

# HANDOUT 1

## Raw Water Supply Master Plan

### Glossary of Terms and Abbreviations

**Acre-Feet per Year (ac-ft/yr)** – A measure of annual water supply volume. It is defined as the annual volume of water covering one acre to a depth of one foot or 43,560 cubic feet per year.

**Availability** – Maximum amount of water that could be produced by a source during a repeat of the drought of record, regardless of whether the supply is physically connected to or legally accessible by the users.

**Catahoula** – A designated groundwater aquifer located below the Gulf Coast Aquifer in this region.

**WAM 3** – The State of Texas water availability model which uses the full amount of all authorized diversions for each river basin.

**Desalination** – The process of removing dissolved solids or salts from water.

**Drought of Record** – The period of historical record when measurements indicate that natural hydrological conditions would have provided the least amount of water supply.

**Existing Water Supply** – Maximum amount of water that is physically connected to and legally accessible by a water user group from existing sources under a repeat of drought of record conditions.

**Firm Yield** – TCEQ defines “firm yield” as “that amount of water that a reservoir could have produced annually if it had been in place during the worst “drought of record”.

**Gallons Per Capita Per Day (GPCD)** – Daily water use per person. Per capita water use is calculated as the total amount of water withdrawn from water supplies divided by the population using that supply.

**Groundwater Reduction Program (GRP)** - A program or plan developed by one or more entities detailing proposed measures to reduce dependence on groundwater production in accordance with applicable regulations.

**Implementation Schedule or Action Plan** – A plan summarizing the assortment of strategies that should be developed and the schedule for incorporating them into the future water system.

**Million Gallons per Day (MGD)** – A measure for water use, usually expressed in millions of gallons of water used per day.

**Municipal Water Demand Projection** – An estimate of the amount of municipal treated water needed to serve the estimated population in future years.

**Non-Municipal Water Demand Projection** - Non-municipal demands generally refer to raw water or non-treated water used for irrigation, industrial, mining, livestock and steam-electric power demands.

**Region H** – The State-designated area surrounding Houston and including all or parts of 15 counties within the Brazos, San Jacinto, Trinity and adjoining coastal basins in this area.

**Return Flows** – Return flows refers to the portion of withdrawn water that is treated and returned to the environment and is then available for other uses.

**Run-of-River** – Supplies allocated under State water permits using no impoundments for storage, but pumped directly from the river or stream.

**Scalping** – Diverting water from a natural water course during extreme rainfall events by pumping, with sufficient flows for all existing senior permits being allowed to pass downstream.

**Scenarios** – An alternative future condition for the supply availability that is a combination of the known risk variables that defines a potential future condition. There can be multiple scenarios developed in this Study depending on the combination of the known risk variables considered.

**Strategy** – A water supply source, either existing supply or new source. This could be a reservoir, groundwater wells, reuse supply, conservation (demand reduction), desalination, and any other potential source.

**Supply Source** – A source of supply, either developed or to be developed, either currently owned or potentially to be owned, originating from surface water sources, groundwater sources, or alternatives sources such as reuse, conservation, desalination, and others.

**Total Qualifying Demand (TQD)** is defined as the volume of groundwater that a large volume groundwater user, producing 10 million gallons or more, is authorized to produce from the Gulf Coast Aquifer under the terms of a Lone Star Groundwater Conservation District-issued permit.

**Water Need** – A projected water supply shortage based on the difference between projected demands and existing water supplies, incorporating specific assumptions.

**Water Rights** – State permits issued to public or private entities to make use of water from a stream, lake, or irrigation canal. The State of Texas may assign water rights to any potential users that apply to divert water from any surface water body which contains state water. Water is allocated to the right holders in the order of seniority, first in right, first in use.

## **Water Measurements**

1 Acre-Foot (AF) = 43,560 cubic feet = 325,851 gallons

1 Acre-Foot per year (Acre-feet/yr, AFY, or ac-ft/yr) = 325,851 gallons per year = 893 gallons per day

1 gallon per minute (gpm) = 1,440 gallons per day = 1.6 ac-ft/yr

1 million gallons per day (mgd or MGD) = 1,000,000 gallons per day = 1,120 ac-ft/yr

1 cubic foot per second (ft<sup>3</sup>/sec or cfs) = 646,272 gallons per day = 723 ac-ft/yr

