

海水淡化與環境營造-淺談吉寶濱海東部海淡廠

Desalination with the Environmentally Friendly Design- Keppel Marian East Desalination Plant

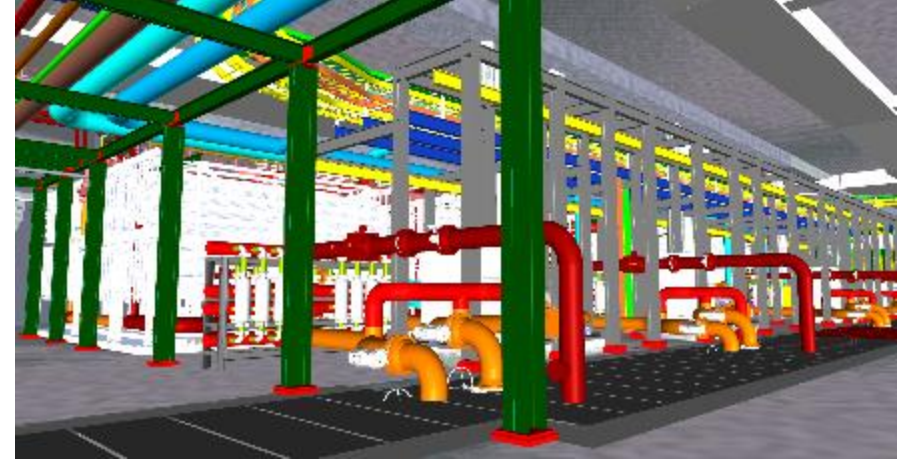
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Agenda

- Introduction of KMEDP
- KMEDP Process design
 - Dual mode
 - Direct coupling
 - Other energy saving approaches
- Conclusions



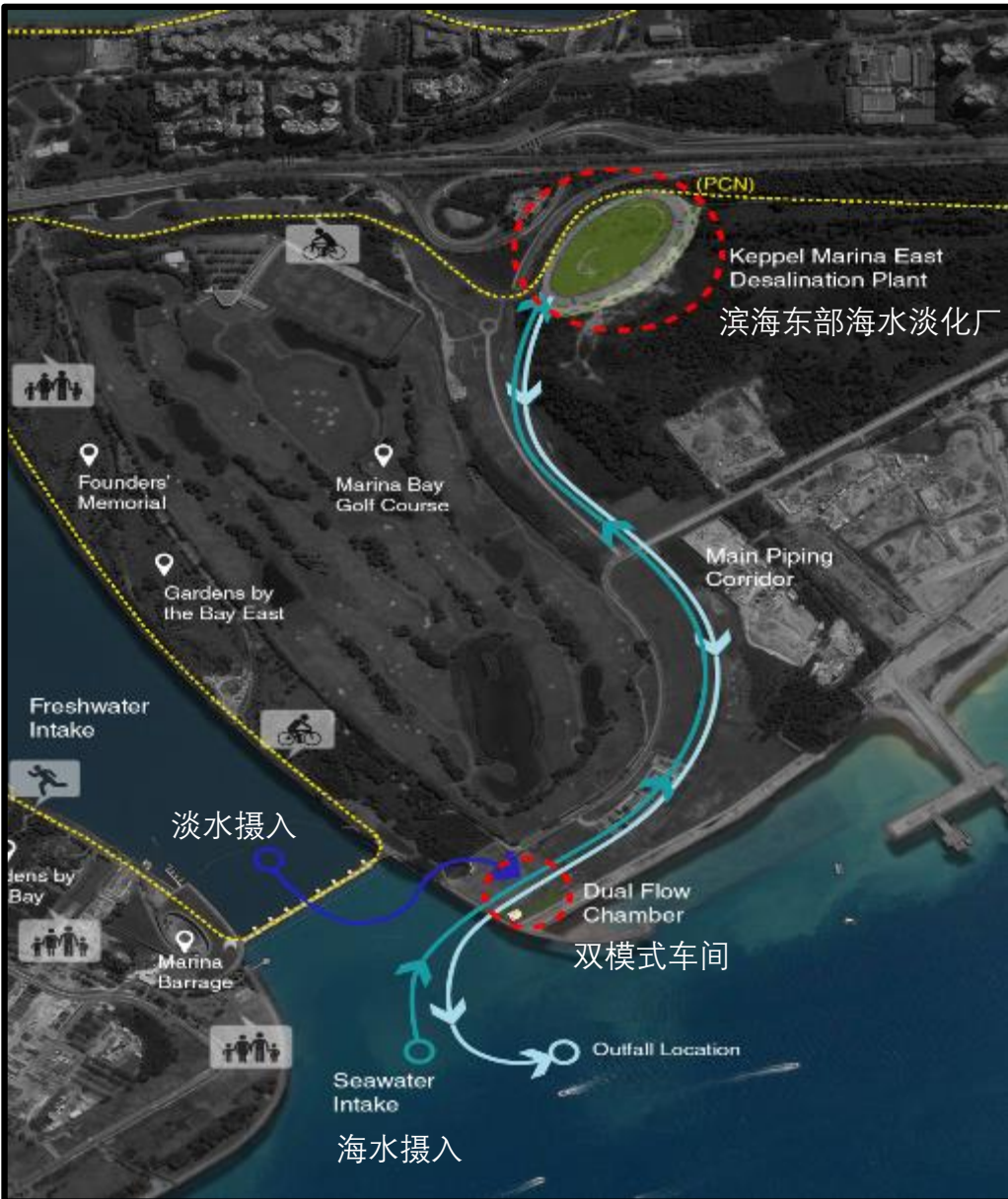
Background

- 137,000 m³/d capacity
- Design Build Own Operate (DBOO) with 25 years operation
- Dual intakes with Sea Water and Reservoir Water
- Green roof top link to Park Connector (accessible to the public)
- Viewing gallery



Project Background and Key Features Overview

計畫背景和主要功能概述



The KMEDP is **Singapore's fourth** desalination plant and is a public private partnership (PPP) between Keppel Infrastructure (through its wholly-owned subsidiary, Marina East Water) and PUB, Singapore's national water agency.

