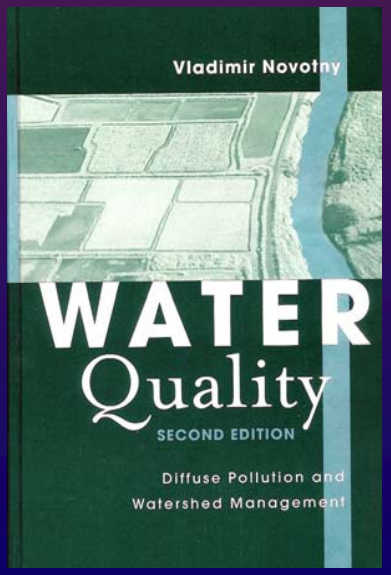
A Review of the Economic Analysis of Beneficial Outcomes for the Boston Harbor Project



Watershed Management

June 2, 2003

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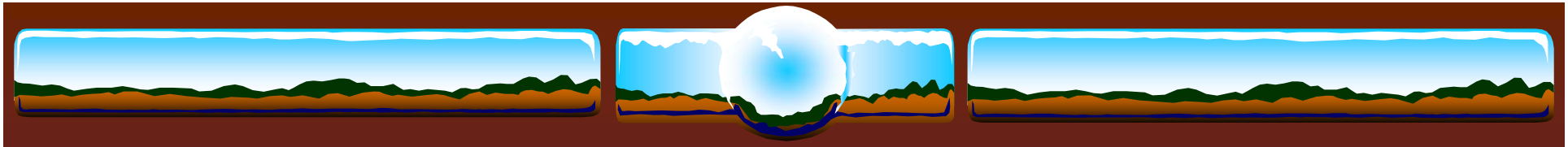
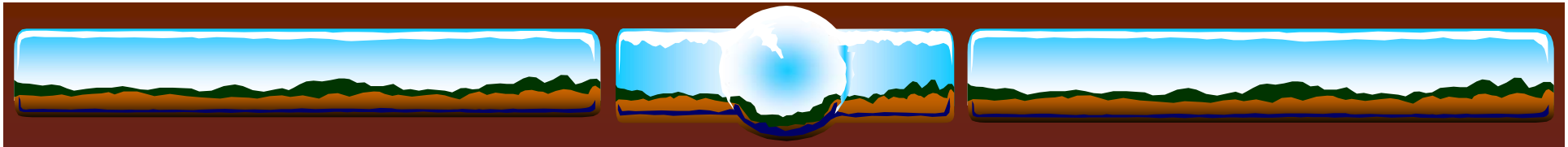


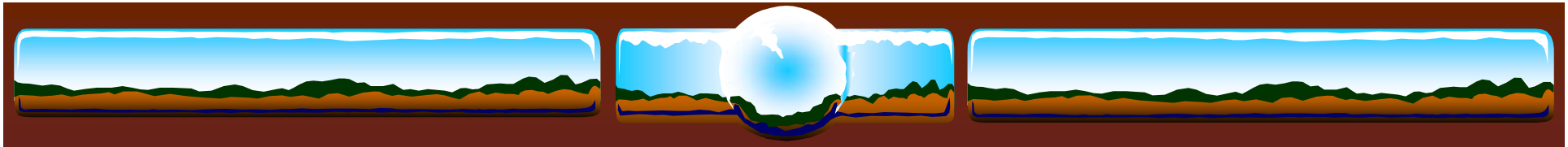
Boston Harbor

- “Estuary” system where Mass Bay mixes with Charles, Mystic, & Neoponset Rivers
- 50 sq. mi. area & 180 miles of shoreline
- Boston metropolitan 2.8 million people
- Provides valuable habitat, recreational activities, commercial fishing, focal point for city



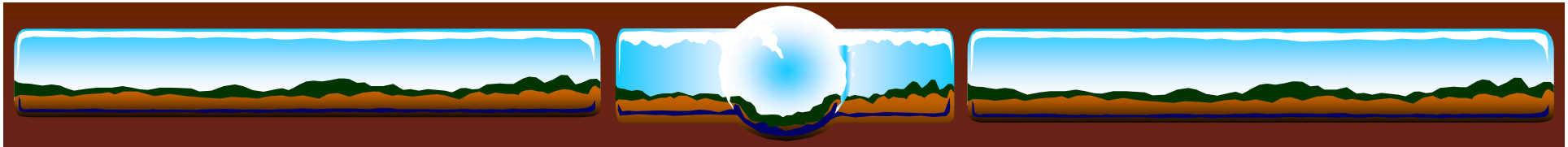
The problem and what happened?

