Sustainable Port Development in Singapore

8th Co-operation Forum

6 October 2015

Port Development Works in Singapore

Pasir Panjang Terminal Phases 3 and 4

- Completed in 2015

Tuas Terminal Development

- On-going

Sustainable Port Development

Outline

- Environmental Impact Assessment
- Relocation of Affected Corals
- R&D Programme – Enhancing Singapore's Coral Reef Ecosystem in a Green Port
- Environmental Monitoring and Management Plan
- Use of Dredged/ Excavated Materials as Reclamation Fill

Environmental Impact Assessment (EIA)

Pasir Panjang Terminal Phases 3 and 4

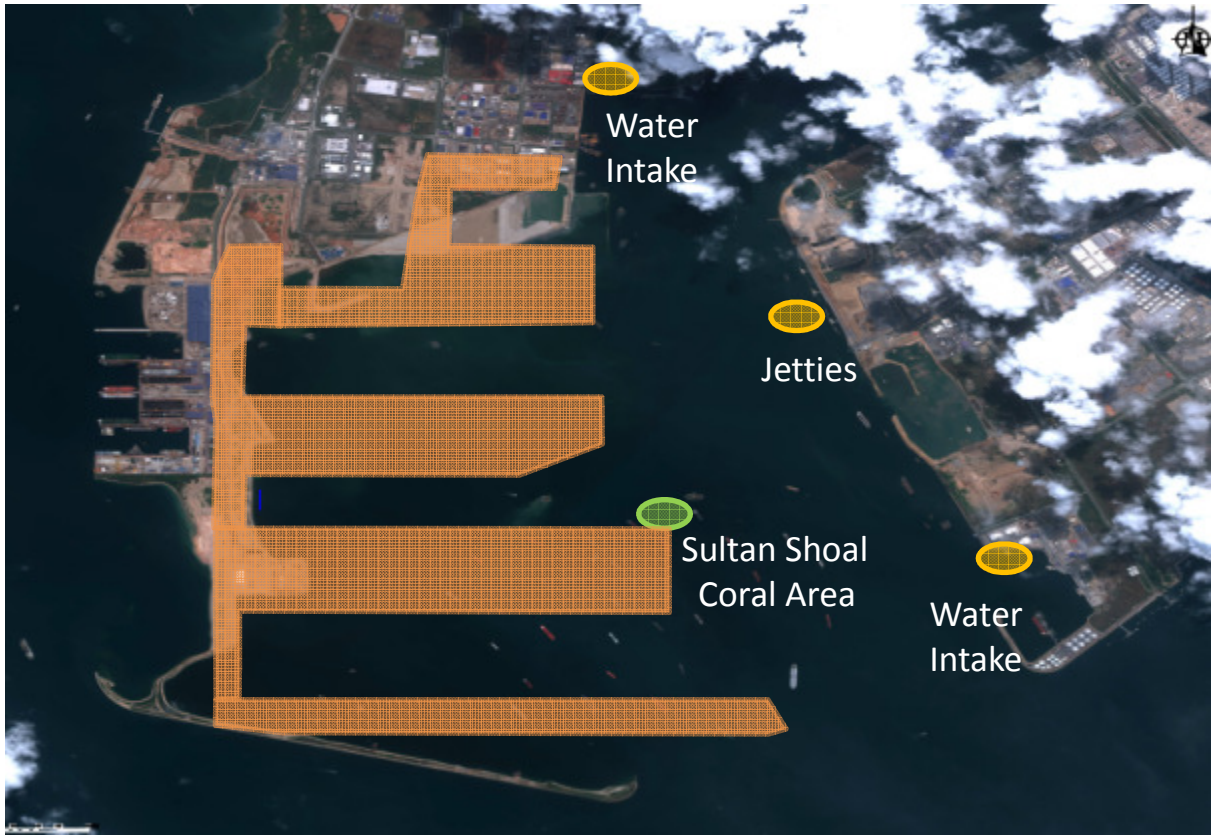
Site Condition

Satellite View of Pasir Panjang Terminal Phases 1 to 4

Environmental Impact Assessment (EIA)

