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Troubled Waters
Golf's future in a Thirsty World

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- NGCOA report on the industries response to restrictions in water availability and quality
- Pressure from increased populations and reducing rainfall.
- Golf seen as an easy target but in fact uses less than 0.5% of 408 billion gallons of water used in the US per day
  - That's still 7.5 billion litres per day

- Water is vital for most golf courses
- Cost and availability is a key issue

How much water does it take to produce....?

- 1 cup of coffee
  - » 150 litres
- ½ litre of milk
  - » 550 litres
- 1 burger
  - » 1800 litres

(Water Footprint Network http://www.waterfootprint.org)

How about a round of golf?

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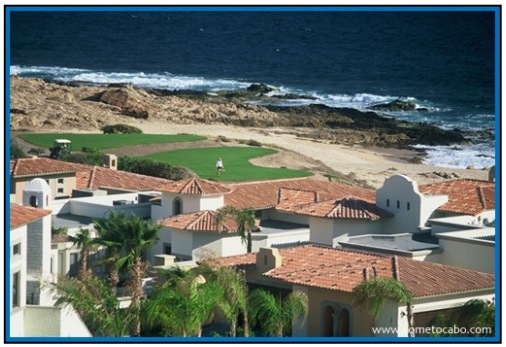
How much water does it take to produce 1 round of golf?

- Northern Europe
  - 650m^3 per day for 100 days
  - Av. 20,000 rounds per year
  - 3,250 litres per round
- Southern Europe
  - 2000m^3 per day for 210 days
  - Av. 25,000 rounds per year
  - 16,800 litres per round
- Middle East
  - 3600m^3 per day for 240 days
  - Av. 40,000 rounds
  - 21,600 litres per day

- Development based around the economics of real estate development
- Over specified systems
  - 1500 head systems in N.Europe
  - €1,000,000 investment in irrigation
- Too expensive to build and maintain



- How do you achieve long term sustainability?
  - Course Appeal
  - Economics
  - Environment

- A successful project is based on a balance of these 3 factors
- It's even more relevant today

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System costs

- Why have the costs for irrigation increased?
  - Increased cost of components
    - wire, plastics, fuel
  - Cost of labour
  - System complexity
    - more accurate management through PC control
  - Over specification?

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Design philosophy

- What is the system for?

Essential to grow turf

Or is it

Supplementary

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How can we make savings?

- Engage professionals that understand what is required and can deliver it first time!
  - Irrigation designer
  - Competent irrigation contractor

- Do we need to design to 100% peak demand?
  - A reduction to 80% of peak would deliver cost savings by reducing pipe sizes, pump sizes, plus water savings.

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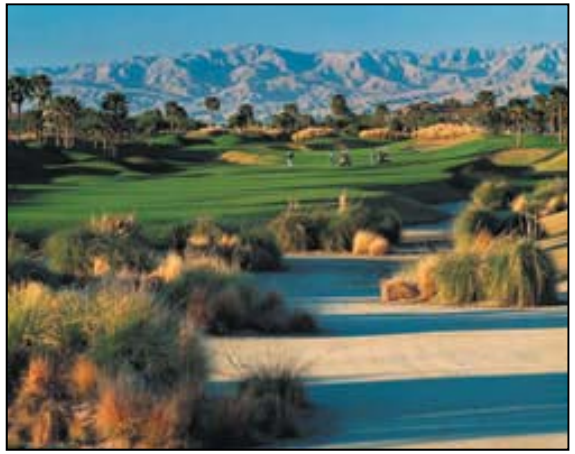
How can we make savings?

- Reduce the irrigated area
  - Arizona already restricts turf grass areas to 90 acres per course



- Use suitable native grasses that will cope with less water and fewer fertilizers, pesticides etc.

