Population and Housing Estimates	First Mesa		Second Mesa		Shungopavi		Keams Canyon		Average
Occupied Housing Units - 2010 US Census	438	3.82%	247	2.71%	204	2.65%	104	4.04%	3.31%
Occupied Housing Units - 2000 US Census	301		189		157		70		
Population - 2010 Census	1555	3.30%	962	1.68%	831	2.78%	304	1.58%	2.33%
Population - 2000 Census	1124		814		632		260		
Average Increase from 2000 to 2010		3.56%		2.20%		2.71%		2.81%	2.82%

*Future Population = Current Population * (1+%Growth Rate)^(# of years*

ADES Population Projection

Year	First Mesa		Second Mesa		Shungopavi		All Hopi Lands	
2010	1555	0.58%	962	0.59%	831	0.56%	6040	0.54%
2013	1582		979		845		6138	
2015	1617	1.10%	1001	1.12%	864	1.12%	6261	1.00%
2035	1961	0.97%	1213	0.97%	1048	0.97%	7455	0.88%
25 Year Average		**0.93%**		**0.93%**		**0.93%**		**0.85%**

*Future Population = Current Population * (1+%Growth Rate)^(# of years*

Estimated Water Demand - 1.25% Growth Rate

Customer Name	Number of Residential Service Connections	Number of "other" Service Connections	Total Number of Service Connections	2013 Reported Annual Production Volume (gallons)	2013 Reported Annual Average Production (GPM)	Year 2015 Design Demand (x1.5 and 1.0125^2)	Year 2035 Design Demand (GPM) (x2 and 1.0125^22)
Shungopavi	146	3	149	10,402,600	19.8	30.4	52
Sipaulovi/Mishongovi (lower)	100	10	110	7,142,300	13.6	20.9	35.7
Sipaulovi/Mishongovi (upper)	25	5	30	2,102,600	4	6.2	10.5
FMCV	580	40	620	49,953,900	95	146.1	249.7
Total without BIA				69,601,400	132.4	203.6	347.9
2nd. Mesa Day School	14	3	17	1,800,000	3.4	5.2	8.9
Keams Canyon	200	6	206	21,497,050	40.9	62.9	107.5
Hopi Jr./Sr. High School	48	13	61	6,501,000	12.4	19.1	32.6
Total with BIA				99,399,450	189.1	290.8	496.9

Estimated Water Demand - 1.8% Growth Rate

Customer Name	Number of Residential Service Connections	Number of "other" Service Connections	Total Number of Service Connections	2013 Reported Annual Production Volume (gallons)	2013 Reported Annual Average Production (GPM)	Year 2015 Design Demand (x1.5 and 1.018^2)	Year 2035 Design Demand (GPM) (x2 and 1.018^22)
Shungopavi	146	3	149	10,402,600	19.8	30.8	58.6
Sipaulovi/Mishongovi (lower)	100	10	110	7,142,300	13.6	21.1	40.3
Sipaulovi/Mishongovi (upper)	25	5	30	2,102,600	4	6.2	11.8
FMCV	580	40	620	49,953,900	95	147.7	281.3
Total without BIA				69,601,400	132.4	205.8	392
2nd. Mesa Day School	14	3	17	1,800,000	3.4	5.3	10.1
Keams Canyon	200	6	206	21,497,050	40.9	63.6	121.1
Hopi Jr./Sr. High School	48	13	61	6,501,000	12.4	19.3	36.7
Total with BIA				99,399,450	189.1	294.0	559.9

Estimated Water Demand - 2.33% Growth Rate

Customer Name	Number of Residential Service Connections	Number of "other" Service Connections	Total Number of Service Connections	2013 Reported Annual Production Volume (gallons)	2013 Reported Annual Average Production (GPM)	Year 2015 Design Demand (x1.5 and 1.0233^2)	Year 2035 Design Demand (GPM) (x2 and 1.0233^22)
Shungopavi	146	3	149	10,402,600	19.8	31.1	65.7
Sipaulovi/Mishongovi (lower)	100	10	110	7,142,300	13.6	21.4	45.1
Sipaulovi/Mishongovi (upper)	25	5	30	2,102,600	4	6.3	13.3
FMCV	580	40	620	49,953,900	95	149.2	315.4
Total without BIA				69,601,400	132.4	208	439.5
2nd. Mesa Day School	14	3	17	1,800,000	3.4	5.3	11.3
Keams Canyon	200	6	206	21,497,050	40.9	64.2	135.8
Hopi Jr./Sr. High School	48	13	61	6,501,000	12.4	19.5	41.2
Total with BIA				99,399,450	189.1	297.0	627.8