Tuas Terminal

Site Condition

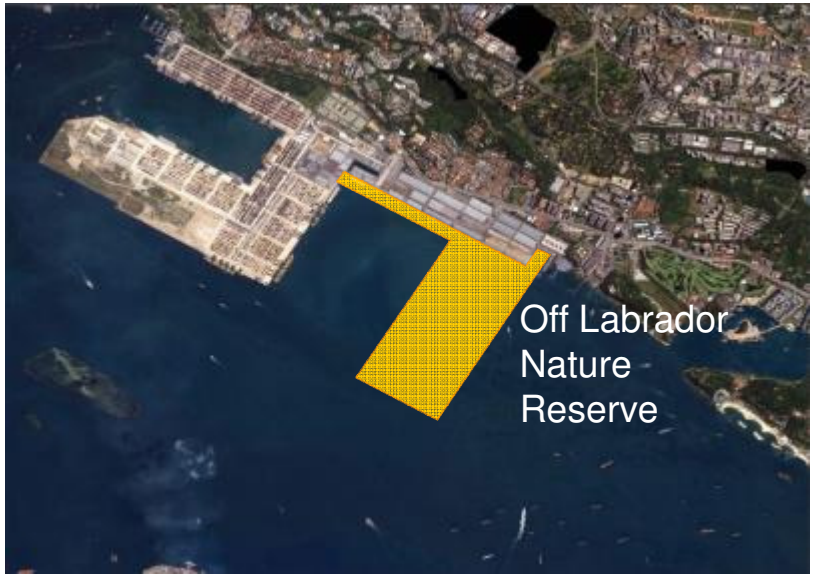


Environmental Impact Assessment (EIA)

- Specialist Consultants engaged to carry out EIA
- Terms of Reference of Specialist Consultants
  - Investigate and Assess Potential Impacts such as
    - Marine Habitats like corals
    - Marine Facilities like water intakes
    - Water Quality
    - Suspended sediment
    - Changes in current regime
  - Setting Environmental Quality Objectives
    - No cross border impact
    - No impact on coastal & recreational facilities and other facilities
    - No or slight impact on nearby coral reefs and seagrass
  - Recommend Measures to Mitigate Potential Impacts, if any
- EIA's Recommendation on the Relocation of Affected Corals

