

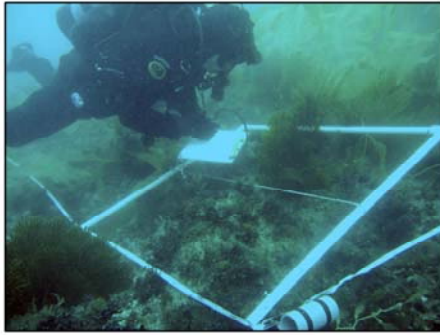
Wheeler North Reef

Jenny McGee
Southern California Edison

SCAR - January 14, 2009
Module 17
(c) Richard Herrmann / SCE

Energy for What's Ahead™

Determining cause(s) of under-performance



Monitoring data were used to:

1. Investigate the reason(s) for Wheeler North Reef's (WNR) failure to sustain a fish standing stock of 28 tons.
2. Develop potential solutions for enhancing WNR's ability to sustain a 28-ton standing stock of reef fish in the future

Energy for What's Ahead™

As required by the permit, the monitoring team conducted independent studies to determine why Wheeler North Reef has failed to meet the fish standing stock requirement and what solutions could be implemented to bring the reef into compliance

Conclusions from independent studies



The present configuration of Wheeler North Reef (174 acres of low relief reef with 48% rock coverage) is not sufficient to consistently meet the performance standard for fish standing stock



How much additional acreage is needed?



Energy for What's Ahead™

These studies, which we have discussed in detail at previous annual workshops, show that Wheeler North Reef is behaving like a natural reef, but that it is not big enough to consistently meet the performance standard pertaining to fish standing stock. This conclusion leads to the question – how much additional reef acreage is needed for the reef to consistently support 28 tons of fish?

Estimated area of additional reef for remediation

Reef Design	Additional acres needed*
Low relief (< 1 m), low rock cover (41%)	200
Low relief (< 1 m), medium rock cover (63%)	125
Low relief (< 1 m), high rock cover (81%)	105

**Number of new additional acres needed for Wheeler North Reef to sustain a fish standing stock of at least 28 tons with 95 % confidence*

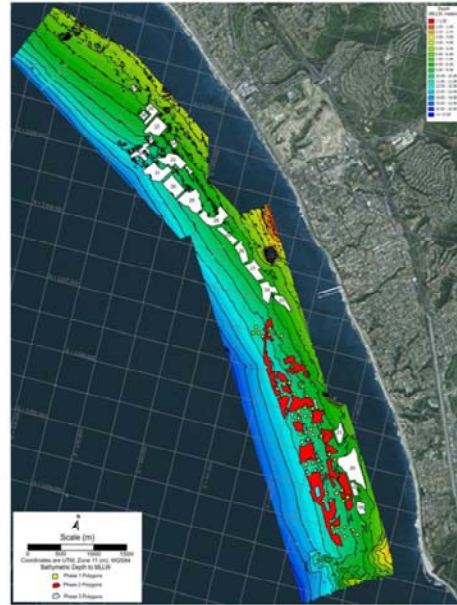
★ Each of these low relief options provides added value for kelp

Energy for What's Ahead™

- Shown here is a summary table with estimates of the number of additional acres of various reef designs that are needed for Wheeler North Reef to sustain a fish standing stock of at least 28 tons
- As you can see the amount of additional acreage varies greatly depending on its rock coverage
- If new additional acres were designed like the existing Wheeler North Reef (i.e., low relief with low rock coverage), then 200 additional acres would be needed, which would more than double its current size
- It would take approximately half of this area (i.e., 105 acres) if the additional acres were low relief with high rock coverage
- Each of these low relief options provides added value for kelp

Phase 3: Reef Expansion Project

- 200-acre low relief/ low coverage reef
- Same design as Wheeler North Reef 12-15 meters deep
- Known performance
- 9 years of biological information
- Requires the least amount of rock
- 150 thousand tons of rock
- 44 barge trips
- 3 separate quarries