# Commonly Used Acronyms

<b>ADF</b>	<b>Average Daily Flow</b>
<b>AFY/afy</b>	<b>acre foot per year</b>
<b>ASR</b>	<b>aquifer storage and retrieval</b>
<b>CFS/cfs</b>	<b>cubic feet per second</b>
<b>CLCND</b>	<b>Chambers Liberty Counties Navigation District</b>
<b>COH</b>	<b>City of Houston</b>
<b>CWA</b>	<b>Coastal Water Authority</b>
<b>DCP</b>	<b>Drought Contingency Plan</b>
<b>GPCD/gpcd</b>	<b>gallons per capita per day</b>
<b>GPM/gpm</b>	<b>gallons per minute</b>
<b>GRP</b>	<b>Groundwater Reduction Program</b>
<b>IBT</b>	<b>Interbasin Transfer</b>
<b>MGD/mgd</b>	<b>million gallons per day</b>
<b>PDF</b>	<b>Peak Daily Flow</b>
<b>RGUP</b>	<b>Regional Groundwater Update Project</b>
<b>RWP</b>	<b>Regional Water Plan</b>
<b>SJRA</b>	<b>San Jacinto River Authority</b>
<b>TCEQ</b>	<b>Texas Commission on Environmental Quality</b>
<b>TQD</b>	<b>Total Qualifying Demand</b>
<b>TRA</b>	<b>Trinity River Authority</b>
<b>TWDB</b>	<b>Texas Water Development Board</b>
<b>WAM</b>	<b>Water Availability Model</b>
<b>WCP</b>	<b>Water Conservation Plan</b>

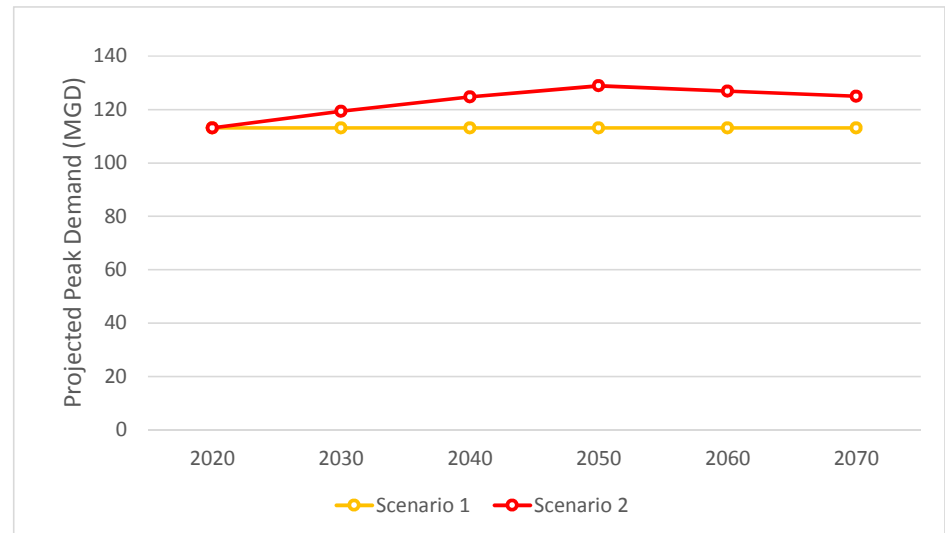
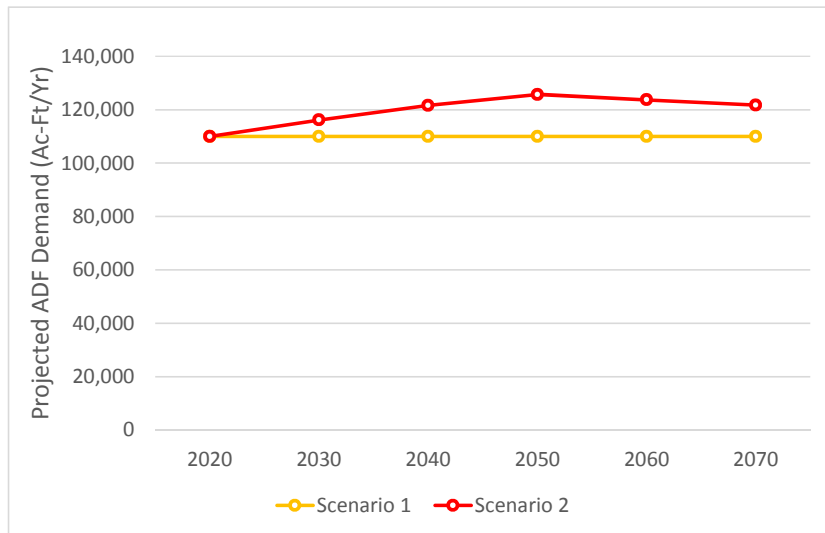
## HANDOUT 2

SAN JACINTO RIVER AUTHORITY CUSTOMER POPULATION PROJECTIONS						
HIGHLANDS POPULATION PROJECTIONS	2016 RWP Population Projection					
	2020	2030	2040	2050	2060	2070
Crosby MUD	2,603	2,768	2,823	2,877	2,932	2,988
Harris County MUD 50	2,177	2,199	2,245	2,277	2,284	2,292
Newport MUD	8,780	9,074	9,302	9,531	9,759	9,988
MONTGOMERY COUNTY POPULATION PROJECTIONS	2020	2030	2040	2050	2060	2070
City of Conroe	76,834	91,712	104,908	117,046	130,038	143,826
City of Oak Ridge North	2,505	2,623	2,772	2,864	2,908	2,923
Montgomery County WC & ID 1	3,102	3,420	3,777	4,175	4,616	5,104
MSEC Enterprises (Montgomery Trace/Crown Oaks)	10,514	12,204	13,993	15,529	16,930	18,298
RAYFORD ROAD MUD	74	104	159	199	231	242
San Jacinto River Authority	96,443	102,321	107,800	114,243	123,681	135,343
Southern Montgomery County MUD	8,051	8,348	8,604	8,791	8,917	9,049
Other SJRA GRP Customers	33,533	33,896	34,022	34,155	34,272	34,277