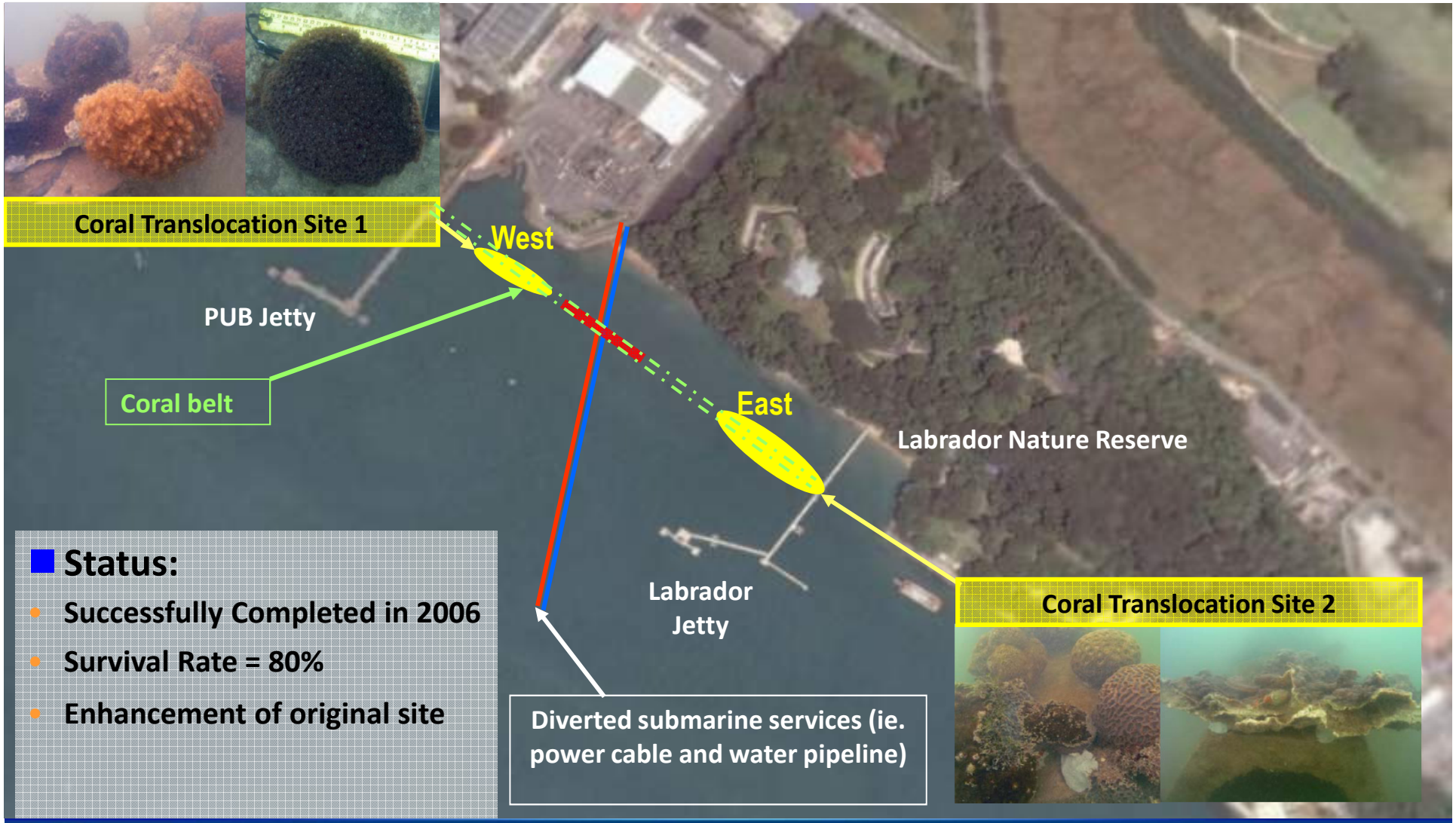
Relocation of Corals

Off Labrador Nature Reserve



Sultan Shoal

Relocation of Corals off Labrador Nature Reserve



- **Status:**
  - Successfully Completed in 2006
  - Survival Rate = 80%
  - Enhancement of original site

Relocation of Corals – NGO Engagement

5 sessions conducted in May/ June 2006 involving volunteers collected rocks embedded with marine organisms to be moved from the impacted area to non-affected areas

Relocation of Corals – NGO Engagement

Relocation of Corals From Sultan Shoal

- **Status:**
  - **Successfully Completed in 2014**
  - **Survival Rate = 100% (from first quarterly monitoring)**