吉寶濱海東部海水淡化廠是新加坡的第四座海水淡化廠，是吉寶基礎設施籌設的全資子公司Marina East Water與新加坡公用事業局之間的公私合作夥伴關係（PPP）。

The plant can produce up to 137,000m³ of fresh drinking water daily.

該廠每天可生產多達137,000 m³的民生自來水。

Singapore's First Direct Coupling Desalination Plant 新加坡第一座直接連接海淡廠

Direct coupling of ultrafiltration and reverse osmosis systems – Omitting ONE pumping cycle results in saving of 15% of energy used in a pumping cycle.

超濾系統和逆滲透系統直接連接可省一個水泵循環，約可節省15%的循環能耗。

Incorporation of advanced system / equipment 整合先進的系統/設備

Singapore's first water desalination plant using UV as primary disinfection

新加坡首座使用紫外線作為主要消毒劑的海水淡化廠。

One of the most compact desalination plants in Singapore 新加坡最精簡的海水淡化廠之一

Compact Pre-treatment achieving nearly 30% reduction in space

精簡的預處理程序減少近 30% 的土地使用

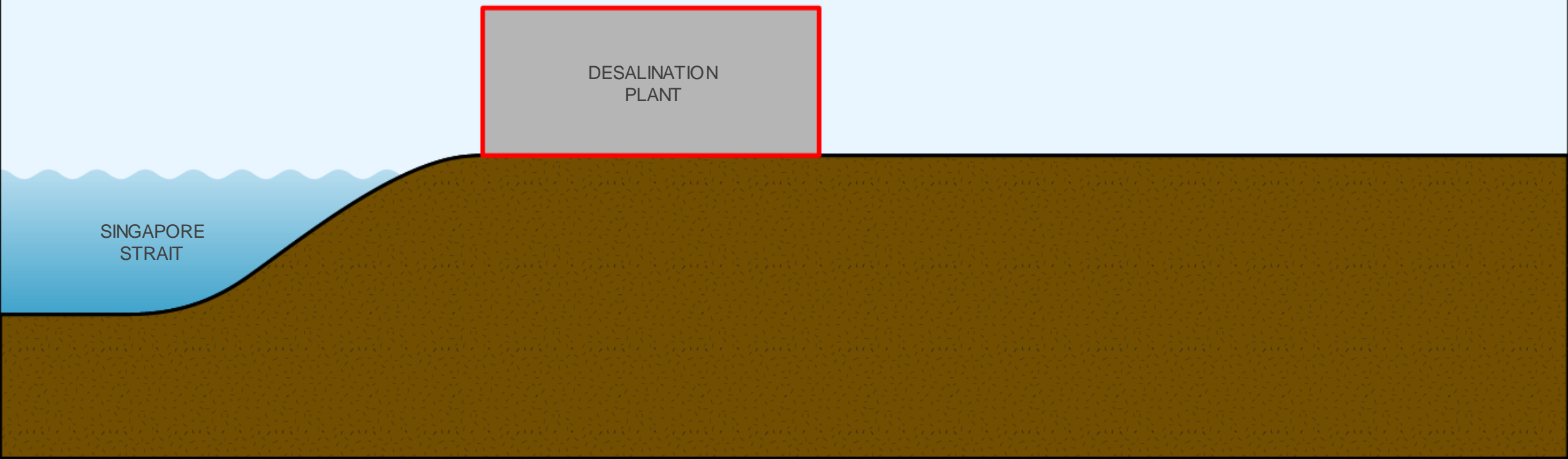
Direct coupling design with omission of booster pump, cartridge filters and UF filtrate tank

直接連接設計，可省略增壓泵、筒式過濾器 and 超濾產水槽

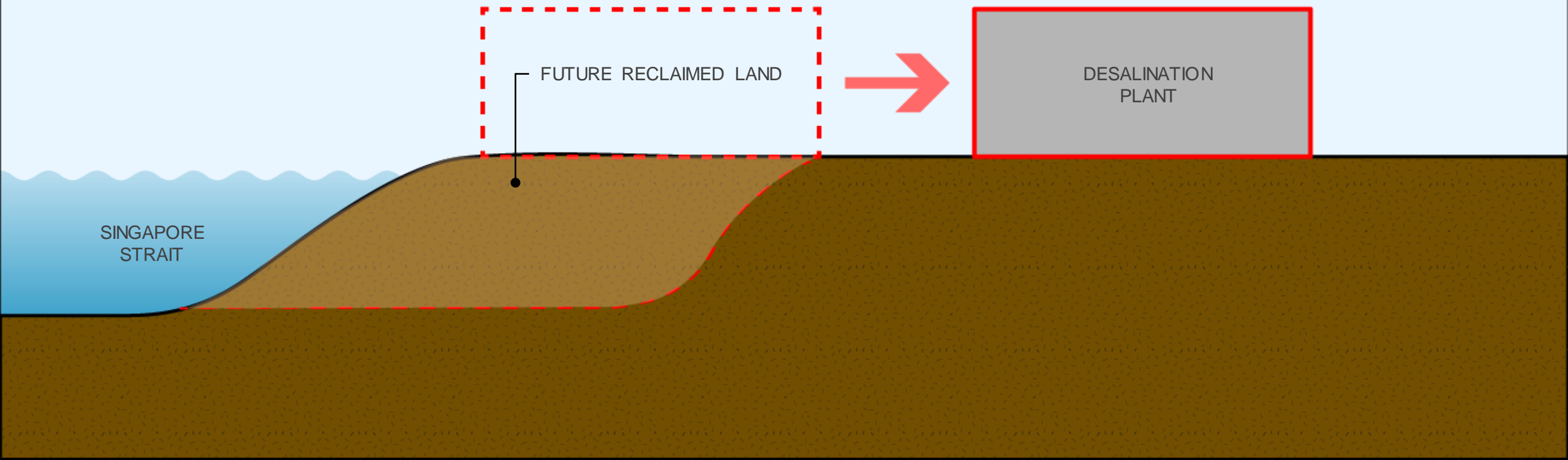
Smaller footprint of UV disinfection system compared to conventional chlorine-based disinfection

