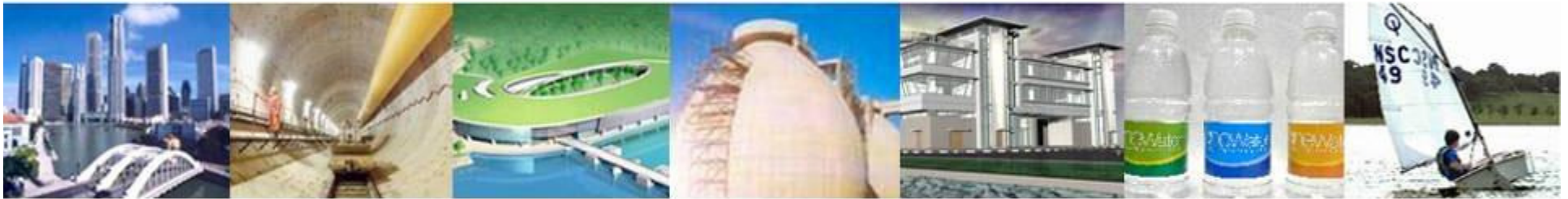


Water for All
Conserve, Value, Enjoy



Overview of Singapore's Deep Tunnel Sewerage System

Yong Wei Hin

Project Director

Deep Tunnel Sewerage System Phase 2 (DTSS 2)

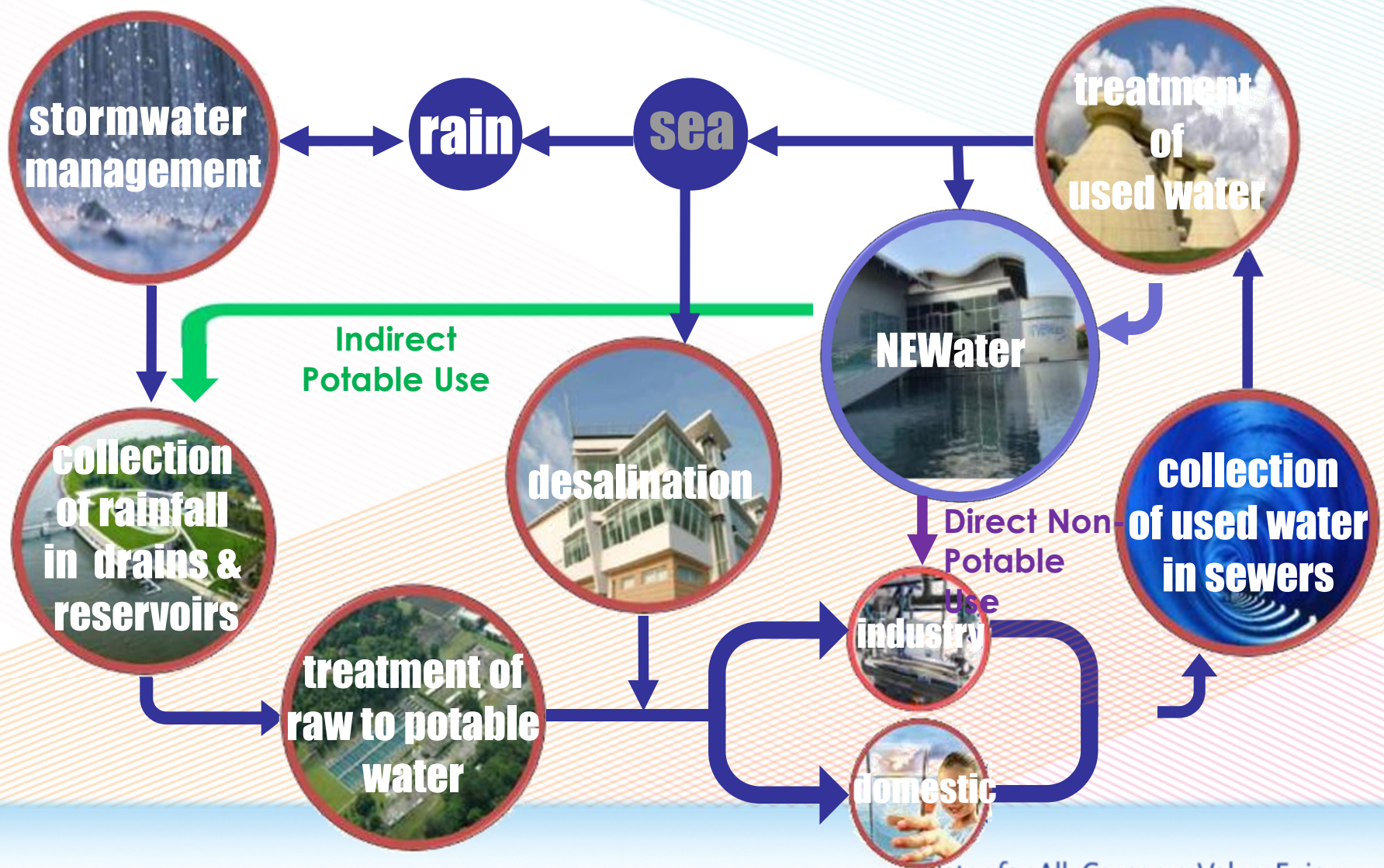
PUB



Outline

- **Background of Singapore's Deep Tunnel Sewerage System (DTSS)**
- **Objectives & Benefits of DTSS**
- **DTSS Phase 1**
- **DTSS Phase 2**

PUB Manages the Complete Water Cycle



Water for All: Conserve, Value, Enjoy



Principles in Play

The principles that guides our future plans to ensure an adequate supply of water for all:



To capture every drop of rain that falls on Singapore



To collect every drop of used water



To recycle every drop of water more than once

DTSS Concept



Benefits of DTSS

Benefits:

- More cost effective
- Free up valuable land
- Ensures sustainability of NEWater
- Robust, Reliable and Resilient



