



Assessment of Existing Seawater Desalination System Integration Practices

Special Committee on Desalination and Recycling
July 26, 2011
Item 3a

**MALCOLM
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 **ARCADIS**

The Water Division of ARCADIS

Project Background

- 2010 Integrated Resources Plan (IRP) Update:
 - Core supply
 - Buffer supply
 - Foundational actions
- Seawater desalination projects may feed into Metropolitan's distribution system
- Ensure successful integration into system
- Areas of interest:
 - Water quality (corrosion, disinfection stability, blending, etc.)
 - Operations (storage, flexibility, hydraulics, peaking, etc.)

Purpose and Goal

Purpose

Evaluate water utility practices for integrating large-scale seawater desalination plants into existing distribution systems

Project Components

- ✓ Bibliography of applicable references
- ✓ Survey of 10 major global seawater desalination plants

Goal

Enable Metropolitan to proactively understand considerations associated with integrating desalinated seawater

Purpose and Goal

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- ✓ Bibliography of applicable references
- ✓ **Survey of 10 major global seawater desalination plants**

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Facility Selection Criteria

Ten (10) prominent seawater desalination plants were selected.

Common Characteristics

RO technology

Significant size

Constructed within the last 10 years

Diverse Characteristics

Geography

Production capacity

Integration methods

Regulatory environment

All ten plants have some key features in common with proposed facilities that may feed into the Metropolitan system.

Surveyed Plant Summary

Plant ID / Location	Country	Capacity (MGD)	On-Line Date	% Seawater Desalination
Tampa	USA	25	2003	≤ 10%
Gold Coast	Australia	33	2009	variable
Melbourne	Australia	108	2012	33%
Perth 1	Australia	33	2006	15-20%
Sydney	Australia	66	2010	15%
Ashkelon	Israel	98	2005	15%
Fujairah 2	UAE	36	2010	95%
Sur	Oman	21	2009	100%
Tuas 1	Singapore	36	2005	10%
Valdelentisco	Spain	35	2007	35-45%

Surveyed Plant Locations



Bromide

- Potential issues:
 - Disinfection by-products
 - Chloramine residual stability
- Half of the plants reported treatment standards

Reported Mitigation Strategies

Blending, two-pass RO process, and/or modifying chloramine residual formation process

Sydney, Australia



Boron

Tuas, Singapore



- Potential impacts to landscape and agriculture
- Eight projects reported boron treatment standards

Reported Mitigation Strategies

Blending and/or two-pass RO process

Fujairah, UAE

Corrosion

- Potential issues
 - System integrity
 - Lead & copper
 - Aesthetics
- Advance studies to evaluate corrosion potential were common



Reported Mitigation Strategies

Meeting corrosion indices goals; Blending;
Post-treatment conditioning to match existing supplies

Water Quality Studies Conducted

- Pipe loop / corrosion testing
- Blending / mixing
- Water quality modeling
- Disinfectant stability
- Disinfection by-product formation
- Pilot testing

Valdelentisco, Spain



Blending Practices

Perth, Australia



- Practices varied:
 - In-pipe
 - Reservoirs
 - Storage tanks
- No plants reported target blending ratios...
- ...However, many acknowledged the usefulness of blending for meeting water quality goals
- Blending ratios vary due to:
 - When lower-cost supplies available
 - Fluctuating demand

Intertie Location

- **Upstream intertie:**
 - Piped to a strategic upstream point in the distribution system
 - **Advantages:** operational flexibility, blending potential, larger demands
- **Nearby intertie:**
 - Injected at a nearby point in the distribution system
 - **Advantages:** avoid long transmission, pumping
- **Both reported**

Ashkelon, Israel



Operations

Tampa Bay, Florida



- **Base-loaded production**
 - Reported where seawater desalination is a high percent of supply
- **Variable production**
 - Reported where existing supplies are available
- **Seawater desalination can provide an important emergency supply**

Reported Lessons Learned

- Testing and modeling can help ensure successful integration
- Consider end uses in the development of water quality goals

Gold Coast, Australia



Melbourne, Australia



- A desalination plant can be an emergency asset, providing backup treatment reliability
- Engage the public early and in all stages of development

Considerations for Metropolitan

- ✓ The “Lessons Learned” from the surveyed plants contain good insight.
- ✓ Thorough water quality studies should be specified and conducted *in advance*.
- ✓ Appropriate post-treatment conditioning is essential for stable water quality.
- ✓ A two-pass RO design can improve water quality and treatment flexibility.
- ✓ Blending in storage tanks can support water quality and operational flexibility.
- ✓ Plant site selection should account for the proposed blending point and associated pipeline alignment (as applicable).
- ✓ Projects integrated with existing supplies are not necessarily base-loaded.
- ✓ Integration costs are site specific and can be a major component of the project.