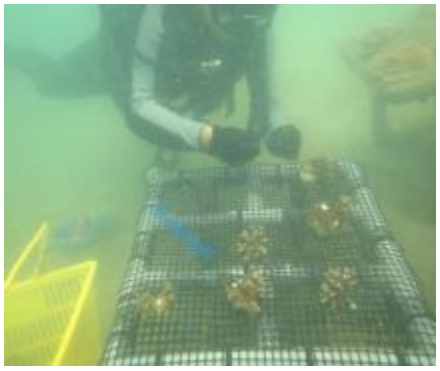
Relocation of Corals – NGO Engagement

Relocation of Corals from Sultan Shoal

R&D Programme - Coral Projects

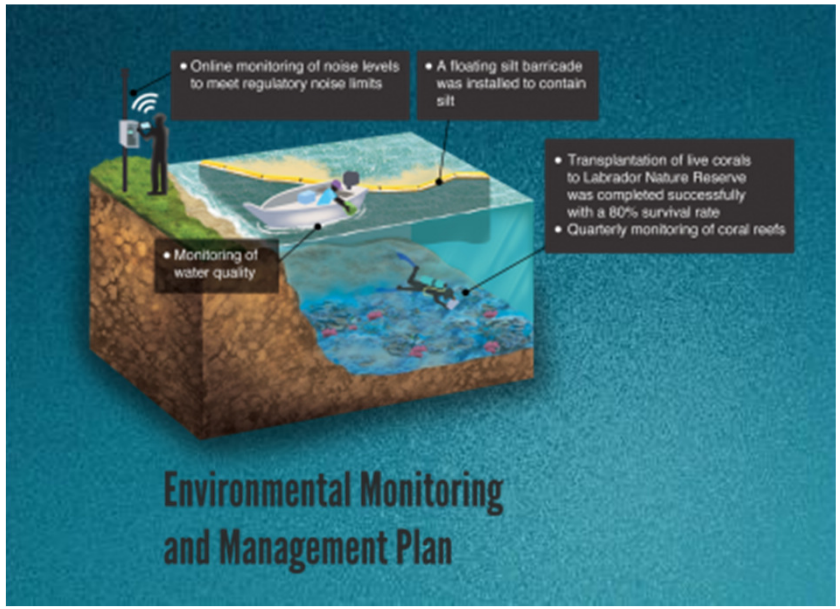
Enhancing Singapore's Corals Reef Ecosystem in a Green Port

- Collaboration with Tropical Marine Science Institute (NUS)
- Set up coral nurseries at Lazarus Island to grow coral fragments picked up from Sultan Shoal after relocation works
- Transfer corals to degraded reef or non-reef areas
  - High survival rates for coral fragments at the nurseries as well as grown fragments which have been relocated to reef areas