與傳統的加氯消毒相比，紫外線消毒系統的佔地面積較小

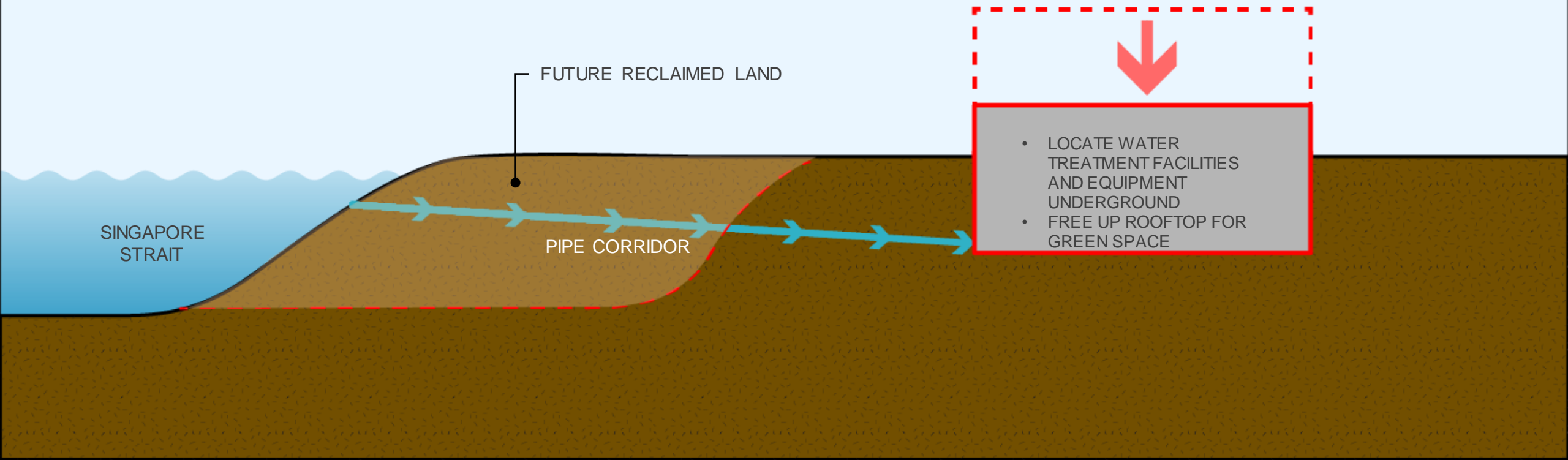
Design Concept Overview– Main Plant 設計概念(1/4)



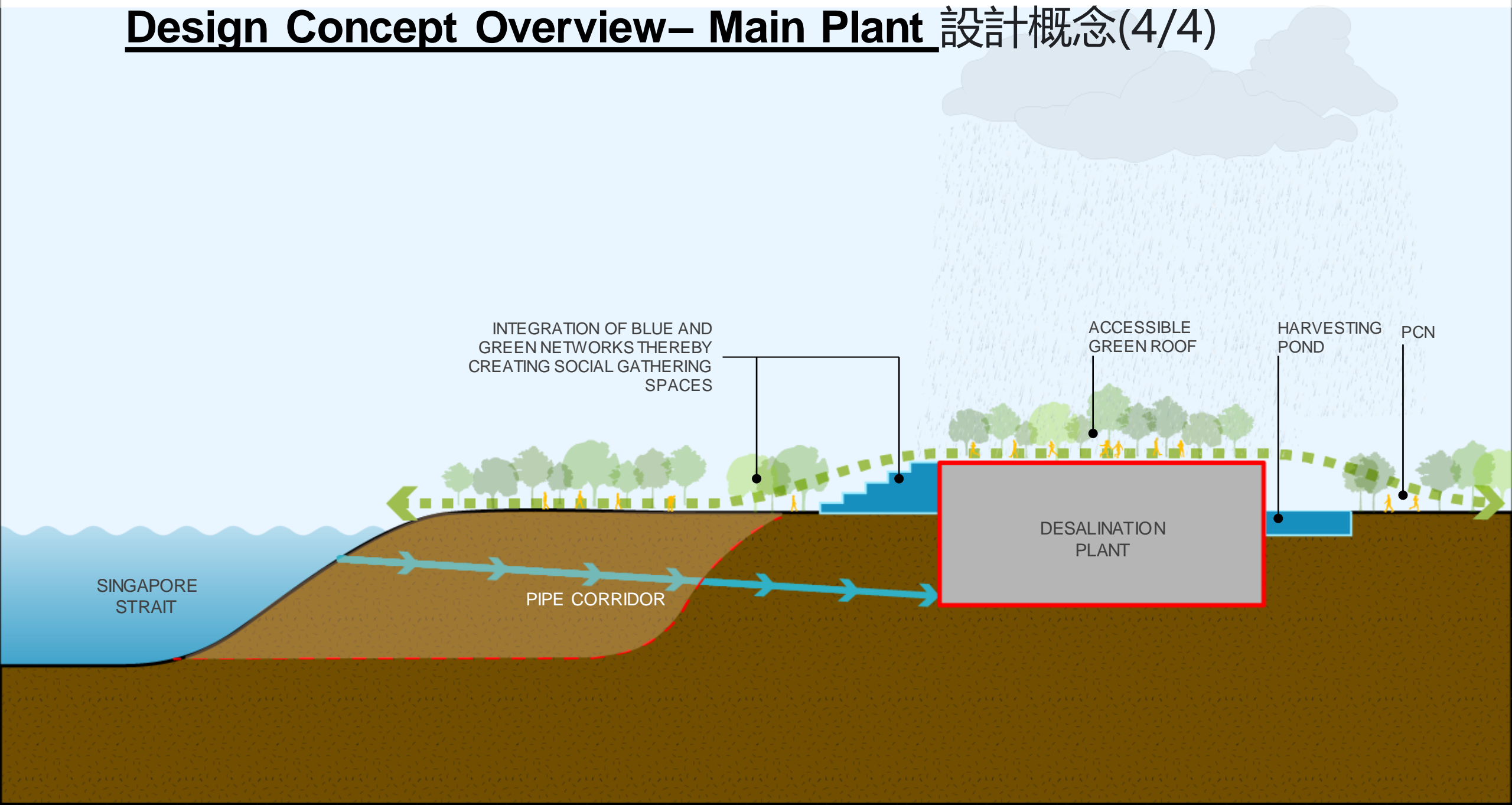
Design Concept Overview– Main Plant 設計概念(2/4)



