

Western Dredging Association 2016 Chapter Meeting

Environmental Management - Lessons Learned Panama Canal Expansion



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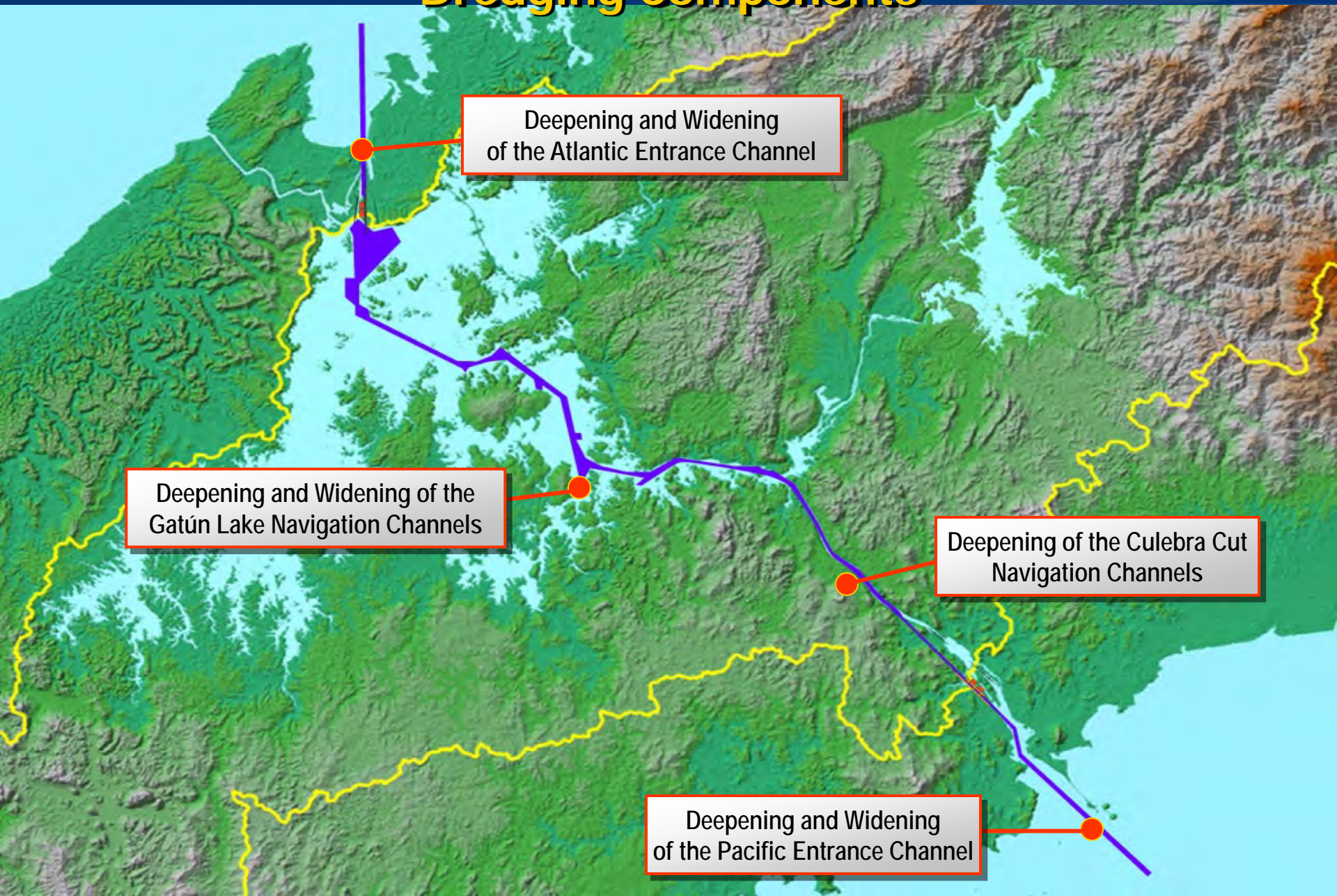


Contents:

- ◆ The Environment
- ◆ Design of Dredging Components
 - Disposal Sites Management and Monitoring
 - Baseline Physical and Chemical Studies
- ◆ EsIA Requirements
- ◆ Public Perception and Involvement
- ◆ Mitigation Works – Precedents?