Existing WRPs & Pumping Stations – 300 ha



Water for All: Conserve, Value, Enjoy



DTSS Phase 1

DTSS Phase I

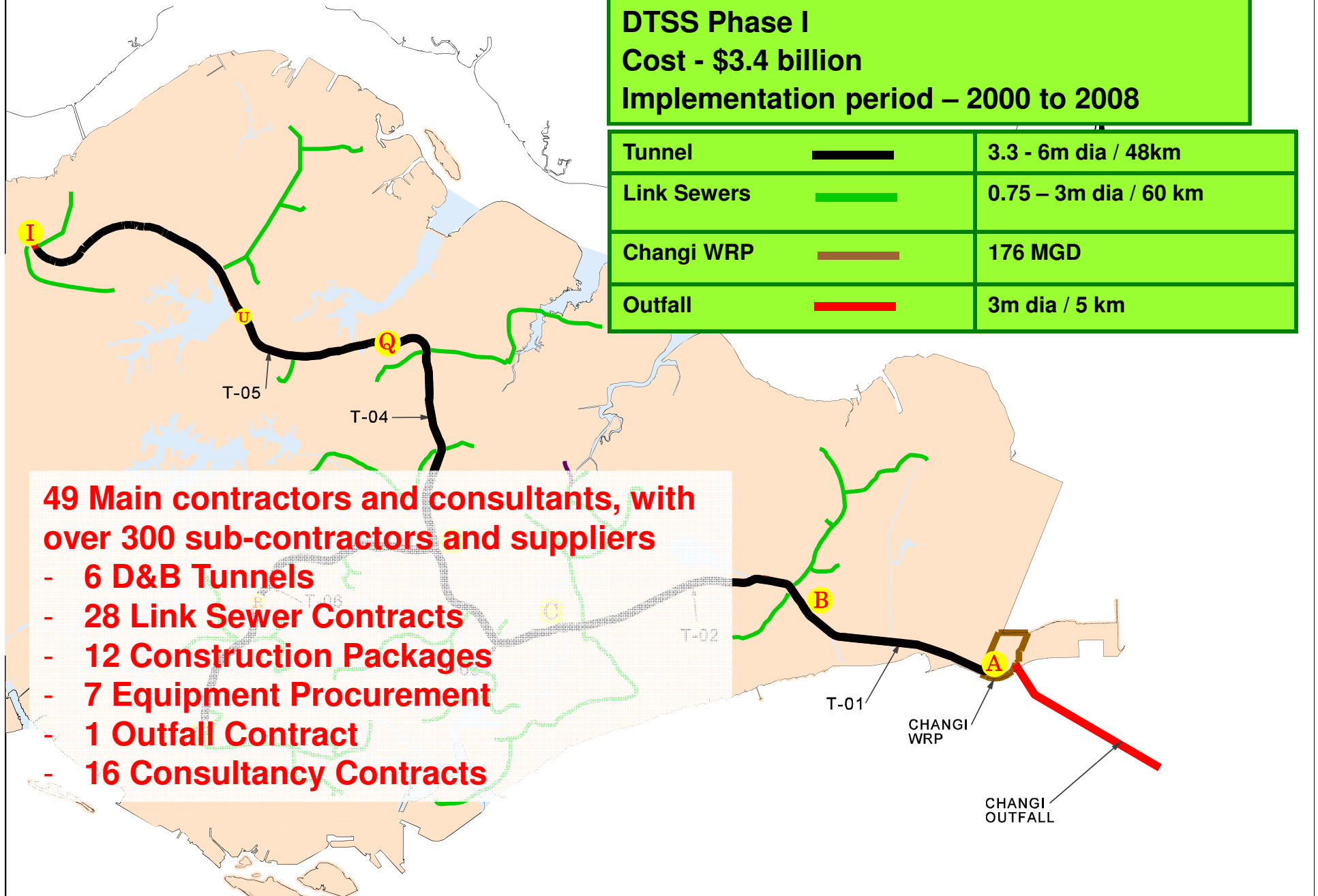
Cost - \$3.4 billion

Implementation period – 2000 to 2008

Tunnel		3.3 - 6m dia / 48km
Link Sewers		0.75 – 3m dia / 60 km
Changi WRP		176 MGD
Outfall		3m dia / 5 km

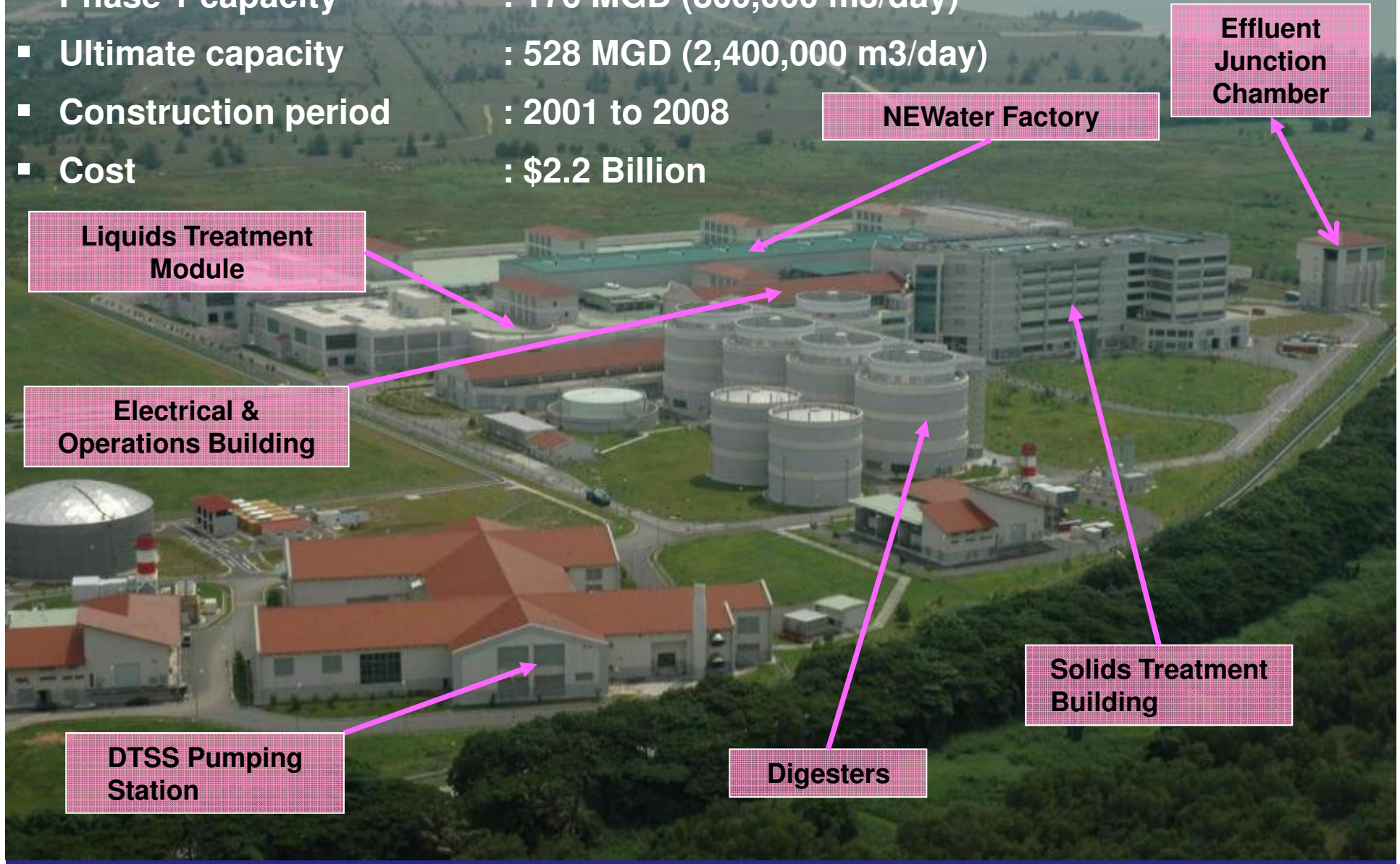
49 Main contractors and consultants, with over 300 sub-contractors and suppliers

- 6 D&B Tunnels
- 28 Link Sewer Contracts
- 12 Construction Packages
- 7 Equipment Procurement
- 1 Outfall Contract
- 16 Consultancy Contracts