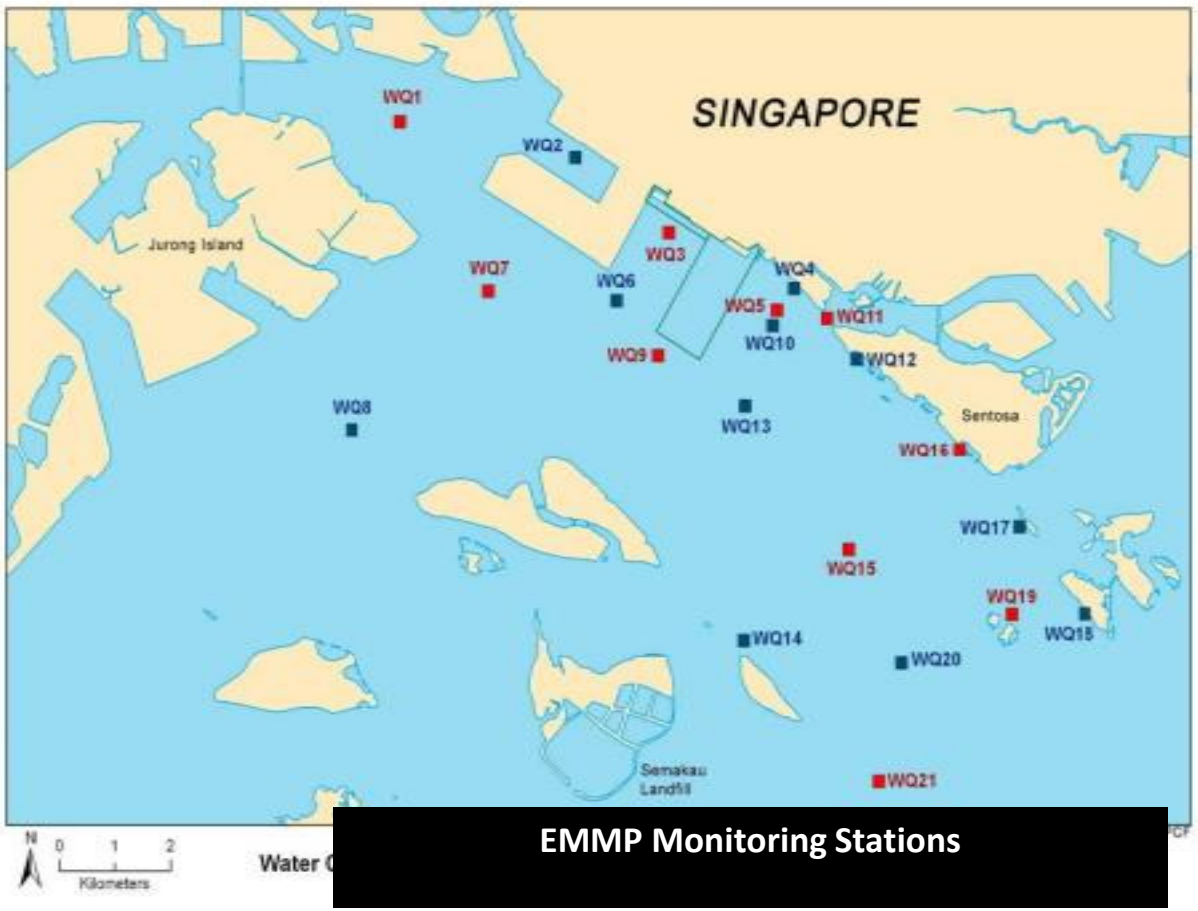

Environmental Monitoring and Management Plan

- Review and Implementation of the recommendations in EIA
- Allocation of Spill Budget and ensuring Contractor's compliance
- Modeling of Real time Plume Movement
- Turbidity and Current Monitoring
- Water Quality Monitoring
- Sedimentation Impact Monitoring
- Trans-Boundary Monitoring



✓ All Environmental Quality Objectives Met

Environmental Monitoring and Management Plan



EMMP Monitoring Stations

Dredging Monitoring

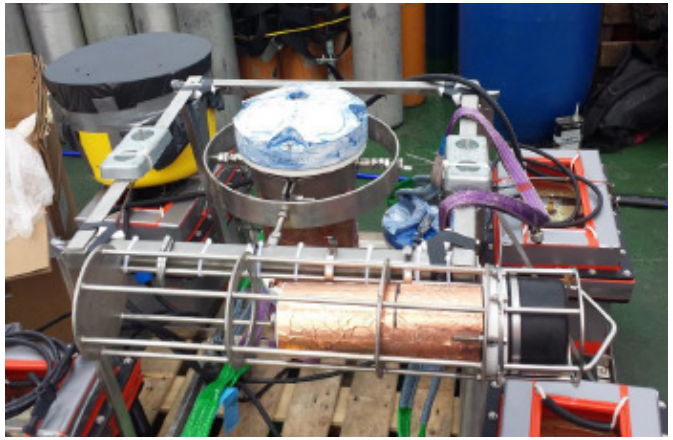
Installation of Siltscreen @ Pasir Panjang