Canal Expansion Program Dredging Components



Deepening and Widening
of the Atlantic Entrance Channel

Deepening and Widening of the
Gatún Lake Navigation Channels

Deepening of the Culebra Cut
Navigation Channels

Deepening and Widening
of the Pacific Entrance Channel

Canal Expansion - Similar to Canal Construction - 100 years later



ENVIRONMENTAL REQUIREMENTS FOR DREDGING ACTIVITIES CANAL EXPANSION PROGRAM



Selection of Excavation Material Disposal Sites for the Canal Expansion



Public Consultation

- ◆ Process initiated during the Referendum information phase in 2006
- ◆ During the EsIA process two public meetings were held, one in the Atlantic and one in the Pacific
- ◆ Community meetings were held to inform about the dredging and the first dry excavation projects
- ◆ EsIA is available at ACP web page
- ◆ Free telephone line and email address available for public participation
- ◆ Two public relations offices will be established (Atlantic and Pacific)

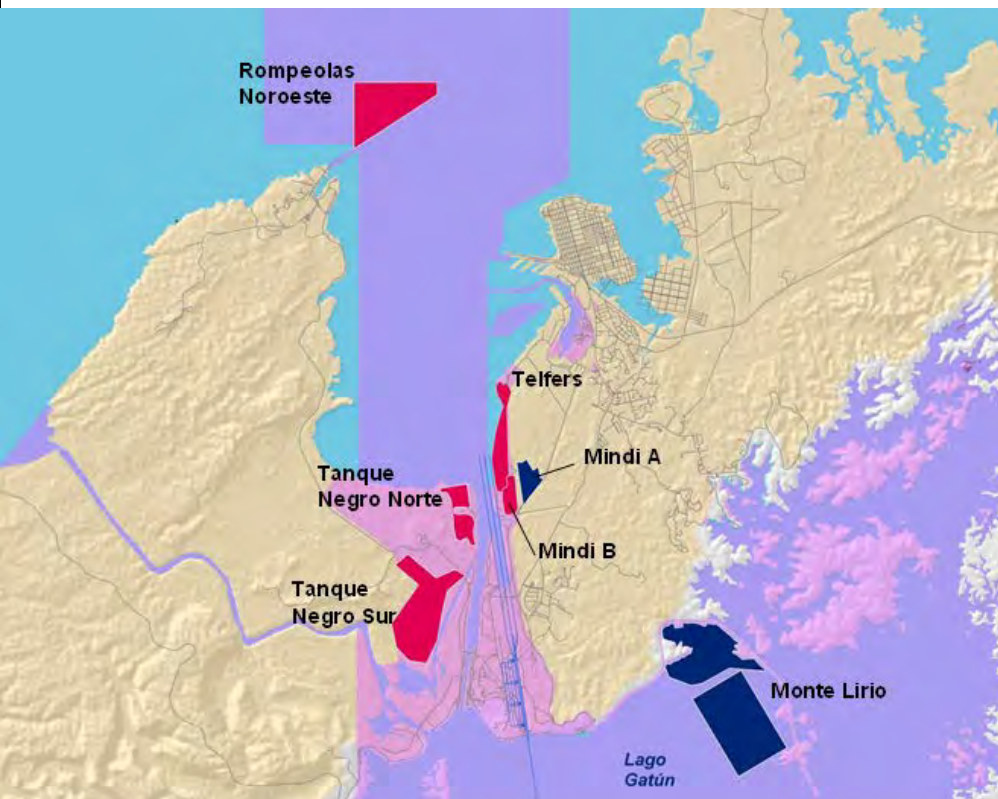


Extensive Consultation During All Project Stages

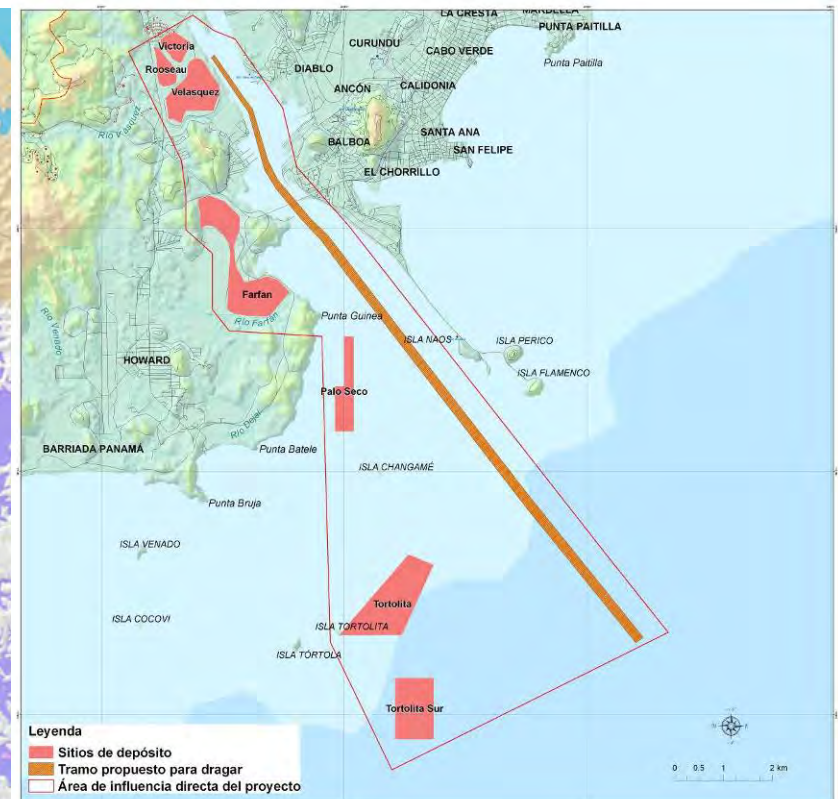
Environmental evaluation of the Atlantic and Pacific disposal sites

- ◆ Baseline studies
- ◆ Evaluation of existing environmental conditions
- ◆ Technical Factors (site preparation, use, and material transportation methods)
- ◆ Environmental Impacts
- ◆ Mitigation and environmental monitoring requirements