Design Concept Overview– Main Plant 設計概念(3/4)

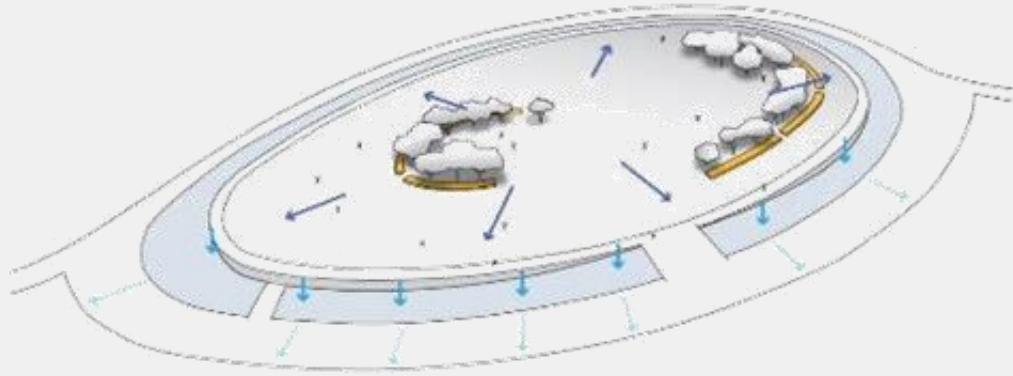


Design Concept Overview– Main Plant 設計概念(4/4)