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Make some key design decisions

- Shape and size tee boxes to allow efficient irrigation
  - Square v Rectangular (requires 50% more sprinklers, can lead to more over throw)
  - Why not round tees?
- Size is important!
  - Narrower greens can be irrigated more efficiently that wide greens

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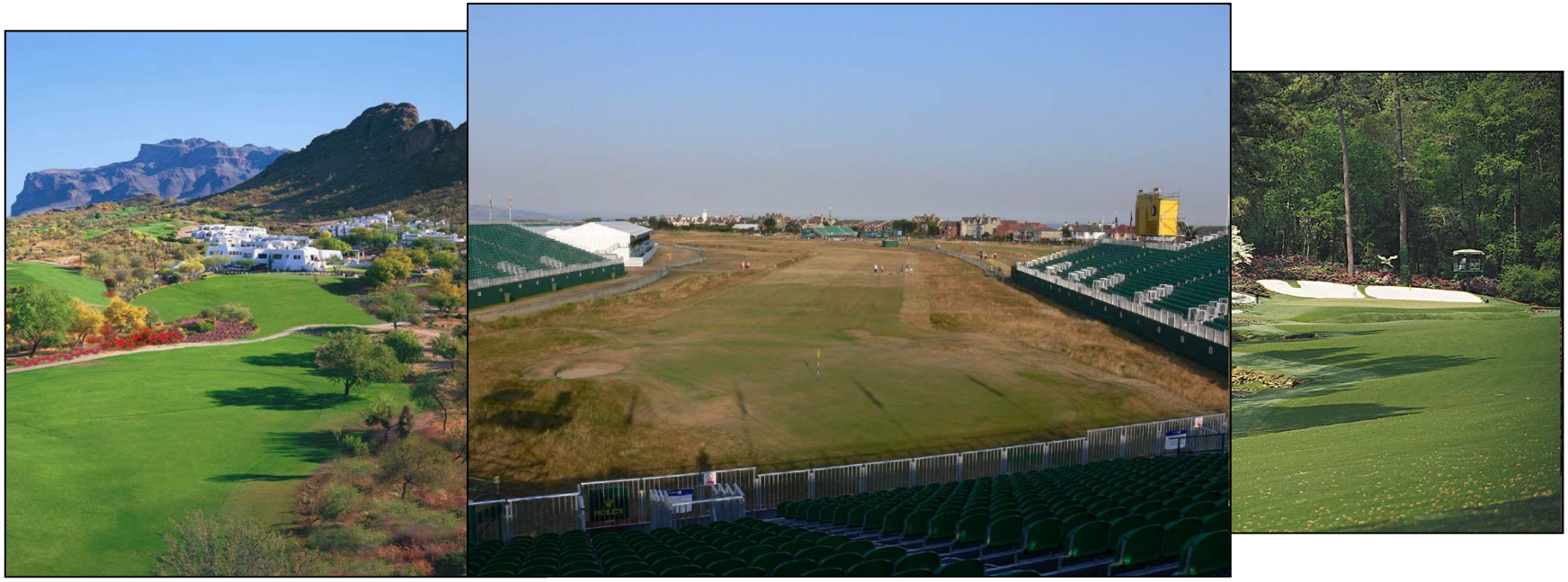
Make some key design decisions

- Fairways
  - The most expensive to irrigate – is it necessary?
  - Can we encourage a more traditional look and playing experience?



This will require some re-education of the golfers!

- The design should maximise the m^2 of turf irrigated for the investment
  - ensure the correct sprinkler, nozzle selection, pressures and spacing.
  - Latest generation sprinklers can achieve significant improvements without sacrificing application efficiencies
- Improve irrigation scheduling to extend irrigation windows
  - Allows for lower capacity systems and therefore lower upfront investment and on going operational costs.
  - May need to adjust other agronomic activities and get acceptance from the members

