who is monitoring demand to meet supply? Why keep letting people move here if we already don't have enough water?
  - *Through the recent drought Austin water customers did an excellent job in responding to calls to conserve water to help manage demand for water during the dry times. This strong community commitment to water conservation continues through on-going efforts to conserve water resources and prepare for future droughts. We can see future droughts being even worse than the most recent drought and our city continuing to grow. Through this Water Forward planning process, we are looking ahead and seeing what possible water options and strategies Austin will need for the future.*

- There's a possibility of drought with climate change. Is there more variability of water availability too? Could we store floodwater?
  - *In a climate study performed by Dr. Katherine Hayhoe for the Austin region, long term projections indicate that there could be longer periods of drought interspersed with more extreme rain events. Strategies aimed at capturing additional water from rain events could be evaluated as part of the planning process.*

- Conservation
  - We're being asked to conserve, but there's lots of new development. We call 311 and nothing happens to those who are in violation.
    - *Austin Water appreciates the efforts and works to follow-up on reported water waste and watering schedule violations.*
  - Single-family homes are the largest water user, based on the chart you showed. What is the City doing to support conservation, especially existing homes?
    - *The watering schedule updates approved by City Council in May 2016 includes this water use sector. There are a wide-range of water conservation programs for the single-family residential sector. Information about many of these program was provided at an information table at the workshop. In recent years, conservation efforts have contributed to a significant reduction in residential gallons used per person per day, from 103 gallons in 2006 to 71 gallons in 2016.*

- Innovation and New Technology or Ideas
  - Water is also rare in other parts of the world. Are you reaching out and looking into what is being done internationally?
    - *One of our project team members, GHD, is a firm from Australia. We are incorporating cutting edge global best practices into our plan.*
  - How transportable is water throughout the country? There are rainy areas like the Pacific Northwest, could other areas use their water?
    - *It's feasible, but very expensive. You need major facilities and equipment like pipes, pumps, reservoirs and moving water long distances expends a lot of energy.*
- Coordination
  - South Austin combined neighborhood plan showed that City departments may not be coordinating as well as we would think.
    - *Imagine Austin has led to increased coordination between departments like Austin Water, Watershed Protection, Austin Energy, and Office of Sustainability on a wide-range of water and sustainability related matters.*
  - Are you considering suburbs like Round Rock? Do you coordinate with them?
    - *There's some coordination with some surrounding municipalities like Cedar Park, Buda and Round Rock, but we generally are planning for Austin's water planning area. Round Rock manages its own supplies.*
- Current Water Use
  - What is the percentage of total volume of graywater use in Austin now, what will it be 50 years out?
    - *Right now, it's a very small percentage, but we anticipate it will be an option in the future. It will be included in our modeling if it is chosen as an option to move forward.*
  - What is the per capita water use now?
    - *122 gallons/person/day right now. In the future, we're predicting using similar numbers as a baseline.*

- What has been the highest per capita water use recently?
    - *In 2006, it was 190 gallons/person/day, overall. We've seen that number trend down because of conservation measures such as the Stage 2 water restrictions that lasted for five years during the drought.*

- Other questions and comments included:
    - A question from a board member of the Las Calinas Condos Homeowners Association off 2222 and Mopac: They've saved 1.5 million gallons of water and are paying more rates and fees because condos are treated as commercial property. Why is that? Why are there increases in rates and fees?
        - *Austin Water explained this group may not be able to answer that specific question but asked this citizen to write down the question so we can respond on follow-up. .*
    - What models are you taking these numbers from, especially regarding climate change? Are they modeling severe climate change?
        - *The climate change adjusted hydrology projections are based on an assemblage of global climate model results which use the Representative Concentration Pathway (RCP) 8.5 greenhouse gas concentration scenario. This is the higher of the two emission scenarios for which projections were developed: RCP 8.5 and RCP 4.5. (Note that RCP 8.5 is more consistent with recent trends than RCP 4.5.)*
    - Without water you can't live. Does modeling have a quota that each person is guaranteed? How does it take the homeless into account?
        - *Demand models are based on current use trends and population and employment projections. The water demand projections at this stage of the plan development process are baseline demands that do not include potential additional future water conservation options that may be recommended as part of the plan. Population projections come from the City demographer. Austin's homeless populations are probably accounted for in those projections of population and water demand.*
    - What does purple signify on the gap graph?
        - *Purple is the gap between supply and demand that over time needs to be made up through a combination of options to increase water supply and decrease demand.*

Following the question and answer session, the Consultant team presented the preliminary water supply- and demand management options that are being considered, followed by a brief question and answer session. Questions and comments included:

- Coordination
  - Concern that this process seems hyper-local. Is there regional or statewide coordination happening?
    - *Austin and a wide-range of interests throughout the basin participate in a TWDB administered regional planning process that results in the adoption of a regional water plan every 5-years. The Water Forward plan is to be updated on a 5-year cycle and can help inform next planning round updates to the Region K plan. The City of Austin meets regularly with the Lower Colorado River Authority to discuss water planning from a basin perspective. The recent drought lead to a lot of coordination and programs like SWIFT that provide access to low-interest loans from the Texas Water Development Board (TWDB) to help manage costs of options like Advanced Metering Infrastructure (AMI) and reclaimed water system improvements. Innovation at the government level usually happens at a smaller scale like a city level. Others in the state may look to Austin as a model on this planning process.*
- Code and Ordinance Questions
  - Will new buildings have ordinances imposed on them?
    - *We haven't decided anything yet, but ordinances do come into play for some of the demand strategies, although the final strategy recommendations haven't been developed yet.*
  - Does this dovetail with CodeNext?
    - *We've been working to track with CodeNext process. Some recommendations out of this process may affect the code, but that will come into play later in the process after recommendations are developed and implementation approaches are developed.*
- Clarifications and Requests for Information
  - Can you tell me more about indirect potable reuse?
    - *Indirect potable reuse is a water supply method of putting highly treated wastewater from a treatment plant into a river, reservoir, or alluvial aquifer for withdrawal and treatment at a water treatment plant for potable purposes.*
  - Cost effectiveness is important. I would like to see detailed breakdown of cost and return on investment (ROI).

- *Right now we have 25 demand management strategies and over 20 supply side strategies. We don't have the time or budget to do a detailed study of all of the strategies at that level. Right now we're doing a high level screening that will reduce the number of options for analysis and evaluation down to 10 water supply options and 10 demand management options.*

- Austin Energy uses a lot of water. Did you talk to them about different technologies they could use to use less water?
  - *We're also coordinating with Austin Energy (AE) on things like converting to using reclaimed water. AE uses reclaimed water at their Sand Hill Energy Center. AE has been looking at various generation plan options including options that use less water.*

- For the indirect potable reuse strategy: What if that stream goes dry and you can't use it to help dilute and clean water that is discharged into it?
  - *These types of strategies require thorough analysis and Texas Commission on Environmental Quality (TCEQ) permitting.*

- San Antonio uses an aquifer to store water now, but the Edwards Aquifer constantly moves around. Is there an aquifer in this area we could use for storage?
  - *Aquifer Storage and Recovery (ASR) is an option that we have been exploring. There are two aquifers in the area that we have looked at thus far, the Trinity Aquifer and the Northern Edwards Aquifer, for which there may be some possibilities.*

- Do we lose control if it's outside of our region?
  - *Legislation passed during the last legislative session resulted in a number of rule changes that addressed various aspects of Aquifer Storage and Recovery (ASR). For the option to be effective it is important to be able to "control the bubble" of water that is stored underground.*

- Are you also looking at water rights issues like rule of capture and surface water priority dates (first in time, first in right)?
  - *Yes, we are aware that there are a wide-range of water rights-related aspects to many of the options being considered. We're looking into various aspects, like permitting, availability of water rights, etc., since they can effect option feasibility and implementation.*

- One strategy mentions renegotiating the amount of water you buy from LCRA. Do they have more available water?
    - *We're looking into it and need to find out the answer to that. LCRA has indicated that they have some water for sale and this amount may change based on various factors, such as development of new resources, commitments made and changes in hydrology.*

Stakeholder Feedback

Dot Exercise

Stakeholders were given 20 sticky dots and were asked give feedback on supply- and demand-side option categories by placing a dot on a grid for each option category indicating 'like it', 'don't like it,' 'okay with it,' or 'need more info.' Stakeholders could also write comments on a post it note and stick it to the board. The results are below.

Preliminary Demand Management Option Categories	Like it	Don't like it	Okay with it	Need more info
Water Loss Control – reducing water losses in AW's water distribution system through strategies like leak detection, reducing main break response time, and performing water main replacements	21			
Automated Metering Infrastructure (AMI) – New meters that provide real time information on customer water use to help encourage efficient water use and identify possible home leaks or other high uses of water that can be corrected by the homeowner	20		2	1
Landscape Transformation – ordinances and/or incentives to encourage changing turf to more water efficient landscaping or limit the amount of turf on properties.	19	1	1	
Irrigation Efficiency – ordinances and/or incentives to encourage the use of water efficient landscape irrigation systems	17	1	1	1
Commercial/Institutional/Industrial Conservation – ordinances and/or incentives to encourage more efficient water use for cooling towers/boiler feeds, AC condensate recovery, swimming pools/decorative fountains, as well as disclosure of inefficient water use fixtures at point of sale	17	2	2	
Plumbing Fixture Efficiency – ordinances and/or incentives to encourage use of Energy Star and WaterSense labeled equipment, and for replacement of non-water efficient plumbing fixtures	14	1	4	3
Onsite Reuse of Water for Non-Potable Uses – ordinances and/or incentives to encourage onsite rainwater harvesting, greywater systems, and dual plumbing (for new developments) in order to reduce the use of drinking water for landscape irrigation and toilet flushing	20	1	1	
Water Use Benchmarking – programs to encourage water efficiency benchmarking for new developments and reporting of water use for large building owners	20		1	
Customer Education/Outreach – programs that continue to educate AW water customers on the conservation and value of water	18		1	
Water Rates/Water Fees– explore how changes in water rates and water fees may further encourage water use efficiency while maintaining affordability	14		6	2

Post it Notes on Demand Management Option Categories Boards:

- Post it placed by "Like it" Column for Water Use Benchmarking: with results visible to public by building, by company, by department, etc. for the + psychological benefit driving uptake on process.
- Post it placed by "Like it" Column for Water Use Benchmarking: Developers should pay for this in their "PUDs" – Developers should have to live in PUDs they build.
- Post it placed by "Like it" Column for Water Rates and Fees: More steeply tiered (progressive) pricing offers best opportunity to pay for needed infrastructure while keeping affordability for low-income residents
- Post it placed by "Like it" Column for Irrigation Efficiency: More than encouragement is needed – ordinance with benchmarks for acceptable water use

Preliminary Supply Side Option Categories	Like it	Don't like it	Okay with it	Need more info
Expanded Reclaimed Water System – expansion of AW's "purple-pipe" reclaimed water system for non-potable uses like irrigation, cooling towers, and toilet flushing	17		3	
Decentralized Options for Wastewater Reuse – use of neighborhood satellite wastewater plants or onsite (building-scale) wastewater treatment for non-potable uses like toilet flushing, cooling towers, and landscape irrigation	19		1	1
Indirect Potable Reuse – various strategies to transport highly treated reclaimed water via natural systems like surface water reservoirs or alluvial aquifers for purification to drinking water quality at an existing water treatment plant	5	4	6	7
Direct Potable Reuse – Purifying highly treated reclaimed water using advanced treatment (similar to desalination treatment) to supplement drinking water supply	4	2	5	8
Rainwater and Stormwater Capture – capture and storage of rainwater and stormwater for various uses like irrigation and toilet flushing (neighborhood-scale)	22		2	
Aquifer Storage and Recovery – storing excess surface water during wet years in underground aquifers for later use during dry years	14	1	2	5
Additional LCRA supply/Enhanced Lake Operations/Capture of Stormwater Inflows – additional LCRA supply and various strategies at Lake Austin and Lady Bird Lake to increase ability to draw water from reservoir storage and minimize lake evaporation during dry years	10	3	1	5
Enhanced Off-Channel Storage at Walter E. Long Lake – if Decker Power Station is taken off line, Decker Lake could be used for additional storage that could provide additional water during dry years	15		4	2
Groundwater– to include brackish groundwater desalination (would require removing salts from brackish groundwater using advanced water treatment for new water supply) and conventional groundwater options	2	2	9	7
Seawater Desalination - removing salts from ocean water using advanced water treatment for new water supply	1	10	2	8

Post it Notes on Supply-Side Option Categories Boards:

- Post it placed in "Don't Like it" Column for Indirect Potable Reuse: Bad idea - will effect the environment - see Dripping Springs POW fight

See Appendix for a photo of one of the boards, as an example.

Comment Forms

Stakeholders were very interested in conservation, rewarding customers for using less water, and enforcing current restrictions to decrease violations. One stakeholder asked for more information about rainwater harvesting and water conservation. One stakeholder suggested using "seeing eye" that shut off automatically in homes to save water. Another stakeholder commented that her Homeowners Association had taken steps to drastically decrease water use by 1.5 million gallons per year in 2016, but stated the condominiums were subject to commercial rates. Stakeholders also had comments about taking a regional approach, coordinating with other City departments and possibly establishing a state water resource management structure.

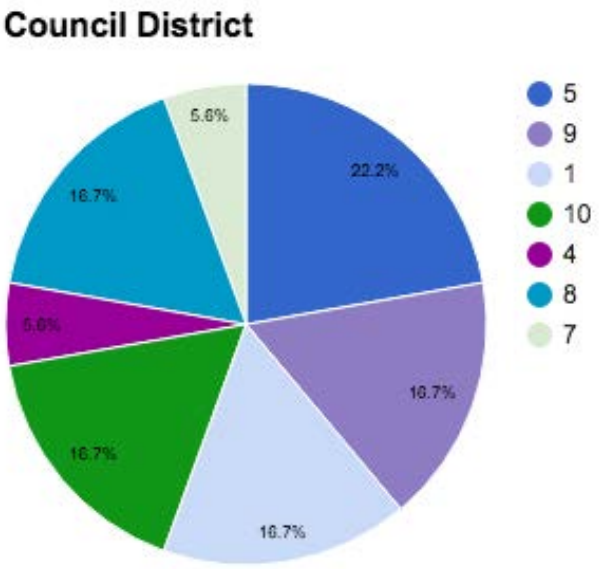
Other feedback included:

- State rules for groundwater rights and where changes may be needed for storage and withdrawal in groundwater aquifers
- Suggestion to eliminate steam boilers for newer technology
- Maintaining flexibility over the 100+ year time frame

Copies of the comment forms and note cards are included in the Appendix.

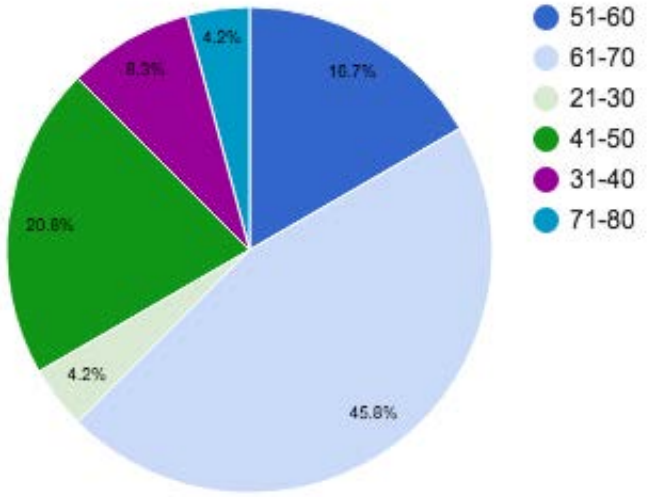
Demographic Breakdown

Of the 24 surveys collected, the following demographic information was self-reported (see copies in the Appendix):

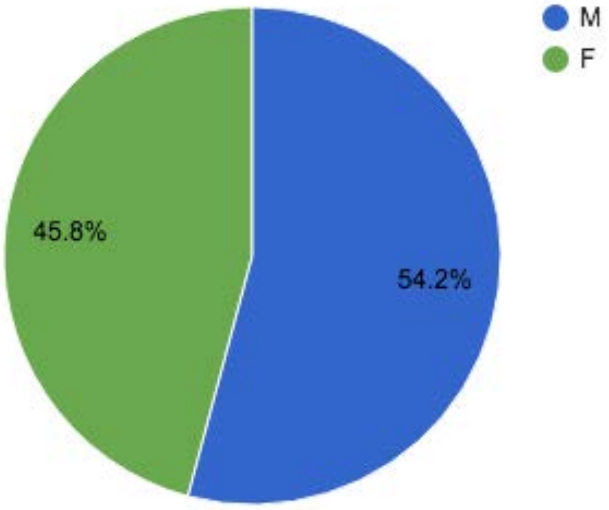


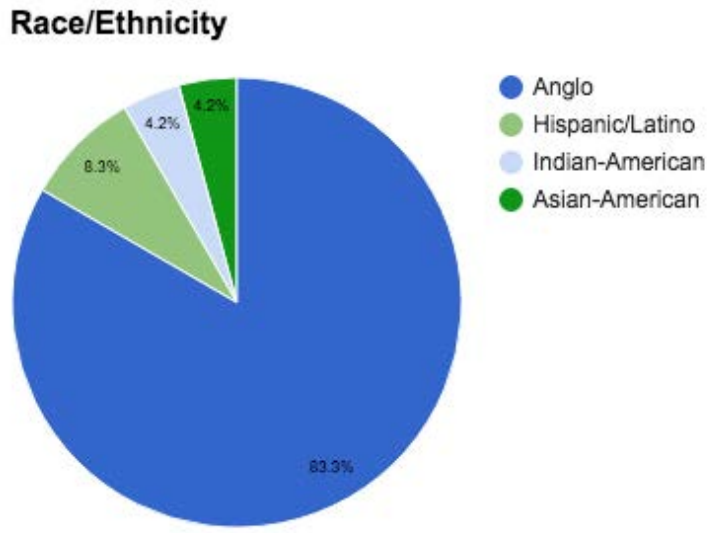
- Six respondents provided their ZIP code instead of their Council District - see below:
  - 78702
  - 78759
  - 78736
  - 78745
  - 78754
  - 78749

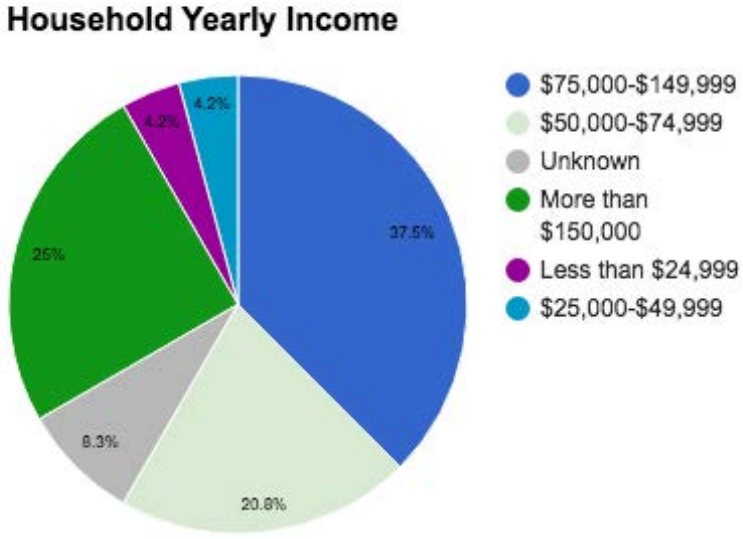
Age Range

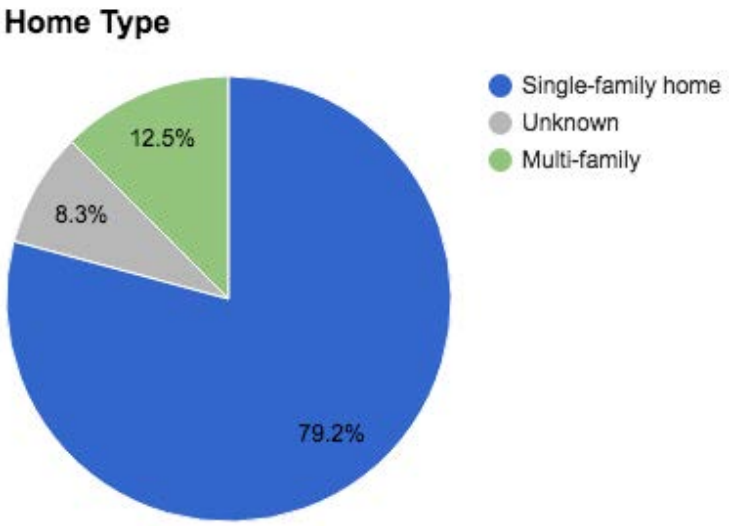


Gender




Race/Ethnicity
4.2%
4.2%
8.3%
83.3%
Anglo
Hispanic/Latino
Indian-American
Asian-American


Household Yearly Income
4.2%
4.2%
37.5%
25%
8.3%
20.8%
$75,000-$149,999
$50,000-$74,999
Unknown
More than $150,000
Less than $24,999
$25,000-$49,999



Next Steps

A new workshop has been added to gather additional public input with a focus on future Water Supply Options being considered in the Water Forward planning process. This newly planned Workshop #3 will be held on April 4, 2017. Following Workshop #3, the next Workshop is tentatively set for August of 2017. Additionally, Austin Water and the project team will also be seeking input through other avenues including community events and other public forums.

Appendix

Due to the large number of additional pages, the appendix section is available upon request from Austin Water.

Austin WATER | WATER FORWARD
INTEGRATED WATER RESOURCE PLAN

Memorandum

To: *Teresa Lutes, Austin Water*
Marisa Flores Gonzalez, Austin Water

From: *Megan Klein, Rifeline*

Copied: Tina Petersen, CDM Smith
Dan Rodrigo, CDM Smith
Linda Rife, Rifeline

Date: *April 4, 2017*

Subject: *Austin Water Integrated Water Resources Plan Workshop 3 Summary Report*
Task 1 – Public Outreach
CDM P/N: 0590-114879

On April 4, 2017, Austin Water hosted the third of five public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). This 100-year water plan will evaluate mid- to long-term water supply and demand management options for the City of Austin. The IWRP planning process provides a holistic and inclusive approach to water resource planning.

The workshop featured presentations from the project team about the plan development process, stakeholder outreach, and supply and demand modeling. After the presentations, stakeholders were asked to give feedback on water supply options in a brief dot exercise. The workshop was held at One Texas Center, Conference Room 325, 505 Barton Springs Road, Austin, Texas 78704, from 6:00 pm to 8:30 pm. Twenty two members of the community attended.