## HANDOUT 3

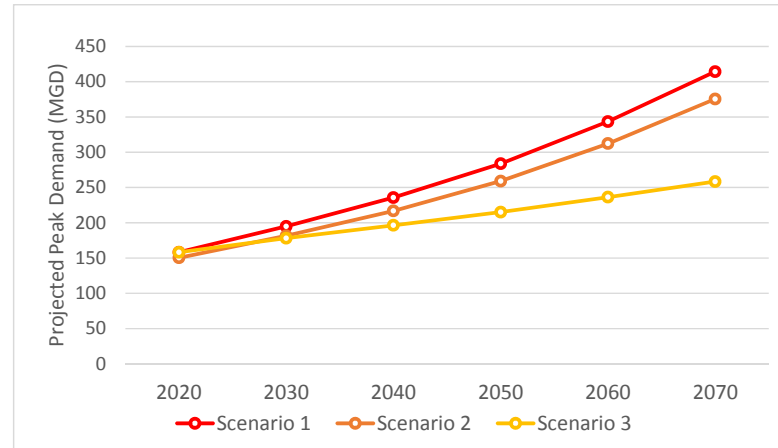
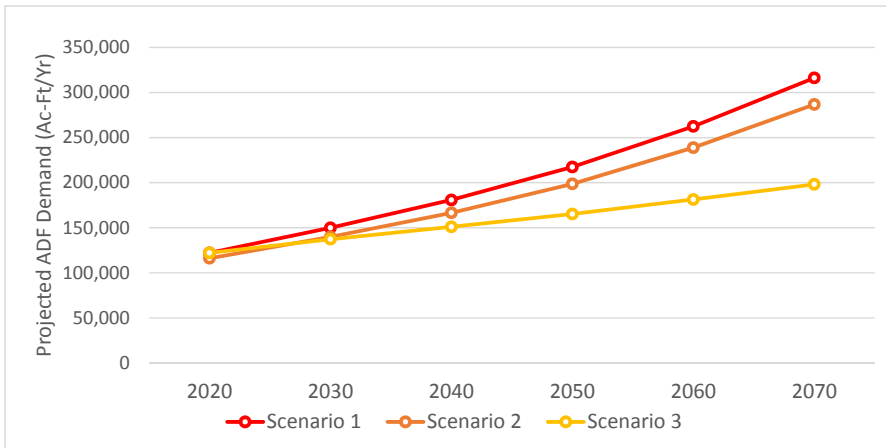
### HIGHLANDS SYSTEM SELECTED DEMAND SCENARIOS

Demand Scenario	Selected Scenario			Total System Demand (Ac-Ft/Yr)						Total System Peak Demand (MGD)					
	Industrial	Irrigation	Municipal	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
Scenario 1	2) Expanded Contracts	1) Current Contracts	1) Current Contracts	109,989	109,989	109,989	109,989	109,989	109,989	113	113	113	113	113	113
Scenario 2	4) Expanded Contracts + Region H Growth	1) Current Contracts	2) Current Contracts + Region H Growth	109,989	116,174	121,625	125,712	123,718	121,757	113	119	125	129	127	125



