

Navajo-Gallup Water Supply Project

**APPENDIX D
COST ESTIMATE SPREADSHEETS**

SJR Alternative: Navajo - Gallup Water Supply Project Cost Scenarios. With GW.

SJR Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Demand Years	Cost 2000 dollars	Navajo		Gallup		Totals
		A/F	\$Cost	A/F	\$Cost	\$ Cost \$
2040	Project Cost \$\$	12,940	\$188,452,168	3,750	\$39,740,045	\$228,192,214
50% Demands	Annual Energy \$		\$1,747,456		\$596,600	\$2,344,055
	Annual O&M \$		\$3,446,640		\$736,459	\$4,183,100
2010	Project Cost \$\$	11,141	\$169,002,355	7,500	\$78,300,643	\$247,302,998
	Annual Energy \$		\$1,668,101		\$1,160,945	\$2,829,046
	Annual O&M \$		\$3,051,375		\$1,322,370	\$4,373,745
2020	Project Cost \$\$	15,230	\$206,032,056	7,500	\$71,616,358	\$277,648,414
	Annual Energy \$		\$2,092,009		\$1,116,018	\$3,208,027
	Annual O&M \$		\$3,521,153		\$1,186,149	\$4,707,302
2030	Project Cost \$\$	21,291	\$252,600,414	7,500	\$64,029,690	\$316,630,105
	Annual Energy \$		\$2,605,354		\$1,068,942	\$3,674,296
	Annual O&M \$		\$4,066,108		\$1,040,265	\$5,106,374
(Attached) 2040	Project Cost \$\$	29,067	\$309,811,865	7,500	\$58,121,032	\$367,932,897
	Annual Energy \$		\$3,249,942		\$1,028,460	\$4,278,402
	Annual O&M \$		\$4,744,196		\$926,440	\$5,670,636
2040: No GW	Project Cost \$\$	32,254	\$330,627,493	7,500	\$56,113,728	\$386,741,221
	Annual Energy \$		\$3,611,272		\$1,014,790	\$4,626,062
	Annual O&M \$		\$4,994,648		\$879,979	\$5,874,626
2040: Laterals Lake Valley, Burnham Whiterock, Whitehorse Lake	Project Cost \$\$		\$6,289,466		Total:	\$393,030,687
	Annual Energy \$		\$45,042			\$4,671,104
	Annual O&M \$		\$50,944			\$5,925,570

SJR Alternative: Navajo - Gallup Water Supply Project Cost/AF over Forty-Year Increments

Demand Years	Cost 2000 dollars	Navajo		Gallup	
		A/F	\$Cost/AF	A/F	\$Cost/AF
2010	Share Cost \$\$	11,141	\$15,169	7,500	\$10,440
	Annual Energy \$		\$150		\$155
	Annual O&M \$		\$274		\$176
2020	Share Cost \$\$	15,430	\$13,528	7,500	\$9,549
	Annual Energy \$		\$137		\$149
	Annual O&M \$		\$231		\$158
2030	Share Cost \$\$	21,391	\$11,864	7,500	\$8,537
	Annual Energy \$		\$122		\$143
	Annual O&M \$		\$191		\$139
2040	Share Cost \$\$	29,067	\$10,659	7,500	\$7,749
	Annual Energy \$		\$112		\$137
	Annual O&M \$		\$163		\$124

NOTE:

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE IS CORE LINE FROM GALLEGOS - YAHTAHEY - WINDOW ROCK - GALLUP - CHURCHROCK
- 3.) NASCHITTI LATERAL INCLUDES SANOSTEE, NEWCOMB, TWO GREY HILLS, SHEEP SPRINGS, NASCHITTI CHAPTERS.
- 4.) COYOTE CYN. JCT. LATERAL INCLUDES CROWNPOINT, DALTON PASS, BECENTI, COYOTE CANYON, STANDING ROCK, LITTLEWATER CHAPTERS.
- 5.) GALLEGOS RESERVOIR COST IS \$38,037,430 FOR 8,800 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) HUERFANO LATERAL IS FROM GALLEGOS/WTP-HUERFANO, NAGEEZI, PUEBLO PINTADO, TORREON NTUA SYSTEM.
- 8.) ASSUMME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.
- 9.) ALL COST ESTIMATES INCLUDES NAPI AND SHIPROCK AREA DEMANDS.

Year 2040

SJR Alternative: Navajo - Gallup Water Supply Project Cost Scenario. With GW.

SJR Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Peaking Factor = 1.3 Demands: 29,066 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,066	\$323,971,647	0	\$0	\$323,971,647
Annual Energy \$		\$3,323,467		\$0	\$3,323,467
Annual O&M \$		\$5,257,567		\$0	\$5,257,567

Peaking Factor = 1.3 Demands: 36,567 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,067	\$309,811,865	7,500	\$58,121,032	\$367,932,897
Annual Energy \$		\$3,249,942		\$1,028,460	\$4,278,402
Annual O&M \$		\$4,744,196		\$926,440	\$5,670,636

NOTE:

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE GOES FROM PNM DIV.-RES./WTP-666HIGHWAY.-WR-GALLUP-GALLUP AREA NAVAJOS.
- 3.) CUTTER LATERAL INCLUDES HUERFANO, NAGEEZI, PUEBLO PINTADO, TORREON, WHITEHORSE LAKE, COUNSELOR CHAPTERS.
- 4.) COYOTE CYN. JCT. LATERAL INCLUDES DALTON PASS, BECENTI, LAKE VALLEY, STANDING ROCK, WHITE ROCK, AND CROWNPOINT, AND LITTLEWATER CHAPTERS.
- 5.) RESERVOIR COST IS \$9,600,000 FOR 1,500 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) ASSUMME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.

Navajo - Gallup Water Supply Project - San Juan River Alternative
(Cost Estimates for Main Pipeline to Gallup and Church Rock, with G.W. demands, plus Gallup Area Navajo Demands)

Chapter Community	Populations		Daily Demand (2,3,4) Gal.	Annual Ground Water Production			Annual Demand Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1)	2040		1986 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$5		Gal./Day(5)	cfs	
	1980									
Hogback Div. Intake	0	0	0	0	0	\$0	0	0	0.00	59.18
Reservoir/WTP	0	0	0	0	0	\$0	0	0	0.00	59.18
NAPI Jct.	0	0	624,820	0	0	\$0	700	624,820	0.97	59.18
Shiprock Jct.	13,804	46,985	3,338,749	0	0	\$0	3,741	4,341,674	6.72	58.22
Sanostee	2,081	7,083	1,123,008	69	153	\$0	1,117	1,295,734	2.00	51.50
Burnham Jct.	246	837	132,971	0	0	\$0	190	174,162	0.27	49.49
Newcomb	1,334	5,281	835,412	113	69	\$0	847	982,745	1.52	49.22
Shedsprings	860	2,246	268,434	0	15	\$0	385	449,856	0.70	47.70
Naschiti	1,538	5,238	536,106	82	77	\$0	862	1,003,213	1.55	47.01
Tohatchi	2,318	7,860	1,282,376	180	207	\$0	1,107	1,284,797	1.99	45.46
Coyote Cyn. Jct.	3,824	20,144	3,226,187	352	798	\$0	2,816	3,267,525	5.06	43.47
Twin Lakes	1,957	6,895	1,071,224	67	153	\$0	1,047	1,215,024	1.68	38.42
Ya-ta-hay Jct.	14,895	50,865	8,106,337	1,100	860	\$0	8,191	9,595,335	14.71	36.53
Chamorro Hill	0	0	0	0	0	\$0	0	0	0.00	21.83
Gallup Jct.	23,600	62,300	9,118,848	4,413	184	\$0	10,009	11,638,368	18.01	21.83
Church Rock	4,099	13,918	2,225,860	250	385	\$0	2,127	2,467,830	3.92	3.85
229,273 2040 Population Served										
33,121 Total Annual Demand(AP)										

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to Friction (5)	Pump Horsepower HP	Storage Demands (6)
	Area sq. ft. (2)	Diameter in.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Hogback Div. Intake	14.80	4.34	52.1	0	5,075	5,075	0	0.0	0.0	0
Reservoir/WTP	14.80	4.34	52.1	285	5,075	5,110	35	0.3	538.2	0
NAPI Jct.	14.80	4.34	52.1	8,109	5,110	5,250	140	7.1	1411.3	0
Shiprock Jct.	14.55	4.30	51.7	91,642	5,250	5,160	-90	80.1	0.0	0
Sanostee	12.87	4.05	48.6	84,323	5,160	5,580	420	86.8	4230.4	4,983,581
Burnham Jct.	12.37	3.97	47.6	51,075	5,580	5,580	10	49.3	475.7	0
Newcomb	12.31	3.96	47.5	19,088	5,580	5,850	-40	18.4	0.0	3,779,794
Shedsprings	11.93	3.90	46.8	51,174	5,850	5,850	340	49.4	3010.7	1,730,217
Naschiti	11.75	3.87	46.4	29,636	5,850	5,890	0	30.1	229.0	3,945,974
Tohatchi	11.36	3.80	45.6	90,183	5,890	6,100	210	91.5	2221.1	4,941,528
Coyote Cyn. Jct.	10.87	3.72	44.6	34,954	6,100	6,250	150	35.4	1308.6	0
Twin Lakes	9.80	3.50	42.0	15,594	6,250	6,380	130	17.8	918.8	4,673,171
Ya-ta-hay Jct.	9.13	3.41	40.9	31,181	6,380	6,580	180	35.1	1273.8	0
Chamorro Hill	8.46	2.64	31.6	20,683	6,580	6,335	375	31.5	1438.8	0
Gallup Jct.	5.46	2.64	31.6	14,523	6,580	6,477	-63	22.4	0.0	0
Church Rock	0.95	1.10	13.2	46,082	6,477	6,660	183	185.7	228.2	9,491,654
997,684 Total Pipeline Length(ft.)										
17,082										