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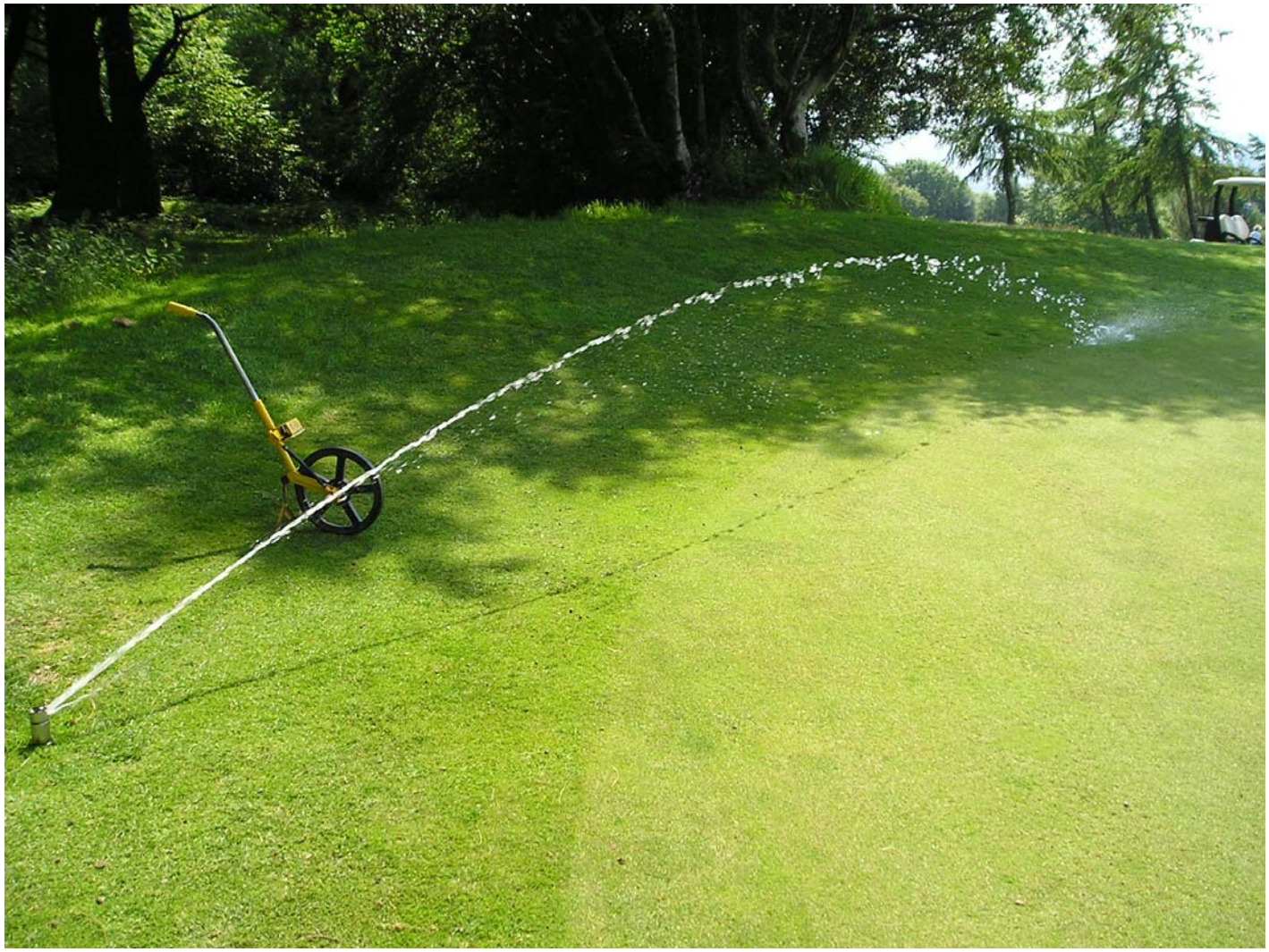
Efficient Irrigation??