- 1980s Boston Harbor one of most polluted harbors in US
- Beach closings, closed shellfish beds, infected finfish
- Series of court cases
- 1985 – state found in violation of CWA
- Boston Harbor Project (BHP) ordered



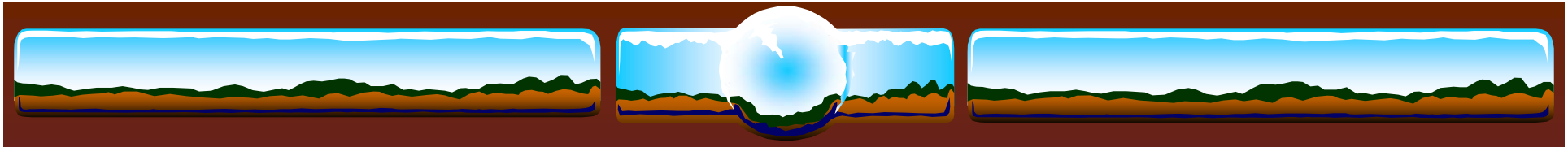
Boston Harbor Project

- Cost - $4 billion
- Objective – to restore the harbor to an environmental standard that citizens of MA want & deserve
- Facility to convert sludge to fertilizer pellets
- DITP
- Tunnel from Nut Island to DITP
- Outfall diffuser system
- CSO control



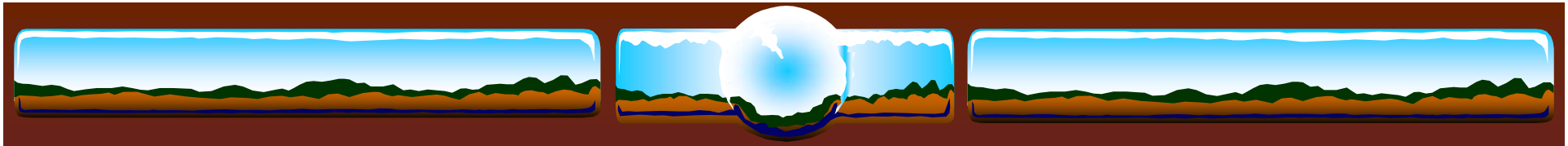
Types of Benefits

Current Use Benefits	Direct Use	<u>In-Stream</u> Recreational – fishing, swimming, boating, rafting, etc. Commercial – fishing, navigation, rafting, etc.
		<u>Withdrawal</u> Municipal – drinking water, waste disposal Agricultural – Irrigation Industrial/Commercial – cooling, process treatment, waste disposal, steam generation
	Indirect Use	<u>Near-Stream</u> Recreational – hiking, picnicking, photography, etc. Relaxation – viewing Aesthetic – enhancement of adjoining amenities



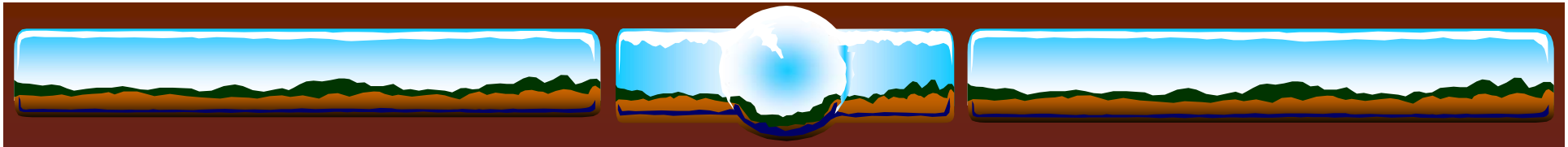
Types of Benefits

Intrinsic Benefits	Potential Use	<u>Option</u> Near-term potential use Long-term potential use
	No Use	<u>Existence</u> Stewardship – maintaining a good environment for everyone to enjoy, including future generations Vicarious consumption – enjoyment from the knowledge that others are using the resource



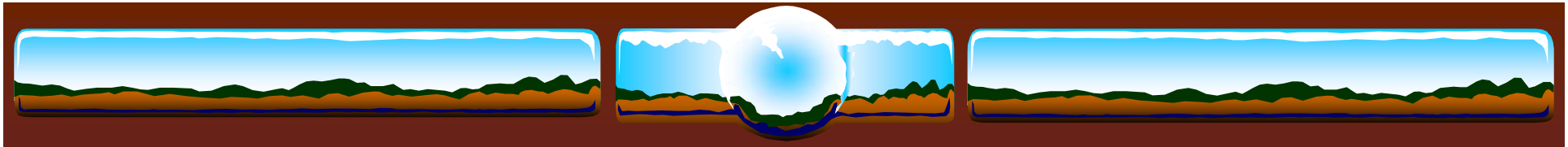
Benefit Estimation Methods for BHP Evaluation

