

Debris Basin Estimate				
Item Description	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Drilling	LS	1	\$ 125,000.00	\$ 125,000.00
Geotechnical	LS	1	\$ 100,000.00	\$ 100,000.00
Mobilization	LS	1	\$ 400,000.00	\$ 400,000.00
Surveying	LS	1	\$ 50,000.00	\$ 50,000.00
Clearing and Grubbing	LS	1	\$ 10,000.00	\$ 10,000.00
Excavation and Foundation Preparation	LS	161508	\$ 3.50	\$ 565,278.36
Clay Core	CY	20000	\$ 15.00	\$ 300,000.00
Drain Gravel	CY	7000	\$ 45.00	\$ 315,000.00
Filter Sand	CY	7000	\$ 45.00	\$ 315,000.00
Structural Fill	CY	127508	\$ 12.00	\$ 1,530,097.22
Dam Face Riprap	CY	2800	\$ 30.00	\$ 84,000.00
Outlet Works (48" Pipe with 48" Guard Gate)	LF	250	\$ 800.00	\$ 200,000.00
Toe Drain Pipe	LF	1500	\$ 25.00	\$ 37,500.00
Beach Area	LS	1	\$ 30,000.00	\$ 30,000.00
Spillway Riprap	CY	100	\$ 30.00	\$ 3,000.00
Spillway Concrete	CY	200	\$ 900.00	\$ 180,000.00
			Subtotal	\$ 4,245,000.00
			Contingency (25%)	\$ 1,061,000.00
			Legal	\$ 25,000.00
			Engineering (20%)	\$ 849,000.00
			Total	\$ 6,180,000.00

Material Estimates			
area of trapezoid $A = ((a+b)/2) * H$		Height of embankment	Station
Cross section		12	100
H (ft)	29	23	200
L (ft)	1600	25	300
W (ft)	12	30	400
Upstream slope	3	28	500
Downstream slope	2.5	25	600
a	12	25	700
b	174	25	800
A (ft^2)	2725	23	900
Volume (CY)	161508	22	1000
		20	1100
		16	1200
		14	1300
		9	1400
		7	1500
		6	1600

Offsite Storage and Recharge Reservoir Estimate				
Item Description	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Drilling	LS	1	\$ 125,000.00	\$ 125,000.00
Geotechnical	LS	1	\$ 100,000.00	\$ 100,000.00
Mobilization	LS	1	\$ 400,000.00	\$ 400,000.00
Surveying	LS	1	\$ 50,000.00	\$ 50,000.00
Clearing and Grubbing	LS	1	\$ 10,000.00	\$ 10,000.00
Excavation and Foundation Preparation	LS	542222	\$ 3.50	\$ 1,898,000.00
Clay Core	CY	20000	\$ 15.00	\$ 300,000.00
Drain Gravel	CY	7000	\$ 45.00	\$ 315,000.00
Filter Sand	CY	7000	\$ 45.00	\$ 315,000.00
Structural Fill	CY	508222	\$ 12.00	\$ 6,099,000.00
Dam Face Riprap	CY	2800	\$ 30.00	\$ 84,000.00
Outlet Works	LF	250	\$ 800.00	\$ 200,000.00
Toe Drain Pipe	LF	1500	\$ 25.00	\$ 38,000.00
Spillway Riprap	CY	100	\$ 30.00	\$ 3,000.00
Spillway Concrete	200	200	\$ 900.00	\$ 180,000.00
			Subtotal	\$ 10,117,000.00
			Contingency (25%)	\$ 2,529,000.00
			Legal	\$ 25,000.00
			Engineering (20%)	\$ 2,023,000.00
			Total	\$ 14,694,000.00

Material Estimates			
area of trapezoid $A = ((a+b)/2)*H$			
Cross section			
H (ft)	40		
L (ft)	3000	1000 ft/side and 3 sides for embankment	
W (ft)	12		
Upstream slope	3 to 1		
Downstream slope	2.5 to 1		
a	12		
b	232		
A (ft^2)	4880		
Volume (CY)	542222		