Population Growth Rate Estimates - Summary

Entity	2000 - 2010 Average Growth Rate	Estimated Range of Possible Growth Rates through 2035	Suggested Population Growth Rate through 2035
US Census - Population	2.33%		
US Census - Occupied Housing	3.31%		
ADES		0.85 - 0.93%	0.93%
TetraTech (2006 report)			2.0%
HDR (2003 report)		1.3 - 2.75%	2.5%
Draft PER			2.0%
USDA (draft PER comments)		1.0 - 1.25%	
This Report:		**1.25 - 2.33%**	**1.8%**

Design Demand vs. Estimated Growth Rate

Estimated Growth Rate	Year 2035 Design Demand (GPM) without the BIA	Year 2035 Design Demand (GPM) with the BIA
1.25%	347.9	496.9
1.80%	392	559.9
2.33%	439.5	627.8

Existing Water Sources

Ex. 9 Wells

Ex. 9 Wells

Regional Water Storage Analysis	Gallons
Storage Required to Top Off All Existing Tanks (assuming each is 50% empty)	524,500
Storage Required to Replace Well 2 Production for 2.5 Days	1,486,800
Storage Requred per Navajo Area Guidelines (2.5 Days less Well 3 Production for 18 hrs)	961,920
Total Proposed Storage Provided by the HAMP	371,264
Total Existing Water Storage	1,049,000
Total Storage after Completion of the HAMP	1,420,264

Well Pump Selection	Pump Make	Pump Model	Rated Motor Horsepower	Expected Actual Horsepower	Flow (GPM)	Head (FT)	Outlet Diameter (in)	Motor Diameter (in)	Efficiency	Phase/Volts/Hz	Starting Amps	Maximum Load Amps
Well #2 Submersible Well Pump	Grundfos	475S-1000-10	100	94.5	413	712	6	8	78%	3/460/60	1211	142
Well #2 Submersible Booster Pump	Grundfos	475S-600-6	60	55.5	413	415	6	8	78%	3/460/60	658	86
Well #3 Submersible Well Pump	Grundfos	475S-1000-10	100	94.5	416	708	6	8	78%	3/460/60	1211	142
Well #3 Submersible Booster Pump	Grundfos	475S-600-6	60	55.5	416	413	6	8	78%	3/460/60	658	86

Estimated Well Production

Ex. 9 Wells

Estimated Propane Fuel Consumption

Well 2			
Well 3			
2nd Mesa Booster			

Booster Pump Sizing	Base Elev	Shungopavi WST Overflow	Maximum Static Lift Required (ft)	Minimum Required Flow Rate (gpm)	Flow (gpm)	Head (ft)	Horsepower	Phase
2nd Mesa Booster	6275	6490	215	120.8				
Grundfos CR20-4					102	223.5	10	1
Grundfos CR32-3					132	229.7	15	3
Grundfos CR45-2					121	227.3	15	3
Grundfos CR64-2					207	250.7	25	3

