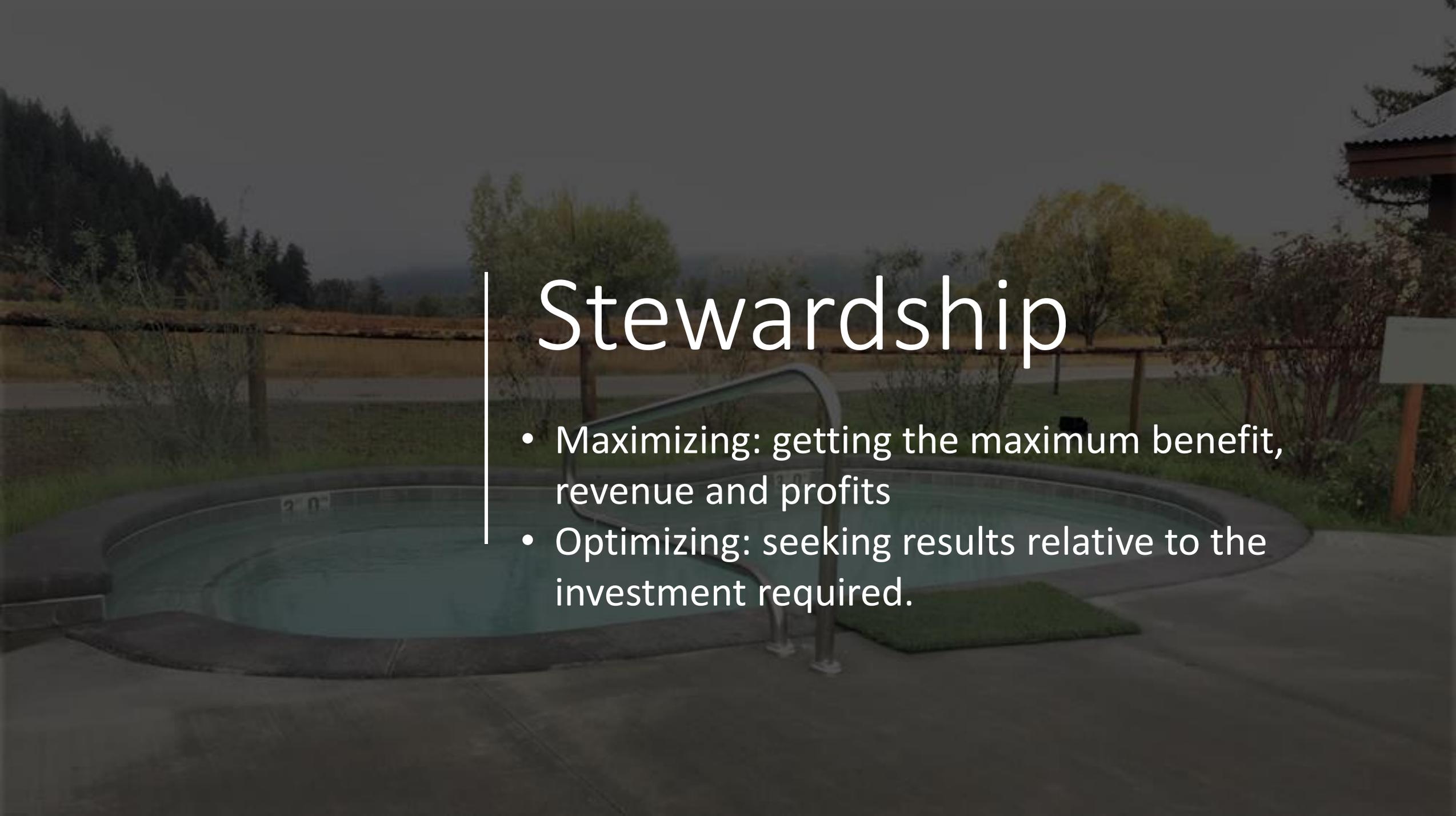


CLOWARD H₂O

Maximizing/Optimizing
~~your~~
Natural Resources



Stewardship

- Maximizing: getting the maximum benefit, revenue and profits
- Optimizing: seeking results relative to the investment required.

Natural Resources

- ❖ Views
 - ❖ Weather
 - ❖ Ambiance
 - ❖ Landscaping
 - ❖ Heat (Hot Water)
 - ❖ Mineral Water
- God/Mother Earth
- DHM
- CLOWARD H₂O
-

Natural Resources + Customer Service = Guest Experience (1-10)

Technical Challenges

- ❖ Heat
- ❖ Minerals
- ❖ Water Clarity
- ❖ Total Dissolved Solids
- ❖ pH
- ❖ Smells
- ❖ Surrounding Geotech
- ❖ Space
- ❖ Codes/Rules/Guidelines

Water Analysis

- ❖ Temperature
- ❖ Flow Rate
- ❖ pH
- ❖ Mineral Content

This information will help you determine what materials are best suited to your equipment, pool finishes, decks and piping.

Should you use Stainless Steel or Fiberglass or PVC or HDPE...?



The Right Equipment

A large artificial waterfall in a swimming pool. The waterfall is made of dark, textured rock panels and is cascading into a pool of clear blue water. Several people are swimming in the pool. In the background, there are trees and a building.

- ❖ Should you Pre-Treat Your Water...?
- ❖ Sand Filters or Regenerative Media Filters...?
- ❖ Fiberglass or Epoxy Pumps...?
- ❖ PVC or PolyPropylene or HDPE...?

- ❖ How do you know... It Depends.

Rotten Eggs Smell...?



- ❖ Hydrogen sulfide gas (H_2S) can be present in hot springs and wells and gives the water a characteristic "rotten egg" odor. As groundwater moves through soil and rock formations containing minerals of sulfate, some of these mineral's dissolve in the water. "sulfur bacteria" or "sulfate-reducing bacteria" transform sulfate and other sulfur containing compounds to hydrogen sulfide gas.
- ❖ In most cases, the rotten egg smell does not directly correspond to the sanitary quality of the water, but it is unpleasant and can have that association in the minds of your guests.
- ❖ Sulfur bacteria are not harmful, but hydrogen sulfide gas in the air can be hazardous at high levels. It is important to take steps to remove the gas from the water or vent the gas to the atmosphere so that it will not collect in low-lying spaces.
- ❖ High levels of sulfates and the presence of sulfate-reducing bacteria can also adversely affect concrete. Concrete exposed to excessive amounts of sulfates in water can disintegrate the concrete over time. Sulfate exposure class and concrete mix designs should be specified.

Got Bugs...?

Natural Hot Springs may have additional challenges... Microscopic Bugs!
Their presence is a deciding factor on how to properly disinfect the water
and how to treat & filter pool water.

- ❖ Iron related Bacteria
- ❖ E-coli Coliform Bacteria
- ❖ Coliform Bacteria
- ❖ Sulfate-Reducing Bacteria
- ❖ Chlorine?
- ❖ Ozone?
- ❖ Ultraviolet?
- ❖ Others...?

How to Optimize Your Natural Resources...?

- ❖ Know and understand what resources you have
- ❖ Know your constraints, local codes
- ❖ Know your customer & the experience you want to offer them
- ❖ Set the Goal/Target and start working