Changi Water Reclamation Plant (CWRP)

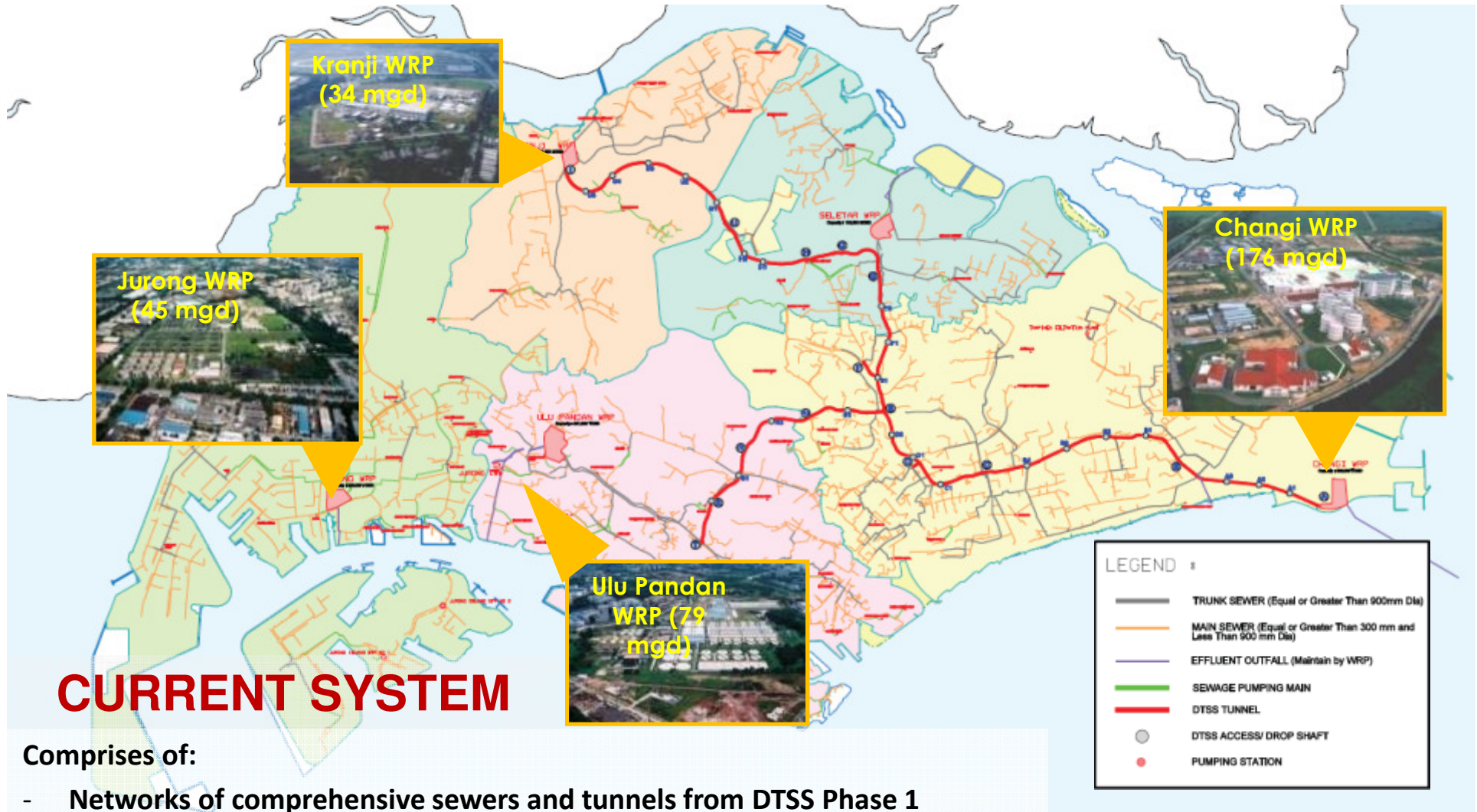
- Phase 1 capacity : 176 MGD (800,000 m³/day)
- Ultimate capacity : 528 MGD (2,400,000 m³/day)
- Construction period : 2001 to 2008
- Cost : \$2.2 Billion