Atlantic site



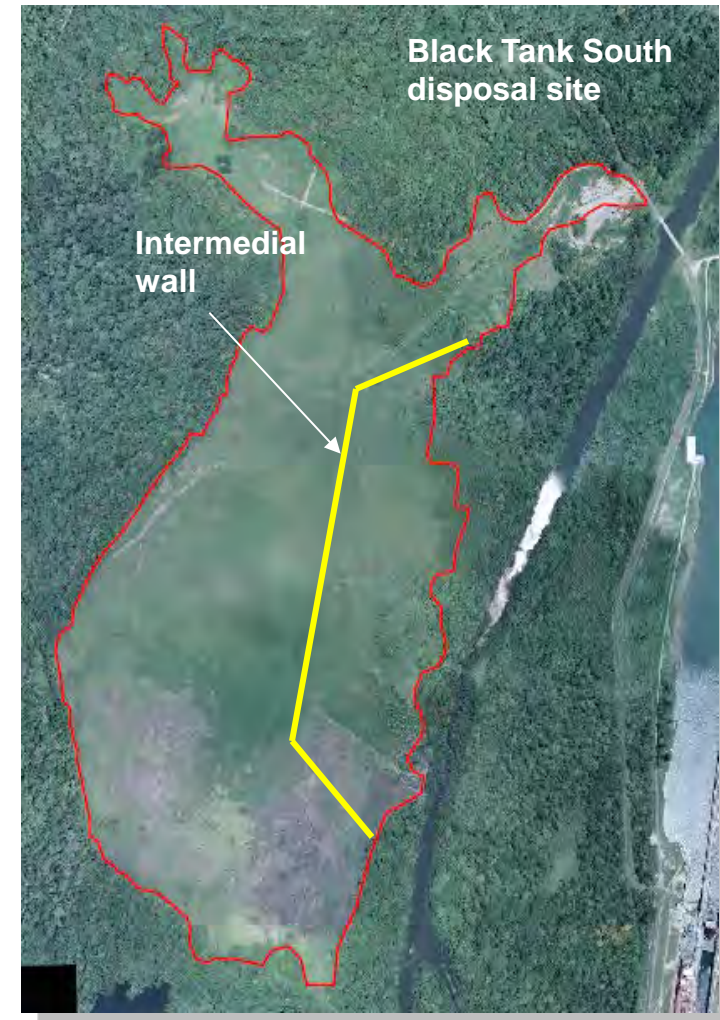
Pacific site



Mitigation Measures – Disposal Sites

Measures to reduce sediments discharges to natural water bodies and/or the canal

- **Use of sediment control weirs;**
- **Filling of spoil sites controlling the secure level corresponding to the perimetric containment;** and
- **Use of transverse intermediate walls.**



Land Disposal

Important:

Design of disposal sites in areas not suitable and of low retention times do not allow for effective sediment retention.

Results:

Movement of sediment to the course of the receiving waters, impact on aquatic fauna and water quality, landscape impacted.



Pipe discharge on site



Exit pipe towards forested area



Discharge exit pipe



Monitoring requirements

Weekly monitoring of suspended solids at the entrance and point of discharge (90% + retention).

Samples to be collected during discharge operations.

Sediment retention



Internal coordination

- Site selection and evaluation
- Monitoring and compliance
- Coordination requirements



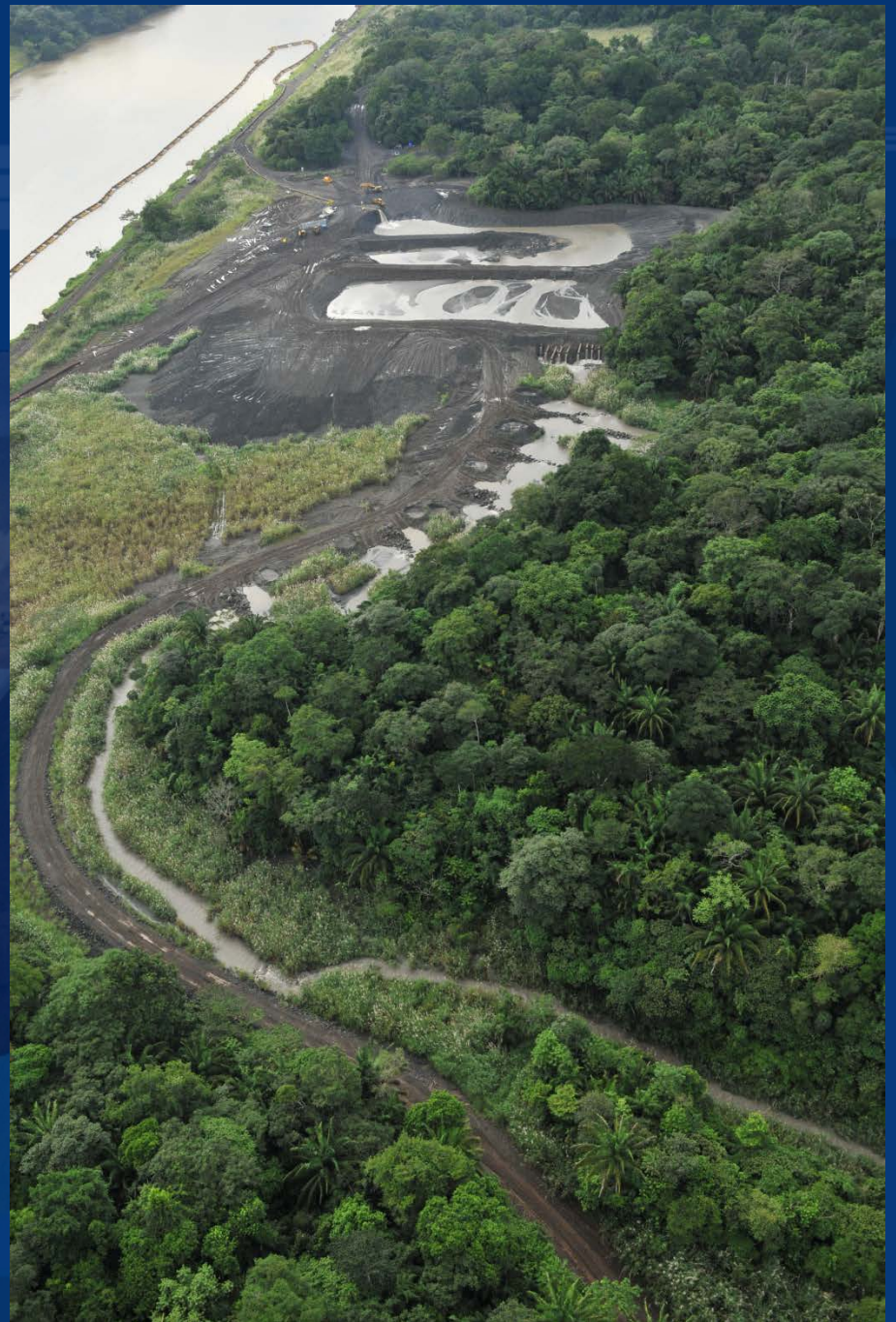
Río Mandinga down stream of disposal site



