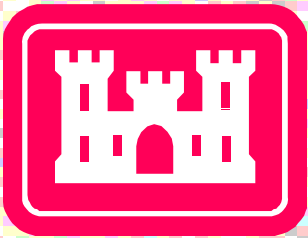
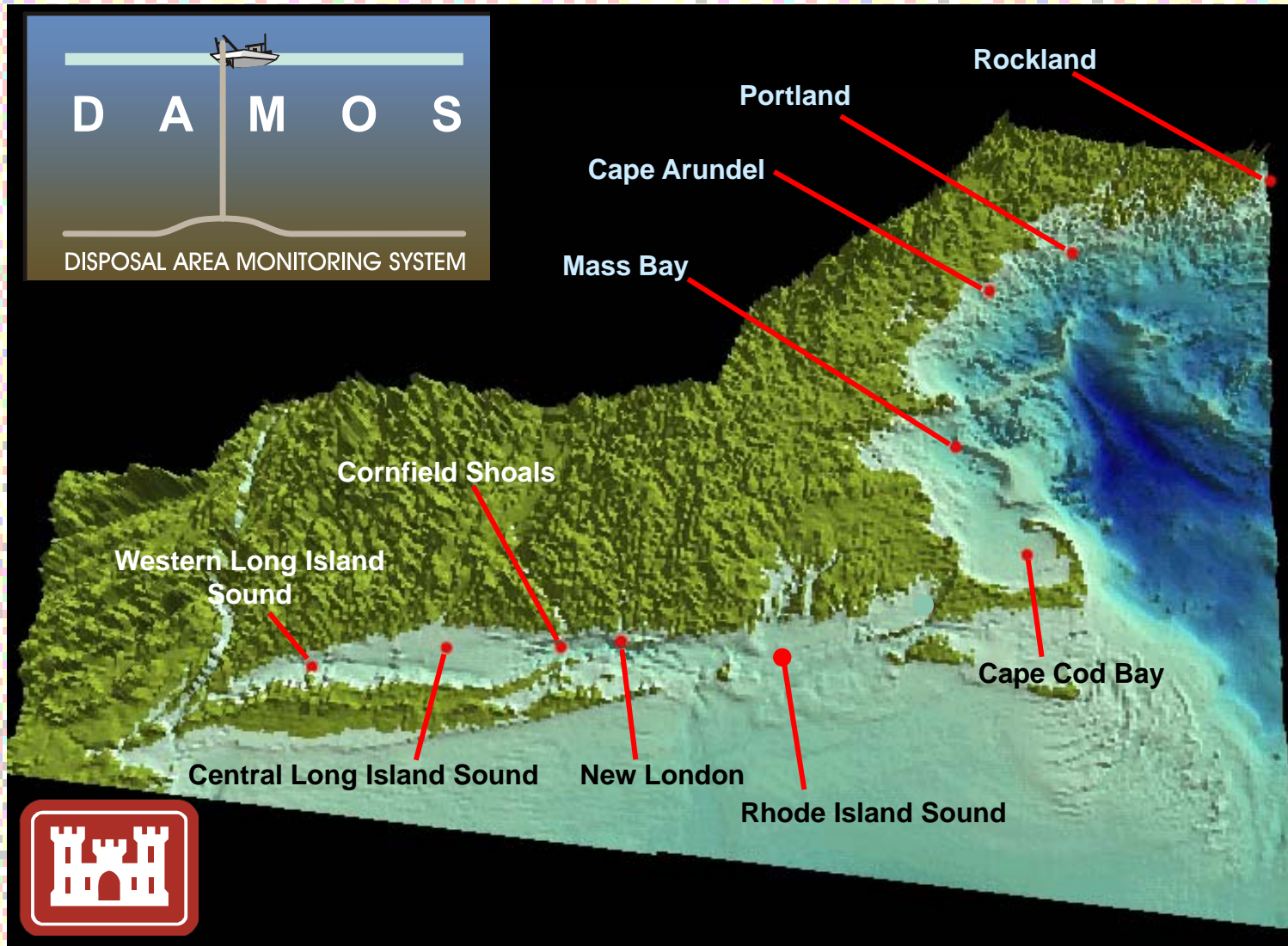