Water for All: Conserve, Value, Enjoy

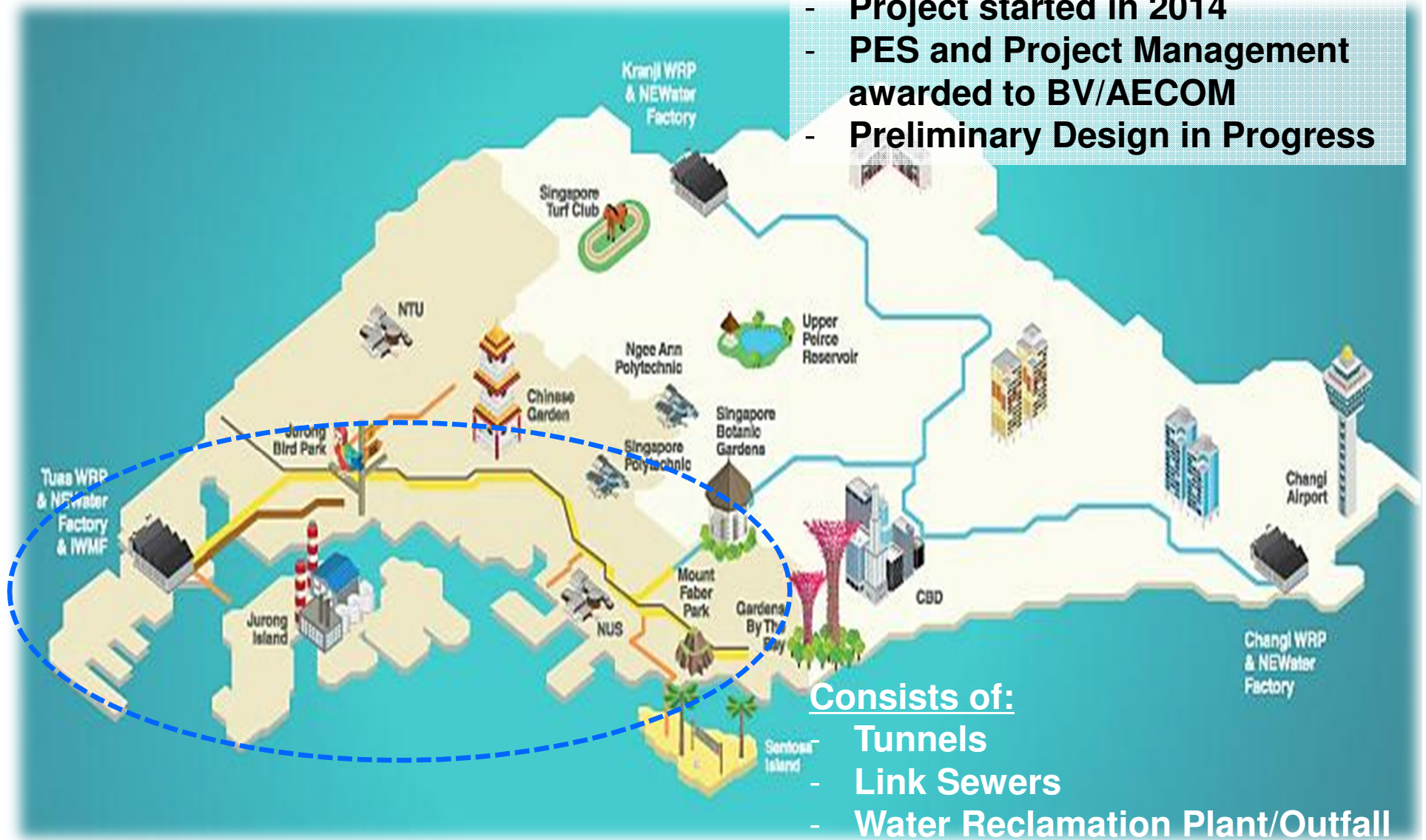


Current Used Water Infrastructure



DTSS Phase 2

- Project started in 2014
- PES and Project Management awarded to BV/AECOM
- Preliminary Design in Progress



Consists of:

- Tunnels
- Link Sewers
- Water Reclamation Plant/Outfall

Water for All: Conserve, Value, Enjoy



Deep Tunnel Sewerage System Phase 2 Project

Presentation to Singapore Water Association Networking Night

30 April 2015



Water for All: Conserve, Value, Enjoy



National
Environment
Agency

Safeguard · Nurture · Cherish

B&V  **AECOM**

A joint venture of Black & Veatch and AECOM

In association with 

AGENDA

- INTRODUCTION
- CONVEYANCE (LINK SEWERS AND TUNNELS)
- TUAS WATER RECLAMATION PLANT (TWRP)
- TIMELINE & DELIVERY APPROACH
- INTEGRATED WASTE MANAGEMENT FACILITY (IWMF)

INTRODUCTION

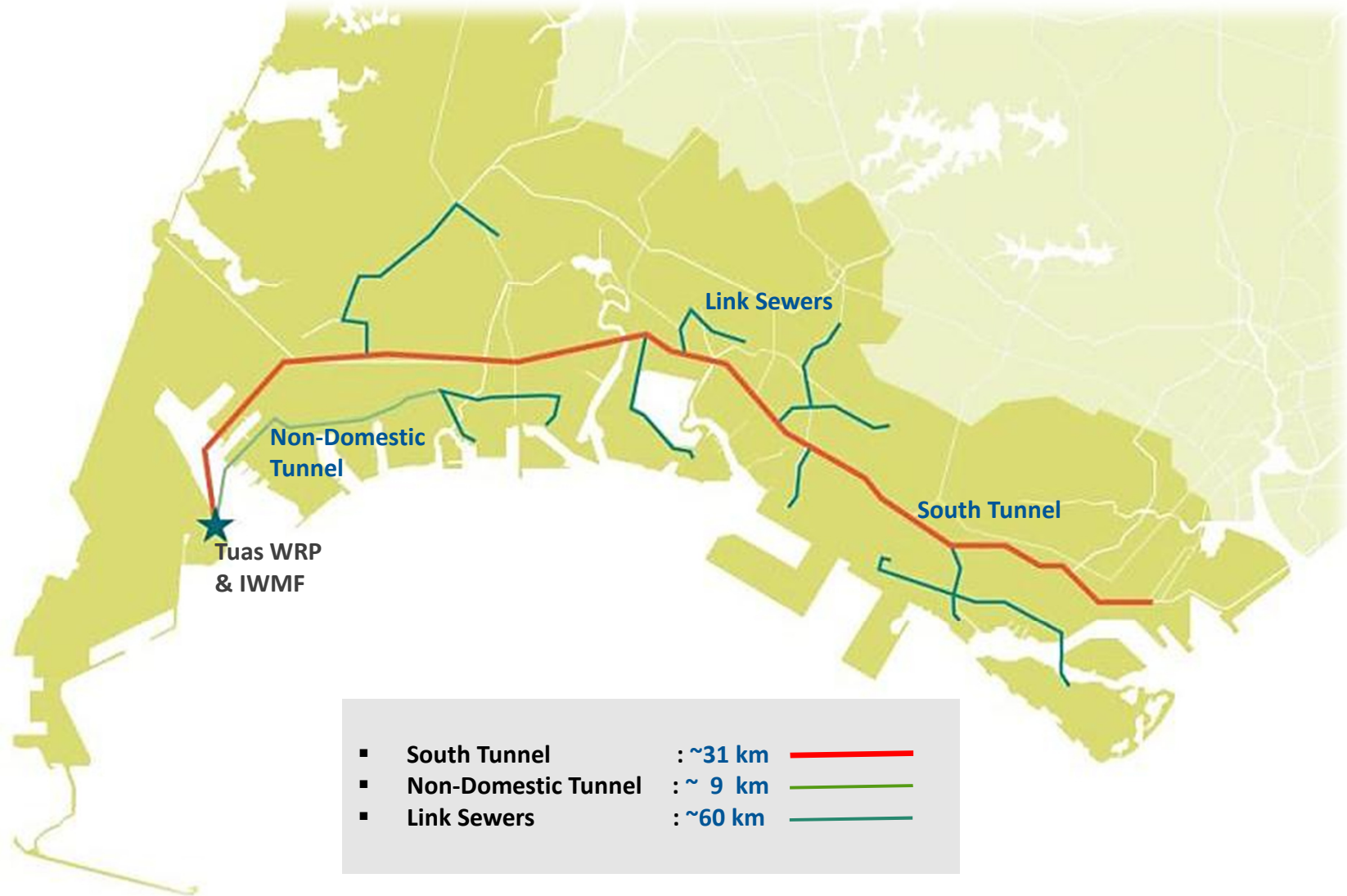
Scope of Professional Engineering Services by B&V+AECOM JV

- Project commenced in April 2014
- Feasibility Study (9 months) – Part A1 (complete)
- Preliminary Design (21 months) – Part A2 (in progress, complete in January 2016)
 - Link Sewers
 - Tunnels
 - Tuas WRP and Outfall
- Engineering Services for the IWMF
- Program Management (Part B) for:
 - TBM tunnelling works to be executed under D&B contracts
 - Detailed design of Link Sewers Tuas WRP and Outfall
 - Construction of Link Sewers Tuas WRP and Outfall