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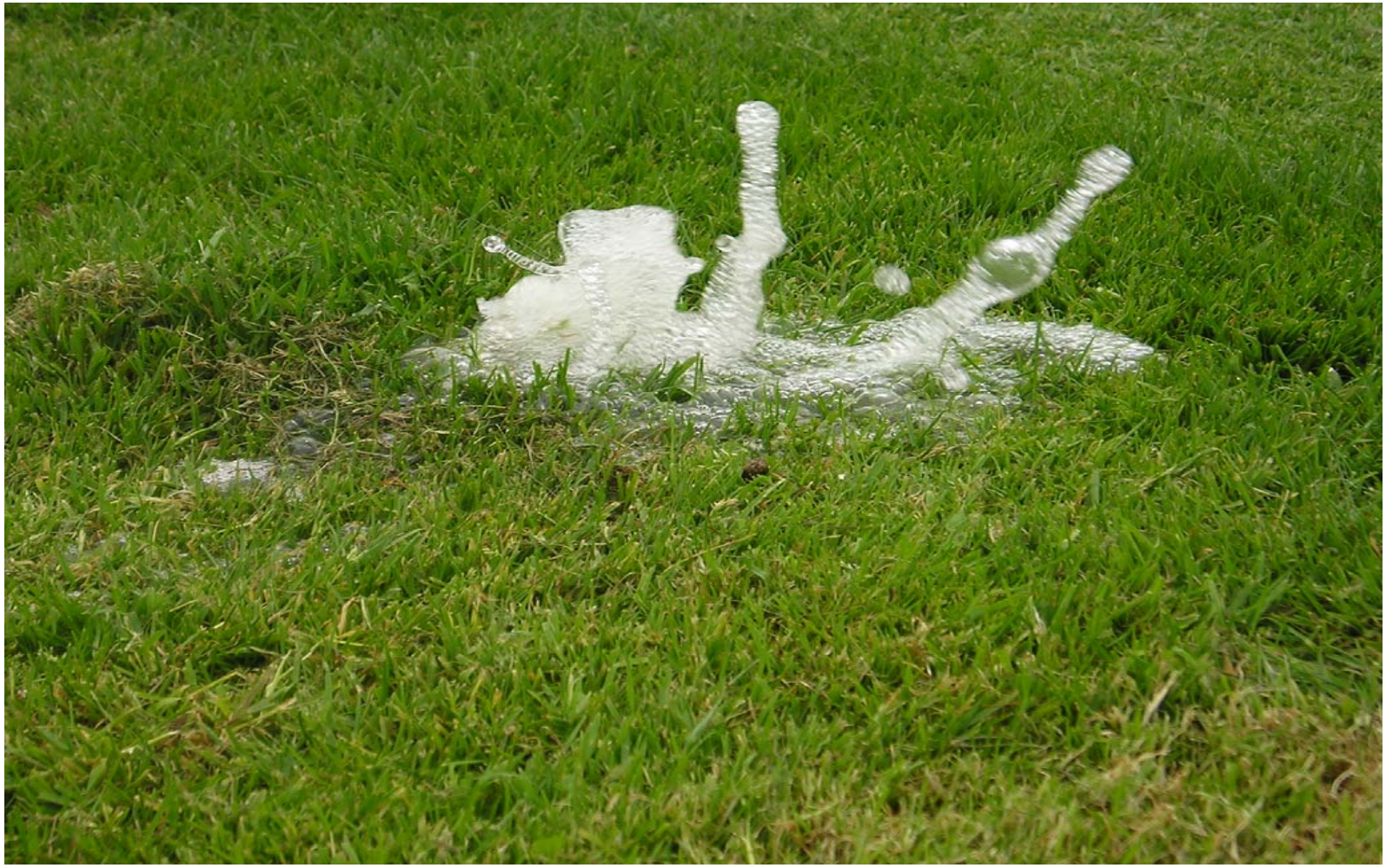

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Other Technologies

- Use of non potable water
  - Treated Sewage Effluent – 12% of US courses use TSE
  - Desalinisation – currently too expensive
  - Water harvesting (storm water gathering)
- Quality is important
  - Poor water quality negates the benefits of efficient systems
  - High salt content in water will require significant flushing using “clean” water

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Other Technologies

- Increased use of water storage to act as a buffer in dry periods
- Improved soil moisture sensors with real time data
- Spectral reflectance to measure turf health in real time allowing improved irrigation decisions to be made
- Use of surfactants to improve balance of the air/water ration in soil profile
    - By adding surfactants to slopes it will increase rate of infiltration and reduce run off

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A summary/check list

- Engage a professional designer
- Consider designing to 80% of peak demand
- Reduce irrigated turf areas
- Use natural grass varieties
- Develop course designs that allow for efficient irrigation
  - Tee shapes, green sizes
- Allow non essential areas to brown off in summer
- Educate the golfer to accept the visual change

- Maximise the ratio of area irrigated to investment made
  - Without reducing irrigation efficiencies
- Extend irrigation windows to reduce system demand
- Use non potable water where possible
- Understand the implications of poor water quality
- Improve water storage
- Use soil moisture sensors
- Be aware of new technologies as they are developed
  - Spectral reflectance
- Utilise other products to maximise the use of your water
  - Surfactants