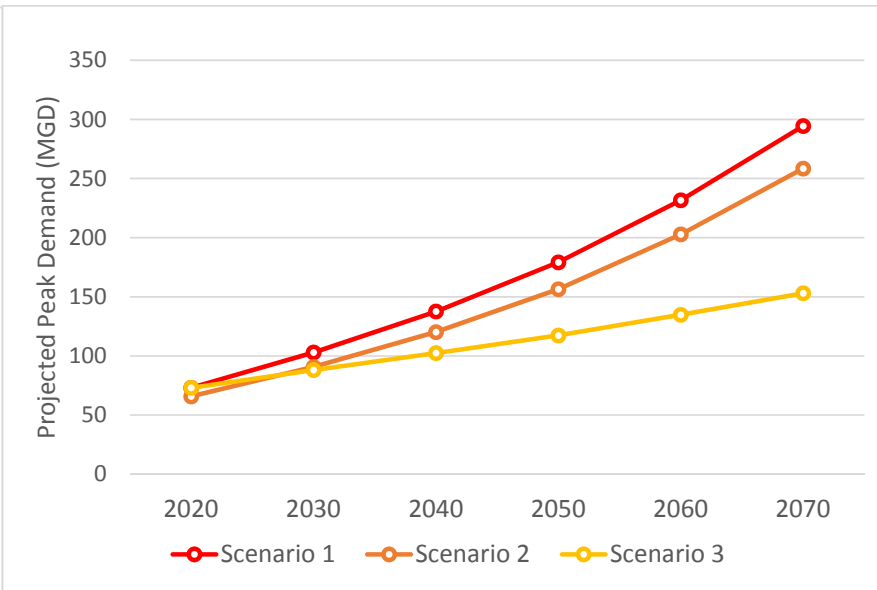
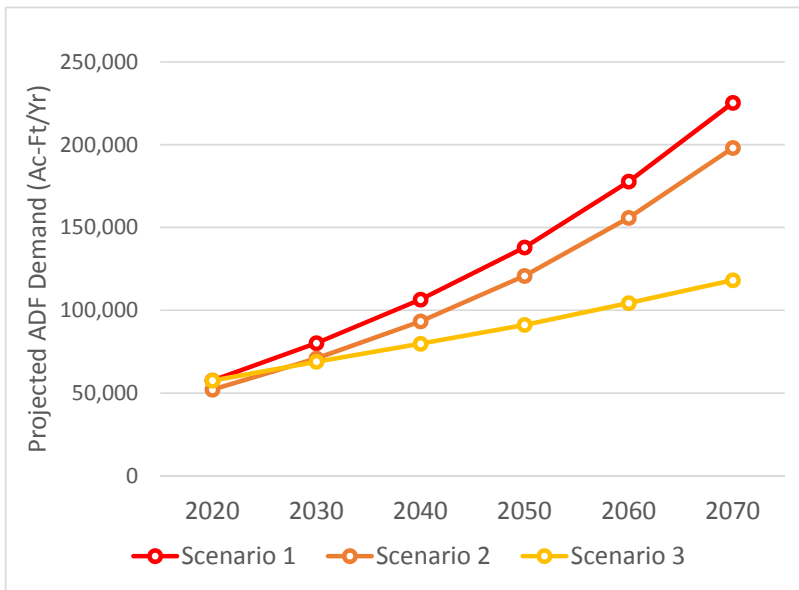
### MONTGOMERY COUNTY DEMAND SCENARIOS (ENTIRE COUNTY)

Scenario	Selected Projection			Total County Demand (Ac-Ft/Yr)						Total County Peak Demand (MGD)					
	Industrial	Irrigation	Municipal	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
Scenario 1	2) Expanded Contracts	1) Current Contracts	4) RGUP Pop + H GPCD + H Industrial	122,152	149,951	180,858	217,363	262,563	316,254	158	195	236	284	344	414
Scenario 2	2) Expanded Contracts	1) Current Contracts	6) RGUP Pop + H GPCD + H Industrial + Baseline Conservation	116,190	139,779	166,541	198,669	238,946	286,861	150	182	217	259	312	376
Scenario 3	2) Expanded Contracts	1) Current Contracts	8) RGUP Pop + H GPCD + H Industrial + SJRA Conservation	122,152	137,259	151,058	165,263	181,343	198,132	158	178	196	215	236	259



### MONTGOMERY COUNTY DEMAND PROJECTIONS(SJRA DEMANDS)

Projection	Selected Projection			Total System Demand (Ac-Ft/Yr)						Total System Peak Demand (MGD)					
	Industrial	Irrigation	Municipal	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
Scenario 1	2) Expanded Contracts	1) Current Contracts	4) RGUP Pop + H GPCD + H Industrial	57,556	80,238	106,459	138,000	177,726	225,321	73	103	138	179	232	294
Scenario 2	2) Expanded Contracts	1) Current Contracts	6) RGUP Pop + H GPCD + H Industrial + Baseline Conservation	52,100	70,920	93,289	120,752	155,872	198,054	66	91	120	156	203	258
Scenario 3	2) Expanded Contracts	1) Current Contracts	8) RGUP Pop + H GPCD + H Industrial + SJRA Conservation	57,556	68,939	79,802	91,164	104,350	118,177	73	88	102	117	135	153





**HANDOUT 4**

<b>PRELIMINARY DRAFT SUPPLY EVALUATION RESULTS</b>									
<b>SUPPLY SCENARIO</b>	<b>Available Supply (Acre-Feet per Year)</b>								
	<b>Highlands</b>							<b>Lake Conroe 4963</b>	<b>Lake Houston 4965</b>
	<b>Highlands 4964</b>	<b>SJRA 5807</b>	<b>Excess Flow 5808</b>	<b>Reuse 5809</b>	<b>CLCND 4279A</b>	<b>Devers 5271</b>	<b>Total</b>		
Base (Current)	55,000	12,100	0	9,344	17,336	36,857	130,637	79,300	117,417
Base 2020	55,000	5,300	0	9,344	17,289	36,730	123,664	79,300	117,400
Optimistic Scenario 2020	55,000	14,100	0	9,344	23,716	46,790	148,950	86,000	122,295
Base 2040	55,000	3,500	0	9,344	17,289	36,730	121,864	77,794	117,400
Optimistic Scenario 2040	55,000	14,100	0	9,344	30,000	56,000	164,444	84,500	134,619
Base 2070	55,000	500	0	9,344	17,289	36,730	118,863	75,500	117,400
Optimistic Scenario 2070	55,000	14,100	0	9,344	31,080	56,000	165,525	84,000	144,080