Low Flow Agricultural Pipeline System				
Item Description	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Mobilization	LS	1	\$150,000.00	\$ 150,000.00
Furnish and Install 18" PVC P.I.P. DR 41 Irrigation Pipe	LF	18760	\$21.50	\$ 403,340.00
Furnish and Install 15" PVC P.I.P. DR 41 Irrigation Pipe	LF	13290	\$15.00	\$ 199,350.00
Furnish and Install 12" PVC P.I.P. DR 41 Irrigation Pipe	LF	21160	\$11.00	\$ 232,760.00
Furnish and Install 18" Isolation Valve	EA	3	\$5,960.00	\$ 17,880.00
Furnish and Install 15" Isolation Valve	EA	3	\$4,270.00	\$ 12,810.00
Furnish and Install 12" Isolation Valve	EA	3	\$3,210.00	\$ 9,630.00
Furnish and Install Traveling Screen	LS	1	\$86,000.00	\$ 86,000.00
Furnish and Install 4" Turnout Assembly	EA	78	\$3,810.00	\$ 297,180.00
Furnish and Install 8" Turnout Assembly	EA	12	\$10,000.00	\$ 120,000.00
Furnish and Install 3" Air Vac	EA	32	\$3,180.00	\$ 101,760.00
			Sub Total	\$ 1,631,000.00
			Contingency (25%)	\$ 408,000.00
			Engineering (12%)	\$ 196,000.00
			Total	\$ 2,235,000.00

Bypass Pipeline				
Item Description	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Furnish and Install 24" PVC P.I.P. DR 41 Irrigation Pipe	LF	5280	\$44.00	\$ 232,000.00
Furnish and Install Diversion Structure	LS	1	\$100,000.00	\$ 100,000.00
Furnish and Install 3" Air Vac	EA	4	\$3,180.00	\$ 13,000.00
			Sub Total	\$ 345,000.00
			Contingency (25%)	\$ 86,000.00
			Engineering (12%)	\$ 41,400.00
			Total	\$ 472,000.00

Enlarge Ditches in Existing Delivery System Estimate				
Item	Unit	Quantity	Unit Cost (\$)	Total Cost (\$)
Surveying	LS	1	\$ 25,000.00	\$ 25,000.00
Hatton Ditch Improvements	LS	1	\$ 175,000.00	\$ 175,000.00
Hatton Ditch Expansion	CY	16100	\$ 30.00	\$ 483,000.00
Expanding Existing Delivery Ditches	LF	43610	\$ 5.00	\$ 218,050.00
			Subtotal	\$ 901,050.00
			Contingency (25%)	\$ 225,262.50
			Engineering (10%)	\$ 90,105.00
			Total	\$ 1,216,000.00

Flood Channel Volume Estimates			
Avg Slope	0.014	from google earth profile	
trapezoidal channel			
b (ft)	10	field measured	
m	2	side slopes	
mannings n	0.03		
Q (cfs)	500	anticipated flow to pass	
y (ft)	3.15	depth of flow	
Grading Swail		Expanding Existing Delivery Ditches	
length of Channel	10745	linear ft of channel	43610
yards/ft	1.5	\$5/ft	
Total CY	16118		
Channel Cross Sectional Area (sq ft)	41.423		
Channel Cross Sectional Area (CY/ft)	1.5342		

The benefits calculated below do not include the monetary benefit of deep aquifer recharge that will be realized with this project. Those benefits are real and will be significant. The benefits also do not account for the increase in value of the annual agricultural benefits over fifty years. The benefits are all presented in present value. For these reasons, this benefit cost analysis is conservative.

