REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2070

HARRISON COUNTY

WUGs:

Harleton WSC
Harrison County Irrigation
Leigh WSC
Harrison County Mining
North Harrison WSC
Panola Bethany WSC
City of Scottsville
City of Waskom

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF HARLETON WSC

Description of Water User Group:

The Harleton WSC system is located in northwest Harrison County and southern Marion County. The WSC served 1,480 connections in 2018. The population is projected to increase from 4,486 persons in 2020 to 6,787 persons in 2070. The WSC is included as a W.U.G. in Harrison and Marion Counties. The system's current water supply consists of four water wells from the Carrizo-Wilcox Aquifer and a contract with NETMWD for surface water from Lake O' the Pines. The total rated capacity of these sources is approximately 610 GPM, or 328 ac-ft/yr. The system is bounded on the west by the Diana SUD, the south Gum Springs WSC, the east by Talley WSC and Cypress Valley WSC, and the north by Lake O' the Pines. The System does have a water conservation plan. The System is projected to have a water supply deficit of 62 ac-ft/yr in 2020 decreasing to 230 ac-ft/yr in 2070.

Water Supply and Demand Analysis:

Harleton WSC, Harrison, Cypress	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Population	3381	3632	3890	4253	4649	5116
Projected Water Demand	345	354	367	394	429	472
Current Water Supply	298	298	298	298	298	298
Projected Supply Surplus (+)/Deficit(-)	**-47**	**-56**	**-69**	**-96**	**-131**	**-174**

Harleton WSC, Marion, Cypress	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Population	1105	1186	1271	1390	1518	1671
Projected Water Demand	113	116	120	129	140	154
Current Water Supply	98	98	98	98	98	98
Projected Supply Surplus (+)/Deficit(-)	**-15**	**-18**	**-22**	**-31**	**-42**	**-56**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the WSC's water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcd threshold set by the planning group. Water reuse was not considered because the system does not have a sewer collection system. Groundwater of acceptable quality is difficult to find in the Harleton Service area. Existing well water is blended with surface water to meet quality standards. Harleton WSC has an existing contract with NETMWD for treated water from Lake O' the Pines.

Strategy	**Firm Yield (AF)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation					
Water Reuse					
Groundwater					
Surface Water	**230**		**$ 4,928**	**652**	**1**

Recommendations:

	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Increase Contract (NETMWD; ac-ft/yr)	62	74	91	127	173	230

The recommended strategy for the Harleton WSC to meet their projected deficiency of 62 ac-ft/yr in 2020 and deficit of 230 ac-ft/yr in 2070 would be to increase their contract with NETMWD just prior to each decade as the deficits occur. The recommended supply source will be the Lake O' the Pines in Marion County. The Lake O' the Pines in Marion County is projected to have a more than ample supply availability to meet the needs of Harleton WSC for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Harleton WSC - Increase Contract	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (0 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$0
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$0**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$0
Environmental & Archaeology Studies and Mitigation	$0
Land Acquisition and Surveying (0 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$0
TOTAL COST OF PROJECT	**$0**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$0
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$0
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (7570 acft/yr @ 651 $/acft)	$4,928,000
TOTAL ANNUAL COST	**$4,928,000**
Available Project Yield (acft/yr)	230
Annual Cost of Water ($ per acft), based on PF=1	$21,426
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$21,426
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$65.74
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$65.74
SRH	*10/4/2019*

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS IRRIGATION IN HARRISON COUNTY

Description of Water User Group:

The Irrigation WUG in Harrison County is a split entity and has a demand that is projected to be constant 701 ac-ft/yr from 2020 to 2070. Irrigation in Harrison County, Cypress Basin has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer, surface water from Cypress Run-of-River permit, and Sabine Run-of-River permit. The total rated available supply from these sources is 35 ac-ft/yr for the Cypress split. Irrigation in Harrison County is projected to have a water supply deficit of 384 ac-ft/yr in 2020 and staying even to a deficit of 384 ac-ft/yr in 2070 for the Cypress split.

Irrigation in Harrison County, Sabine Basin has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer surface water from Sabine Run-of-River permit, and Cypress Run-of-River permit. The total rated available supply from these sources is 134 ac-ft/yr for the Sabine split. Irrigation in Harrison County is projected to have a water supply deficit of 148 ac-ft/yr in 2020 thru 2070 for the Sabine split.

Water Supply and Demand Analysis:

Mining Harrison Cypress	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Projected Water Demand						
Cypress	419	419	419	419	419	419
Sabine	282	282	282	282	282	282
Total	**701**	**701**	**701**	**701**	**701**	**701**
Current Water Supply						
Cypress	35	35	35	35	35	35
Sabine	134	134	134	134	134	134
Total	**169**	**169**	**169**	**169**	**169**	**169**
Projected Supply Surplus (+)/Deficit(-)						
Cypress	-384	-384	-384	-384	-384	-384
Sabine	-148	-148	-148	-148	-148	-148
Total	**-532**	**-532**	**-532**	**-532**	**-532**	**-532**

Evaluation of Potentially Feasible Water Management Strategies:

Three alternative strategies were considered to meet the Harrison County Irrigation water supply shortages as summarized in the following table. Advanced conservation and water reuse was not considered because operational procedures for the existing irrigation is not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply. New wells in the Queen City Aquifer was identified as a potentially feasible strategy for the WUG.

Strategy	**Firm Yield (AF)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation					
Water Reuse					
Groundwater Queen City Aquifer Cypress Basin	**484**	**$ 577,000**	**$ 58,000**	**$ 120**	**Minimal**
Groundwater Queen City Aquifer Sabine Basin	**161**	**$ 193,000**	**$ 19,000**	**$ 118**	**Minimal**
Surface Water					

Recommendations:

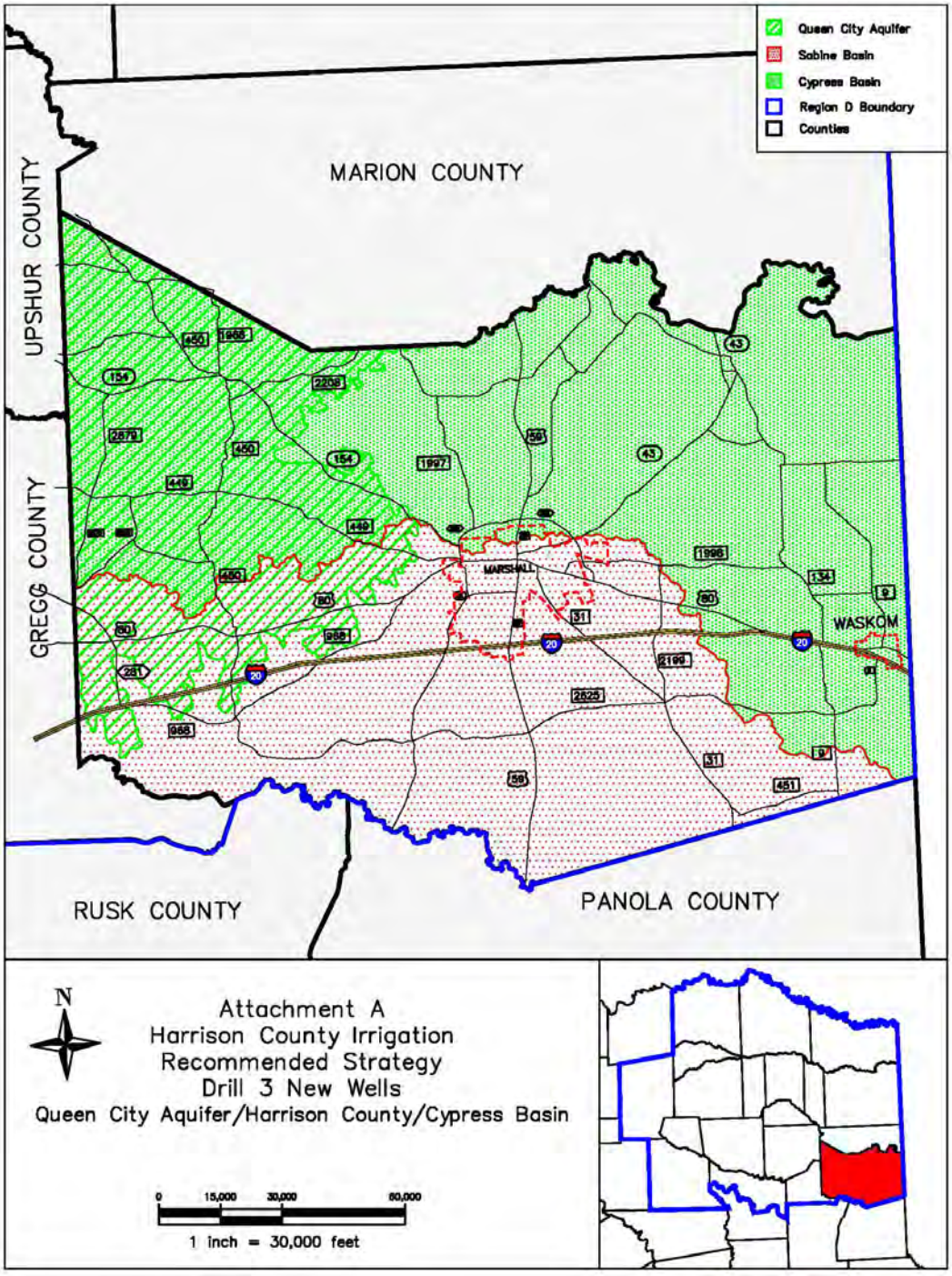
	2020	**2030**	**2040**	**2050**	**2060**	**2070**
Drill New Wells (Queen City Aquifer, Cypress Basin; ac-ft/yr)	484	484	484	484	484	484
Drill New Wells (Queen City Aquifer, Sabine Basin; ac-ft/yr)	161	161	161	161	161	161

The recommended strategy for the Harrison County Irrigation, Cypress Basin, to meet their projected deficit of 384 ac-ft/yr in 2020 through 2070 would be to construct three water wells prior to 2020 as the deficits occur. The recommended supply source will be the Queen City Aquifer in Harrison County. Three wells with rated capacity of 100 gpm each would provide approximately 161 acre-feet each or 484 ac-ft/yr.

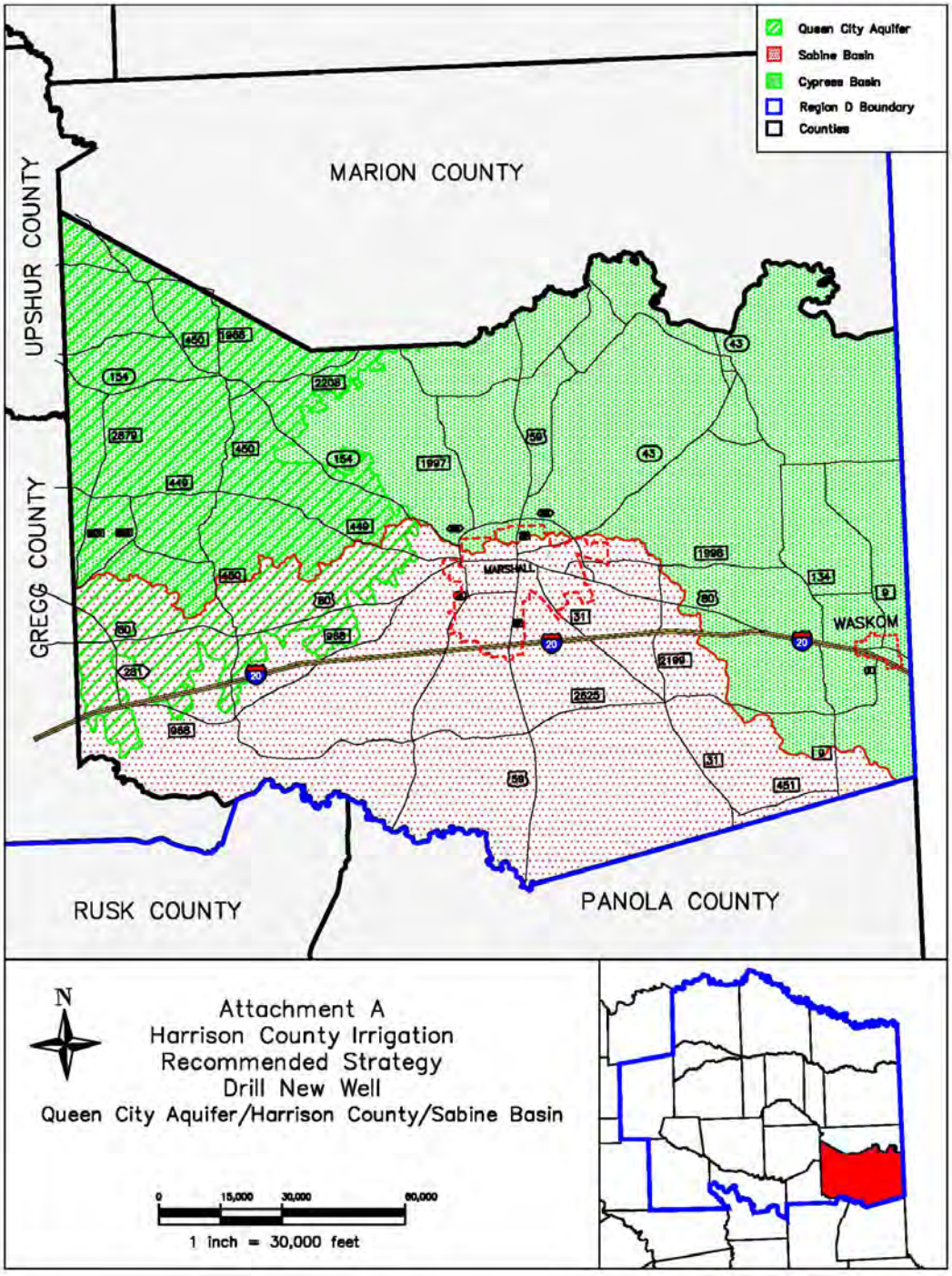
The recommended strategy for the Harrison County Irrigation, Sabine Basin, to meet their projected deficit of 148 ac-ft/yr in 2020 from 2070 would be to construct one water well prior to 2020. The recommended supply source will be the Queen City Aquifer in Harrison County Sabine. One well with rated capacity of 100 gpm each would provide approximately 161 ac-ft/yr. The Queen City Aquifer in Harrison County Sabine is projected to have a more than ample supply availability to meet the needs of the Irrigation in Harrison County for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Irrigation Harrison Cypress - Drill New Well Queen City Aquifer Harrison Cypress	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$414,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$414,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$145,000
Environmental & Archaeology Studies and Mitigation	$2,000
Land Acquisition and Surveying (2 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$16,000
TOTAL COST OF PROJECT	**$577,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$41,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$4,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (168446 kW-hr @ 0.08 $/kW-hr)	$13,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$58,000**
Available Project Yield (acft/yr)	484
Annual Cost of Water ($ per acft), based on PF=1	$120
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$35
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.37
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.11
Stanley Hayes	*10/3/2019*


Queen City Aquifer
Sabine Basin
Cypress Basin
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
MARSHALL
WASKOM
N
Attachment A
Harrison County Irrigation
Recommended Strategy
Drill 3 New Wells
Queen City Aquifer/Harrison County/Cypress Basin
0 15,000 30,000 60,000
1 inch = 30,000 feet

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Irrigation Harrison Sabine - Drill New Well Queen City Aquifer Harrison Sabine	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$138,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$138,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$48,000
Environmental & Archaeology Studies and Mitigation	$1,000
Land Acquisition and Surveying (1 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$6,000
TOTAL COST OF PROJECT	**$193,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$14,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$1,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (56149 kW-hr @ 0.08 $/kW-hr)	$4,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$19,000**
Available Project Yield (acft/yr)	161
Annual Cost of Water ($ per acft), based on PF=1	$118
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$31
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.36
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.10
Stanley Hayes	*10/3/2019*


Queen City Aquifer
Sabine Basin
Cypress Basin
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
MARSHALL
WASKOM
N
Attachment A
Harrison County Irrigation
Recommended Strategy
Drill New Well
Queen City Aquifer/Harrison County/Sabine Basin
0
15,000
30,000
60,000
1 inch = 30,000 feet

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LEIGH WATER SUPPLY CORPORATION

Description of Water User Group:

The Leigh WSC system is located in northeastern Harrison County. In 2018, the system had 1974 residential connections. The population is projected to increase from 1,852 persons in 2020 to 2,801 persons in 2070. The System is included as a W.U.G. in Harrison County. The system's current water supply consists of eight water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 809 GPM, or 435 ac-ft/yr. The system is bounded on the north by Caddo Lake WSC, on the east by the State of Louisiana, on the south by Waskom Rural WSC, and on the west by the City of Marshall and North Harrison WSC. The System does have a water conservation plan. The System is projected to have a water supply surplus of 24 ac-ft/yr in 2020 decreasing to a deficit of 21 ac-ft/yr in 2040 continuing in a decline to 159 ac-ft/yr in 2070.