Dredged Material Testing and Evaluation

Thomas J. Fredette, PhD
US Army Corps of Engineers
New England District



New England Open Water Disposal Sites

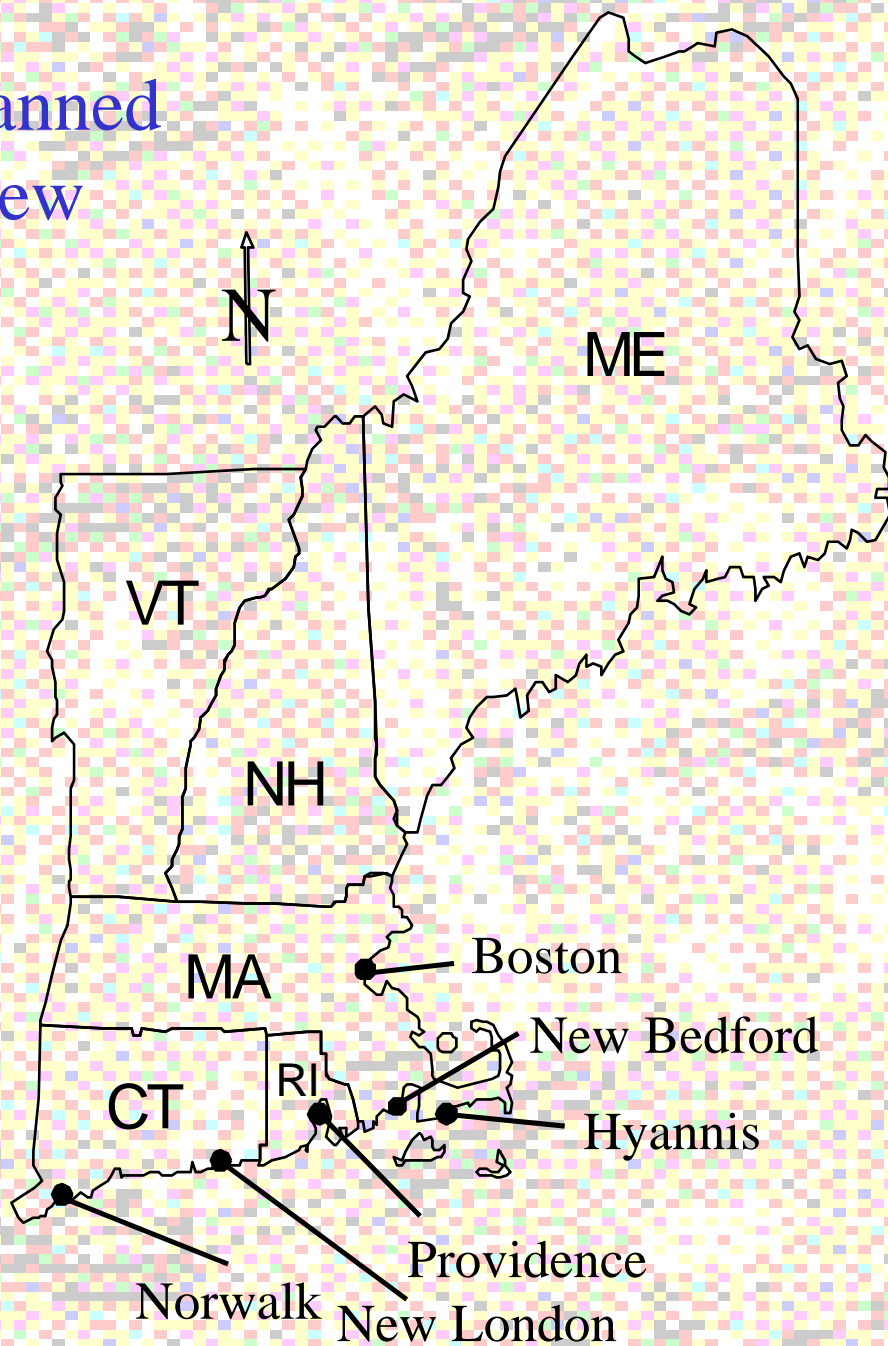


Disposal Area Monitoring System

DAMOS



Existing and Planned CAD Sites in New England



NE CAD Alternative Experience

Confined Aquatic Disposal Cells

1981 – Norwalk Harbor ~ 2,500 cu m

1989 – New Bedford Harbor Pilot

1996 – Hyannis Harbor ~25,000 cu m

1998-2000 – Boston Harbor 600,000 cu m

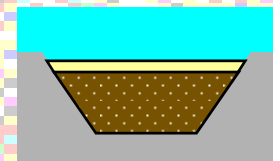
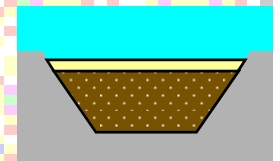
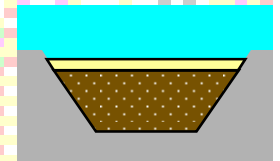
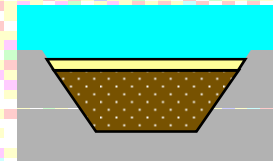
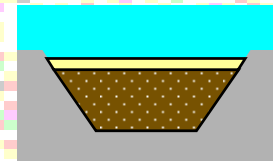
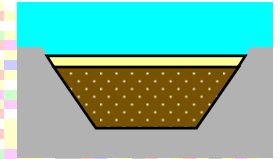
2003-? - Providence Harbor

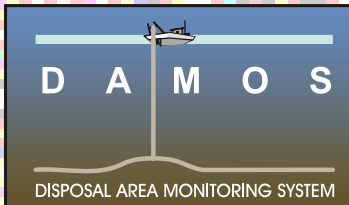
~900,000 cu m

2005 - Norwalk Harbor - ~25,000 cu m

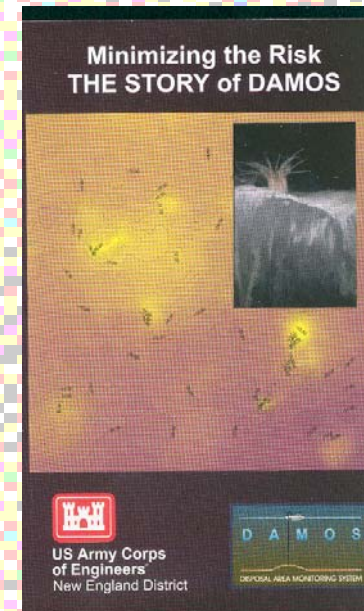
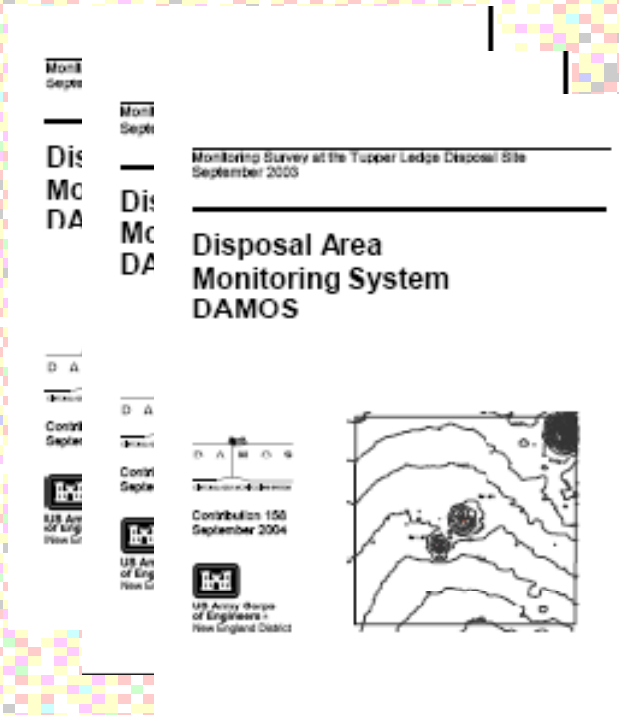
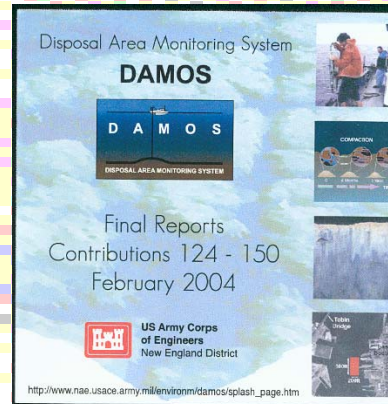
2005-? – New Bedford Harbor - TBD

2006 - New London Harbor – 115,000 cu m





DAMOS Products



<http://www.nae.usace.army.mil/damos/index.asp>

Testing and Evaluation Goal

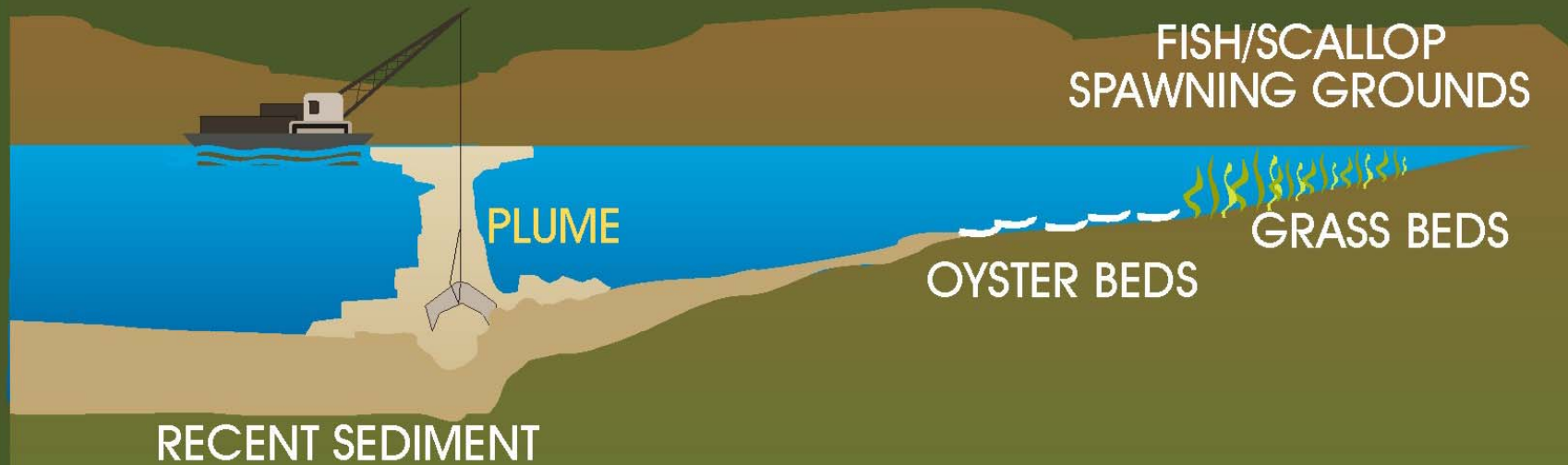
Minimize Impacts to:

Dredging Site

Placement Site



DREDGING SITE RISKS

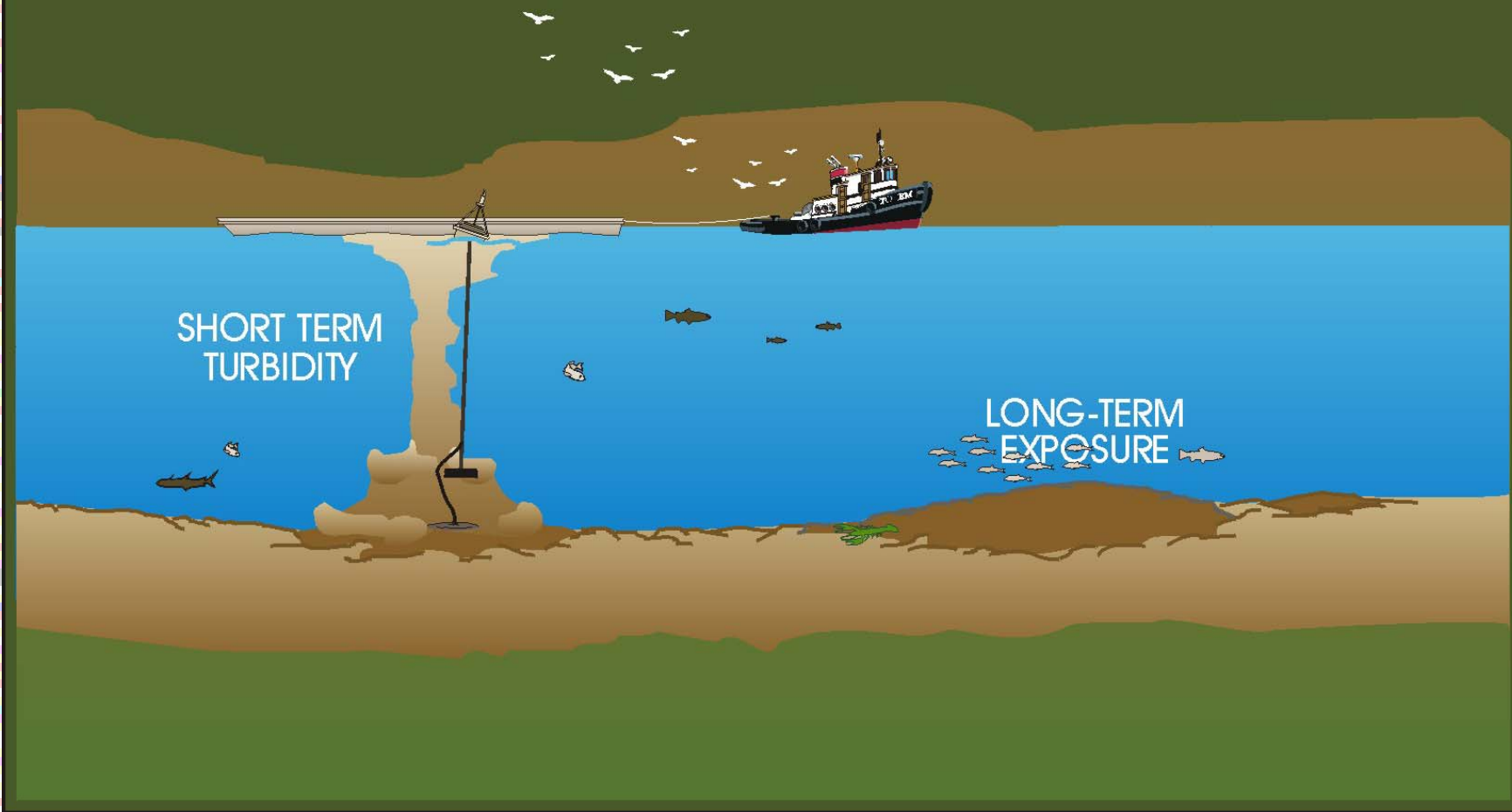


Other Potential Dredging Impacts

- Circulation Changes (salinity)
- Resource Entrainment (hydraulic dredging)
- Habitat Modification/Loss
- Fishery Migration Blockage
- Noise