Outreach and Publicity

Austin Water publicized the event in the following ways:

- Austin Water emailed the following eNewsletter lists a notice about the workshop (see Appendix A for invitation):
  - Water Forward (438 stakeholders)
  - WaterWise Residential List (Mailing list of 15,029 people)
  - WaterWise Commercial List (Mailing list of 205 people)

- Austin Water emailed invitations to groups and individuals on the Water Forward stakeholder list, including:
  - Neighborhood associations
  - Businesses, developers, and professional organizations
  - Environmental advocates
  - Civic Leaders
  - Faith-based organizations
  - Education representatives
- Austin Water reached out to City Council members and engaged the IWRP Task Force.
- Austin Water emailed the staff liaisons for the Water Wastewater Commission, Resource Management Commission (RMC), and the Environmental Commission.
- Austin Water invited attendees of past stakeholder outreach meetings.
- Posted information to Next Door, Facebook and Twitter.
- Posted information to the Water Forward website, http://austintexas.gov/waterforward.

Copies of the sign in sheets are available in the Appendix B

Presentation

Austin Water staff provided an overview of the background of Austin Water, the Integrated Water Resource Plan and the planning process, as well as past and future public outreach activities. The presentation highlighted:

- Austin Water's demand and population
- History, drivers, objectives and goals of the plan
- IWRP plan development process and public outreach activities

Austin Water outlined past stakeholder activities including workshops one and two, as well as three targeted stakeholder meetings with industry experts. The presentation highlighted some of the feedback stakeholders have given, how it has influenced the plan so far, and how it will be incorporated moving forward.

Austin Water presented an overview of the water demand forecast. The presentation highlighted:

- Historical and future projected population figures
- Water use types
- Forecast assumptions
- Impact of weather
- Historical and future demand

Austin Water presented the preliminary water needs analysis and projected supply and demand at several planning horizons. A copy of the full PowerPoint presentation is available in the Appendix C.

The project team then held a brief question and answer session following the first set of presentations. Question and comments included:

What is outdoor water use?

- *It generally means irrigation for lawns and landscapes and other uses of water outdoors such as car washing and maintaining water levels in swimming pools.*

Is the State of Texas involved or connected with what's being looked at in Austin?

- *To some extent, yes, because we're part of the state's regional water planning process which is updated on a 5-year cycle. This particular Water Forward effort is a City of Austin effort. Many of the things we're looking at locally are also part of the Region K water plan, as part of the State water planning process, and vice versa. The modeling we're using is a state-wide model (TCEQ WAM, or water availability model) so we're looking at our supply in a statewide context.*

For the water availability model (WAM), did it anticipate the multiple months where there were zero inflows?

- *Yes, the historical inflows, including the unprecedentedly low inflows in year 2011 have been added into the modeling.*

Given that the period of record is all post-industrial era and already within an altered climate period, by applying an additional climate change factor, isn't climate change being over-emphasized?

- *Not from our point of view – it can be thought of in a context of modeling a projected additional difference in the region's hydrology due to additional climate change. We have flows that we know of from the past that our modeling is based on. We're essentially modeling additional change that is projected to occur beyond what is already seen in the historical record.*

The intergovernmental global consortium on climate change predicts things will get much worse in SW US. I'm glad you're looking at this. When you say climate change, I'm assuming you're talking about CO2, greenhouse gases. In the current political climate, do you have an issue selling this idea to the current government, given that some don't acknowledge climate change?

- *From feedback we have received, we believe the community is supportive of us looking at climate change. Some of these things may change over time, and folks may become more accepting of these ideas.*

The stakeholder mentioned that we may need to think about how these ideas are funded given the political climate.

Who buys water wholesale?

- *Small cities, MUDs, water control and improvement districts. There are about 17 wholesale customers. The overall percentage of water use they make up is about 7%.*

Can you explain why 600,000 AF is the emergency trigger level?

- *The Lower Colorado River Authority (LCRA) has a water management plan for lakes Travis and Buchanan, and they work with stakeholders and update the LCRA Water Management Plan (WMP) on a periodic basis. The 600,000 AF combined lakes Travis and Buchanan emergency storage volume trigger is the emergency trigger level in the prior WMP, and that number is in the current WMP. The emergency trigger level relates how much water would need to be available in the reservoirs for supplying needs until drought breaks. The number may need to change upward in the future, from 600,000 AF, as circumstances change. [Note: LCRA set this number in 1992 as part of the three criteria for when a drought worse than a drought of record is triggered and the City incorporates this storage trigger into its drought contingency plans as a trigger for a stage of drought action.]*

We heard reliability is important as is the diversification of water supply – it still seems like the Colorado River is the main supply moving forward. Is there another plan?

- *The Colorado River is currently and is planned to be Austin's core water supply throughout the 100 year planning horizon. When we look at the portfolios of options, we have various metrics that will weight supply diversity and other approaches to assess this aspect of supply reliability. At that point, we'll be able to see which portfolios are the most reliable, balanced against other consideration factors such as cost, feasibility, etc. The supply options you'll see tonight are categories, which include supply augmentation options that are not Colorado River system-based.*

Following the question and answer session, the Austin Water team talked through the IWRP development process and explained the portfolio development process. They also presented the preliminary water supply options that are being considered, including some strategies that have been

added by Water Forward Task Force members between Workshops #2 and #3, followed by a brief question and answer session.

Questions and comments included:

Given what we heard in the beginning, it sounded like sustainability and conservation are important to the community. How do you square that with the options you presented?

- *Not included in this presentation are the objectives and sub-objectives that these portfolios will be evaluated against. Sustainability and conservation are included in the Environmental objective, so scoring of how well portfolios of options do with regard to these factors will be included in the process. All of the objectives and sub-objectives were created with input from the community.*

I'm concerned about brackish water desalination. What is the plan for disposal of the minerals and salts that are left?

- *We're at an early stage in the planning process, so specifics on that aspect of that option have not been determined at this stage. Through the plan development additional information will be developed for each option as the process proceeds. We will note this concern. In this process it is important to consider factors like desalination brine disposal.*

In the places these strategies are being used now, how do they do it?

- *Evaporation brine disposal (evaporation ponds) – this is mostly done in West Texas now. In some places desalination brine is disposed of through deep well injection.*

What is the aquifer storage and recovery process, which involves putting water into an aquifer?

- *Aquifer storage and recovery (ASR) involves drilling wells to inject water into an aquifer in wet times for storage. After water is stored up over a period of time, the stored water could be accessed during drought times to supplement supply. ASR is being used in San Antonio, Kerrville, El Paso and Florida now.*

In Florida, they use it because the everglades are depleting so quickly. Where would we put it?

- *We've taken some preliminary looks at the Northern Edwards and Trinity aquifers. Additional aquifers may also be considered including the Carrizo-Wilcox aquifer.*

Would these be aquifers that would be owned by the city, or how would it affect private wells?

- *The general concept is you look for a place you can generally control surface access to the water stored in the underground aquifer. City-owned land or a place the aquifer isn't easily accessible by private well owners could be considered.*

How can we become more informed to what the options are?

- *The 21 options being considered in this screening process are posted on the City of Austin's Boards and Commissions website for the Austin Integrated Water Resource Planning Community Task Force (Water Forward Task Force). There's a link to this site on the Austin Water website. We combined the options into categories to make this process more efficient. You're also welcome to attend upcoming Task Force meetings to learn more about the options as the process continues and more information is developed.*

Interbasin transfer is very limited in Texas and would require changes at the legislature, what makes this option different?

- *The interbasin transfer option was added to the list of options for consideration based on input from the public and Task Force members. The idea is to leave no stone unturned and see if it may be a viable option. We don't have specifics at this time however, more information would need to be developed should this option move through the screening process. Regulatory hurdles would need to be taken into account further into the process.*

Given that water is a commodity that relates to survival, what prevents a higher authority from coming in and tapping our reservoir, and what is our ability to deny wholesale entities the access to water?

- *[In Texas, surface water in a watercourse is owned by the state. LCRA holds the state permits to distribute water from Lakes Travis and Buchanan, which is a vested right protected by law.] Austin has a contract with LCRA and we have a partnership with them. We have an ongoing interest in making sure we have the supply we've contracted for and that it's protected. One of the needs we've identified is continuing to work with our regional partners to make sure our core water supply stays reliable. This IWRP process highlights the need for regional coordination and working with our partners to make sure we have the supply we'll need in the future. [With regard to new contracts for supply from Travis and Buchanan, the decision is made by LCRA which takes into consideration existing commitments. Note that the City of Austin is also a wholesale water supplier, by contract, to a number of entities in the Austin area. These wholesale customers generally follow the City's drought contingency plans in implementing use reductions during drought conditions and other emergencies.]*

You're apparently not allowed to consider at all the shape of your population growth curve. Thirty or 40 years ago, that population growth was due to students staying here. Later it was a general economic growth climate. Now it's high tech and government incentives to attract people here, ignoring water as a resource. At some point, people will want to stop moving here or will choose to leave because it's no longer a nice place to live. Is anyone looking at sociological factors for population growth?

- *The City of Austin is continually looking at population growth in Austin and the region as plans are developed for the future in our community. The current plan development effort is based on*

current City Demographer projections, however, we plan to update this plan every five years, so we can account for population changes along the way. It's not a one size fits all strategy, it's a dynamic process.

Stakeholder Feedback

Dot Exercise

Stakeholders were given 15 sticky dots and were asked give feedback on supply-side options by placing a dot on a grid for each option category indicating 'like it', 'don't like it,' 'OK with it,' or 'need more info.' Stakeholders could also write comments on a post it note and stick it to the board. The results are below.

Preliminary Supply Side Option Categories	Like it	Don't like it	Okay with it	Need more info
Expanded Reclaimed Water System – expansion of AW's "purple-pipe" reclaimed water system for non-potable uses like irrigation, cooling towers, and toilet flushing	14		4	
Decentralized Options for Wastewater Reuse – use of neighborhood satellite wastewater plants or onsite (building-scale) wastewater treatment for non-potable uses like toilet flushing, cooling towers, and landscape irrigation	18		1	
Indirect Potable Reuse – various strategies to transport highly treated reclaimed water via natural systems like surface water reservoirs or alluvial aquifers for purification to drinking water quality at an existing water treatment plant	6	6	1	3
Direct Potable Reuse – Purifying highly treated reclaimed water using advanced treatment (similar to desalination treatment) to supplement drinking water supply	13	1	2	3
Rainwater and Stormwater Capture – capture and storage of rainwater and stormwater for various uses like irrigation and toilet flushing (neighborhood-scale)	21			
Aquifer Storage & Recovery – storing excess surface water during wet years in underground aquifers for later use during dry years	4	1	8	4
Additional LCRA supply/Enhanced Lake Operations/Capture of Stormwater Inflows – additional LCRA supply and various strategies at Lake Austin and Lady Bird Lake to increase ability to draw water from reservoir storage and minimize lake evaporation during dry years	6		2	8
New Off-Channel Reservoir - Development of a new off channel reservoir within the Austin vicinity that could be used for additional storage to provide additional water during dry years	5	3	2	5
Groundwater– to include brackish groundwater desalination (would require removing salts from brackish groundwater using advanced water treatment for new water supply) and conventional groundwater options	5	5		5
Seawater Desalination - removing salts from ocean water using advanced water treatment for new water supply	4	9	1	3

Inter-Basin Transfers – Transfer and conveyance of water from available surface water supplies in other river basins	1	9	2	5
Partnership Approaches – Explore partnership approaches with other entities on regional strategies which could include aquifer storage and recovery, purchase of available water supply, or other partnerships	6	5		5

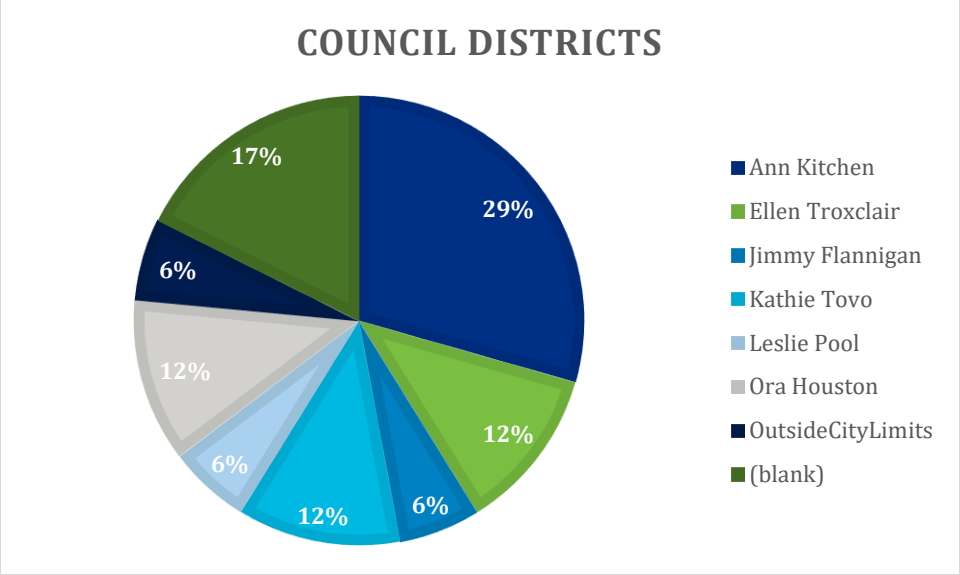
See Appendix D for a photo of one of the boards, as an example.

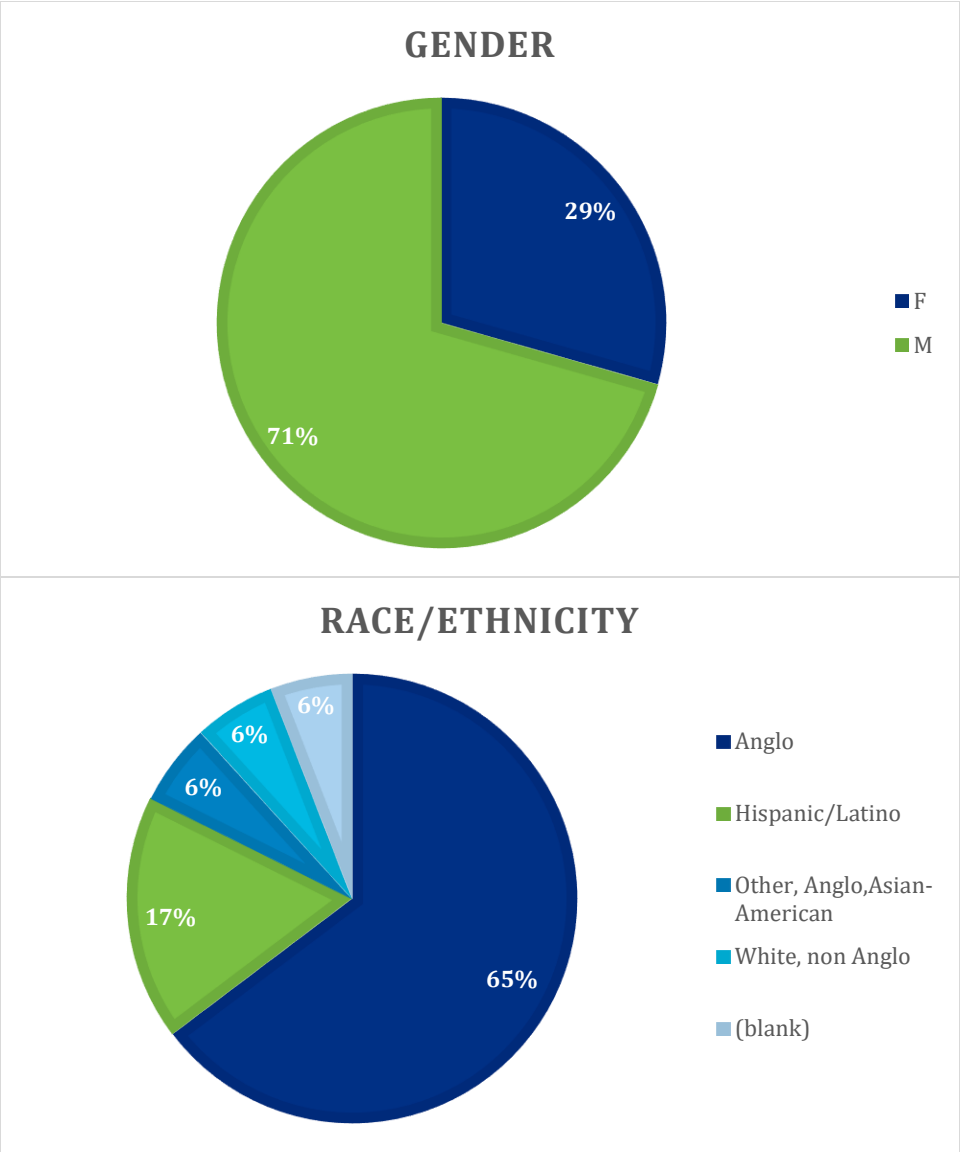
Comment Forms

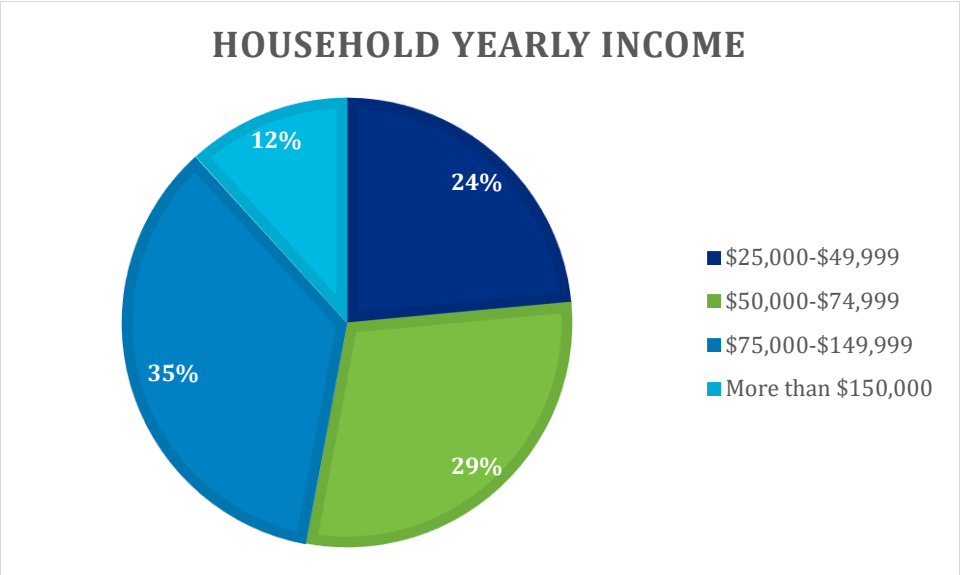
Copies of the comment forms and note cards are included in the Appendix E.

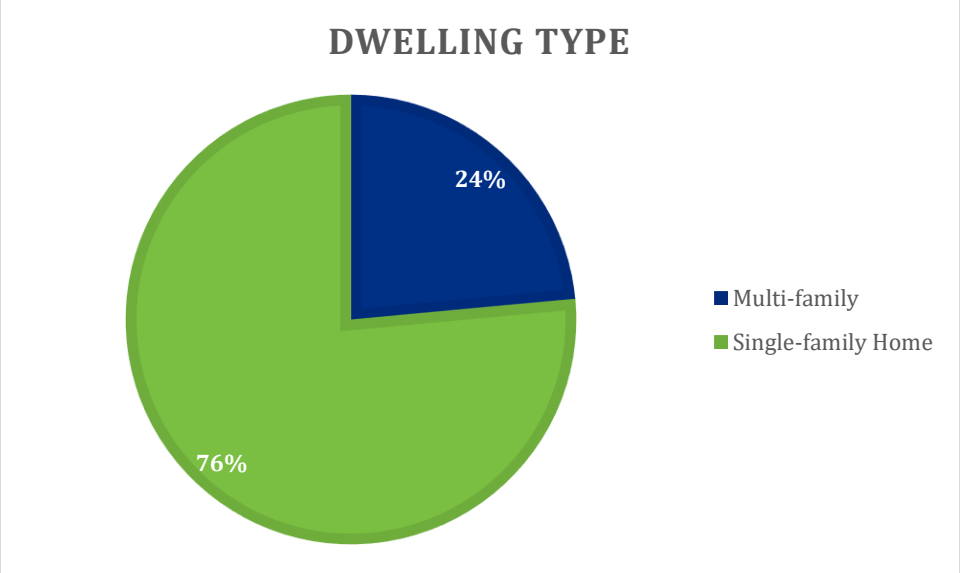
Demographic Breakdown

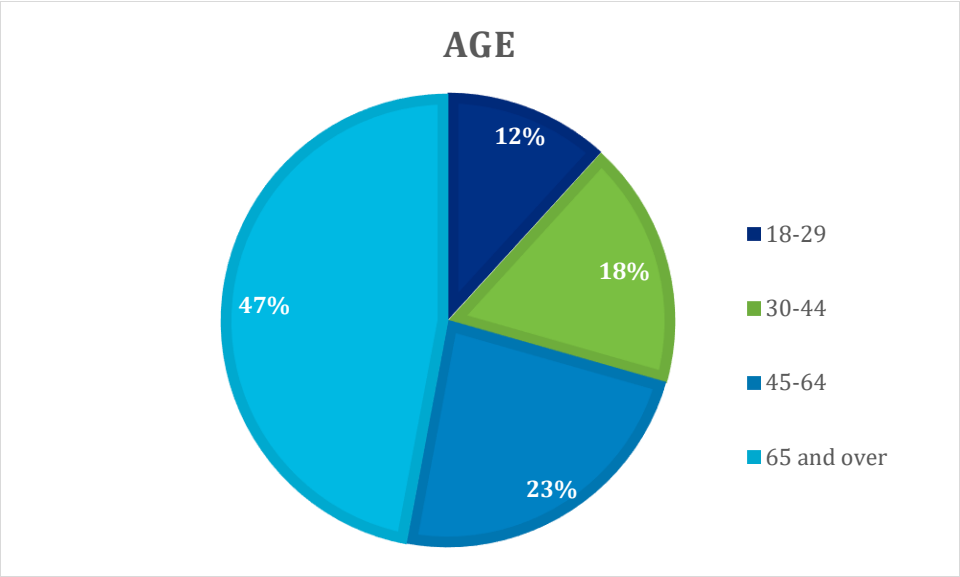
Of the 17 surveys collected, the following demographic information was self-reported (see copies in Appendix F):




GENDER
29%
71%
F
M
RACE/ETHNICITY
65%
17%
6%
6%
6%
Anglo
Hispanic/Latino
Other, Anglo,Asian-American
White, non Anglo
(blank)


HOUSEHOLD YEARLY INCOME
12%
24%
35%
29%
$25,000-$49,999
$50,000-$74,999
$75,000-$149,999
More than $150,000


DWELLING TYPE
24%
76%
Multi-family
Single-family Home



- Three respondents did not know their district and one respondent was from outside of city limits and so provided the following ZIP codes:
  - 78759
  - 78749
  - 78731
  - 78620

Next Steps

The next Workshop is tentatively planned for August 2017. In the meantime, Austin Water and the project team will strive to collect additional public feedback, incorporate stakeholder feedback, and provide additional public engagement opportunities.