Water Quality Monitoring

Silt Traps

Environmental Monitoring and Management Plan

Deployment of Instruments



Use of Dredged and Excavated Materials for Reclamation

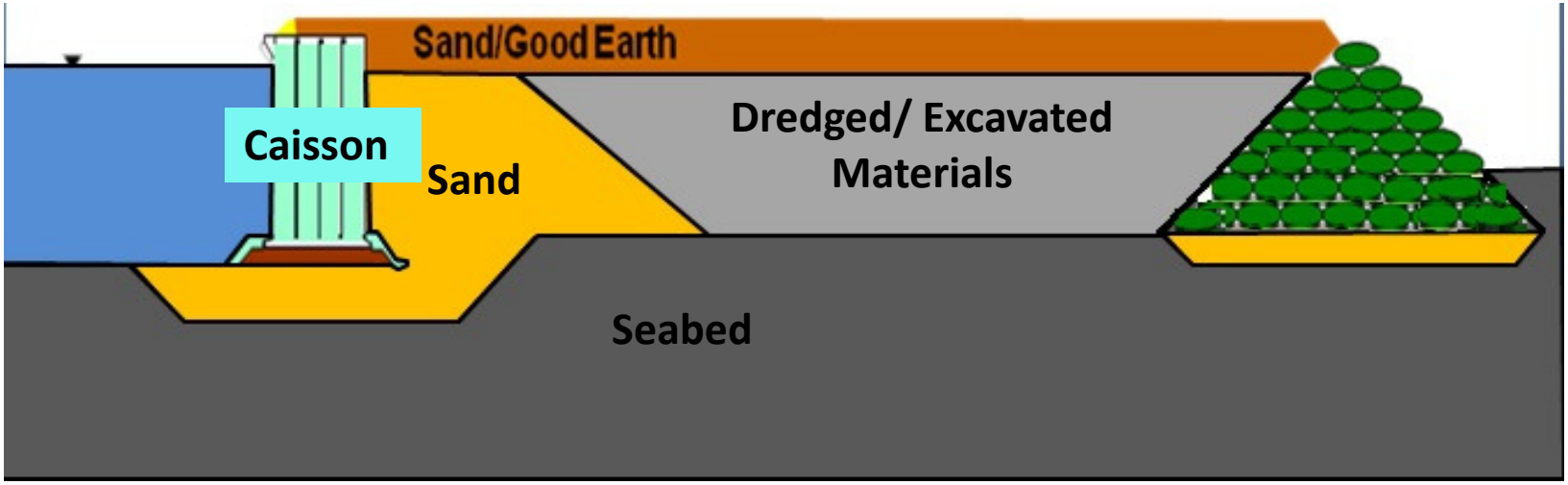
- Sand is usually used for reclamation
- To reduce the sand quantity, dredged and excavated materials were studied
- The dredged and excavated materials used in the reclamation are from several sources, such as marine clay and other soft clayey materials dredged from the site and excavated from construction sites, eg road, MRT and building projects
- Alternative materials, such as cement mixed soil was also used
- Reduce the sand quantity by about 45% for PPT Phases 3 and 4 and up to 60% at Tuas

Benefits:

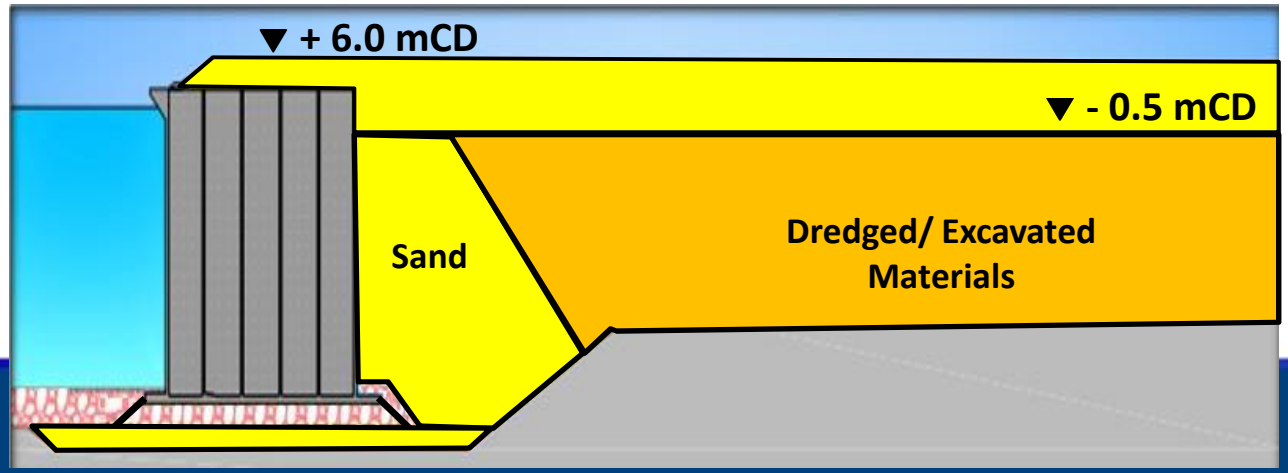
- Reduce reliance on sand for reclamation,
- Reduce the need for disposal grounds and
- Reduce cost of projects due to reduced amount of sand use