Chapter Community	Total Capital Cost						Annual	
	Reservoir / WTP \$ (10)	Pump \$ (8)	Storage \$ (9)	Pipe Diameter used (in.)	Pipe-Common \$ (11)	Pipe-Rock \$ (11)	Energy Cost \$	O&M Cost \$
Hogback Div. Intake	\$2,000,000						\$12,000	\$120,000
Reservoir/WTP	\$54,701,005	\$208,955	\$0	52	\$48,252	\$6,031	\$54,960,278	\$319,874
NAPI Jct.		\$863,696	\$0	52	\$1,300,830	\$189,620	\$2,334,161	\$276,678
Shiprock Jct.		\$0	\$0	52	\$14,621,106	\$1,905,525	\$16,827,832	\$0
Sanostee	\$2,589,012	\$1,256,675	\$0	50	\$14,532,291	\$1,893,441	\$20,311,419	\$828,387
Burnham Jct.	\$291,121	\$0	\$0	46	\$7,536,257	\$981,444	\$8,810,821	\$93,258
Newcomb	\$0	\$962,421	\$0	46	\$2,817,234	\$366,790	\$4,146,445	\$0
Shedsprings	\$1,842,530	\$599,282	\$0	48	\$7,583,868	\$982,546	\$10,078,096	\$140,356
Naschiti	\$140,126	\$962,421	\$0	46	\$4,183,420	\$544,286	\$3,630,253	\$44,888
Tohatchi	\$1,258,317	\$1,256,675	\$0	46	\$12,730,987	\$1,566,331	\$17,042,980	\$435,445
Coyote Cyn. Jct.	\$799,648	\$0	\$0	46	\$4,834,275	\$641,977	\$5,375,900	\$256,160
Twin Lakes	\$962,322	\$1,256,675	\$0	42	\$2,003,236	\$260,328	\$4,122,561	\$180,135
Ya-ta-hay Jct.	\$779,576	\$0	\$0	42	\$4,003,034	\$520,225	\$5,122,784	\$249,730
Chamorro Hill	\$880,405	\$0	\$0	32	\$1,094,768	\$259,480	\$3,138,579	\$292,030
Gallup Jct.	\$0	\$0	\$0	32	\$1,417,264	\$183,987	\$1,601,251	\$0
Church Rock	\$139,635	\$2,305,200	\$0	14	\$2,081,603	\$275,512	\$4,801,951	\$44,731
Sub-Total	\$56,701,008	\$10,454,345	\$8,719,419		\$81,761,106	\$10,649,306	\$168,285,214	\$3,602,632
Capital Cost	\$56,701,008	\$10,454,345	\$8,719,419		\$81,761,106	\$10,649,306	\$168,285,214	\$3,602,632
Contingency Cost	20%						\$33,657,043	
Mobilization Cost	10%						\$16,828,521	
Indirect Cost	27%						\$45,437,008	
Totals							\$264,207,785	

- NOTES:**
- ALL POPULATIONS FROM 1980 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1980
 - CITY OF GALLUP ANNUAL DEMAND IS 7.5M GPD.
 - NAVAJO NATION DEMAND OF THE GALLUP PER CAPITA AND BASED ON 2040 PROJECTED DEMAND.
 - PIPELINE HEAD LOSS BASED ON HAZEN-WILLIAMS HEAD LOSS FORMULA (SLOPE FROM FRICTION COEFFICIENT).
 - ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 2040 ANNUAL DEMAND. COST FROM THE 1980 NAVAJO CONSTRUCTION COST DATA AND ADJUSTED TO 2000 DOLLARS.
 - STORAGE COST AND PUMP DEMANDS, NAVAJO, TWO DRY HILLS, BURNHAM, TONTO, MEXICAN SPRING, CHURCH ROCK, PINEBLADE, NAVAJO LAKE, AND HANDBO FOR THE COST ESTIMATE SHEET.
 - NAVAJO GALLUP DAILY PEAKING FACTOR OF 1.30
 - NAVAJO VELOCITY 4.0 FEET PER SECOND FROM NAVAJO ASSOCIATES, 1980.
 - ASSUME ENERGY PER FOOT FROM NAVAJO ASSOCIATES, 1980. COST PROVIDED TO 2000 GALLONS ASSUME PUMPING EFFICIENCY AT 70%.
 - HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEAD LOSS FORMULA (SLOPE FROM FRICTION COEFFICIENT).
 - BASED ON NAVAJO ANALYSIS BASED ON 2040 COSTS FROM NAVAJO, MEXICAN SPRING, A. VISION SOURCE, ASSUME WTP COST \$45,101,038.
 - PIPE INSTALLED COST FROM NAVAJO ANALYSIS BASED ON 2000 NAVAJO DOLLARS. ASSUME 80% OF PIPE LENGTH IS COMMON AND 20% IS ROCK EXCAVATION.
 - SETTLING RESERVOIR IS ASSUMED TO BE 1.5M AF CAPACITY. COST ESTIMATE FROM SETTLING AND NATATA.
 - ANNUAL ENERGY COST BASED ON NAVAJO NATION 2040 ANNUAL DEMAND COST - WTP, PUMPING BASED ON 2040 PER NAVAJO HOUR.
 - NAVAJO DEMAND COST BASED ON WTP COST, 20% DEMAND COST, WITHIN RESERVOIR COST - WTP, PUMP COST - WTP, STORAGE COST - WTP, PIPELINE COST - WTP.
 - WATERGATE COST INCLUDES ADDITIONAL MOBILIZATION/REPAIR AND APPURTENANCES AT 10% ADDITIONAL CONTINGENCY COST AT 20%.
 - INDIRECT COST INCLUDES FACILITIES, 10% TERRESTRIAL CONTRACT ADMIN. 10%, BURNHAM 2%, NAVAJO 2%, MEXICAN SPRING 2%, CHURCH ROCK 2%, PINEBLADE 2%, NAVAJO LAKE 2%, HANDBO 2%, DESIGN SURVEY 10%, TRAVEL 2%, DESIGN 10% AND CONSTRUCTION OTHER 10%.

Navajo - Gallup Water Supply Project - San Juan River Alternative
(Cost Estimate for Lateral Waterline from Cutral Reservoir to Huerfano, Nageezi, Pueblo Pintado, Tonnem)

Chapter Community	Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cummulative Flow
	(1)		(2,4)	1998 Prod.	Est. 2040 Prod.	Est. GW Dev.				
	1990	2043	Gal.	Ac-Ft	Ac-Ft	Cost \$3	Ac-Ft	Gal./Day(6)	cfs	cfs
Cutral Dam Intake/WTP	0	0	0	0	0	\$0	0	0	0.00	6.19
Huerfano	511	1,739	278,289	50	31	\$0	281	325,799	0.50	6.19
Nageezi	981	3,339	534,250	21	15	\$0	583	977,117	1.05	5.88
Counseelor	2,447	8,229	1,332,831	5	31	\$0	1,462	1,696,442	2.62	4.84
Tonnem	1,950	6,671	1,057,412	113	75	\$0	1,120	1,299,432	2.01	2.01

20,079 2040 Population Served 4.00 MGD
3,646 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (3)	Pump Horsepower (5)	Storage Demands (5) Gal
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Cutral Dam Intake/WTP	1.55	1.40	16.8	0	5,930	5,930	0	0.0	0.0	0
Huerfano	1.55	1.40	16.8	136,961	5,930	6,850	920	412.4	1336.2	1,253,072
Nageezi	1.42	1.35	16.1	61,308	6,850	6,950	100	211.6	287.1	2,604,296
Counseelor	1.16	1.21	14.6	105,773	6,950	6,960	-60	365.1	206.7	4,863,978
Tonnem	0.50	0.80	9.6	85,396	6,850	6,800	-260	508.5	81.0	4,997,816

289,438 Total Pipeline Length(ft.) 1,911
73.78 Total Pipeline Length (Miles)

	Total Capital Cost						Annual Energy Cost
	Water Treatment (\$10)	Pump (\$8)	Storage (\$5)	Pipe Diameter used (in.)	Pipe-Common (\$11)	Pipe-Rock (\$11)	
Cutral Dam Intake/WTP	\$5,715,197	\$0	\$0	18	\$0	\$0	\$5,715,197
Huerfano	\$817,775	\$320,423	\$0	18	\$7,735,813	\$1,014,245	\$9,886,256
Nageezi	\$175,889	\$559,352	\$0	15	\$3,115,144	\$410,084	\$4,300,259
Counseelor	\$125,517	\$1,296,675	\$0	15	\$5,374,472	\$797,506	\$7,505,170
Tonnem	\$49,566	\$1,296,675	\$0	10	\$2,912,223	\$392,204	\$4,650,868
Sub-Total	\$5,715,197	\$1,169,546	\$3,513,125		\$19,137,652	\$2,524,038	\$32,059,559
Capital Cost	\$5,715,197	\$1,169,546	\$3,513,125		\$19,137,652	\$2,524,038	\$32,059,559
Contingency Cost	20%						\$6,411,912
Mobilization Cost	10%						\$3,205,956
Indirect Cost	27%						\$8,556,081
Totals							\$50,333,507

Treatment	\$114,538
Pump Stations	\$374,654
Storage Tanks	\$489,190
Annual Operation and Maintenance Cost	
Treatment	\$1,145,359
Pump Stations	\$46,782
Storage Tanks	\$140,525
Conveyance Pipe	\$108,308
	\$1,440,974
Total	\$1,930,164

NOTES:

- ALL 1998 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
- ASSUME NAVAJO DEMAND OF 80 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS
- ASSUMED NAVAJO STORAGE DEMANDS ARE BASED ON 2040 GALLONS PER CAPITA AND 4.5 PERSONS-HOUSEHOLD
- ASSUME GALLONS/DAY PER PERSON FACTOR OF: 1.20
- ASSUME VELOCITY OF 4 FEET PER SECOND FROM INCH ASSOCIATES, 1990
- ASSUME 8000 GPM PER PUMP FROM INCH ASSOCIATES, 1990. COST INDEXED TO 2040 ON 1990 ASSUME PUMPING EFFICIENCY AT: 70%
- HEAD LOSS BASED ON 4 FEET PER 100 FEET BASED ON HAZENWILLIAMS HEADLOSS FORMULA (DOUBLE FROM FRICTION COEFFICIENT)
- BASED ON MINIMUM ANALYSIS BASED ON 800 GPM FROM MINIMUM HEADLOSS ANALYSIS & MINOR SOURCES. ASSUME WTP COST OF: \$4,715,197
- PIPE INSTALLED COST FROM MINIMUM ANALYSIS BASED ON 2040 GPM ASSUME 80% OF PIPE LENGTH IS COMMON AND 20% IS ROCK EXCAVATION
- ASSUME A CUTOFF OVERSIGHT ARE COST OF: \$1,000,000
- ANNUAL ENERGY COST BASED ON INTENSITY OF PUMPING ANNUAL GPM COST 7.10¢. PUMPING BASED ON 10.00 GPM PER HOUR/24 HOUR
- ANNUAL GPM COST BASED ON WTP COST: 800 GPM COST, INTENSITY OF PUMPING COST: 7.10¢. PUMP COST: 7.10¢. STORAGE COST: 7.10¢. PIPELINE COST: 7.10¢
- INDIRECT COST INCLUDES ADDITIONAL MOBILIZATION AND APPROPRIATE AT 10% ADDITIONAL CONTINGENCY COST AT 20%
- INDIRECT COST INCLUDES MOBILIZATION, 10%, TRAVEL, 20%, CONTRACT ADMIN., 10%, SHAPPING, 10%, EARTHWORK, 10%, DESIGN & 5% DESIGN SURVEY 1%, INVEST 2%, DESIGN 1%, AND CONSTRUCTION OVERHEAD 1%

