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ITEM 1 – CISTERN

The Baucells report seems to suggest that a below-ground cistern will be constructed out of reinforced concrete. The cistern capacity is 28 m^3, or roughly 1000 ft^3. While a below-ground holding tank offers many advantages, such as keeping the water cool and limiting the growth of algae, such a storage device may be difficult to construct, especially given the need to provide a cover for it. Storage for such a quantity implies a 10 ft cube, with a roof measuring perhaps 11 ft by 11 ft. This would need to be an engineered structure.

One alternative would be to use fabricated high-density polyethylene (HDPE) tanks, which are commercially available in 4000 gallon sizes. One manufacturer is Chem-Tainer (800-275-2436), who can provide a tank fabricated of green polyethylene to reduce algae growth. It is also UV stabilized for outdoor use, so these could be placed on pads above-ground. The cost of these tanks would be $5752 for two, plus freight and the cost of forming and placing a concrete pad for each tank. Hold-downs are available for additional cost for tanks such as these for anchorage in high wind or seismic zones. While recommended, these would probably not be absolutely necessary. Since the location of the cistern is to be in a valley, high winds would not be expected, although since conditions are impossible to predict, it may be advisable to provide anchorage.

ITEM 2 – PUMP AND DRIVER

The final selection of a pump will depend on the philosophy chosen for this project. There are a multitude of pumps available, and many combinations of flowrates that may be used to achieve the desired results.

The Baucells report specified a flowrate of 2 l/sec, or 31.7 GPM. This is a reasonable flow, and it would take 236 minutes to pump the entire day's capacity of 7500 Gallons. If the locals draw off 1538 GPD at the cistern, then the pumping time would be reduced to 188 minutes. The 236 minute figure (4 hours) should be used to size the equipment, however.

Using 2" diameter pipe for the suction and discharge lines and rounding the flow up to 35 GPM yields a line velocity of 3.35 fps, and a TDH of 255 ft (110 PSI). The friction losses in the pipe contribute only 40 ft of the TDH, so the bulk of the head requirement is due to the elevation to which the water must be pumped.

This is a low-flow high-head application, and a penalty will be paid in pumping efficiency. This leads to a higher-than-expected power requirement, which in turn raises the cost of the pump driver. The flow may be reduced, but this will increase the amount of time required for pumping, with a subsequent increase in operation time of the generator.

OPTION 1: Electric Pump with Diesel Powered Generator (35 GPM at 255 ft TDH)

Goulds manufactures an in-line 11-stage pump (Goulds Model 2SVB1J4L0) 5 HP pump that closely matches the desired flow. This pump has flanged connections and a 240 V single-phase TEFC motor suitable for outdoor use. The pump lists for $2742, but discounts may be available.

A 5 HP (3729 W) motor would require a 4000 W generator. Bowers Power Systems (800-858-5881) can supply a Baldor Model DG6E portable diesel generator rated for 5500 continuous watts. It retails for $3090. Fuel capacity on this model is 4.6 Gallons for a run time of 4.6 to 6 hours. Pumping 35 GPM would require 3.6 hours of operation per day. A fuel tank for diesel storage may be considered, as the generator capacity would be adequate for only 1 day of operation. Another catalog sheet from McMaster Carr is attached, depicting a 120 gallon tank for diesel storage. This would provide approximately 33 days worth of operation. The cost for this tank is $1075.