Design Concept Overview – Sustainability Features

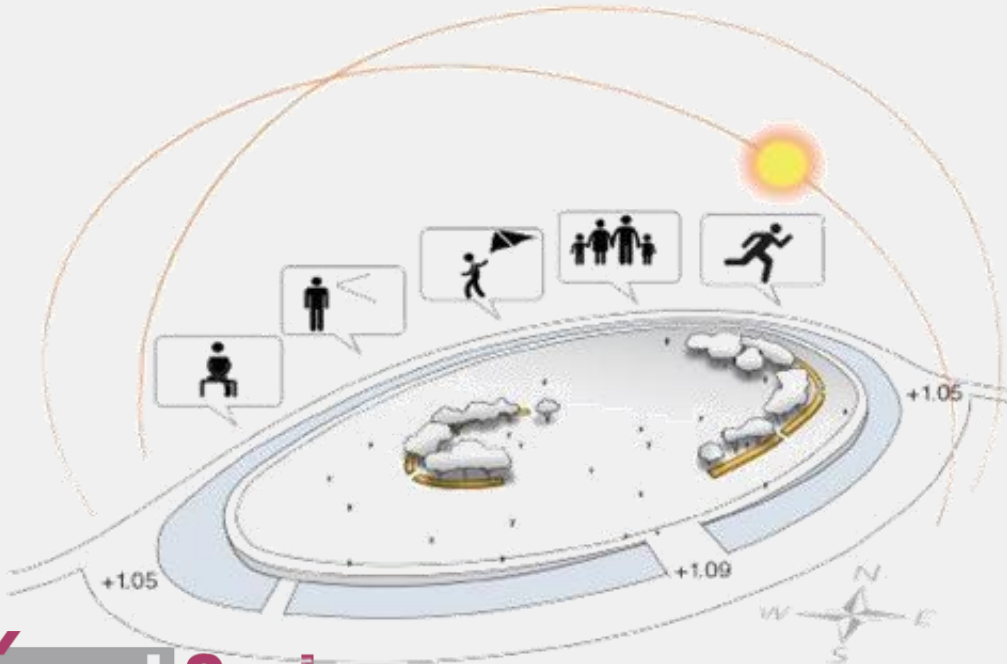
設計概念 - 永續功能



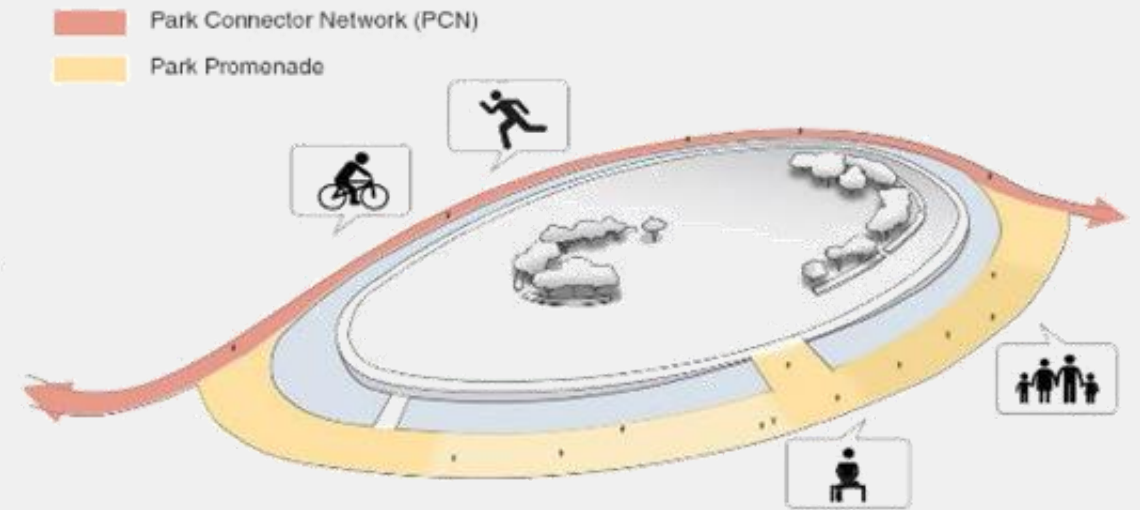
RESILIENT DESIGN



GREEN FABRIC AND BIODIVERSITY



INFRASTRUCTURE AS PUBLIC SPACE



CAR-LITE

KMEDP's Sustainability Design Features 永續性功能設計



The design of the KMEDP challenges conventional approaches to what large infrastructural facilities should look like.

濱海東部海水淡化廠設計對於傳統基礎設施的常規方法提出了挑戰。

Designed exclusively for people, the green roof blends into the existing environment to demonstrate that buildings as large as these can not only coexist, but be effortlessly integrated into an inclusive, park-like attraction.

人性化的綠色屋頂與週邊環境融合，此證明如此大的建築物亦可如此完美的融入到一個整合性的公園式景點中。

The Plant incorporates environmentally friendly elements within its landscape design, such as a stormwater managing strategy and a water harvesting system to retain rainwater as features and recycles water for irrigation and other uses.

該廠在景觀設計中融入了環保元素，例如雨水管理策略和集水系統，以保留雨水作為景觀特色，並回收水用於灌溉和其他用途。