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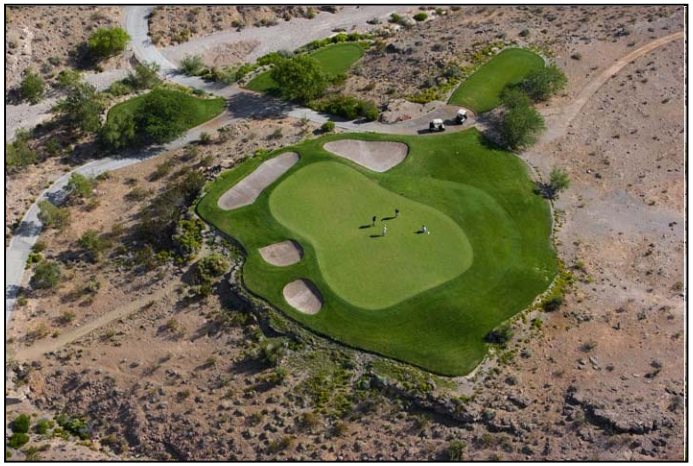
Conclusions:

- The challenge is to produce a course that people want to play;
  - whilst ensuring the balance between the commercial necessities, the environment and the practicalities of long-term maintenance.
- Focus on the key areas of the course with the resources available
- Use sound design principles and the best technology
- Can we really justify building another course in a location such as this?



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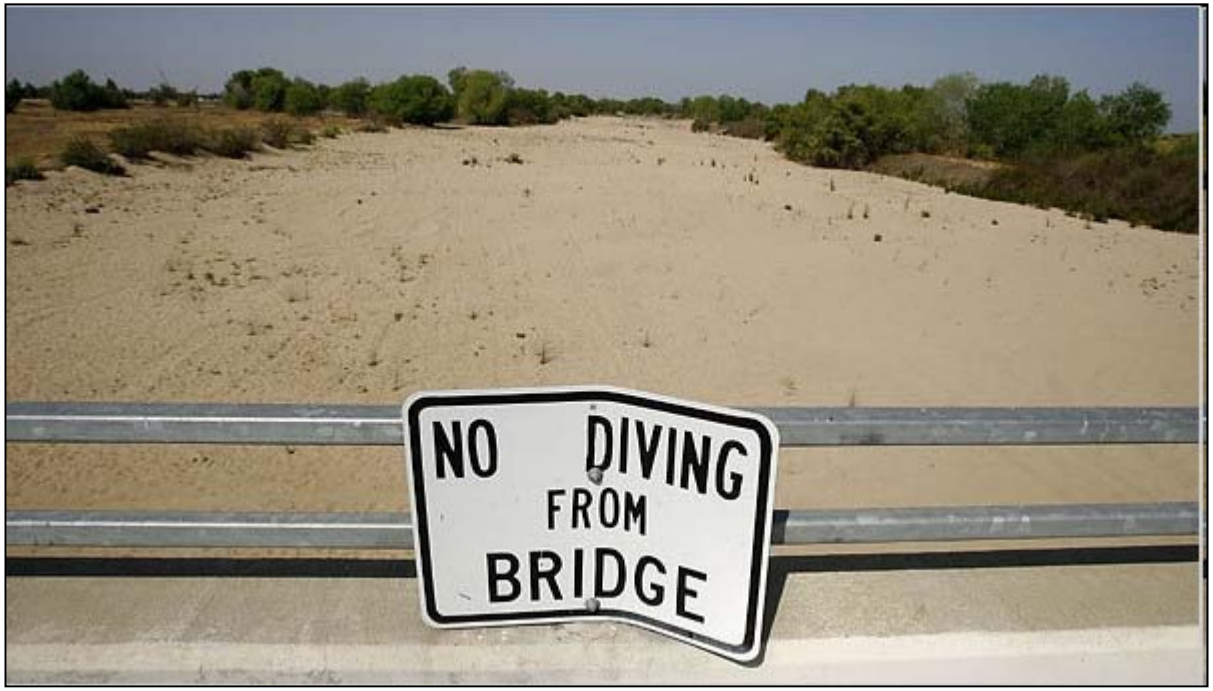

THANK YOU