Navajo - Gallup Water Supply Project - San Juan River Alternative
(Cost Estimate for Lateral Waterline to Red Rock NTUA Water Line)

Chapter Community	Populations(1,2)		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1) 1990	2040	Gal.	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. Prog. Dev. Cost \$	Ac-Ft	Gal./Day(8)	cts	cts
Gallup Jct.	0	0	0	0	0	\$0	0	0	0.00	3.95
Red Rock	3,815	12,985	2,077,840	78	138	\$0	2,189	2,540,774	3.93	3.93

12,385 2040 Population Served

2,189 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to Friction	Pump Horsepower	Storage Demands
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.	(9) ft.	HP	(5) Gal.
Gallup Jct.	0.98	1.12	13.4	0	6,477	6,477	0	0.0	0.0	0
Red Rock	0.98	1.12	13.4	26,320	6,477	6,750	273	106.1	241.6	9,772,209

26,320 Total Pipeline Length(ft.)

242

4.98 Total Pipeline Length (Miles)

	Total Capital Cost							Annual Energy Cost	
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$		
Gallup Jct.	\$0	\$0	\$0	14	\$0	\$0	\$0	Treatment	\$0
Red Rock		\$147,830	\$2,305,200	14	\$1,189,436	\$157,429	\$3,799,894	Pump Stations	\$47,356
Sub-Total	\$0	\$147,830	\$2,305,200		\$1,189,436	\$157,429	\$3,799,894		\$47,356
Capital Cost	\$0	\$147,830	\$2,305,200		\$1,189,436	\$157,429	\$3,799,894	Annual Operation and Maintenance Cost	
Contingency Cost	20%						\$758,979	Treatment	\$0
Mobilization Cost	10%						\$379,889	Pump Stations	\$5,913
Indirect Cost	27%						\$1,025,971	Storage Tanks	\$62,208
Totals							\$5,965,834	Conveyance Pipe	\$104,856

Total \$152,211

NOTES:

1. ALL NEW POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
2. BASELINE NAVAJO DEMAND OF RW DRAINAGE PROJECTS AND BASED ON 2040 PROJECTED DEMANDS.
3. ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 3.00 GAL/HOUSEHOLD & 4.4 PERSON/HOUSEHOLD COST FROM THE 1980 MANSION CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
4. RED ROCK DEMANDS INCLUDE RED ROCK, BREADSPRINGS, CHINO, TWIN CHAPTAIN
5. BASELINE SLOPE / RWT PEAKING FACTOR OF 1.30
6. BASELINE VELOCITY / 4 FEET PER SECOND FROM 1980 RESOURCES
7. JAVANE (BANK) PIPE FROM 1980 ASSOCIATES, 1980, COST ADDED TO 2000 (GT/HP) ASSUME PUMPING EFFICIENCY AT 70%
8. HEAD LOSS BASED ON 1 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA, EXCEPT FOR FRICTION COEFFICIENT
9. BASED ON IMPROV ANALYSIS BASED ON BID COSTS FROM 1985-1990, MORGANSON MATERIALS & LABOR SOURCES, ASSUME WTP COST OF \$0
10. PIPE INSTALLED COST FROM IMPROV ANALYSIS BASED ON BID PRICES COLLATED, ASSUME 5% OF PIPE LENGTH IS COMMON AND 95% IS ROCK EXCAVATION
11. ANNUAL ENERGY COST BASED ON 0.075 KWH/RESERVOIR/ANNUAL OAM COST * 1% PLUMBING BASED ON \$0.05 PER KWH/WT HOUR
12. ANNUAL OAM COST BASED ON WTP COST, BOR OAM COST, HEAD/RESERVOIR COST * 1% PLUMBING COST * 1% STORAGE COST * 1% PIPELINE COST * 1% PLUMBING
13. MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/DEMOGRAPHIC AND APPURTENANCES AT 1% ADDITIONAL CONTINGENCY COST AT 1%
14. INDIRECT COST INCLUDES FACILITIES 1%, 10% CONTRACT ADMIN 1%, ENVIRON 2%, BASEMENTS 1%, GEOTECH 1%, ADHOC 1%, DESIGN SURVEY 1%, INVEST 1%, DESIGN 1% AND CONSTRUCTION OBER 1%

Navajo - Gallup Water Supply Project - San Juan River Alternative
(Cost Estimate for Lateral Waterline to Coyote Canyon, Standing Rock, and Dalton Pass MTUA Water Line)

Chapter Community	Populations(1,2)		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1)			1998 Prod.	Est. 2040 Prod.	Est. Prog. Dev.				
	1990	2040	Gal	Ac-Ft	Ac-Ft	Cost \$	Ac-Ft	Gal./Day(5)	cfs	cfs
Coyote Cyn. Jct.	0	0	0			0	0	0	0.00	5.06
Coyote Canyon	1,234	4,200	672,034	32	61	0	692	902,849	1.24	5.06
Standing Rock	251	854	136,694	34	77	0	76	88,339	0.14	3.81
Dalton Pass	4,439	15,109	2,417,469	285	660	0	2,048	2,378,737	3.68	3.68

20,164 2040 Population Served

2,816 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (5)	Pump Horsepower	Storage Demands (5)
	Area sq ft (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Coyote Cyn. Jct.	1.26	1.27	15.2	0	6,250	6,250	0	0.0	0.0	0
Coyote Canyon	1.26	1.27	15.2	35,938	6,250	6,160	-90	124.1	27.9	3,087,881
Standing Rock	0.95	1.10	13.2	81,321	6,160	6,280	120	327.8	276.8	338,764
Dalton Pass	0.92	1.08	13.0	37,998	6,280	6,740	460	153.2	365.5	8,830,096

155,257 Total Pipeline Length(FL)

670

29.40 Total Pipeline Length (Miles)

Chapter Community	Total Capital Cost							Annual Energy Cost
	Water Treatment \$(10)	Pump \$(8)	Storage \$(6)	Pipe Diameter used (In.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	
Coyote Cyn. Jct.	\$0	\$0	\$0	16	\$0	\$0	\$0	Treatment \$0
Coyote Canyon	\$17,066	\$962,421	16	\$1,828,059	\$240,286	\$3,045,952	\$3,045,952	Pump Stations \$131,394
Standing Rock	\$169,412	\$212,079	14	\$3,675,005	\$486,408	\$4,542,902	\$4,542,902	
Dalton Pass	\$223,671	\$2,305,200	14	\$1,717,180	\$227,279	\$4,473,330	\$4,473,330	\$131,394
Sub-Total	\$0	\$410,169	\$3,479,699		\$7,218,245	\$954,072	\$12,062,185	Annual Operation and Maintenance Cost
Capital Cost	\$0	\$410,169	\$3,479,699		\$7,218,245	\$954,072	\$12,062,185	Treatment \$0
Contingency Cost	20%						\$2,412,437	Pump Stations \$18,407
Mobilization Cost	10%						\$1,206,218	Storage Tanks \$139,188
Indirect Cost	27%						\$3,256,790	Conveyance Pipe \$40,862
Totals							\$18,937,630	Total \$327,850

NOTES :

- 1) ALL 1998 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1998
- 2) AVERAGE NAVAJO DEMANDS OF 160 GALLONS PER CAPITA AND BASED ON 1998 PROJECTED DEMANDS
- 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 2,000 GALLONS/HOUSEHOLD @ 4.5 PERSONS/HOUSEHOLDS COST FROM THE 1998 HEAVY CONSTRUCTION COST DATA AND INDEXED TO 1998 DOLLARS
- 4) DALTON PASS DEMANDS INCLUDE DALTON PASS, CROWBERRY, LITTLEWATER, REDDYS LAKE VALLEY, AND WHITE ROCK CHAPTERS
- 5) AVERAGE GALLONS/DAY PER CAPITA FACTOR OF 1.30
- 6) AVERAGE VELOCITY IN FEET PER SECOND FROM NHA ASSOCIATES, 1998
- 7) AVERAGE BRHP PER PUMP FROM NHA ASSOCIATES, 1998, COST INDEXED TO 1998 (BRHP) AVERAGE PUMPING EFFICIENCY AT 70%
- 8) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (DRAUGHT RICH FRICTION COEFFICIENT)
- 9) BASED ON HANDBOOK ANALYSIS BASED ON 100 COSTS FROM MICHIGAN, MICHIGAN NADAPLE & LUBON SOURCES. AVERAGE WTP COST OF \$0
- 10) PIPE INSTALLED COST FROM HANDBOOK ANALYSIS BASED ON 2001 PER FOOT DOLLARS. AVERAGE 10% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION
- 11) ANNUAL ENERGY COST BASED ON WTP COST, BOR O&M COST, INTAKE/SERVICER COST * 6%, PUMP COST * 6%, STORAGE COST * 6%, PIPELINE COST * 6.5%
- 12) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/DEMOBILIZATION AND APPROPRIATE AT 10% ADDITIONAL CONTINGENCY COST AT 20%
- 13) INDIRECT COST INCLUDES INFLATION 1%, TENDENCY 1%, CONTRACT ADMIN. 1%, EMPLOYMENT 1%, EMBODIMENT 1%, GEOCHEM 0.5%, ADHOC 0.5%, DESIGN SURVEY 1%, INVEST 2%, DESIGN 0%, AND CONSTRUCTION OVERS. 10%

Navajo - Gallup Water Supply Project - San Juan River Alternative
(Cost Estimate for Main Wasteline from Yachtney to Rock Springs and Window Rock)

Chapter Community	Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1) 1990	2040	(2,3,4) Gal.	1990 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. Prog. Dev. Cost \$	Ac-Ft	Gal./Day(6)	cms	cms
Ya-ta-hay Jct.	0	0	0	0	0	\$0	0	0	0.00	14.71
Rock Springs	3,118	10,813	1,698,056	58	123	\$0	1,779	2,064,723	3.19	14.71
Window Rock	11,767	40,052	6,408,281	1,043	787	\$0	6,412	7,440,812	11.51	11.51

50,663 2040 Population Served

8,191 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction	Pump Horsepower	Storage Demands
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.	(8) ft.	HP	(5) Gal.
Ya-ta-hay Jct.	3.88	2.18	26.0	0	6,580	6,580	0	0.0	0.0	0
Rock Springs	3.68	2.16	26.0	29,439	6,580	6,760	200	57.9	614.7	7,941,242
Window Rock	2.88	1.91	23.0	58,887	6,850	6,760	110	127.0	442.3	28,617,740

88,326 Total Pipeline Length(ft.)

