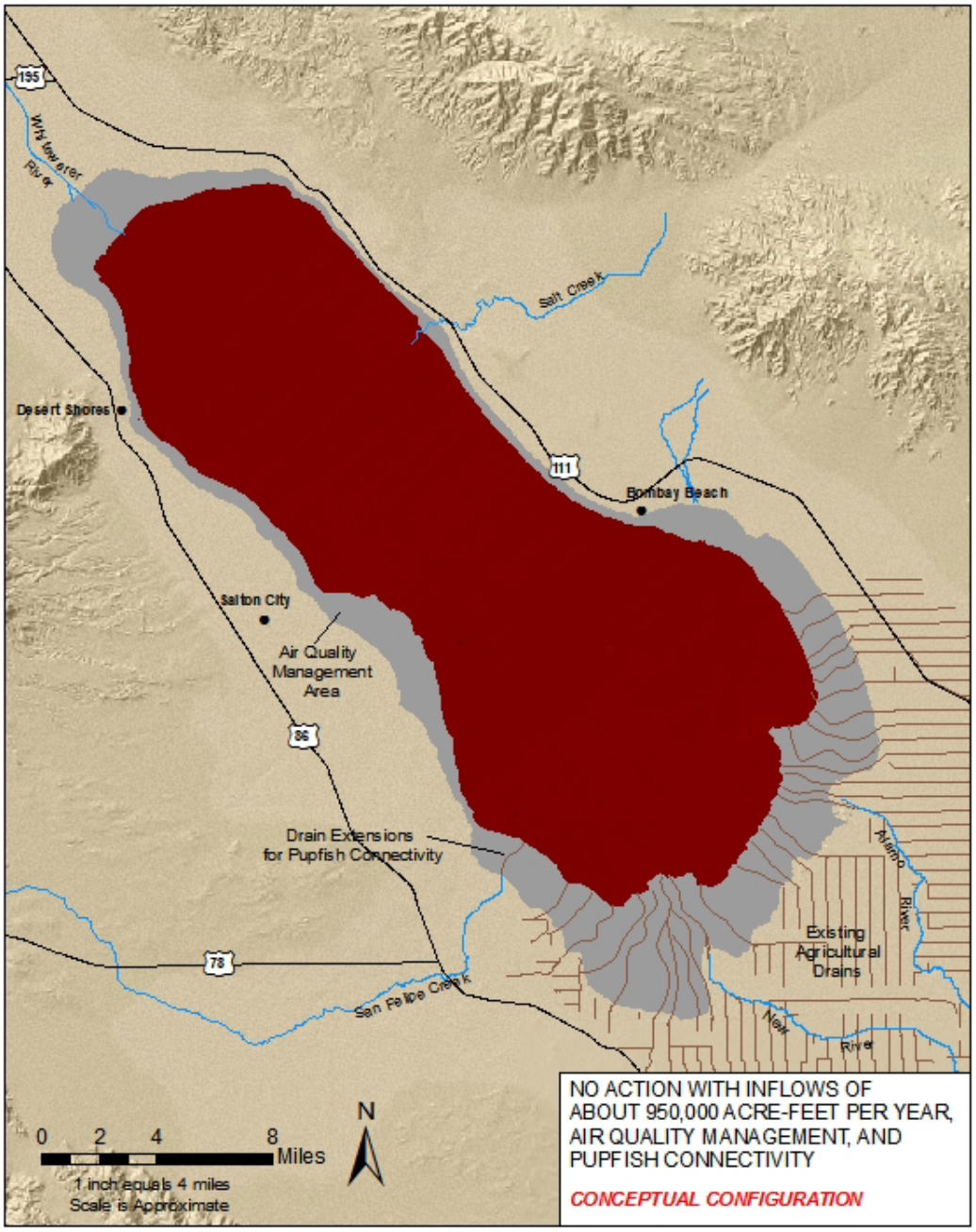
Salton Sea Ecosystem Restoration Infrastructure/Alternatives Work Group Meeting

December 1, 2005

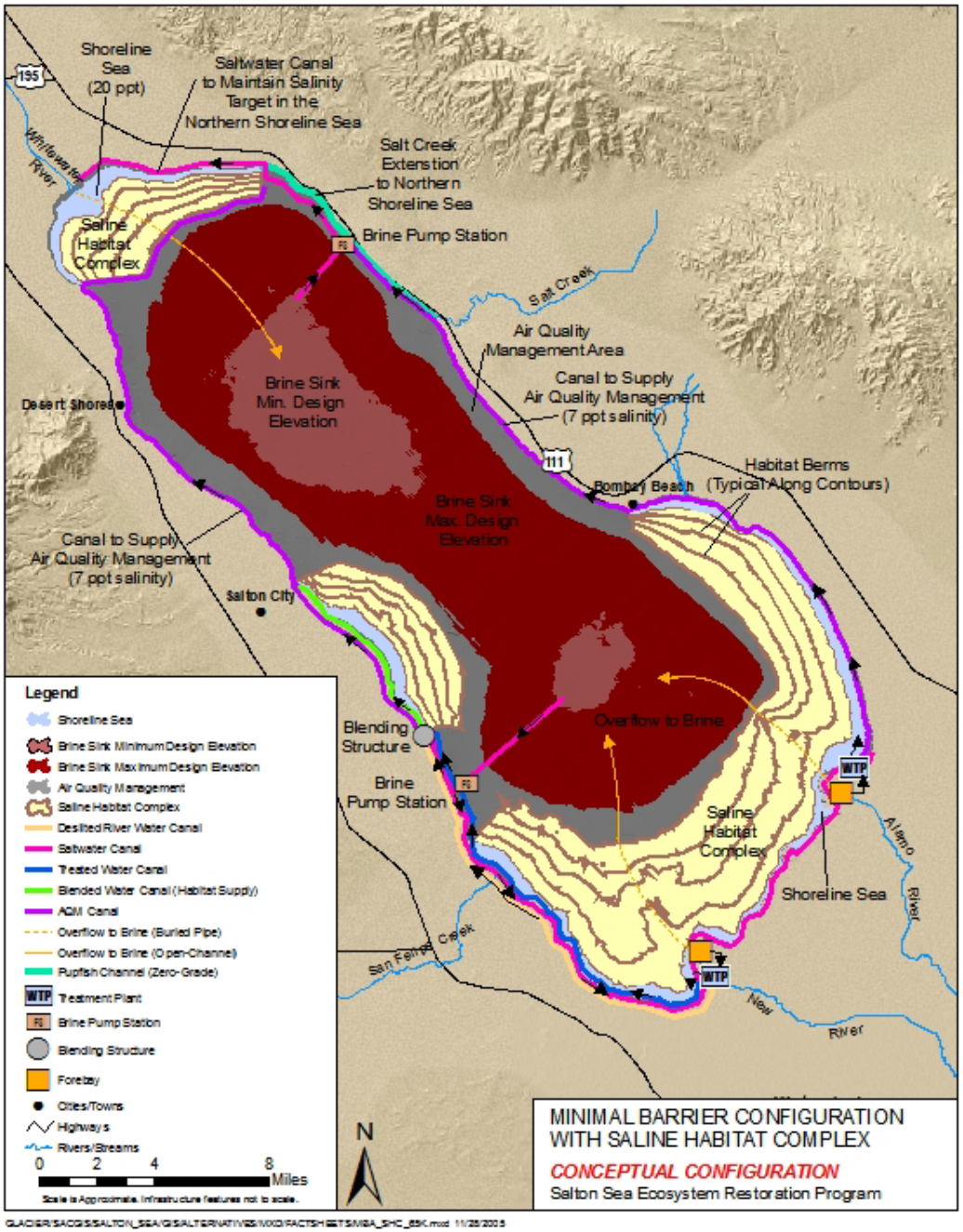
Agenda

- **Update on Alternatives**
- **Constructability Issues Discussion**
  - **Barriers, Perimeter Dikes, Habitat Berms**
    - Design Alternatives
    - Materials/Quarry
    - Placement
    - Foundation Treatment/Dredging
  - **Construction Impacts**
- **Project Phasing**



No Action

- **Air Quality Management Below -235**
- **Pupfish Connectivity when Sea Salinity is >90 ppt**



Minimum Barrier Alternative

- **Maximum created Saline Habitat Complex (SHC)**
  - **Up to 75,000 Acres**
- **Shoreline Seas for Water distribution and Pupfish**
- **Water Treatment for SHC**
- **No Deep Marine Sea**

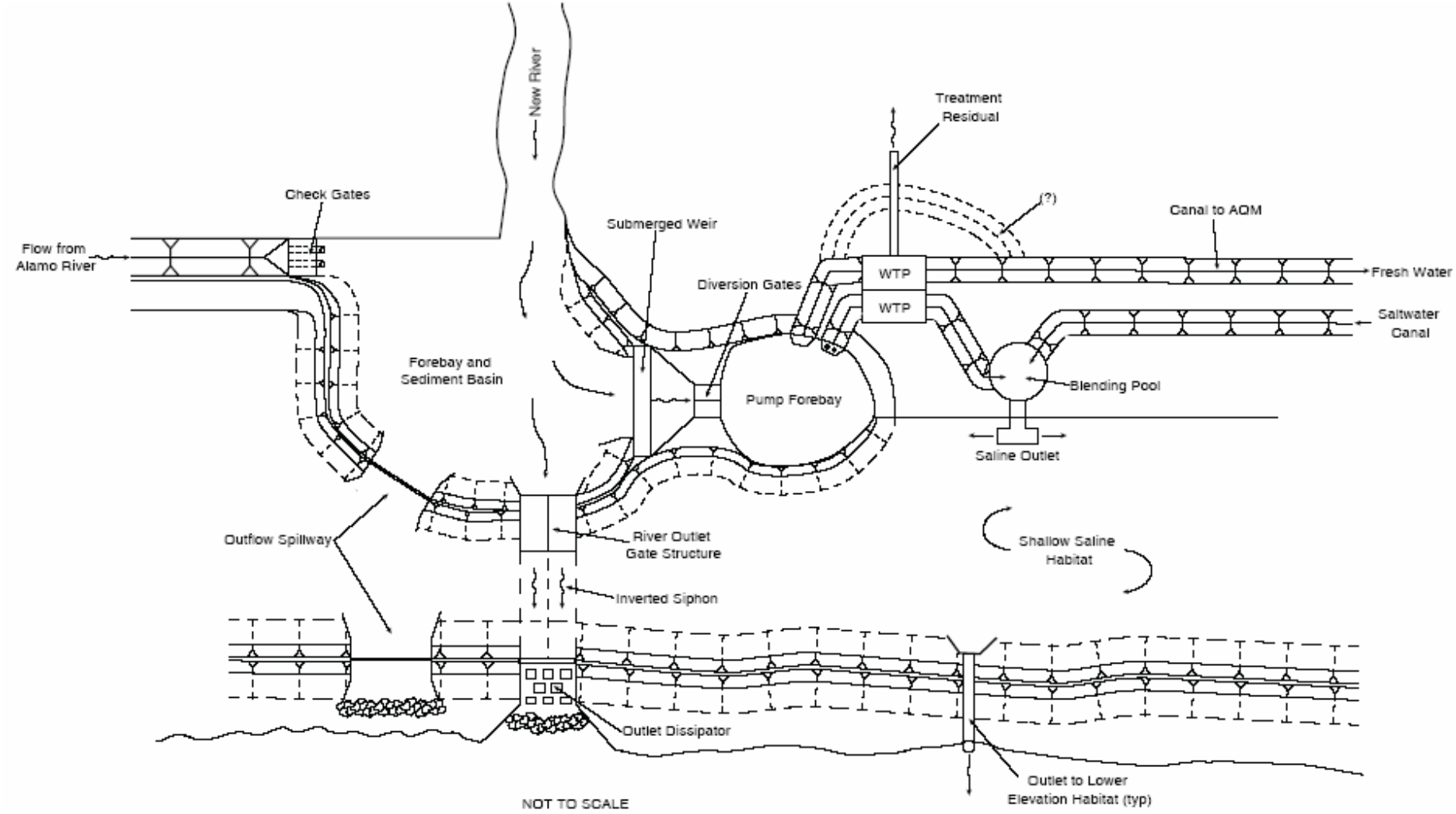
Minimal Barrier Alternative

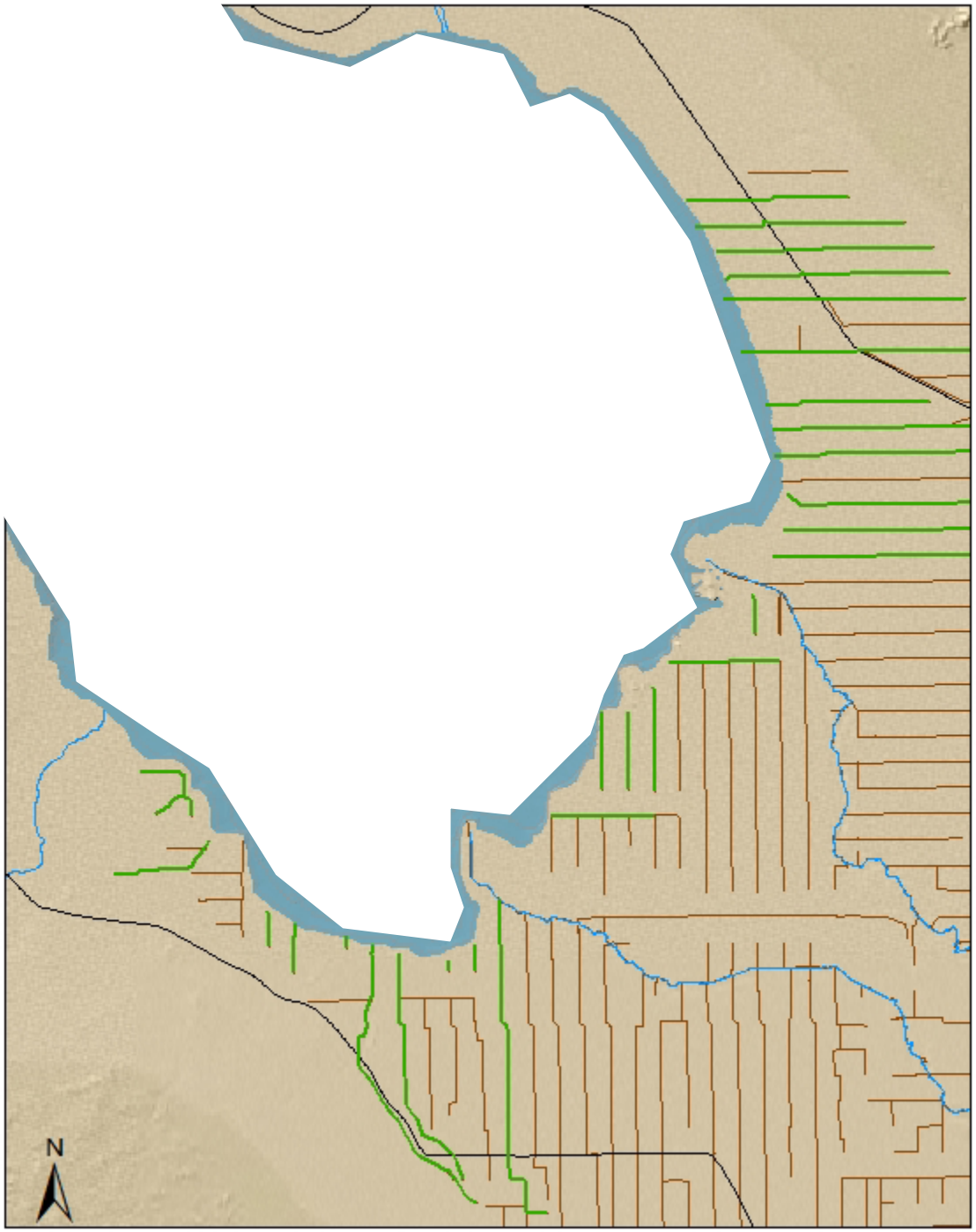
- **Objectives**
  - **Create maximum managed habitat with available water supply**
  - **Create habitats in places of maximum habitat value**
  - **Create and arrange saline habitats that can replace estuary functions**
  - **Provide pupfish connectivity to sea habitat as possible**
  - **Provide improved water quality to habitat**