Water Supply and Demand Analysis:

Cypress River Basin

	2020	2030	2040	2050	2060	2070
Population	1519	1631	1747	1910	2088	2297
Projected Water Demand	337	355	374	406	443	487
Current Water Supply	357	357	357	357	357	357
Projected Supply Surplus (+)/Deficit(-)	**20**	**2**	**-17**	**-49**	**-86**	**-130**

Sabine River Basin

	2020	2030	2040	2050	2060	2070
Population	333	358	383	419	458	504
Projected Water Demand	74	78	82	89	97	107
Current Water Supply	78	78	78	78	78	78
Projected Supply Surplus (+)/Deficit(-)	**4**	**0**	**-4**	**-11**	**-19**	**-29**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the Leigh WSC's water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcd threshold set by the planning group. Water reuse was not considered because the system does not have a sewer collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the system and surface water treatment is not economically feasible for a system of this size. Wells in the Queen City Aquifer in the Cypress Basin were identified as a potentially feasible strategy for this WUG.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**162**	**$ 1,973,000**	**$ 159,000**	**$ 981**	**Minimal**
Surface Water					

Recommendations:

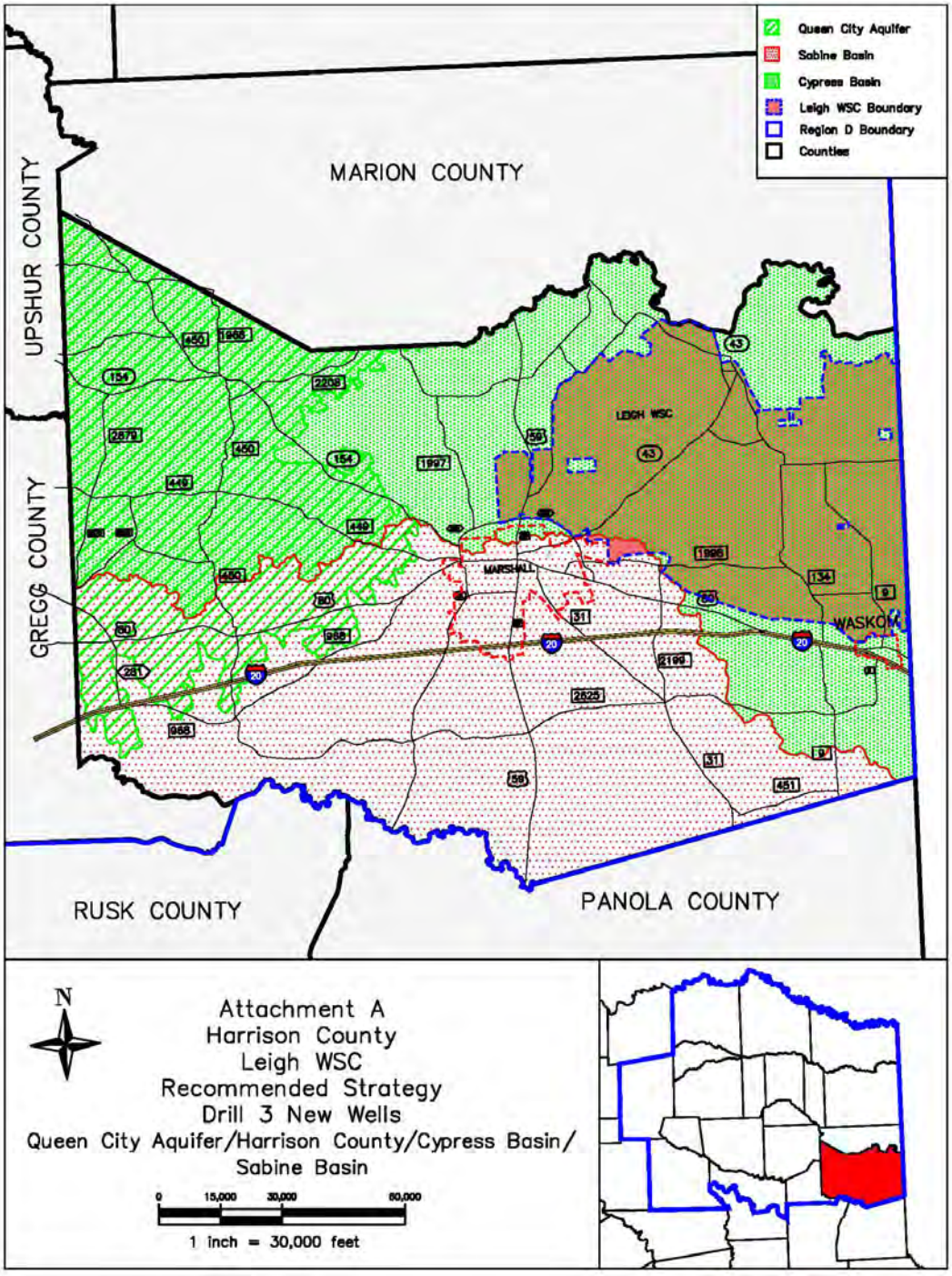
	2020	2030	2040	2050	2060	2070
Drill New Wells (Queen City Aquifer, Cypress Basin; ac-ft/yr)	0	0	54	108	108	162

The recommended strategy for Leigh WSC to meet their projected deficit of 21 ac-ft/yr in 2040 and 159 ac-ft/yr in 2070 would be to construct three additional water wells similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Harrison County Cypress. Three wells with rated capacity of 100 gpm each would provide approximately 54 acre-feet each. The Queen City Aquifer in Harrison County Cypress is projected to have a more than

ample supply availability to meet the needs of Leigh WSC for the planning period. During the planning period three wells will be drilled in the Queen City formation of the Cypress River Basin.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Leigh WSC - Drill New Well Queen City Aquifer Harrison Cypress	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$1,394,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$1,394,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$488,000
Environmental & Archaeology Studies and Mitigation	$33,000
Land Acquisition and Surveying (2 acres)	$5,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$53,000
TOTAL COST OF PROJECT	**$1,973,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$139,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$14,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (78900 kW-hr @ 0.08 $/kW-hr)	$6,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$159,000**
Available Project Yield (acft/yr)	162
Annual Cost of Water ($ per acft), based on PF=1	$981
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$123
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.01
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.38
Stanley Hayes	*10/3/2019*


Queen City Aquifer
Sabine Basin
Cypress Basin
Leigh WSC Boundary
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
LEIGH WSC
MARSHALL
WASKOM
N
Attachment A
Harrison County
Leigh WSC
Recommended Strategy
Drill 3 New Wells
Queen City Aquifer/Harrison County/Cypress Basin/
Sabine Basin
0
15,000
30,000
60,000
1 inch = 30,000 feet

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS MINING IN HARRISON COUNTY – CYPRESS

Description of Water User Group:

The Mining WUG in Harrison County is a split entity and has a total demand that is projected to be decreasing from 2,462 ac-ft/yr in 2020 to 855 ac-ft/yr in 2070. Mining in Harrison County, Cypress has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer and Queen City Aquifer, and contract with Sabine River Authority for surface water from Lake Fork. The total rated available supply from these sources is 320 ac-ft/yr in 2020 increasing to 363 ac-ft/yr in 2070. Mining in Harrison County is projected to have a water supply deficit of 205 ac-ft/yr in 2020 and increasing to a surplus of 183 ac-ft/yr in 2070 for the Harrison Cypress split.

Mining in the Harrison County Sabine split has a current water supply consisting of water wells from the Carrizo-Wilcox Aquifer, surface water from Sabine Run-of-River permit, and contract with Sabine River Authority for surface water from Lake Fork. The total rated available supply from these sources is 612 ac-ft/yr in 2020 increasing to 657 ac-ft/yr in 2070. Mining in Harrison County is projected to have a water supply deficit of 1,361 ac-ft/yr in 2020 decreasing to a deficit of 18 ac-ft/yr in 2070 for the Sabine split.

Water Supply and Demand Analysis:

Mining Harrison	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Projected Water Demand						
Cypress	525	437	366	297	229	180
Sabine	1,973	1,640	1,374	1,115	859	675
Total	**2,462**	**2,077**	**1,740**	**1,412**	**1,088**	**855**
Current Water Supply						
Cypress	320	329	337	346	353	363
Sabine	612	621	631	640	648	657
Total	**932**	**950**	**968**	**986**	**1,001**	**1,020**
Projected Supply Surplus (+)/Deficit(-)						
Cypress	-205	-108	-29	49	124	183
Sabine	-1,361	-1,019	-743	-475	-211	-18
Total	**-1,566**	**-1,127**	**-772**	**-426**	**-87**	**165**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the Harrison County Mining water supply shortages as summarized in the following table. Advanced conservation and water reuse was not considered because operational procedures for the existing mines is not available. Surface water alternatives were omitted since there is not a supply source within close proximity to the county with available supply. Wells in the Queen City Aquifer (portions in the Cypress Creek and Sabine River basins) were identified and evaluated as a potentially feasible strategy for the WUG.

Strategy	**Firm Yield (AF)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation					
Water Reuse					
Groundwater Queen City Aquifer Cypress Basin	**332**	**$ 384,000**	**$ 39,000**	**$ 117**	**Minimal**
Groundwater Queen City Aquifer Sabine Basin	**1,452**	**$1,555,000**	**$ 183,00**	**$ 126**	**Minimal**
Surface Water					

Recommendations:

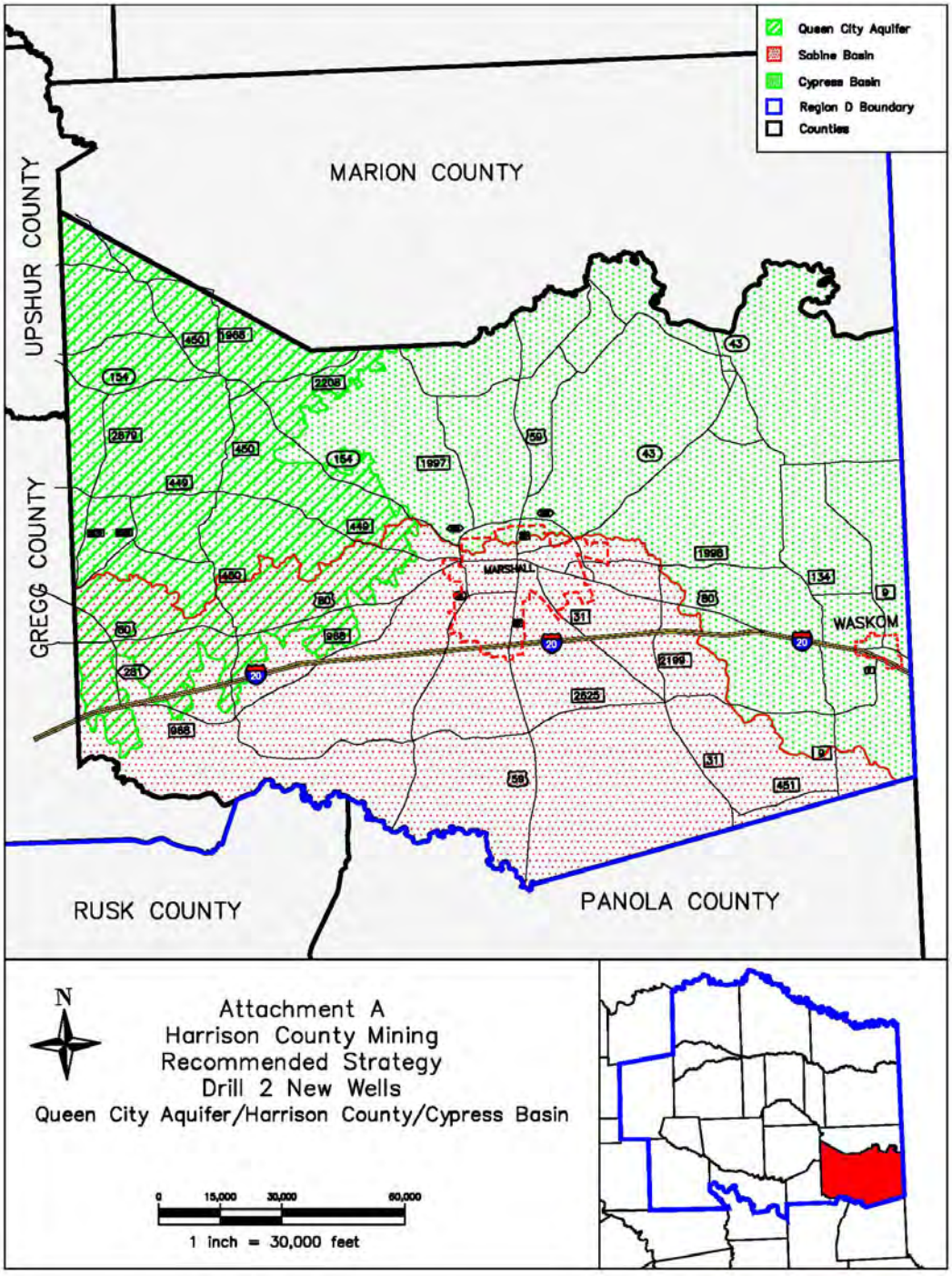
	2020	2030	2040	2050	2060	2070
Drill New Wells (Queen City Aquifer Cypress Basin; ac-ft/yr)	332	332	332	332	332	332
Drill New Wells (Queen City Aquifer Sabine Basin; ac-ft/yr)	1,452	1,452	1,452	1,452	1,452	1,452

The recommended strategy for the Harrison County Mining, Cypress Basin, to meet their projected deficit of 205 ac-ft/yr in 2020 and 29 ac-ft/yr in 2040 would be to construct two additional water wells similar to their existing wells just prior to each decade as the deficits occur to 2040. The recommended supply source will be the Queen City Aquifer in Harrison County Cypress. Two wells with rated capacity of 100 gpm each would provide approximately 161 acre-feet each or 332 ac-ft/yr.