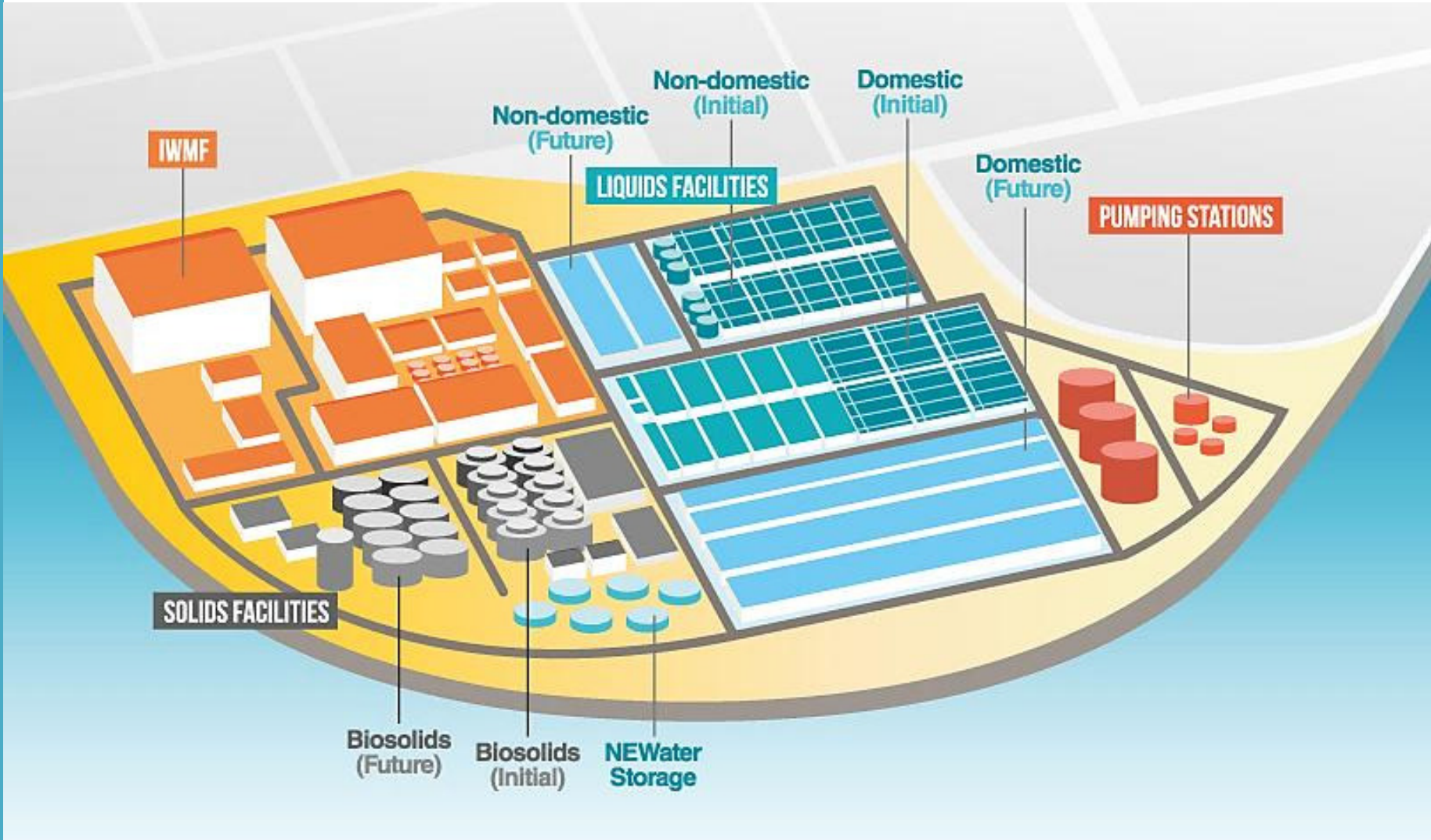
CONVEYANCE (LINK SEWERS AND TUNNELS)

Link Sewers and Tunnels

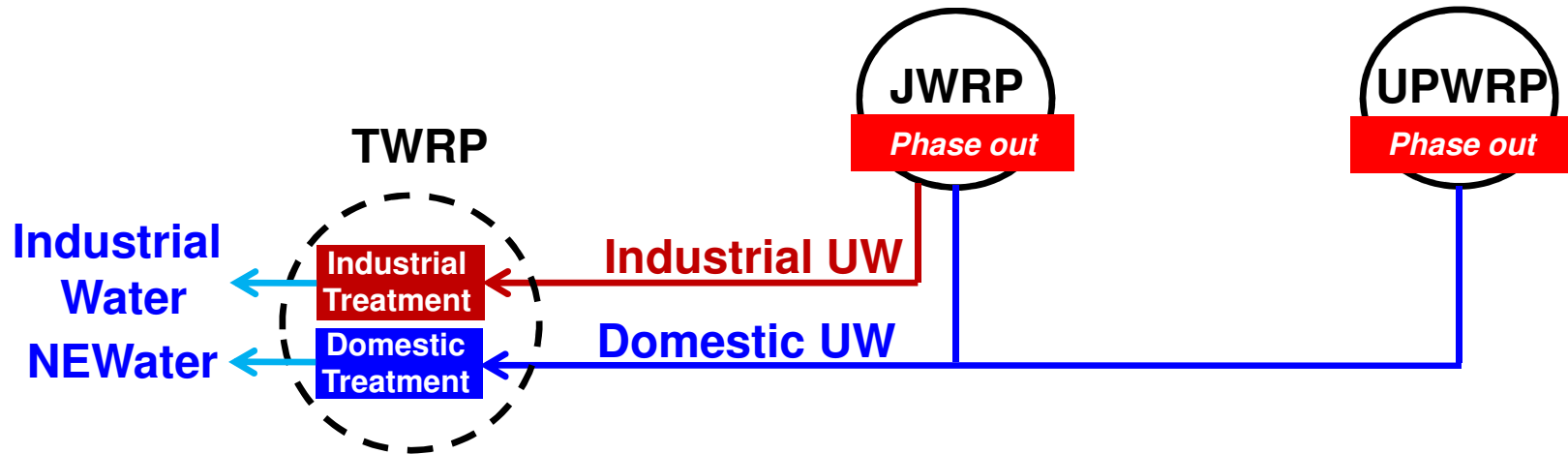


TUAS WATER RECLAMATION PLANT (TWRP)

Tuas Water Reclamation Plant (TWRP)



Tuas Water Reclamation Plant

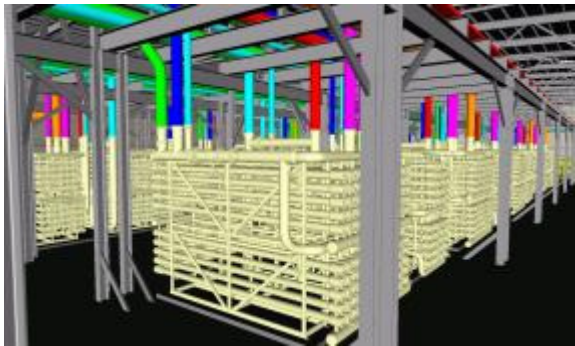


- Unlike CWRP, TWRP will treat 2 used water streams, which are conveyed separately.
 - TWRP's initial treatment capacity
 - **Used Water Treatment: 176 MGD (800,000 m³/day)**
 - ❑ *Domestic Module: 143 MGD (650,000 m³/day)*
 - ❑ *Industrial Module: 33 MGD (150,000 m³/day)*
- & NEWater Treatment**



