

Enhancing Construction Safety via a **Safety Digital Twin** - Centralized Management Platform

Contract No. DC/2018/03

Expansion of Sha Tau Kok Sewage Treatment Works Phase 1 and
Village Sewerage in Tong To

Presented by

Ms. Carol HO Ka-ye, Chief Engineer/Consultants Management, Drainage Services Department





Agenda

Background

Development of Safety Digital Twin

Continuous Development Roadmap

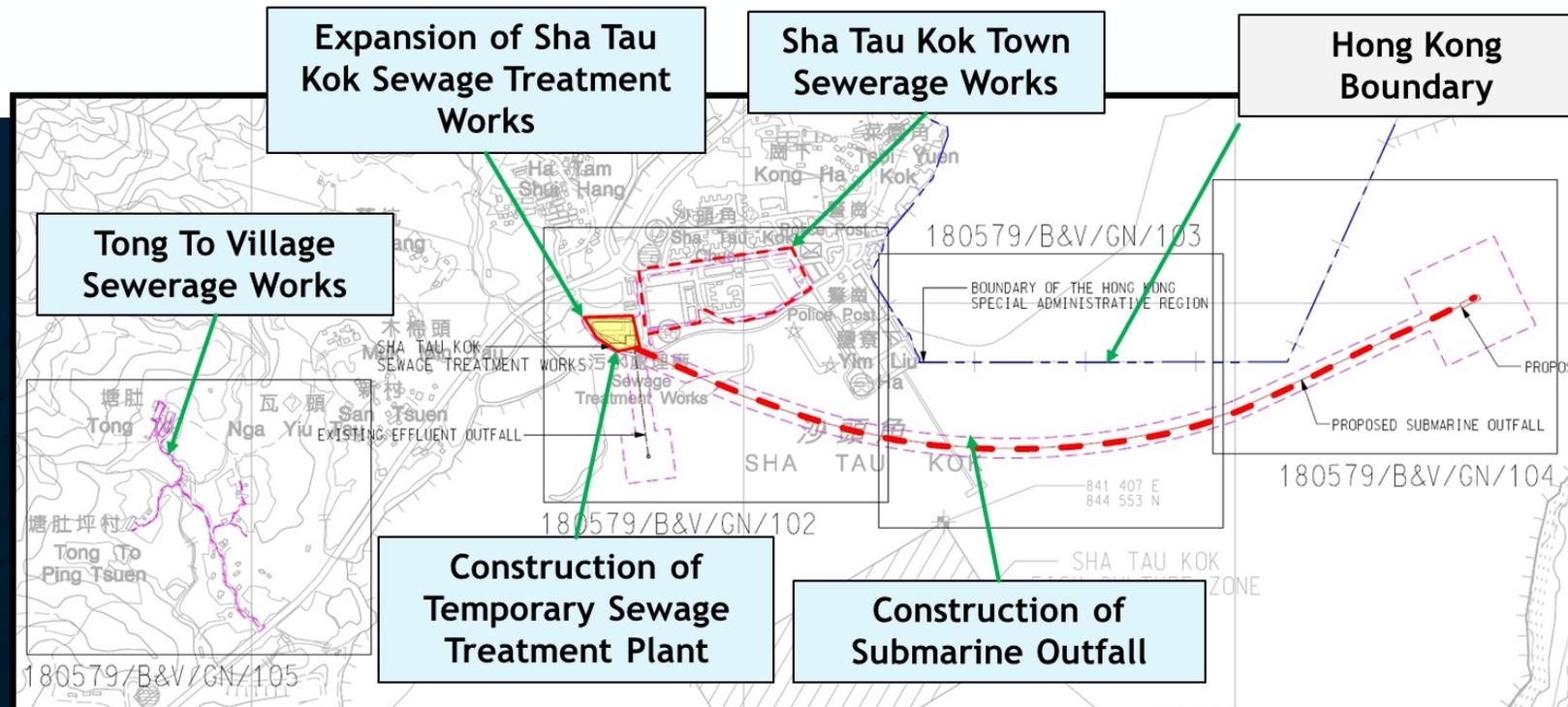
DSD Commitment for Safety



Background Contract



Existing Sha Tau Kok Sewage Treatment Works



DC/2018/03	Expansion of Sha Tau Kok Sewage Treatment Works Phase 1 and Village Sewerage in Tong To
Employer	Drainage Services Department
Consultants	Binnies Hong Kong Limited
Contractor	Build King – Kum Shing Joint Venture
Forecast Tendered total of the Prices	\$1,123 Million
Starting Date	21 November 2018
Anticipated Completion Date	Q1 2025
NEC3 Option	ECC Option C