The KMEDP allows people to adopt the building as their own and to ultimately understand the importance of water as an significant natural resource in the life of a nation.

濱海東部海水淡化廠讓人們將基礎設施視為自成一格的建築物，並了解水是國家生命中重要的自然資源。

Design Concept Overview– Main Plant 設計概念—主廠房



Design Concept Overview – Dual Flow Chamber

設計概念—雙水源模式取水泵站



Artist's Impression – Bird's Eye View



As Built – Bird's Eye View



Artist's Impression – Viewing Gallery Entrance



As Built – Viewing Gallery Entrance



Artist's Impression – Green Roof and Promenade Area



As Built – Green Roof and Promenade Area



Artist's Impression – Harvesting Pond



As Built – Harvesting Pond



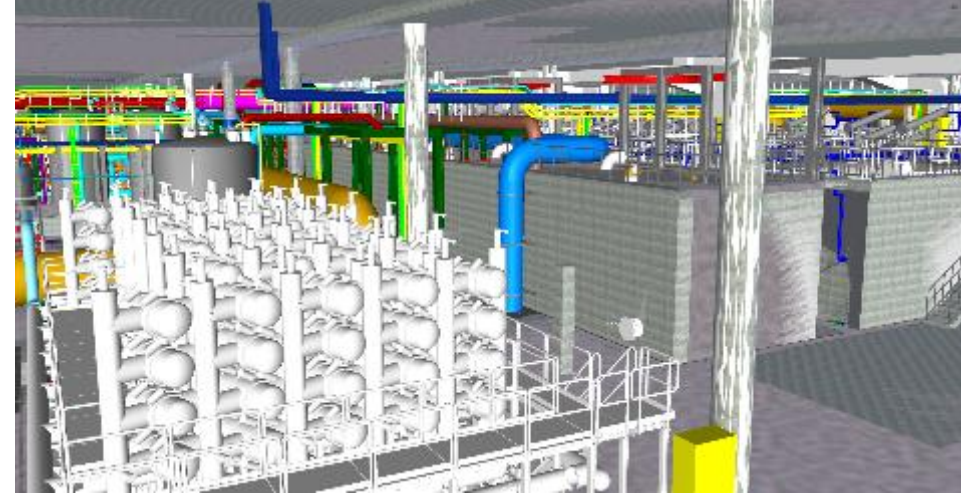
Introduction of KMEDP

KMEDP Process design

Conclusions

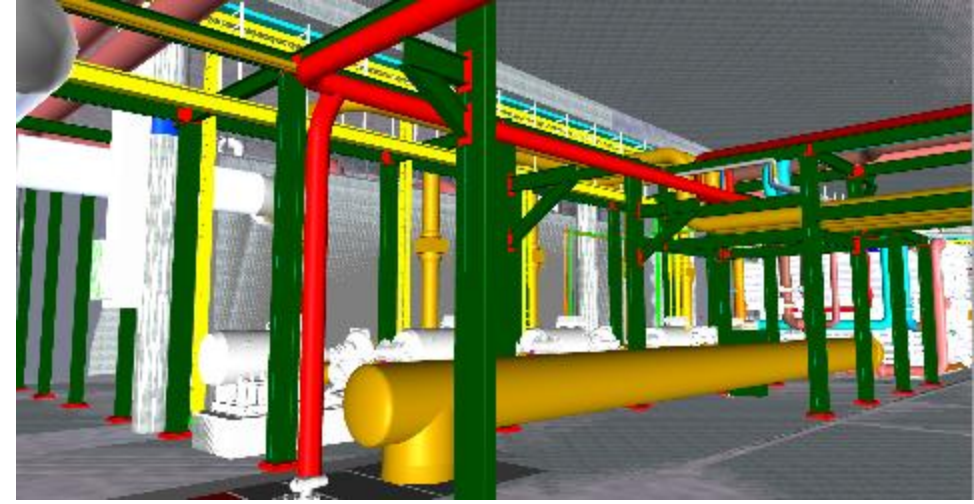
Energy Efficiency Improvement

- Dual mode
 - Sea water: SWRO+ Low pressure RO (LPRO)
 - Reservoir water: LPRO
- Direct coupling
- Split permeate
- Energy recovery device
- Variable frequency drive pump