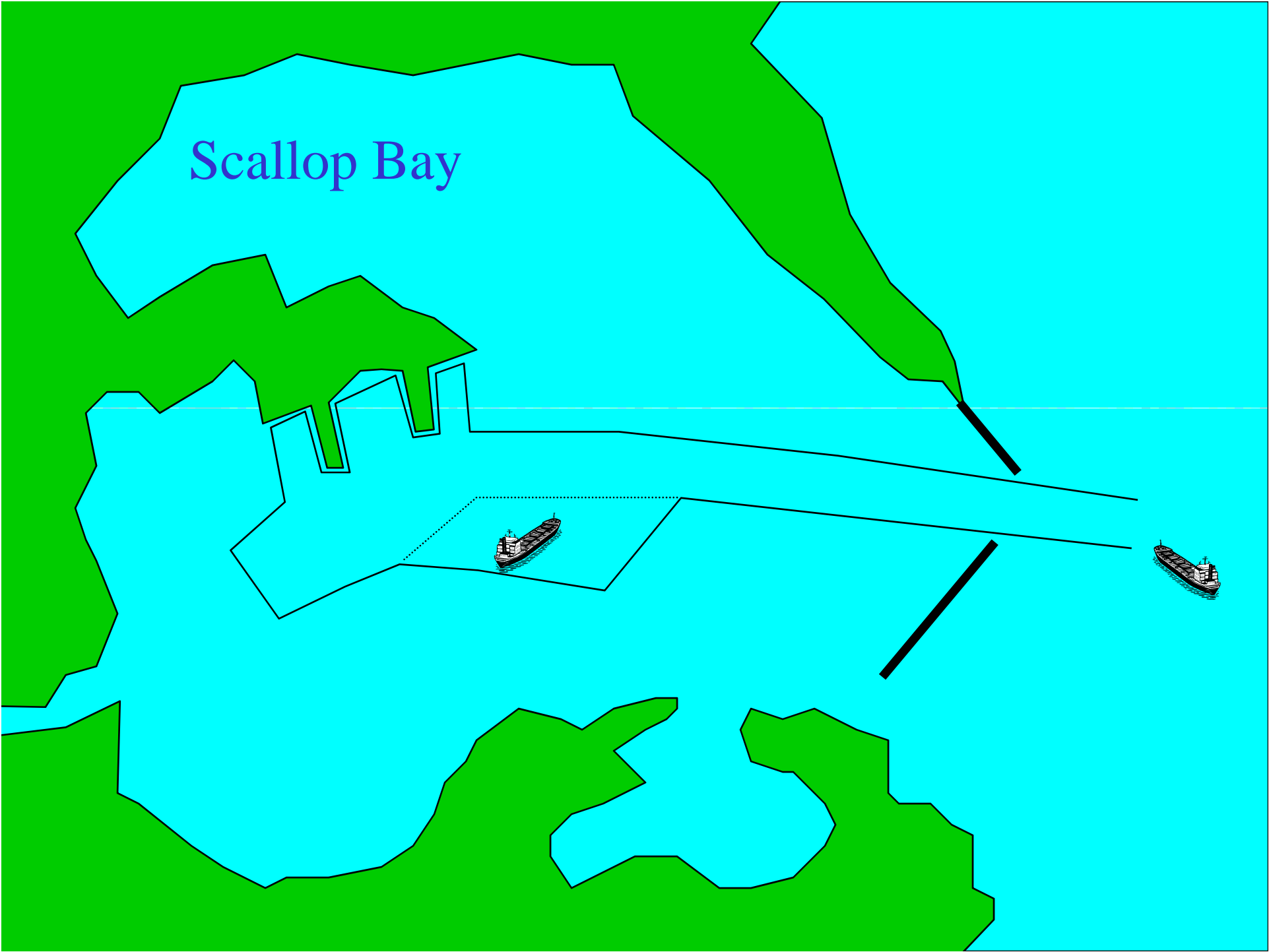
DISPOSAL SITE RISKS



Resource Issues



Scallop Bay



Project Coordination



Impact Assessment

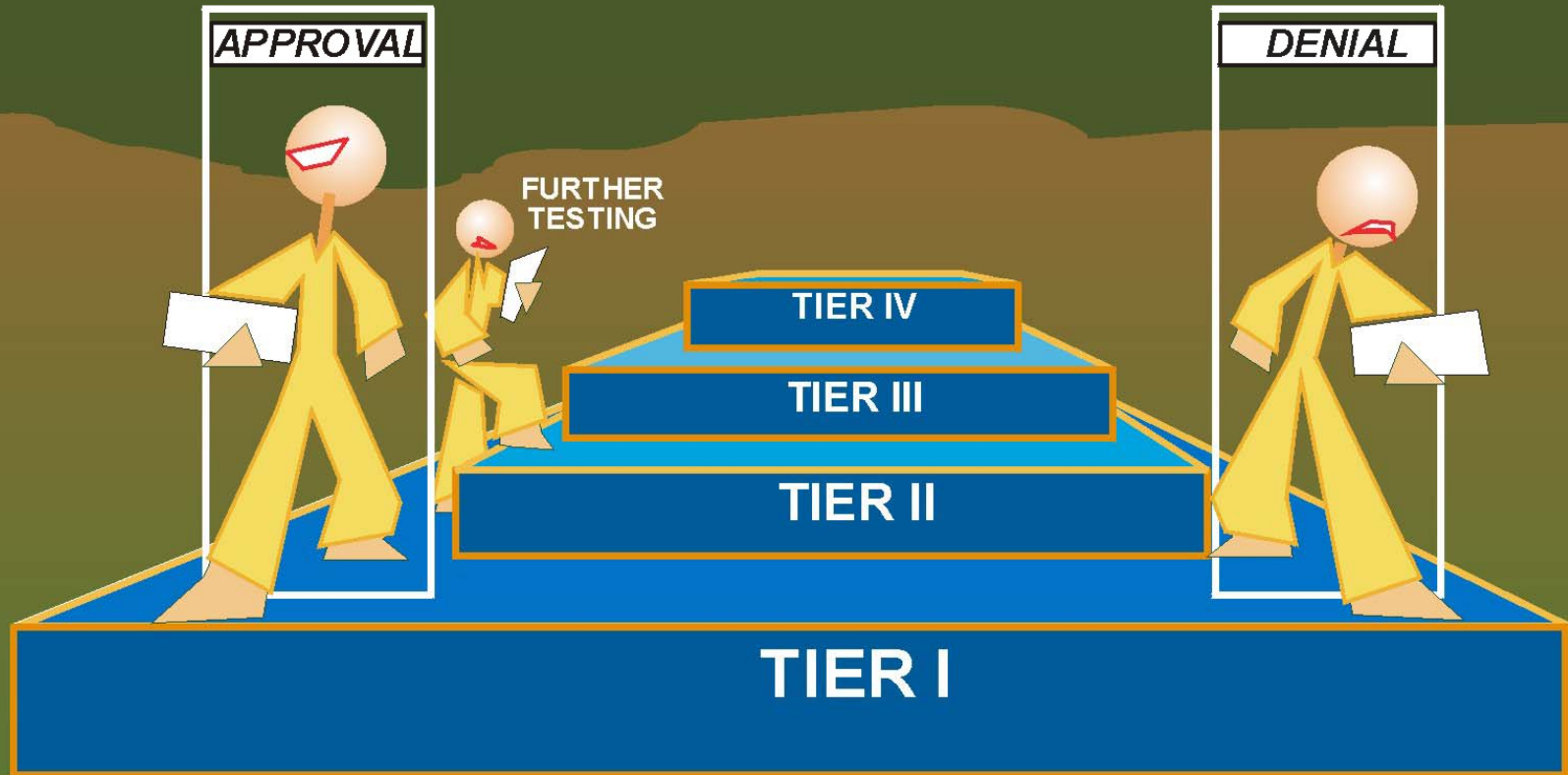
- **Characterize sediment and placement site**
- ***Predict* physical and chemical changes due to placement**
- ***Predict* and accept the biological response**
- ***Predict* and accept the risk to humans**
- **Issue permit**

Impact Monitoring

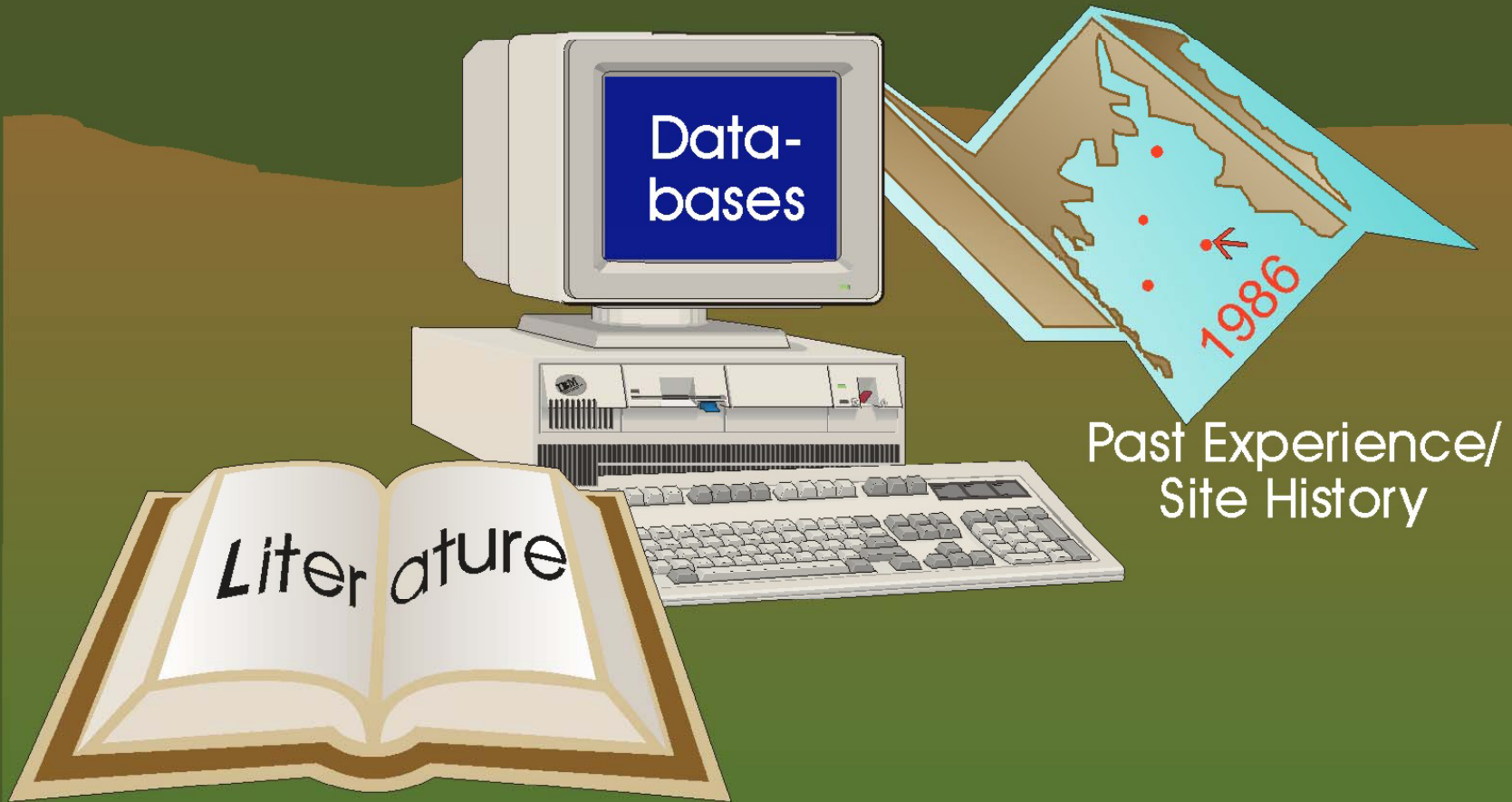
- **Use Predictions/Hypotheses**
- **Was the assessment correct?**



***TIERS ARE LEVELS OF TESTING WITH
THREE POSSIBLE OUTCOMES AT EACH LEVEL***

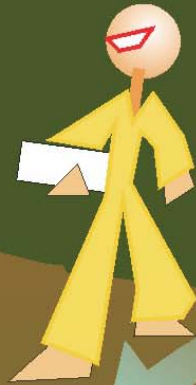


TIER I METHODS



TIER I

Outcome
(Existing Information)