Future Sha Tau Kok Sewage Treatment Works



Background Project Highlights

Multi-disciplinary

- Civil Works
 - Foundation, ELS, Structures, Roads and Drainage, Sewers, Outfall
- E&M Works
 - Treatment equipment, building services



Multi-stage

- Design, construction, operation and demolition of temporary plant
- Construction of new plant during operation of temporary plant



Construction 2.0

- BIM
- Digital Works Supervision System (DWSS)
- Sensory technologies
- Artificial Intelligence
- Common Data Environment





Background Construction 2.0 Technology Adoption



Jan 19
R&D &
Implementation of
DWSS Mobile
Application

Contract
Commencement

Nov 18

Mar 19
Construction of
MiC Site Office



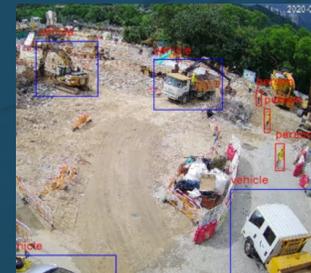
Dec 19
Adoption of
Survey Sensor

Aug 19
Trial Adoption of
Smart Helmet



Oct 20
Adoption of
Smart Helmet 2.0

Jul - Aug 20
Adoption of AI Video Analytic &
VR for Safety Training



Nov 20
Launching of Centralized
Management Platform



2021
Continuous
Enhancement of