HANDOUT NO. 5  
MONTGOMERY SYSTEM TRIGGERS

Drought Stages	Conroe Trigger Elevation	% Municipal Demand Reduction	% Municipal Winter Demand Reduction	% Industrial Demand Reduction	Storage	% Storage
Stage 1	199	0%	0%	0%	368,744	91%
Stage 2	197	10%	5%	0%	333,407	82%
Stage 3	194	20%	10%	5%	284,109	70%
Stage 4	190	30%	15%	30%	225,933	56%

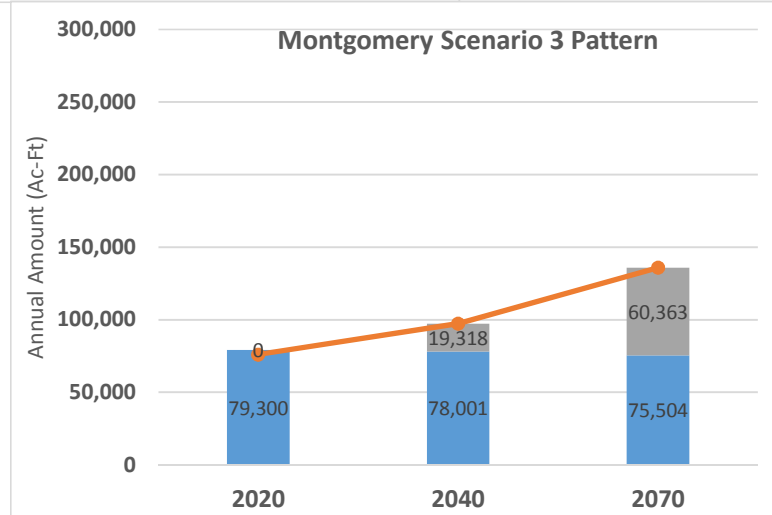
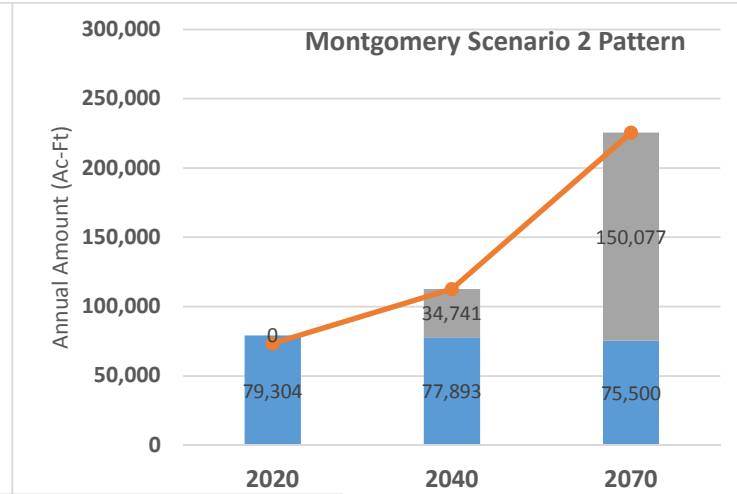
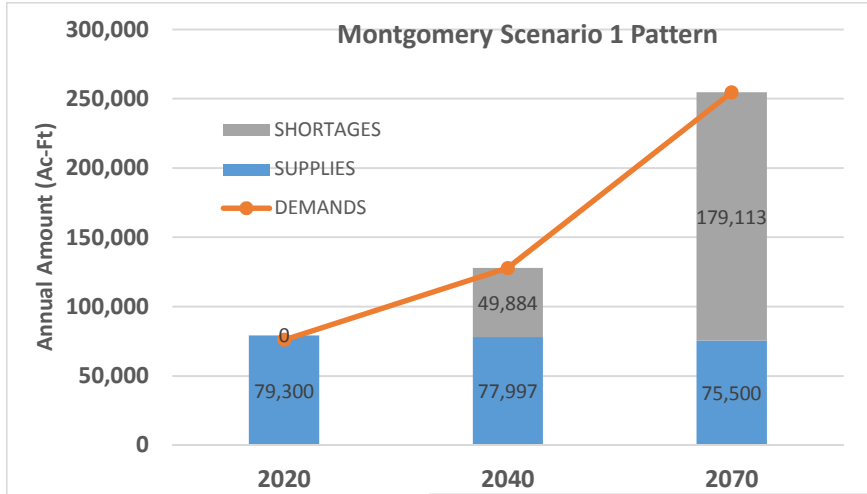
HIGHLANDS SYSTEM TRIGGERS

Drought Stages	Lake Houston Trigger Elevation	% Municipal Demand Reduction	% Municipal Winter Demand Reduction	% Industrial Demand Reduction	Storage	% Storage	Trinity Romayor Gage Trigger
Stage 1	43	0%	0%	0%	104,508	88%	< 1,000 cfs
Stage 2	42	10%	5%	0%	94,627	79%	< 1,000 cfs
Stage 3	40	20%	10%	5%	74,866	63%	-
Stage 4	38	30%	15%	30%	60,579	51%	-