Appendix

Due to the large number of additional pages, the appendix section is available upon request from Austin Water.

Austin WATER | WATER FORWARD
INTEGRATED WATER RESOURCE PLAN

Memorandum

To: *Marisa Flores Gonzalez, Austin Water*
Teresa Lutes, Austin Water

From: *Lyndsi Lambert and Laura Atlas, Rifeline*

Copied: *Tina Petersen, CDM Smith*
Dan Rodrigo, CDM Smith
Lynda Rife, Rifeline

Date: *August 28, 2017*

Subject: *Austin Water Integrated Water Resources Plan Workshop 4 Summary Report*
Task 1 - Conduct Public Outreach and Participation
CDM P/N: 0590-114879

On August 16, 2017, Austin Water hosted the fourth of five public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). This 100-year water plan will evaluate mid- to long-term water supply and demand management options for the City of Austin. The IWRP planning process provides a holistic and inclusive approach to water resource planning.

The workshop featured presentations from the project team about the plan development process including key process steps completed, stakeholder outreach conducted to date including emerging themes from stakeholder feedback, supply and demand options as well as portfolio development and evaluation. After presentations, stakeholders were invited to participate in two Question and Answer sessions followed by facilitated small group discussions.

The workshop was held at the Canyon View Events Center (Austin Board of Realtors Building) located at 4800 Spicewood Springs Road, Austin, TX from 6:00 pm to 8:00pm. 24 members of the community attended (18 participants attended in person and 6 participants attended via webinar).

Outreach and Publicity

Austin Water publicized the event in the following ways:

- Austin Water emailed the following eNewsletter lists a notice about the workshop (see Appendix A for invitation):
  - Water Forward (Mailing list of 440 people)

  - WaterWise Residential List (Mailing list of 15,026 people)
  - WaterWise Commercial List (Mailing list of 206 people)
- Austin Water emailed invitations to groups and individuals on the Water Forward stakeholder list, including:
  - Neighborhood associations
  - Businesses, developers, and professional organizations
  - Environmental advocates
  - Civic Leaders
  - Faith-based organizations
  - Education representatives
- Austin Water reached out to City Council members and engaged the IWRP Task Force.
- Austin Water emailed the staff liaisons for the Water Wastewater Commission, Resource Management Commission (RMC), and the Environmental Commission.
- Austin Water invited attendees of past stakeholder outreach meetings.
- Posted information to Next Door, Facebook and Twitter.
- Posted information to the Water Forward website, http://austintexas.gov/waterforward.

Copies of the , invitations (Appendix A), and sign in sheets (Appendix B)are available in the Appendix Section.

Presentation

Lynda Rife of Rifeline provided a summary of the workshop agenda and explained that there was a webinar option available. The agenda for the workshop included:

- Welcome
- Where We Are in the Process
- What We Have Heard to Date
- Options Characterization

- Q&A
- Portfolio Development Process and Themes
- Q&A
- Facilitated Discussion on Themes:
  - Water supply reliability
  - Cost and affordability
  - Conservation of resources

A copy of the presentation is provided in Appendix C.

Marisa Flores Gonzalez, Austin Water's Water Forward Project Manager, provided an overview of the Integrated Water Resource Plan (IWRP), goals for a resilient water future and the planning process. The presentation highlighted:

- Introduction to Integrated Water Resources Plan (IWRP)
- Drivers for Austin's IWRP
- Development process
- Key process steps completed

Geneva Guerrero, Community Engagement Specialist, Austin Water, provided information on past and future stakeholder activities including public workshops and the Summer Series held at libraries in each City Council district. The presentation highlighted:

- Stakeholder feedback at public workshops and Summer Series
- Emerging themes
- How public input will be incorporated

Tina Petersen, Project Principal with CDM Smith (the main Consultant team for the Water Forward effort), provided information on the process of selecting and characterizing water supply and demand management options. The presentation highlighted:

- The options characterization process including demand management options, decentralized options, and supply options

Examples of characterized options including demand management options, decentralized options and supply options with information on project yield, costs, and climate resiliency of the options

The project team then presented the first of two-scheduled question and answer sessions, facilitated by Lynda Rife of Rifeline. Questions and answers included:

- Demand Management Options, Decentralized Options, and Supply Options
  - Did you look at additional supply options? For example, how can we improve the water flow at the headwaters of the Colorado River to improve or enhance water down river?
    - *We didn't look at that option specifically, but in general other options can be considered in the future. In an overall sense, there is a need for continued regional collaboration.*
  - Did you determine the size for the decentralized options?
    - *With decentralized options, we looked at average-sized homes or lots and cost drivers were based on spatial differences and whether water would be used for indoor and/or outdoor needs.*
  - Does the city have direct aquifer access?
    - *We are evaluating this. Aquifer Storage and Recovery (ASR) in the Carrizo-Wilcox Aquifer is an option being evaluated in the Water Forward process.*
  - Are the options targeting new development only?
    - *Some of the options are targeting only new development projected to occur over the planning horizon, however, some options are targeting both existing and new construction/development.*
  - We built our home to harvest rainwater, but because there was no incentive from the city, we stopped using it. Would there be an incentive for this in the future?
    - *One of the options included in the evaluation process is lot-scale rainwater harvesting. Should this option be selected for inclusion in the plan recommendations, one of the*

implementation pathways could be incentive-based. In addition to incentive implementation, ordinance-based implementation approaches may also be considered.

- [One written question received via comment card] What are cost drivers for lot size rainwater harvesting and stormwater harvesting?
  - *The key cost drivers for lot-scale rainwater and stormwater harvesting include how and where the water will be used (indoors/outdoors), the sizing of the storage tank, and sizing of equipment and other facilities, including pumps.*

- Dan Rodrigo of CDM Smith presented information on the process of developing and evaluating integrated water resource plan portfolios. The objectives for strong portfolios include water supply benefits, economic benefits, societal benefits, implementation benefits, and environmental benefits. Each of the five objectives are tied to the three key factors of sustainability: economic, social, and environmental. Highlights of the presentation included:
  - The Water Forward Task Force gave input to the process of applying weighed values to the five objectives.
  - A needs assessment was conducted to look at supplies and identified needs and map them into the future.
  - Portfolios were created to meet identified needs.
  - Using an adaptive management approach, the IWRP will be updated on a 5-year cycle.
  - The goal is to evaluate the portfolios on different objectives, and stakeholder feedback is an important part of the process.
- The presenters then held a brief question and answer session following the presentation on portfolio development and evaluation. Questions and answers included:
  - Do you look at the years gone by when water was needed in a hurry because people moved in quickly? When big bumps happen we're behind the curve. Can we look at what has happened historically?
    - *We work to forecast what the future growth might be. We have methods to track demand and growth in order to be able to bring on additional options as needed. For example, for some options we may have the opportunity to lay the groundwork by doing studies and engineering design, and time construction in sync with the timing of need.*
  - The Texas legislature requires a vote on annexation. Can the city of Austin restrict growth?

- *Newly approved legislation regarding annexation is a recent development. Potential impacts to long-range service area planning will need to be looked at and could potentially be incorporated in future plan updates, as appropriate.*

- We have years of surplus that we need to manage. I'm surprised by options like desalination. Why don't we build a reservoir to save water?
  - *We are looking at storage options for Austin like San Antonio has done. San Antonio has a Carrizo-Wilcox Aquifer Storage and Recovery (ASR) facility. A Carrizo-Wilcox ASR project is an option we are considering with Water Forward. We have experienced times of drought and times of much wetter conditions.*
  - *We look at averages, but it's the extremes that you have to manage. With Water Forward we are working to account for climate change into the future. It is projected that there will be periods of more intense and longer droughts punctuated by wetter rainy periods. Over time, with extended periods of high temperatures and the associated water loss due to evaporation, aquifer storage and recovery storage would help manage this type of hydrologic condition.*

Stakeholder Feedback

Facilitated Table Discussion

Lynda Rife, of Rifeline, invited stakeholders to participate in facilitated table discussions. There were three tables set around the room, and the participants rotated to each one at 12 minute intervals based on randomly assigned groups of three. Project team members facilitated discussion and took notes at each table.

Below are summary points from the discussion on the following three themes: conservation of resources and environmental stewardship, cost and affordability, and water supply reliability. Notes from the discussion can be found in Appendix D

- Conservation of resources and environmental stewardship
  - Implement landscape water efficiency
  - Extend current water supply
  - Implement ordinances for new development to capture rainwater (alternative water)
  - Use decentralized wastewater reuse
  - There are location challenges for decentralized systems

- Think about soil as part of conservation.
- Keep more water on landscapes.
- Storm water capture could help with flooding
- Consider inclusion of residential in expansion of reclaimed "purple pipe" system option
- Incentivize large volume users to use less water
- Encourage/allow reclaimed water filling stations/trucks
- Utilize AC condensate for beneficial uses
- Encourage more graywater usage from indoor sinks
- Encourage irrigation efficiency incentives through education
- Consider social justice as part of conservation strategies
- Encourage low-impact development
- Look at LCRA/Environmental flows as part of the plan

- Cost and Affordability
  - Rainwater harvesting is a good onsite option
  - Enforcement of ordinances will have to be planned to be cost effective
  - Lower water rates by planning better
  - Secure water supply opportunities
  - Increase water rates to encourage conservation
  - Encourage large companies to use reclaimed water
  - Rate payers should see an itemized bill showing what they are paying for
  - The trend is that water utility costs are going up
  - Utilize education to optimize use
  - Effective enforcement is important

- City should create a fund that developers pay into for future water supplies/buying land for future needs
- Distribute costs equitably

- Water Supply Reliability
  - Use storage options in excess water years to store available water
  - Maintain water supply for basic needs
  - New water supply for new growth provides water security
  - We need cushion for future needs
  - Utilize aquifer storage & recovery option and off-channel reservoirs to store water for use in dry times
  - Diversify water supplies
  - Having a difficult time seeing the need for seawater desalination
  - It is good to have meetings and evaluate the plan every 5 years
  - Timing is important for planning for the future
  - Consider downstream needs
  - Pay attention to climate change
  - Need water available to fight fires and other safety measures

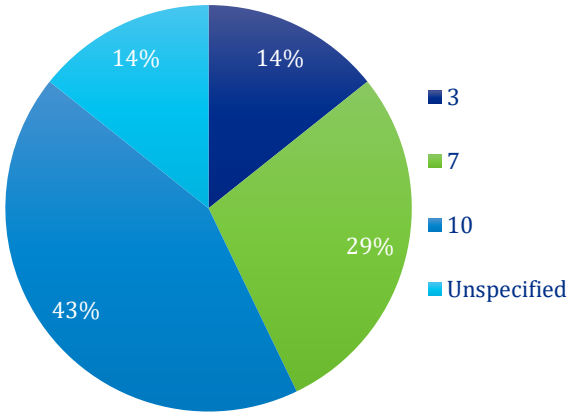
After the facilitated discussion sessions, participants were encouraged to take a look at the information boards around the room and ask questions to Austin Water staff and other workshop presenters.

Demographic Breakdown

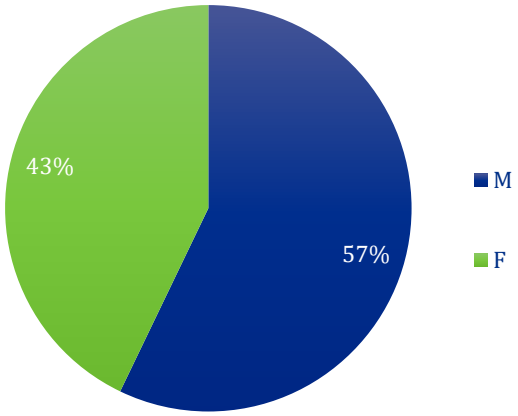
Of the seven demographic surveys completed, the following demographic information was self-reported. Copies of the demographics forms can be found in Appendix E:

- One respondent did not live in Austin City Council Districts and provided the ZIP code below:
  - 78745

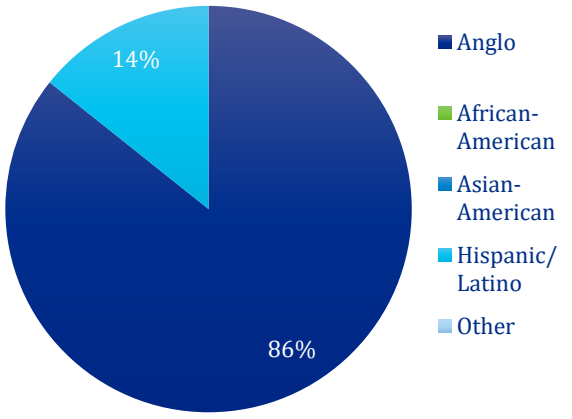
Council District



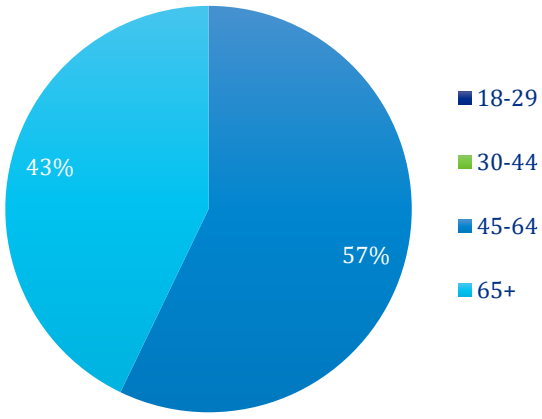
Gender

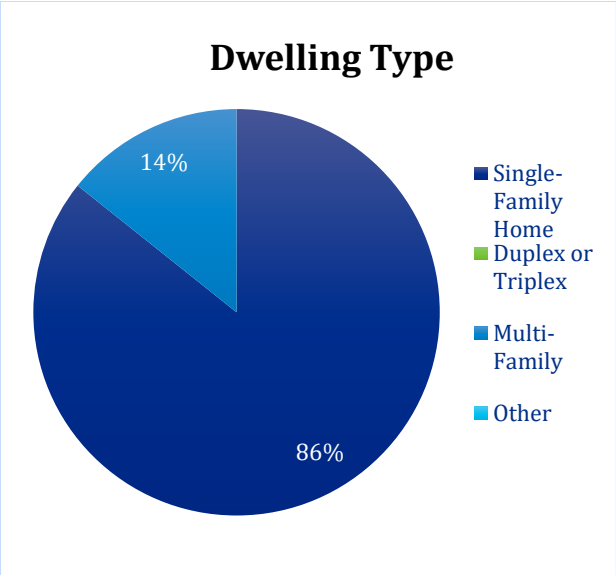


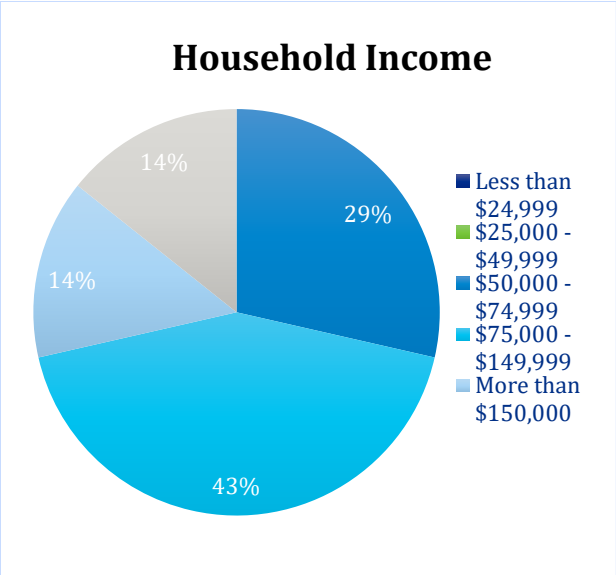
Race/ Ethnicity



Age







Next Steps

The next Workshop is tentatively set for early 2018. In the meantime, Austin Water and the project team will strive to incorporate stakeholder feedback and begin developing potential portfolio options.

Appendix

Due to large number of additional pages, appendix section available upon request from Austin Water.

Austin WATER | WATER FORWARD
INTEGRATED WATER RESOURCE PLAN

Memorandum

To: *Teresa Lutes, Austin Water*
Marisa Flores Gonzalez, Austin Water

From: *Lynda Rife, Rifeline*

Copied: Tina Petersen, CDM Smith
Dan Rodrigo, CDM Smith

Date: *March 21, 2018*

Subject: *Austin Water Integrated Water Resources Plan Workshop 5 Summary Report*
Task 1 – Public Outreach
CDM P/N: 0590-114879

On March 21, 2018, Austin Water hosted the fifth of five public workshops in order to collect public input for the Integrated Water Resource Plan (IWRP). The workshop featured presentations from the project team including a recap of the plan development process, themes from stakeholder feedback, portfolio development and evaluation, and draft plan recommendations and benefits. After presentations, attendees were invited to participate in two Question and Answer sessions followed by an Open House where attendees were invited to view draft plan recommendation benefits and get their questions answered by project team members.

The workshop was held at the Dawson Elementary School Cafeteria located at 3001 S. 1st Street, Austin, TX 78704 from 6:00 p.m. to 8:00 p.m. Twenty-nine (29) members of the community attended (24 attended in person and five (5) attended via webinar).

Outreach & Publicity

Austin Water publicized the event in the following ways:

- Austin Water emailed the following e-newsletter lists a notice about the workshop (see Appendix A for invitation):
  - Water Forward (495 stakeholders)
  - WaterWise Residential List (15,000 stakeholders)
  - WaterWise Commercial List (206 stakeholders)

- Austin Water emailed invitations to groups and individuals on the Water Forward stakeholder list, including:
  - Neighborhood Associations
  - Businesses, Developers & Professional Organizations
  - Environmental Advocates
  - Civic Leaders
  - Faith-Based Organizations
  - Education Representatives
- Austin Water also:
  - Reached out to City Council members
  - Engaged the IWRP Task Force
  - Emailed staff liaisons for the following commissions:
    - *Water Wastewater Commission*
    - *Resources Management Commission*
    - *Environmental Commission*
  - Made announcements on social media including:
    - *Nextdoor*
    - *Facebook*
    - *Twitter*
  - Water Forward website: http://austintexas.gov/waterforward

Copies of sign in sheets are available in Appendix B.

Presentation

Lynda Rife of Rifeline welcomed attendees and provided a summary of the workshop agenda. She explained that there was a webinar option available enabling attendees to join virtually. The agenda for the workshop included:

- Review Water Forward Plan Drivers
- Understand Evaluation Processes
- Draft Plan Recommendations and Benefits

- Adaptive Management Concept and Next Steps
- Q&A (after each presenter)
- Open House: Draft Plan Recommendations, Benefits and Facilitated Discussion
- Invitation to Complete a Survey and/or Comment Form

See PowerPoint Presentation slides in Appendix C.

Dan Rodrigo of CDM Smith provided a recap of the IWRP process and the themes of public input received to date (key themes include clean safe drinking water, water supply reliability, conservation of resources, cost and affordability, and environmental stewardship). He explained how Austin Water is working to plan for future droughts and water resource needs based on different scenarios. He also explained how needs for portfolio development were considered, how needs would increase over time, and how meeting those needs would require planning well in advance to ensure that resources were available when needed.

After providing an overview of the process for developing and evaluating integrated water portfolios, Dan made note of the five objectives for assessing portfolios: water supply benefits, economic benefits, societal benefits, implementation benefits, and environmental benefits. Finally, Dan reviewed a summary of portfolio evaluations including Hybrid 1, Hybrid 2, Max Conversation, Max Reliability, Max Implementation, Max Local Control, and Max Cost-Effectiveness.

The project team then opened the first of two question and answer sessions, facilitated by Lynda Rife of Rifeline. Questions and answers included:

1. How did you decide on the weights for the different objectives/criteria?

2. *A Council-Appointed Water Planning Task Force in 2014 developed a final report that included a matrix with listed criteria and weighting information, which was used as a starting point. This set of criteria was fleshed out and refined for the Water Forward process based on process requirements and input from the Water Forward Task Force, the consultant team, city staff and others.*

3. Last year, the Texas Legislature passed a law providing for landowners in a city's extraterritorial jurisdiction (ETJ) to vote to decide if they want to be annexed. Will the City of Austin continue to supply water to new developments in the ETJ?

   Time will tell on the long-term effects of that law; the Water Forward Plan will be updated on a 5-year cycle and the City will make plan adaptations, as needed, in the future. The City will continue to be actively involved in monitoring potential service area changes as they make occur in the future.

   Conservation is prominent in each of the portfolios. What is included in this? Behavior? Fixtures?

   Question was saved because the next presentation would go through the contents of portfolios in more detail, where the question might be answered through the presentation.

   During presentation #2 Marisa Flores Gonzalez, Austin Water, addressed these questions during the explanation of Hybrid 1 and Water Conservation Strategies slides.

With the City's current Lower Colorado River Authority (LCRA) contract set to expire in 2100, what was assumed with regard to the availability of water for the Austin Water Utility after that point in time?

It was assumed that in the future the City would renew and extend that contract with LCRA.

4. Since this is an integrated plan, what is the involvement/role of regional providers such as LCRA and surrounding communities and water utilities?

5. *City of Austin envisions working with regional partners to protect and enhance the water supply. The City will engage in numerous outreach efforts including coordinating with the LCRA and the Regional Water Planning Group (Region K). The City will continue to share information with others in the basin and identify regional issues.*

Marisa Flores Gonzalez, Austin Water's Water Forward Project Manager, provided an overview of the Draft Water Forward Plan Recommendations and benefits. The presentation highlighted:

- Hybrid 1 components
- Water Conservation Strategies
- Water Supply Strategies
- Benefits of the Plan, including:
  - Meeting Future Demands & Population Growth
  - Stretching Our Current Supplies
  - Supply Diversification & Resilience
  - Strengthening Drought Resilience & Planning for Climate Change
  - Maximizing Local Water Sources
  - Planning for Climate Change & Uncertainties through Adaptive Management
- Key Points About Plan's Adaptive Management Approach

1.

The project team then opened the second of two-planned question and answer sessions, facilitated by Lynda Rife. Questions and answers included:

2. How is the City planning to fund programs to address future leaks and failures in the city's water infrastructure? Are the funds enough?