CMP with Digital
Twin Technologies



Development of Safety Digital Twin Construction 2.0 Technology Adoption

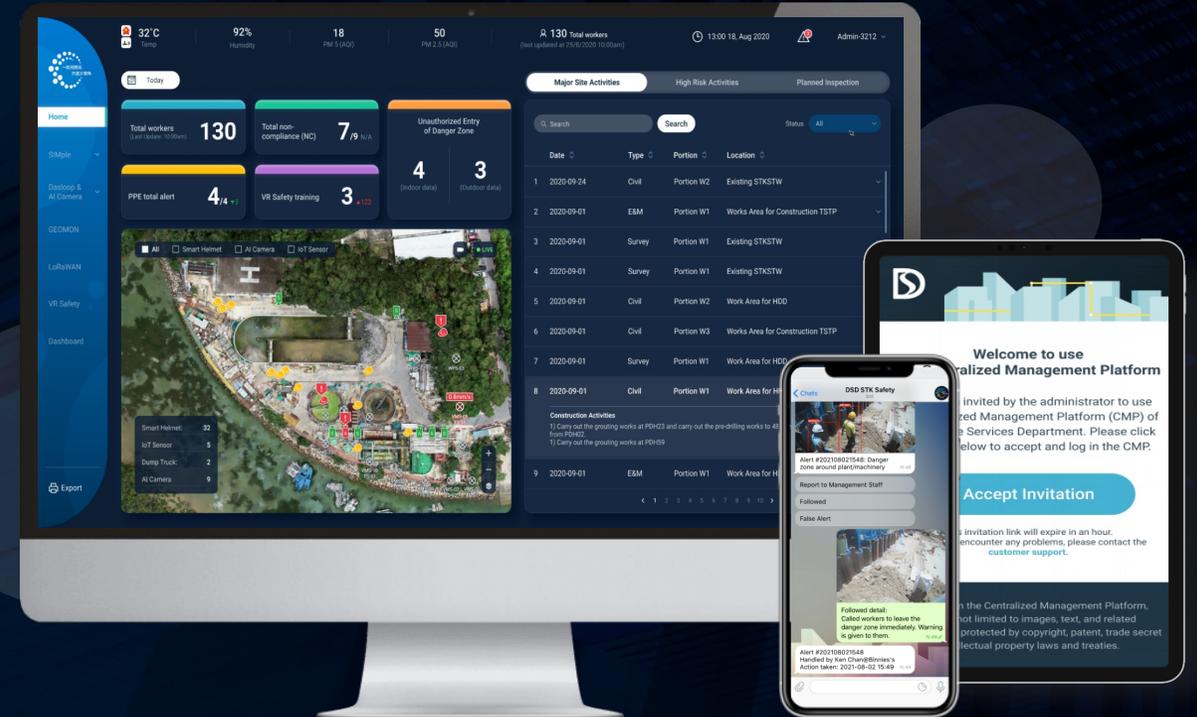
Opportunity

Vast & various data

Multiple sensors & systems for real-time monitoring

Solution

Safety Digital Twin –
Centralized Management Platform

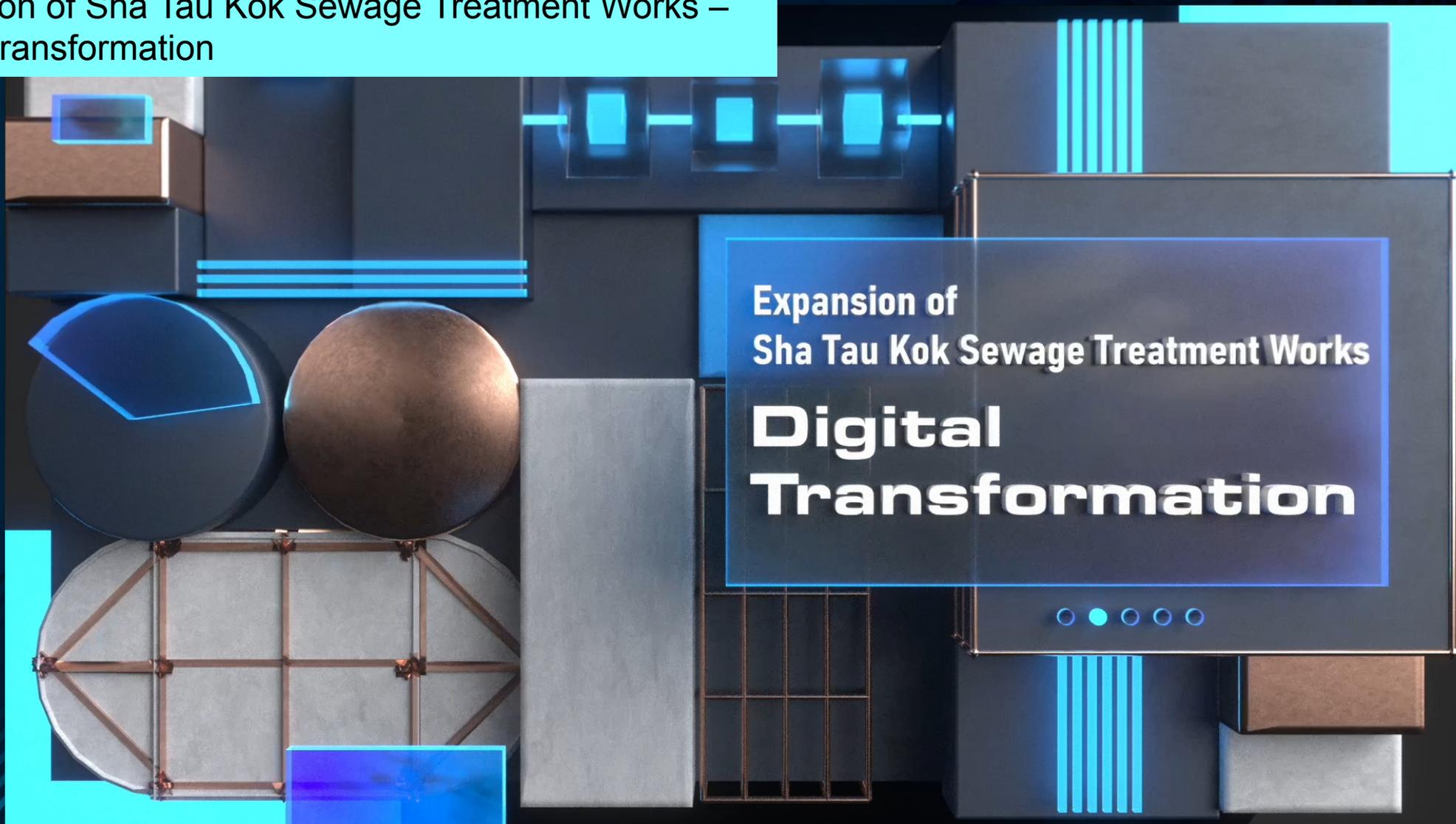


Accessible Anywhere & Anytime



Development of Safety Digital Twin Construction 2.0 Technology Adoption

Expansion of Sha Tau Kok Sewage Treatment Works –
Digital Transformation





Safety Digital Twin - Centralized Management Platform

A Single Source of Truth Connecting the Physical & Digital World

CENTRALIZED MANAGEMENT PLATFORM



Actualize Safety Digital Twin

Achieved Single Source of Truth

CENTRALIZED MANAGEMENT PLATFORM



Data Analysis

Better Decision Making to Physical World



Predictive Alert

Follow-up Action





Safety Digital Twin - Centralized Management Platform

Critical Application: Instant Monitoring & Preventive Alerts for Confined Space Works