Receptor	Method	Reliability of Method	Reliability/ Availability of Data
Swimming	Travel cost (logit model)	Excellent	Excellent
	Regional participation	Good	Fair to Good
	Beach closings cost savings	Fair	Fair to Good
Boating	Regional participation	Fair	Fair
Fishing	Regional participation	Fair	Fair



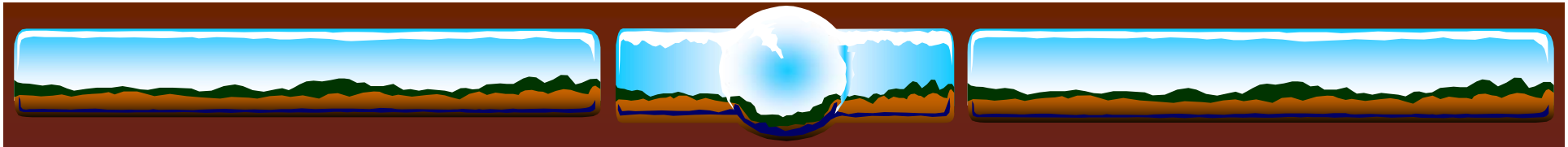
Benefit Estimation Methods for BHP Evaluation

Receptor	Method	Reliability of Method	Data Reliability/ Availability
Health Swimming	Dose-response function (incidence of disease)	Excellent	Good
Food Consumption	Dose-response function (incidence of disease)	Good	Fair to Good
Commercial Fisheries	Demand & supply functions	Good	Fair
Intrinsic Benefits Fishing	Contingent valuation survey	Fair	Fair
	Direct % of Recreation Benefits	Good	Good



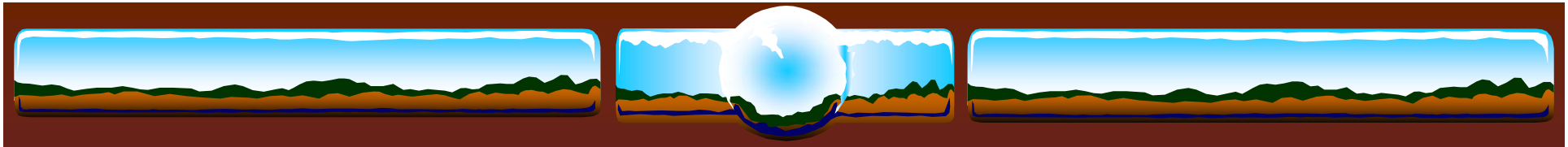
Recreational Swimming Benefits

- Seasonal attendance of affected beaches is 4 million
- Three methods of evaluating
  - Increased participation
  - Increased participation + higher utility
  - Lost participation due to beach closings



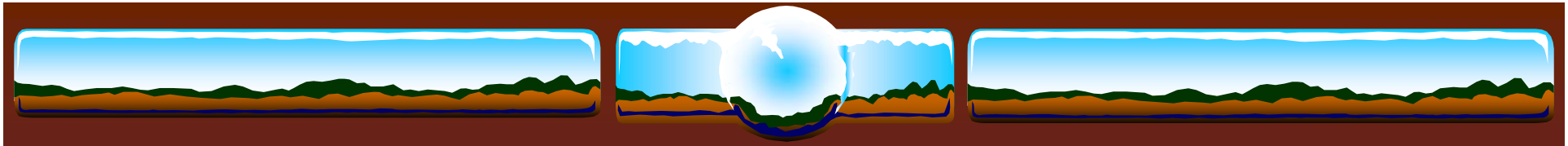
Swimming Increased Participation

- Identify areas affected by pollution abatement options
- Calculate excess seasonal beach supply
- Estimate range of increased participation
- Relate increase to pollution abatement option
- Calculate value of increased participation by applying range of user day values



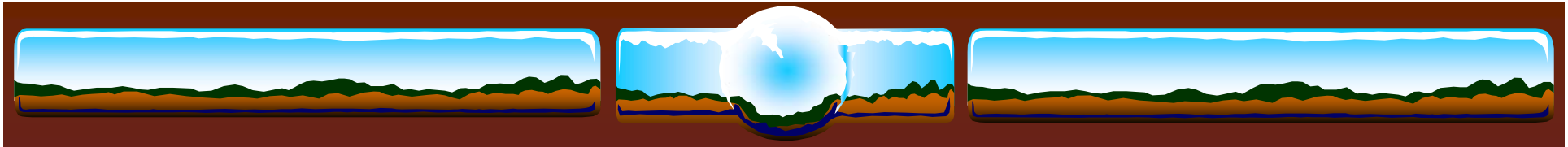
Swimming Increased Participation

- From regional participation studies
  - Number of unmet user days is 4.3-5.2 million
  - User day values
    - Higher range: $5.80-$11.06
    - Lower range: $1.60-$5.80
- Number of assumptions made