1.057

16.73 Total Pipeline Length (Miles)

Total Capital Cost								
Water Treatment \$(10)	Pump \$(8)	Storage \$(9)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$		
\$0	\$0	\$0	26	\$0	\$0	\$0	Annual Energy Cost	
\$378,203	\$378,203	\$1,728,900	26	\$2,345,352	\$304,981	\$4,758,436	Treatment	\$0
\$270,670	\$270,670	\$6,339,300	24	\$4,345,622	\$365,779	\$11,521,371	Pump Stations	\$207,220
								\$297,220
							Annual Operation and Maintenance Cost	
							Treatment	\$0
							Pump Stations	\$25,675
							Storage Tanks	\$322,728
							Conveyance Pipe	\$37,809
								\$388,412
Sub-Total	\$0	\$646,873	\$8,068,200	\$6,690,974	\$870,760	\$16,278,807	Total	\$393,632
Capital Cost	\$0	\$646,873	\$8,068,200	\$6,690,974	\$870,760	\$16,278,807		
Contingency Cost	20%					\$3,255,361		
Mobilization Cost	10%					\$1,627,681		
Indirect Cost	27%					\$4,394,738		
Totals						\$25,554,586		

NOTES:

1. ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
2. ASSUME NAVAJO DEMANDS OF 100 GALLONS PER CAPITA AND BASED ON 1990 PROJECTED DEMANDS
3. ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 2.5MG GALL/HOUSEHOLD @ 4.5 PERSON/HOUSEHOLD. COST FROM THE 1990 MANSION HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
4. ROCK SPRINGS DEMANDS INCLUDE ROCK SPRINGS, TAYATON, AND MANUELITO CHAPTERS. WINDOW ROCK INCLUDES ST. MICHAELS AND PT. DEBANCE CHAPTERS
5. ASSUME GALLON/DAY PEAKING FACTOR OF 1.30
6. ASSUME VELOCITY 4 FT/SEC FOR DESIGN FROM AHEM ASSOCIATES, 1999
7. ASSUME GPM/HP PER PUMP FROM AHEM ASSOCIATES, 1999. COST INDEXED TO 2000 (BPM/HP) ASSUME PUMPING EFFICIENCY AT 70%
8. HEAD LOSS BASED ON 4.7 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (DUCTILE IRON FRICTION COEFFICIENT)
9. BASED ON HINDR ANALYSIS BASED ON NO COSTS FROM AHEM-HAL MORRISON MATERIAL & LABOR SOURCES. ASSUME WTP COST OF \$0
10. PIPE INSTALLED COST FROM HINDR ANALYSIS BASED ON 2000 PUMPING DOLLARS. ASSUME 10% OF PIPE LENGTH IS DITCHING AND 10% IS ROCK EXCAVATION.
11. ANNUAL ENERGY COST BASED ON WTA/ENTRANCE SUPPORT ANALYSIS. DAM COST * 10% PUMPING BASED ON 30 IN PER SECOND HOUR
12. ANNUAL DAM COST BASED ON WTP COST. 20% DAM COST, 10% PUMPING COST * 10%, STORAGE COST * 10%, PIPELINE COST * 10%
13. MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANCES AT 10% ADDITIONAL CONTINGENCY COST AT 20%
14. INDIRECT COST MAJOR FACILITIES 1%, TENDERS, CONTRACT ADMIN. 1%, EMPLOY. 2%, BASEMENTS 1%, DESIGN 1%, DESIGN SURVEY 1%, MAINT. 2%, DESIGN 6%, AND CONSTRUCTION 66.6%.

(Cost Estimate for Lateral Waterline to Manzanita NTUA Water Line)

Gallup Jct.
Manuelito

339 Total Annual Demand(AF)

Gallup Jr.
Marshall

40

Gustafson J. C.
Murray J. L.

Total	\$39,002
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[illegible]

NIIP Alternative: Navajo - Gallup Water Supply Project Cost Scenarios. With GW.

NIIP Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Demand Years	Cost 2000 dollars	Navajo		Gallup		Totals \$ Cost \$
		A/F	\$Cost	A/F	\$Cost	
2010	Project Cost \$\$	11,141	\$177,472,504	7,500	\$84,323,220	\$261,795,724
	Annual Energy \$		\$1,209,292		\$677,369	\$1,886,661
	Annual O&M \$		\$929,415		\$1,770,058	\$2,699,473
2020	Project Cost \$\$	15,230	\$221,037,608	7,500	\$76,811,215	\$297,848,823
	Annual Energy \$		\$1,559,858		\$644,212	\$2,204,070
	Annual O&M \$		\$1,508,585		\$1,553,408	\$3,061,993
2030	Project Cost \$\$	21,291	\$289,756,411	7,500	\$69,702,466	\$359,458,877
	Annual Energy \$		\$1,862,118		\$807,680	\$2,469,798
	Annual O&M \$		\$2,409,182		\$1,309,836	\$3,719,018
2040	Project Cost \$\$	29,067	\$326,392,762	7,500	\$63,733,056	\$390,125,818
	Annual Energy \$		\$2,391,538		\$577,956	\$2,969,494
	Annual O&M \$		\$2,947,375		\$1,130,182	\$4,077,559
2040: No GW	Project Cost \$\$	32,254	\$348,110,088	7,500	\$61,334,101	\$409,444,189
	Annual Energy \$		\$2,645,752		\$566,693	\$3,212,445
	Annual O&M \$		\$3,243,243		\$1,079,273	\$4,322,516
2040: Laterals Lake Valley, Burnham Whiterock, Whitehorse Lake	Project Cost \$\$		\$8,121,709		Total:	\$417,565,891
	Annual Energy \$		\$53,903			\$3,266,344
	Annual O&M \$		\$24,396			\$4,346,911

NIIP Alternative: Navajo - Gallup Water Supply Project Cost/AF over Forty-Year Increments

Demand Years	Cost 2000 dollars	Navajo		Gallup	
		A/F	\$Cost/AF	A/F	\$Cost/AF
2010	Share Cost \$\$	11,141	\$15,929	7,500	\$11,243
	Annual Energy \$		\$109		\$90
	Annual O&M \$		\$83		\$236
2020	Share Cost \$\$	15,230	\$14,514	7,500	\$10,241
	Annual Energy \$		\$102		\$86
	Annual O&M \$		\$99		\$207
2030	Share Cost \$\$	21,291	\$13,610	7,500	\$9,294
	Annual Energy \$		\$87		\$81
	Annual O&M \$		\$113		\$175
2040	Share Cost \$\$	29,067	\$11,229	7,500	\$8,498
	Annual Energy \$		\$82		\$77
	Annual O&M \$		\$101		\$151

NOTE:

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE IS CORE LINE FROM GALLEGOS - YAHTAHEY - WINDOW ROCK - GALLUP - CHURCHROCK
- 3.) NASCHITTI LATERAL INCLUDES SANOSTEE, NEWCOMB, TWO GREY HILLS, SHEEP SPRINGS, NASCHITTI CHAPTERS.
- 4.) COYOTE CYN. JCT. LATERAL INCLUDES CROWNPOINT, DALTON PASS, BECENTI, COYOTE CANYON, STANDING ROCK, LITTLEWATER CHAPTERS.
- 5.) GALLEGOS RESERVOIR COST IS \$38,037,430 FOR 8,800 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) HUERFANO LATERAL IS FROM GALLEGOS/WTP-HUERFANO, NAGEEZI, PUEBLO PINTADO, TORREON NTUA SYSTEM
- 8.) ASSUME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.
- 9.) ALL COST ESTIMATES INCLUDES NAPI AND SHIPROCK AREA DEMANDS.

2040 NIIP Alternative: Navajo - Gallup Water Supply Project Cost. With GW.

NIIP Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Peaking Factor = 1.3 Demands: 29,066 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,066	\$353,693,927	0	\$0	\$353,693,927
Annual Energy \$		\$2,433,493		\$0	\$2,433,493
Annual O&M \$		\$3,734,238		\$0	\$3,734,238

Peaking Factor = 1.3 Demands: 36,567 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,067	\$326,392,762	7,500	\$63,733,056	\$390,125,818
Annual Energy \$		\$2,391,538		\$577,956	\$2,969,494
Annual O&M \$		\$2,947,375		\$1,130,182	\$4,077,556

NOTE:

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE IS CORE LINE FROM GALLEGOS - YAHTAHEY - WINDOW ROCK - GALLUP - CHURCHROCK
- 3.) NASCHITTI LATERAL INCLUDES SANOSTEE, NEWCOMB, TWO GREY HILLS, SHEEP SPRINGS, NASCHITTI CHAPT
- 4.) COYOTE CYN. JCT. LATERAL INCLUDES CROWNPOINT, DALTON PASS, BECENTI, COYOTE CANYON, STANDING ROCK, LITTLEWATER CHAPTERS.
- 5.) GALLEGOS RESERVOIR COST IS \$36,037,430 FOR 8,800 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) HUERFANO LATERAL IS FROM GALLEGOSWTP-HUERFANO,NAGEEZI, PUEBLO PINTADO, TORREON NTUA SYSTEM.
- 8.) ASSUMME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.