Minimal Barrier – Key Points

- **Construct perimeter dike for north and south shoreline sea first (extend dike as far as possible)**
- **Limit inflow to shoreline sea using inflow regulating structures**
- **Blend brine sink water with (treated) inflows to maintain 20 ppt salinity**
- **Construct habitat berms for Saline Habitat Complex (SHC) in dry as Sea recedes**
- **Distribute water to saline habitat complex**
- **Control SHC inflows so at least 75% area is between 20-60 ppt**
- **Maintain pupfish connectivity**
- **Treat drainage water to reduce ecorisk in shoreline sea**

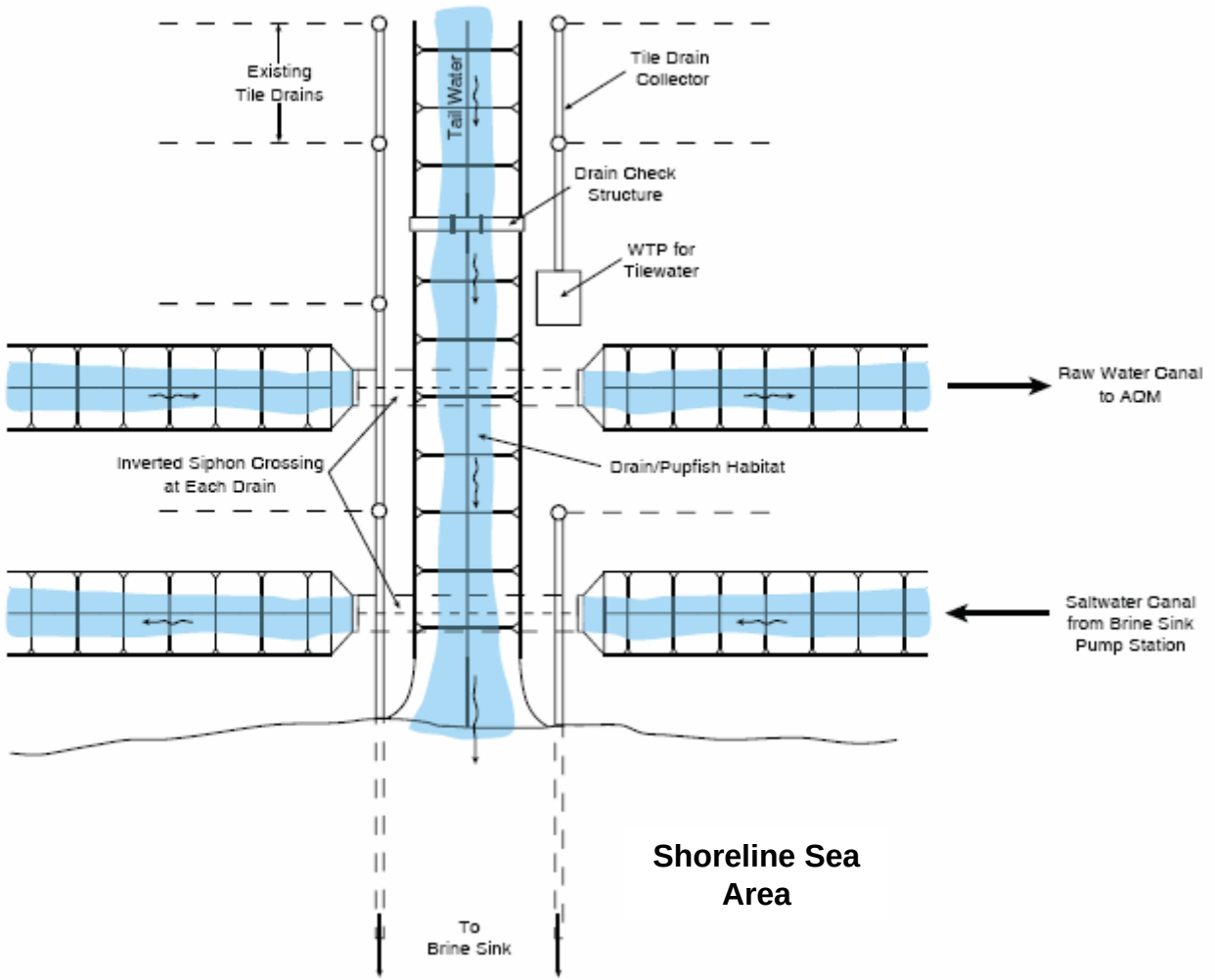
River Inflow Control Structures





Direct Agricultural Drainages could be significant inflow to “Shoreline Sea”

Shoreline Conveyance of Saltwater and Desilted River Water at Agricultural Drainages for Pupfish Connectivity

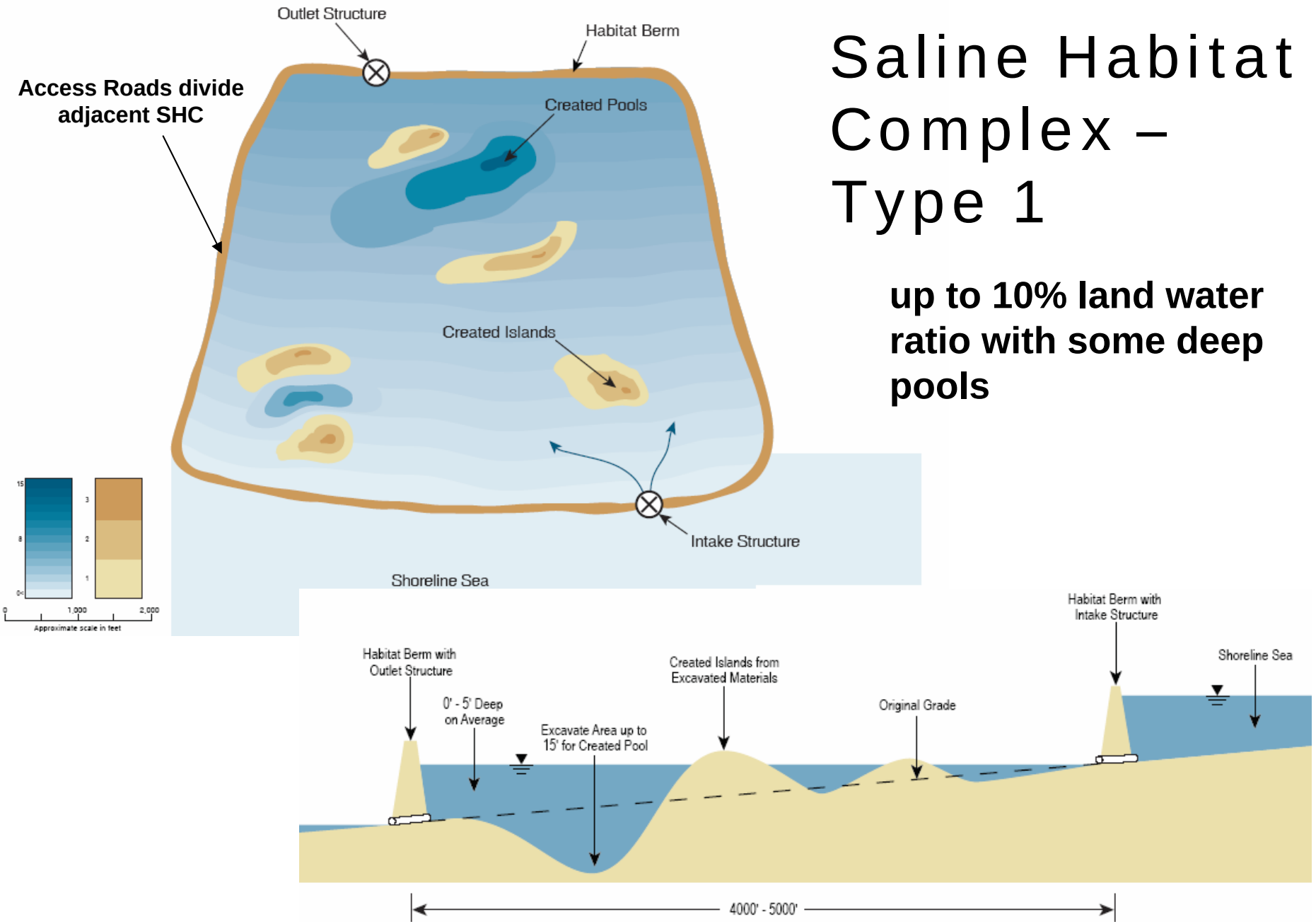


Saline Habitat Complex

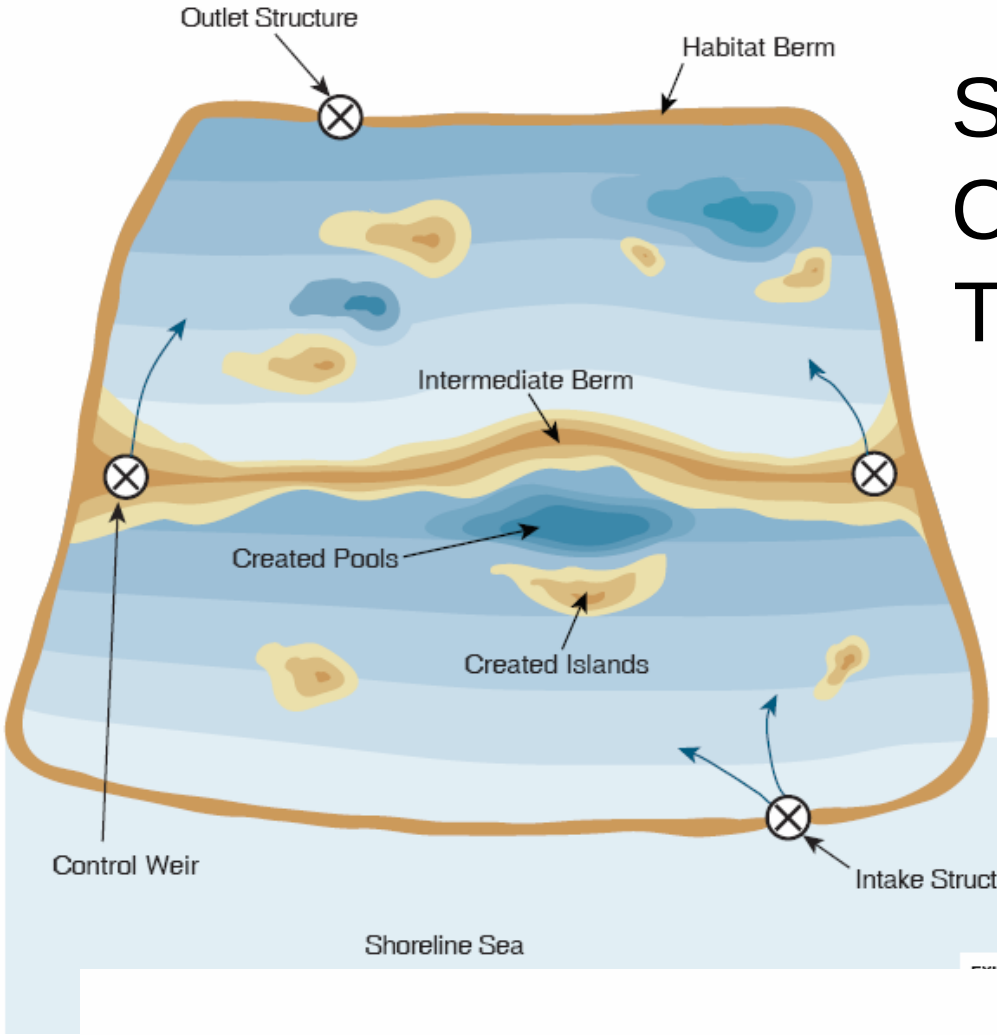
- **Supply is distributed through managed "Shoreline Sea"**
  - **Sea serves as pupfish connectivity area**
  - **Extend dike to capture drainages and pupfish areas**
- **Habitat Complex is created as Sea recedes**
- **Habitat Berms created along Sea contours**
  - **about every 6 feet drop**
  - **limited height allows simple construction**
- **Various Types of Habitat can be created**
  - **salinity, depth, flow**
- **Excavated areas within each SHC can create more habitat features and complexity**
- **Flows must be managed in each SHC**
  - **Provide access to flow control structures**