Tuas Water Reclamation Plant

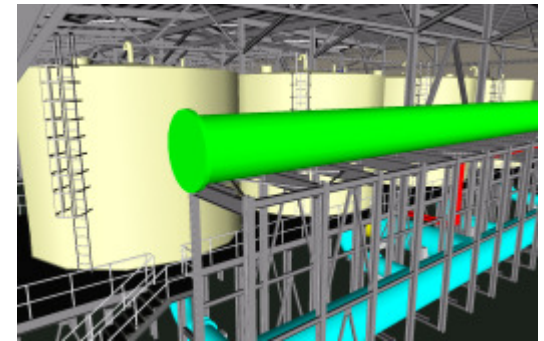
Advanced treatment plant that will be robust and reliable, energy efficient, space efficient and will require less manpower to operate and maintain



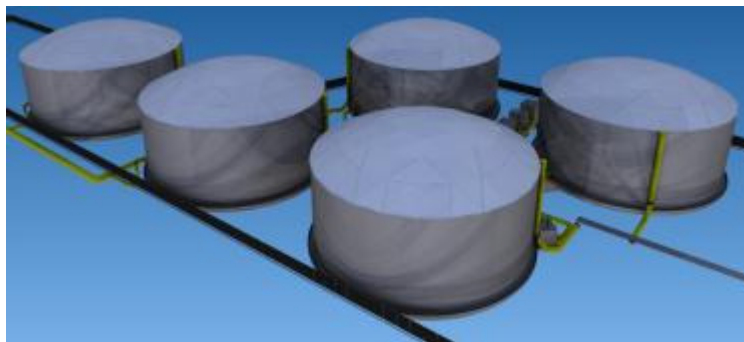
MBR direct to RO for NEWater (No MF/UF Stage)



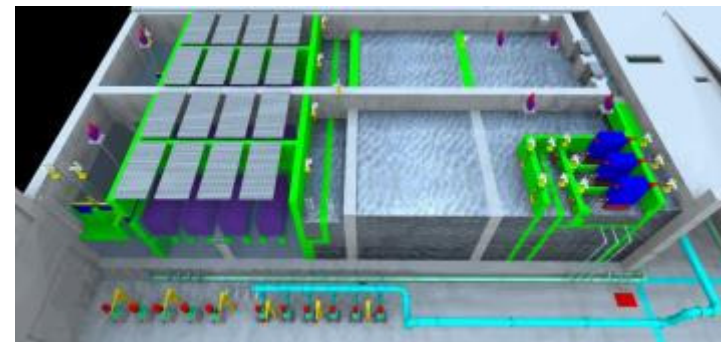
Separate Domestic and Industrial Treatment Streams



Energy Efficient Technologies



Maximise NEWater recovery



Wet Weather Sidestream Treatment



Tuas Water Reclamation Plant

Technologies are being tested and proven in Singapore

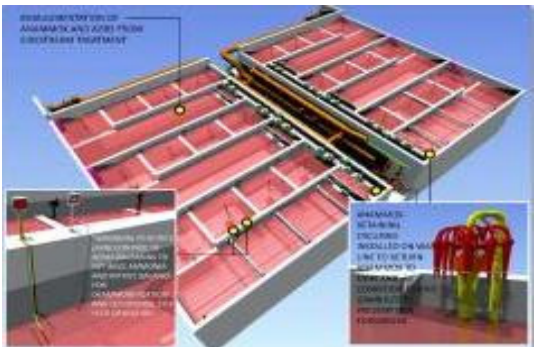
DTSS PHASE 2 PROJECT



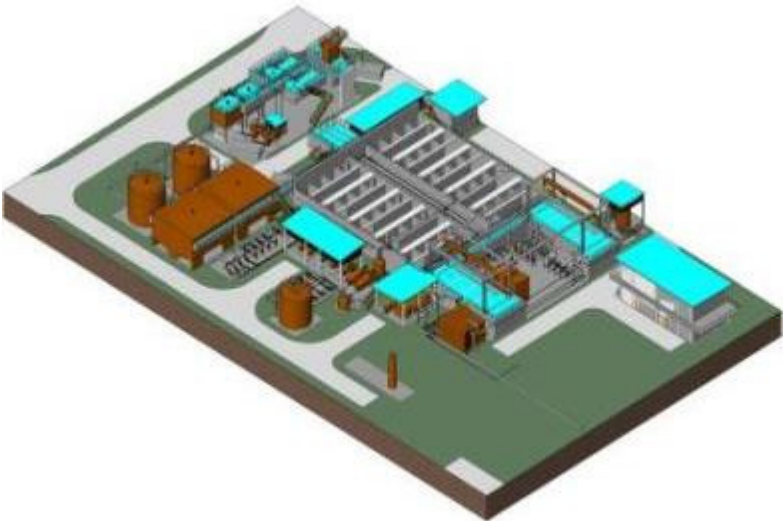
Piloting Bio-EPT @ UPWRP



UASB Demo Plant @JWRP



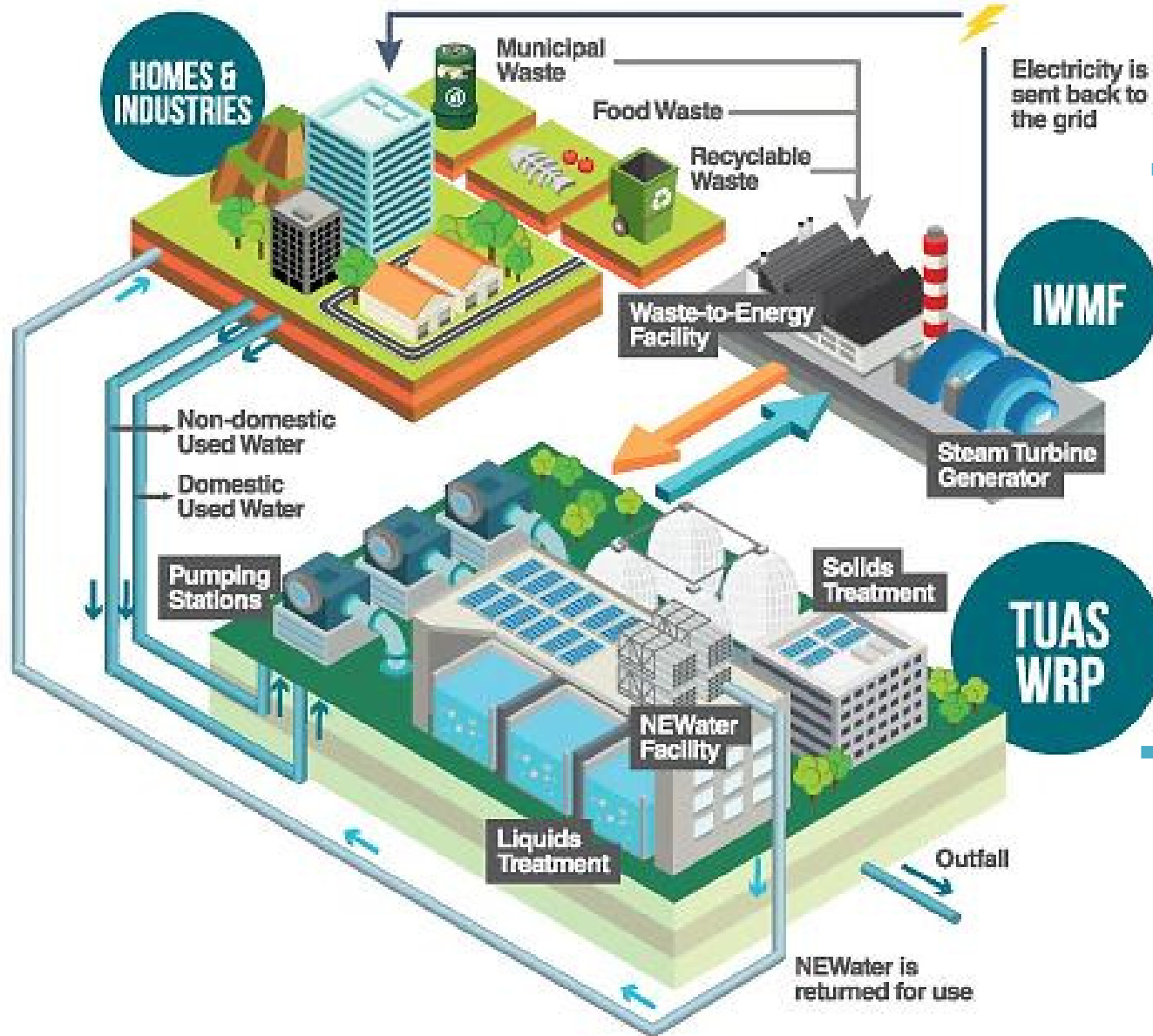
Piloting Food Waste and Sludge Co-Digestion @ UPWRP