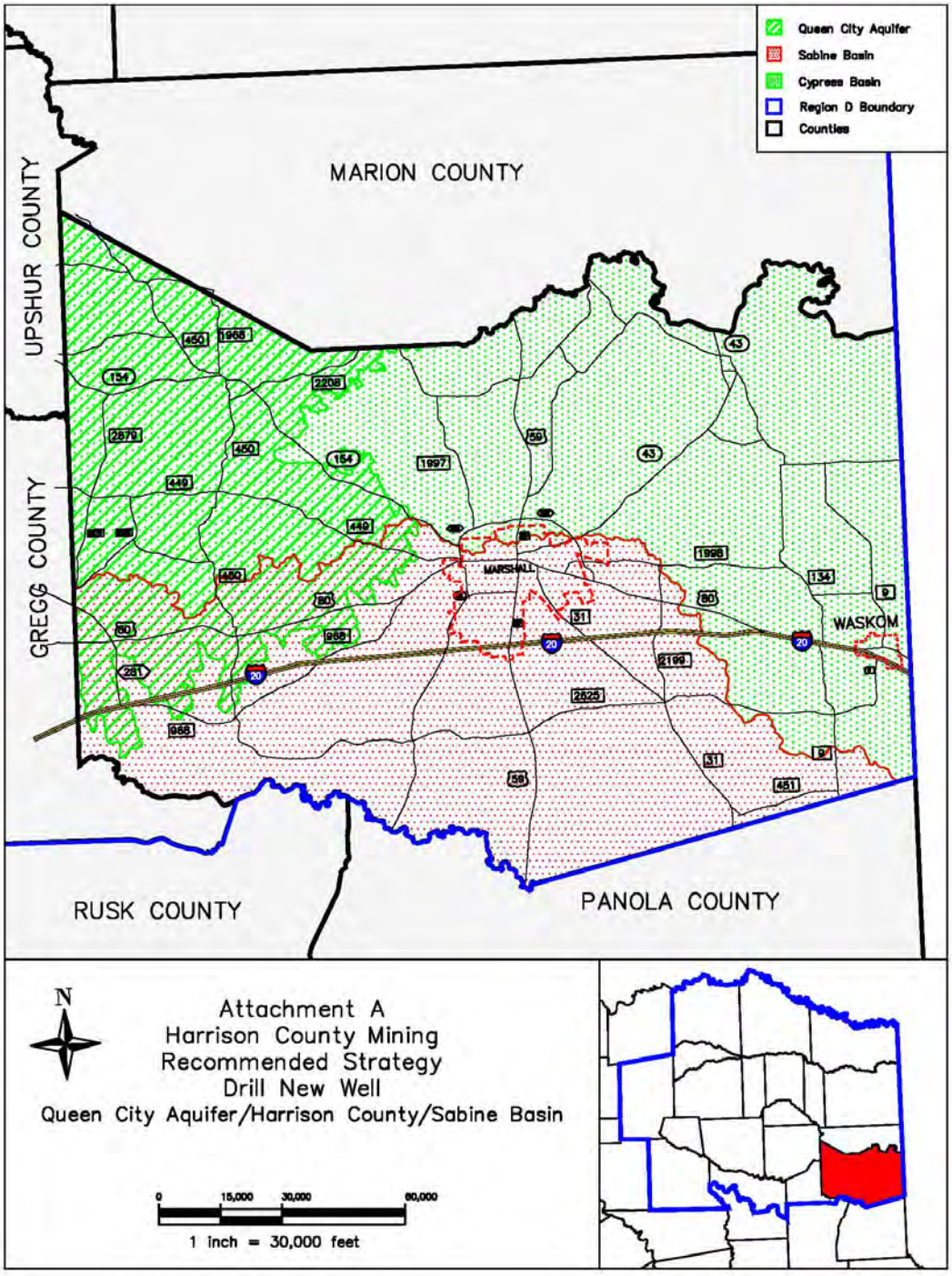
The recommended strategy for the Harrison County Mining, Sabine Basin, to meet their projected deficit of 1,361 ac-ft/yr in 2020 would be to construct one additional water well similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Harrison County Sabine. Nine wells with rated capacity of 100 gpm each would provide approximately 161 acre-feet each or 1,452 ac-ft/yr. The Queen City Aquifer in Harrison County Sabine is projected to have a more than ample supply availability to meet the needs of the Mining in Harrison County for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Mining Harrison Cypress - Drill New Well Queen City Aquifer Harrison Cypress	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
#NAME?	#NAME?
Transmission Pipeline (6 in dia., miles)	#NAME?
Transmission Pump Station(s) & Storage Tank(s)	#NAME?
Well Fields (Wells, Pumps, and Piping)	#NAME?
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	#NAME?
Advanced Water Treamtent Facility (MGD)	#NAME?
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**#NAME?**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	#NAME?
Environmental & Archaeology Studies and Mitigation	$1,000
Land Acquisition and Surveying (1 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	#NAME?
TOTAL COST OF PROJECT	**#NAME?**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	#NAME?
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	#NAME?
Intakes and Pump Stations (2.5% of Cost of Facilities)	#NAME?
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	#NAME?
Advanced Water Treatment Facility	#NAME?
#NAME?	#NAME?
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**#NAME?**
Available Project Yield (acft/yr)	332
Annual Cost of Water ($ per acft), based on PF=1	$0
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$0
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.00
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.00
Stanley Hayes	*10/3/2019*


Queen City Aquifer
Sabine Basin
Cypress Basin
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
MARSHALL
WASKOM
N
Attachment A
Harrison County Mining
Recommended Strategy
Drill 2 New Wells
Queen City Aquifer/Harrison County/Cypress Basin
0 15,000 30,000 60,000
1 inch = 30,000 feet

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Mining Harrison Sabine - Drill New Well Queen City Aquifer Harrison Sabine	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$1,118,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$1,118,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$391,000
Environmental & Archaeology Studies and Mitigation	$4,000
Land Acquisition and Surveying (5 acres)	$0
Interest During Construction (3% for 1 years with a 0.5% ROI)	$42,000
TOTAL COST OF PROJECT	**$1,555,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$109,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$11,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (782434 kW-hr @ 0.08 $/kW-hr)	$63,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$183,000**
Available Project Yield (acft/yr)	1,452
Annual Cost of Water ($ per acft), based on PF=1	$126
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$51
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$0.39
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.16
Stanley Hayes	*10/4/2019*


Queen City Aquifer
Sabine Basin
Cypress Basin
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
MARSHALL
WASKOM
N
Attachment A
Harrison County Mining
Recommended Strategy
Drill New Well
Queen City Aquifer/Harrison County/Sabine Basin
0
15,000
30,000
60,000
1 inch = 30,000 feet

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE NORTH HARRISON WSC

Description of Water User Group:

The North Harrison WSC is located in north central Harrison County and serves the community of Woodlawn and an area immediately north of the City of Marshall. In 2018, the system had 505 residential connections. The population is projected to increase from 1,374 persons in 2020 to 2,078 persons in 2070. The City is included as a W.U.G. in Harrison County. The system's current water supply consists of three water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 300 GPM, or 161 ac-ft/yr. The system is bounded on the north by Harleton WSC, on the east by Leigh WSC, on the south by the City of Marshall, and on the west by the Cypress Valley WSC. The WSC does not have a water conservation plan. North Harrison WSC is projected to have a water supply surplus of 20 ac-ft/yr in 2020 decreasing to a deficit of 32 ac-ft/yr in 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Population	1374	1475	1580	1727	1889	2078
Projected Water Demand	141	145	150	161	176	196
Current Water Supply	161	161	161	161	161	161
Projected Supply Surplus (+)/Deficit (-)	**20**	**16**	**11**	**0**	**-15**	**-32**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the North Harrison WSC water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcpd threshold set by the planning group. Water reuse was not considered because the WSC does not have a sewer collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the WSC and surface water treatment is not economically feasible for a system of this size. Groundwater wells in the Queen City Aquifer (Cypress Creek Basin) were identified as a potentially feasible strategy for the WUG.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**54**	**$ 612,000**	**$ 50,000**	**$ 926**	**Minimal**
Surface Water					

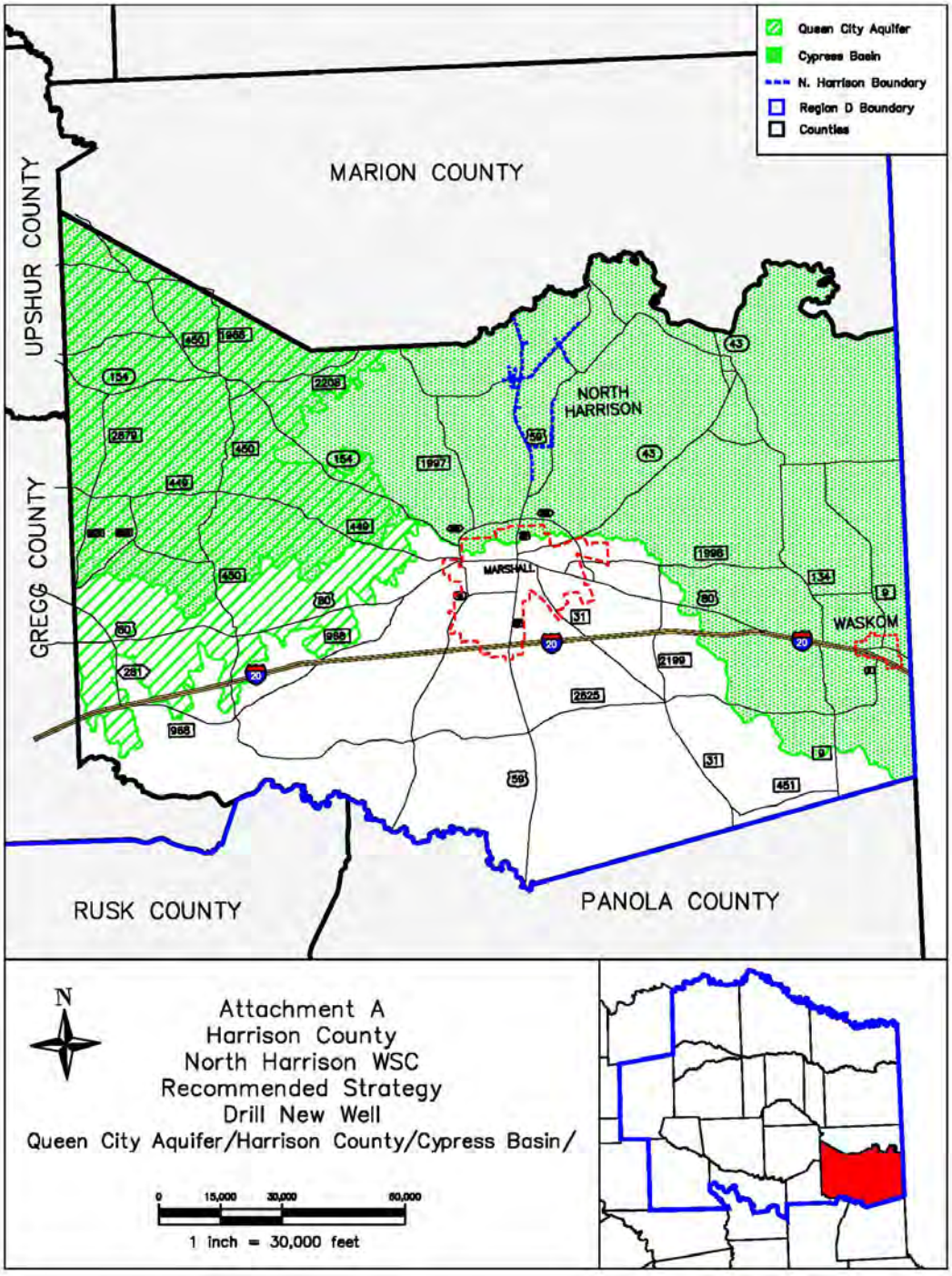
Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Queen City Aquifer, Cypress Basin; ac-ft/yr)	0	0	0	0	54	54

The recommended strategy for the North Harrison WSC to meet their projected deficit of 15 ac-ft/yr in 2060 and 32 ac-ft/yr in 2070 would be to construct one additional water well similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Harrison County Cypress. One well with rated capacity of 100 gpm each would provide approximately 54 acre-feet. The Queen City Aquifer in Harrison County Cypress is projected to have a more than ample supply availability to meet the needs of the North Harrison WSC for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
North Harrison WSC - Drill New Well Queen City Aquifer Harrison Cypress	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$431,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$431,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$151,000
Environmental & Archaeology Studies and Mitigation	$11,000
Land Acquisition and Surveying (1 acres)	$2,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$17,000
TOTAL COST OF PROJECT	**$612,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$43,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$4,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (38784 kW-hr @ 0.08 $/kW-hr)	$3,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$50,000**
Available Project Yield (acft/yr)	54
Annual Cost of Water ($ per acft), based on PF=1	$926
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$130
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.84
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.40
Stanley Hayes	*9/30/2019*


Queen City Aquifer
Cypress Basin
N. Harrison Boundary
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
NORTH HARRISON
MARSHALL
WASKOM
N
Attachment A
Harrison County
North Harrison WSC
Recommended Strategy
Drill New Well
Queen City Aquifer/Harrison County/Cypress Basin/
0 15,000 30,000 60,000
1 inch = 30,000 feet

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE PANOLA BETHANY WSC

Description of Water User Group:

The Panola Bethany WSC is located in southeastern Harrison County and serves the communities of Panola and Bethany an area northeast of the City of Carthage. In 2018, the system had 545 residential connections. The population is projected to increase from 1,508 persons in 2020 to 3,407 persons in 2070. The WSC is included as a W.U.G. in Harrison County. The system's current water supply consists of five water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 576 GPM, or 310 ac-ft/yr. The system is bounded on the north by Waskom Rural WSC, on the east by the State of Louisiana, on the south by the Deadwood WSC, and on the west by the City of Carthage. The WSC has a water conservation plan. Panola Bethany WSC is projected to have a water supply surplus of 12 ac-ft/yr in 2020 decreasing to a deficit of 332 ac-ft/yr in 2070.

Water Supply and Demand Analysis:

Panola Bethany WSC Harrison Cypress	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Population	142	166	202	254	289	321
Projected Water Demand	28	32	38	48	54	60
Current Water Supply	29	29	29	29	29	29
Projected Supply Surplus (+)/Deficit(-)	**1**	**-3**	**-9**	**-19**	**-25**	**-31**

Panola Bethany WSC Harrison Sabine	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Population	1274	1488	1813	2278	2593	2875
Projected Water Demand	253	288	345	430	489	542
Current Water Supply	262	262	262	262	262	262
Projected Supply Surplus (+)/Deficit(-)	**9**	**-26**	**-83**	**-168**	**-227**	**-280**

Panola Bethany WSC Panola Sabine	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Population	92	111	134	169	192	211
Projected Water Demand	18	21	25	32	36	40
Current Water Supply	19	19	19	19	19	19
Projected Supply Surplus (+)/Deficit(-)	**1**	**-2**	**-6**	**-13**	**-17**	**-21**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the Panola Bethany WSC water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcpd threshold set by the planning group. Water reuse was not considered because the WSC does not have a sewer collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the WSC and surface water treatment is not economically feasible for a system of this size. Groundwater wells in the Queen City Aquifer (Sabine Basin) were identified as a potentially feasible strategy for the WUG.