Low/No Risk

Inadequate Information

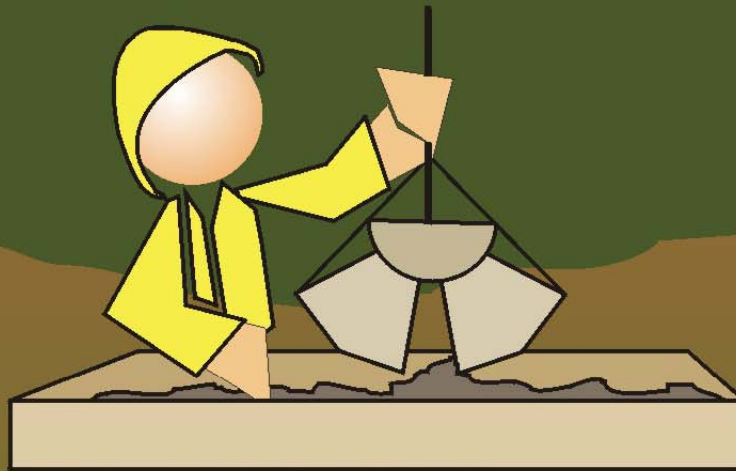
Potential Risk

Beach Nourishment
Wetlands Construction
Open Water Disposal

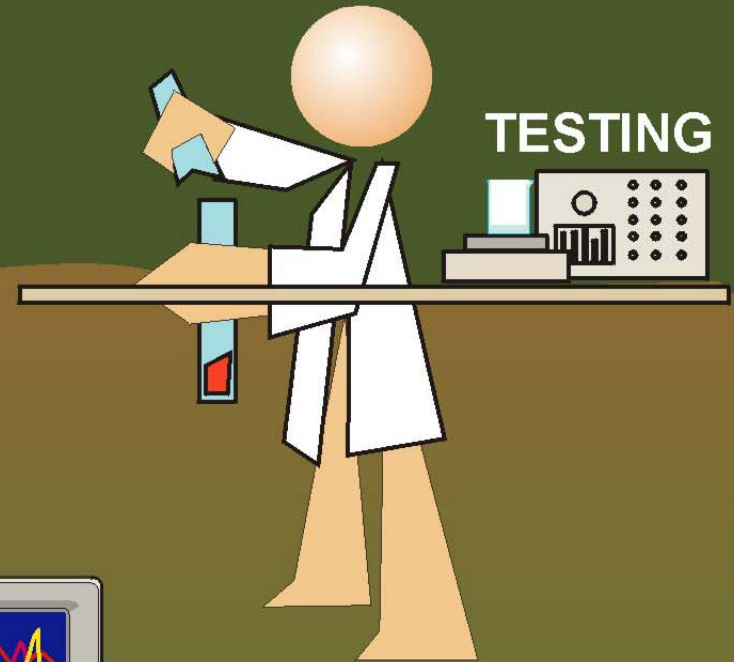
Go To Tier II Testing



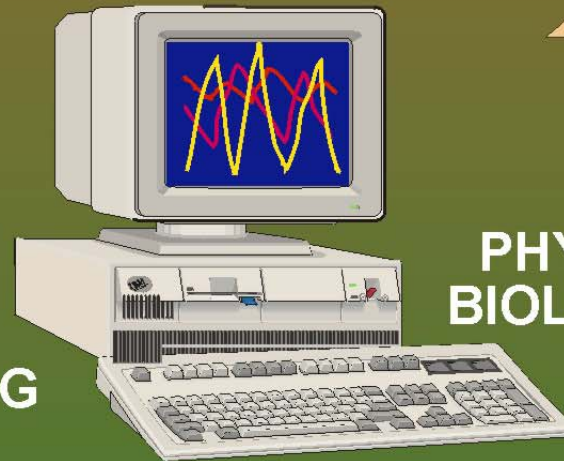
TIER II TESTING METHODS



RECONNAISSANCE
SAMPLING



TESTING

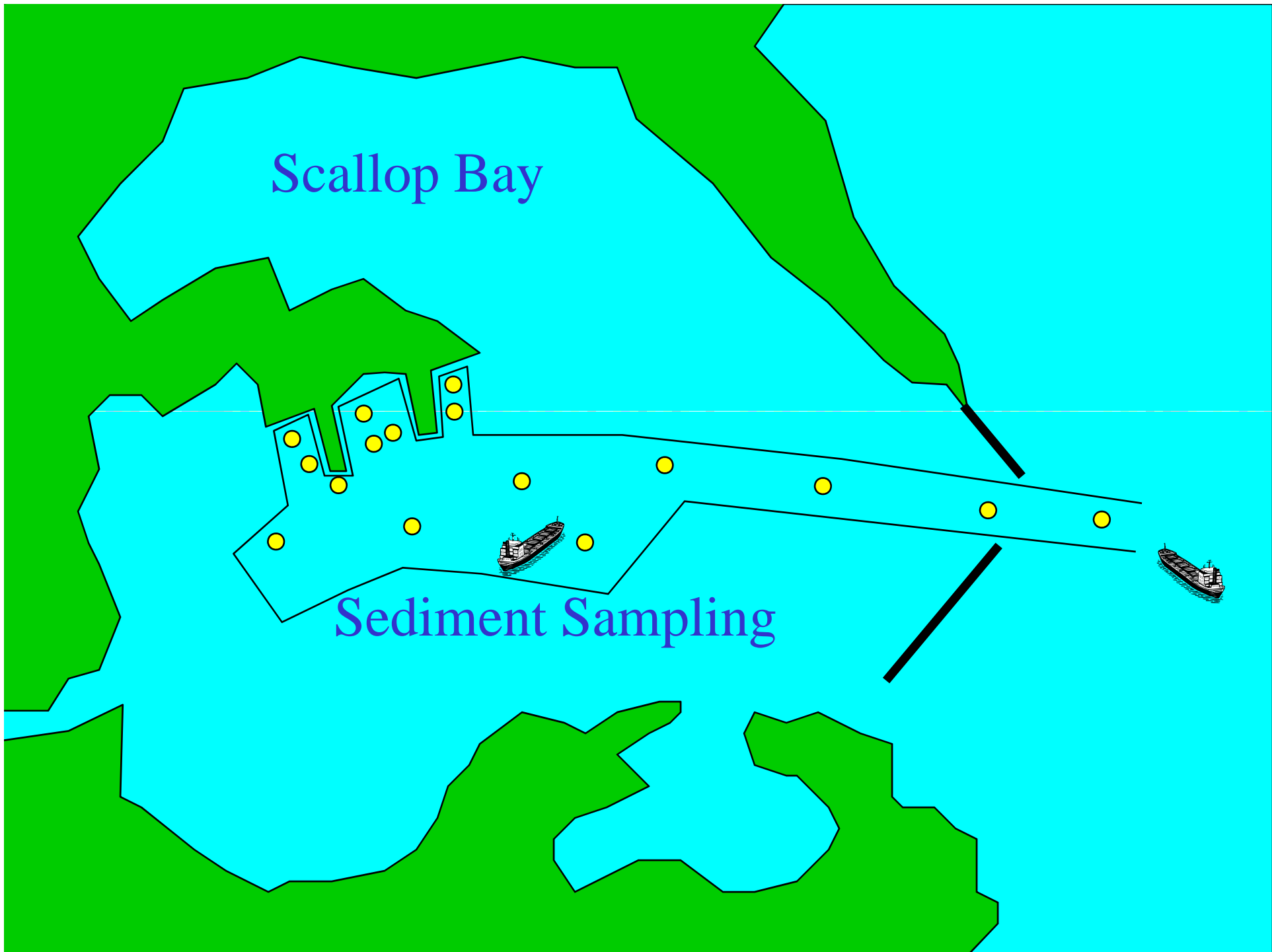


MODELING

PHYSICAL IMPACT
BIOLOGICAL IMPACT

Scallop Bay

Sediment Sampling



Typical Test Contaminants

- Metals

Cadmium, Mercury, Lead, Zinc,
Copper, Chromium, Nickel

- Organics

Polyaromatic Hydrocarbons (PAH),
PCBs, Pesticides

- Others based on “reason to believe”

Evaluation of Chemical Data

Reference Site Concentrations

Earth's Crust Abundance

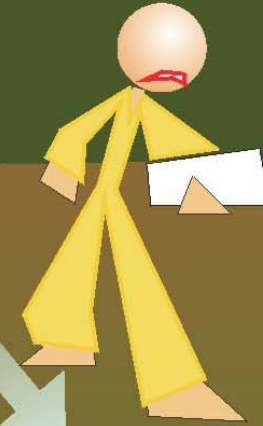
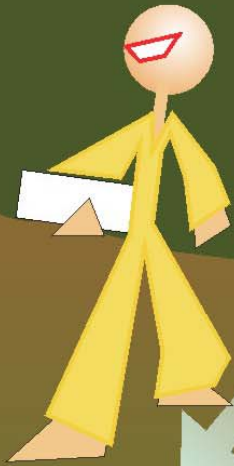
Previous Nearby Project Results