Energy for What's Ahead™

5

Reef Permits

- CEQA Environmental Impact Report
- Water Resources Control Board
- Army Corps of Engineers
- Coastal Commission
- AQMD Air Quality Offset Credits
- Ca. State Lands Lease



Energy for What's Ahead™

Monitoring Success: The Pathway Forward

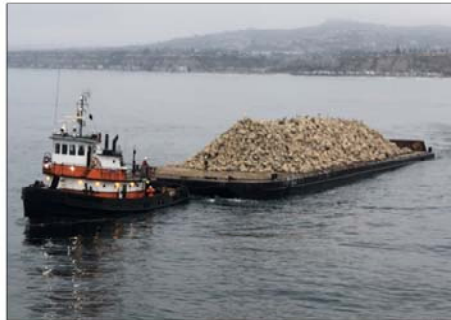
- Shift to cumulative performance standards:
 - **896 tons of fish**
 - **4,800 acres of kelp**
 - Defined compliance period tied to SONGS Operation life 32 years
 - Reduced annual monitoring
 - Hard substrate monitoring every 5 years
 - Cumulative approach + Reef Expansion = 20 - 30 years to success
- VS.
- No remediation + existing approach > 100 years to success

Energy for What's Ahead™

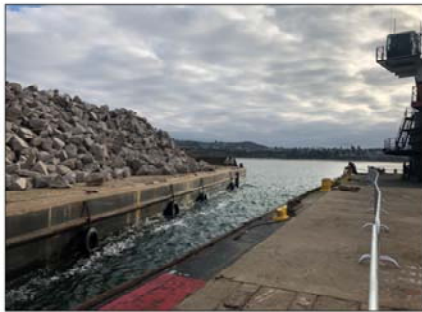
Reef Expansion Project

Season 1 Construction Summary

- Tons Placed: 91,895
- Acres Constructed: 119
- Polygons Constructed: 11
- Rock barges from Mexico: 4
- Rock barges from Catalina: 23
- Manhours worked: 18,981
- Construction dates: July 19 through September 30
- Tons placed per day: 1,600 av
- NO safety incidents or spills



Energy for What's Ahead™



Energy for What's Ahead™

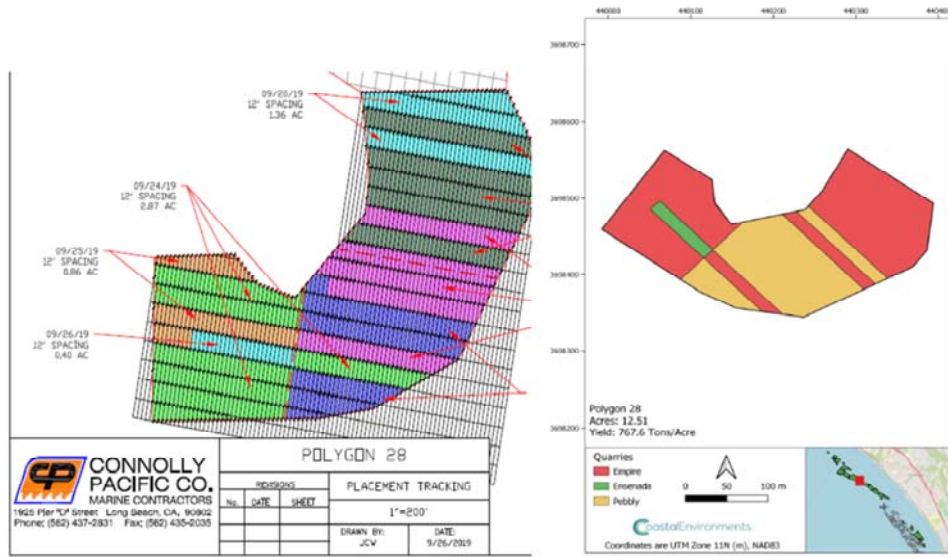
Marine Wildlife

Monitor Roles:

- Species identification
- Monitor compliance with applicable laws
- Stop Work Authority to avoid marine animal collisions or harm
- Total number of sightings: 1,378
- Total number of animals: 1,253
- Total Stop Work orders: 17
- Exclusion Zone: 500 feet small mammals; 1,640 feet large mammals
- Trained dedicated boatmen to monitor transport vessels