Strategy	**Firm Yield (AF)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation					
Water Reuse					
Groundwater	**336**	**$ 2,399,000**	**$ 195,000**	**$ 580**	**Minimal**
Surface Water					

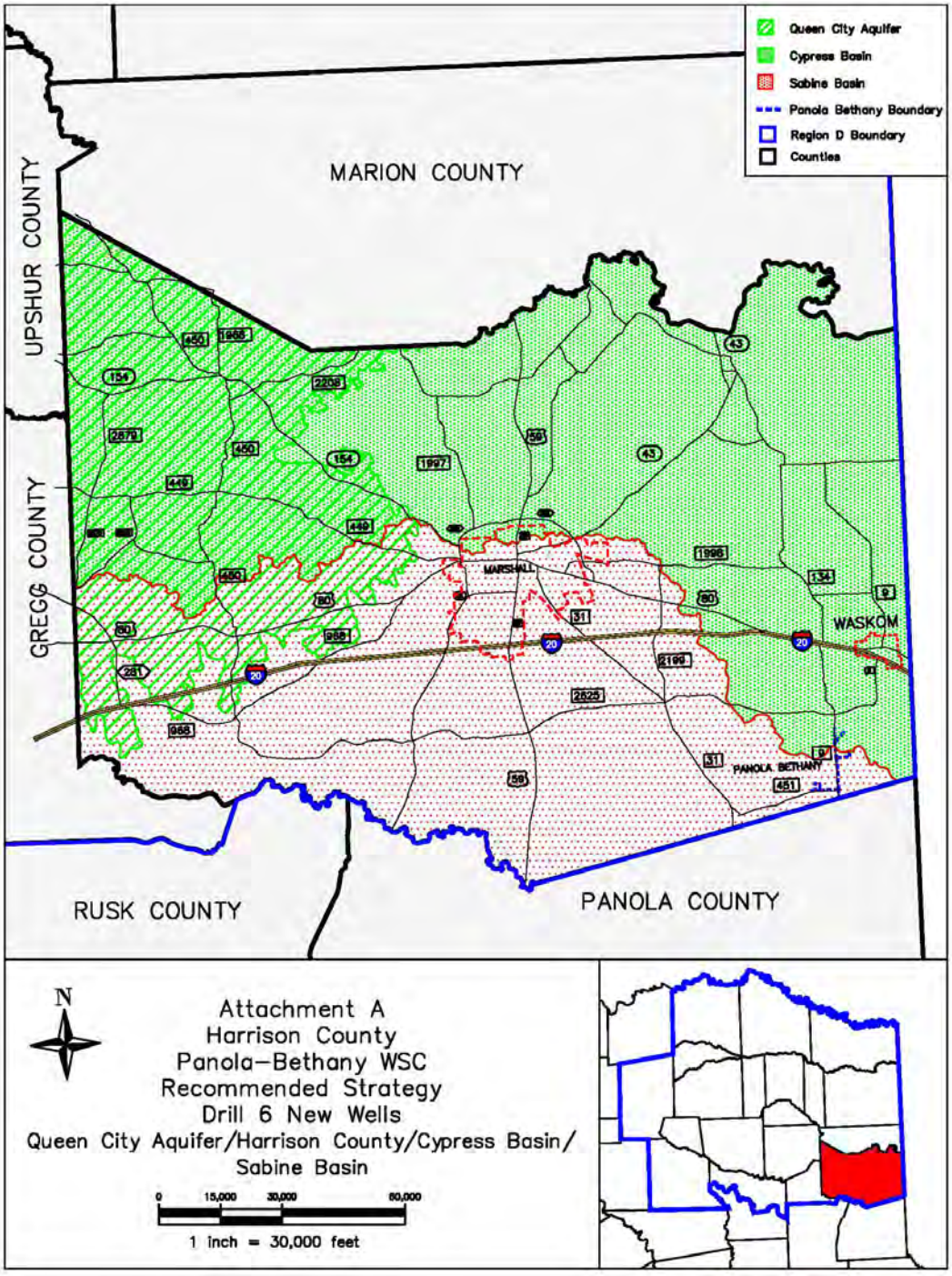
Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Queen City Aquifer, Sabine Basin; ac-ft/yr)	0	56	112	224	280	336

The recommended strategy for the Panola Bethany WSC to meet their projected deficit of 31 ac-ft/yr in 2030 and 332 ac-ft/yr in 2070 would be to construct six additional water wells similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Harrison County Sabine. One well with rated capacity of 105 gpm each would provide approximately 56 acre-feet each or 336 ac-ft/yr total. The Queen City Aquifer in Harrison County Sabine is projected to have a more than ample supply availability to meet the needs of the Panola Bethany WSC for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Panola Bethany WSC - Drill New Well Queen City Aquifer Harrison Sabine	
Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$1,745,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$1,745,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$611,000
Environmental & Archaeology Studies and Mitigation	$13,000
Land Acquisition and Surveying (3 acres)	$11,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$66,000
TOTAL COST OF PROJECT	**$2,446,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$172,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$17,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (116962 kW-hr @ 0.08 $/kW-hr)	$9,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$198,000**
Available Project Yield (acft/yr)	336
Annual Cost of Water ($ per acft), based on PF=1	$589
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$77
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.81
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.24
Stanley Hayes	*9/29/2019*


Queen City Aquifer
Cypress Basin
Sabine Basin
Panola Bethany Boundary
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
MARSHALL
WASKOM
PANOLA BETHANY
N
Attachment A
Harrison County
Panola-Bethany WSC
Recommended Strategy
Drill 6 New Wells
Queen City Aquifer/Harrison County/Cypress Basin/
Sabine Basin
0 15,000 30,000 60,000
1 inch = 30,000 feet

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE CITY OF SCOTTSVILLE

Description of Water User Group:

The City of Scottsville is located in southeastern Harrison County and serves the incorporated city limits and an area immediately north, east, and south of the City of Scottsville. In 2018, the system had 480 residential connections. The population is projected to increase from 1,141 persons in 2020 to 1,727 persons in 2070. The City is included as a WUG. in Harrison County. The system's current water supply consists of three water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 402 GPM, or 216 ac-ft/yr. The system is bounded on the east by the Waskom Rural Water WSC #1, on the south by Blocker Crossroads WSC, on the west by the City of Marshall, and the north by Leigh WSC. The City does not have a water conservation plan. The City of Scottsville is projected to have a water supply deficit of 31 ac-ft/yr in 2020 increasing to a deficit of 141 ac-ft/yr in 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Population	1141	1227	1314	143	1570	1727
Projected Water Demand	247	260	274	298	325	357
Current Water Supply	216	216	216	216	216	216
Projected Supply Surplus (+)/Deficit(-)	**-31**	**-44**	**-58**	**-82**	**-109**	**-141**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the City of Waskom water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcpd threshold set by the planning group. Water reuse was not considered because the City does not have a central sewer collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the City and surface water treatment is not economically feasible for a system of this size. Wells in the Queen City Aquifer (Cypress Basin) in Harrison County were identified as a potentially feasible strategy for the WUG.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**162**	**$ 1,429,000**	**$ 116,000**	**$ 716**	**1**
Surface Water					

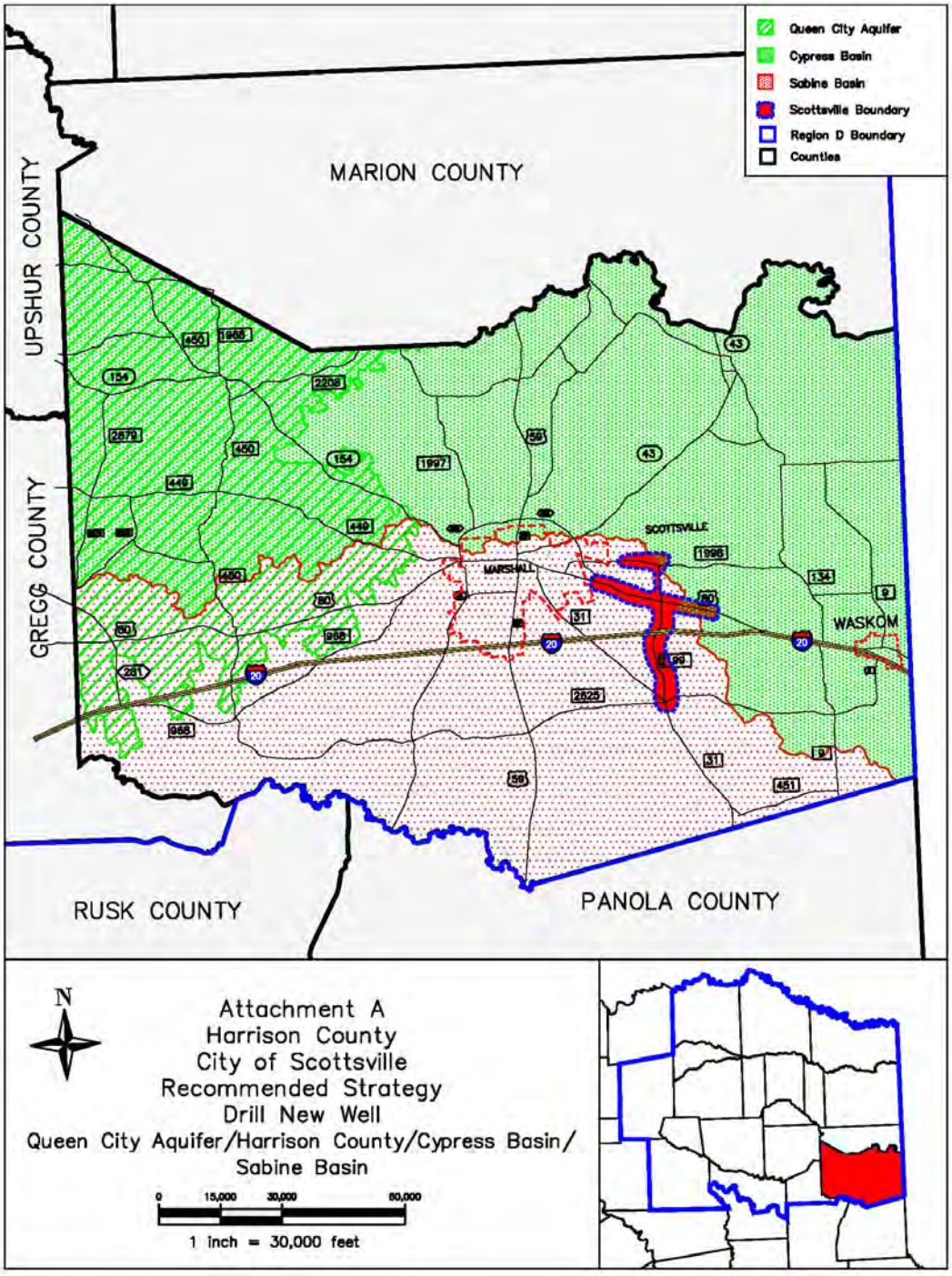
Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Queen City Aquifer, Cypress Basin; ac-ft/yr)	54	54	108	108	162	162

The recommended strategy for the City of Scottsville to meet their projected deficit of 31 ac-ft/yr in 2020 and 141 ac-ft/yr in 2070 would be to construct one additional water well similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Harrison County Cypress. Three wells with rated capacity of 100 gpm each would provide approximately 54 acre-feet each or 162 ac-ft/yr. The Queen City Aquifer in Harrison County Cypress is projected to have a more than ample supply availability to meet the needs of the City of Scottsville for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
Scottsville - Drill New Well Queen City Aquifer Harrison Sabine	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$1,001,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$1,001,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$350,000
Environmental & Archaeology Studies and Mitigation	$34,000
Land Acquisition and Surveying (2 acres)	$5,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$39,000
TOTAL COST OF PROJECT	**$1,429,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$101,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$10,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (56392 kW-hr @ 0.08 $/kW-hr)	$5,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$116,000**
Available Project Yield (acft/yr)	162
Annual Cost of Water ($ per acft), based on PF=1	$716
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$93
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.20
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.28
Stanley Hayes	*9/29/2019*


Queen City Aquifer
Cypress Basin
Sabine Basin
Scottsville Boundary
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
SCOTTSVILLE
MARSHALL
WASKOM
N
Attachment A
Harrison County
City of Scottsville
Recommended Strategy
Drill New Well
Queen City Aquifer/Harrison County/Cypress Basin/
Sabine Basin
0 15,000 30,000 60,000
1 inch = 30,000 feet

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE CITY OF WASKOM

Description of Water User Group:

The City of Waskom is located in southeastern Harrison County and serves the incorporated city limits and an area immediately north, east, and south of the City of Waskom. In 2018, the system had 1,526 residential connections. The population is projected to increase from 2,924 persons in 2020 to 4,424 persons in 2070. The City is included as a W.U.G. in Harrison County. The system's current water supply consists of nine water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 631 GPM, or 339 ac-ft/yr. The system is bounded on the east, south, and west by the Waskom Rural Water WSC #1. The City does not have a water conservation plan. The City of Waskom is projected to have a water supply deficit of 96 ac-ft/yr in 2020 increasing to a deficit of 275 ac-ft/yr in 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Population	2924	3141	3365	3678	4020	4424
Projected Water Demand	435	453	475	512	559	614
Current Water Supply	339	339	339	339	339	339
Projected Supply Surplus (+)/Deficit(-)	**-96**	**-114**	**-136**	**-173**	**-220**	**-275**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the City of Waskom water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcd threshold set by the planning group. Water reuse was not considered because the City does not have a demand for non-potable water. Surface water alternatives were omitted since there is not a supply source within close proximity to the City and surface water treatment is not economically feasible for a system of this size. Groundwater wells in the Queen City Aquifer (Cypress Creek Basin) were identified as a potentially feasible strategy for the WUG.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**324**	**$ 2,399,000**	**$ 195,000**	**$ 602**	**Minimal**
Surface Water					