Culebra Cut disposal site



Bas Obispo disposal site



Camacho disposal site



Length of the piping
approx. 600 m

Due Diligence Review Performance Standards (PS) Compliance



Rescue and Relocation

PS 4: **Community Health, Safety and Security**
Works away from populated areas; measures to protect communities health & safety

Principle 6: Grievance Mechanism
ACP informs communities and Office for community relations will be established. A grievance mechanism has been established

HIGH ENVIRONMENTAL STANDARDS

Basic Environmental Requirements:

- ◆ Environmental Impact Studies and Enforcing Resolutions
- ◆ Panamanian Laws and Regulations
- ◆ ACP Standards
- ◆ Public involvement

Environmental and Health & Safety Aspects Addressed:

- ◆ Noise and Vibrations
- ◆ Water Management
- ◆ Erosion and Sedimentation Control
- ◆ Wildlife Rescue



Land reclmation - Orquidea Island



Recovery process at Orquídea Island due to D'Arlesseps Island removal

Benefits:

- Augmented island size.
- Reduced execution time
- Less water turbidity
- Reduce impact to the navigational channel



Dredging projects

Include in the specifications:

- **Plume dispersion restrictions**
- **Retention percentages**
- **Monitoring requirements**
- **Proper compaction of the retention dikes to avoid filtration and/or erosion**
- **Competent material to be used for diking and working roads**
- **Overhead flights highly recommended during operations to evaluate plume dispersion and impacts**



Environmental Considerations

Criteria for Terrestrial Sites

- Check land ownership, administrative or tenure condition
- Ecological Structures
- Type of vegetation
- Presence of endangered/protected species
- Socio-economic conditions
- Impacts on surrounding communities
- Cultural resources



Criteria for Marine Sites

- Habitat alteration and/or destruction
- Water quality impacts
- Impacts to biota
- Impacts to commercially important species
- Impacts to the socio-economic conditions of surrounding populations
- Legal and institutional issues



*Works were carefully planned, evaluated, monitored and executed to **prevent, minimize, and mitigate** adverse impacts and improve environmental performance*