Demo Scale @UPWRP



Co-location of TWRP and IWMF - Overview



- IWMF receives & treats municipal solid waste, food waste, NRP recyclables and dewatered sludge, producing electricity, heat, ash, used water and recyclables.

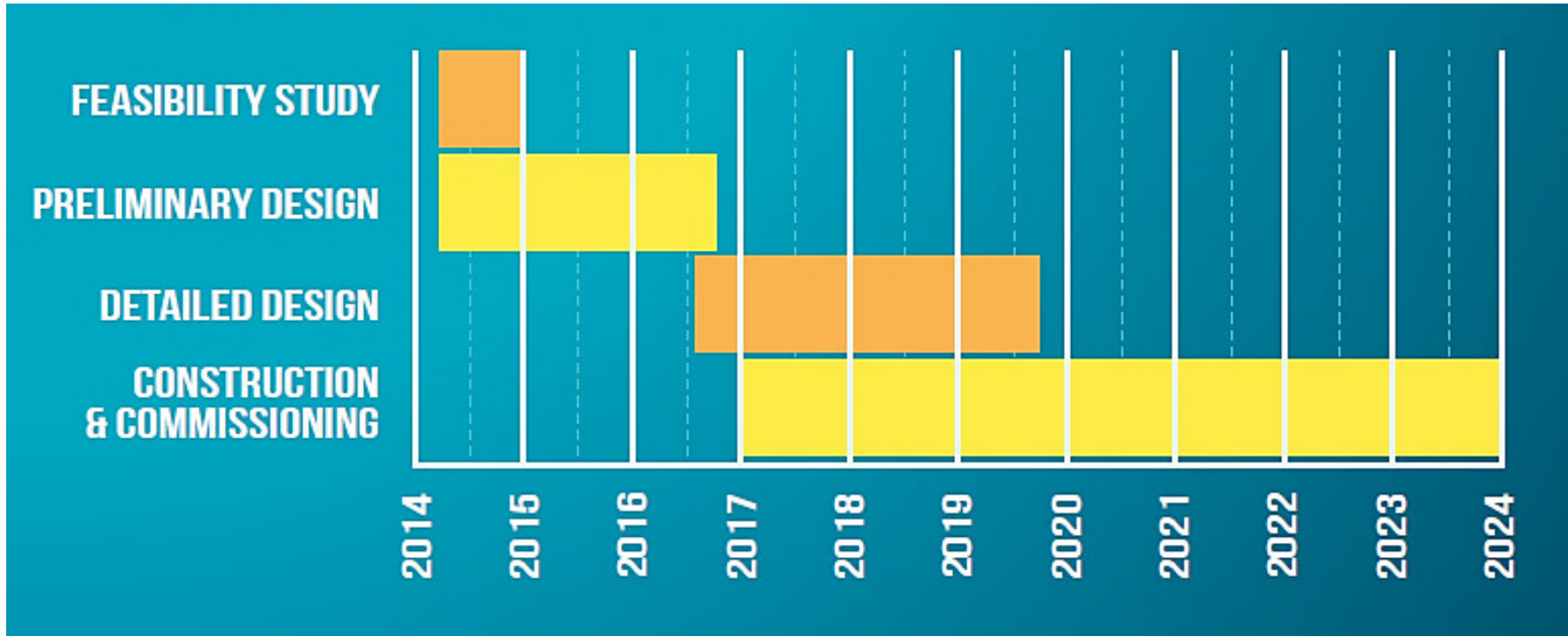
- TWRP receives & treats used water; producing biogas, sludge & water