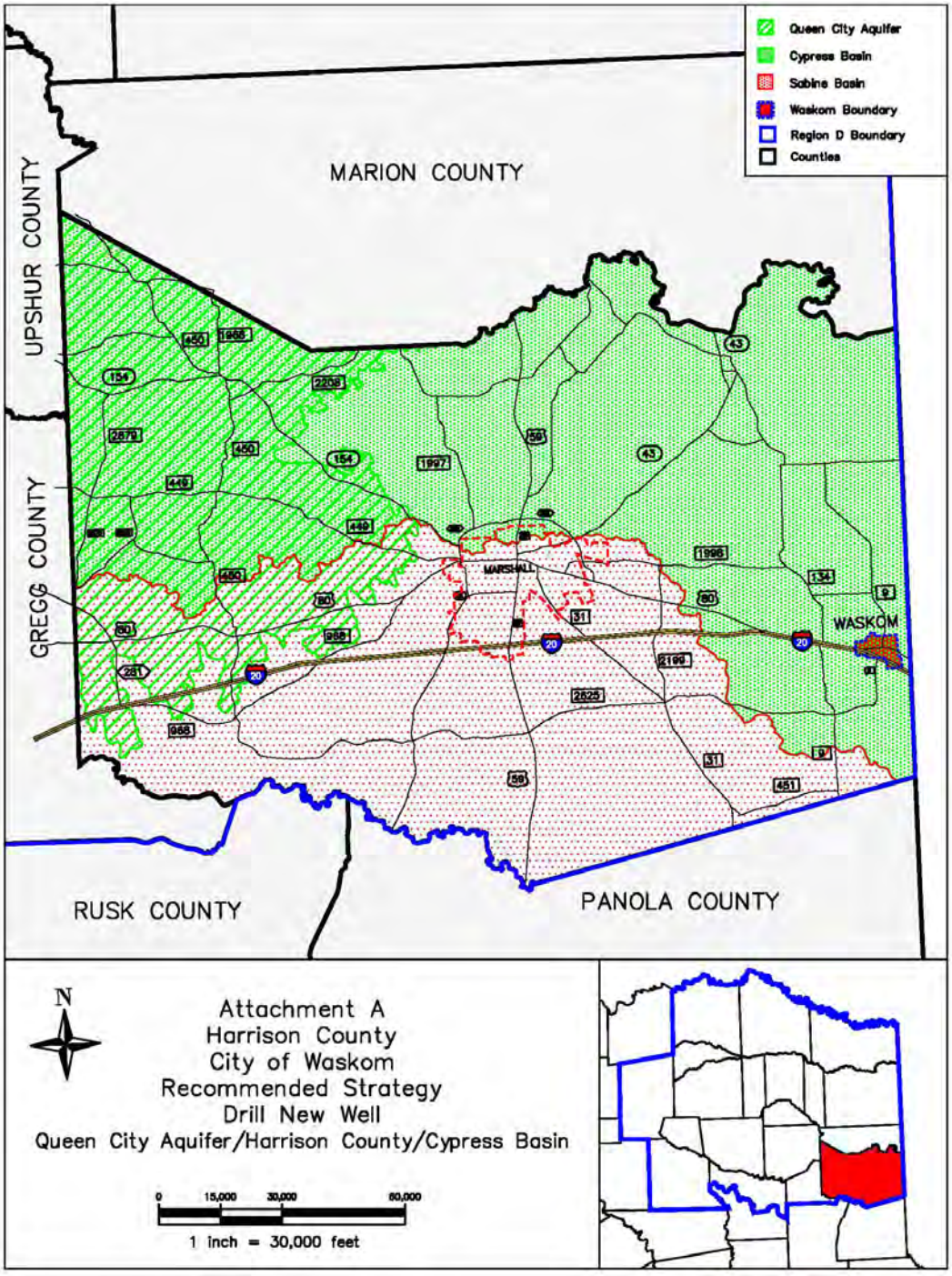
Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Queen City Aquifer, Cypress Creek Basin; ac-ft/yr)	108	162	162	216	270	324

The recommended strategy for the City of Waskom to meet their projected deficit of 96 ac-ft/yr in 2020 and 275 ac-ft/yr in 2070 would be to construct one additional water well similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Queen City Aquifer in Harrison County Cypress. Six wells with rated capacity of 100 gpm each would provide approximately 54 acre-feet each or 324 ac-ft/yr. The Queen City Aquifer in Harrison County Cypress is projected to have a more than ample supply availability to meet the needs of the City of Waskom for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.

Cost Estimate Summary *Water Supply Project Option* *September 2018 Prices*	
City of Waskom - Drill New Well Queen City Aquifer Harrison Cypress	
Cost based on ENR CCI 11170.28 for September 2018 and	
a PPI of 202.4 for September 2018	
Item	***Estimated Costs for Facilities***
CAPITAL COST	
Dam and Reservoir (Conservation Pool acft, acres)	$0
Off-Channel Storage/Ring Dike (Conservation Pool acft, acres)	$0
Terminal Storage (Conservation Pool acft, acres)	$0
Primary Pump Station (0 MGD)	$0
Transmission Pipeline (6 in dia., miles)	$0
Transmission Pump Station(s) & Storage Tank(s)	$0
Well Fields (Wells, Pumps, and Piping)	$1,711,000
Storage Tanks (Other Than at Booster Pump Stations)	$0
Water Treatment Plant (0 MGD)	$0
Advanced Water Treamtent Facility (MGD)	$0
Conservation (Leaking Pipe/Meter Replacement)	$0
Integration, Relocations, & Other	$0
TOTAL COST OF FACILITIES	**$1,711,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$599,000
Environmental & Archaeology Studies and Mitigation	$13,000
Land Acquisition and Surveying (3 acres)	$11,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$65,000
TOTAL COST OF PROJECT	**$2,399,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$169,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$17,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (112785 kW-hr @ 0.08 $/kW-hr)	$9,000
Purchase of Water (acft/yr @ $/acft)	$0
TOTAL ANNUAL COST	**$195,000**
Available Project Yield (acft/yr)	324
Annual Cost of Water ($ per acft), based on PF=1	$602
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$80
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$1.85
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$0.25
Stanley Hayes	*10/4/2019*


Queen City Aquifer
Cypress Basin
Sabine Basin
Waskom Boundary
Region D Boundary
Counties
MARION COUNTY
UPSHUR COUNTY
GREGG COUNTY
RUSK COUNTY
PANOLA COUNTY
MARSHALL
WASKOM
N
Attachment A
Harrison County
City of Waskom
Recommended Strategy
Drill New Well
Queen City Aquifer/Harrison County/Cypress Basin
0 15,000 30,000 60,000
1 inch = 30,000 feet

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2070

HOPKINS COUNTY

WUGs:

Brinker WSC
City of Cumby
Hopkins County Irrigation
Hopkins County Livestock
Martin Springs WSC
Miller Grove WSC
Hopkins County Mining

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF BRINKER WATER SUPPLY CORPORATION IN HOPKINS COUNTY

Description of Water User Group:

Brinker WSC provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2050. The WUG population is projected to be 2,369 by 2020 and increases to 4,198 by 2070. The WSC utilizes groundwater from the Carrizo-Wilcox aquifer and has a contract for water supply with City of Sulphur Springs for 77 ac-ft/yr. Brinker WSC is projected to have a deficit of 12 ac-ft in 2050, increasing to a deficit of 83 ac-ft by 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Population	2,369	2,737	3,071	3,456	3,825	4,198
Projected Water Demand	253	281	307	341	377	413
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	329	328	328	329	330	330
Projected Supply Surplus (+) / Deficit (-)	**76**	**47**	**21**	**-12**	**-47**	**-83**

Evaluation of Potentially Feasible Water Management Strategies:

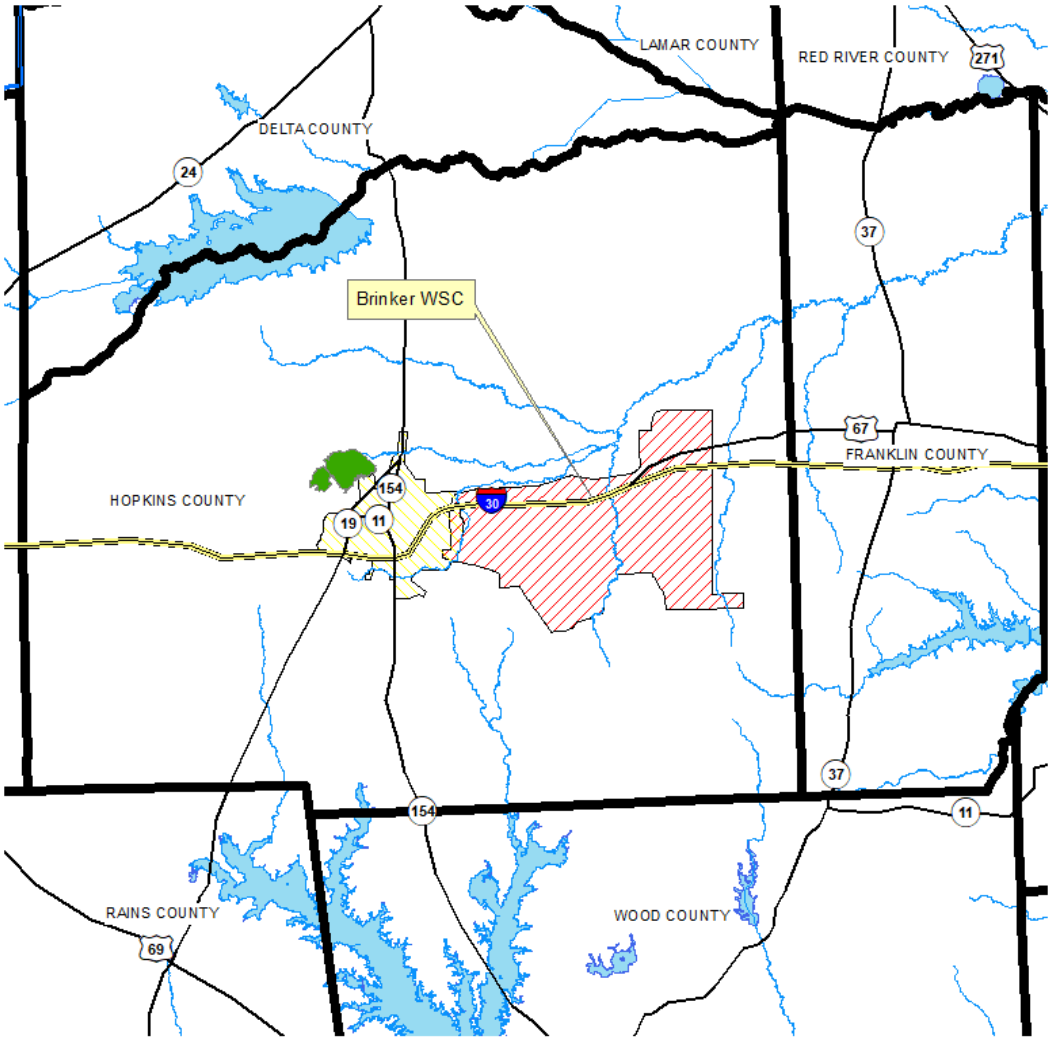
Five alternative strategies considered to meet the WSC's water supply shortages. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Additional use of groundwater has been identified as a likely source of water for Brinker WSC in Hopkins County; however, projected needs exceed the availability of groundwater in the Sulphur basin based on the modeled available groundwater (MAG) estimates and review of available information from a local hydrogeological assessment. A potential regionalization strategy is the Wood County Pipeline. Purchase of additional surface water from Sulphur Springs Lake under the existing contract from the City of Sulphur Springs was also considered.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Drill New Wells (Carrizo-Wilcox, Sulphur Basin)	**83**	**$1,405,000**	**$175,000**	**$2,108**	**1**
Increase Existing Contract w/ Sulphur Springs	**83**	**$0**	**$95,000**	**$1,145**	**1**
Wood County Pipeline	**83**	**$3,567,000**	**$409,000**	**$4,928**	**2**

Recommendations:

	2020	2030	2040	2050	2060	2070
Increase Existing Contract (ac-ft/yr)	0	0	0	12	47	83

To meet the identified needs for Brinker WSC, the recommended strategy is to increase the existing surface water contract from the City of Sulphur Springs prior to 2050.



Attachment A

Brinker WSC
Recommended Strategy
Increase Existing Contract (Sulphur Springs)

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Brinker WSC - Increase Contract w/ Sulphur Springs

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (83 acft/yr @ 1150.25 $/acft)	$95,000
TOTAL ANNUAL COST	**$95,000**
Available Project Yield (acft/yr)	83
Annual Cost of Water ($ per acft), based on PF=1	$1,145
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$1,145
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.51
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$3.51

JMP *9/30/2019*

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF CUMBY

Description of Water User Group:

The City of Cumby provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2020. The WUG population is projected to be 1,044 by 2020 and increases to 1,755 by 2070. The City of Cumby utilizes groundwater from the Nacatoch aquifer through 4 wells with a combined production capacity of 223 gpm. The City of Cumby is projected to have a deficit of 13 ac-ft in 2020 and increasing to a deficit of 88 ac-ft by 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Population	1,044	1,212	1,363	1,496	1,660	1,755
Projected Water Demand	133	149	164	178	197	208
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	120	120	120	120	120	120
Projected Supply Surplus (+) / Deficit (-)	**-13**	**-29**	**-44**	**-58**	**-77**	**-88**

Projected Supply Surplus (+) / Deficit (-) by Basin	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Sabine	-13	-27	-41	-54	-71	-81
Sulphur	0	-2	-3	-4	-6	-7
Total	**-13**	**-29**	**-44**	**-58**	**-77**	**-88**

Evaluation of Potentially Feasible Water Management Strategies:

There were five alternative strategies considered to meet the WSC's water supply shortages. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. The system is not presently large enough to treat surface water in a cost-effective manner. Additional groundwater from the Nacatoch Aquifer has been considered as a potential water management strategy. A potential regionalization strategy considered is the Wood County Pipeline where in the city could construct an eleven (11) mile long 8-inch diameter waterline that ties into a branch of the Wood County Pipeline near Sulphur Springs.

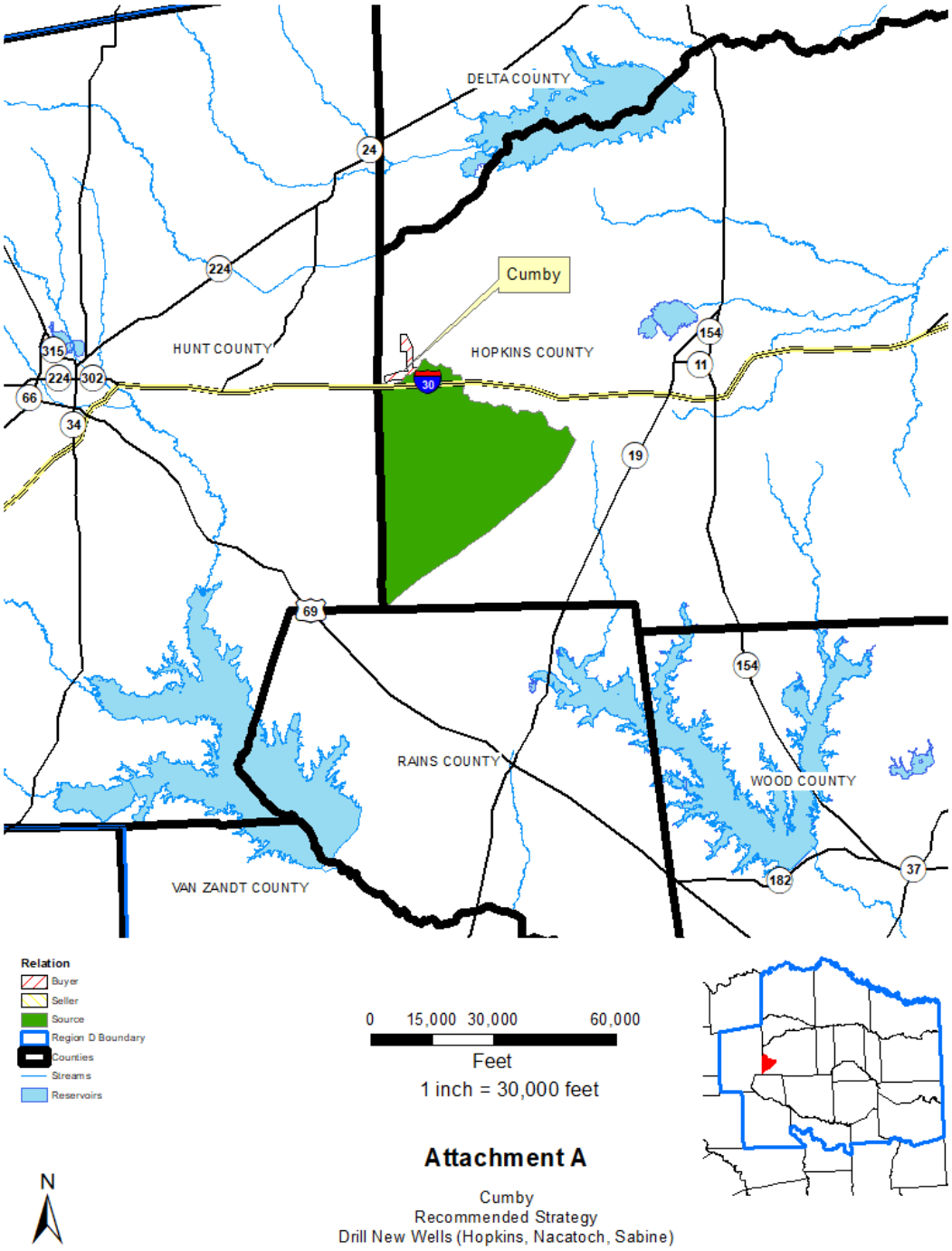
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Drill New Wells (Nacatoch Aquifer, Sabine Basin, Hopkins County)	**88**	**$938,000**	**$142,000**	**$1,614**	**1**
Wood County Pipeline	**88**	**$4,809,000**	**$511,000**	**$5,807**	**2**

Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Nacatoch Aquifer, Sabine Basin, Hopkins County; ac-ft/yr)	13	29	44	58	77	88

The recommended strategy for the City of Cumby to meet their projected deficit of 13 ac-ft/yr in 2020 and 88 ac-ft/yr in 2070 would be to construct two additional water wells similar to their existing wells just prior

to the decade as the deficits occur. The recommended supply source will be the Nacatoch Aquifer in Hopkins County, Sabine River Basin. A well operating at an average of 85 gpm is capable of delivering 46 ac-ft per year per well. The Nacatoch Aquifer in Hopkins County, Sabine River Basin, is projected to have sufficient supply availability to meet the needs of the City of Cumby for the planning period.