Saline Habitat Complex – Type 1

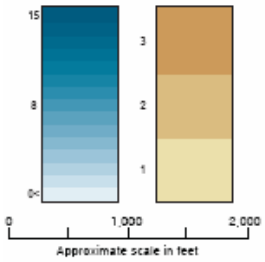
up to 10% land water ratio with some deep pools

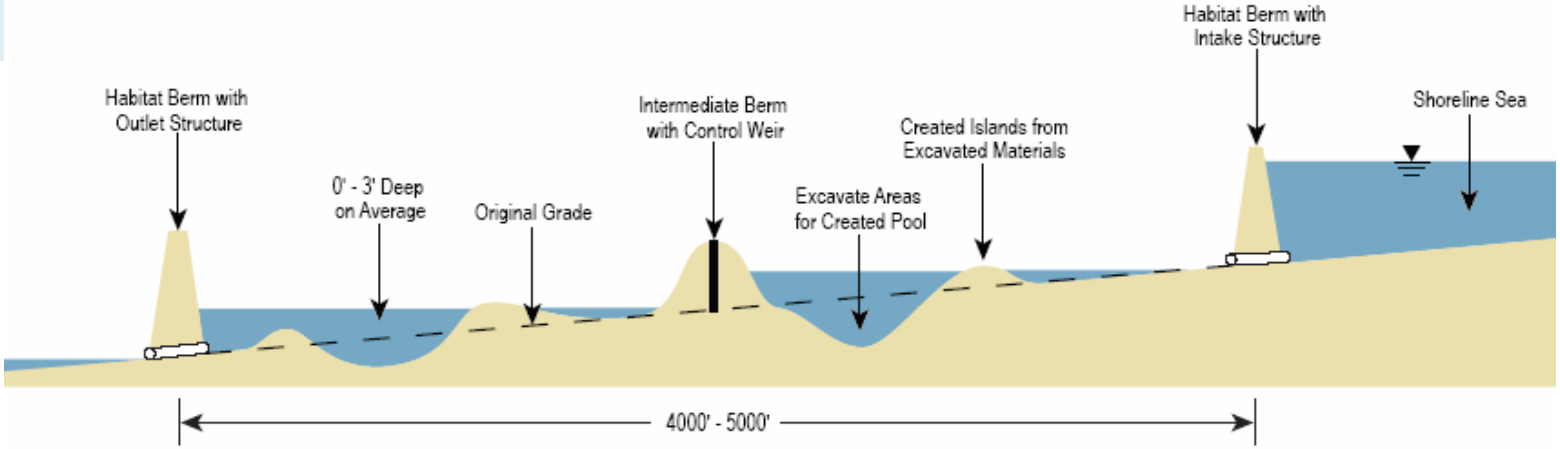


Saline Habitat Complex – Type 2

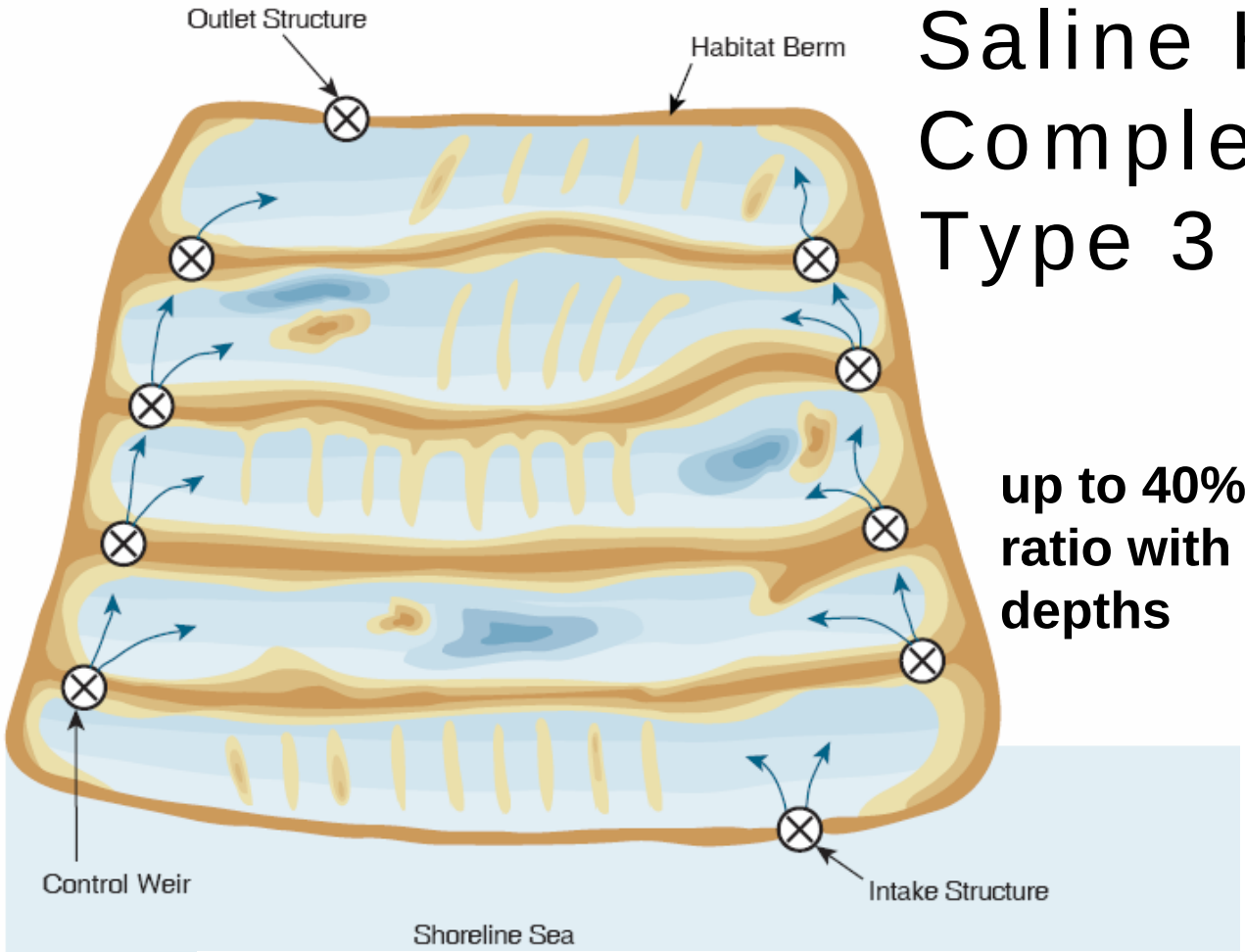


up to 20% land water ratio with some deeper pools

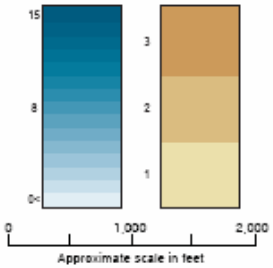


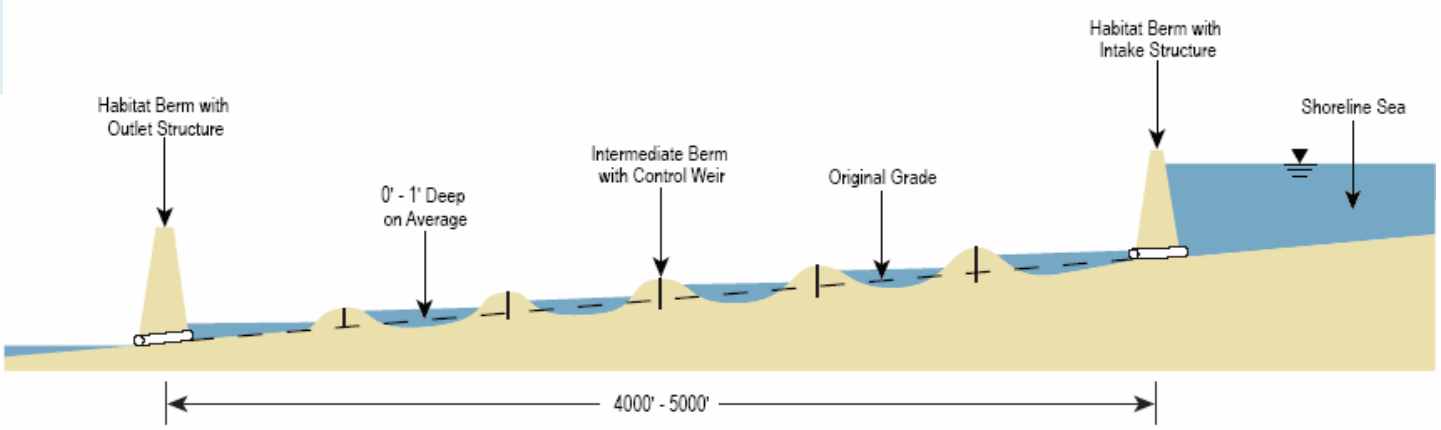


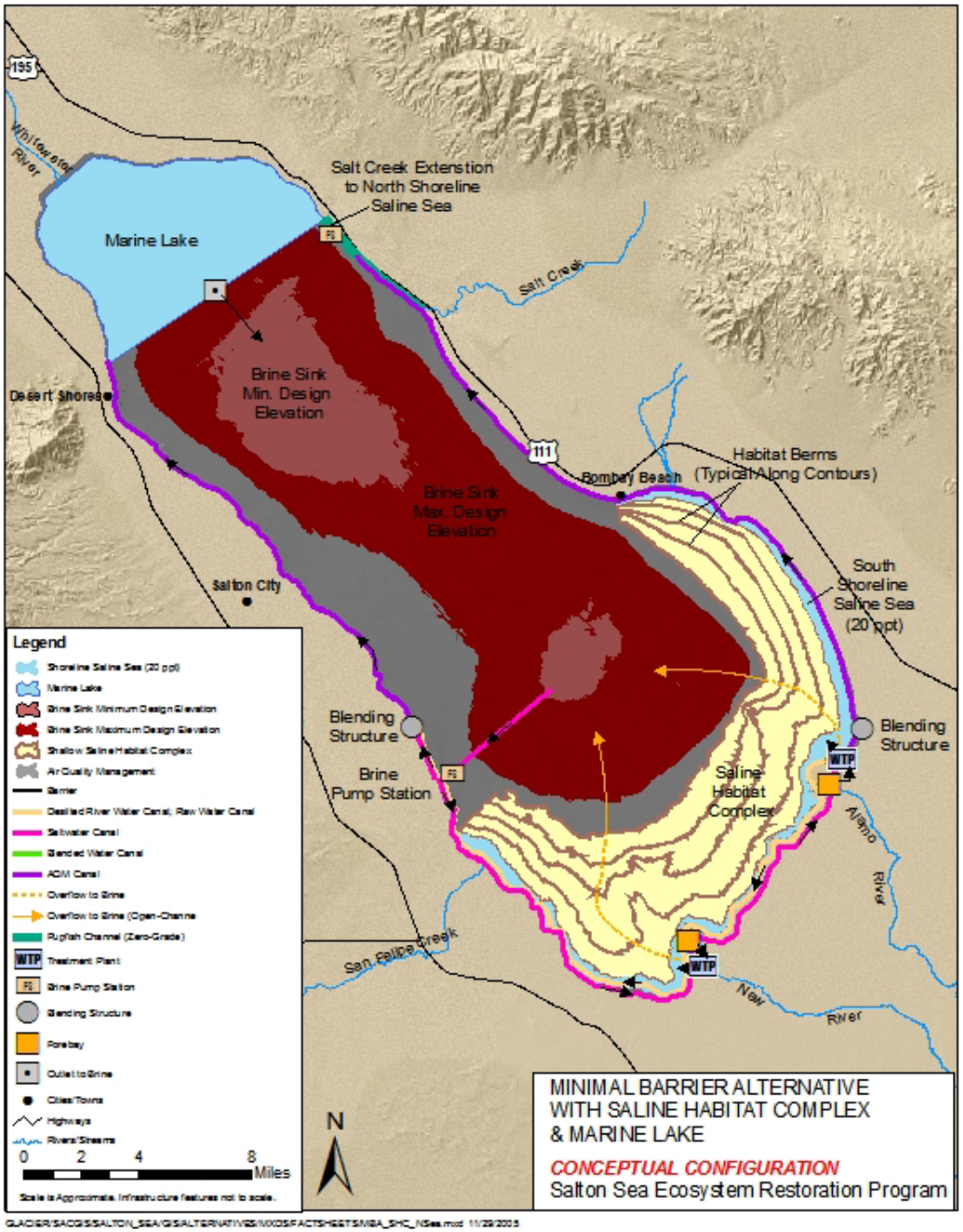
Saline Habitat Complex – Type 3



up to 40% land water ratio with shallow depths

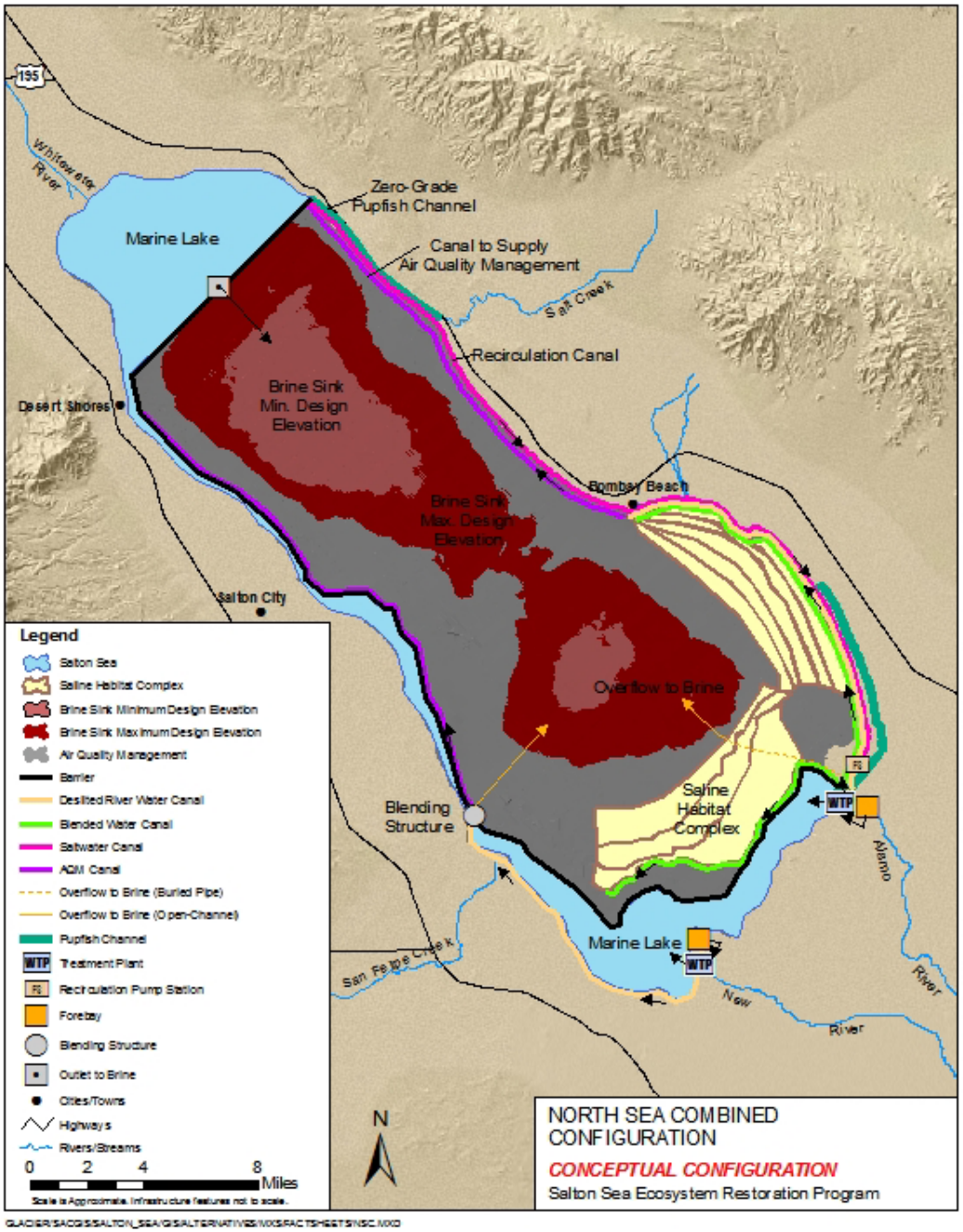






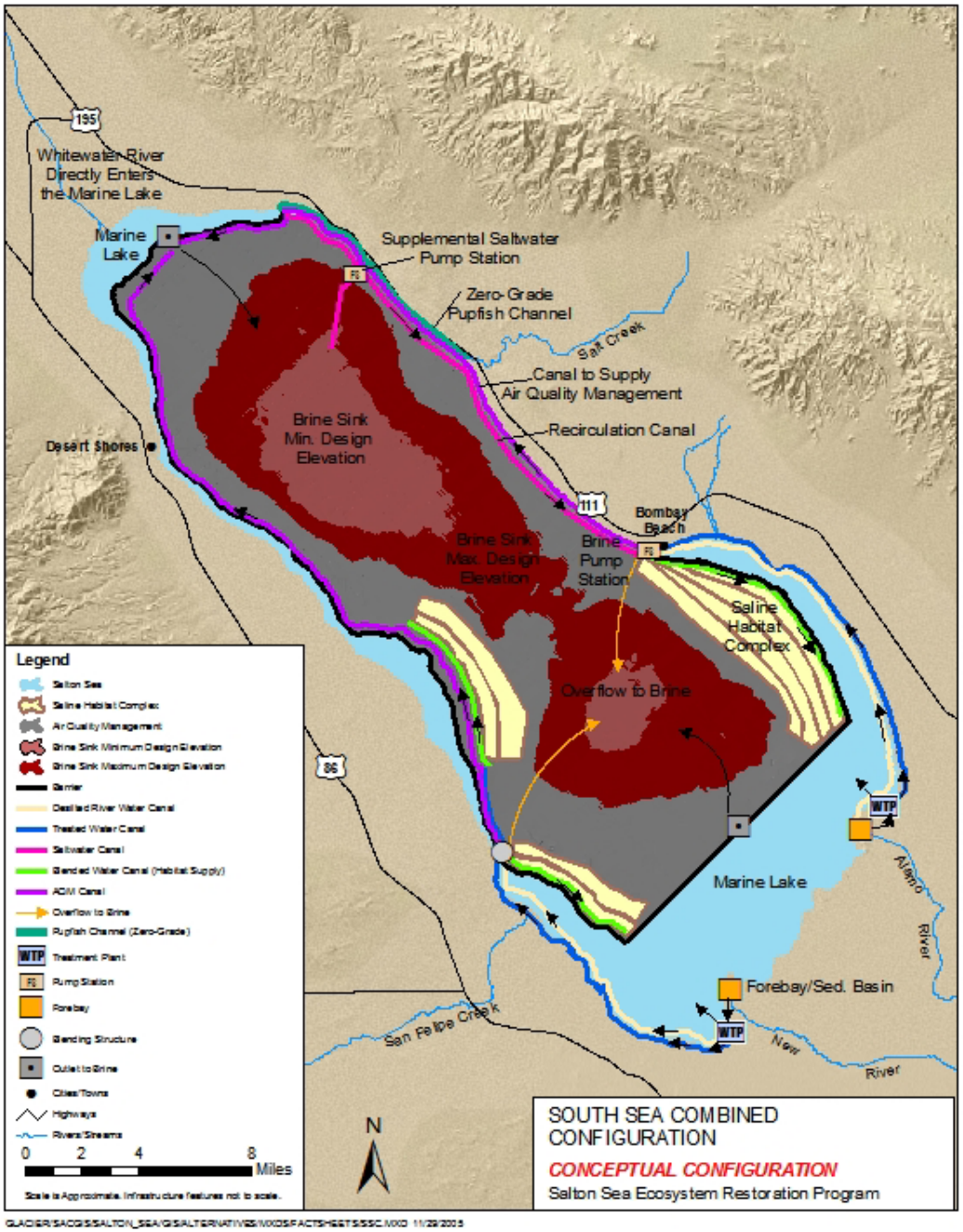
North Sea with SHC

- **Barrier at 13 miles north of mid-Sea**
- **27,000 acre Sea**
- **50,000 Acres SHC (38,000 acres water)**
- **Water treatment for Sea and SHC**
