Water Importation Cost Analysis

The following tables show the considerations, estimated values, and calculated values for the transportation of the imported water from Holbrook to Sun Valley Ranch.

Site and Vehicle Considerations

Item	Capacity (gal)	Variable
Delivery Vehicle Water Capacity	800	D_w
On Site Water Tank Size	4800	S_T

Estimated Transportation Parameters

Item	Quantity (units)	Variable
Site to Source Distance	26 (miles)	l
Vehicle/Fuel Cost	$0.56/mi	C_V
Vehicle/Fuel Cost (Round Trip)**	$14.56	$C_{VR} = l \cdot C_V$
Source Water Price	$1.75 (per 1000 gal)	C_W

Estimated Site Considerations

Item	Quantity (units)	Variable
Sun Valley Population*	5-10 (people)	N_P
Specific Water Demand*	55±10 (gal/(person·day))	W_u
Total Water Demand*	225~650 (gal/day)	$W_d = N_P \cdot W_u$
Minimum Site Water Reserve**	7~21 (days)	$S_R = \frac{S_T}{W_d}$
Expected Occupation Length	184 (days)	D_O

Water importation costs based on actual and estimated considerations of site and vehicle.

Item	Quantity	Variable
Expected Number of Annual Water Deliveries**	53~158	$A_D = \frac{S_T}{D_W} \cdot \frac{D_o}{S_R}$
Annual Transportation Expenses**	$771.68~$2300.48	$AT_E = A_D \cdot (C_{VR})$
Annual Water Expenses**	$72.45~$209.30	$AW_E = (C_W \cdot W_d \cdot D_O)$

*Estimated Value

**Calculated Based on estimation

Annual water expenses neglect the cost of vehicle maintenance. The upper and lower limits are appropriately used to justify water expenses where the declared variable may appear in formulas for subsequent variables.

The calculations for an estimated population of 10 people with a water demand of 55 gal/person/day are provided below.

$$Assuming\ population\ of\ 10\ people\ (N_P) and\ a\ per\ capita\ water\ demand\ of\ \frac{55\frac{gal}{person}}{day}$$

$$\text{Total Water Demand: } W_d = N_P \cdot W_u = 10\ people * \frac{55\frac{gal}{person}}{day} = 550\ gal/day$$

$$\text{Minimum Site Water Reserve: } S_R = \frac{S_T}{W_d} = \frac{4800\ gal}{550\frac{gal}{day}} = 8.72\ days \approx 9\ days$$

$$\text{Expected Number of Annual Deliveries: } A_D = \frac{S_T}{D_W} \cdot \frac{D_o}{S_R} = \left(\frac{4800\ gal}{800\ gal} * \frac{184\ days}{9\ days}\right) = 122.67$$

Assuming average fuel price (P_F) and average vehicle efficiency (η_F)

$$\text{Round Trip Fuel Cost: } C_{VR} = l \cdot C_{VR} = 26\ miles * \frac{\$0.56}{mile} = \$14.56$$

Annual Transportation Expenses: $AT_E = A_D \cdot (C_{VR}) = 122.67 * (\$14.56) = \$\mathbf{1786.08}$

Annual Water Expenses:

$$AW_E = (C_W \cdot W_d \cdot D_O) = \frac{\$1.75}{1000gal} * \ 550\frac{gal}{day} * 184\ days = \$\mathbf{177.10}$$