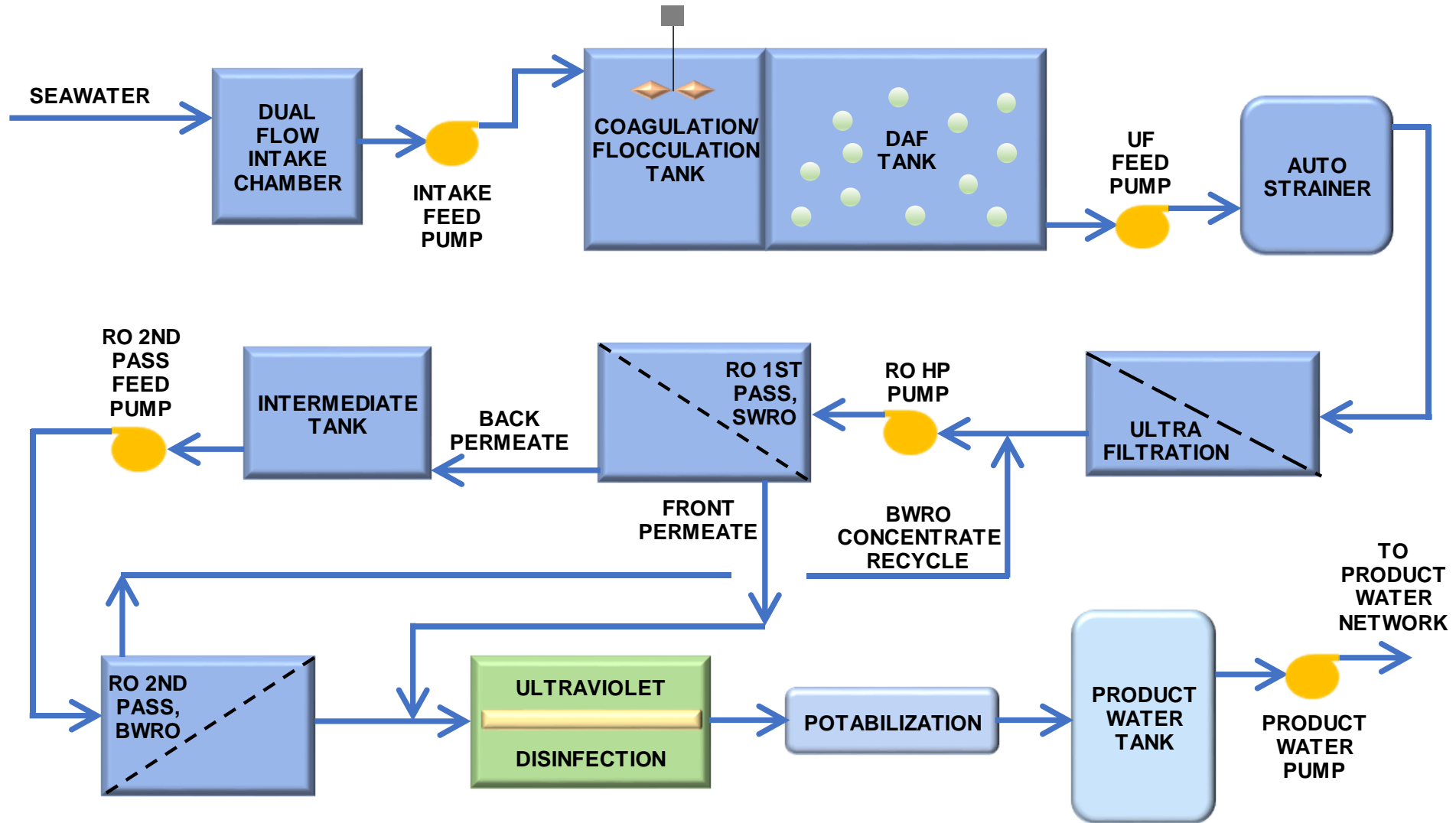


Process

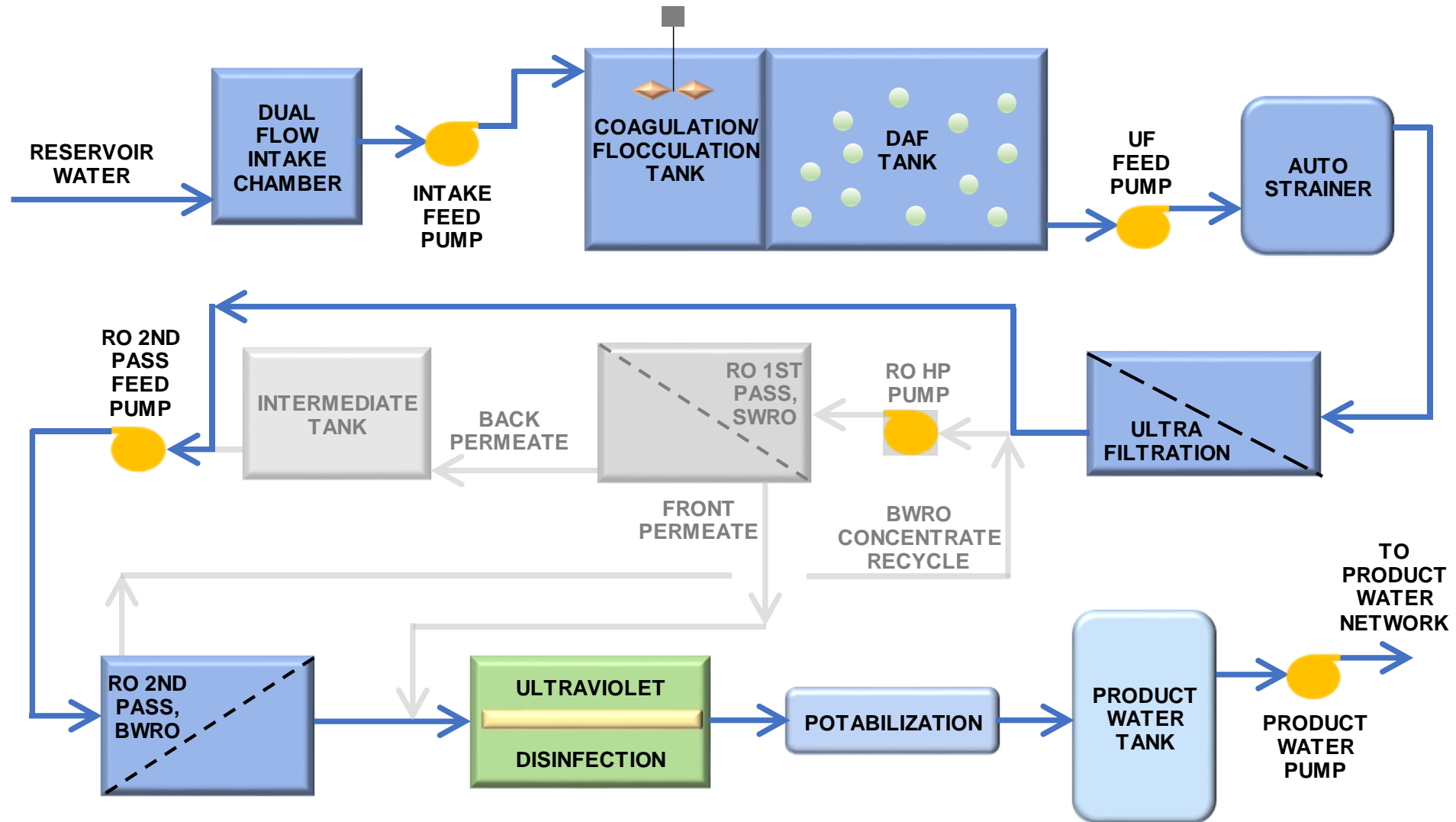
- Intake passive screens
- Dual flow chamber
- Dissolved air flotation (DAF)
- Micro strainer
- Ultrafiltration (UF)
- RO: SWRO and LPRO
- Post treatment (i.e., UV, mono-chloramine, lime, CO₂, Fluoridation)