- **Pupfish connectivity**



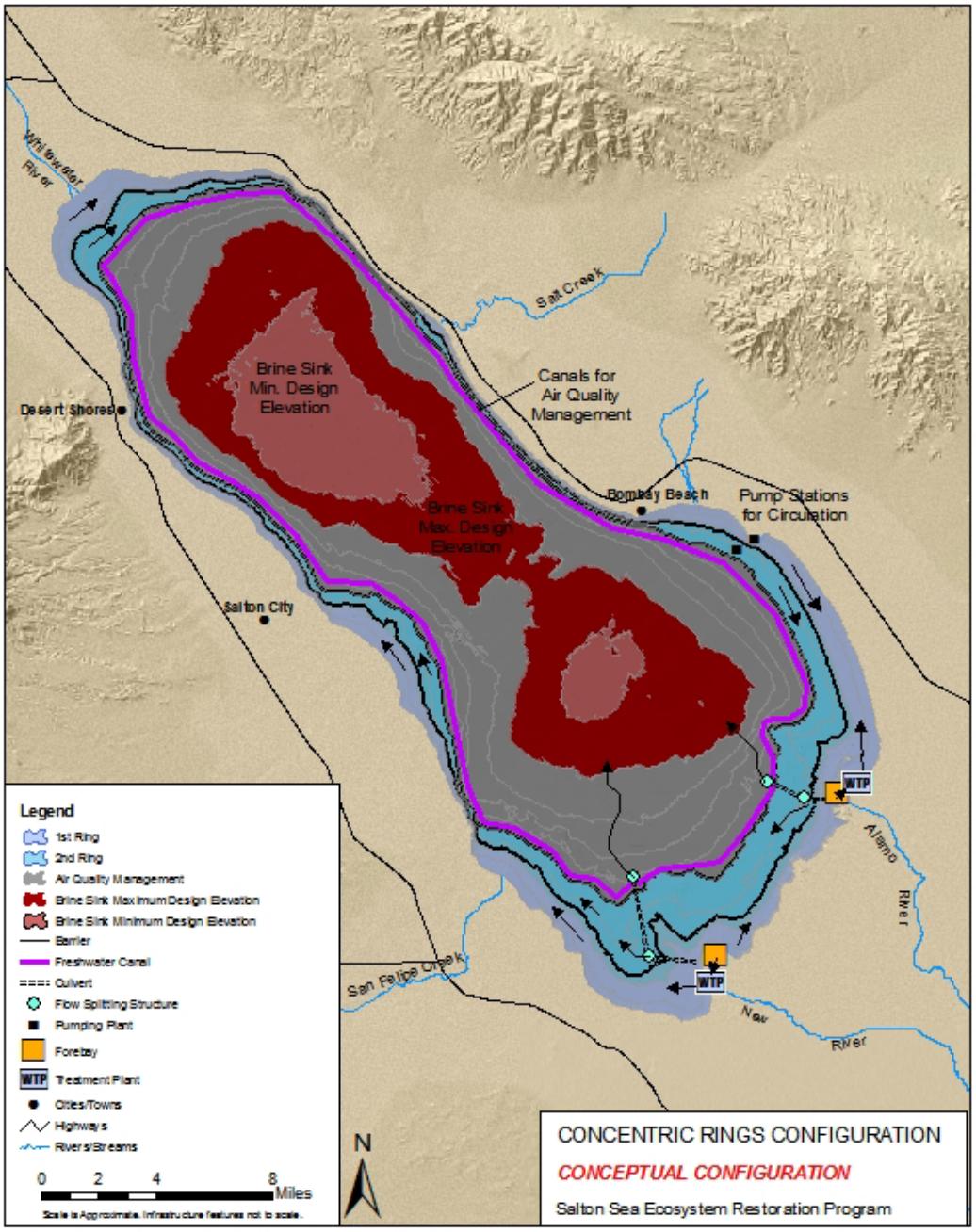
North Sea Combined with SHC

- **Barrier at 14 miles north of mid-sea**
- **25,000 acres SHC (18,000 ac water)**
- **Recirculation**
- **Water Treatment for Sea and SHC**
- **Pupfish Connectivity**



South Sea Combined with SHC

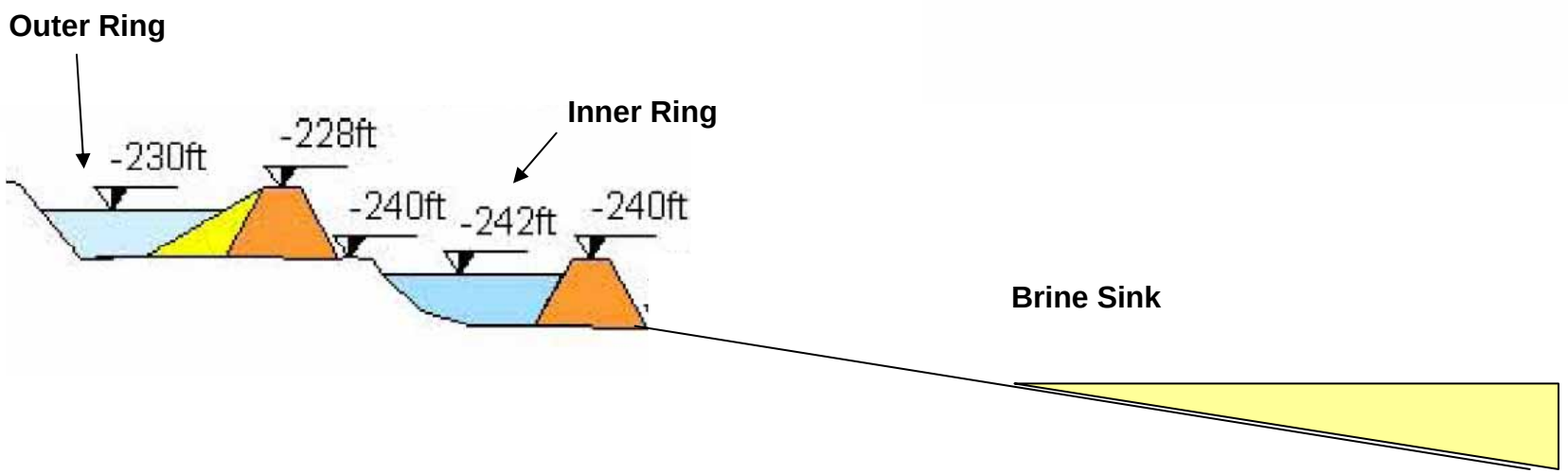
- **Barrier at 10 miles south of mid-sea**
- **25,000 acres SHC (18,000 ac water)**
- **Recirculation**
- **Water treatment for Sea and SHC**
- **Pupfish connectivity**



Concentric Rings

- **Two Sea rings**
  - **20 ppt outer**
  - **35 ppt inner**
- **60,000 Acre Seas**
- **Habitat within Sea rings**
- **Water treatment for Sea**
- **Recirculation**
- **Pupfish Connectivity**