Village Water Storage Analysis	Existing Capacity (gals)	Existing Capacity (ft^3)	Height	Diameter	Current (2013) Days of Water Storage	Additional Storage Proposed by HAMP	Estimated 2015 Days of Water Storage	Estimated 2035 Days of Storage	Required 2035 Design Storage per Navajo Area Guidelines (Based on a Pro-Rata Share of HAMP Storage and Well 3 Yield)	Total Storage (Existing and Proposed)
FMCV										
East Polacca Tank	500,000	66,840			5.2		4.2	2.2	690,276	895,113
West Polacca Tank	200,000	26,736								
Upper First Mesa Tank	8,000	1,069								
Pro-Rata Share of Radio Tower Tanks						187,113				
Shungopavi										
Shungopavi Tank	250,000	33,420			8.8		6.5	3.4	144,282	289,019
Pro-Rata Share of Radio Tower Tanks						39,019				
Lower Sipaulovi/Mishongnovi										
Lower Sipaulovi Tank	75,000	10,026			3.8		6.2	3.2	98,891	187,172
Pro-Rata Share of Radio Tower Tanks						26,730				
Pro-Rata Share of Upper Sipaulovi Tank						85,441				
Upper Sipualovi/Mishongnovi										
Upper Sipaulovi/Mishongnovi Tank	16,000	2,139			2.8		5.5	2.9	28,956	48,960
Pro-Rata Share of Radio Tower Tanks						7,854				
Pro-Rata Share of Upper Sipaulovi Tank						25,106				
Totals	1,049,000	140,231			4.8 (ave)	371,264	6.4 (ave)	3.4 (ave)		

Proposed Water Storage Tanks	Number of Tanks	Capacity (gals)	Capacity (ft^3)	Height	Diameter	Total Storage
Phase 1B WSTs - Radio Tower Tanks	1	260,717	34853	24	43	260,717
Phase 3 WST - Upper Sipaulovi Tank	1	110,547	14778	24	28	110,547
Total Proposed Storage	2					371,264

Existing Water Storage Tanks	Existing Capacity (gals)	Existing Capacity (ft^3)	Height	Diameter	Current (2013) Days of Water Storage
East Polacca Tank	500,000	66,840			5.2
West Polacca Tank	200,000	26,736			
Upper First Mesa Tank	8,000	1,069			
Shungopavi Tank	250,000	33,420			8.8
Lower Sipaulovi Tank	75,000	10,026			3.8
Upper Sipaulovi/Mishongnovi Tank	16,000	2,139			2.8
Totals	1,049,000	140,231			4.8 (ave)

Hydraulic Analysis

Approximate Elevations	feet	static psi
Radio Tower WST Base Elevation	6275	11.1
Radio Tower WST Overflow Elevation	6307	0.0
Ex. 9 Wells		
Tawa'ovi Approximate High Elev	5955	149.6
Tawa'ovi Approximate Low Elev	5885	179.9
Booster Station Base Elev - Inlet	6275	11.1
Hopi Cultural Center	6315	73.5
Shungopavi Elevated Tank Ground	6352	57.5
Shungopavi Elevated Tank Base Elev	6464.5	8.8
Shungopavi Elevated Tank Overflow	6490	0.0
North Shungopavi	6330	67.1
South Shungopavi	6370	49.7
Shungopavi High Point	6385	43.2
Sipaulovi Proposed Upper Tank Base	6348	11.1
Sipaulovi Proposed Upper Tank Over	6380	0.0
Sipaulovi Hydropneumatic System	6305	29.7
Upper Sipaulovi	6325	21.0
Ex. 9 Wells		
Upper Mishongnovi	6285	38.4
Proposed Toreva PRV inlet	6050	140.1
Proposed Toreva PRV outlet	6050	45.0
Toreva	5900	109.9
Proposed Lower Sipaulovi PRV inlet	5850	131.6
Proposed Lower Sipaulovi PRV outlet	5850	40.0
Lower Sipaulovi WST Base Elevation	5780	70.3
2nd Mesa Day School WST Base Elev	5700	104.9
Alternate WST Base Elevation	6225	32.7
Original Elevated WST Base Elevation	6290	4.6
East Polacca WST Base Elev - Inlet	5984.5	136.8
East Polacca WST Overflow Elev	6006.8	0.0
West Polacca WST Base Elev	5823.5	11.4
West Polacca WST Overflow Elev	5856.5	0.0
Keams Canyon WTP Elev	5813	224.9
Pressure Class Threshold	5757.8	235.0
Phase 1 Low Point Elevation	5740	242.7

Static pressures estimated at tank levels of 80% full
For PRVs: Pressure max upstream = 3(pressure downstream)+23psi*
DR 18 PVC C900 Pipe will be used for static pressures under 235 psi
DR 14 PVC C900 Pipe will be used for static pressures over 235 psi