## HANDOUT 6

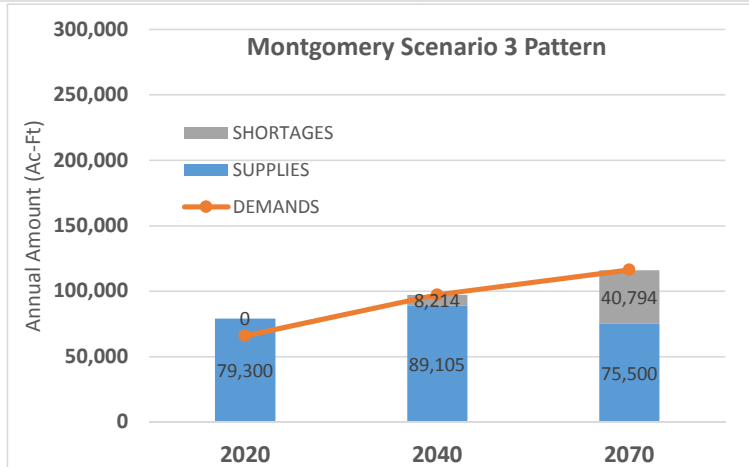
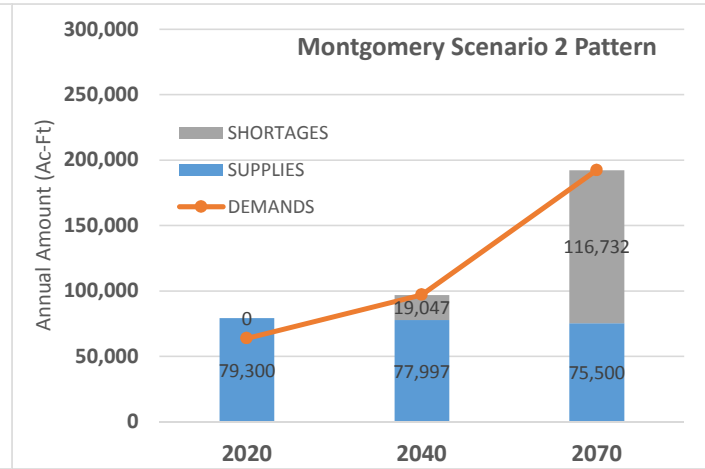
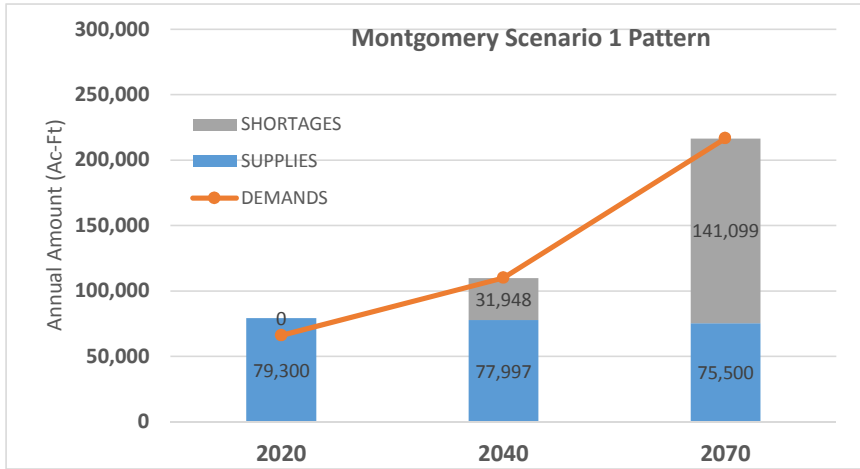
SUMMARY OF MONTGOMERY COUNTY NEEDS ANALYSIS (BASE SCENARIO)

Base	SUPPLIES			DEMANDS			SHORTAGES		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
2020	79,300	79,304	79,300	76,069	73,401	76,069	0	0	0
2040	77,997	77,893	78,001	127,882	112,634	97,320	49,884	34,741	19,318
2070	75,500	75,500	75,504	254,613	225,577	135,867	179,113	150,077	60,363