Concentric Rings Section



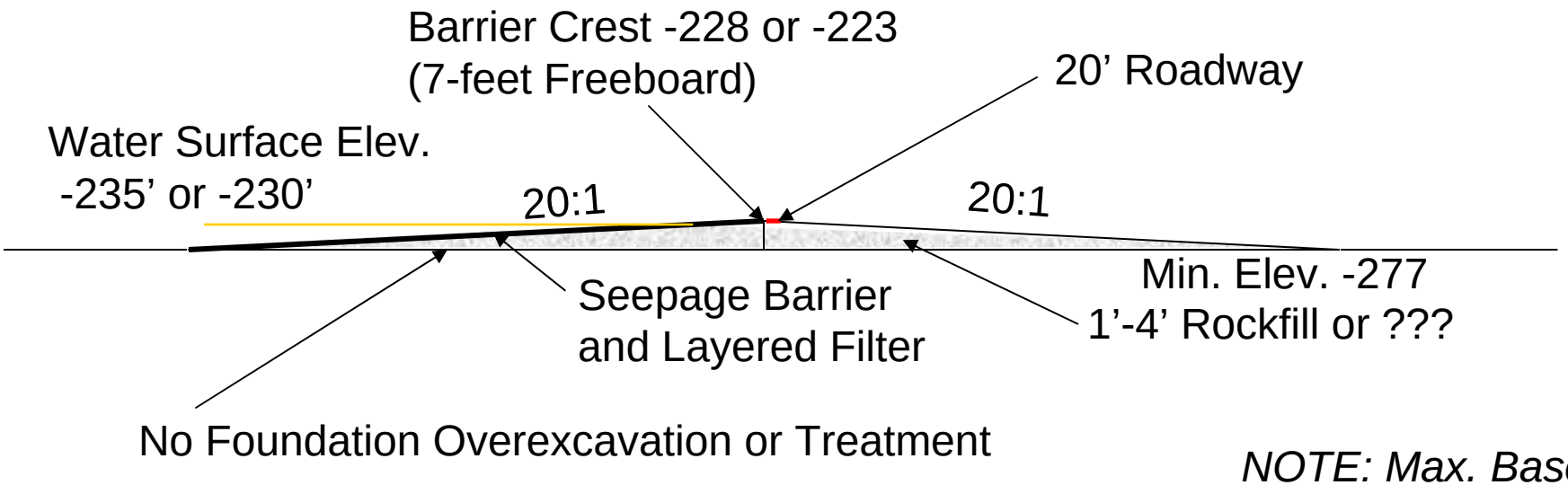
Concentric Rings – Key Points

- **Construct outer barrier first**
  - **Initial construction in wet**
- **Limit inflow to each ring for salinity control**
  - **Requires forebay basin and flow control at river confluences**
  - **Bypass excess inflows to Brine Sink**
- **Provide circulation to achieve minimum 20 ppt salinity in entire ring**
  - **300 cfs pump station in ring to increase Alamo and New River salinity**
- **Create habitat within Sea rings**
- **Construct downstream perimeter dikes as Sea recedes**
- **Geotubes not being considered at this time**

Barriers

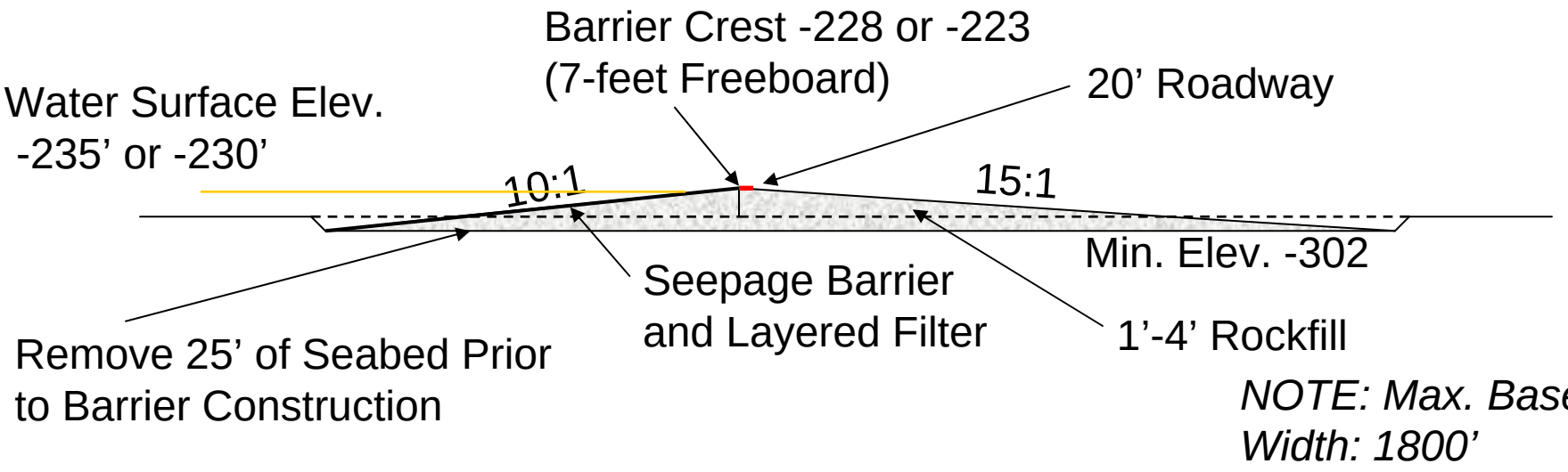
- **Major structure across Sea**
  - **Between 20 and 55 feet tall (plus over excavation)**
  - **Division of Safety of Dams jurisdiction**
  - **USBR Public Protection Guidelines**
- **Design Criteria**
  - **Seismic**
  - **Settlement**
  - **Seepage**
  - **Offsets**
  - **Flooding/overtopping**
  - **Constructability**

Proposed Barrier Section

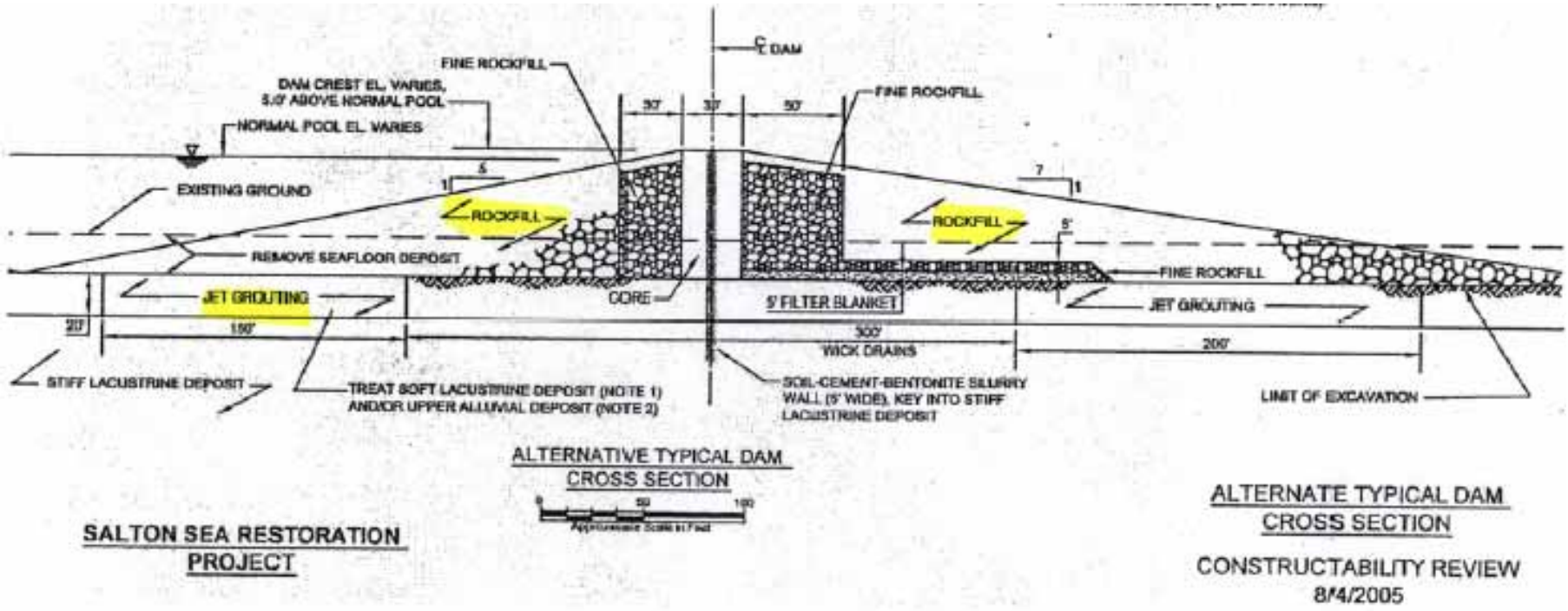


NOTE: Max. Base Width: 2000’

Alternate Barrier Section



USBR Barrier Dam Alternative



ALTERNATIVE TYPICAL DAM CROSS SECTION

SALTON SEA RESTORATION PROJECT

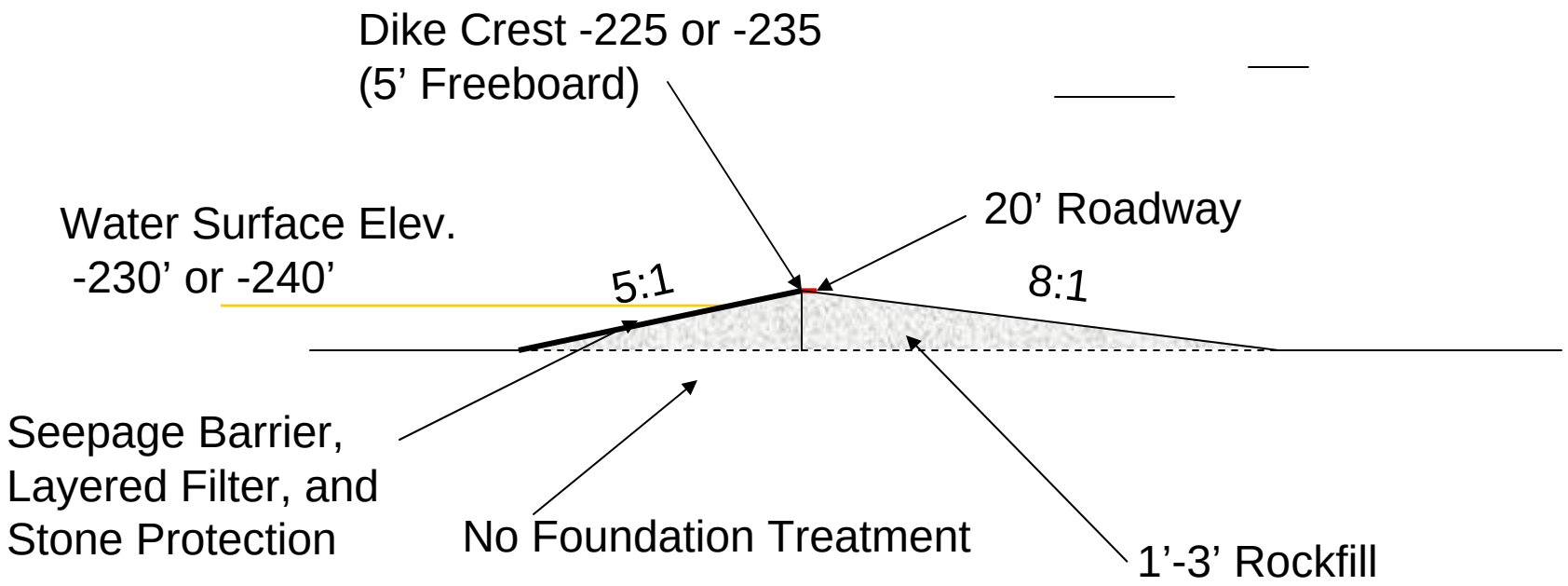
ALTERNATE TYPICAL DAM CROSS SECTION

CONSTRUCTABILITY REVIEW
8/4/2005

Perimeter Dikes

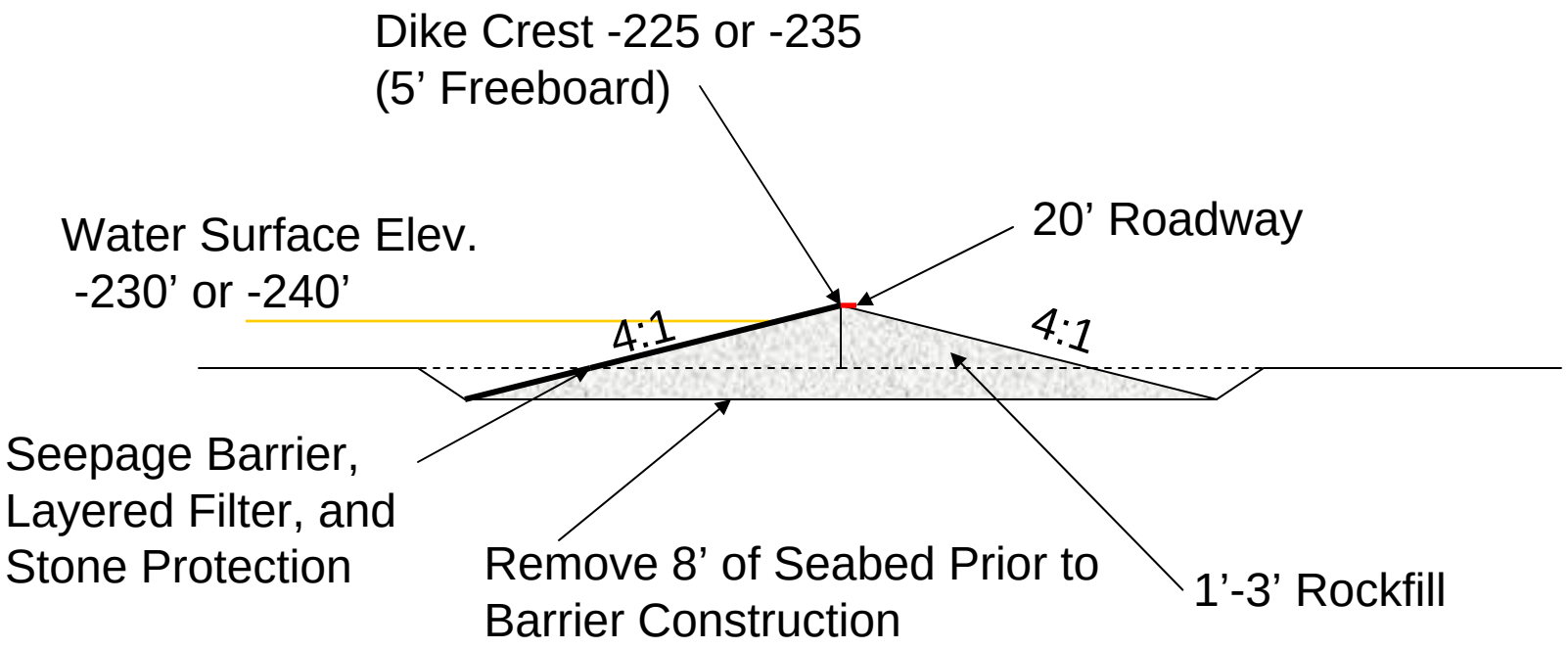
- **Impounds significant water volume but height is 15 - 20 feet max. (water less than 15 feet high)**
- **Must satisfy DSOD and USBR Public Protection Guidelines Standards**
- **Used in Concentric Rings, Combined configurations, and in Min. Barrier (Shoreline Sea only)**

Proposed Perimeter Dike Section (15’ and less)