The City continually plans for these types of infrastructure improvements through Austin Water's Renewing Austin Program; infrastructure improvements are typically incorporated into the City's Capital Improvements Program (CIP) process.

The most cost-effective strategy is to change how we develop properties. Has there been any analysis/modeling to determine whether the proposed changes in CodeNEXT will help us achieve

our demand-side management goals to be set forth in Water Forward? Are any of the strategy options being incorporated now in CodeNEXT or otherwise?

For the recommended Water Forward options requiring code changes, the City will be holding public input forums to receive public input on the implementation requirements for the options. For example, for future ordinances that may be required to implement recommendations on alternative water options, Austin Water plans to seek public input throughout the ordinances development process, including aspects of applicability, requirements, etc. Throughout the process Austin Water has continued to track the CodeNext process and is not aware of any incompatibilities with Water Forward recommendations.

When Aquifer Storage Recovery (ASR) was discussed previously (approx. 2010), Austin Water (AW) suggested it was not feasible due to impacts to the infrastructure (i.e. lime build-up in AW pipes). How have those concerns been resolved?

3. *The City has looked at ASR in the past. Previously the city had looked at the Edwards Aquifer for short-term storage and there was concern about injecting lime softened water into the formation which could create scaling in the system/pipelines and cause diminished return of taking water out of the aquifer. The City is currently evaluating ASR in the Carrizo-Wilcox Aquifer for long-term storage for drought supply augmentation. If approved for implementation, there would be additional study and analysis needed and piloting. A suitable aquifer potentially may require additional water treatment prior to injecting and after extracting; long-term storage would be beneficial for stretching water supply over a period of years to manage drought situations.*

4. Is the City looking into alternative water sources such as atmospheric water generation to recharge aquifers?

5. *Cloud seeding did not make it through the screening process early on in the project.*

Will the City of Austin mandate dual plumbing in new, single family homes which makes it easy for greywater reuse?

6. *Draft Water Forward Plan Recommendations do included recommendations regarding dual plumbing; the City is recommending to initially require dual plumbing in larger-scale commercial and multi-family new development. Part of the implementation process will include determining sector applicability and phasing.*

If developers are taking on costs such as rainwater harvesting, why is it so expensive?

7. *Unit costs were included on one of the presentation slides. The costs shown are community costs which include costs that may be borne by both developers and Utility customers. Although rainwater harvesting is one of the higher cost options on a unit costs basis, it serves multiple benefits.*

Where is the supply diversification? Brackish is the only new supply, which will be implemented in 60 years.

While a number of the options originate from Colorado River supplies, they include aspects that benefit supply diversification, such as the storage options like aquifer storage and recovery and a new off-channel reservoir. Some of the options are from new local sources such as storm water and rainwater

capture; brackish groundwater desalination is projected to be implemented later in the plan timeline; additionally, this plan will be updated every five years and new water supply options that may emerge can be evaluated at each plan update.

If you pump water into an aquifer, anyone can pump it out under Texas law. How will you regulate this situation?

The City will be looking at developing conservation easements, purchasing acreage, or other approaches, in the area of an ASR project in order to help protect the "bubble" of stored water.

8. Are advanced water meters currently available? The costs associated with some of these options will be incurred regardless which portfolio is selected (i.e. repair and maintenance of infrastructure to reduce loss). Are the costs indicated on the slide above and beyond what can be anticipated?

9. *The City is currently testing technology with an Advanced Metering Infrastructure (AMI) Pilot Study in River Place and is working with a consultant to develop an AMI plan to expand the program to all Austin Water customers (completion is expected within the next five to seven years). The City spends approximately $20-25 million per year on replacing leaking pipes; the City is using several different innovative strategies (i.e. imagery, leak detection equipment, etc.). While the City is currently making expenditures in these areas, future planned expenditures will be incorporated in future capital improvements plans.*

10. Where is the brackish water coming from? Matagorda Bay? Why not state that up front?

The recommended brackish groundwater option would not coming from Matagorda Bay; the City is still identifying a suitable brackish groundwater aquifer, which would be located generally in the Central Texas area

11. How will the plan be implemented? Partnership with homeowners, commercial, businesses? How enforceable is this plan?

12. *For some options, the plan will be implemented through future changes to codes and ordinances, where applicable. For some options, the plan will be implemented through incentive programs. Other options will be implemented through completion of projects through Austin Water's Capital Improvements Program (CIP).*

Does Water Forward propose incentives or changes to regulations to encourage indoor reuse, not just reuse for landscaping?

Requirements for installation of on-site dual plumbing for new developments with a phased implementation approach are recommended; through the implementation process, the City will work to determine sector and scale applicability. The recommendation is for the initial phase to apply to new development in the larger commercial and multi-family sector.

Questions and comments noted by participants in comment cards are attached in Appendix D

Stakeholder Feedback

Open House

Following the presentations and Q&As, participants were invited to participate in an Open House where display boards detailed Draft Water Forward Plan Recommendation benefits and project team members were available to answer questions and engage in deeper conversation.

Below is a list of the boards displayed (see Appendix E for details):

- Meeting Future Demands & Population Growth
- Stretching Our Current Supplies
- Supply Diversification & Resilience
- Strengthening Drought Resilience & Planning for Climate Change
- Maximizing Local Water Sources
- Planning for Climate Change & Uncertainties through Adaptive Management

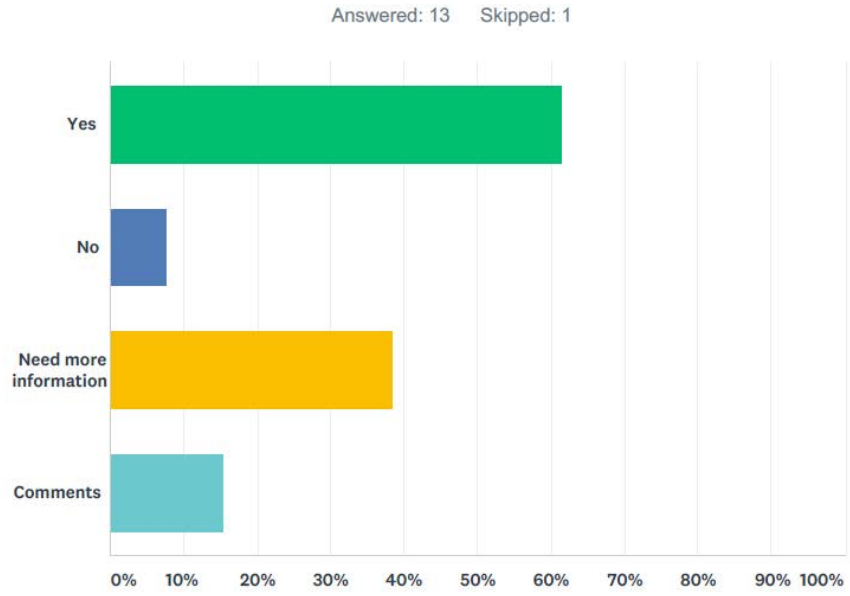
A recap of what was heard from participants is outlined below:

- Atmospheric conditions (an attendee was interested in removing moisture from the atmosphere to develop water, not focused on cloud seeding)
- Concern to make sure enough water is returned back to the lakes/rivers for the environment and downstream users
- Discussed climate change assumptions
- Discussed how the City potentially plans to incorporate the Draft Water Forward Plan Recommendations into the Region K and State Water Plan
- Concern expressed over how firm 325,000 ac-ft/yr will be available for the City of Austin down the road
- Interest expressed regarding if other entities using the same water supplies as Austin have been incorporated into this plan.

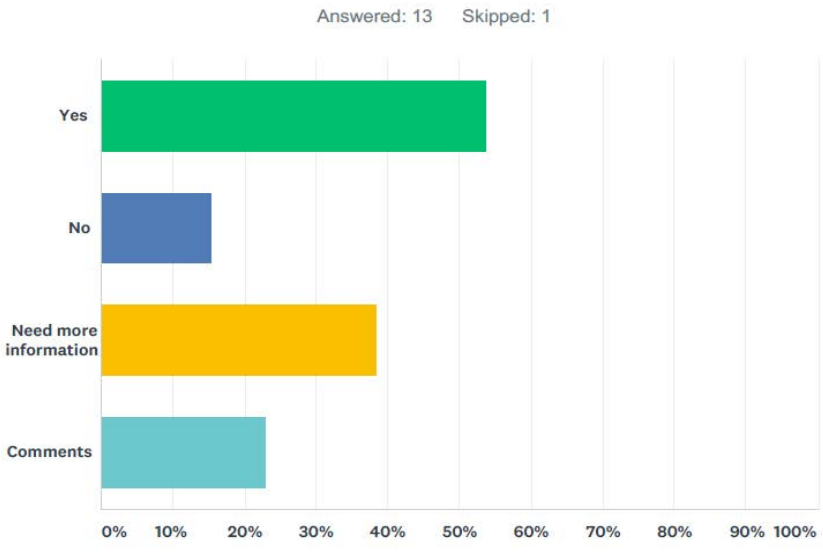
Survey Results

Stakeholders were also invited to complete a survey in order to provide feedback on the Draft Water Forward Plan Recommendations. Of the 29 stakeholders who attended, 14 submitted a survey (48% response rate). See Appendix F for scans of surveys and associated comments.

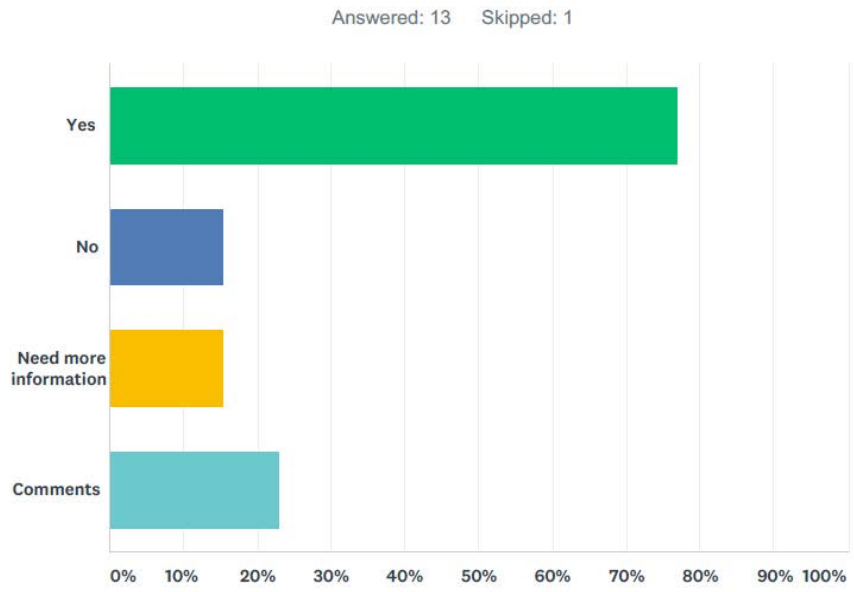
Question #1: Are the recommendations clear?



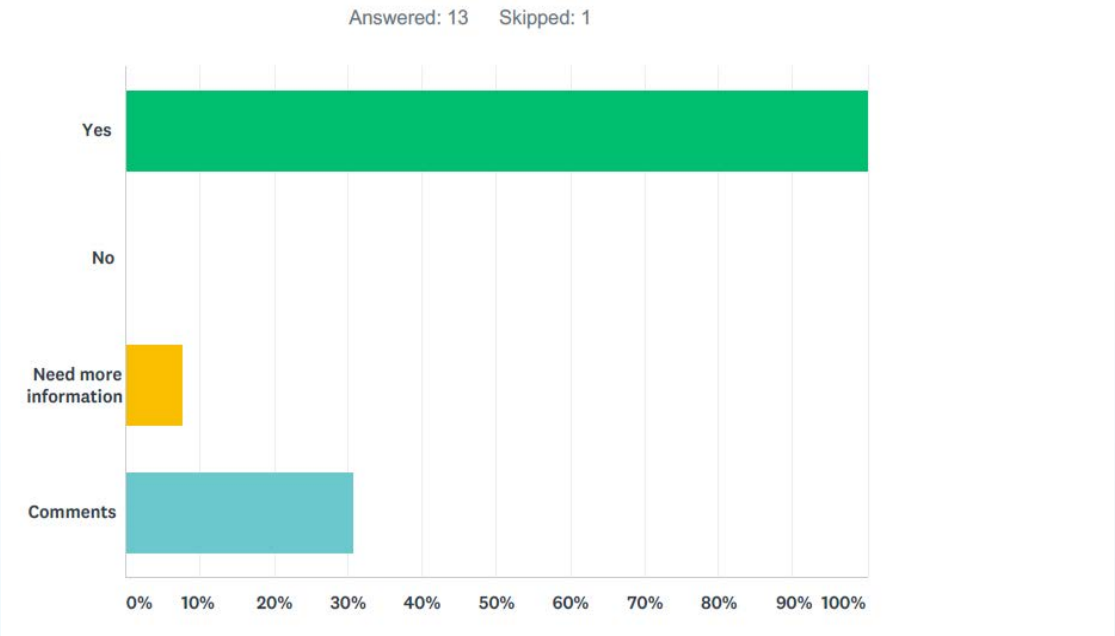
Question #2: Are you comfortable with the recommendations?



Question #3: Have we addressed all the benefits adequately?

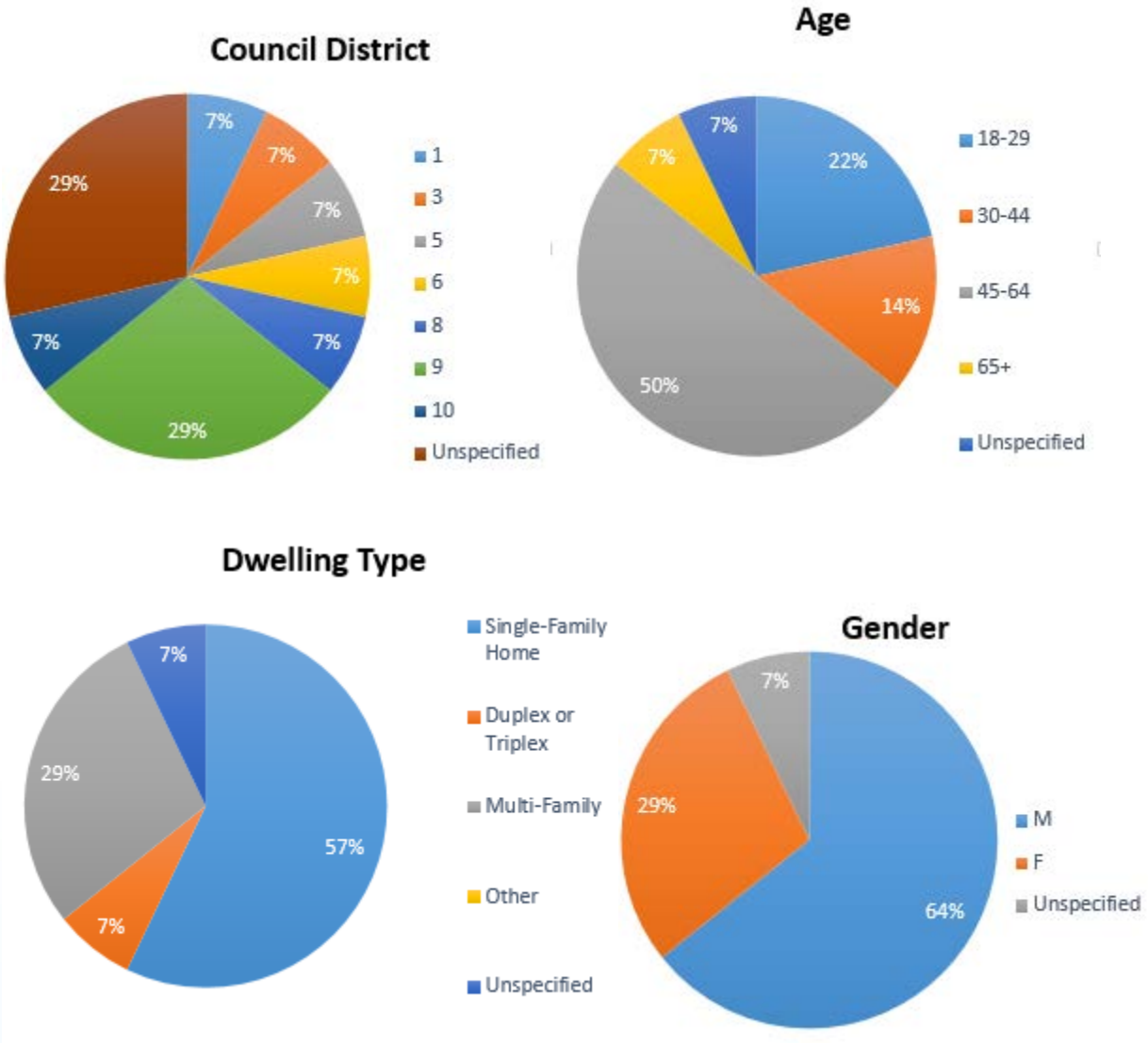


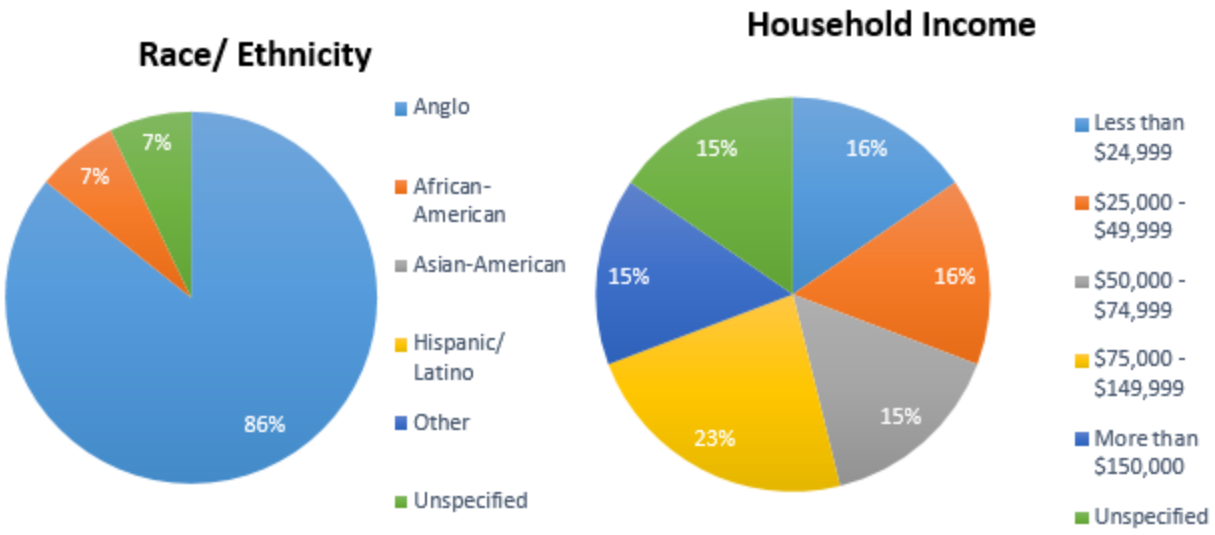
Question #4: Do You Understand the Need for Adaptive Management?



Demographic Breakdown

Of the 14 surveys collected, the following demographic information was self-reported (see copies in Appendix F):





Next Steps

As needed, the Austin Water team will refine the Draft Water Forward Plan Recommendations based on stakeholder input then continue conducting outreach in order to finalize the plan. The final plan will then be presented to City Council for approval. Implementation will only move forward upon Council approval.

Appendix

Due to the large number of additional pages, the appendix section is available upon request from Austin Water.

APPENDIX B: INTEGRATED WATER RESOURCES PLANNING PROCESS OVERVIEW

The Water Forward Integrated Water Resources Plan (IWRP) is a comprehensive planning process undertaken by Austin Water (AW) to evaluate water supply and demand management options. The Mission Statement for the IWRP is as follows:

The Integrated Water Resource Plan (IWRP) will provide a mid- and long-term evaluation of, and plan for, water supply and demand management options for the City of Austin in a regional water supply context.

Through public outreach and coordination of efforts between City departments and the Austin Integrated Water Resource Planning Community Task Force (Task Force), the IWRP offers a holistic and inclusive approach to water resource planning.

The plan embraces an innovative and integrated water management process with the goal of ensuring a diversified, sustainable, and resilient water future, with strong emphasis on water conservation.

The purpose of this appendix is to provide an overview of how demand-side and supply options were screened and characterized. It also establishes the primary objectives, sub-objectives, and performance measures that were used to evaluate portfolios (combinations of individual options). Above all, it provides the framework for how the IWRP process provided a transparent, unbiased analysis of the tradeoffs between various portfolios to meet the IWRP objectives.

B.1 Preliminary Estimation of Water Supply Needs

An important aspect of the IWRP is to evaluate existing water supplies under different hydrologic conditions and compare these supplies to forecasted water demands. This provided preliminary estimates of short-term, medium-term and long-term water supply needs. The Colorado River Basin Water Availability Model (WAM) was be used for evaluation of future water supply needs for the forecasted demands in years 2020, 2040, 2070 and 2115, under different hydrologic scenarios which are planned to include the historical hydrologic period of record, climate change adjusted hydrology, and randomized re-sequenced hydrology.

Forecasted demands were simulated against various hydrologic scenarios, and measures of supply shortage were produced. No portfolios of water supply or demand-side options were used in this preliminary water supply needs analysis. The purpose of this assessment is to gain an understanding of the characteristics of potential water supply needs. Subsequent tasks in the IWRP process took this and other information into account in the development of portfolios.

B.2 Evaluation Process Overview

The Austin IWRP evaluation process is based on an established planning process that explores both demand-side and supply-side options in an integrated manner in order to meet multiple objectives. The IWRP process also explores risks and uncertainty related to different potential hydrologic and climatic futures over the next 100 years.

In development of the IWRP, the following terms were used:

Objectives	• Broadly stated goals of the IWRP that drive the evaluation process.
Sub-objectives	• Adds further clarity to the objectives, and forms the basis for the evaluation criteria used to score portfolios.
Performance Measures	• Metrics that indicate how well sub-objectives are being achieved.
Options	• Individual water supply and demand-side management projects or programs.
Portfolios	• Combinations of options that are evaluated against the performance measures.

The IWRP process is summarized in **Figure 1**. The process begins with defining the objectives, sub-objectives, and performance measures. The sub-objectives together with the performance measures serve as the evaluation criteria by which IWRP portfolios were measured against.