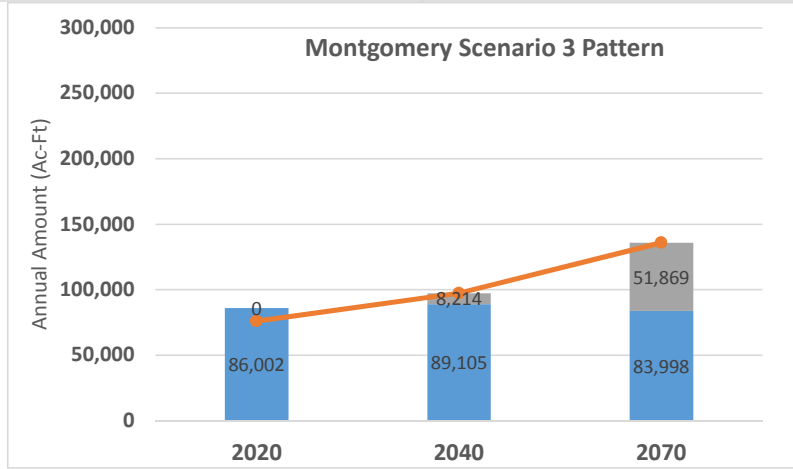
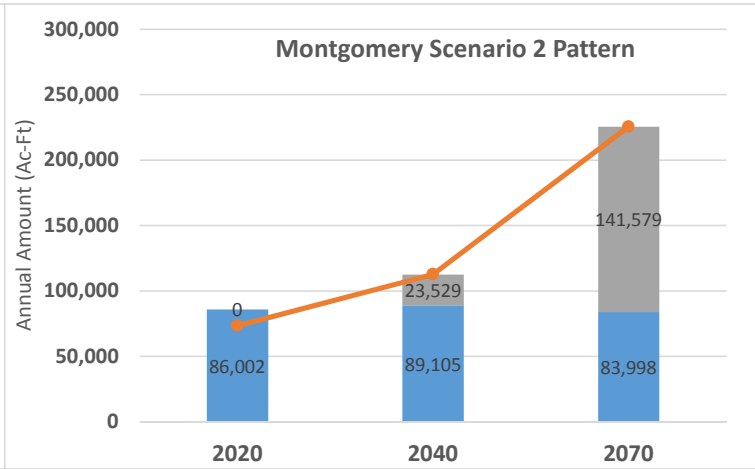
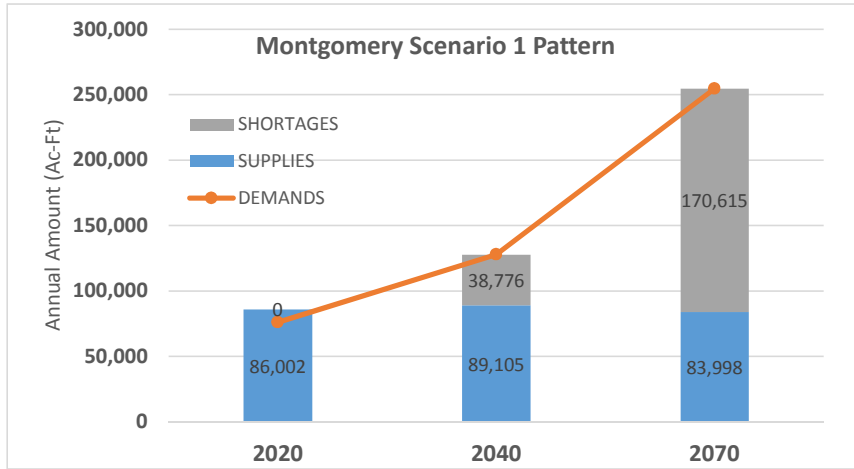
SUMMARY FOR MONTGOMERY COUNTY NEEDS ANALYSIS (DROUGHT CONTINGENCY SCENARIO)

Drought Contingency Mode	SUPPLIES			DEMANDS			SHORTAGES		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
	2020	79,300	79,300	79,300	66,017	63,753	66,017	0	0
2040	77,997	77,997	89,105	109,945	97,044	97,320	31,948	19,047	8,214
2070	75,500	75,500	75,500	216,599	192,232	116,294	141,099	116,732	40,794



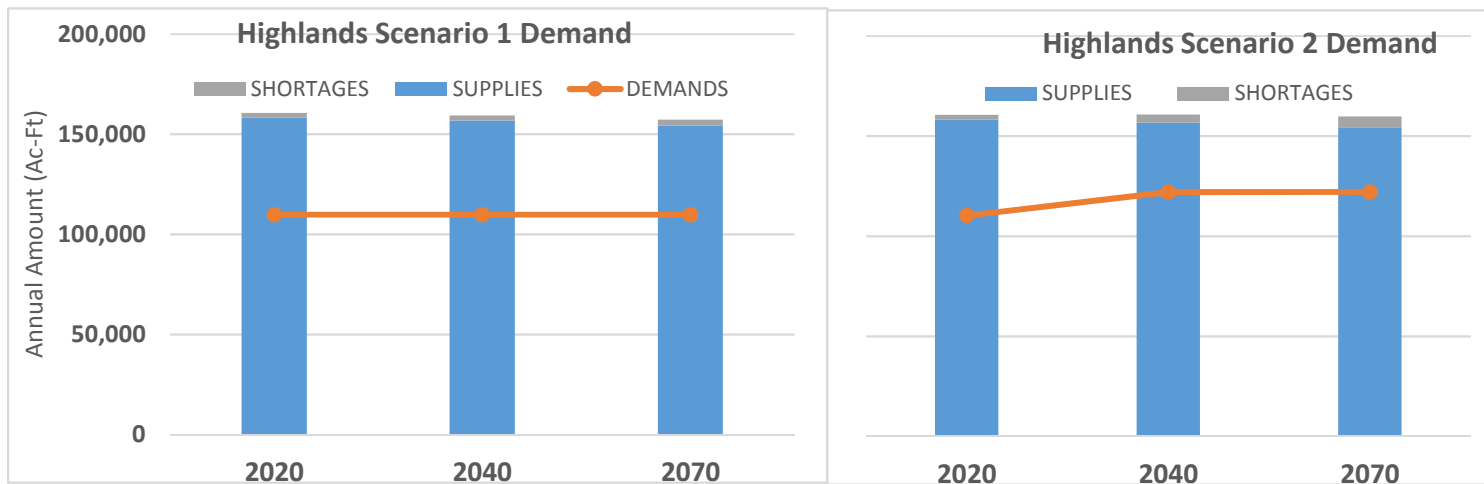
SUMMARY OF MONTGOMERY COUNTY NEEDS ANALYSIS (OPTIMISTIC CONDITIONS)