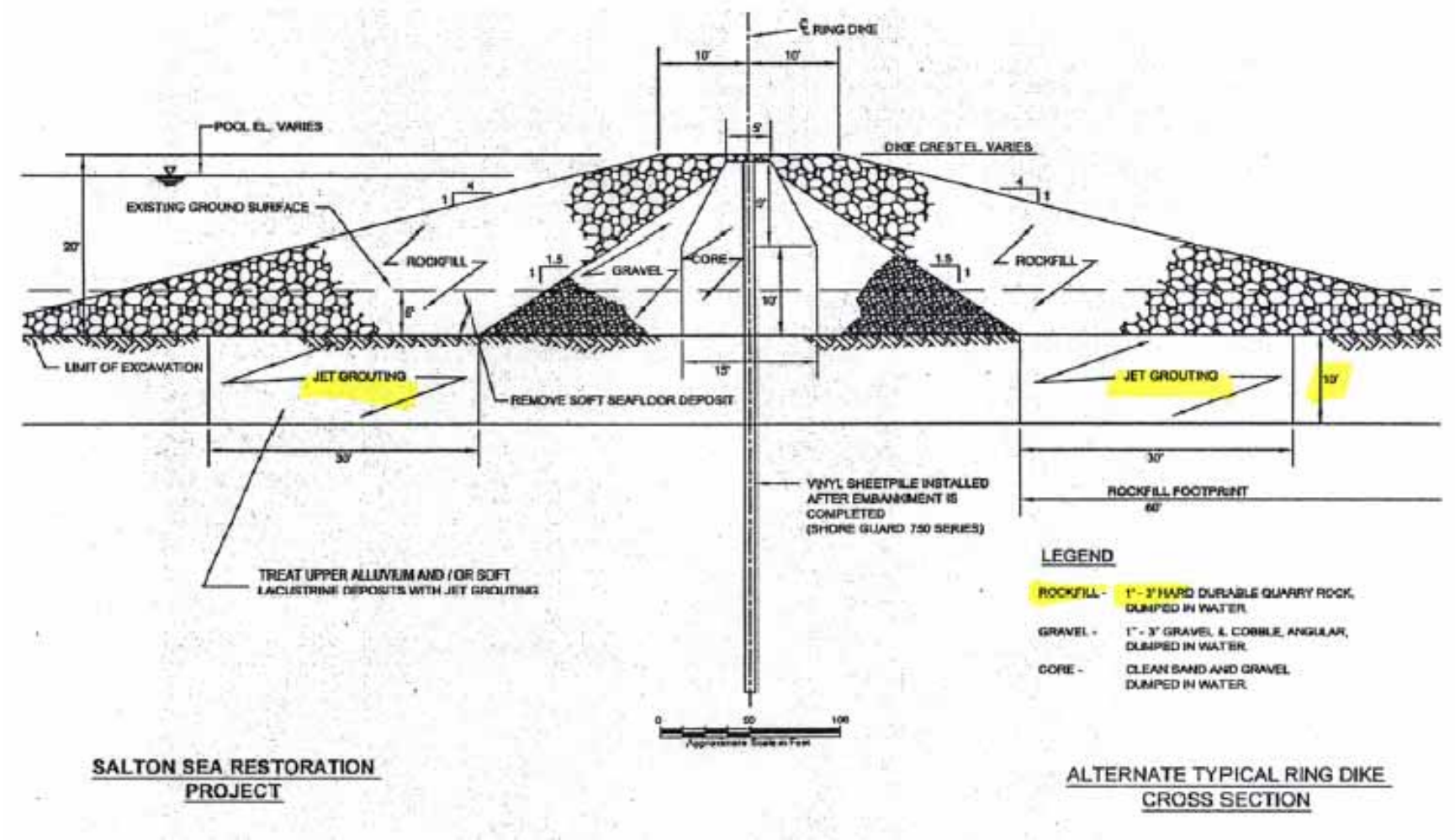
NOTE: Max. Base Width: 360’

Alternate Perimeter Dike Section (15’ and less)



NOTE: Max. Base Width: 200’

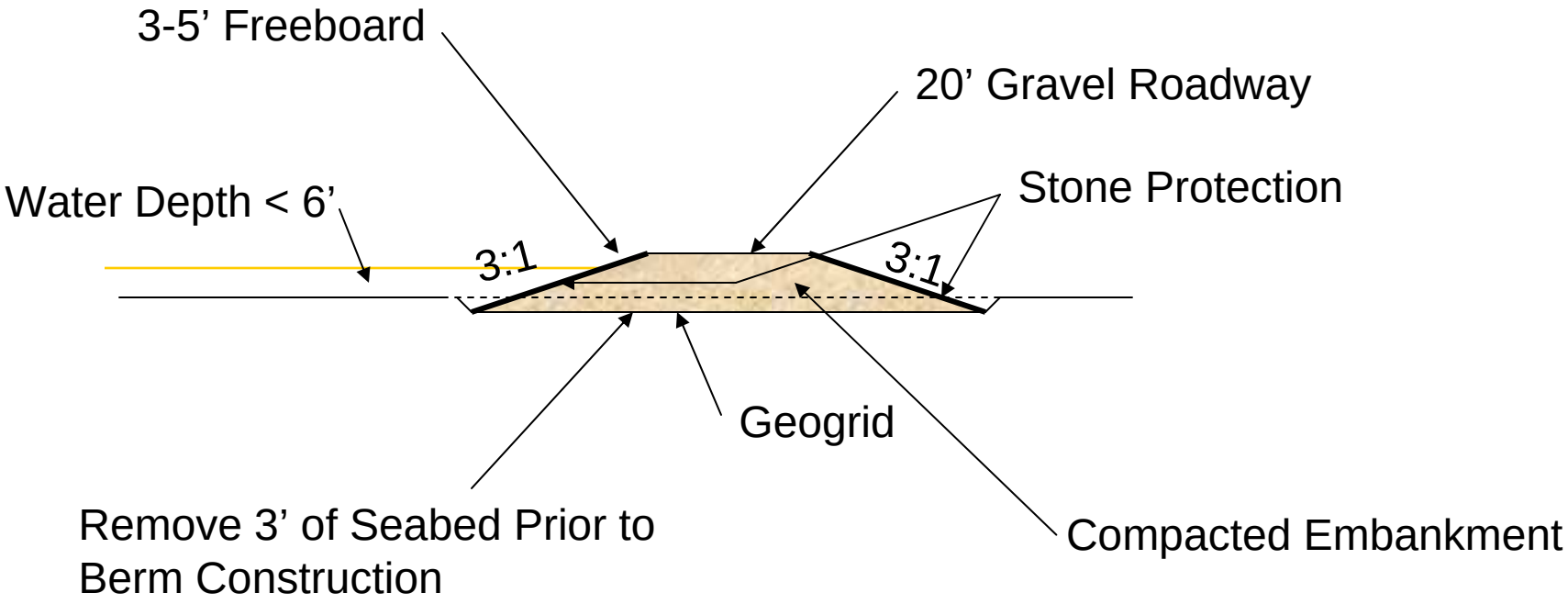
USBR Perimeter Dike Alternative



Habitat Berms

- **Constructed in the dry**
- **Not DSOD jurisdictional**
- **Minimal loss of facility or habitat if failure**
- **Local compacted embankment**
- **Used in Saline Habitat Complex (Main Berms)**

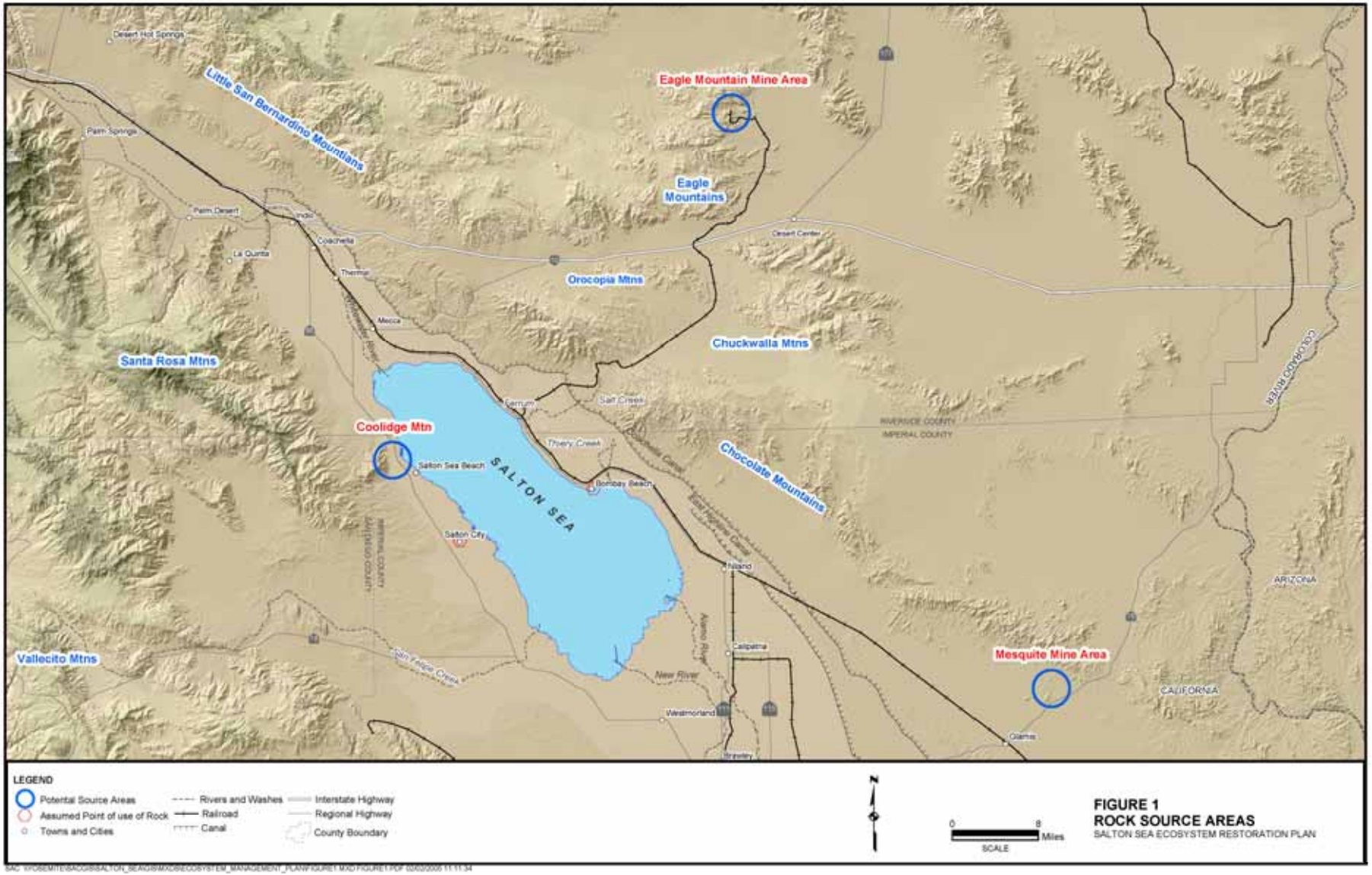
Habitat Berm
(<10’ and Dry Construction)



Challenges

- **Barrier and Perimeter Dike quantities may range from 60 to 130 Million Cubic Yards (DWR Design)**
  - **Majority assumed “well graded” rock from 1 to 4 foot in diameter**
  - **Equipment limitations**
- **Quarry**
  - **Each Side?**
  - **Distance**
  - **Methods/Handling**
- **Rock placement**
  - **Water**
  - **Land**
- **Production rates on rockfill**
  - **5 MCY per year may be possible**

Rock sources under investigation



Challenges

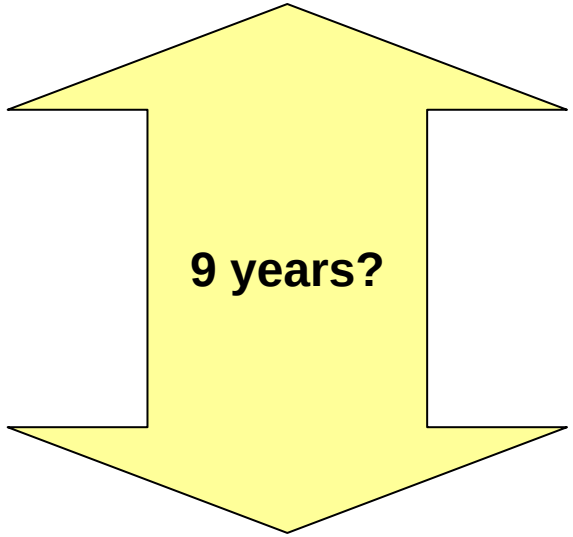
- **Foundation**
  - **Lack of Data / Data extrapolation**
  - **Sea floor deposits (organics)**
  - **Overexcavation**
  - **Treatment**
  - **Settlement**
  - **Liquifaction Potential**
- **Dredging Disposal**
  - **In-Sea Disposal**
  - **Use as Habitat**

Challenges

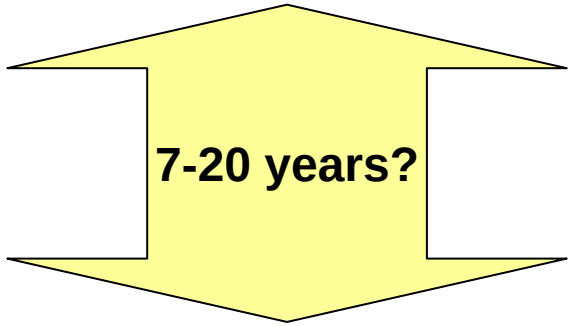
- **Air Quality**
  - **Construction Emmisions on Rock Transport ONLY**
    - May take 20+ years to transport 100 MCY rock to site by truck (20 miles RT)
  - **Use of electric conveyors less emmissive, but Rock may be too large**
- **Schedule**
  - **Delayed habitat benefits**
  - **Degraded water quality**
  - **Construction methods**