Navajo - Gallup Water Supply Project - NIIP Alternative
(Cost Estimate for Main Waterline to Gallup and Church Rock, with G.W. demands, plus Gallup area Navajo Demands)

Chapter Community	Populations		Daily Demand Gal	Annual Ground Water Production			Annual Demand Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1) 1990	2040		1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$3		Gal./Day(6)	cfs	
Galligos Reservoir	0	0	0	0	0	\$0	0	0	0.00	65
WTP	0	20,873	3,964,870	0	0	\$0	4,441	4,966,595	7.68	65
Huerfano Jct.	5,899	20,079	3,212,592	208	153	\$0	3,446	3,998,790	6.19	57
Burnham	246	837	133,971	0	0	\$0	150	174,162	0.27	51
Lake Valley	637	2,168	346,909	22	46	\$0	543	397,595	0.62	51
Naschit Jct.	5,914	19,789	3,168,291	851	334	\$0	3,213	3,728,550	5.77	50
Tohatchi	2,318	7,890	1,282,378	180	307	\$0	1,107	1,284,797	1.99	44
Coyote Cyn. Jct.	5,287	17,996	2,879,286	330	752	\$0	2,473	2,870,330	4.44	42
Twin Lakes	1,967	6,695	1,071,224	104	153	\$0	1,047	1,215,024	1.88	38
Yah-ta-hay Jct.	14,885	50,665	8,106,337	1,048	890	\$0	8,191	9,505,235	14.71	36
Gameroo Hill	0	0	0	0	0	\$0	0	0	0.00	21
Gallup Jct.	23,600	82,350	9,116,848	105	184	\$0	10,029	11,638,368	18.01	21
Church Rock	4,069	13,918	2,228,800	275	398	\$0	2,127	2,487,630	3.82	3

223,240 2040 Population Served

36,587 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (ft)	Pump Horsepower HP	Storage Demand (ft) Gal
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Galligos Reservoir	16.34	4.56	54.7	0	5,980	5,980	0	0.0	0.0	
WTP	16.34	4.56	54.7	1,000	5,980	8,005	45	0.8	485.9	
Huerfano Jct.	14.42	4.29	51.4	4,478	6,005	6,010	5	3.9	83.5	
Burnham	12.87	4.05	48.8	58,732	6,010	6,195	185	52.2	1980.1	
Lake Valley	12.81	4.04	48.5	72,046	6,195	5,740	-455	66.3	0.0	
Naschit Jct.	12.65	4.01	48.2	75,272	5,740	5,895	-45	73.6	234.8	
Tohatchi	11.21	3.78	45.3	82,686	5,895	6,100	405	63.9	2553.1	4,941.2
Coyote Cyn. Jct.	10.71	3.69	44.3	34,954	6,100	6,250	150	37.3	1301.2	
Twin Lakes	9.60	3.50	42.0	15,594	6,250	6,380	130	17.6	918.8	4,673.1
Yah-ta-hay Jct.	9.13	3.41	40.9	31,181	6,380	6,560	180	35.1	1273.8	
Gameroo Hill	5.46	2.64	31.6	20,482	6,560	6,490	-70	31.6	0.0	
Gallup Jct.	5.46	2.64	31.6	15,072	6,490	6,477	-13	23.3	36.4	
Church Rock	0.95	1.10	13.2	46,041	6,477	6,580	183	185.8	228.1	9,491.1

456,518 Total Pipeline Length(ft.)
86.46 Total Pipeline Length (Miles)

10,095

Chapter Community	Total Capital Cost						Annual	
	Reservoir / WTP \$(10)	Pump \$(9)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Energy Cost \$	O&M Cost \$
Galligos Reservoir	\$38,037,430						\$226,225	\$2,282,246
WTP	\$49,816,237	\$297,025	\$0	58	\$173,806	\$22,702	\$50,309,769	\$301,448
Huerfano Jct.		\$51,149	\$0	52	\$710,155	\$93,774	\$854,079	\$18,385
Burnham		\$1,211,807	\$0	50	\$8,740,667	\$1,138,639	\$11,091,313	\$388,192
Lake Valley		\$0	\$0	50	\$11,100,088	\$1,448,253	\$12,548,338	\$0
Naschit Jct.		\$143,688	\$0	48	\$11,257,130	\$1,485,623	\$12,868,440	\$46,029
Tohatchi		\$2,174,501	\$1,298,875	46	\$11,672,354	\$1,518,638	\$16,862,168	\$696,582
Coyote Cyn. Jct.		\$795,305	\$0	44	\$4,711,388	\$612,595	\$5,120,287	\$255,089
Twin Lakes		\$562,322	\$962,421	42	\$2,003,236	\$260,323	\$2,788,907	\$180,135
Yah-ta-hay Jct.		\$779,576	\$0	42	\$4,003,004	\$520,205	\$5,302,784	\$249,730
Gameroo Hill		\$0	\$0	32	\$1,998,788	\$259,480	\$2,258,268	\$0
Gallup Jct.		\$22,287	\$0	32	\$1,470,840	\$180,942	\$1,684,049	\$7,133
Church Rock		\$139,803	\$2,305,200	14	\$2,080,664	\$275,396	\$4,800,644	\$44,721
Sub-Total	\$87,853,687	\$6,178,242	\$4,584,296		\$59,931,105	\$7,804,766	\$186,332,077	\$2,185,444
Capital Cost	\$87,853,687	\$6,178,242	\$4,584,296		\$59,931,105	\$7,804,766	\$186,332,077	\$2,185,444
Contingency Cost							\$23,266,415	\$23,266,415
Mobilization Cost							\$18,633,208	\$18,633,208
Indirect Cost							\$44,908,861	\$44,908,861
Totals							\$261,141,360	\$261,141,360

NOTES:

1. NAVJO 1990 POPULATION FROM CENSUS DATA FROM THE "CHAPTER MAJORS, 1990 EDITION, DIVISION OF COMMUNITY DEVELOPMENT"
2. GALLUP DEMANDS ARE 7.38 AF PER YEAR FOR THE YEAR 2040
3. ASSUME NAVJO DEMANDS OF 780 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS
4. ASSUME 70% AF PER YEAR FOR NAVJO DELIVERY WILL BE AT THE WTP FACILITY. BHPROCK LITERALS DEMANDS AT THE WTP ALSO (3.74 AF/YR)
5. ESTIMATED IN-VAID STORAGE DEMANDS ARE BASED ON AVO DAILY DEMAND - ON PROD - 3 DAYS COST FROM THE 1998 MEANS HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2008 DOLLARS
6. STORAGE DEMANDS ARE ONLY MET FOR TOHATCHI, MEDICAN SPRINGS, TWIN LAKES, MANUELITO, AND CHURCH ROCK CHAPTERS, SINCE THEY FALL ON THE MAIN LINE TO GALLUP.
7. ASSUME GALLUP DAY PEAKING FACTOR OF: 1.30 EXCEPT FOR NAVJO DEMANDS WHICH IS 1.1 P P
8. ASSUME VELOCITY 4.4 FEET PER SECOND FROM (BPM ASSOCIATES, 1998)
9. ASSUME 80%WP PER PUMP FROM (BPM ASSOCIATES, 1998) COST ADDED TO 2008 (BPM) ASSUME PUMPING EFFICIENCY AT: 70%
10. HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZENWILLIAMS HEADLOSS FORMULA. SLIGHTLY FROM FRICTION COEFFICIENT
11. BASED ON IN-VAID ANALYSIS BASED ON BID COSTS FROM MICHIGAN, MONTANA, MINNESOTA, & VENDOR SOURCES. ASSUME WTP COST OF: \$49,816,237
12. PIPE INSTALLED COST FROM IN-VAID ANALYSIS BASED ON BID COSTS FROM MICHIGAN, MINNESOTA, & VENDOR SOURCES. ASSUME 90% OF PIPE LENGTH IS COMMON AND 10% IS ROCK ELEVATION
13. GALLIGOS RESERVOIR IS ASSUMED TO BE 100 AF PLUS CAPACITY. 1998 COST ESTIMATE FROM USBR INDEXED TO 2008
14. ANNUAL ENERGY COST BASED ON 100 AF PER YEAR. ANNUAL O&M COST * 10% PLUMBING BASED ON \$0.30 PER HOUR/FT HOUR
15. ANNUAL O&M COST BASED ON WTP COST: BOR O&M COST, INFRASTRUCTURE COST * 1% PIPE COST * 1%, STORAGE COST * 1%, PIPELINE COST * 1.5%
16. MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION PREPARATION AND APPURTENANTS AT 10% ADDITIONAL CONTINGENCY COST AT 20%
17. INDIRECT COST INCLUDES FACILITATING 1%, TENDON 2%, CONTRACT ADMIN. 1%, ENGINEERING 1.5%, EARTHWORK 1.5%, GEOCHEM 0.5%, AGCHEM 0.5%, DESIGN SURVEY 1%, INVEST 2%, DESIGN 1%, AND CONSTRUCTION OBSER. 10%

Navajo - Gallup Water Supply Project - NIIP Alternative
(Cost Estimate for Lateral Waterline from Gallup/WTP to Huerfano, Nageezi, Pueblo Pintado, Toremón)

Chapter Community	Populations		Daily Demand (3,4) Gal.	Annual Ground Water Production			Annual Demand Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1) 1990	2040		1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$3		Gal./Day(8)	cfs	
Huerfano Jct.	0	0	0	0	0	\$0	0	0	0.00	6.1
Huerfano	511	1,739	278,289	59	31	\$0	281	325,799	0.50	6.1
Nageezi	981	3,339	534,250	31	15	\$0	583	677,117	1.05	5.6
Counseor	2,447	8,329	1,332,631	5	31	\$0	1,462	1,696,442	2.62	4.6
Toremón	1,960	6,671	1,067,412	113	76	\$0	1,120	1,299,432	2.01	2.0