Optimistic Conditions	SUPPLIES			DEMANDS			SHORTAGES		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
	2020	86,002	86,002	86,002	76,069	73,401	76,069	0	0
2040	89,105	89,105	89,105	127,882	112,634	97,320	38,776	23,529	8,214
2070	83,998	83,998	83,998	254,613	225,577	135,867	170,615	141,579	51,869



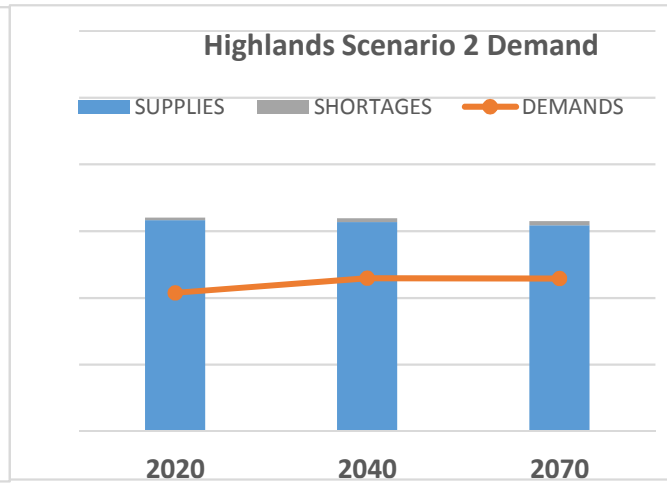
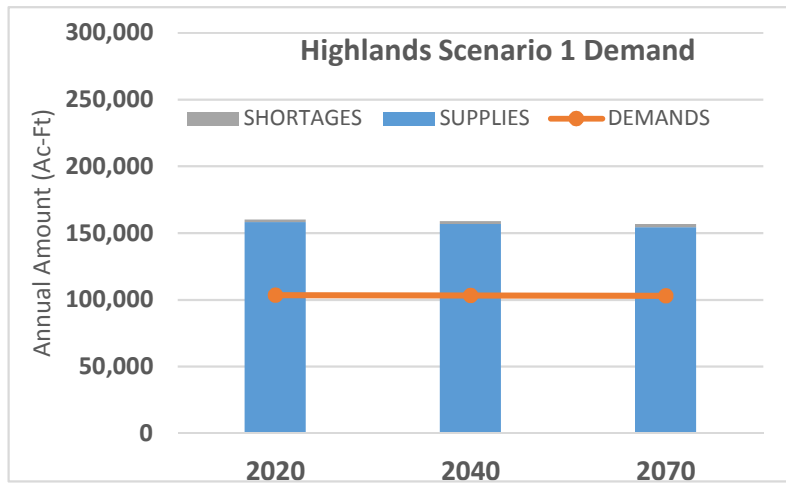
SUMMARY OF HIGHLANDS NEEDS ANALYSIS (BASE SCENARIO)

Base	SUPPLIES		DEMANDS		SHORTAGES	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
2020	158,105	158,105	109,827	110,319	2,493	2,528
2040	156,696	156,696	109,827	121,990	2,622	4,120
2070	154,397	154,397	109,827	122,122	2,836	5,441



SUMMARY OF HIGHLANDS NEEDS ANALYSIS (DROUGHT CONTINGENCY SCENARIO)

Drought Contingency	SUPPLIES		DEMANDS		SHORTAGES	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
	2020	158,105	158,105	103,403	103,819	1,973
2040	156,696	156,696	103,327	114,747	2,093	2,862
2070	154,397	154,397	103,080	114,587	2,238	3,060





SUMMARY OF HIGHLANDS NEEDS ANALYSIS (OPTIMISTIC CONDITIONS)

OPTIMISTIC CONDITIONS	SUPPLIES		DEMANDS		SHORTAGES	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
2020	171,604	171,604	109,827	110,319	76	77
2040	172,076	172,076	109,827	121,990	0	44
2070	172,358	172,358	109,827	122,122	0	45