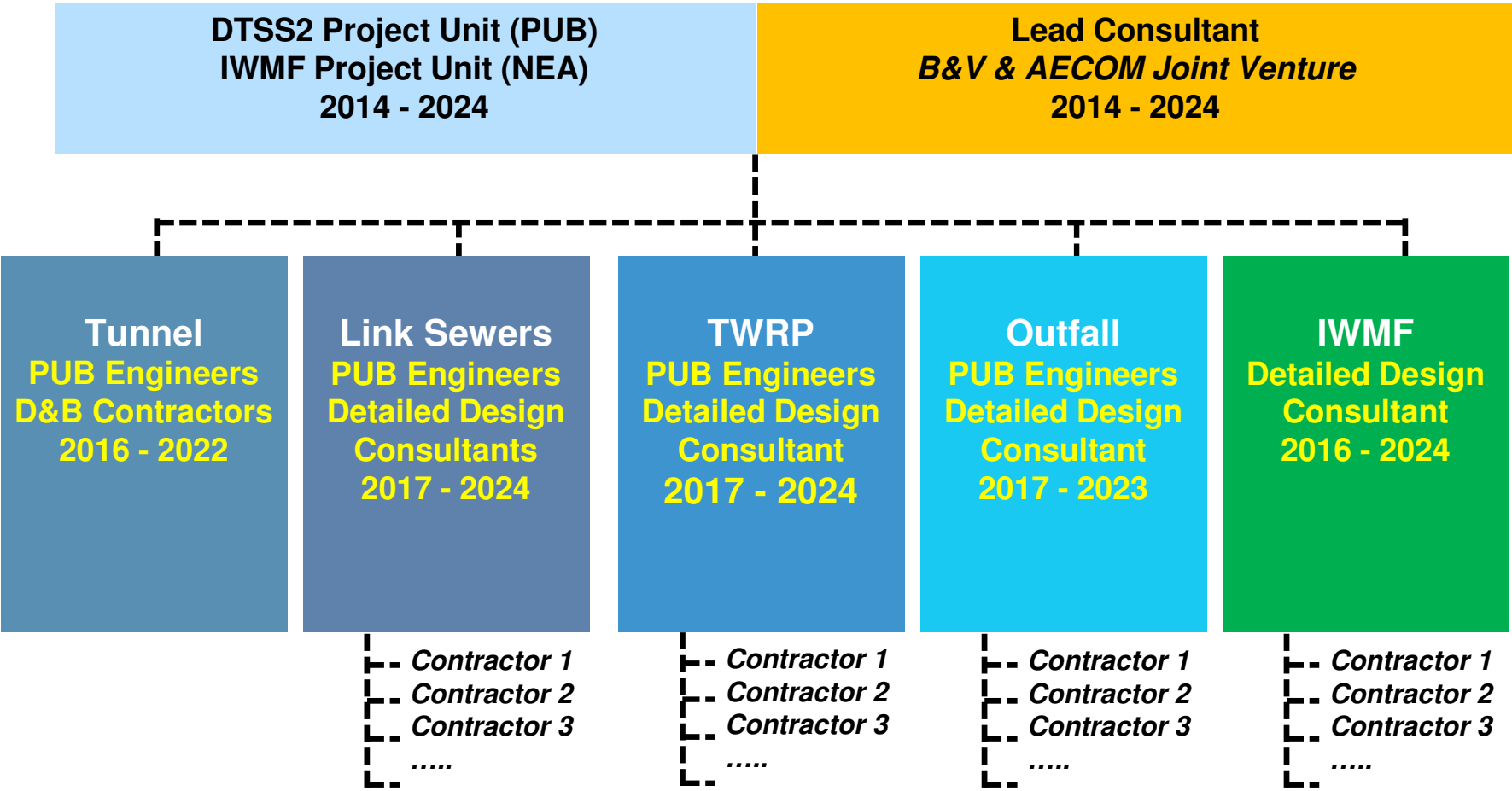
TIMELINE & DELIVERY APPROACH

DTSS Phase 2 Timeline

DTSS PHASE 2 PROJECT



Delivery Approach for DTSS Phase 2 and IWMF



INTEGRATED WASTE MANAGEMENT FACILITY

Key Drivers of IWWMF



Maximise Resource & Energy Recovery



Minimise Environmental Impact



Optimise IWWMF-TWRP Co-location Synergies & Land Footprint



Keep Waste Disposal Cost Affordable



Optimise Waste Management System Resilience



Develop a World-Class Solid Waste Treatment Facility

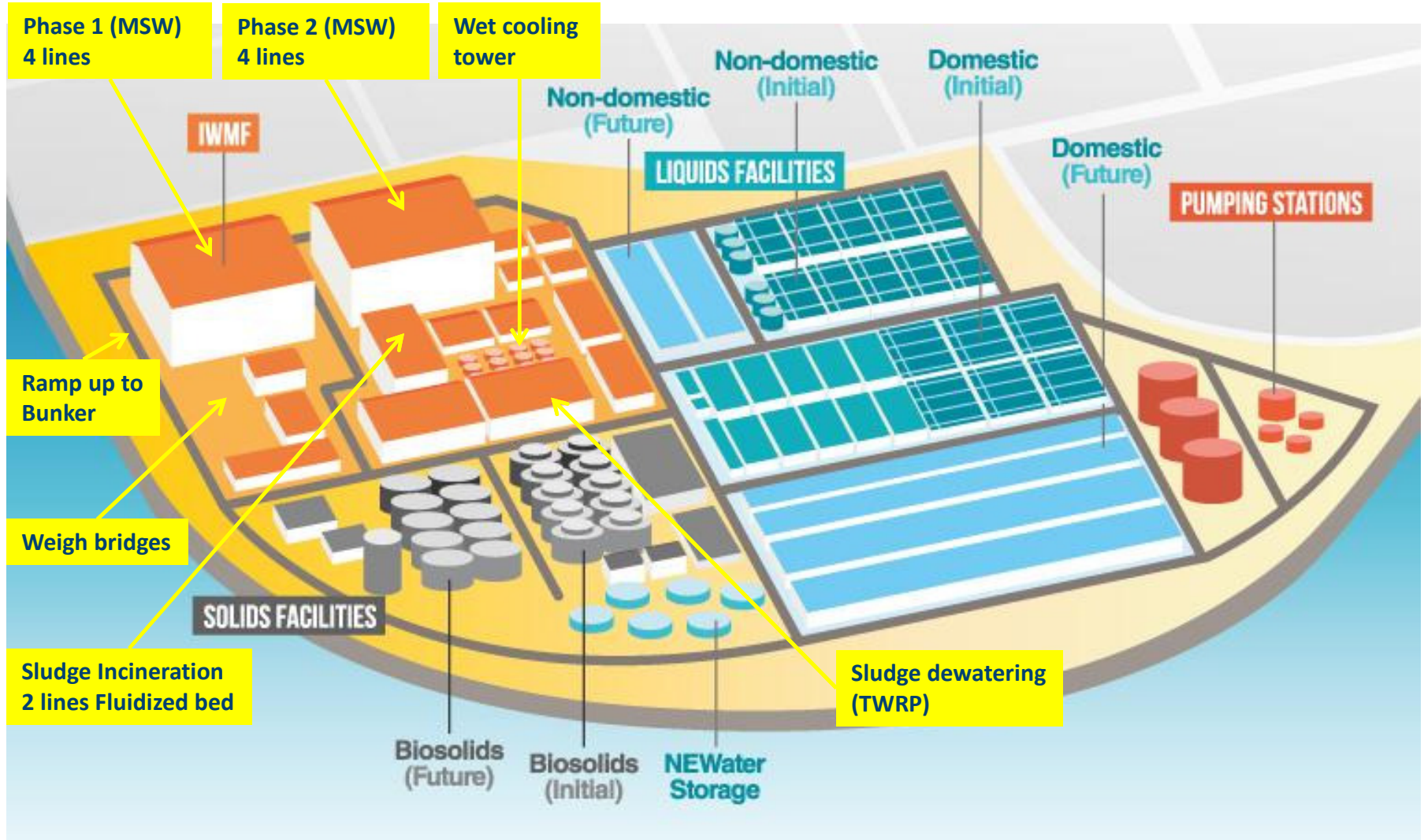


Scope and Approach

- Ramboll are sub-consultants to B&V + AECOM JV
- Detailed layout plan of the IWMMF
- Systems and Processes within the IWMMF
- Evaluation of technologies and optimal capacity
 - Incineration technology selection and no./capacity of lines
 - Flue gas cleaning and turbine cooling
 - Incineration Bottom Ash (IBA) and Incineration Fly Ash (IFA)
 - Source Segregated Food Waste (SSFW) and Source Sorted Recyclable Waste (SSRW)
 - Drying and Incineration of Sludge (co-incineration and/or fluidised bed)
- Financial and administrative arrangements



IMWF and TWRP – Overall site concept





THANK YOU