Screening Values

Action List

TIER II

Outcome



Material Acceptable

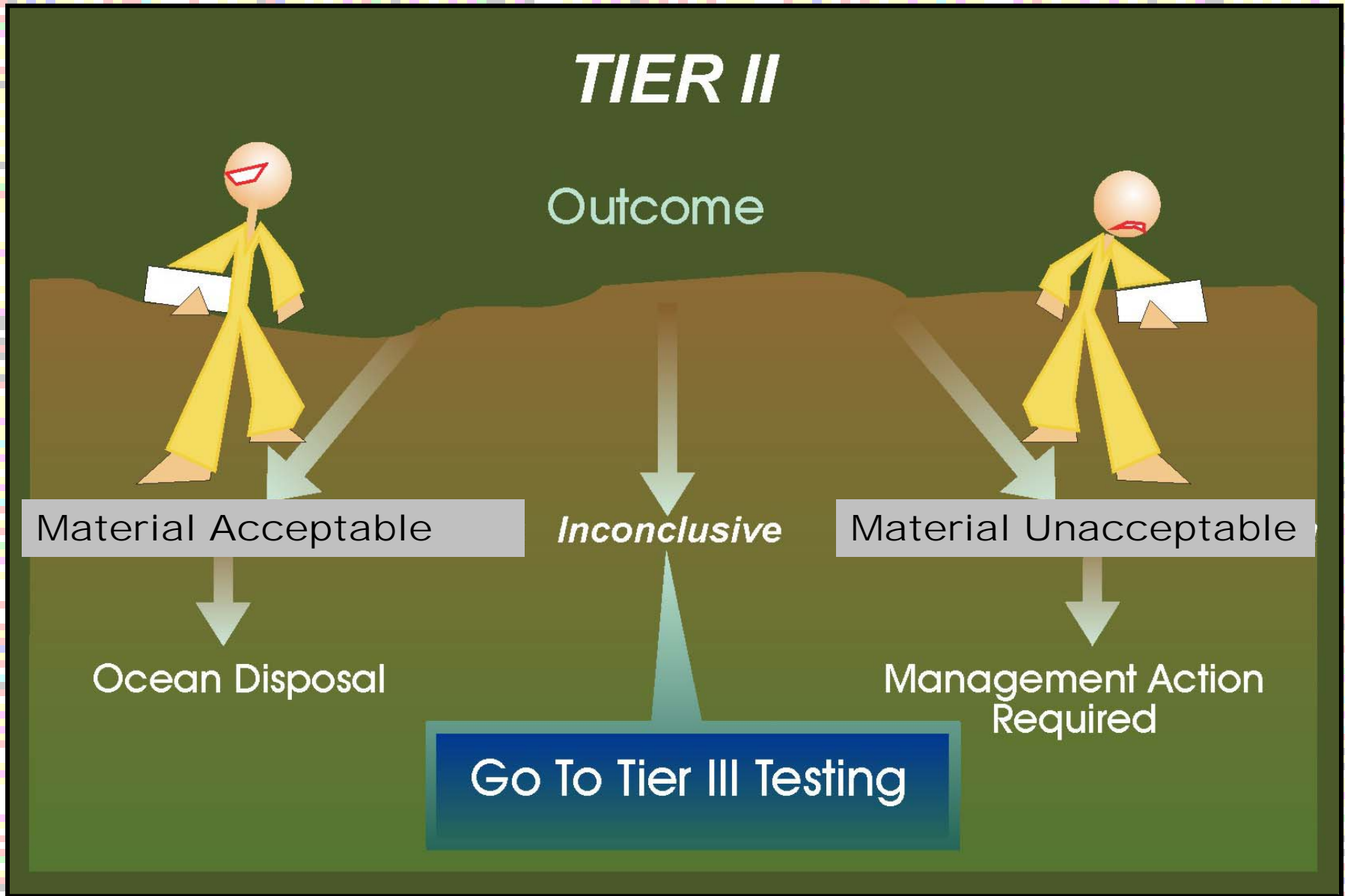
Inconclusive

Material Unacceptable

Ocean Disposal

Management Action
Required

Go To Tier III Testing



TIER III BIOLOGICAL EFFECTS TESTING

- Toxicity
- Bioaccumulation



TIER IV

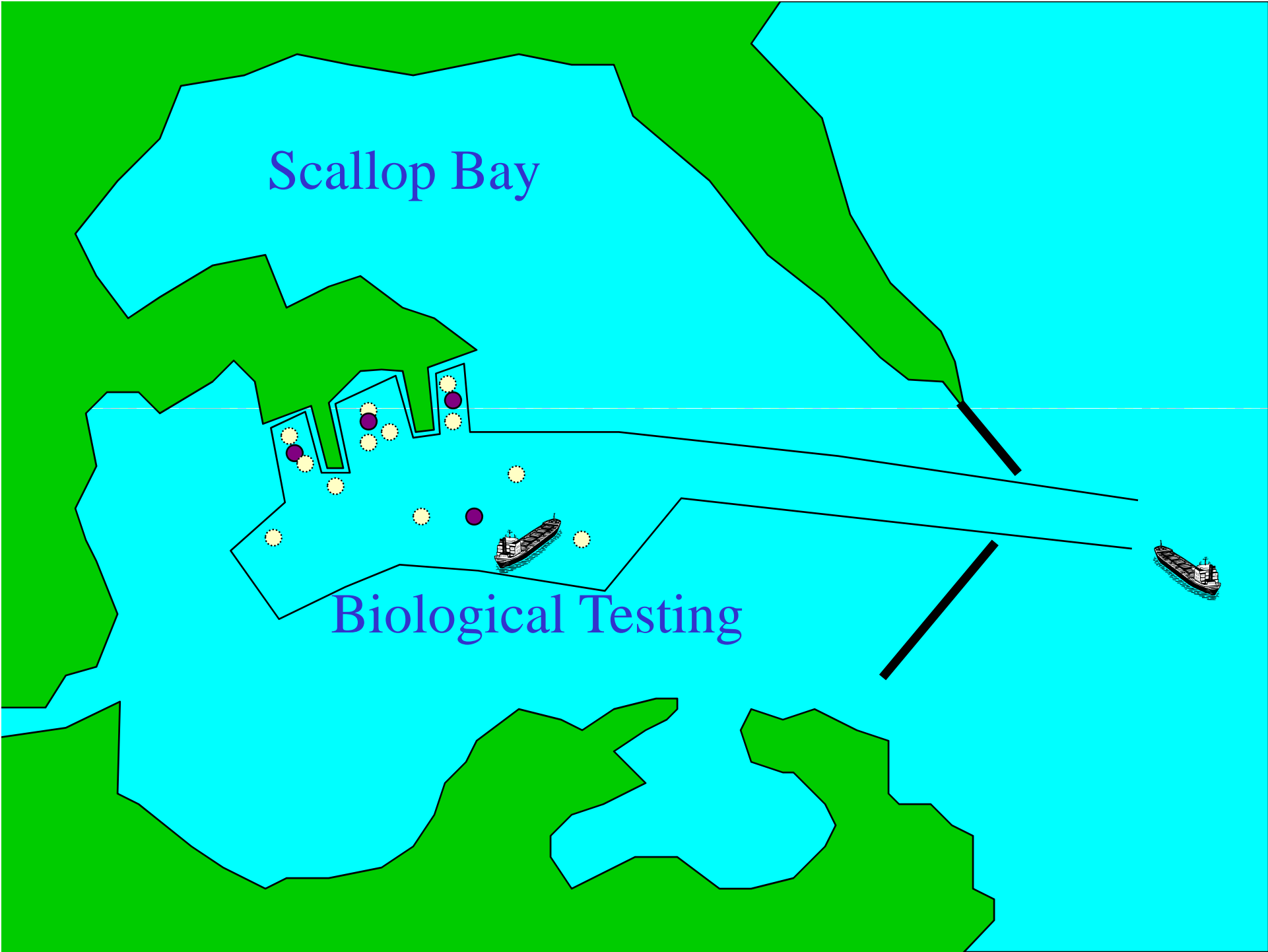
TIER III

TIER II

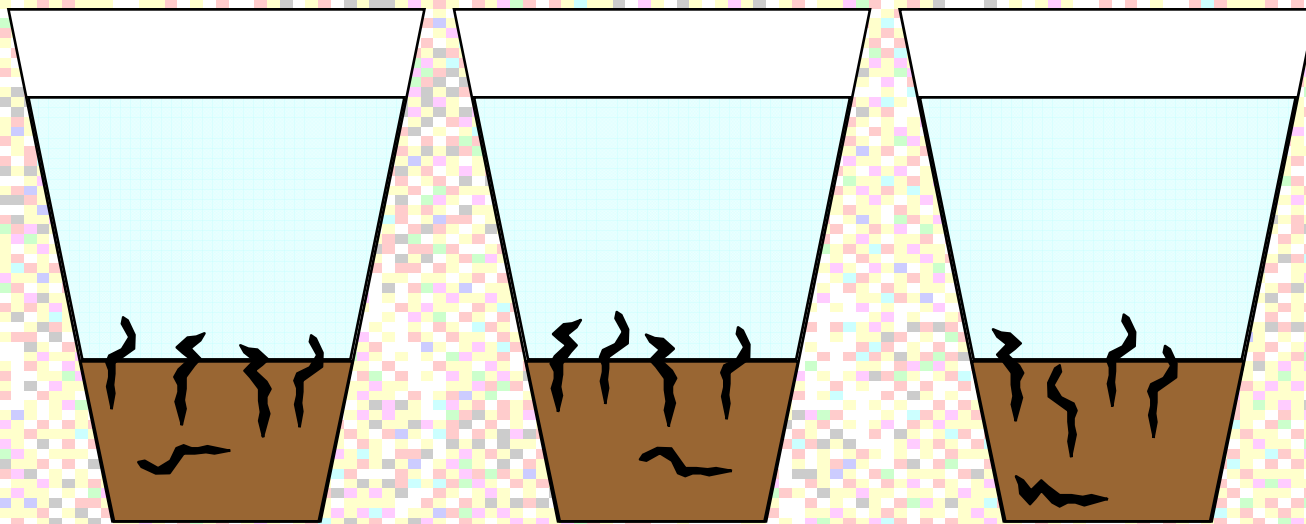
TIER I

Scallop Bay

Biological Testing



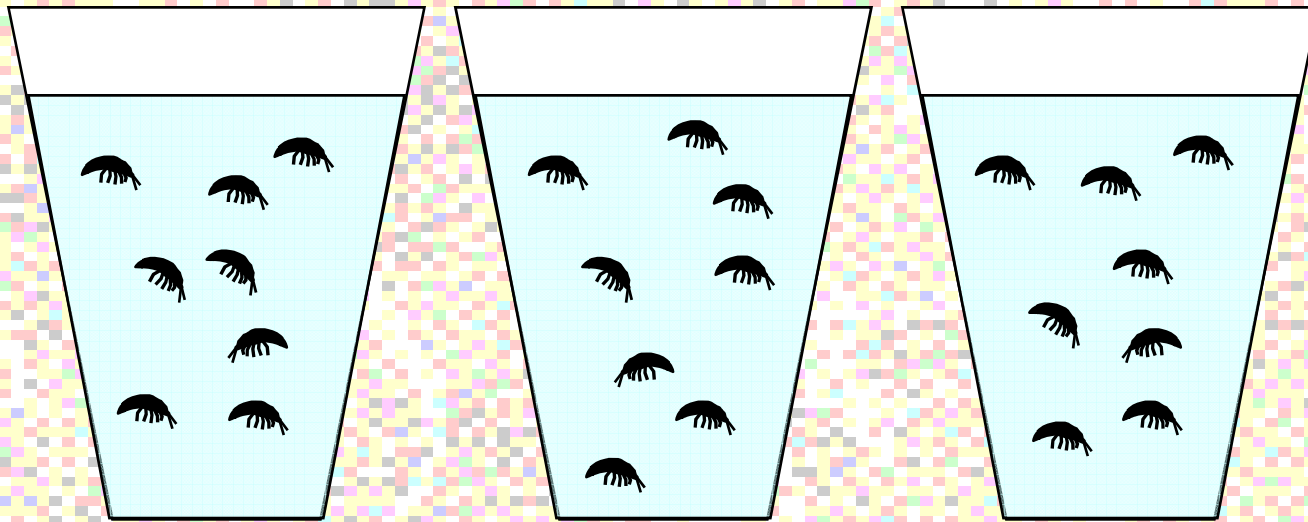
Bioassay/Bioaccumulation Tests



Toxicity - 10 Days

Chemical Uptake - 28 Days

Bioassay/Water Column Tests



Toxicity - 48-96 Hours

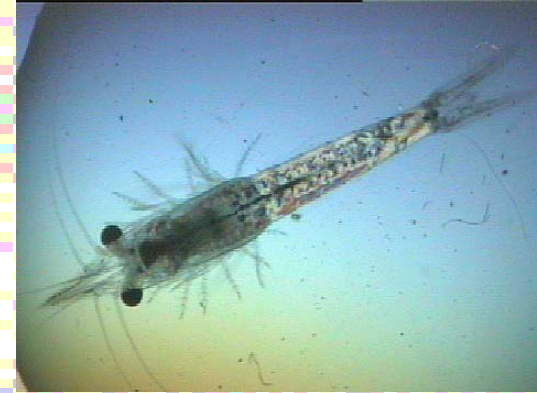