Prior to developing portfolios, identification and characterization of various water supply and demand-side options took place. The process started with a larger number of options, which were screened down to a smaller number using a set of criteria. These criteria include a high-level unit-cost comparison and a high-level implementation risk comparison. Those options that pass the screening process were evaluated and characterized in greater detail.

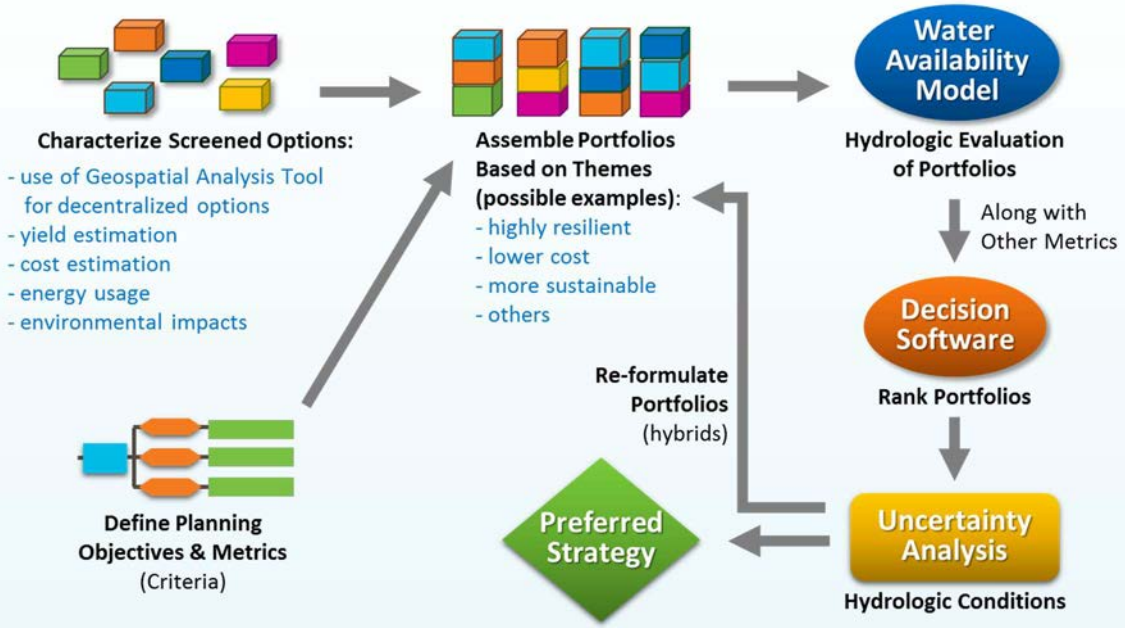


Figure B-1. AW IWRP Planning Process

To evaluate how different combinations of multiple options score against all of the IWRP objectives and sub-objectives, groupings of options were combined in various ways to develop portfolios. The portfolios were developed around themes such as “Maximize Reliability” or “Maximize Cost-Effectiveness” or “Maximize Conservation”. Themes were developed by AW with input from the Task Force and community. Each portfolio was then evaluated in terms of how well it achieves the sub-objectives, under various hydrologic conditions (for example historical and climate change scenarios). Ultimately, the portfolios were ranked and a preferred IWRP strategy was recommended for implementation. A preferred IWRP strategy may be a combination of several high-ranking portfolios using an adaptive management approach that would implement various options within the portfolios based on triggers, such as demand growth, hydrologic conditions and other factors.

B.3 Objectives and Performance Measures

The IWRP planning objectives serve as the framework for how the IWRP is developed. Objectives are usually categorized into primary and secondary (or sub-objectives). Primary objectives are more general, while sub-objectives help define the primary objectives in more specific terms. Note that throughout this appendix the terms *objective* and *primary objective* are used interchangeably. Based on decision science literature and consulting best practices, sub-objectives should have the following attributes:

- **Be Distinctive:** to distinguish between one portfolio and another
- **Be Measurable:** in order to determine if they are being achieved, either through quantitative or qualitative metrics
- **Be Non-Redundant:** to avoid overlap and avoid bias the ranking of portfolios
- **Be Understandable:** be easily explainable and clear
- **Be Concise:** to focus on what is most important in decision-making

The IWRP objectives and sub-objectives were developed by AW/consultant team, with input from the Task Force. The objectives were formulated based on the previous 2014 Task Force and centered around principles of sustainability (balanced between economic, environmental, social needs). Initial sub-objectives were formulated with a “defining question” to establish the intent of the sub-objective. A preliminary list of 25 draft sub-objectives was developed as part of a full day workshop held with the AW/consultant team. Based on input from the Water Forward Task Force (previously referred to as IWRP Task Force) through a survey, the sub-objectives were reduced to 14, which aligns well with decision science literature and consulting best practices.

For each sub-objective, a performance measure is required. The performance measure is used to indicate how well a sub-objective is being achieved. Where possible, quantitative performance measures were established based on a review of available data and anticipated output from the various IWRP analyses, tools, and modeling efforts. In certain instances, a qualitative score is the most suitable performance measure. Qualitative scores were established based on a combination of quantitative analysis, professional judgment, and input from subject matter experts, including AW staff/consultant team. **Table B-1** presents the refined list of primary objectives, sub-objectives and performance measures.

In any decision-making process, primary objectives are generally not all equally important. Thus, developing a set of weights is necessary to better reflect the difference in values and preferences among the various objectives. The AW/consultant team initially developed a draft set of weights for the objectives and sub-objectives. The weighting of objectives from the 2014 Task Force process were considered in developing the initial draft weighting set. A survey was sent to the Water Forward Task Force with draft

weightings for objectives and sub-objectives to solicit input. This survey information was provided for review and discussion by the Task Force. Additional input provided was considered by AW and the consultant team in the process of refining the weighting set, which are presented in Error! Reference source not found.

Table B-1. Refined list of primary objectives, sub-objectives and performance measures

Objective	Sub-Objective	Defining Question	Performance Measure
Water Supply Benefits	Minimize Vulnerability	How much of the water needs[1] identified in the IWRP are met during 12-months of worst-case drought? Vulnerability describes the magnitude of shortages relative to defined water needs, if shortages occur.	Geometric mean of model results from different hydrologic scenarios. Percent of volume of water needs[1] met during worst 12-months of drought under various hydrologic scenarios.
	Maximize Reliability	How many months are water needs[1] identified in the IWRP fully met during the period of simulation? Reliability describes the frequency of shortages relative to defined water needs, if shortages occur.	Geometric mean of model results from different hydrologic scenarios. Percent of time water needs[1] were met during the period of record for various hydrologic scenarios.
Economic Benefits	Maximize Cost-Effectiveness	What is the total capital (construction) and operations/maintenance costs of all projects/programs in the portfolio over the lifecycle, divided by the sum of all water yield produced by the portfolio?	Unit cost ($/AF) expressed as a present value sum of all costs over the lifecycle, including utility and customer costs.
	Maximize Advantageous External Funding	Does the portfolio have an opportunity for advantageous external funding from Federal, State, local, and private sources?	External Funding Score (1-5), where 1 = low potential and 5 = high potential
Environmental Benefits	Minimize Ecosystem Impacts	To what extent does the portfolio positively or negatively impact receiving water quality (e.g., streams, river, lakes), terrestrial and aquatic habitats throughout Austin, and net streamflow effects both up and downstream from Austin?	Ecosystem Impact Score (1-5), where 1 = high combined negative impacts and 5 = high combined positive impacts
	Minimize Net Energy Use	What is the net energy requirement of the portfolio, considering energy generation?	Incremental net change in kWh
	Maximize Water Use Efficiency	What is the reduction in water use from water conservation, and reuse for the portfolio?	Potable per capita water use (gallon/person/day)
Social Benefits	Maximize Multi-Benefit Infrastructure/ Programs	To what extent does the portfolio provide secondary benefits such as enhanced community livability/beautification, increased water ethic, ecosystem services, or others?	Multiple Benefits Score (1-5), where 1 = low benefits and 5 = high benefits
	Maximize Net Benefits to Local Economy	To what extent do the supply reliability and water investments of the portfolio protect and improve local economic vitality, including permanent job creation?	Local Economy Score (1-5), where 1 = high negative impact and 5 = high positive impact;
	Maximize Social Equity and Environmental Justice	To what extent does the portfolio support social equity and environmental justice, with emphasis on underserved communities?	Social Equity and Environmental Justice Score (1-5), where 1 = significant support and 5 = minimal support
Implementation Benefits	Minimize Risk	How significant are the major risks and uncertainties associated with implementation of projects?	Qualitative score (1-5), where 1=more water supply provided from high risk projects and 5 = less supply provided from high risk projects.
	Maximize Local Control/Local Resource	To what extent does Austin Water control operations of the water resource and is the resource from the local area?	Qualitative score (1-5), where 1=less water under Austin Water's control and from local water sources 5=more water under Austin Water's control and from local water sources.

[1] Water needs identified in the IWRP are referred to as Type 1, 2, and 3 Need. These needs are described Appendix F

Table B-2 Objective and Sub-Objective Weights

Primary Objective	Objective Weight	Sub-Objective	Sub-Objective Weight
▪ **Water Supply Benefits**	35%	Minimize Vulnerability	28%
		Maximize Reliability	7%
▪ **Economic Benefits**	20%	Maximize Cost-Effectiveness	15%
		Maximize Advantageous External Funding	5%
▪ **Environmental Benefits**	20%	Minimize Ecosystem Impacts	8%
		Minimize Net Energy Use	6%
		Maximize Water Use Efficiency	6%
▪ **Social Benefits**	13%	Maximize Multi-Benefit Infrastructure/Programs	5%
		Maximize Net Benefits to Local Economy	4%
		Maximize Social Equity and Environmental Justice	4%
▪ **Implementation Benefits**	12%	Minimize Risk	7%
		Maximize Local Control / Local Resource	5%

B.4 Options Screening and Characterization

Prior to developing portfolios for detailed evaluation, it is important to evaluate individual supply and demand-side options. This allows for more informed portfolio development and ultimately portfolios that are better at meeting overall IWRP objectives. To do this, two key steps are required: options screening and a standardized options characterization process.

B.4.1 Options Screening Method

Through a process with Task Force and community input that started with a "blue-sky" list of options, approximately 21 water supply options and 25 demand-side options were identified for initial screening by AW/consultant team. Through the screening process these 47 options were narrowed down to a total of 25 supply and demand-side options (13 supply-side and 12 demand-side) that were carried forward for further characterization. The list of options identified for screening generally fall under the following main categories:

- Water Conservation Options
- Lot-scale Decentralized Options (e.g., rainwater harvesting, stormwater harvesting, graywater reuse, blackwater reuse, or A/C condensate reuse)
- Centralized and Community-Scale Decentralized Wastewater Reuse Options
- Storage Options (e.g., Aquifer Storage and Recovery or a New Off-Channel Reservoir)
- New Supply Options (e.g., desalination of brackish groundwater)

The screening process compared high-level, order-of-magnitude unit costs of the options to an index score of implementation risks created specifically for option screening. All of the options were plotted together for these two parameters to see where outliers exist (meaning those options that have higher

unit costs and higher implementation risks). The outlier options were recommended for elimination from more detailed characterization.

B.4.2 Options Characterization Method

For options carried forward from screening to portfolio evaluation, a summary characterization was developed. Each of these options were characterized using a standardized *Options Characterization Template* (including, for example, estimated yield and cost). The resulting set of characterized options were used as a "menu" for forming thematic portfolios (for example, a portfolio that has "High Resiliency" as its theme, as described in more detail below). A list of the characterization metrics, associated units, and a metric definition are provided in **Table B-3** for demand management options and **Table B-4** for supply options. Option characterizations were based on the best available technical information; however, more detailed analysis of these options will be required prior to implementation.

Table B-3. Demand Management Options Characterization Template

Metric Name	Unit	Metric Definition
Average Annual Yield	AFY	The estimated average annual demand savings achievable by the measure
Supply Type	Qualitative Selection	Annual or emergency/drought
Unit-Cost	$/AF	Total annual cost of the measure for both the utility and the customer minus cost savings from reduced water production and wastewater treatment costs (in 2017 dollars) divided by the estimated average annual yield
Benefit Cost Ratio	Ratio	Average annual yield divided by the unit cost
Climate Resiliency	Qualitative Index	The relative susceptibility of an option to future hydrologic variability
Advantages	Qualitative Description	Narrative on positive attributes of option, including as it relates to portfolio evaluation sub-objectives
Disadvantages	Qualitative Description	Narrative on negative attributes of option, including as it relates to portfolio evaluation sub-objectives

Table B-4. Supply Options Characterization Template

Metric Name	Unit	Metric Definition
Estimated Yield	AFY	The estimated incremental average annual new supply (or demand saving) to AW
Supply Type	Qualitative Selection	Annual or emergency/drought
Unit-Cost	$/AF	Total annual cost of the option (in current dollars) divided by the new supply yield. Cost will include both customer and utility perspectives and will include a high-level estimate of likelihood of use if designated as an emergency/drought-only supply
Climate Resiliency	Qualitative Index	The relative susceptibility of an option to future hydrologic variability
Advantages	Qualitative Description	Narrative on positive attributes of option, including as it relates to portfolio evaluation sub-objectives
Disadvantages	Qualitative Description	Narrative on negative attributes of option, including as it relates to portfolio evaluation sub-objectives

B.5 Portfolio Development and Evaluation

Options carried forward from screening and through characterization were available for inclusion in IWRP portfolios. Water supply and demand-side options were combined into portfolios that will meet supply needs under different hydrologic scenarios to various degrees of reliability.

Portfolios were formed based on objective-based themes and then evaluated against the IWRP sub-objectives and performance measures. The IWRP produced analyses and demand/supply comparisons for the forecast years 2020, 2040, 2070, and 2115, and portfolios were compared and ranked using combined scores factoring in the different forecasts.

B.5.1 Method for Formulation of Portfolios

To evaluate how different combinations of multiple options score against all of the IWRP objectives and sub-objectives, groupings of options were combined in various ways to develop portfolios. The number of potential combinations of options (i.e. portfolios) is too large to produce a meaningful analysis for the AW IWRP. As a result, portfolios were developed around major themes that align with the IWRP objectives. For example, what would a portfolio look like if the only objective is to maximize supply resiliency? Based on the options characterization results we can develop a portfolio whose sole focus is on supply resiliency and does not consider other objectives such as cost or environmental impact. By developing these initial portfolios that "push" the bounds of each of the most important objectives, trade-offs can be easily identified which can then provide insights in developing "hybrid" portfolios that are more balanced and have a better likelihood of meeting numerous objectives well.

Initial thematic portfolios were developed by the AW/consultant team based on input from stakeholders, including the Water Forward Task Force, and the community.

The initial portfolio themes were:

- **Minimize Cost:** Options with the lower unit costs ($/acre-foot) were selected.
- **Maximize Conservation:** Demand management options and those supply options seen to most sustainably utilize water already available as part of the existing water supply system, such as decentralized lot- and community-scale options.
- **Maximize Resiliency:** Options that produce consistent supply benefits under all hydrologic variability were considered for this portfolio.
- **Maximize Ease of Implementation:** Options that were considered easy or moderately easy to implement were selected for this portfolio.
- **Maximize Local Control:** Options in which Austin Water would have control over the projects and the water supply sources in terms of cost, yield, development, and operations.

B.5.2 Portfolio Evaluation Method

When evaluating a diverse set of portfolios against multiple objectives it is typically not possible to find a single portfolio that meets the needs or priorities of every stakeholder. Instead, the goal is to evaluate trade-offs between options and objectives, which were used make an informed decision on selecting a preferred portfolio. To do this, the AW IWRP utilized multi-criteria decision analysis (MCDA) to evaluate portfolios. The MCDA process relies on the performance measures and performance weights (outlined in

previous sections) and a suite of tools. It is important to note that final recommendation will be "human-based," not computer model-based.

B.5.2.1 Overview of IWRP Tools

The software Criterium Decision Plus (CDP), developed by Infoharvest Inc., is the primary software used to conduct MCDA; however, it is dependent upon input from other IWRP tools and also input from stakeholders and subject matter experts. Each portfolio underwent modeling and assessment that generated raw quantitative and raw qualitative performance measure scores. The below tools served major roles in development of performance measure scores for the AW IWRP:

- **Colorado Basin Water Availability Model (WAM)** – computer-based simulation model, developed and used by the Texas Commission on Environmental Quality (TCEQ) quantifying the amount of water that would be flowing in the Colorado River and available to water rights under a specified set of conditions (e.g. water use, naturalized hydrology, etc.)

- **Geospatial Decentralized Supply Suite of Tools** –set of geospatial analysis processes that evaluates the end user demands, supply yield, cost, and avoided costs associated with storm/gray/black water capture infrastructure

- **Disaggregated Demand Forecasting Model** – end-use based water demand forecast model including residential, multifamily, and commercial sectors; includes impacts of conservation (including Drought Contingency Plan implementation).

- **Portfolio Evaluation Spreadsheet Tool** – spreadsheet tool utilized to assemble options into portfolios based on supply needs (difference between existing supplies and future demands under different hydrologic scenarios), and used to estimate total portfolio costs from individual unit costs for each option.

- **Criterium Decision Plus** – an industry-leading commercial software to compare and rank portfolios based on multiple criteria (see below for detailed description).

B.5.2.2 Description of Water Availability Model Use in Portfolio Evaluation

In order to evaluate the robustness of the portfolios, each portfolio was evaluated under four hydrologic scenarios:

1. **Historic Hydrology**: based on the historical period of record from 1940 to 2016 maintaining the historical sequence of years.

2. **Extended Sampling of Historic Hydrology:** based on an extended 10,000-year simulation made up of resequenced years from the historic hydrology, this sequence is used to develop a range of conditions worse than the drought of 2007-2016

3. **Historic Hydrology with Climate Change Adjustments:** based on a climate change scenario ensemble that adjusts the historical hydrology, but maintains the historical sequence of years.

4. **Extended Sampling of Historic Hydrology with Climate Change Adjustments**: based on an extended 10,000-year simulation made up of resequenced years from the climate change-

adjusted historic hydrology, this sequence is used to develop a range of conditions worse than the drought of 2007-2016

Additional detail related to each future climate condition is included in Appendix X. Where applicable, for each future hydrologic and climate condition new raw performance measure scores will be generated for each portfolio for use. Not all performance measure scores will be impacted by a change in future climate conditions; however, sub-objectives such as Maximize Water Reliability and showed a level of sensitivity.

B.5.2.3 Description of Criterium Decision Plus Software

Criterium Decision Plus (CDP) was used to rank portfolios. This software tool converts raw performance measured in different units into standardized scores so that the performance measures can be summarized into an overall value. Through CDP, a multi-attribute rating technique was applied to score and rank the selected portfolios. One advantage of the multi-attribute rating technique is that the resulting scores are non-relative and thus not dependent on the number of portfolios. This allows for the addition of portfolios, such as hybrid portfolios, without impact to the scores of those portfolios previously evaluated. **Figure 3** summarizes the multi-attribute rating technique that is used by CDP to compare and rank portfolios.

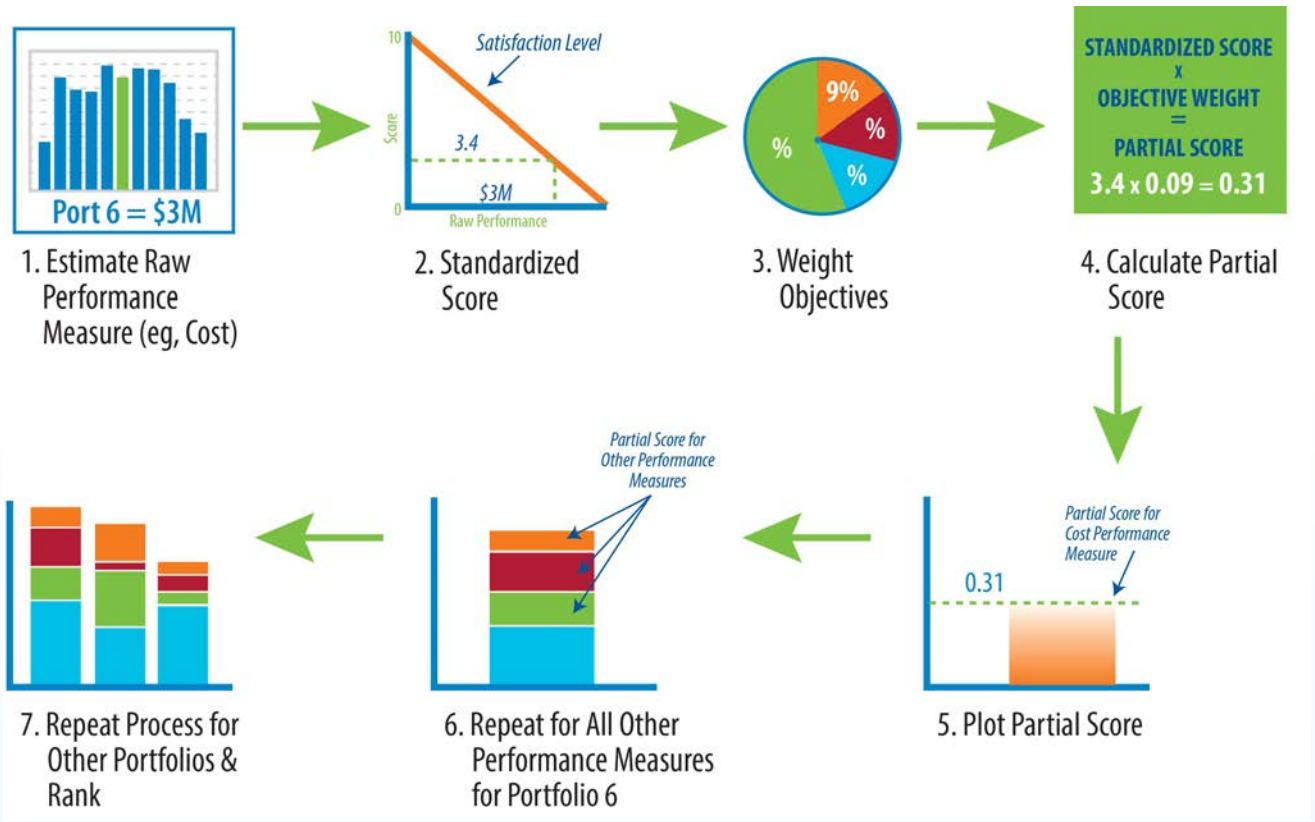


Figure B-2. Multi-Attribute Rating Technique Used by CDP Software to Rank Portfolios

Multi-attribute rating uses 7 steps to score and rank portfolios. In step 1, raw performance for all of the portfolios is compared for a given criterion (in this case cost). Step 2 standardizes the performance into a score from 0 to 10. In this example, Portfolio 6's cost performance is fairly expensive so its standardized score is fairly low (e.g., 3.4 out of 10). This step is important because performance is measured in different units (i.e., cost in dollars, reliability in AFY). Step 3 assigns weights to the objective and Step 4 calculates a partial score for a given portfolio based on the multiplication of the standardized score (Step 2) and

weight (Step 3). The partial score is plotted (Step 5), and then the whole process is repeated for a given portfolio for all of the other performance measures (Step 6). This creates a total score that can then be compared to other portfolios. Steps 1-6 are repeated for all portfolios and compared so they can be ranked (Step 7).