Sea Water Mode

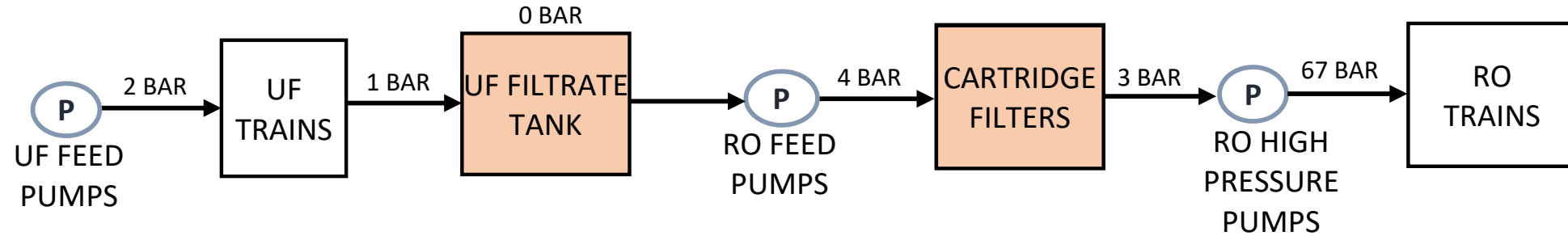


Reservoir water Mode

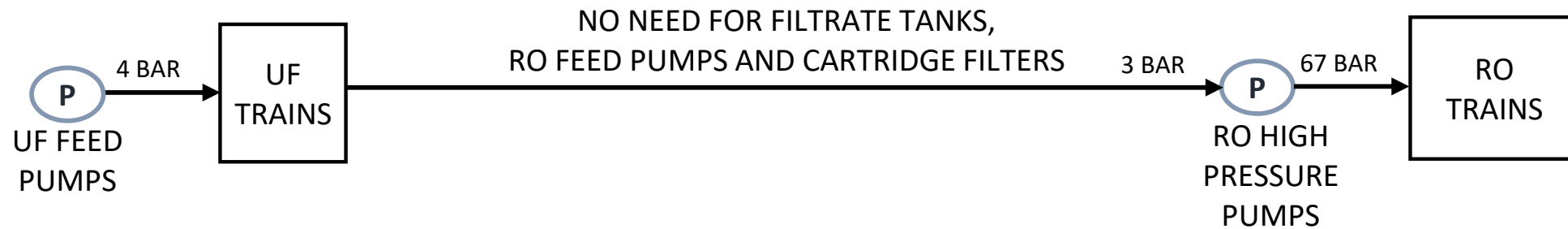


Direct coupling

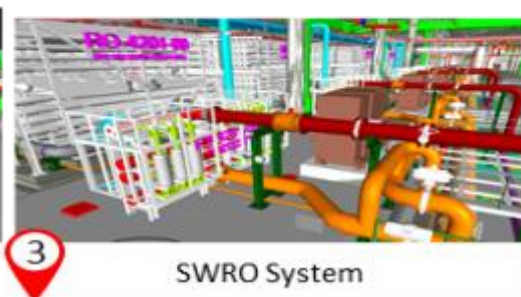
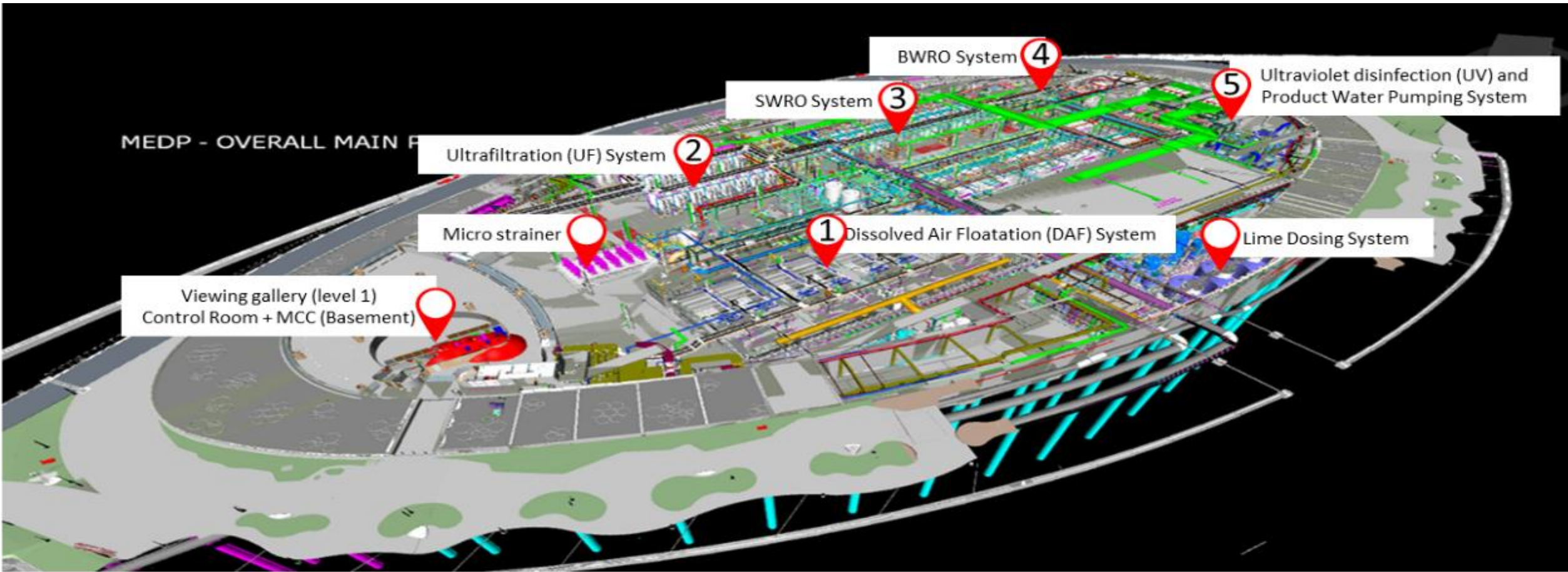
CONVENTIONAL UF - RO CONFIGURATION



DIRECT COUPLED UF - RO CONFIGURATION



Enhanced Engineering Process – 3D BIM 先進工程設計



Introduction of KMEDP

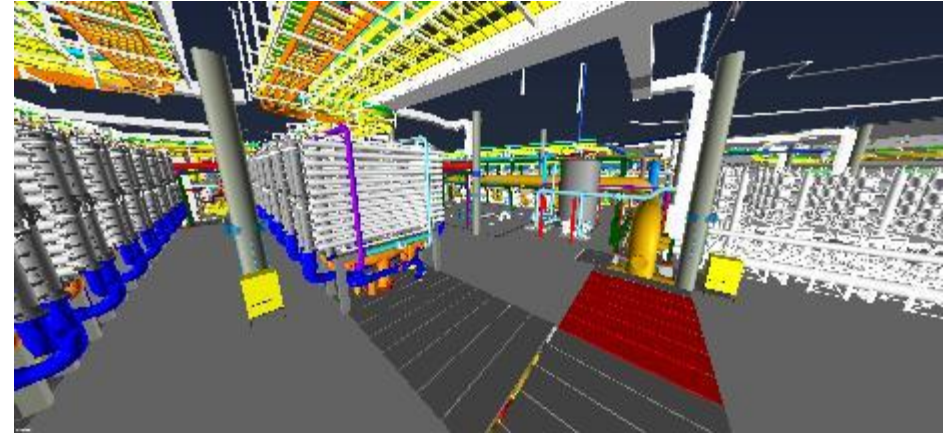
KMEDP Process design

Conclusions

Conclusions

- KMEDP provides an environmentally friendly community space
- KMEDP includes sustainable features in landscape
- KMEDP with capability to operate in both sea water and reservoir water mode
- KMEDP utilizes direct coupling to save more energy
- KMEDP provides highly efficient energy recovery devices (ERD) for the 1st pass SWRO system
- KMEDP utilizes the split partial configuration hence reduce pumping costs as well as reduce the capital costs of the plant
- KMEDP uses micro strainers as pre-treatment before UF and RO systems
- High-power consumption pumps are equipped with VFD

Video



The background image is a photograph of a modern architectural interior. It features a long, narrow wooden walkway that leads towards a glass door. The walls are made of perforated metal, and the ceiling has a grid of small circular holes. The lighting is soft and even, creating a clean and professional atmosphere.

Thank You