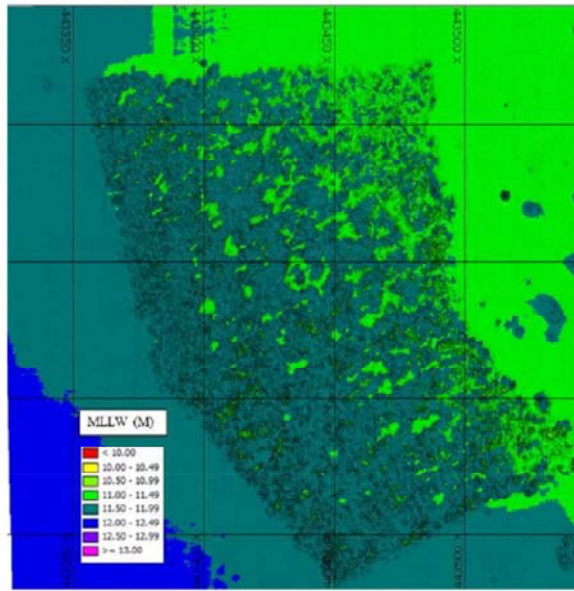


Construction Verification



During construction the spacing, rock source, and barge are tracked daily; post construction we are able to model the make up of each polygon using this data.

Construction Verification

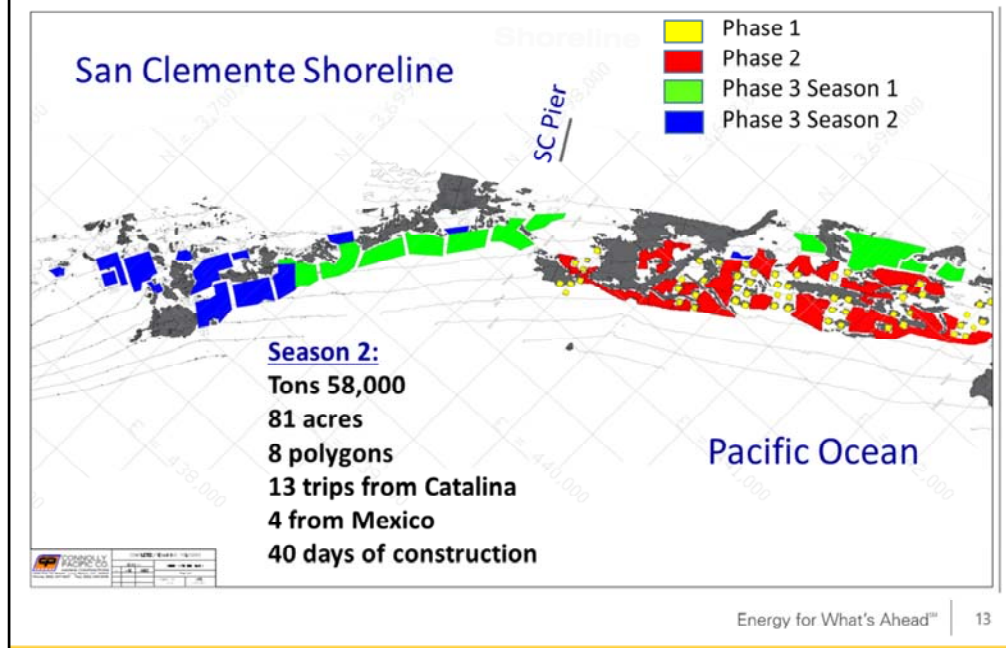


- Multi-Beam Sonar Surveys determine footprint of each polygon
- Dive surveys determine percent cover of hard substrate (rock)

Photo: Sun-illuminated Color Shaded Relief Bathymetry – Polygon 18
Data collected by Coastal Environments

Energy for What's Ahead™ | 12

Construction Status



Some of the blue polygons area “contingency” for Phase 3 and will not be constructed.

Wheeler Construction Team Practicing COVID-19 Safety