20,079 2040 Population Served

\$0

3,446 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (9) ft.	Pump Horsepower HP	Storage Demands (5) Gal
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Huerfano Jct.	1.55	1.40	16.8	0	6,010	6,010	0	0.0	0.0	
Huerfano	1.55	1.40	16.8	96,798	6,010	6,803	793	297.5	1093.6	1,253.07
Nageezi	1.42	1.35	16.1	61,308	6,803	6,947	144	211.6	327.8	2,604.29
Counseor	1.16	1.21	14.6	105,773	6,947	6,800	-147	365.1	163.9	5,002.35
Toremón	0.50	0.80	9.6	85,396	6,800	6,892	-108	506.5	130.5	4,997.81

351,265 Total Pipeline Length(ft.)
66.53 Total Pipeline Length (Miles)

1,716

Chapter Community	Total Capital Cost						Annual Energy Cost
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	
Huerfano Jct.	\$0	\$0	\$0	18	\$0	\$0	\$0
Huerfano		\$669,279	\$320,423	18	\$5,579,730	\$731,550	\$7,300,932
Nageezi		\$200,493	\$362,421	16	\$3,115,144	\$410,084	\$4,688,141
Counseor		\$100,308	\$1,296,675	16	\$5,374,472	\$707,506	\$7,478,961
Toremón		\$79,581	\$1,296,675	10	\$2,912,223	\$382,204	\$4,680,983
Sub-Total	\$0	\$1,049,960	\$3,876,194		\$16,981,570	\$2,241,353	\$24,149,077
Capital Cost	\$0	\$1,049,960	\$3,876,194		\$16,981,570	\$2,241,353	\$24,149,077
Contingency Cost	20%						\$4,829,815
Mobilization Cost	10%						\$2,414,908
Indirect Cost	27%						\$6,520,251
Totals							\$37,914,051

Annual Energy Cost
Treatment \$0
Pump Stations \$336,345
Annual Operation and Maintenance Cost
Treatment \$0
Pump Stations \$41,996
Storage Tanks \$155,048
Conveyance Pipe \$96,115
Total \$629,506

NOTES:

- ALL 1990 POPULATIONS FROM "1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION", 1990
- ASSUME NAVAJO DEMANDS OF 180 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS
- ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - GW PROD * 5 DAYS. COST FROM THE 1989 MERRILL HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS
- ASSUME GALLON/DAY PEAKING FACTOR OF 1.30
- ASSUME \$600/HP PER PUMP FROM (M&M ASSOCIATES, 1989). COST INDEXED TO 2000 (\$40/HP) ASSUME PUMPS EFFICIENCY AT: 70%
- HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (DUCTILE IRON FRICTION COEFFICIENT)
- BASED ON M&M ANALYSIS BASED ON BID COSTS FROM M&M-MORRISON MAHERLE, & USBOR SOURCES. ASSUME WTP COST OF \$0
- PIPE INSTALLED COST FROM M&M ANALYSIS BASED ON BOR-PAL 1999 DOLLARS. ASSUME 80% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION
- ANNUAL ENERGY COST BASED ON INSTANTANEOUS RESERVOIR ANNUAL O&M COST * 10%. PUMPING BASED ON 30.0 M PER HOUR/1000 HP
- ANNUAL O&M COST BASED ON WTP COST. BOR O&M COST * 10% + RESERVOIR COST * 10% + PUMP COST * 10% + STORAGE COST * 10% + PIPELINE COST * 10%
- MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 20%
- INDIRECT COST INCLUDES FACILITATING 1%, TENDON 2%, CONTRACT ADMIN. 1%, ENVIRON. 2%, EASEMENTS 1%, GEO-EX. 0.5%, ACH-EOL 0.5%, DESIGN SURVEY 1%, INVEST. 2%, DESIGN 6%, AND CONSTRUCTION OBSER. 10%

Navajo - Gallup Water Supply Project - NWP Alternative
(Cost Estimate for Lateral Waterline to Red Rock NTUA Water line)

Chapter Community	Populations (1,2)		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1) 1990	2040	Gal.	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$	Ac-Ft	Gal./Day(6)	cfs	cfs
Gallup Jct.	0	0	0	0	0	\$0	0	0	0.00	
Red Rock	3,815	12,985	2,077,840	78	138	\$0	2,189	2,540,774	3.93	
	12,985 2040 Population Served					\$0	2,189 Total Annual Demand(AF)			

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to Friction (9)	Pump Horsepower HP	Storage Demand (5) Ga
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Gallup Jct.	0.98	1.12	13.4	0	6,490	6,490	0	0.0	0.0	
Red Rock	0.98	1.12	13.4	26,320	6,490	6,750	260	106.1	233.3	9.77
	26,320 Total Pipeline Length(ft.)				4.98 Total Pipeline Length (Miles)			233		

Total Capital Cost							Annual Energy Cost	
Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	Treatment	
Gallup Jct.	\$0	\$0	14	\$0	\$0	\$0	\$0	\$0
Red Rock	\$142,760	\$2,305,200	14	\$1,189,436	\$157,429	\$3,794,825	Pump Stations	\$45,732
Sub-Total	\$0	\$142,760		\$1,189,436	\$157,429	\$3,794,825		\$45,732
Capital Cost	\$0	\$142,760		\$1,189,436	\$157,429	\$3,794,825	Annual Operation and Maintenance C	
Contingency Cost	20%						Treatment	\$0
Mobilization Cost	10%						Pump Stations	\$5,710
Indirect Cost	27%						Storage Tanks	\$92,208
Totals						\$5,957,875	Conveyance Pipe	\$6,734
								\$104,653
							Total	\$150,385

NOTES:

- 1) ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
- 2) ASSUME NAVAJO DEMANDS OF 180 GALLONS PER CAPITA AND BASED ON 1990 PROJECTED DEMANDS
- 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - ON PROD - 5 DAYS. COST FROM THE 1993 MANSION HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS
- 4) RED ROCK DEMANDS INCLUDE RED ROCK, BREADSPRING, CHICKILTAH CHAPTERS
- 5) ASSUME GALLON / DAY PEAKING FACTOR OF: 1.30
- 6) ASSUME VELOCITY 4.4 FEET PER SECOND FROM (PWA ASSOCIATES, 1995)
- 7) ASSUME 500HP PER PUMP FROM (PWA ASSOCIATES, 1995). COST INDEXED TO 2000 (BASED ON ASSUME PUMPING EFFICIENCY AT 70%
- 8) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEAD LOSS FORMULA (SHUTTLE WORTH FRICTION COEFFICIENT)
- 9) BASED ON HNDWR ANALYSIS BASED ON BID COSTS FROM MS-AHOL HORNISH MANUEL, A USBOR SOURCE. ASSUME WTP COST \$0
- 10) PIPE INSTALLED COST FROM HNDWR ANALYSIS BASED ON \$0.45/FT (1990 DOLLARS). ASSUME 80% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION
- 11) ANNUAL ENERGY COST BASED ON INTAKE/RESERVOIR ANNUAL O&M COST * 10%, PUMPING BASED ON \$0.04 PER KILOWATT HOUR
- 12) ANNUAL O&M COST BASED ON WTP COST, \$0.04 O&M COST, INTAKE/RESERVOIR COST * 4%, PUMP COST * 4%, STORAGE COST * 4%, PIPELINE COST * 2.5%
- 13) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 20%
- 14) INDIRECT COST INCLUDES FACILITATING 1%, TRUCKING 1%, CONTRACT ADMIN. 1%, ENVPROM 2%, EASEMENT 1%, GEOCHD 0.5%, ACHEOL 0.5%, DESIGN SURVEY 1%, INVEST 2%, DESIGN 6%, AND CONSTRUCTION OBSER. 10%

Navajo - Gallup Water Supply Project - NHP Alternative
(Cost Estimate for Lateral Waterline to Coyote Canyon, Standing Rock, and Dalton Pass NTUA Water Line)

Chapter Community	Populations(1,2)		Daily Demand Gal.	Annual Ground Water Production			Annual Demand Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1) 1990	2040		1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$		Gal./Day(5)	cfs	
Coyote Cyn. Jct.	0	0	0	0	0	\$0	0	0	0.00	4.44
Coyote Canyon	1,234	4,200	672,034	32	61	\$0	692	802,849	1.24	4.44
Standing Rock	251	854	136,684	34	77	\$0	76	88,339	0.14	3.20
Dalton Pass	3,802	12,941	2,070,561	263	614	\$0	1,705	1,979,142	3.06	3.06

17,996 2040 Population Served

\$0

2,473 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (9) ft	Pump Horsepower HP	Storage Demands (5) Gal
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Coyote Cyn. Jct.	1.11	1.19	14.3	0	6,250	6,250	0	0.0	0.0	0
Coyote Canyon	1.11	1.19	14.3	35,938	6,250	6,160	-90	144.8	39.5	3,087,881
Standing Rock	0.80	1.01	12.1	81,321	6,160	6,280	120	391.9	265.4	339,764
Dalton Pass	0.77	0.99	11.8	37,996	6,280	6,740	460	183.1	319.2	7,612,083

155,267 Total Pipeline Length(ft.)