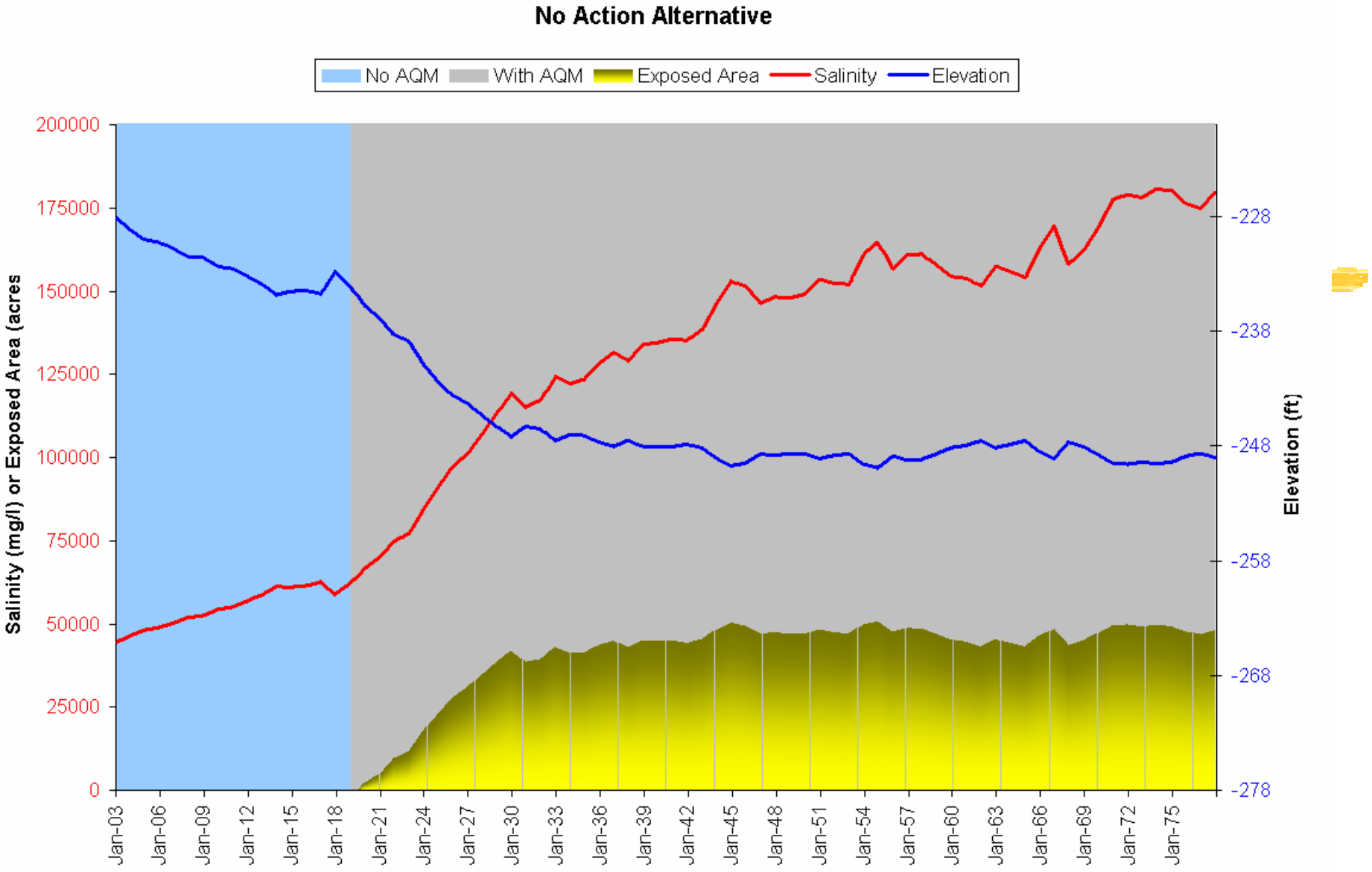
Project Phasing

- **Schedule**
  - **PEIR with Preferred Alternative**
  - **Project Specific EIR**
  - **Preliminary and Final Design**
  - **Financing**
  - **Construction Bids/Award**
  - **Permits**



  - **Mobilization**
  - **Begin Construction**
  - **End Initial Construction**




No Action Alternative
No AQM
With AQM
Exposed Area
Salinity
Elevation
Salinity (mg/l) or Exposed Area (acres
Elevation (ft)
200000
175000
150000
125000
100000
75000
50000
25000
0
-228
-238
-248
-258
-268
-278
Jan-03
Jan-06
Jan-09
Jan-12
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Jan-21
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Jan-27
Jan-30
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Jan-36
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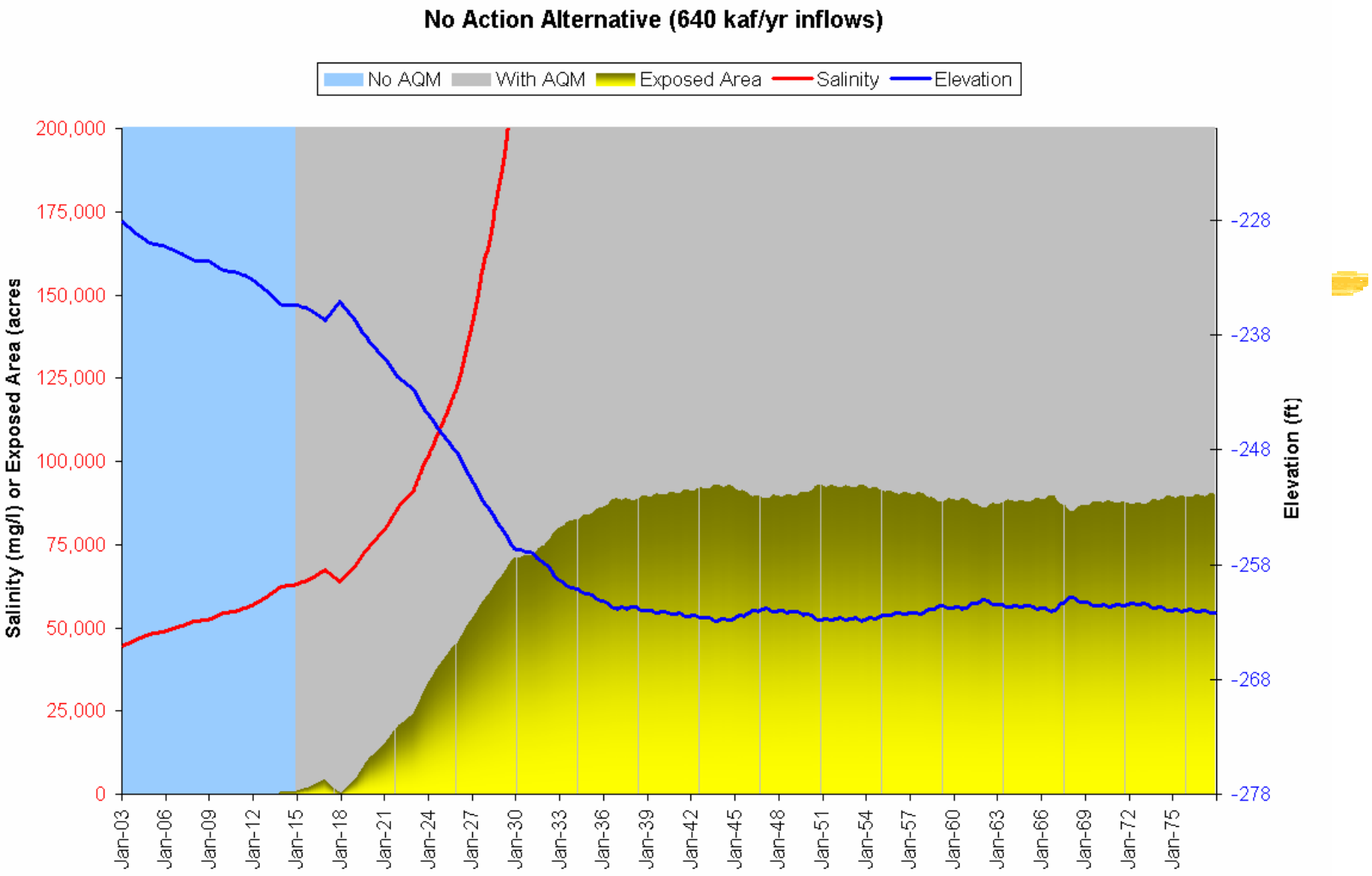
Jan-69
Jan-72
Jan-75


No Action Alternative (640 kaf/yr inflows)
No AQM
With AQM
Exposed Area
Salinity
Elevation
Salinity (mg/l) or Exposed Area (acres
Elevation (ft)
200,000
175,000
150,000
125,000
100,000
75,000
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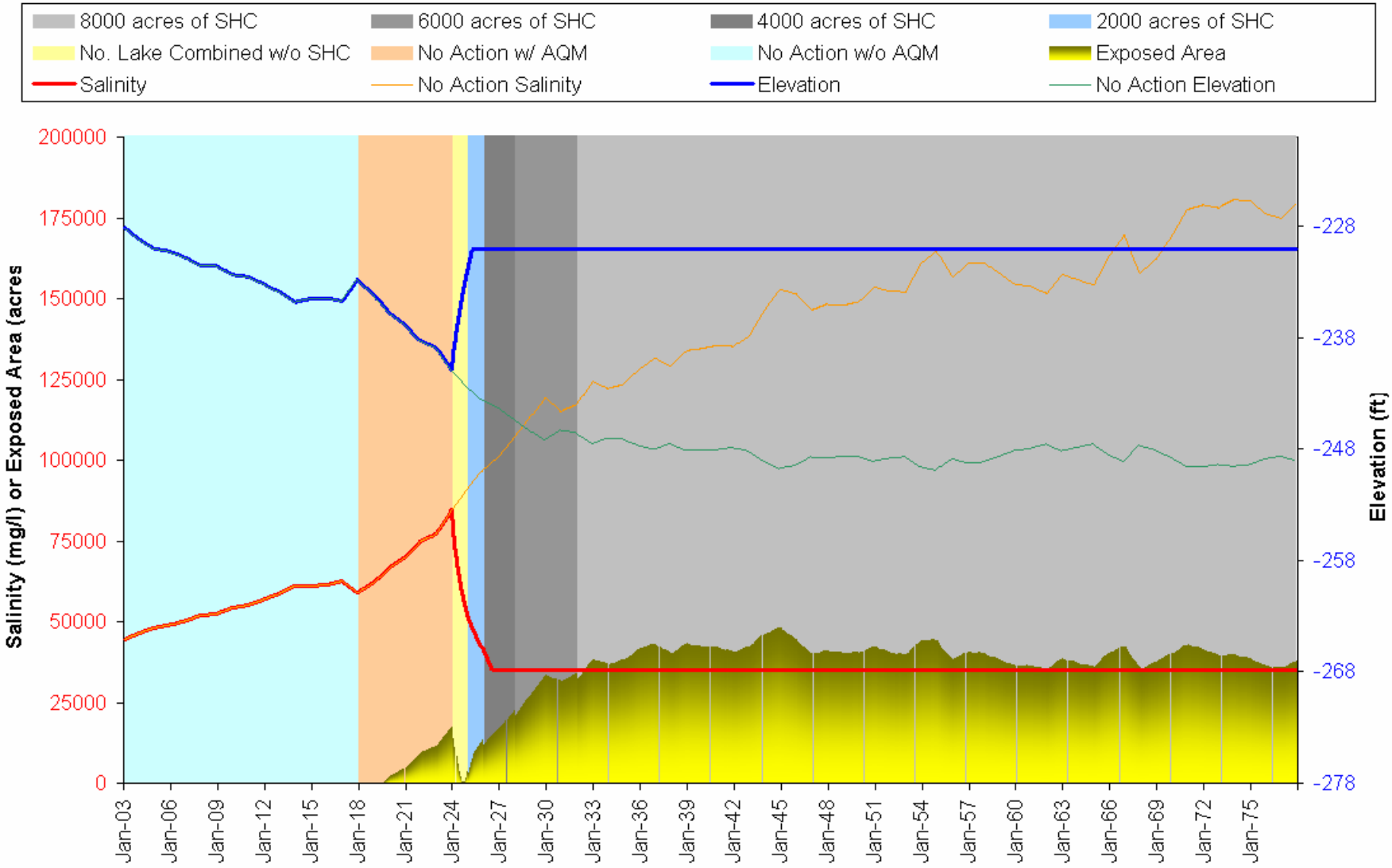
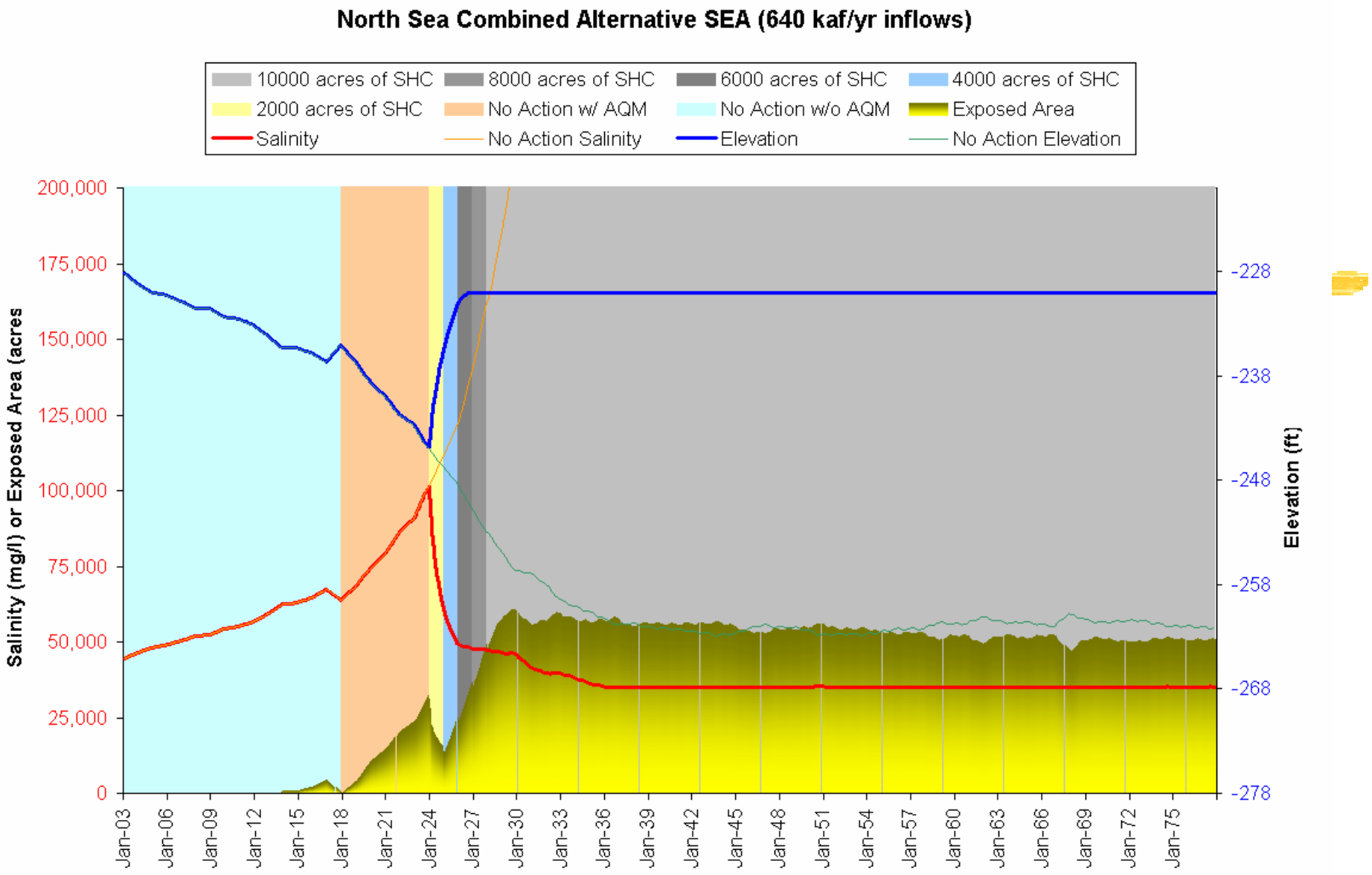
North Sea Combined Alternative SEA Chart