Attachment A

Cumby
Recommended Strategy
Drill New Wells (Hopkins, Nacatoch, Sabine)

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Cumby - Drill New Wells (Hopkins, Nacatoch Aquifer, Sabine Basin)

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$626,000
Water Treatment Plant (0.2 MGD)	$33,000
TOTAL COST OF FACILITIES	**$659,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$231,000
Environmental & Archaeology Studies and Mitigation	$15,000
Land Acquisition and Surveying (2 acres)	$7,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$26,000
TOTAL COST OF PROJECT	**$938,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$66,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$6,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$20,000
Advanced Water Treatment Facility	$0
Pumping Energy Costs (70120 kW-hr @ 0.08 $/kW-hr)	$6,000
Purchase of Water (88 acft/yr @ 500 $/acft)	$44,000
TOTAL ANNUAL COST	**$142,000**
Available Project Yield (acft/yr)	88
Annual Cost of Water ($ per acft), based on PF=1	$1,614
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$864
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$4.95
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$2.65

JMP *9/30/2019*

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF IRRIGATION IN HOPKINS COUNTY

Description of Water User Group:

The Irrigation WUG in Hopkins County has a demand that is projected to remain constant at 4,769 ac-ft/yr for the planning period. The Irrigation WUG in Hopkins County is supplied by groundwater from the Carrizo-Wilcox Aquifer and run-of-river diversions from the Sabine and Sulphur Rivers. A deficit of 4,627 ac-ft/yr is projected to occur throughout the planning period.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Projected Water Demand	4,769	4,769	4,769	4,769	4,769	4,769
Current Water Supply	144	144	144	144	144	144
Projected Supply Surplus (+)/Deficit(-)	**-4,627**	**-4,627**	**-4,627**	**-4,627**	**-4,627**	**-4,627**

Projected Supply Surplus (+)/Deficit(-) by Basin	2020	2030	2040	2050	2060	2070
Sabine	2	2	2	2	2	2
Sulphur	-4,627	-4,627	-4,627	-4,627	-4,627	-4,627
Cypress	0	0	0	0	0	0
Total	**-4,625**	**-4,625**	**-4,625**	**-4,625**	**-4,625**	**-4,625**

Evaluation of Potentially Feasible Water Management Strategies:

Three alternative strategies were considered to meet the projected shortages for Hopkins County Irrigation. Advanced water conservation for irrigation practices was not considered, as present irrigation practices likely already incorporate many BMPs to extend water supplies, thus no additional conservation would be feasible. The use of reuse water from nearby municipalities is not considered feasible as it would not be effective to deliver reuse water to the distributed farm irrigation systems. Groundwater from the Carrizo-Wilcox and Nacatoch aquifers has been identified as a potential source of water for irrigation in Hopkins County. The construction of a pipeline to convey raw surface water from Sulphur Springs Lake purchased via the City of Sulphur Springs was also considered as a potential alternative to meet projected demands. A potential regionalization strategy that was considered is the Wood County Pipeline which the WUG could tie-in to a branch of the Wood County Pipeline routed toward Sulphur Springs, Tx.

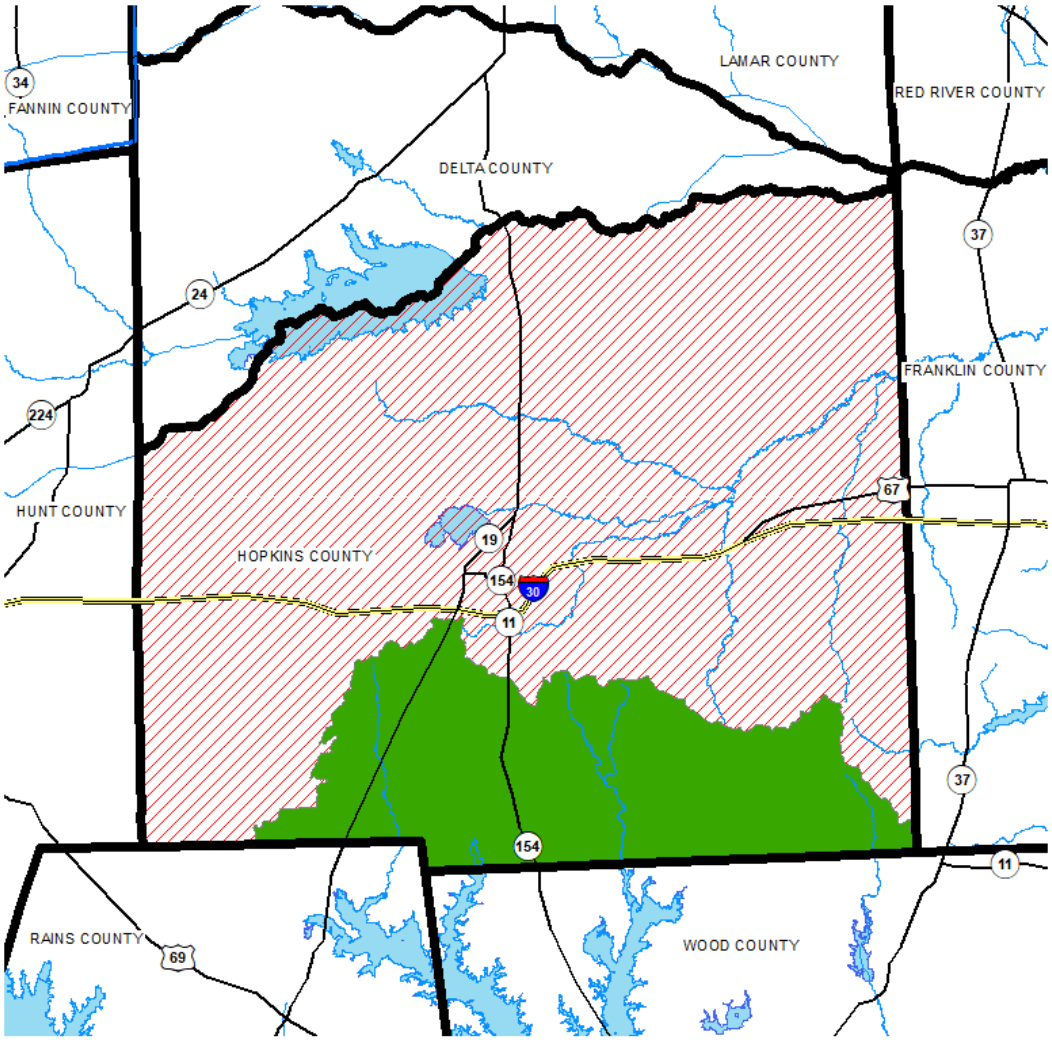
Strategy	Strategy Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Drill New Wells (Carrizo-Wilcox, Cypress Basin)					
Drill New Wells (Carrizo-Wilcox, Sabine Basin)	**931**	**$2,814,000**	**$748,000**	**$803**	**1**
Drill New Wells (Carrizo-Wilcox, Sulphur Basin)	**4,627**	**$10,927,000**	**$3,511,000**	**$759**	**2**
Drill New Wells (Nacatoch, Sulphur Basin)					
Sulphur Springs Raw Water Pipeline	**4,627**	**$38,392,000**	**$9,039,000**	**$1,954**	
Wood County Pipeline Tie-in	**4,627**	**$13,522,000**	**$7,181,000**	**$1,552**	**2**

Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Carrizo-Wilcox, Sabine Basin; ac-ft/yr)	**0**	**0**	**111**	**387**	**575**	**931**
Drill New Wells (Carrizo-Wilcox, Sulphur	**4,627**	**4,627**	**4,516**	**4,240**	**4,052**	**3,696**

Basin; ac-ft/yr)						

The recommended strategies for the Hopkins County Irrigation to meet their projected deficit of 4,227 ac-ft/yr would be to construct by 2020 twelve additional water wells with a rated capacity of 300 gpm in the portion of the Carrizo-Wilcox Aquifer located in Hopkins County in the Sulphur River Basin. This portion of the Carrizo-Wilcox Aquifer is projected to have sufficient source availability to only meet a portion of the projected irrigation demands for Hopkins County. It is thus recommended that by 2040 three additional water wells with a rated capacity of 300 gpm be constructed in the portion of the Carrizo-Wilcox Aquifer located in the Sabine River Basin in Hopkins County. This portion of the aquifer is projected to have sufficient source availability to meet the remaining Hopkins County Irrigation needs over the remainder of the 2020-2070 planning period.



Attachment A

Irrigation Hopkins Co
Recommended Strategy
Drill New Wells (Hopkins, Carrizo-Wilcox, Sabine)

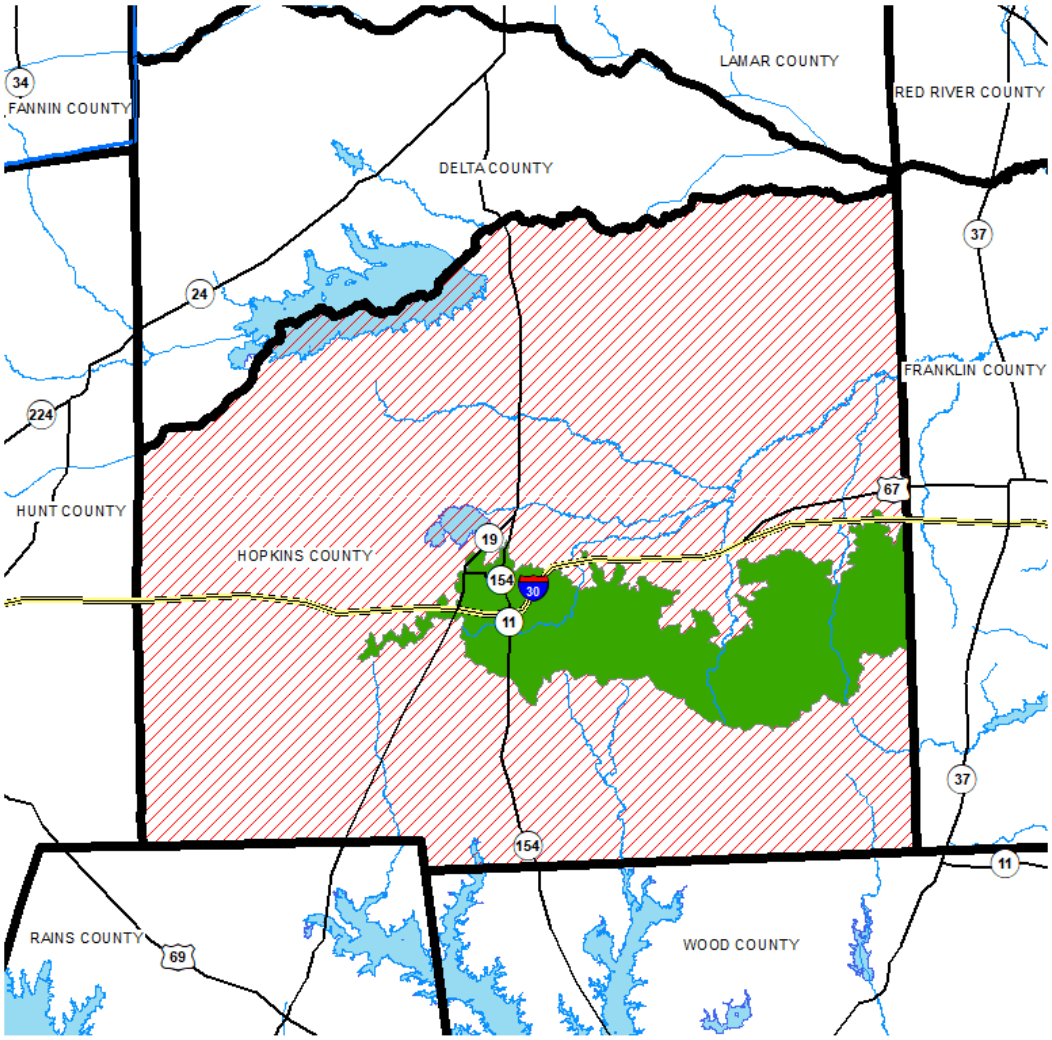
Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Hopkins County Irrigation - Drill New Wells (Hopkins, Carrizo-Wilcox Aquifer, Sabine Basin)

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$1,984,000
TOTAL COST OF FACILITIES	**$1,984,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$694,000
Environmental & Archaeology Studies and Mitigation	$45,000
Land Acquisition and Surveying (5 acres)	$15,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$76,000
TOTAL COST OF PROJECT	**$2,814,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$198,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$20,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (796548 kW-hr @ 0.08 $/kW-hr)	$64,000
Purchase of Water (931 acft/yr @ 500 $/acft)	$466,000
TOTAL ANNUAL COST	**$748,000**
Available Project Yield (acft/yr)	931
Annual Cost of Water ($ per acft), based on PF=1	$803
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$591
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.47
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.81

JMP *10/5/2019*



Attachment B

Irrigation Hopkins Co
Recommended Strategy
Drill New Wells (Hopkins, Carrizo-Wilcox, Sulphur)

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Hopkins County Irrigation - Drill New Wells (Hopkins, Carrizo-Wilcox Aquifer, Sulphur Basin)