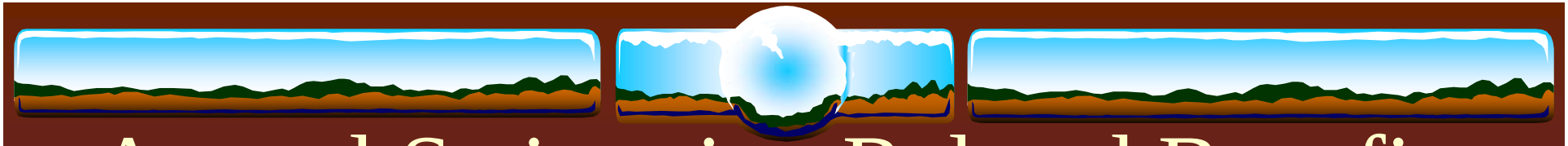
Swimming Increased Participation & Higher Utility

- Logit model used to calculate unmet demand
  - Site choice model – predicts portion of all beach visits that will be made to a particular beach
  - Visitation model – predicts total number of visits an individual makes to any beach
  - Function of distance from sites, socioeconomic factors, & water quality variables
  - Resulted in average value per visitor day of $11.06



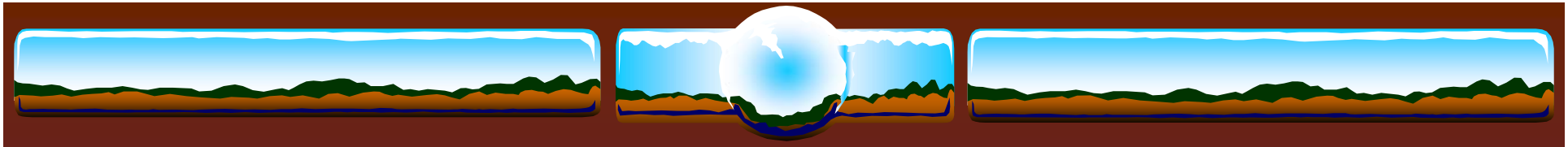
Beach Closings

- $ value of number of beach closings = average consumer surplus/daytrip * daily attendance at each beach * number of beach closings due to poor water quality
- Different health standards used to trigger beach closings
  - Federal standard: 200 MPN/100 ml fecal coliform
  - MDC standard: 500 MPN/100 ml fecal coliform



Annual Swimming Related Benefits

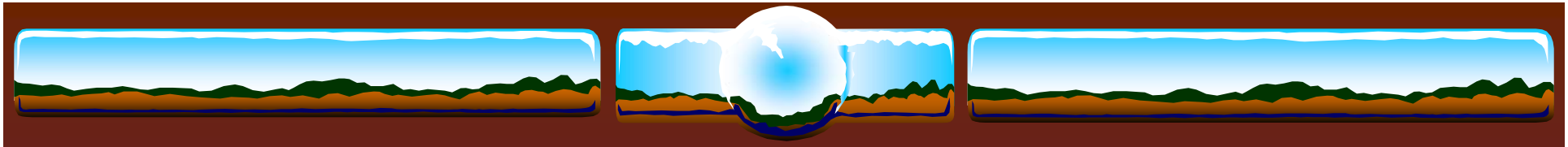
CSO+Secondary Treatment+Ocean Outfall (Millions of 1982$/2003$)		
Increased Participation – Recreation Studies		
High	Low	Moderate
21.5/41.0	2.1/4.0	9.4/18.0
Increased Participation & Higher Utility – Logit Model		
High	Low	Moderate
20.3/38.6	13.6/25.8	16.9/32.2
Beach Closings – 200 MPN Fecal Coliform Standard		
High	Low	Moderate
7.1/13.5	1.0/2.0	3.7/7.1
Beach Closings – 500 MPN Fecal Coliform Standard		
High	Low	Moderate
3.5/6.7	0.5/1.0	1.8/3.5



Discussion of Swimming Benefits

CSO+Secondary Treatment+Ocean Outfall (Millions of 1982$/2003$)		
Increased Participation – Recreation Studies		
High	Low	Moderate
21.5/41.0	2.1/4.0	9.4/18.0