624

29.49 Total Pipeline Length (Miles)

Total Capital Cost								
Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$		
\$0	\$0	\$0	14	\$0	\$0	\$0	Annual Energy Cost	
\$24,164	\$24,164	\$862,421	14	\$1,624,086	\$214,957	\$2,825,628	Treatment	\$0
\$162,452	\$162,452	\$212,078	12	\$3,222,079	\$429,588	\$4,025,187	Pump Stations	\$122,364
\$195,363	\$195,363	\$1,728,900	12	\$1,505,547	\$200,729	\$3,630,539	Annual Operation and Maintenance Cost	
Sub-Total	\$0	\$381,879	\$2,903,399	\$8,351,712	\$845,273	\$10,482,364	Treatment	\$0
Capital Cost	\$0	\$381,879	\$2,903,399	\$8,351,712	\$845,273	\$10,482,364	Pump Stations	\$15,279
Contingency Cost	20%					\$2,096,473	Storage Tanks	\$118,136
Mobilization Cost	10%					\$1,048,236	Conveyance Pipe	\$35,985
Indirect Cost	27%					\$2,830,238		\$167,400
Totals						\$16,457,311	Total	\$289,764

NOTES:

- 1) ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
- 2) ASSUME NAVAJO DEMANDS OF 180 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS
- 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - GH PROD * 5 DAYS COST FROM THE 1993 MANSHEIM CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS
- 4) DALTON PASS DEMANDS INCLUDE DALTON PASS, CHIMNEYPOINT, LITTLEWATER, RECENT, LAKE VALLEY, AND WHITEROCK CHAPTERS
- 5) ASSUME GALLON/DAY PEAKING FACTOR OF 1.20
- 6) ASSUME VELOCITY = 4 FEET PER SECOND FROM PHM ASSOCIATES, 1993
- 7) ASSUME 3500HP PER PUMP FROM PHM ASSOCIATES, 1993. COST INDEXED TO 2000 (\$1000HP ASSUME PUMPING EFFICIENCY 70%)
- 8) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA. (SMOOTH PIPE FRICTION COEFFICIENT)
- 9) BASED ON INDIAN ANALYSIS BASED ON BHO COSTS FROM MHC-HMA, MONTGOMERY MANVILLE, & USBOR SOURCES. ASSUME WTP C \$0
- 10) PIPE INSTALLED COST FROM INDIAN ANALYSIS BASED ON BHO(PIH) 1993 DOLLARS. ASSUME 50% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION
- 11) ANNUAL ENERGY COST BASED ON INTAKE/RESERVOIR ANNUAL O&M COST * 10%. PUMPING BASED ON \$0.06 PER KILOWATT HOUR
- 12) ANNUAL O&M COST BASED ON WTP COST: BOR DAM COST, INTAKE/RESERVOIR COST * 5%, PUMP COST * 4%, STORAGE COST * 4%, PIPELINE COST * 0.5%
- 13) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/REPREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 20%
- 14) INDIRECT COST INCLUDES FACILITATING 1%, TEND 2%, CONTRACT ADMIN. 1%, ENVIRON. 2%, EASEMENTS 1%, GEOCHEM. 0.5%, ACH-EOL 0.5%, DESIGN SURVEY 1%, INVEST 2%, DESIGN 5%, AND CONSTRUCTION OBSER. 10%

Navajo - Gallup Water Supply Project - NIP Alternative
(Cost Estimate for Main Waterline from Tanshery to Rock Springs and Window Rock)

Chapter Community	Populations		Daily Demand (2,3,4) Gal.	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1) 1990	2040		1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$	Ac-Ft	Gal./Day(6)	cfs	cf
Ya-ta-hay Jct.	0	0	0	0	0	\$0	0	0	0.00	
Rock Springs	3,118	10,613	1,698,056	58	123	\$0	1,779	2,064,723	3.19	
Window Rock	11,767	40,052	6,408,281	1,043	767	\$0	6,412	7,440,612	11.51	

50,665 2040 Population Served

\$0 8,191 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction	Pump Horsepower	Stor. Dem.
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.	(9)	HP	(5) G
Ya-ta-hay Jct.	3.68	2.16	26.0	0	6,560	6,560	0	0.0	0.0	
Rock Springs	3.68	2.16	26.0	29,439	6,560	6,760	200	57.9	614.7	7.9
Window Rock	2.88	1.91	23.0	58,887	6,760	6,760	0	127.0	237.0	28.6

83,326 Total Pipeline Length(ft.)

852

16.73 Total Pipeline Length (Miles)

Chapter Community	Total Capital Cost						Annual Energy Cost	
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (In.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	
Ya-ta-hay Jct.	\$0	\$0	\$0	26	\$0	\$0	\$0	Treatment \$0
Rock Springs	\$376,203	\$376,203	\$1,728,900	26	\$2,345,352	\$304,981	\$4,755,436	Pump Stations \$166,979
Window Rock	\$145,049	\$145,049	\$6,339,300	24	\$4,345,622	\$585,779	\$11,395,750	\$166,979
Sub-Total	\$0	\$521,252	\$8,068,200		\$6,690,974	\$870,760	\$16,151,187	Annual Operation and Maintenance \$0
Capital Cost	\$0	\$521,252	\$8,068,200		\$6,690,974	\$870,760	\$16,151,187	Treatment \$0
Contingency Cost	20%						\$3,230,237	Pump Stations \$20,850
Mobilization Cost	10%						\$1,615,119	Storage Tanks \$322,728
Indirect Cost	27%						\$4,360,820	Conveyance Pipe \$37,809
Totals							\$25,357,363	Total \$548,385

NOTES:

- 1) ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
- 2) ASSUME NAVAJO DEMAND OF 180 GALLONS PER CAPITA AND BASED ON 20-YR PROJECTED DEMAND
- 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVO DAILY DEMAND - ON PROD 15 DAYS. COST FROM THE 1989 MANSHEA CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS
- 4) ROCK SPRINGS DEMANDS INCLUDE ROCK SPRINGS, TANSHERY, AND MANUELITO CHAPTERS. WINDOW ROCK INCLUDES ST. MICHAELS AND FT. DEFANCE CHAPTERS
- 5) ASSUME GALLON / DAY PEAKING FACTOR OF 1.30
- 6) ASSUME VELOCITY 4 FT PER SECOND FROM (P&M ASSOCIATES, 1992)
- 7) ASSUME 3000 GPM PER PUMP FROM (P&M ASSOCIATES, 1992). COST INDEXED TO 2000 (\$812/HP) ASSUME PUMPING EFFICIENCY AT 70%
- 8) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA. (DUCTILE IRON FRICTION COEFFICIENT)
- 9) BASED ON KNOWN ANALYSIS BASED ON BID COSTS FROM MBE-HON, MICHIGAN MANUFACTURE, & USBOR SOURCES. ASSUME WTP COST \$0
- 10) PIPE INSTALLED COST FROM (P&M) ANALYSIS BASED ON (P&M) 1999 DOLLARS. ASSUME 10% OF PIPE LENGTH IS COMMON AND 90% IS ROCK EXCAVATION
- 11) ANNUAL ENERGY COST BASED ON WTP COST: WTP COST * 10%, PUMPING COST * 1%, STORAGE COST * 1%, PIPELINE COST * 0.5%
- 12) ANNUAL O&M COST BASED ON WTP COST: WTP COST * 1%, PUMP COST * 1%, STORAGE COST * 1%, PIPELINE COST * 0.5%
- 13) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION PREPARATION AND APPURTENANTS AT 10% ADDITIONAL CONTINGENCY COST AT 20%
- 14) INDIRECT COST INCLUDES FACILITATING 1%, TRNG 2%, CONTRACT ADMIN 1%, ENVIRON 2%, ESTIMATING 1%, GEOCHEM 0.5%, ACQ-OL 0.5%, DESIGN SURVEY 1%, INVEST 2%, DESIGN 6%, AND CONSTRUCTION OBSER 10%

Navajo - Gallup Water Supply Project - NHP Alternative
(Cost Estimate for Lateral Waterline from mainline to Naschiti, Sheepsprings, Newcomb, Two Grey Hills, Sanostee)

Chapter Community	Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1)	2040	(3,4)	1998 Prod.	Est. 2040 Prod.	Est. GW Dev.	Ac-Ft	Gal./Day(6)	cfs	cfs
	1990		Gal	Ac-Ft	Ac-Ft	Cost \$\$				
Naschiti Jct.	0	0	0	0	0	\$0	0	0	0.00	5.77
Naschiti	1,539	5,238	836,136	82	77	\$0	862	1,000,213	1.55	5.77
Sheepsprings	560	2,246	359,434	0	15	\$0	386	449,656	0.70	4.22
Newcomb	1,534	5,221	835,413	680	89	\$0	847	962,746	1.52	3.53
Sanostee	2,081	7,063	1,133,306	89	153	\$0	1,117	1,295,734	2.00	2.00

19,789 2040 Population Served

\$0 3,213 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction	Pump Horsepower	Storage Demands
	Area	Diameter	Diameter	Length	Beginning	Ending	Change	(9)	HP	(5)
	sq. ft.(7)	ft.	inches	ft.	ft.	ft.	ft.	ft.		Gal
Naschiti Jct.	1.44	1.36	16.3	0	5,695	5,695	0	0.0	0.0	0
Naschiti	1.44	1.36	16.3	51,679	5,695	5,890	195	178.4	349.2	3,846,974
Sheepsprings	1.06	1.16	13.9	29,635	5,890	5,893	-7	119.4	76.9	1,730,217
Newcomb	0.88	1.06	12.7	51,174	5,893	5,550	-333	206.3	0.0	3,779,794
Sanostee	0.50	0.80	9.6	51,019	5,550	5,580	30	303.8	108.5	4,983,591

183,507 Total Pipeline Length(ft.)
34.76 Total Pipeline Length (Miles)

535

	Total Capital Cost								
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$		
Naschiti Jct.	\$0	\$0	\$0	16	\$0	\$0	\$0	Annual Energy Cost	\$0
Naschiti	\$213,688	\$962,421	\$962,421	16	\$2,625,881	\$345,678	\$4,147,667	Treatment	\$0
Sheepsprings	\$47,087	\$598,352	\$598,352	14	\$1,398,245	\$177,257	\$2,162,941	Pump Stations	\$104,803
Newcomb	\$0	\$962,421	\$962,421	14	\$2,312,622	\$306,089	\$3,581,131	Annual Operation and Maintenance Cost	\$0
Sanostee	\$66,386	\$1,296,875	\$1,296,875	10	\$1,739,879	\$234,318	\$3,337,258	Treatment	\$0
Sub-Total	\$0	\$327,161	\$3,820,869		\$8,017,627	\$1,083,340	\$13,228,997	Pump Stations	\$13,088
Capital Cost	\$0	\$327,161	\$3,820,869		\$8,017,627	\$1,083,340	\$13,228,997	Storage Tanks	\$152,835
Contingency Cost	20%						\$2,645,799	Conveyance Pipe	\$40,088
Mobilization Cost	10%						\$1,322,900		\$206,009
Indirect Cost	27%						\$3,571,829	Total	\$310,813
Totals							\$20,769,526		