Typical 10-Day Bioassay Species (Amphipod)



Other Common Test Organisms

Benthic Toxicity

- Mysids
- Polychaetes
- Chironomids



Water Column Toxicity

- Mysids
- Juvenile Fish
- Bivalve Larvae
- Echinoderm Larvae



Common Test Organisms

Bioaccumulation

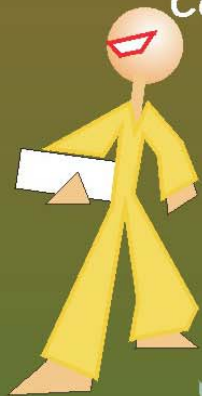
- Clams
- Polychaetes



TIER III

Tier III Outcome
Toxicity

ACCEPTABLE RESULT
Dredged Material Shows
Comparable Effect as
Reference Area



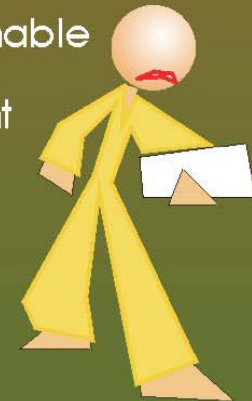
Assess
Bioaccumulation
Potential

Acceptable

Nonacceptable

UNACCEPTABLE RESULT
Dredged Material More Effect
Than Reference Area

Ocean Disposal Questionable
or Acceptable with
Special Management
(e.g. Capping)