B.5.2.4 Example of Portfolio Ranking

As outlined above, there are two primary inputs to CDP: (1) raw performance of a portfolio against each performance measure; and (2) the relative importance of the objectives and performance measures (see **Table B-3**).

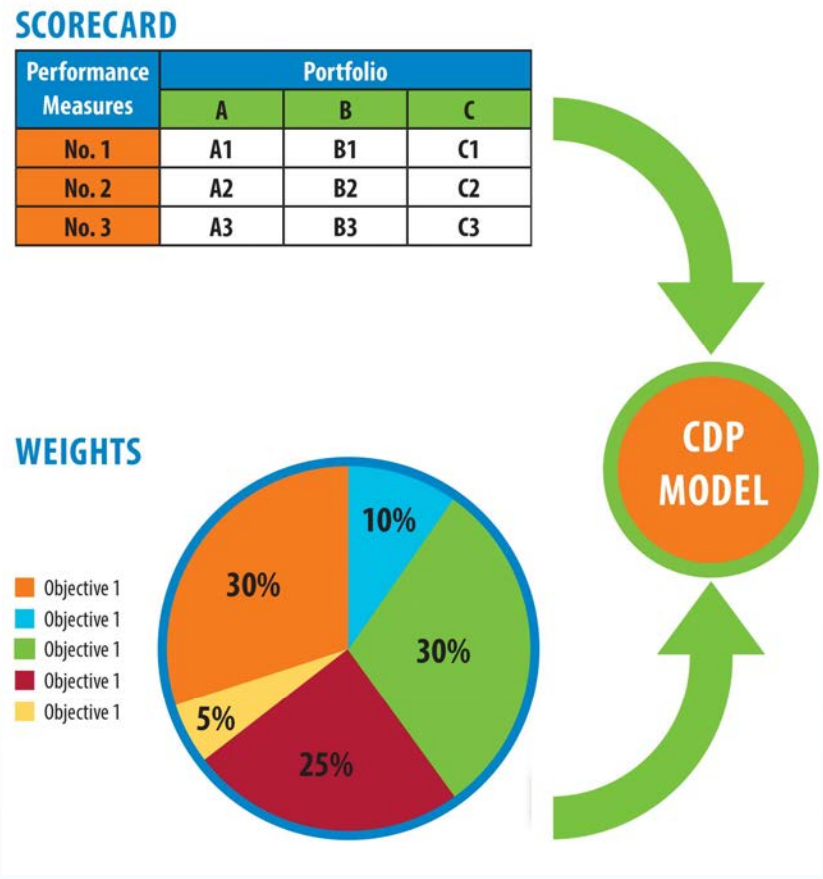


Figure B-3. Inputs to CDP

The raw performance measure scores were standardized by CDP to a unitless scale that ranges from 0 to 1 using the multi-attribute rating technique (described above). The CDP model then multiplied the unitless performance scores by the relative weight of each associated sub-objective. These weighted unitless scores were then aggregated to the objective level and an overall portfolio score was determined. This process was repeated for each portfolio and the portfolios were ranked based on their overall scores. **Table B-4** presents an example of how portfolios are ranked based on a set of primary objectives and their weights of importance. This process is powerful because it not only ranks portfolios but clearly shows trade□offs between the objectives.

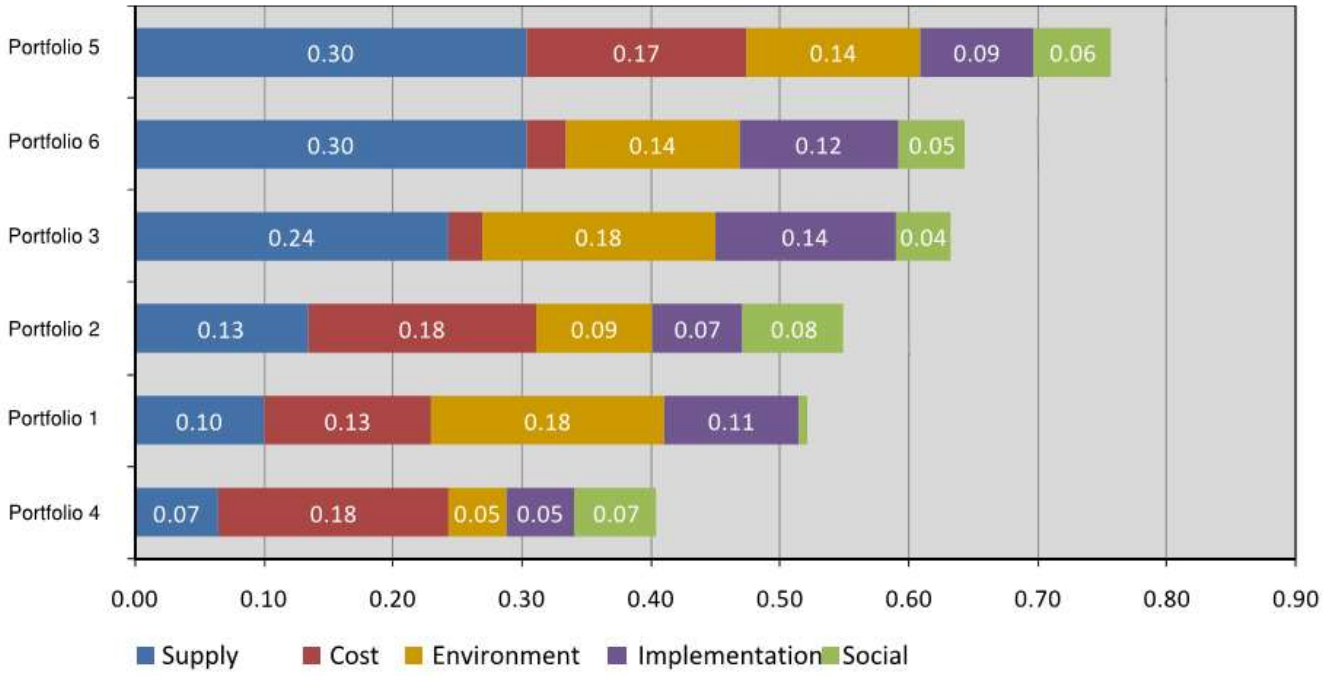


Figure B-4. Illustrative Example of Portfolio Ranking Using CDP Software

In this example of portfolio ranking, the larger the color bar segments the better the portfolio performs for a given objective. For example, Portfolio 5 has the best supply reliability and hence the longer bar segment for the supply objective. Portfolio 6 also has the best supply reliability score, but it is not as cost-effective (meaning it is higher in cost) than Portfolio 5 and hence it has a relatively small bar segment for the cost objective.

APPENDIX C: WATER FORWARD DISAGGREGATED DEMAND MODEL

This document presents an overview of the Disaggregated Demand Model developed by Austin Water staff as part of the IWRP. The Disaggregated Demand Model (DDM) was developed and refined as part of an ongoing collaboration between Austin Water and IWRP Consultant, CDM Smith. The DDM makes use of historical billing, historical land use, and historical and projected demographic data to project potential water use for each IWRP planning horizon (2020, 2040, 2070, 2115).

The foundation of the IWRP water demand estimates is the underlying DDM, which was used to produce the baseline water demand assessment among other things. Austin Water staff began development of the DDM in advance of the IWRP and refinements to the DDM have continued throughout the process. The DDM is an Excel-based tool that forecasts water use by sector, subsector, and end use at geographic planning units-scale for current demands as well as the key planning periods of 2020, 2040, 2070, and 2115. The DDM provides the analytical environment for assessing potential water savings from demand management measures being evaluated during plan development. The DDM also includes functionality to assess water demands under future climatic scenarios and tracks water consumption by end uses (such as toilets, sinks, and irrigation) which informs the assessment of yield potential for decentralized supply options. The following sections describe the model attributes, development, and primary data sources.

C.1 Disaggregated Demand Model Attributes

For analysis purposes, it is useful to group water demands according to similar user characteristics. These groupings are known as sectors. The DDM model sector classifications are listed below. The water use sectors are further refined into subsectors and outdoor and indoor end uses, as shown in **Figure C-1**.

DDM sectors include:

- Single family residential (SFR)
- Multi-family residential (MFR)
- Commercial (COM), which includes large volume customers in the Industrial and University subsectors
- Wholesale Customers (WHL)
- City of Austin (COA)

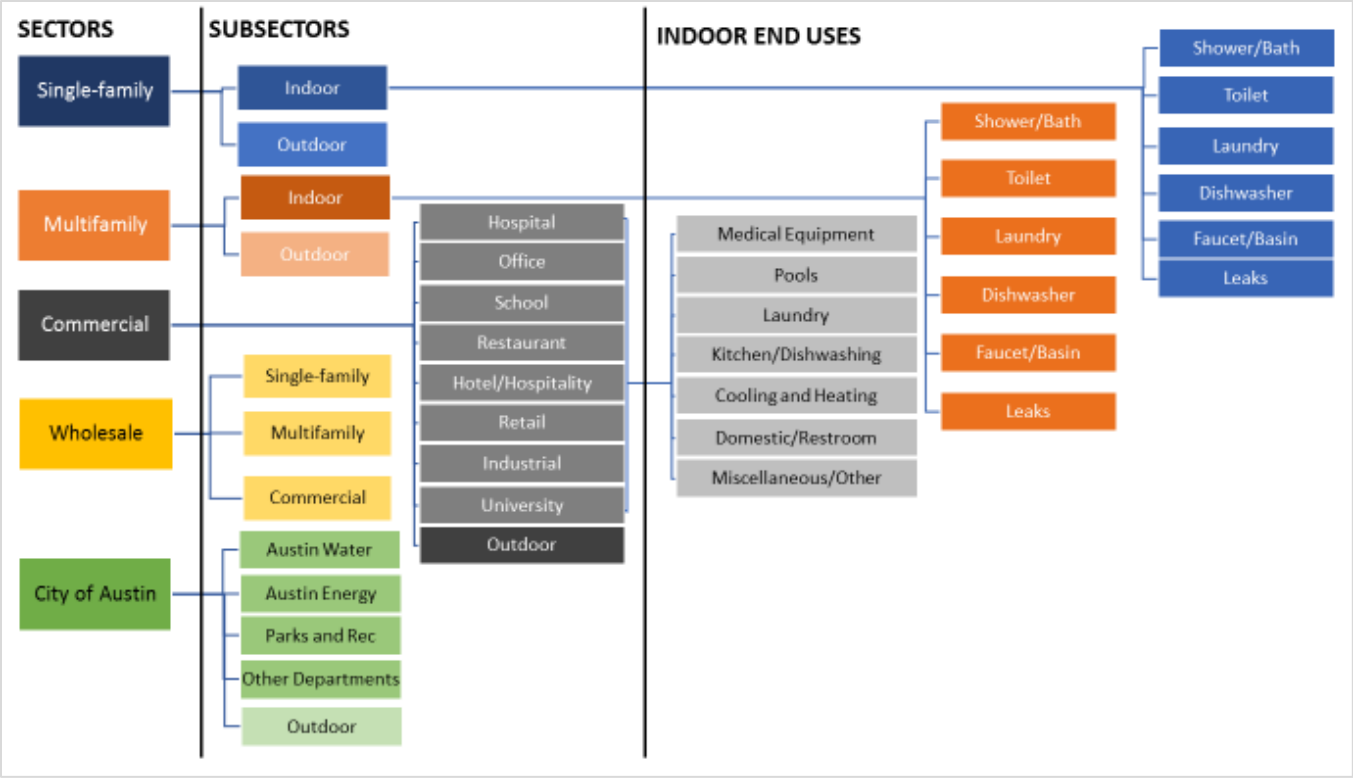


Figure C-1. Disaggregated Demand Model Sectors, Subsectors, and End Uses

Analysis was conducted using geographic units developed in harmony with Imagine Austin, Austin's comprehensive plan. The geographic units are known as the Delphi, Trends, and Imagine Austin (DTI) polygons and they divide the city into 230 contiguous polygons. The area coverage by the DTI polygons includes the City of Austin's full and limited purpose jurisdictions as well as the city's extra-territorial jurisdiction, as shown in **Figure C-2**. Census blocks within the DTI polygons were used to create a comprehensive 2010 baseline count of the population and number of single-family and multifamily residential units in the polygon. Employment estimates were also generated for each polygon. These baseline and projected demographics are the primary drivers of water use in the city. So, for each DTI polygon, the tool provides an estimate of existing and future water demands by sector, subsector, and end use.

The DDM also produces a number of summary charts, tables, and graphics that support and inform the IWRP. For example, the tool allows for relatively quick assessment of the impact of a demand management measure on overall system, sectoral, or source water demand.

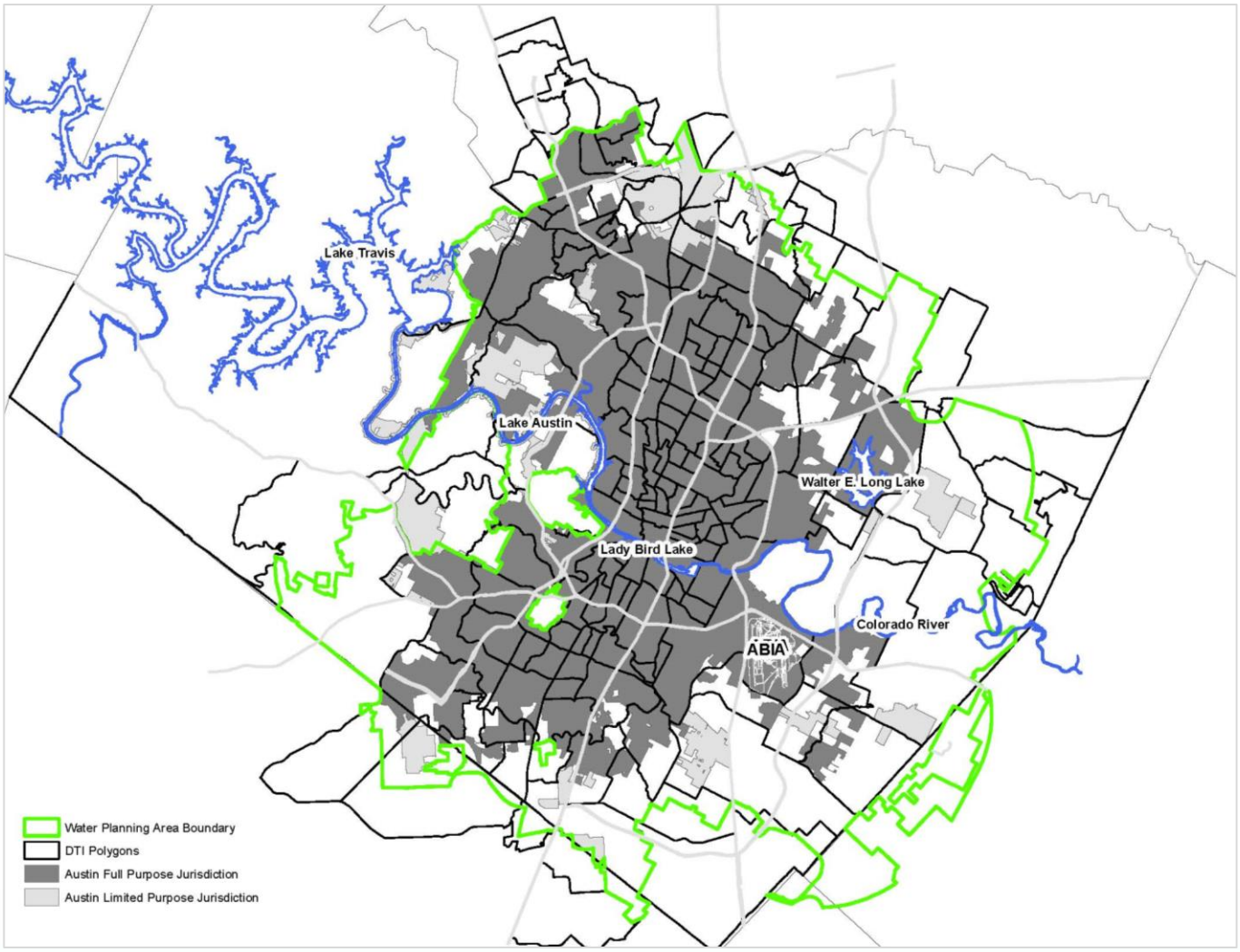


Figure C-2. Disaggregated Demand Model DTI Geographic Units

Primary Data Sources

The primary data sources for developing the DDM are described below:

- Delphi – Trend – Imagine Austin (DTI) Polygons - Geographic unit of analysis for Austin Water DDM. The data include long-range, small-polygon-based population and employment forecasts produced by the City Demographer in conjunction with Austin Water. Contains estimates of water service population, single family and multifamily units, and employment for 2010, as well as projections for 2020, 2040, 2070, and 2115.
- SOCRATES Employment Dataset - Standardized Occupational Components for Research and Analysis of Trends in Employment System (SOCRATES). Feature point dataset created by the Texas Workforce Commission featuring a complete listing of employers within Austin as well as pertinent data (minimum and maximum number of employees, North American Industry Classification System code, sales volumes, etc.) for the year 2010.

- Austin Water Billing Accounts and Consumption Data - Historical billing records (in the form of GIS feature point datasets) for every Austin Water customer in 2010 and 2012-2015. Note that 2011 data were excluded due to errors introduced when the city switched billing systems.
- COA Building Permit Data - All approved building permit data provided by the city's Development Services Department in the form of a database (the Application Management and Data Automation database known as AMANDA) and Shapefiles of permits by year.
- 2010 Land Use GIS polygon.

C.2 Population and Employment Projections

The City of Austin Demographer worked closely with Austin Water staff to develop estimates of retail and wholesale water service population that built off historical 2010-2015 estimates and extended projections through 2115. These estimates are shown in numerical form in Table and illustrated in figure.

Table C-1. Long Range Population Forecast Scenario for the Austin Water Planning Area

Year	Austin Water Served Population Forecast – Retail and Wholesale	Annualized Growth Rate
2010	875,936	
2015	977,491	2.2%
2020	1,101,632	2.4%
2025	1,216,291	2.0%
2030	1,342,884	2.0%
2035	1,464,571	1.7%
2040	1,577,760	1.5%
2045	1,692,174	1.4%
2050	1,808,586	1.3%
2055	1,927,901	1.3%
2060	2,051,178	1.2%
2065	2,179,649	1.2%
2070	2,314,769	1.2%
2075	2,458,265	1.2%
2080	2,610,656	1.2%
2085	2,772,495	1.2%
2090	2,944,366	1.2%
2095	3,126,892	1.2%
2100	3,320,732	1.2%
2105	3,526,590	1.2%
2110	3,745,208	1.2%
2115	3,977,380	1.2%

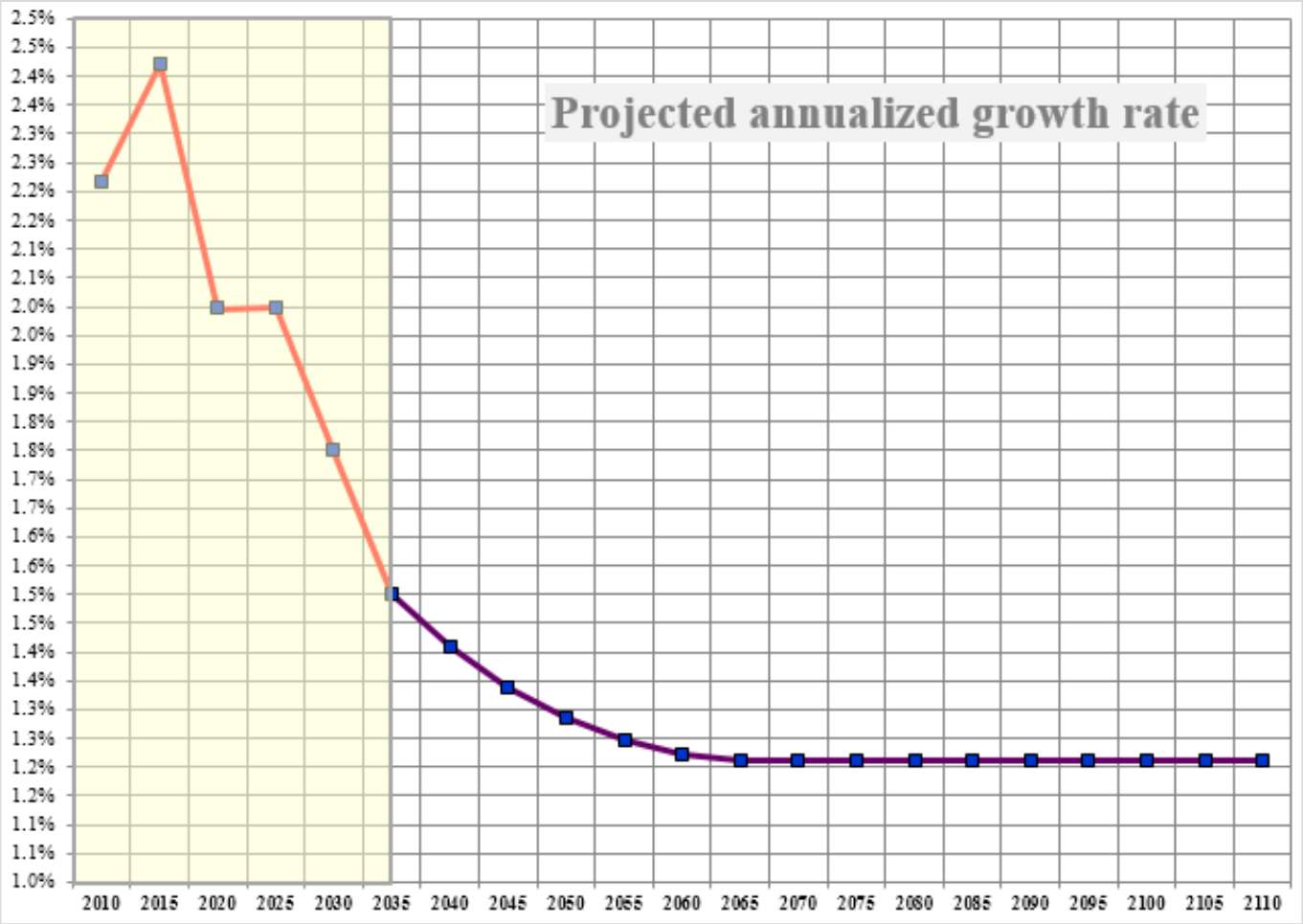


Figure C-3. Long Range Population Forecast Projected Annualized Growth Rate

C.3 Billing Data Preparation

C.3.1 Billing Data Processing

Historical billing data was taken from several sources. The 2010 billing data was collected from the City of Austin's Customer Information System (CIS). The 2012 through 2015 billing data was collected from the City of Austin's Customer Care and Billing (CCB) system. 2011 billing data was excluded from the model due to inconsistencies introduced in the data when the City of Austin switched from the CIS to the CCB system.