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
CAPITAL COST	
Well Fields (Wells, Pumps, and Piping)	$7,703,000
TOTAL COST OF FACILITIES	**$7,703,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$2,696,000
Environmental & Archaeology Studies and Mitigation	$159,000
Land Acquisition and Surveying (15 acres)	$76,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$293,000
TOTAL COST OF PROJECT	**$10,927,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$769,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$77,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (4393140 kW-hr @ 0.08 $/kW-hr)	$351,000
Purchase of Water (4627 acft/yr @ 500 $/acft)	$2,314,000
TOTAL ANNUAL COST	**$3,511,000**
Available Project Yield (acft/yr)	4,627
Annual Cost of Water ($ per acft), based on PF=1	$759
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$593
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$2.33
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.82

JMP *10/5/2019*

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LIVESTOCK IN HOPKINS COUNTY

Description of Water User Group:

The Livestock WUG in Hopkins County has a demand that is projected to remain constant at 5,498 ac-ft/yr for the planning period. The Livestock WUG in Hopkins County is supplied by groundwater from the Carrizo-Wilcox and Nacatoch Aquifers, livestock local supplies from the Cypress, Sulphur, and Sabine basins and surface water purchased from Sulphur Springs. A deficit of 1,068 ac-ft/yr is projected to occur in 2020 increasing to 1,219 ac-ft/yr by 2070 in the Sulphur basin. In both the Cypress and Sabine basins a surplus of 424 ac-ft/yr is projected by 2020 increasing to 577 ac-ft/yr by 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Projected Water Demand	5,498	5,498	5,498	5,498	5,498	5,498
Current Water Supply	4,854	4,854	4,854	4,854	4,855	4,856
Projected Supply Surplus (+)/Deficit(-)	**-644**	**-644**	**-644**	**-644**	**-643**	**-642**

Projected Supply Surplus (+)/Deficit(-) by Basin	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Sabine	366	387	433	436	486	508
Sulphur	-1,068	-1,090	-1,140	-1,143	-1,196	-1,219
Cypress	58	59	63	63	67	69
Total	**-644**	**-644**	**-644**	**-644**	**-643**	**-642**

Evaluation of Potentially Feasible Water Management Strategies:

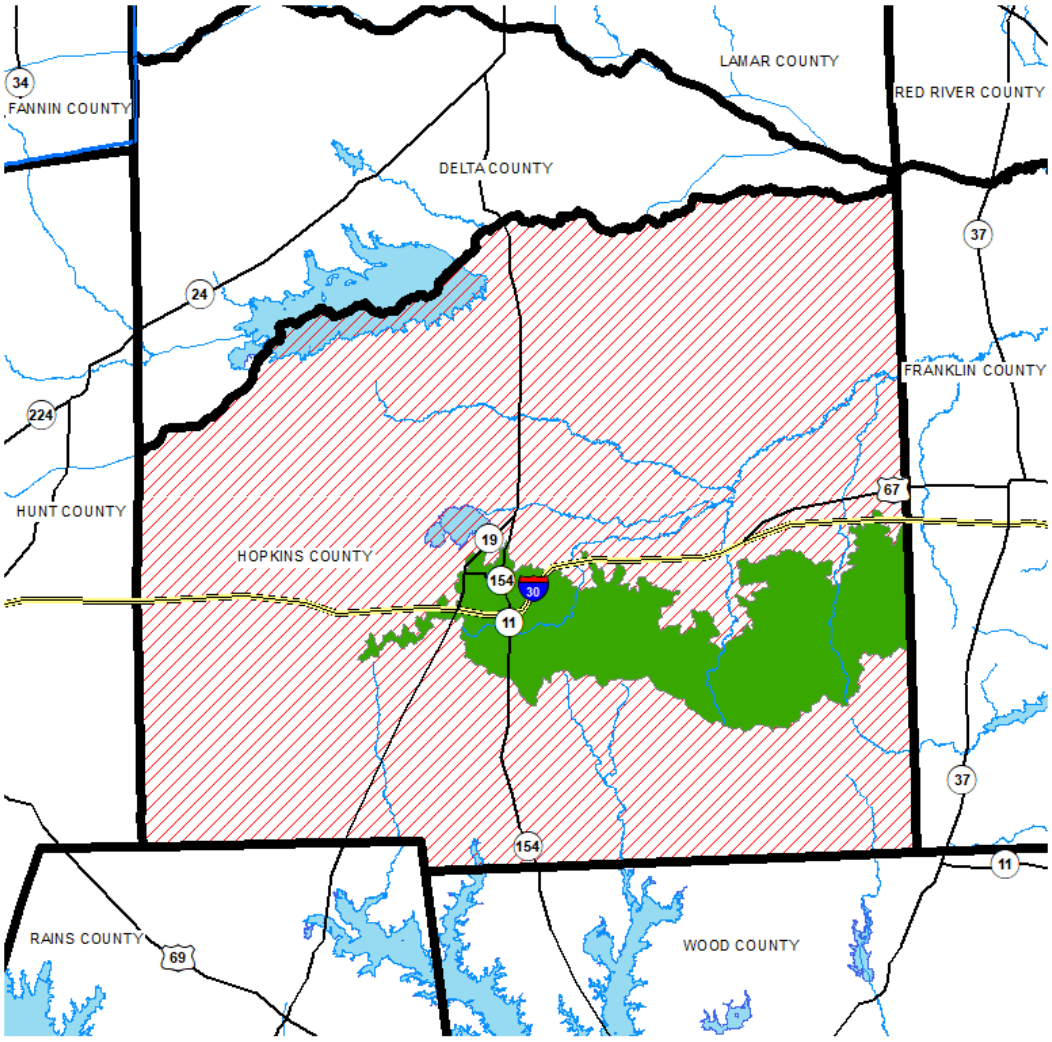
Eight alternative strategies were considered to meet the projected shortages for Hopkins County Livestock. Advanced water conservation for livestock practices was not considered, as present livestock practices likely result in sale of the livestock to reduce demand and extend water supply. The use of reuse water is not considered feasible as there is no centralized water supply. Groundwater from the Carrizo-Wilcox and Nacatoch aquifers has been identified as a potential source of water for irrigation in Hopkins County; however, the total needs exceed the availability of groundwater in the Nacatoch Aquifer based on the modeled available groundwater (MAG) estimates. Increasing the existing contract with the City of Sulphur Springs was also considered as a potential alternative to meet projected demands. A potential regionalization strategy that was considered is the Wood County Pipeline which the WUG could tie-in to a branch of the Wood County Pipeline routed toward Sulphur Springs, Tx.

Strategy	Strategy Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Drill New Wells (Carrizo-Wilcox, Cypress Basin)					
Drill New Wells (Carrizo-Wilcox, Sabine Basin)					
Drill New Wells (Carrizo-Wilcox, Sulphur Basin)	**1,219**	**$6,373,000**	**$1,198,000**	**$983**	**2**
Drill New Wells (Nacatoch, Sulphur Basin)					
Increase Contract w/ Sulphur Springs	**1,219**	**$0**	**$1,434,000**	**$1,176**	**1**
Wood County Pipeline	**1,219**	**$8,273,000**	**$706,000**	**$2,021**	**2**

Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Carrizo-Wilcox, Sulphur Basin; ac-ft/yr)	**1,068**	**1,090**	**1,140**	**1,143**	**1,196**	**1,219**

The recommended strategy for the Hopkins County Livestock to meet their projected deficit of 1,219 ac-ft/yr would be to construct 13 additional water wells with a rated capacity of 75 gpm in the Carrizo-Wilcox/Sulphur/Hopkins aquifer. The recommended supply source will be the Carrizo-Wilcox Aquifer in Hopkins County, Sulphur River Basin. The portion of the Carrizo-Wilcox Aquifer in the Sulphur River Basin in Hopkins County is projected to have sufficient supply availability to meet the needs of Hopkins County Livestock over the planning period.



Attachment A

Livestock Hopkins Co
Recommended Strategy
Drill New Wells (Hopkins, Carrizo-Wilcox, Sulphur)

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Livestock Hopkins County - Drill New Wells (Hopkins, CarrizoWilcox Aquifer, Sulphur Basin)

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
CAPITAL COST	
Well Fields (Wells, Pumps, and Piping)	$4,375,000
TOTAL COST OF FACILITIES	**$4,375,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$1,531,000
Environmental & Archaeology Studies and Mitigation	$203,000
Land Acquisition and Surveying (18 acres)	$93,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$171,000
TOTAL COST OF PROJECT	**$6,373,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$448,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$44,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (1205103 kW-hr @ 0.08 $/kW-hr)	$96,000
Purchase of Water (1219 acft/yr @ 500 $/acft)	$610,000
TOTAL ANNUAL COST	**$1,198,000**
Available Project Yield (acft/yr)	1,219
Annual Cost of Water ($ per acft), based on PF=1	$983
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$615
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.02
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.89

JMP *9/30/2019*

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF MARTIN SPRINGS WATER SUPPLY CORPORATION

Description of Water User Group:

Martin Springs WSC provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2070. The WUG population is projected to be 3,502 by 2020 and increases to 6,214 by 2070. Martin Springs WSC utilizes groundwater from the Carrizo-Wilcox aquifer and has a contract with the City of Sulphur Springs for surface water supply from Lake Chapman. Martin Springs WSC is projected to have a deficit of 29 ac-ft in 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Population	3,502	4,097	4,641	5,130	5,715	6,214
Projected Water Demand	424	478	529	578	642	698
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	668	667	666	668	669	669
Projected Supply Surplus (+) / Deficit (-)	**244**	**189**	**137**	**90**	**27**	**-29**

Projected Supply Surplus (+) / Deficit (-) by Basin	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Sabine	204	158	113	75	22	-27
Sulphur	40	31	24	15	5	-2
Total	**244**	**189**	**137**	**90**	**27**	**-29**

Evaluation of Potentially Feasible Water Management Strategies:

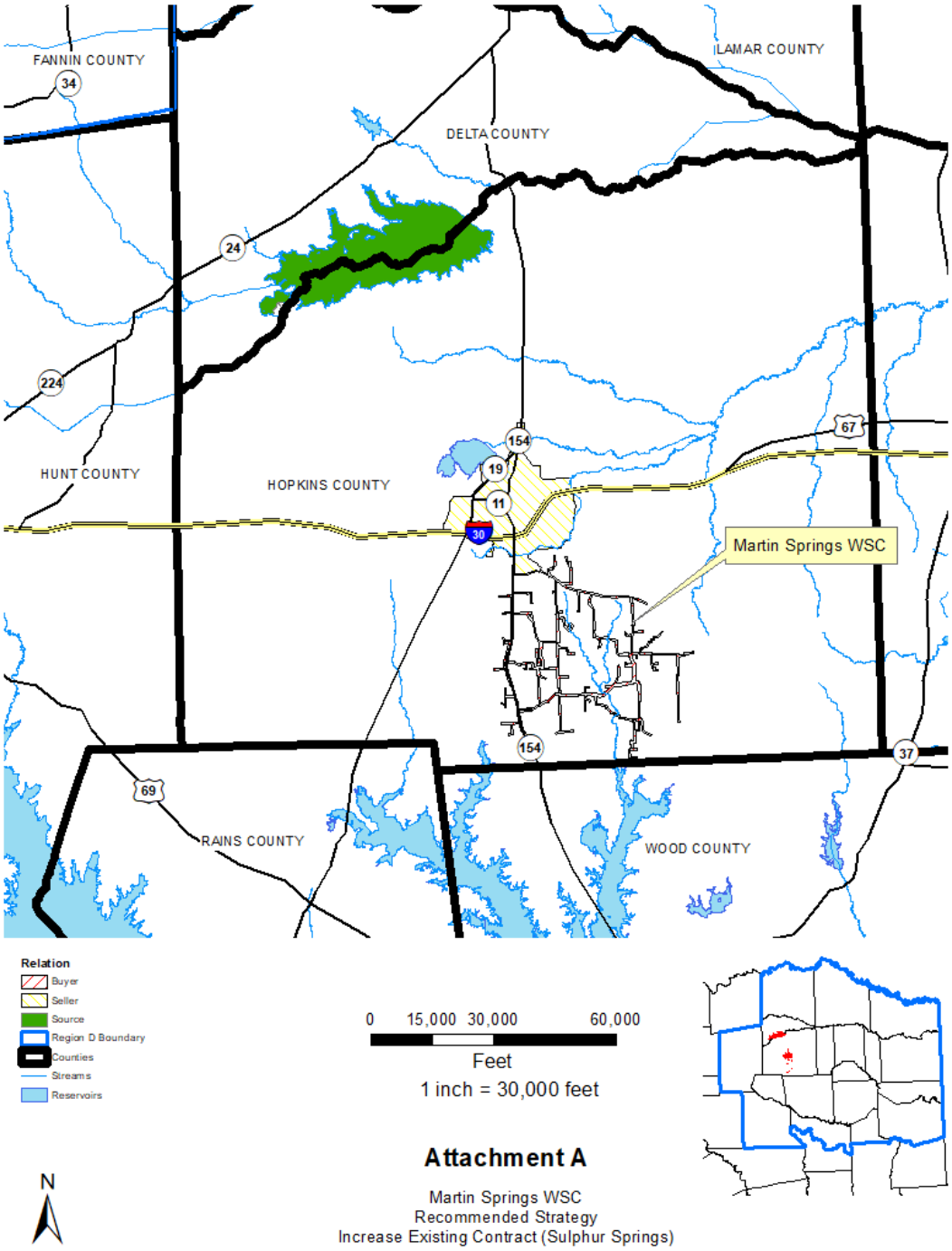
Six alternative strategies were considered to meet the WSC's water supply shortages. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Additional use of groundwater has been identified as a potential source of water for Martin Springs WSC in Hopkins County. A potential regionalization strategy that was considered is the Wood County Pipeline. Increasing the existing contract with Sulphur Springs was identified and considered as a potentially feasible strategy.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Env. Impact
Advanced Water Conservation					
Water Reuse					
Drill New Wells (Carrizo-Wilcox Aquifer, Sabine Basin)					
Drill New Wells (Carrizo-Wilcox Aquifer, Sulphur Basin)	**29**	**$360,000**	**$55,000**	**$1,897**	**1**
Increase Existing Contract w/ Sulphur Springs	**29**	**$0**	**$34,000**	**$1,172**	**1**
Wood County Pipeline	**29**	**$1,574,000**	**$166,000**	**$5,724**	**2**

Recommendations:

	2020	2030	2040	2050	2060	2070
Increase Existing Contract w/ Sulphur Springs	**0**	**0**	**0**	**0**	**0**	**29**

The recommended strategy for Martin Springs WSC to meet their projected deficit of 29 ac-ft/yr in 2070 is to increase the existing contract supply from Sulphur Springs for water from their portion of Lake Chapman.



Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Martin Springs WSC - Increase Existing Contract w/ Sulphur Springs

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
ANNUAL COST	
Operation and Maintenance	
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treamtent Facility	$0
Pumping Energy Costs (0 kW-hr @ 0.08 $/kW-hr)	$0
Purchase of Water (29 acft/yr @ 1176 $/acft)	$34,000
TOTAL ANNUAL COST	**$34,000**
Available Project Yield (acft/yr)	29
Annual Cost of Water ($ per acft), based on PF=1	$1,172
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$1,172
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.60
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$3.60

JMP *9/30/2019*

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF MILLER GROVE WATER SUPPLY CORPORATION

Description of Water User Group:

Miller Grove WSC provides water service in Hopkins County. It is projected that the users in the WUG will have a shortage in 2020. The WUG population is projected to be 1,451 by 2020 and increases to 1,896 by 2070. Miller Grove WSC utilizes groundwater from the Carrizo-Wilcox aquifer. Miller Grove WSC is projected to have a deficit of 8 ac-ft by 2020 increasing to 52 ac-ft by 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Population	1,451	1,559	1,649	1,706	1,802	1,896
Projected Water Demand	200	208	215	221	232	244
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	192	192	192	192	192	192
Projected Supply Surplus (+) / Deficit (-)	**-8**	**-16**	**-23**	**-29**	**-40**	**-52**

Evaluation of Potentially Feasible Water Management Strategies:

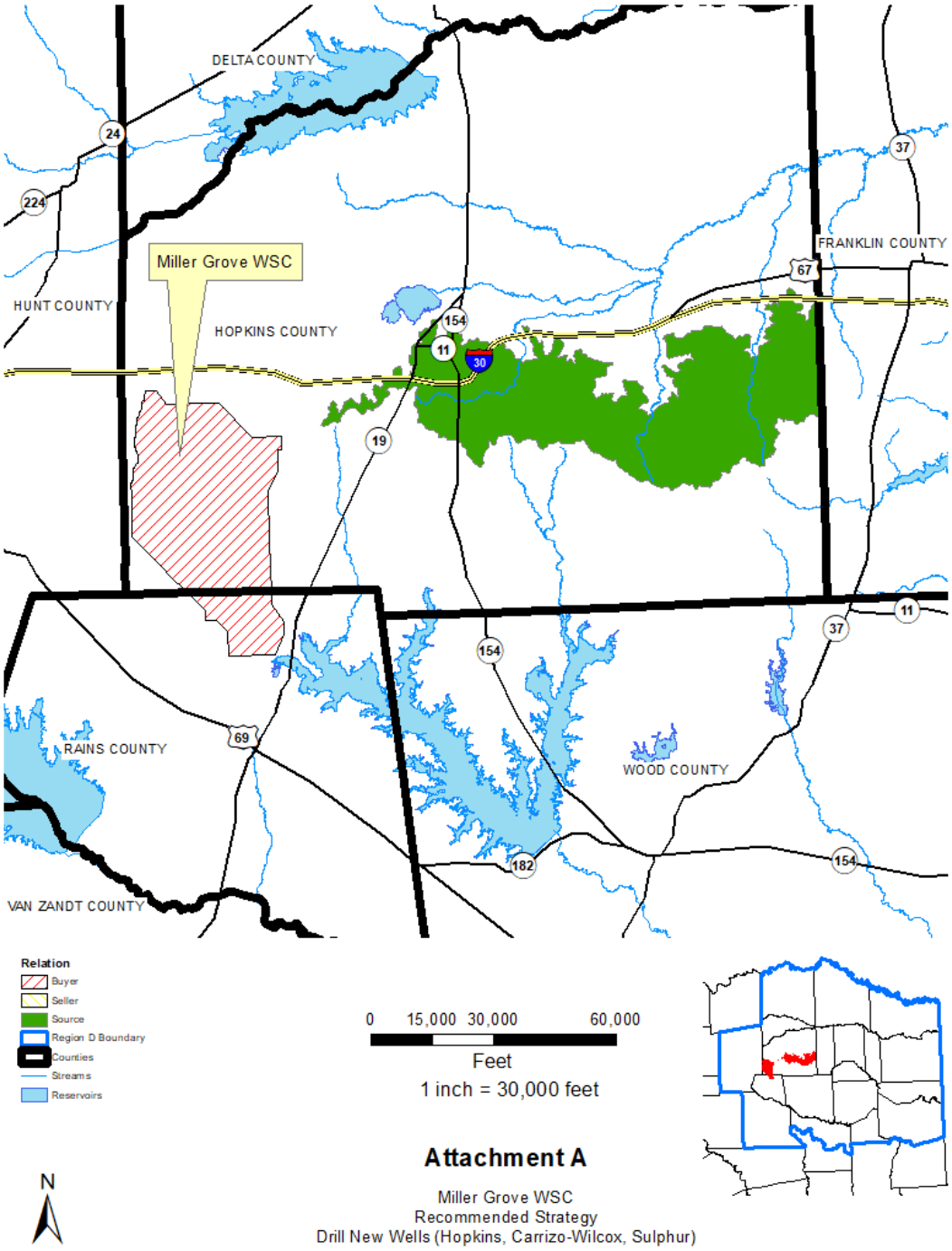
Five alternative strategies were considered to meet the WSC's water supply shortages. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Additional use of groundwater has been identified as a potential source of water the WSC. Purchase of surface water from Chapman Lake under contract from Sulphur Springs was also considered. A potential regionalization strategy that was considered is the Wood County Pipeline.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Env. Impact
Advanced Water Conservation					
Water Reuse					
Drill New Wells (Carrizo-Wilcox Aquifer, Sulphur Basin)	**52**	**$886,000**	**$113,000**	**$2,173**	**1**
New Contract (Chapman, Sulphur Springs)	**52**	**$2,319,000**	**$242,000**	**$4,654**	**1**
Wood County Pipeline Tie-in	**52**	**$1,587,000**	**$200,000**	**$3,846**	**2**

Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Carrizo-Wilcox Aquifer, Sabine; ac-ft/yr)	**8**	**16**	**23**	**29**	**40**	**52**

The recommended strategy for Miller Grove WSC to meet their projected deficit of 8 ac-ft/yr in 2020 and 52 ac-ft/yr in 2070 would be to construct two additional water wells with a rated capacity of 75 gpm in the Carrizo-Wilcox/Sulphur/Hopkins aquifer. Two wells with rated capacity of 75 gpm each would provide approximately 40 acre-feet each. Construction of this well in the year preceding the decade of need would allow for sufficient provision of supply to meet the projected demands.



Attachment A

Miller Grove WSC
Recommended Strategy
Drill New Wells (Hopkins, Carrizo-Wilcox, Sulphur)

Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Miller Grove WSC - Drill New Wells (Hopkins, CarrizoWilcox Aquifer, Sulphur Basin)

Cost based on ENR CCI 11170.28 for September 2018 and a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
Well Fields (Wells, Pumps, and Piping)	$597,000
Water Treatment Plant (0.1 MGD)	$26,000
TOTAL COST OF FACILITIES	**$623,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$218,000
Environmental & Archaeology Studies and Mitigation	$15,000
Land Acquisition and Surveying (2 acres)	$6,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$24,000
TOTAL COST OF PROJECT	**$886,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$62,000
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$6,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$16,000
Advanced Water Treamtent Facility	$0
Pumping Energy Costs (41422 kW-hr @ 0.08 $/kW-hr)	$3,000
Purchase of Water (52 acft/yr @ 500 $/acft)	$26,000
TOTAL ANNUAL COST	**$113,000**
Available Project Yield (acft/yr)	52
Annual Cost of Water ($ per acft), based on PF=1	$2,173
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$981
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$6.67
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$3.01

JMP *9/30/2019*

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF MINING IN HOPKINS COUNTY

Description of Water User Group:

Mining in Hopkins County has a demand that is projected to increase from 1,031 ac-ft/yr in 2020 to 1,577 ac-ft/yr in 2070. This WUG is projected to be supplied by groundwater from Nacatoch Aquifer and a nominal amount of surface water purchased from Sulphur Springs for potable use. A deficit of 227 ac-ft/yr is projected to occur in 2020 and increase to 639 ac-ft/yr by 2070.

Water Supply and Demand Analysis:

	2020	2030	2040	2050	2060	2070
Projected Water Demand	1,031	1,124	1,222	1,329	1,446	1,577
Current Water Supply	804	841	862	885	913	938
Projected Supply Surplus (+)/Deficit(-)	**-227**	**-283**	**-360**	**-444**	**-533**	**-639**

Projected Supply Surplus (+)/Deficit(-) by Basin	2020	2030	2040	2050	2060	2070
Sulphur	-149	-186	-236	-293	-352	-422
Sabine	-71	-89	-112	-138	-166	-198
Cypress	-7	-8	-12	-13	-15	-19
Total	**-227**	**-283**	**-360**	**-444**	**-533**	**-639**

Evaluation of Potentially Feasible Water Management Strategies:

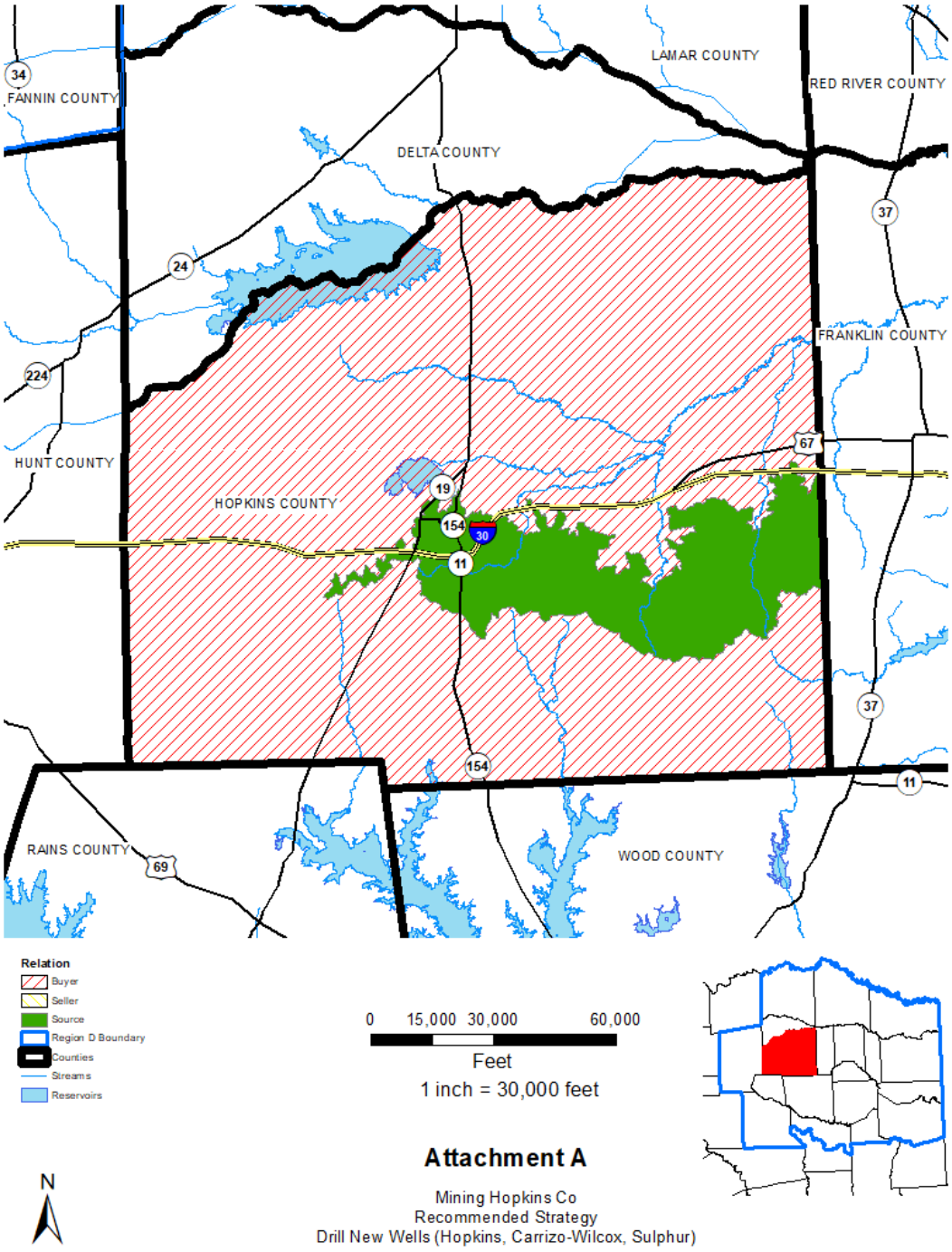
Advanced water conservation for mining practices was not considered, as present operations of the facilities are not available. The use of reuse water from nearby municipalities was not considered feasible as it would not be effective to deliver reuse water to the mining locations. Since the projected demands for mining in Hopkins County are primarily due to overburden dewatering, it was assumed that projected needs would likely be met by additional groundwater pumping. Increasing the existing contract from Sulphur Springs could provide additional supply. Additionally, the Wood County Pipeline regional strategy was evaluated as a feasible supply source.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Env. Impact
Advanced Water Conservation					
Water Reuse					
Drill New Wells (Nacatoch Aquifer, Sulphur Basin)					
Drill New Wells (Carrizo-Wilcox Aquifer, Sulphur Basin)	639	$3,376,000	$628,000	$983	1
Increase Existing Contract from Sulphur Springs	639	$0	$751,000	$1,175	1
Wood County Pipeline Tie-in	639	$5,367,000	$1,365,000	$2,136	2

Recommendations:

	2020	2030	2040	2050	2060	2070
Drill New Wells (Carrizo-Wilcox Aquifer, Sulphur Basin; ac-ft/yr)	**227**	**283**	**360**	**444**	**533**	**639**

The recommended strategy for the Hopkins County Mining to meet their projected deficit of up to 639 ac-ft/yr would be to construct seven (7) additional water wells with a rated capacity of 75 gpm in the Carrizo-Wilcox/Sulphur/Hopkins aquifer. The recommended supply source will be the Carrizo-Wilcox Aquifer in Hopkins County, Sulphur River Basin. The portion of the Carrizo-Wilcox Aquifer in the Sulphur River Basin in Hopkins County is projected to have sufficient supply availability to meet the needs of Hopkins County Mining over the planning period.



Cost Estimate Summary
Water Supply Project Option
September 2018 Prices

Mining Hopkins County - Drill New Wells (Hopkins, CarizzoWilcox Aquifer, Sulphur Basin)

Cost based on ENR CCI 11170.28 for September 2018 and
a PPI of 201.9 for September 2018

Item	*Estimated Costs for Facilities*
CAPITAL COST	
Well Fields (Wells, Pumps, and Piping)	$2,313,000
TOTAL COST OF FACILITIES	**$2,313,000**
Engineering and Feasibility Studies, Legal Assistance, Financing, Bond Counsel, and Contingencies (30% for pipes & 35% for all other facilities)	$810,000
Environmental & Archaeology Studies and Mitigation	$111,000
Land Acquisition and Surveying (10 acres)	$51,000
Interest During Construction (3% for 1 years with a 0.5% ROI)	$91,000
TOTAL COST OF PROJECT	**$3,376,000**
ANNUAL COST	
Debt Service (3.5 percent, 20 years)	$237,000
Reservoir Debt Service (3.5 percent, 40 years)	$0
Operation and Maintenance	
Pipeline, Wells, and Storage Tanks (1% of Cost of Facilities)	$23,000
Intakes and Pump Stations (2.5% of Cost of Facilities)	$0
Dam and Reservoir (1.5% of Cost of Facilities)	$0
Water Treatment Plant	$0
Advanced Water Treatment Facility	$0
Pumping Energy Costs (602971 kW-hr @ 0.08 $/kW-hr)	$48,000
Purchase of Water (639 acft/yr @ 500 $/acft)	$320,000
TOTAL ANNUAL COST	**$628,000**
Available Project Yield (acft/yr)	639
Annual Cost of Water ($ per acft), based on PF=1	$983
Annual Cost of Water After Debt Service ($ per acft), based on PF=1	$612
Annual Cost of Water ($ per 1,000 gallons), based on PF=1	$3.02
Annual Cost of Water After Debt Service ($ per 1,000 gallons), based on PF=1	$1.88

JMP *9/30/2019*