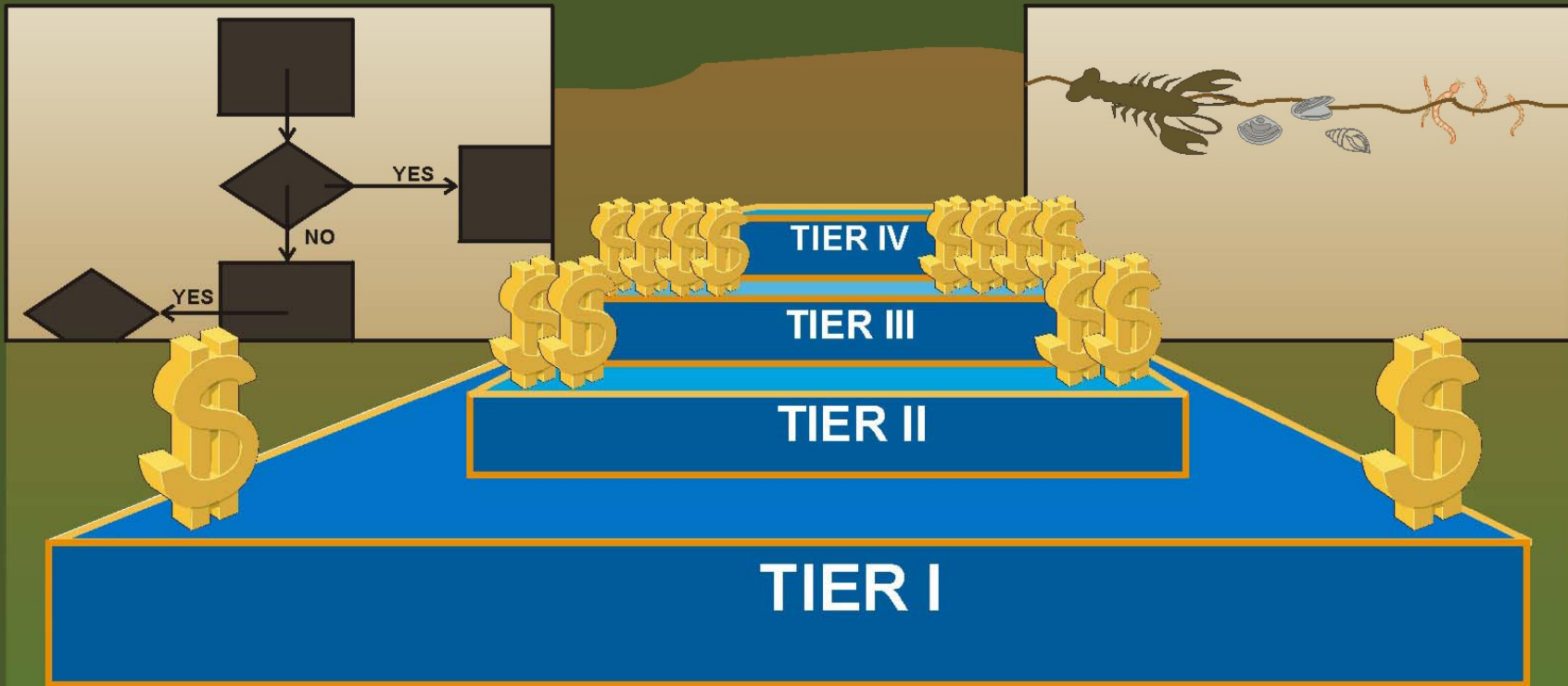
Go To Tier IV Testing

Evaluation of Biological Data




- Reference Site Results
- Risk Assessment Calculations
- Comparison to Seafood Health Limits



TIERED TESTING



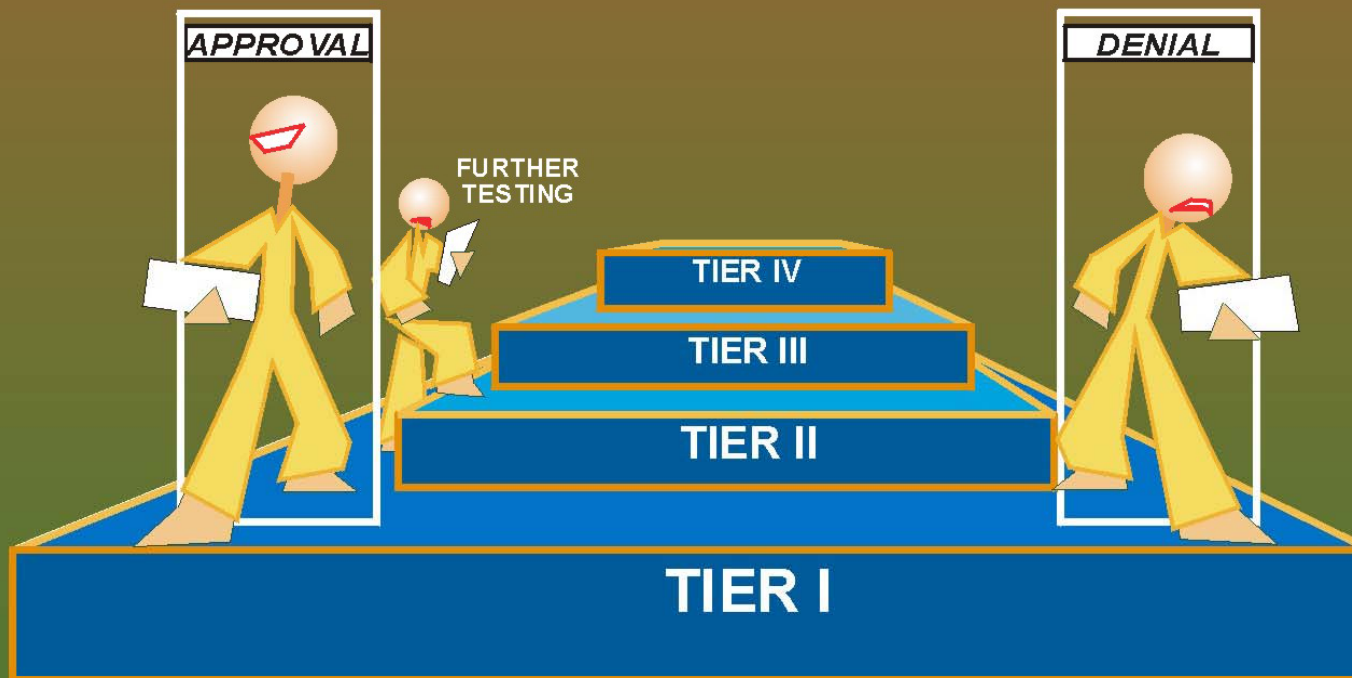
Testing Costs Increase with Tiers

- Chemical Tests  US\$ >2,500
- Toxicity Tests  >US\$10,000
 - Benthic/Sediment
 - Water Column
- Bioaccumulation  >US\$100,000

THE TIERED APPROACH

Summary:

- Used to Systematically Evaluate Projects
- A Protocol to Save Unnecessary Time and Expense
- Criteria Are Based on Best Professional Judgement



Project Scenario 1			
Marina Dredging Project - 8,000 cubic meters			
Sediment Chemistry Tests (ppm - mg/kg dry weight)			
	Marina S1	Marina S2	Reference
Zinc	465	413	110
Lead	225	185	85
Copper	180	195	45
Nickel	55	42	40
Mercury	1.6	1.8	0.15
Cadmium	6	5.6	0.3
tPCBs	3.4	4.2	0.6
DDE	0.09	0.11	0.07
%silt/clay	97	95	92

Biological Testing Results - % Survival						
10 Day Toxicity Tests						
Amphipod - Species 1				Mysid - Species 2		
% Survival						
Rep. #	Marina	Reference	Control	Marina	Reference	Control
1	18	95	97	0	80	85
2	0	88	100	4	78	100
3	4	91	97	8	65	96
4	14	100	100	0	92	94
5	0	100	100	2	80	100
Mean	7.2	94.8	98.8	2.8	79	95
Decision Criteria - Significance & 20%+ lower						

Project Scenario 2			
Marina Dredging Project - 8,000 cubic meters			
Sediment Chemistry Tests (ppm - mg/kg dry weight)			
	Marina S1	Marina S2	Reference
Zinc	115	113	110
Lead	84	92	85
Copper	62	42	45
Nickel	38	33	40
Mercury	0.12	0.11	0.15
Cadmium	0.5	0.35	0.3
tPCBs	0.65	0.5	0.6
DDE	0.07	0.05	0.07
%silt/clay	97	95	92

Biological Testing Results - % Survival

10 Day Toxicity Tests						
Amphipod - Species 1			Mysid - Species 2			
Rep. #	% Survival			% Survival		
	Marina	Reference	Control	Marina	Reference	Control
1	78	95	97	82	80	85
2	64	88	100	77	78	100
3	81	91	97	78	65	96
4	64	100	100	83	92	94
5	82	100	100	85	80	100
Mean	73.8	94.8	98.8	81	79	95
Decision Criteria - Significance & 20%+ lower						