Account information from the CIS and CCB billing systems was spatially located to create billing point layers for 2010 and 2012, 2013, 2014, and 2015. Billing point layers are geospatial representation of the locations of water use points that include data on monthly water usage, and water use sector classifications in the form of rate classes. All billing data sets were normalized so that usage amounts corresponded with calendar month usage rather than billing cycle usage. This was accomplished using the daily average of the billing cycle and the number of days in the billing cycle that occurred in each calendar month.

C.3.2 Billing Data Classification

The 2010 billing point layer was overlaid on the City's 2010 land use layer to look for inconsistencies between the billing point rate class and the land use type. Edits were made to both the billing point layer

and the land use layer where appropriate so that they matched each other (i.e. single-family accounts on single family land use parcels, commercial accounts on commercial parcels, etc.). If there was no change to land use after 2010 for billing points with corrected rate classes, the rate class correction was automatically assumed to apply to all future years.

For new accounts added post 2010, the new billing points were overlaid on the City's building permit data and given the rate class that corresponded to the type of development indicated by the building permit data. All remaining unmatched new accounts were given the rate class that corresponded with the account information contained in CCB.

For the purpose of the disaggregated demand model, rate classes were assigned to residential accounts to match census housing unit classifications as shown in **Table C-2**.

Table C-2. Disaggregated Demand Model Rate Class and Development Type Classifications

Type of Development	DDM Rate Class	Census Unit Classification
Detached single family residences	R - Residential	Single Family Detached
Duplex (shared vertical wall)	D*- Duplex	Single Family Attached
Duplex (shared horizontal wall)	D*- Duplex	2 units per structure
Mobile homes	R - Residential	Mobile Homes
Townhomes/Condos 1 unit in structure	R - Residential	Single Family Attached
Townhomes/Condos 2 units in structure	D*- Duplex	Single Family Attached
Townhomes/Condos 3+ units in structure	M - Multifamily	Single Family Attached
Three to Fourplex	M - Multifamily	Three to Four
5+ Units	M - Multifamily	Five plus

*all dual-family accounts (New Rate Class of D) were included in the multi-family sector in the model

C.4 Demographic Data Preparation

C.4.1 Development of Single Family and Multi Family Unit Estimates

For 2010 through 2015, each single family residential billing point contained a count of residential units at the location. To develop estimates of multifamily units, the sum of all single-family units was subtracted from the number of occupied units in a DTI polygon as estimated from 2010 decennial Census data. Estimation of 2010 through 2015 total multifamily units by DTI polygon was further validated by a significant research effort that aimed to develop unit counts for all multifamily developments where unit count information could be found.

To create projections, two constraints were used:

- The ratio of single family to multifamily units per DTI polygon as derived from 2010 unit estimates (described in the previous paragraph). Note that the ratio of single family to multi-family units was trended toward a larger share of multifamily in future planning horizons, in keeping with development trends.

- Single family and multifamily household sizes per DTI polygon were scaled from 2012 five-year American Community Survey. Household sizes were scaled to recreate the relationship between 2010 single family and multifamily units (described above) and the estimated 2010 population per DTI polygon. Once calculated for each DTI polygon, the scaled household sizes were held constant through all future planning horizons.

The ratios of single family to multifamily units and the scaled household sizes were used to break down total projected population for each DTI polygon into single family and multifamily units for the years 2020, 2040, 2070, and 2115 by an iterative optimization process to satisfy both constraints.

C.4.2 Commercial Subsector Classification of Employees

The total estimate of employees in 2010 was disaggregated into seven commercial subsectors: Hospitals, Offices, Schools and Universities, Restaurants, Hospitality Services, Retail/Commerce, and Industrial (which includes Large Volume).

Classifications were developed using the SOCRATES dataset, which is a product developed by the Texas Workforce Commission that contains average employment estimates for every employer within the DTI polygons, categorized by industry type using the North American Industry Classification System. These average employment figures were classified into one of seven commercial (COM) subsectors.

Then, employment was trended linearly to create 2115 estimates for each DTI polygon, maintaining the same ratios of each subsector's share of employment, unless discrepancies from the linear trend were observed via billing data (i.e., the emergence of new subsector employment within a DTI).

C.4.3 Wholesale and Large Volume Customer Estimates

Wholesale customers were contacted by Austin Water staff for information pertaining to relative ratios of single family and multifamily populations and employment, where possible. Large Volume customers were also contacted for information regarding potential to expand and plans for facility growth.

C.5 Development of Historical Water Use Factors

Historical water billing data was classified into customer sectors and subsectors, and then sector or subsector annual water usage was aggregated to the DTI polygon level. This annual total was then divided by either the appropriate number of units or employees, depending on the sector or subsector, to develop water use factors (WUFs). For example, single family residential households were analyzed by DTI polygon, and WUFs were estimated by dividing annual water usage within the single-family sector for a DTI polygon by the estimated number of single family housing units within the DTI for each of the years of record (2013-2015).

In this fashion, WUFs were calculated for each customer class of Austin Water: Single Family, Multifamily, Commercial (including commercial subsectors), Wholesale, and City of Austin. Therefore, WUFs are presented as either annual gallons per housing unit (for residential customers) or annual gallons per employee (for nonresidential customers) for each of the years between 2013 and 2015. Reference years of 2013-2015 were chosen due to consistency in billing classifications, as well as the observed variability in climate conditions. The mathematical average WUF for each sector or subsector in each DTI polygon was calculated using these reference years to develop a Base Year WUF used for projections.

In some cases, demographic growth was predicted for DTI polygons with zero historical water usage. For these polygons, future demand projections were calculated by multiplying the expected demographic

counts by the median WUF of all DTIs within the same customer sector subsector. For example, future water demand within a DTI polygon with no historical (2013-2015) single family usage but with single family units projected in a planning horizon year was accounted for by multiplying the projected number of single family units by the median base year WUF among all other single-family base year WUFs. This same process was applied for the multifamily and commercial subsectors.

C.6 Development of End Use Data

C.6.1 Indoor and Outdoor Water Use

For the single family residential sector, a minimum month analysis was performed using single family residential billing data aggregated to the DTI polygon level to estimate outdoor water use and determine the ratio of outdoor to indoor water use within each DTI polygon. Monthly water use totals were divided by the number of days in each month to obtain an average daily water use value for each month. The month that contained the lowest average daily water use value was determined to be the "minimum month" and taken as the assumed daily value for indoor water use. This minimum daily water use value was multiplied by 365 (or 366 in 2012) to obtain an estimate for annual indoor use. The estimate for annual indoor use was subtracted from the total annual use to obtain an estimate for annual outdoor use, at the DTI level.

The "outdoor ratio," assumed to be the percent of water use for outdoor and irrigation purposes, was obtained by dividing the estimate for annual outdoor use by total annual use. An outdoor ratio was calculated for each DTI polygon. A city-wide median value for outdoor ratio was calculated using the outdoor ratios developed for each DTI Polygon. In calculating this median value, DTI Polygons with 12 or fewer total units were excluded. The city-wide median was then used as the outdoor ratio for DTI Polygons with 12 or fewer units, which was about 10 DTI polygons per year.

A minimum month analysis was also conducted for Multifamily Residential, Commercial, and City of Austin to estimate indoor and outdoor usage by parcel within each DTI polygon. Parcels with a dedicated irrigation meter were first identified. When a parcel contained a dedicated irrigation meter, other usage within the parcel was assumed to be only indoor and thus was excluded from minimum month calculations of indoor usage. Once parcels with dedicated irrigation meters were identified, a minimum month calculation was conducted for all other parcels. Specifically, the lowest monthly usage for each parcel without a dedicated irrigation meter was identified. This value was multiplied by 12 to get the total annual indoor usage for each parcel. The difference between the total parcel water usage and the calculated indoor usage was identified as annual outdoor usage. Parcels were then aggregated to the DTI polygon level retaining the overall outdoor and indoor usage. This process was conducted for all sectors as data were available.

C.6.2 Indoor End Use Ratios

In the DDM, the user inputs the distribution of indoor water use among specific end uses of water for each sector for the historical years 2013, 2014 and 2015. End use ratios were developed for the Single-family Residential, Multifamily Residential, and Commercial sectors and subsectors, including University and Industrial Large Volume, as described in the following sections.

C.6.2.1 Single-family Residential

Table C-3 shows the distribution of indoor water by end use for the single-family sector as determined by a 2015 Austin Water analysis. For the baseline water use, the most recent distribution for 2015 is assumed.

Table C-3. Distribution of Indoor Water Use for Single-Family Residential Sector

Year	Showers/ Baths	Toilets	Clothes Washers	Dishwashers	Faucets / Basins	Leaks
2010	24.5%	21.7%	19.3%	1.7%	15.8%	17.0%
2012	23.7%	20.7%	18.9%	1.7%	16.4%	18.5%
2013	23.9%	19.9%	18.6%	1.7%	16.9%	19.1%
2014	24.1%	18.9%	18.3%	1.7%	17.4%	19.6%
2015	24.1%	18.4%	17.9%	1.7%	17.8%	0.201

C.6.2.2 Multifamily Residential

A literature review was conducted to identify relevant estimates of indoor multifamily residential water use by end use. Different studies use different classifications of end uses to represent the total indoor water use. Note that some studies provide estimates for some indoor end uses, but do not provide sufficient information to permit a total allocation (100%) of all indoor uses. For example, some studies simply estimate the toilet, shower and clothes washer usage in gallons per day without reference to the total indoor water use. These data limitations make the calculation of these uses as percentages of total indoor use more difficult.

Three studies were identified in which multifamily residential indoor water use is adequately identified to calculate the percent of water use by end use. These studies are:

- Los Angeles Department of Water and Power (LADWP) Conservation Potential Study 2016 by CDM Smith – multifamily water use parameters for the LADWP end use model were derived from surveys of multifamily property managers and owners
- Embedded Energy in Water Studies Study 3: End-use Water Demand Profiles by Aquacraft, 2011
- University of Arizona Water Resources Research Center (WRRC), City of Tucson Water Use 2007

The distribution of multifamily residential indoor water use from each of these studies is summarized in **Table C-4**. The data are averaged according to the six DDM multifamily residential indoor end use categories.

Table C-4. Distribution of Indoor Water Use for Multifamily Residential Sector

End Use	LADWP	Tucson	Aquacraft	Average
Toilet	13.8%	23.0%	35%	23.9%
Shower	17.8%	16.2%	23%	
Bath	1.7%		2%	
Shower/Bath	19.6%	16.2%	25%	20.3%
Faucet	20.7%	17.6%	24%	20.8%
Dishwasher	1.0%	1.4%	1%	1.1%
Washing Machine	12.2%			
Central Laundry Facility	8.9%			
Laundry	21.1%	14.9%	5%	13.7%

End Use	LADWP	Tucson	Aquacraft	Average
Water Quality System	4.1%			
Cooling/Condensing	1.6%			
Leaks			9.5%	
Other Indoor	18.2%		0.5%	
Other/Leaks	23.9%	26.9%	10%	20.3%
Total	100%	100%	100%	100%

C.6.2.3 Commercial Sector

End uses for the Commercial sector include:

- Medical Equipment (MEQ)
- Pools (POL)
- Laundry (LND)
- Kitchen (KCH)
- Heating and Cooling (HVC)
- Domestic (DOM) (bathroom uses)
- Miscellaneous (MSC)

A literature review was conducted to identify relevant estimates of indoor water use by end use among the seven Commercial subsectors for the end uses in the DDM. Four studies were identified in which Commercial, Institutional, and Industrial indoor water use is adequately identified by sector and end use to calculate the percent of water use by end use as required for the model. These studies are:

- Los Angeles Department of Water and Power (LADWP) Conservation Potential Study 2016 by CDM Smith – CII sector water use parameters for the LADWP end use model were derived from an extensive literature review of CII end use studies.
- Gleick, P. A. (2003), Waste Not, Want Not: The Potential for Urban Water Conservation in California.
- EPA. (2016) EPA WaterSense - Commercial Buildings.
- Water Research Foundation (WRF, formerly the AWWARF) 2000, Commercial and Institutional End Uses of Water.

As with the multifamily residential findings, the distribution of indoor water use by end uses were aligned and averaged across reports for end use classifications specified in the DDM. Not all reports had data for all seven Commercial subsectors. In particular, data were limited for the Retail and Industrial subsector as Hospitals, Offices, Schools, Restaurants and Hotels have been the primary focus of CII studies. These percentages are shown in **Table C-5** and summarized in **Table C-6**. As with the multifamily residential sector, the average value is assumed for the current water usage in the forecast.

For the Hospital subsector, the literature review provides a distribution of end uses for traditional hospitals. However, the Austin Water customer billing classification of Hospitals includes medical and dental offices. Therefore, the end use distribution for the Hospital sector is adjusted to reflect proportionally more domestic (restroom) use and less kitchen and laundry uses for this sector.

For the Retail subsector, studies of end use provide a distribution of end uses for establishments with kitchen/deli services and HVAC systems (e.g., grocery stores) and establishments where the water use is primarily restroom usage (e.g., gas stations). For this analysis, it is assumed that the AW Retail customer subsector is about half represented by establishments with kitchen/deli and HVAC, and about half represented by establishments with mostly domestic use. For the Industrial subsector, process water is listed under the Miscellaneous end use.

Table C-5. Indoor Water Use Distribution Studies for Select Commercial Sectors

Offices	LADWP	Gleick	EPA	WRF	Average
Domestic	38.2%	41.9%	47.4%	46.9%	43.5%
Kitchen	1.2%	4.8%	16.7%	0.0%	5.8%
Laundry	0.0%	0.0%	0.0%	0.0%	0.0%
Medical Equipment	0.0%	0.0%	0.0%	0.0%	0.0%
HVAC	30.8%	37.1%	35.9%	41.5%	36.3%
Miscellaneous	29.8%	16.1%	0.0%	11.5%	14.4%
Restaurants	**LADWP**	**Gleick**	**EPA**	**WRF**	**Average**
Domestic	49.0%	36.2%	32.3%	32.2%	37.4%
Kitchen	38.7%	48.9%	54.2%	50.9%	48.2%
Laundry	0.0%	0.0%	0.0%	0.0%	0.0%
Medical Equipment	0.0%	0.0%	0.0%	0.0%	0.0%
HVAC	0.0%	2.1%	1.0%	1.9%	1.3%
Miscellaneous	12.3%	12.8%	12.5%	15.0%	13.1%
Schools	**LADWP**	**Gleick**	**EPA**	**WRF**	**Average**
Domestic	60.5%	71.4%	63.4%	68.7%	66.0%
Kitchen	5.8%	7.1%	9.9%	8.9%	7.9%
Laundry	0.5%	0.0%	4.2%	3.5%	2.0%
Medical Equipment	0.0%	0.0%	0.0%	0.0%	0.0%
HVAC	12.5%	0.0%	15.5%	7.0%	8.7%
Miscellaneous	20.8%	21.4%	7.0%	11.9%	15.3%

Hospitals	LADWP	Gleick	EPA	WRF	Average	Hospitals & Medical Offices, adjustment
Domestic	22.3%	29.8%	37.6%	29.7%	29.8%	35%
Kitchen	4.2%	9.5%	7.5%	6.6%	7.0%	5%
Laundry	0.3%	2.4%	9.7%	6.5%	4.7%	3%
Medical Equipment	4.8%	26.2%	16.1%	6.6%	13.4%	13%
HVAC	50.3%	32.1%	21.5%	33.8%	34.4%	34%
Miscellaneous	18.1%	0.0%	7.5%	16.9%	10.6%	10%

Hotels	LADWP	Gleick	EPA	WRF	Average
Domestic	42.9%	56.7%	35.7%	30.0%	41.3%
Kitchen	14.8%	11.1%	16.7%	16.6%	14.8%
Laundry	11.1%	15.6%	19.0%	15.1%	15.2%
Medical Equipment	0.0%	0.0%	0.0%	0.0%	0.0%
HVAC	10.7%	11.1%	14.3%	9.5%	11.4%
Miscellaneous	20.5%	5.6%	14.3%	28.7%	17.2%
Retail	**LADWP Grocery Stores**		**LADWP Gas Stations**		**Average**
Domestic	18.2%		86.0%		52.1%
Kitchen	15.4%		2.9%		9.2%
Laundry	0.0%		0.0%		0.0%
Medical Equipment	0.0%		0.0%		0.0%
HVAC	46.4%		0.0%		23.2%
Miscellaneous	20.0%		11.1%		15.5%
Industrial	**LADWP**				**Average**
Domestic	10.5%				10.5%
Kitchen	0.0%				0.0%
Laundry	0.0%				0.0%
Medical Equipment	0.0%				0.0%
HVAC	48.0%				48.0%
Miscellaneous	41.5%				41.5%

Table C-6. Distribution of Indoor Water Use for Commercial Subsectors

	MEQ	POL	LND	KCH	HVC	DOM	MISC
Hospitals	13.0%	0.0%	3.0%	5.0%	34.0%	35.0%	10.0%
Offices	0.0%	0.0%	0.0%	5.8%	36.3%	43.5%	14.4%
Schools	0.0%	0.0%	2.0%	7.9%	8.7%	66.0%	15.3%
Restaurants	0.0%	0.0%	0.0%	48.2%	1.3%	37.4%	13.1%
Hotels	0.0%	0.1%	15.2%	14.8%	11.4%	41.3%	17.2%
Retail	0.0%	0.0%	0.0%	9.2%	23.2%	52.1%	15.5%
Industrial	0.0%	0.0%	0.0%	0.0%	48.0%	10.5%	41.5%

C.6.2.4 Universities

End use ratios for universities in the DDM were based on an analysis of water use among campus facilities at the University of North Carolina – Chapel Hill that was performed for the Orange Water and Sewer Authority (OWASA) which serves the UNC campus. The UNC study included multiple research and laboratory facilities, a large hospital complex, and a state-of-the-art centralized steam/cooling facility in addition to the traditional campus classrooms, offices, and dormitories. There is a subcategory of 'Other' which includes facilities such as the student center, rec center, stadium, basketball arena, theaters, etc.

The data used in this analysis is from 1991 to 1998. However, it is the only detailed end use analysis of a university campus found by the study team. At the time of the study, UNC was very progressive in terms of implementing water conservation on campus and it was assumed that subsequent improvements in water use efficiency would likely have progressed equally among the various campus facilities.

Table C-7 displays an aggregated percent of water use for each of the university subsectors into the seven end use categories of the AW model. These percentages are weighted across the seven UNC subsectors based on the average annual water use of each subsector. The resulting recommended end use distribution is highlighted in bold in the column labeled "weighted %".

Large volume industrial end-uses were estimated based upon correspondence with facility operators from AW's current large volume customers. The end-uses employed were similar to those found in the Industrial subsector, with different assumptions regarding the distribution of end-use shares.

Table C-7. Distribution of Indoor Water Use for Universities (From end use study at UNC-Chapel Hill, '91-98)

	MEQ	POL	LND	KCH	HVC	DOM	MISC	Average MGD	% Total Volume
Classroom/Faculty	0%	0%	0%	0%	0%	78%	22%	0.07	3.3%
Laboratory/Research	0%	0%	0%	0%	0%	45%	55%	0.38	18.1%
Offices/Administration	0%	0%	0%	0%	0%	58%	42%	0.03	1.6%
Student Housing	0%	0%	12%	11%	0%	63%	14%	0.31	14.6%
Hospital/Patient Care	10%	0%	11%	5%	0%	30%	44%	0.24	11.3%
Other (Theaters, Stadium, Student Center)	0%	3%	29%	1%	0%	53%	14%	0.22	10.0%
Utilities (Centralized Facility)	0%	0%	0%	0%	99%	0%	1%	0.87	41.1%
Weighted %	1.1%	0.3%	5.9%	2.3%	40.6%	29.5%	20.3%		

C.7 Water Use Projection Methodology

C.7.1 Passive Conservation

Changes to plumbing and/or housing code that would impact future water use were analyzed per sector and used to develop percentage reductions in total (indoor + outdoor) water demand. These passive reductions in water use were then applied to each of the four planning horizon years (2020, 2040, 2070, and 2115) as a percent reduction in the WUF for the year of interest.

Below are the two best management practice options that were modelled in the DDM as passive conservation:

- Require or incentivize government-recognized energy and water efficiency-labeled residential and commercial fixtures (included in baseline assumptions in portfolios).
- Incentivize or require toilet, urinal, and bathroom faucet aerator efficiencies (included in baseline assumptions in portfolios).

C.7.2 Consumption, Pumpage, and Diversions

Water demand was projected as the mathematical product of the sector/subsector base year WUF and demographic count for each DTI for each planning horizon year. End use level projection estimates were developed by multiplying the base year WUF by the appropriate end use ratios for each sector and

subsector. Projected demand for all DTI polygons were then aggregated so that city-wide total consumption for each customer sector/subsector could be calculated in each planning horizon year. In this fashion, total consumption by sector/subsector and city-wide was calculated and tallied for each planning year of interest.

Consumption estimates were then added to estimates of non-revenue water losses to determine a city-wide pumpage estimate. Non-revenue water losses were related to historical distribution system attributes (length of distribution mains, number of connections, etc.) for the study period, and projected into the future based on anticipated distribution system attributes based on population and density projections. Finally, city-wide pumpage was also multiplied by a loss factor representing the historical difference between water diversions from the Colorado River and water pumped from city-owned water treatment plants (caused by water used in the water treatment process train). Therefore, a final estimate of water diversions from the Colorado River could be estimated for each planning horizon year.