Use of Dredged and Excavated Materials for Reclamation

Typical cross sections of the Pasir Panjang Terminal Phases 3 &4



Cross section view of filling works at Tuas Terminal Phase 1



Use of Dredged and Excavated Materials for Reclamation

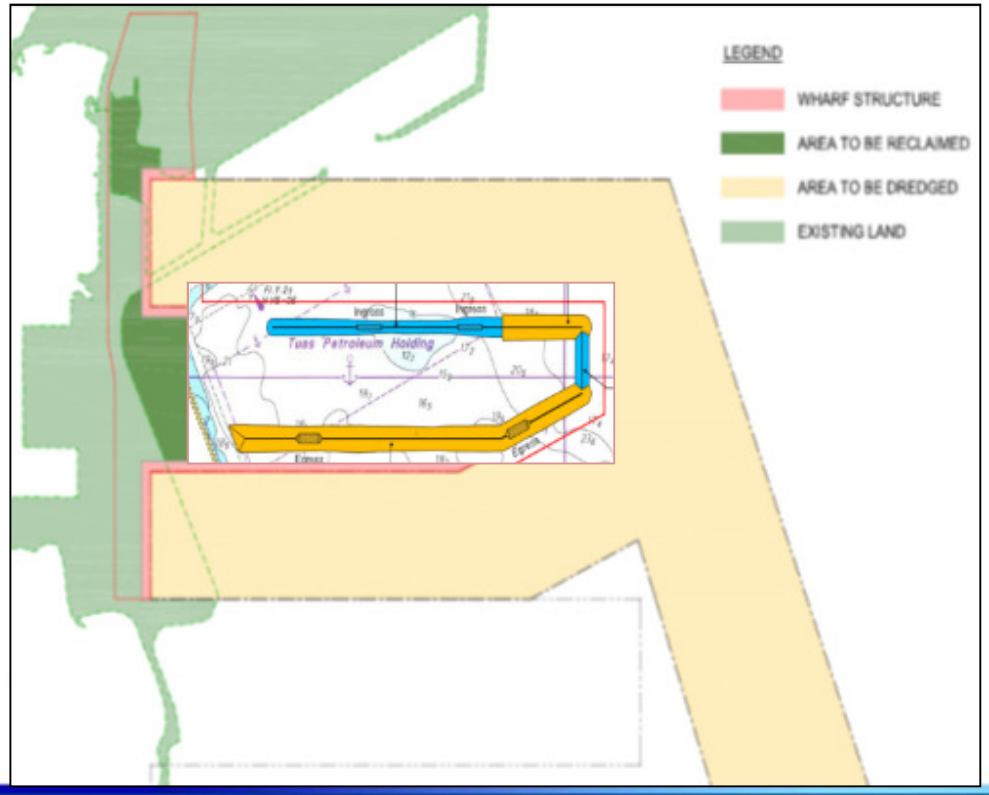
Barge carrying excavated earth and dredged soft clays

Trailer Suction Hopper Dredger (TSHD) connected via Land Pipeline

Use of Dredged and Excavated Materials for Reclamation

Tuas Terminal Phase 1

- Excavated earth and dredged soft clay are recycled as reclamation fill



Excavated Earth from Land Construction

Grab Dredger (Marine Clay)

Conclusion

Sustainable Port Development Initiatives

- Environmental Impact Assessment prior to commencement of works
- Successful corals relocation
- Results of coral R&D programme encouraging
- Environmental Management and Monitoring Programme to ensure that the Environmental Quality Objectives were met
- Successful innovative use of Alternative Materials as Reclamation Fills – Recycling and Green
- Pasir Panjang Terminal Phases 3 &4 successfully completed and commissioned in 2015

For Information