- NOTES:
- 1) ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
 - 2) ASSUME NAVAJO DEMANDS OF 100 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS.
 - 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - GW PROD - 5 DAYS COST FROM THE 1999 MERRILL HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
 - 4) ASSUME GALLONS/DAY PLACING FACTOR OF 1.30
 - 5) ASSUME VELOCITY 4 FEET PER SECOND FROM (PDM ASSOCIATES, 1998)
 - 6) ASSUME \$800/HP PER PUMP FROM (PDM ASSOCIATES, 1998) COST INDEXED TO 2000 (\$113/HP) ASSUME PUMPING EFFICIENCY AT 70%
 - 7) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (DUCOTLE IRON FRICTION COEFFICIENT)
 - 8) BASED ON MICHNA ANALYSIS BASED ON 1990 COSTS FROM MBE-HWA, MORRISON MATERIAL, 4 USBOR SOURCES ASSUME WTP COST \$0
 - 9) PIPE INSTALLED COST FROM MICHNA ANALYSIS BASED ON 1990 COSTS FROM MBE-HWA, MORRISON MATERIAL, 4 USBOR SOURCES ASSUME WTP COST \$0
 - 10) ANNUAL ENERGY COST BASED ON INTAKE/RESERVOIR ANNUAL O&M COST * 10%, PUMPING: BASED ON 30.0 GAL PER KWH/HR
 - 11) ANNUAL O&M COST BASED ON WTP COST: BOR O&M COST, INTAKE/RESERVOIR COST * 5%, PUMP COST * 4%, STORAGE COST * 4%, PIPELINE COST * 2.5%
 - 12) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/REMOVAL AND APPURTENANCES AT 10% ADDITIONAL CONTINGENCY COST AT 20%
 - 13) INDIRECT COST INCLUDE FACILITIES 1%, TOOL 2%, CONTRACT ADMIN. 1%, ENVIRON. 2%, EASEMENTS 1%, GEOCHEM. 3.5%, AD-ECOL. 3.5%, DESIGN SURVEY 15, INVEST. 2%, DESIGN 5%, AND CONSTRUCTION ORDER 10%

Navajo - Gallup Water Supply Project - NIIP Alternative
(Cost Estimate for Lateral to Shiprock/666 Jct. from Gallup Reservoir)

Chapter Community	2040 Shiprock Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumms Flo
	Total Population	Population Served	Gal	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$	Ac-Ft	Gal/Day(8)	cfs	ctf
WTP	0	0	0	0	0	\$0	0	0	0.00	
Hogback	0	0	0	0	0	\$0	0	0	0.00	
Shiprock	46,985	20,873	3,339,749	0	0	\$0	3,741	4,341,674	6.72	

20,873 2040 Population Served

3,741 Total Annual Demand(AF)

Chapter Community	Pipe Dimensions				Elevation			Headloss due to friction	Horsepower	Stor Dema
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.	(9) ft.	HP	(5, Ga
WTP	1.68	1.46	17.5	0	6,010	6,010	0	0.0	0.0	
Hogback	1.68	1.46	17.5	139,824	6,010	5,400	-610	421.1	0.0	
Shiprock	1.68	1.46	17.5	55,532	5,400	5,164	-236	167.2	0.0	

195,356 Total Pipeline Length(ft.)
37.00 Total Pipeline Length (Miles)

	Total Capital Cost						Annual	
	Reservoir / WTP \$(10)	Pump \$(8)	Storage \$(9)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Energy Cost \$	O&M Cost \$
WTP	\$0	\$0	\$0	18	\$0	\$0	\$0	\$0
Hogback		\$0	\$0	18	\$7,897,520	\$1,035,446	\$8,932,966	\$44,665
Shiprock		\$0	\$0	18	\$3,136,551	\$411,234	\$3,547,785	\$17,739
Sub-Total	\$0	\$0	\$0		\$11,034,071	\$1,446,680	\$12,480,751	\$62,404
Capital Cost	\$0	\$0	\$0		\$11,034,071	\$1,446,680	\$12,480,751	
Contingency Cost	20%						\$2,496,150	
Mobilization Cost	10%						\$1,248,075	
Indirect Cost	27%						\$3,369,803	
Totals							\$19,594,779	

NOTES:

- 1) NAVAJO 1990 POPULATION FROM CENSUS DATA FROM THE "CHAPTER PAGES, 1992 EDITION, DIVISION OF COMMUNITY DEVELOPMENT"
- 2) GALLUP DEMANDS ARE 4,399 AF PER YEAR FOR THE YEAR 2010.
- 3) ASSUME NAVAJO DEMANDS OF 180 GALLONS PER CAPITA AND BASED ON 2010 PROJECTED DEMANDS.
- 4) ASSUME NO PIPELINE DEMANDS FOR NIIP, SINCE THEIR DEMANDS ARE MET VIA NIIP CANALS.
- 5) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 2,000 GAL/HOUSEHOLD @ 4.5 PERSONS/HOUSEHOLD. COST FROM THE 1993 MEANS HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
- 6) STORAGE DEMANDS ARE ONLY MET FOR BURRHEAD, NASCHETTL, TONCHALI, MEXICAN SPRINGS, AND THIN LINED CHAPTERS, SINCE THEY FALL ON THE MAIN LINE TO GALLUP.
- 7) ASSUME GALLON / DAY PEAKING FACTOR OF 1.30
- 8) ASSUME VELOCITY 14 FEET PER SECOND FROM (FROM ASSOCIATES, 1999)
- 9) ASSUME 8800HP PER PUMP FROM (FROM ASSOCIATES, 1999). COST INDEXED TO 2000 (\$818HP) ASSUME PUMPING EFFICIENCY AT 70%.
- 10) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (EXCLUDE FROM FRICTION COEFFICIENT)
- 11) BASED ON INDIAN ANALYSIS BASED ON BID COSTS FROM MBE-HSA, JOHNSON HANDELS, & USBOR SOURCES. ASSUME WTP COST \$5,119,511
- 12) PIPE INSTALLED COST FROM INDIAN ANALYSIS BASED ON BOR PLAN (1998 DOLLARS). ASSUME 90% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION.
- 13) GALLUP RESERVOIR IS ASSUMED TO BE 4,300 AF PLUS CAPACITY. 1998 COST ESTIMATE FROM USBR INDEXED TO 2000.
- 14) ANNUAL ENERGY COST BASED ON INTAKE/STORAGE/ANNUAL O&M COST * 10%. PUMPING BASED ON \$0.04 PER KILOWATT HOUR.
- 15) ANNUAL O&M COST BASED ON WTP COST: BOR O&M COST, INTAKE/STORAGE COST * 8%, PUMP COST * 4%, STORAGE COST * 4%, PIPELINE COST * 0.5%.
- 16) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/REPREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 20%.
- 17) PROJECT COST INCLUDE FACILITIES: 1%, TENDERS, CONTRACT ADMIN: 1%, E&H FROM 2%, E&M FROM 1%, GEOCHEM 0.5%, ACHOL 0.5%, DESIGN SURVEY: 1%, INVEST: 2%, DESIGN: 8%, AND CONSTRUCTION OBSER: 10%.

Navajo - Gallup Water Supply Project - NIIP Alternative

(Cost Estimate for Lateral Waterline to Manuelito NTUA Water line)

Chapter Community	Populations(1,2)		Daily Demand Gal	Annual Ground Water Production			Annual Demand Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1) 1990	2040		1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$		Gal./Day(6)	cfs	
Gallup Jct.	0	0	0	0	0	\$0	0	0	0.00	0.6'
Manuelito	631	2,148	343,641	78	46	\$0	339	393,348	0.81	0.6'

2,148 2040 Population Served

\$0

339 Total Annual Demand(AP)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (9) ft.	Pump Horsepower HP	Storage Demands (5) Gal
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Gallup Jct.	0.15	0.44	5.3	0	6,477	6,477	0	0.0	0.0	0
Manuelito	0.15	0.44	5.3	47,050	6,477	6,375	-102	506.7	39.9	1,512,872

47,050 Total Pipeline Length(ft.)

40

8.91 Total Pipeline Length (Miles)

Chapter Community	Total Capital Cost						Annual Energy Cost
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (In.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	
Gallup Jct.	\$0	\$0	\$0	6	\$0	\$0	\$0
Manuelito	\$24,434	\$599,352	\$0	6	\$1,092,292	\$152,426	\$1,868,505
Sub-Total	\$0	\$24,434	\$599,352		\$1,092,292	\$152,426	\$1,868,505
Capital Cost	\$0	\$24,434	\$599,352		\$1,092,292	\$152,426	\$1,868,505
Contingency Cost	20%						\$373,701
mobilization Cost	10%						\$186,850
ndirect Cost	27%						\$504,496
Totals							\$2,933,553
							Total \$39,002

NOTES:

1. ALL 1990 POPULATIONS FROM "1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION", 1990
2. ASSUME NAVAJO DEMANDS OF 100 GALLONS PER CAPITA AND BASED ON 2010 PROJECTED DEMANDS.
3. ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - ON PROD - 5 DAYS. COST FROM THE 1988 MEANS HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
4. RED ROCK DEMANDS INCLUDE RED ROCK, BREADSPRINGS, CHICHILTAH CHAPTERS.
5. ASSUME GALLON / DAY PEAKING FACTOR C = 1.50
6. ASSUME VELOCITY = 4 FEET PER SECOND FROM PCH ASSOCIATES, 1990
7. ASSUME 500HP PER PUMP FROM PCH ASSOCIATES, 1990. COST INDEXED TO 2000 (\$612/HP) ASSUME PUMPING EFFICIENCY 70%
8. HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA. (DUGTILE IRON FRICTION COEFFICIENT)
9. BASED ON HNDWR ANALYSIS BASED ON BID COSTS FROM M&E-HOL, NORMAN MANERLE, & USBOR SOURCES. ASSUME WTP \$0
10. PIPE INSTALLED COST FROM HNDWR ANALYSIS BASED ON BOR-PHA(199 DOLLARS). ASSUME 90% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION.
11. ANNUAL ENERGY COST BASED ON: INTAKE/RESERVOIR ANNUAL O&M COST * 10%, PUMPING: BASED ON \$0.08 PER KILOWATT HOUR.
12. ANNUAL O&M COST BASED ON: WTP COST; BOR O&M COST; INTAKE/RESERVOIR COST * 8%, PUMP COST * 4%, STORAGE COST * 1%, PIPELINE COST * 0.5%.
13. MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/REPREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 20%.
14. INDIRECT COST INCLUDE FACILITATING: 1%, TRIP: 2%, CONTRACT ADMIN: 1%, EHVIRON: 2%, EASEMENTS: 1%, GEOCHEM: 0.5%, AGROEOL: 0.5%, DESIGN SURVEY: 1%, INVEST: 2%, DESIGN: 8%, AND CONSTRUCTION OBSER: 10%.