C.8 Baseline Model Results

The baseline projections found within the DDM results summary represent the trended water use based upon water use patterns occurring between 2013-2015 in each DTI polygon and customer sector/subsector. These baseline projections include historical conservation efforts and projected savings from passive conservation, but do not reflect additional savings from recommended Water Forward options. Therefore, they do not attempt to predict actual water consumption, as total water consumption will likely differ as the Austin community implements additional conservation and reuse strategies. The baseline results of the DDM are meant to be a starting place to assess the various demand management and supply strategies considered in the Water Forward planning process. **Figure C-4.** Citywide Baseline Demand Forecast to Figure **C-9** illustrate the baseline results of the DDM.

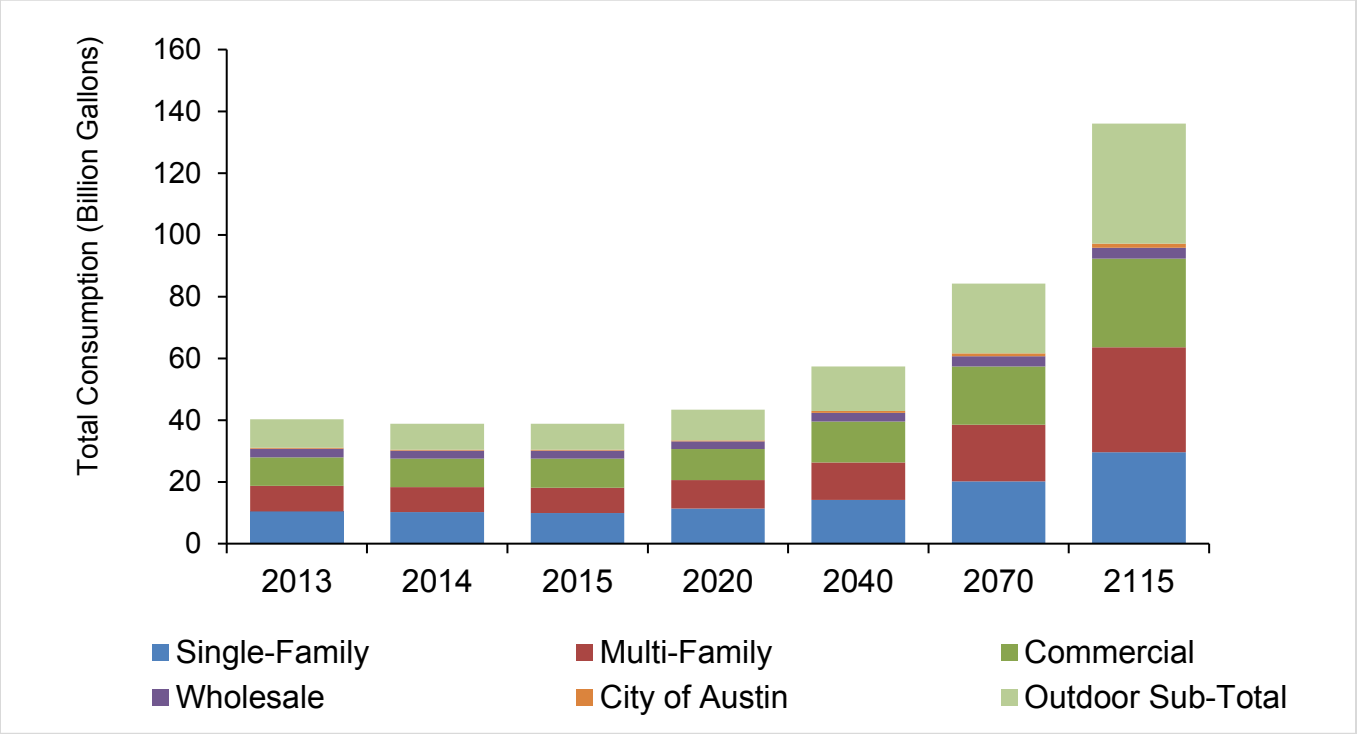


Figure C-4. Citywide Baseline Demand Forecast

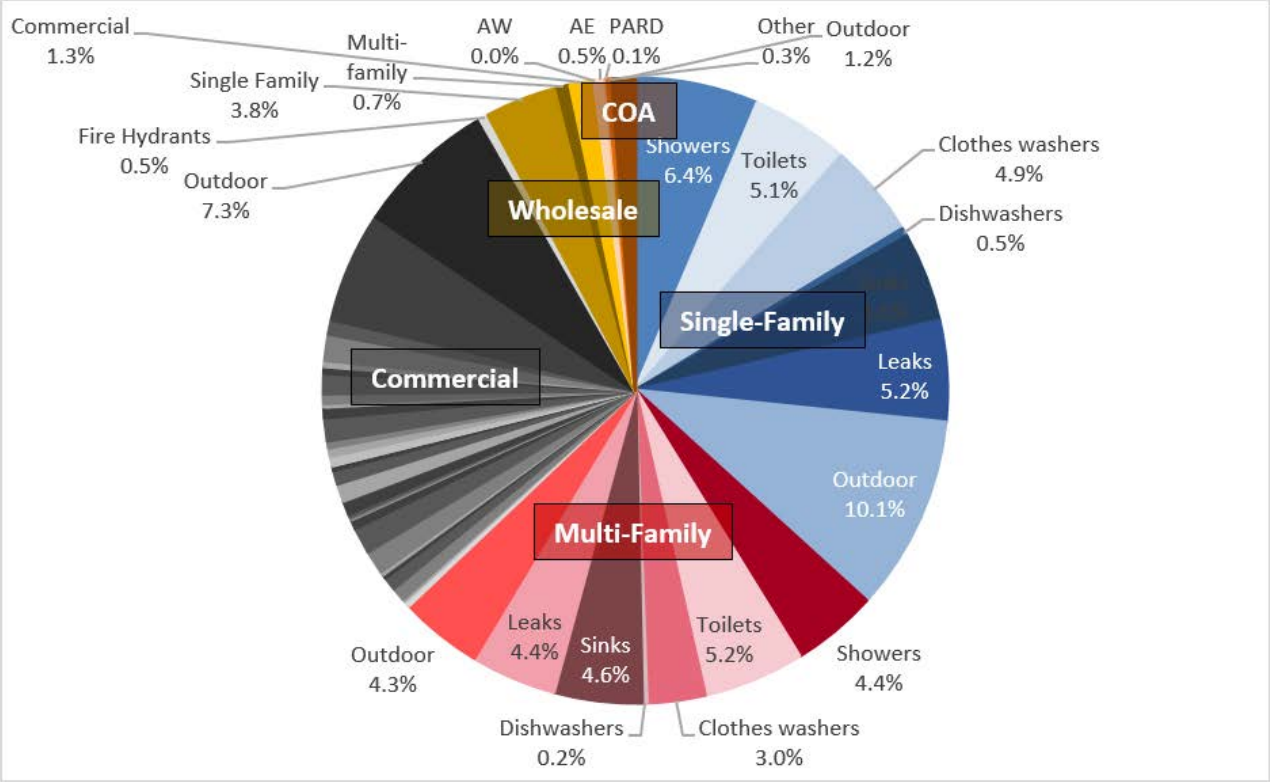


Figure C-5. Baseline 2020 Demands

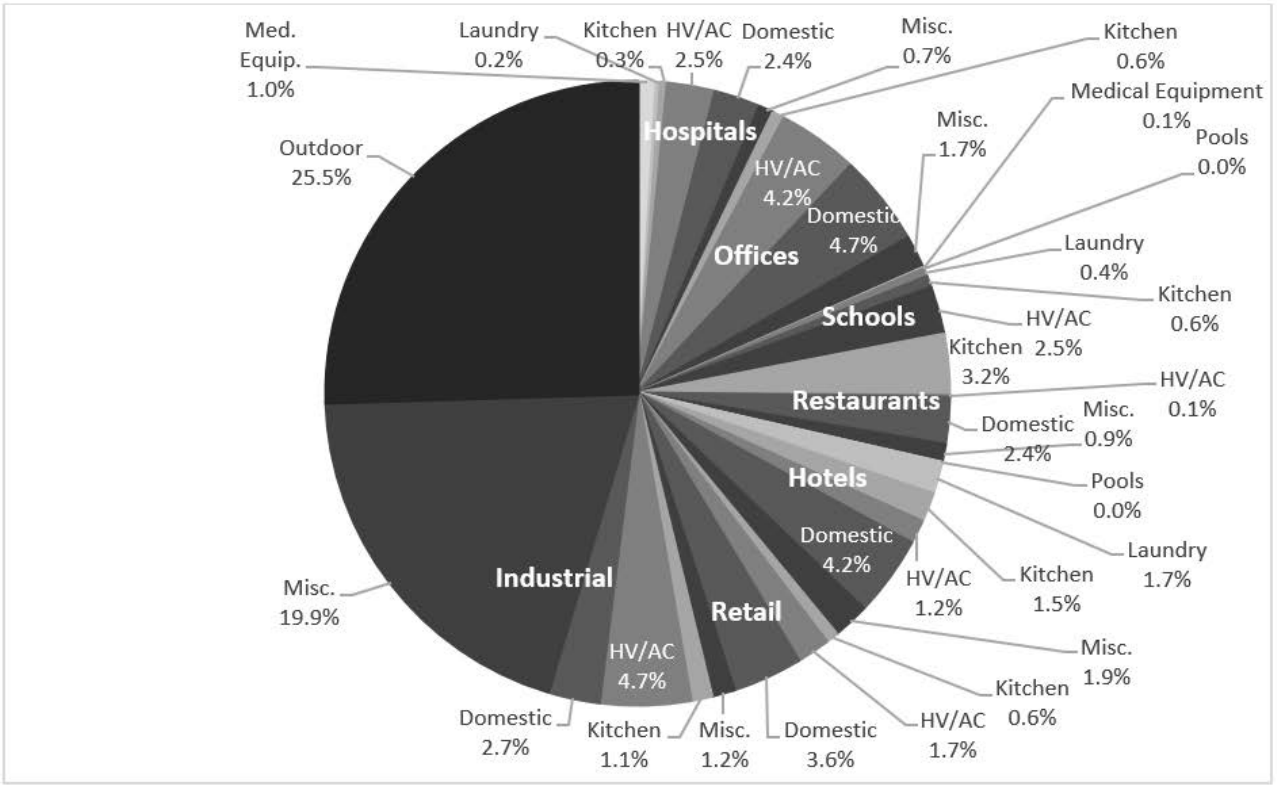


Figure C-6. Baseline 2020 Commercial Subsector Demands

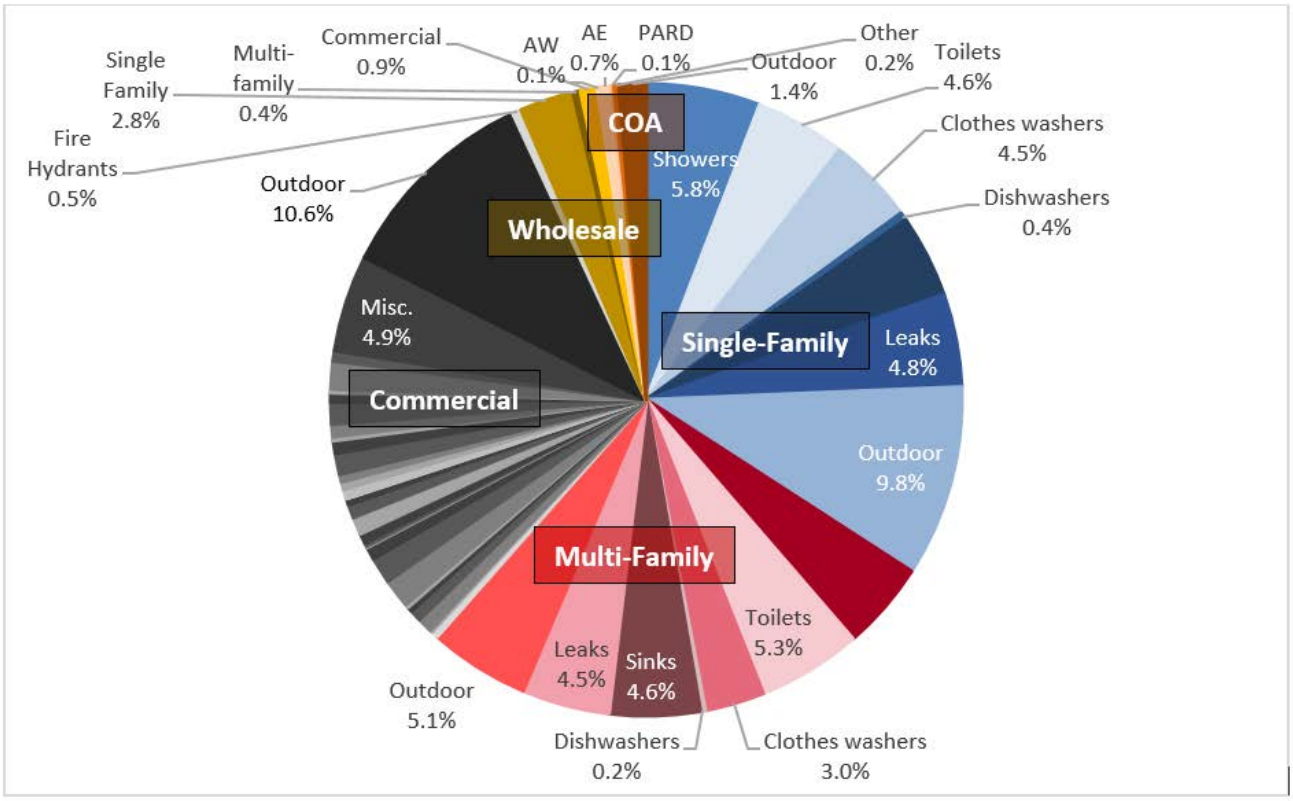


Figure C-7. Baseline 2115 Demands

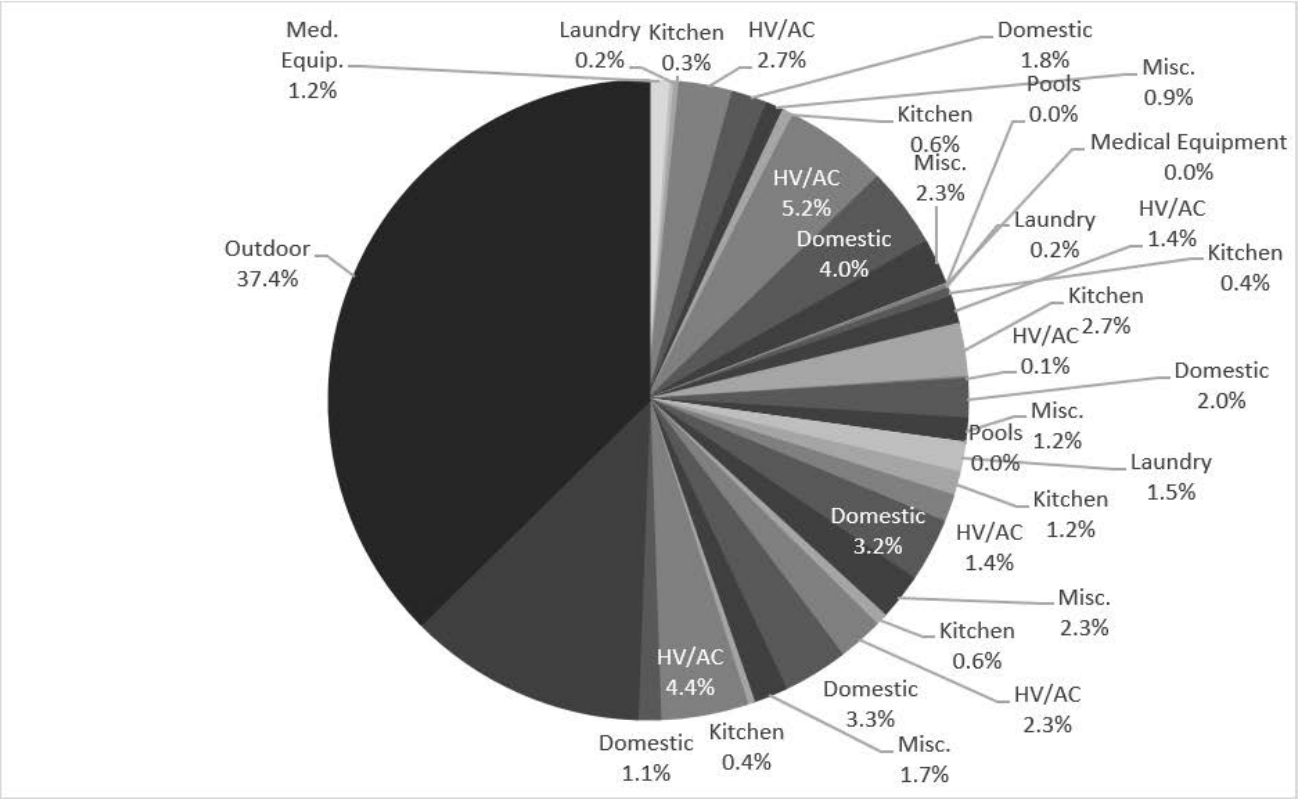
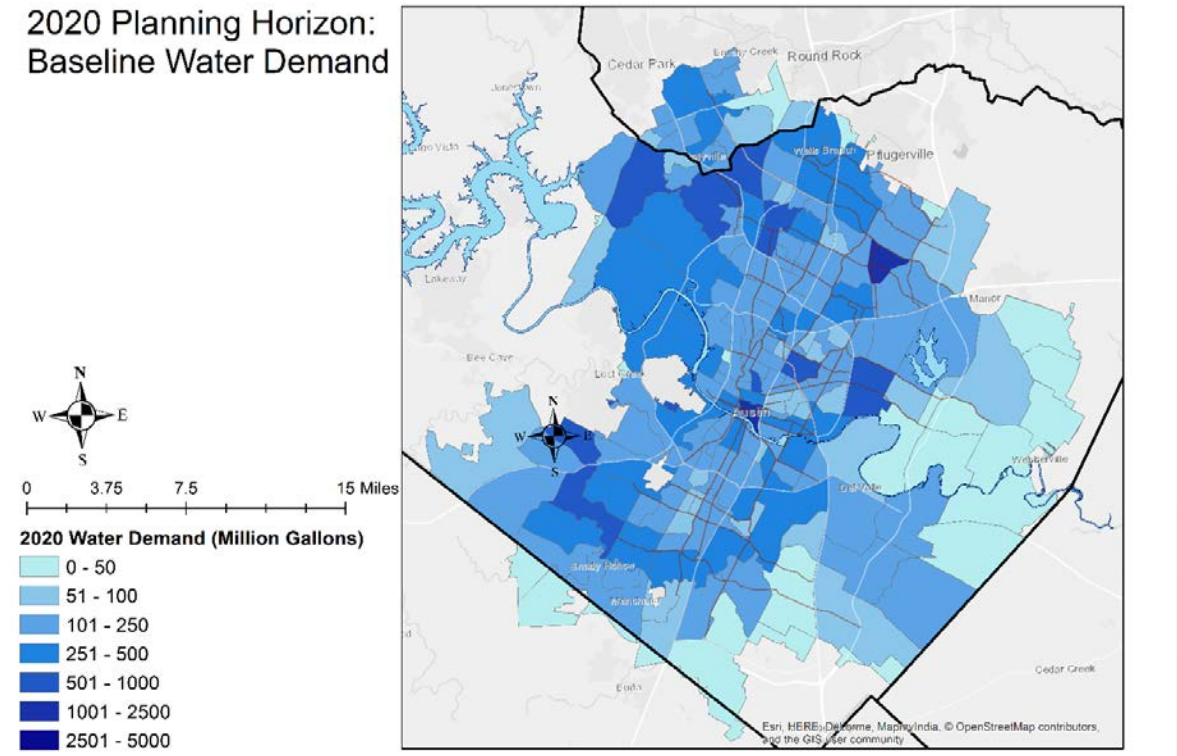


Figure C-8. Baseline Commercial Subsector Demands



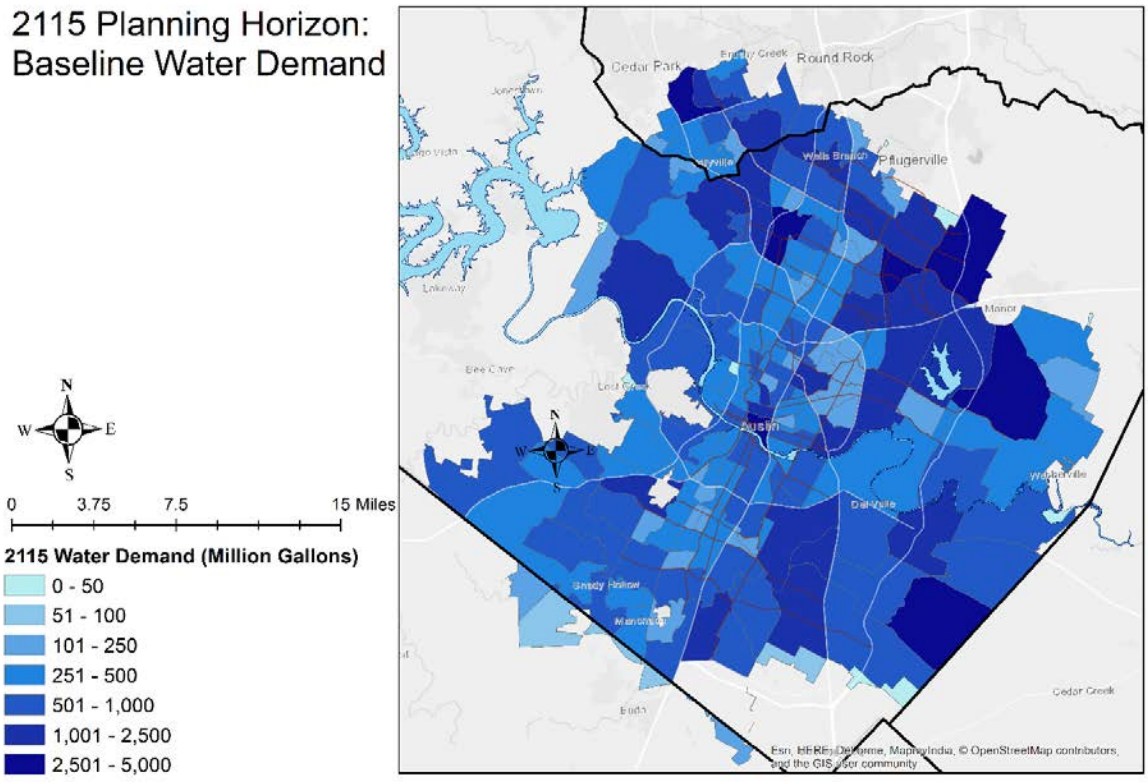


Figure C-9. Map of DTIs by DDM water demand in 2020 and 2115