- Neglects the increased WTP for improved water quality
- Higher values are probably more appropriate



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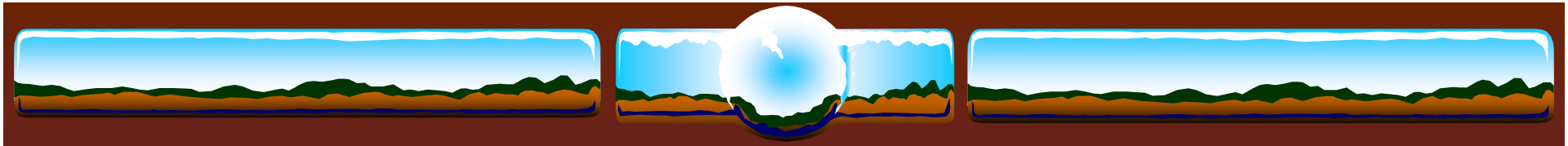
CSO+Secondary Treatment+Ocean Outfall (Millions of 1982$/2003$)		
Increased Participation & Higher Utility – Logit Model		
High	Low	Moderate
20.3/38.6	13.6/25.8	16.9/32.2

- Relies on travel costs to simulate prices
- Fecal coliform (used as water quality parameter) is highly correlated to O&G, the most frequently perceived water quality indicator for the model



Discussion of Swimming Benefits

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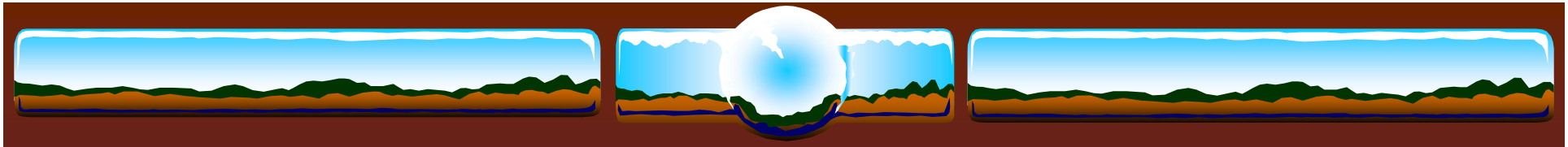
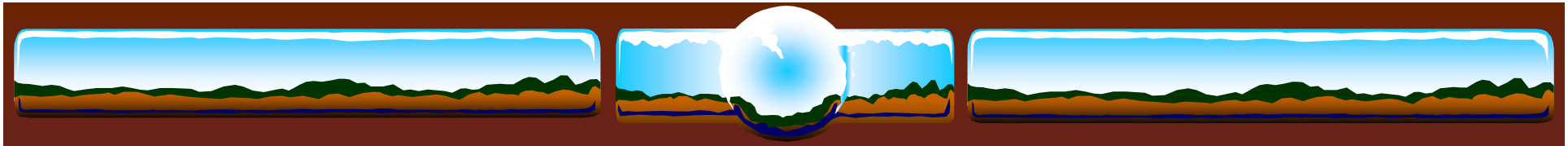
High	Low	Moderate
3.5/6.7	0.5/1.0	1.8/3.5

- Greater benefits seen for beaches w/ poorest water quality
- Underestimates total benefits
  - Does not account for increased number of visits
  - Does not incorporate the increased WTP for safer, cleaner beaches



Intrinsic Benefits

- Existence – the value an individual is WTP for the knowledge the resource exists & is preserved
- Option value – amount an individual is WTP for improved environmental quality to have the right to use the resource in the future
  - Independent of individual's current use status
  - Called bequest values when they include intergenerational concerns



Intrinsic Benefits

CSO + Ocean Outfall (Millions of 1982$/2003$)		
High	Low	Moderate
21.8/41.6	10.1/19.3	15.9/30.3
CSO + Secondary Treatment (Millions of 1982$/2003$)		
High	Low	Moderate
23.2/44.2	10.7/20.4	17.0/32.4

- No WTP data for Boston Harbor
- Several studies attempt to correlate intrinsic values & user values -> intrinsic benefits at least half of the recreational use benefits

Conclusions

- Recreational benefits are largest source of monetizable benefits
  - Swimming has largest benefits ~$41 million/year
  - Boating has 2nd largest benefits ~$20 million/year
  - Recreational fishing & preservation of Boston Harbor Islands follow
- Commercial fishing & health benefits are less considerable
- Intrinsic benefits in range of $20.4-$44.2 million/year
- Substantial benefits also accrued in Charles River