North Sea Combined Alternative SEA (640 kaf/yr inflows)
10000 acres of SHC
8000 acres of SHC
6000 acres of SHC
4000 acres of SHC
2000 acres of SHC
No Action w/ AQM
No Action w/o AQM
Exposed Area
Salinity
No Action Salinity
Elevation
No Action Elevation
Salinity (mg/l) or Exposed Area (acres
Elevation (ft)
200,000
175,000
150,000
125,000
100,000
75,000
50,000
25,000
0
-228
-238
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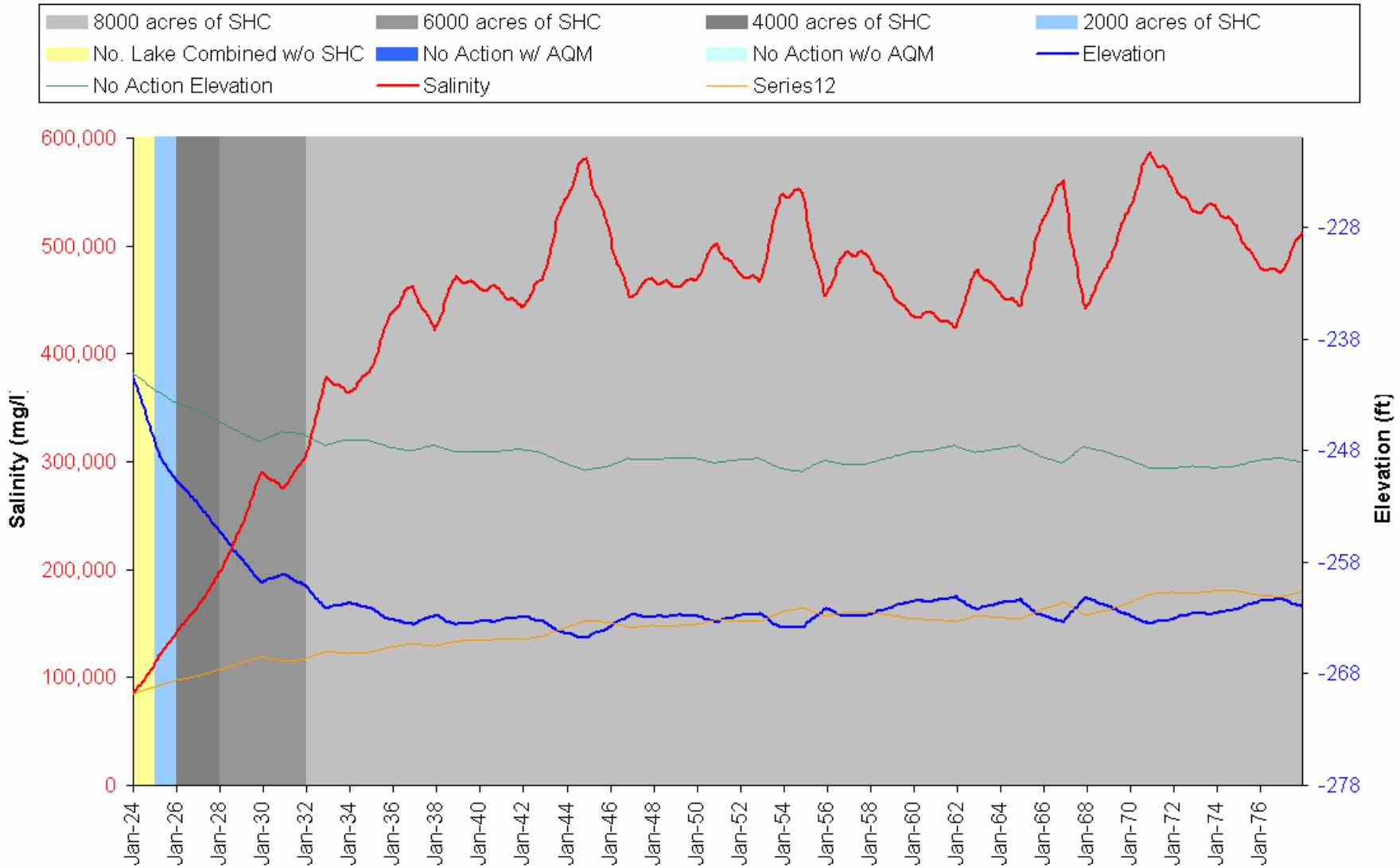
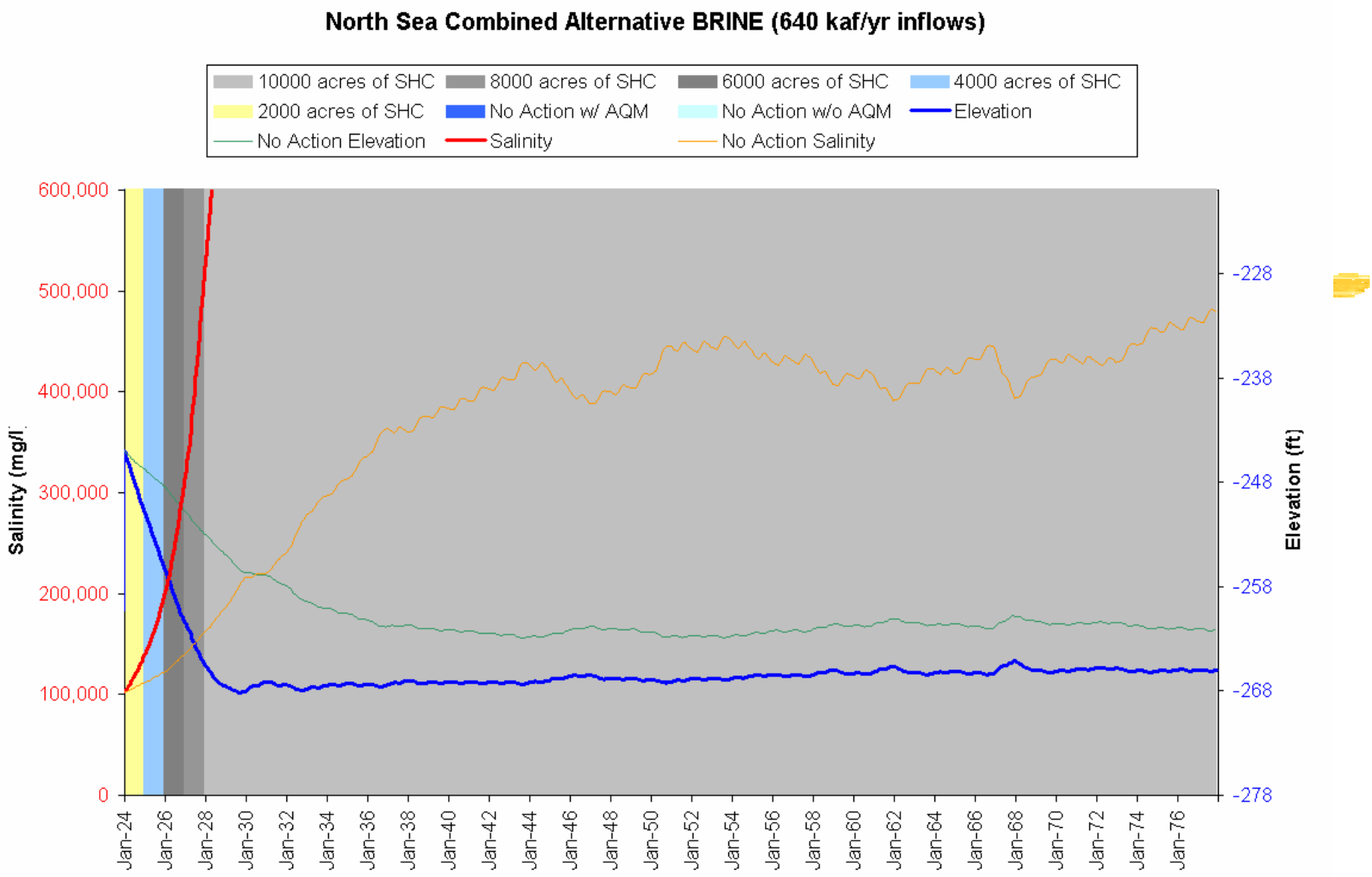
North Sea Combined Alternative BRINE Chart




North Sea Combined Alternative BRINE (640 kaf/yr inflows)
10000 acres of SHC
8000 acres of SHC
6000 acres of SHC
4000 acres of SHC
2000 acres of SHC
No Action w/ AQM
No Action w/o AQM
Elevation
No Action Elevation
Salinity
No Action Salinity
Salinity (mg/l
Elevation (ft)
600,000
500,000
400,000
300,000
200,000
100,000
0
-228
-238
-248
-258
-268
-278
Jan-24
Jan-26
Jan-28
Jan-30
Jan-32
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Jan-36
Jan-38
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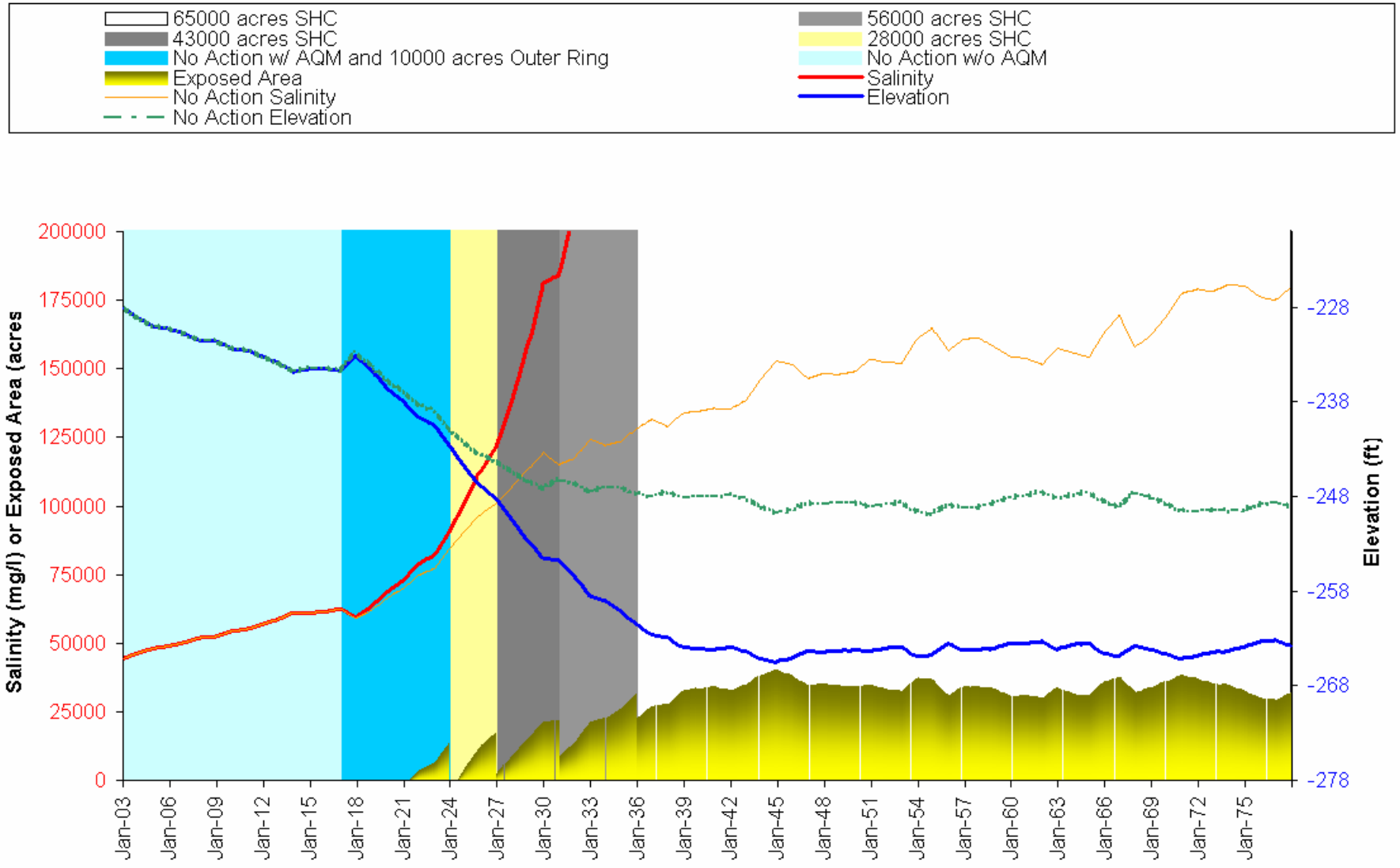
Jan-76

Minimum Barrier Alternative SEA chart



Minimum Barrier Alternative (640 kaf/yr inflows)