Basis of Benefits		
	Quantity	Notes
Homes	211	Number of Homes in Kanosh and Surrounding area Flood Map area (from Google Earth; individually counted and appear to be occupied)
Businesses	4	Number of Businesses in Kanosh
Post Office	1	Number of Businesses in Kanosh
Fire Station	1	Number of Businesses in Kanosh
Church	1	Number of Businesses in Kanosh
	Property Value	Notes
Homes	\$ 175,000.00	*Based on Zillow estimates; see documentation from Zillow in Attachment
Businesses	\$ 200,000.00	Assumed Property Value of Businesses
Post Office	\$ 150,000.00	Assumed Property Value of Post Office
Fire Station	\$ 150,000.00	Assumed Property Value of Fire Station
Church	\$ 300,000.00	Assumed Property Value of Church
	Quantity	Notes
Acres	3550	Cultivated acres in service area
Alfalfa Yield	2	Tons per acre (first crop)
Grain Yield	2	Tons per acre
Alfalfa	\$ 180.00	average price per ton of alfalfa (market value based on shareholder sales of crops)
Grain	\$ 110.00	average price per ton of grain (market value based on shareholder sales of crops)
Pumping Cost	\$ 17.00	Pumping cost per acre based on electric bill and fuel costs; shareholders pumps vary in power supply (e.g. diesel pumps vs electric)
	Residential Flood Damages	Notes
		Dollar Value of Flood Damage Caused by Debris Basin Failure
Homes	\$ 9,231,000.00	Assumed 25% of all homes 100% damaged by flood wave caused by debris basin failure
Homes	\$ 13,847,000.00	Assumed 75% of all homes 50% damaged by flood wave caused by debris basin failure
Businesses	\$ 400,000.00	Assumed 50% damaged by flood wave caused by debris basin failure
Post Office	\$ 75,000.00	Assumed 50% damaged by flood wave caused by debris basin failure
Fire Station	\$ 75,000.00	Assumed 50% damaged by flood wave caused by debris basin failure
Church	\$ 150,000.00	Assumed 50% damaged by flood wave caused by debris basin failure
Subtotal	\$ 23,778,000.00	
		Dollar Value of Flood Damage Caused by exceeding existing infrastructure capacity
Homes	\$ 1,846,000.00	Assumed 20% of all homes 25% damaged by flood event exceeding current flood channel capacity
Total Residential Flood Damage	\$ 25,624,000.00	

Agricultural Production Estimates Prior To Pressurized Irrigation		Notes
Alfalfa acres	2130	Assumed 60% of all acres is alfalfa
Grain acres	1420	Assumed 40% of all acres is grain
Alfalfa Revenue (1st crop)	\$ 766,800.00	2130 acres * 2 tons/acre * \$180/ton
Grain Revenue	\$ 312,400.00	1420 acres * 2 tons/acre * \$110/ton
Alfalfa Revenue (2nd-4th Crops)	\$ 172,530.00	Assumed 10% of alfalfa is watered with a yield of 1.5 ton/acre
Revenue Prior to PI	\$ 1,252,000.00	Revenue Prior to Pressurized Irrigation System
Agricultural Production Estimates After Pressurized Irrigation		Notes
Alfalfa Acres	3195	Assumed 90% of all acres is alfalfa; shareholders don't plant as much alfalfa now because they are worried they won't have enough water
Grain Acres	355	Assumed 10% of all acres is grain; some shareholders will likely still plant some grain
Alfalfa Revenue	\$ 1,150,200.00	3195 acres * 2 tons/acre * \$180/ton
Grain Revenue	\$ 78,100.00	355 acres * 2 tons/acre * \$110/ton
Alfalfa Revenue 2nd Crop	\$ 977,670.00	Assumed 100% of land irrigated and 85% yield; assumed water available for second crop would come from 500 ac-ft of storage and no seepage losses in the delivery system
Alfalfa Revenue 3rd Crop	\$ 920,160.00	Assumed 100% of land irrigated and 80% yield; assumed water available for third crop would come from additional storage reservoir of 600 ac-ft eliminating the seepage in the delivery system (100% increase) and installing the bypass line (100% increase)
Alfalfa Revenue 4th Crop	\$ 345,060.00	Assumed 40% of land irrigated and 75% yield; assumed water available for fourth crop would come from eliminating the seepage in the delivery system (100% increase) and installing the bypass line (100% increase)
Revenue After PI	\$ 3,471,000.00	Revenue After Pressurized Irrigation System
Revenue Difference	\$ 2,219,000.00	Revenue Difference before and after Pressurized Irrigation System
Annual Pumping Costs	\$ 48,280.00	Assumed 50% of acres near town are pumped and 90% of land below town is pumped
Annual Maintenance Costs	\$ 20,000.00	Annual maintenance cost of ditches

	Benefit Summary	Notes
Residential Flood Damage Benefit	\$ 25,624,000.00	
Agricultural Flood Damage Benefit	\$ 1,252,000.00	Assumed no revenue due to sediment on fields and fields damaged in system
Agricultural Production Benefit	\$ 110,950,000.00	\$2.219M annually for 50 years
Agricultural Maintenance Benefit	\$ 1,000,000.00	\$20k annually for 50 years
Agricultural Pumping Benefit	\$ 2,414,000.00	\$48,280 annually for 50 years
Total Project Benefits	\$ 141,240,000.00	