Confined Space Modules under CMP: DWSS x BIM x Smart Helmets x Sensors



Processing
permit-to-works
through DWSS

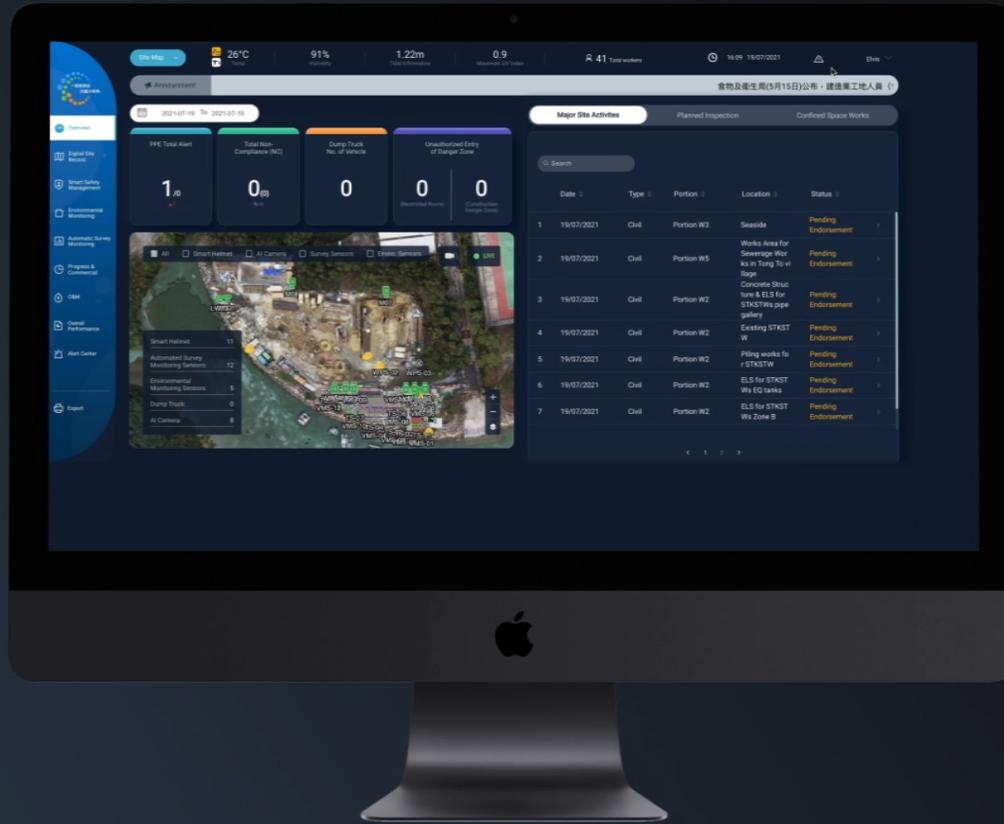
- Digitalised workflow for confined space operation with DWSS for authorisation and checking
- Enhanced monitoring and supervision with application of safety helmets & sensors



Safety Digital Twin - Centralized Management Platform

Critical Application: Instant Alert Handling by Chatbot

Safety Alert Handling: Alert Centre x Chatbot



- Instant alert handling everywhere, every site personnel
- Immediate reporting and data reflection in alert centre on CMP
- Data collection and analysis for continuous improvement



Safety Digital Twin - Centralized Management Platform

Risk Anticipation and Visualization with the Use of BIM

Enhanced Collaboration and Risk Anticipation:
4D BIM x Reality Model x Construction Sequence Simulation

Timeline across Project Life Cycle



Reality Model vs BIM



Construction Sequence Simulation



Continuous Development Roadmap

Data Driven Decision Making & Predictive Analysis

Example: Predictive insight of workers' health by Smart Helmet & AI CCTV

The dashboard displays a live aerial view of a construction site. On the left, there are four alert cards: '14/28 Worker status', '13 Smart helmet alert', '2 AI Camera alert', and '1 Dump truck'. A central pop-up window shows a 'Standstill Detected' alert for worker 'Cheung Wai Ho' (Surveyor, Staff ID: 085749-12, Company: ISP Ltd., Location: Site Office). Below the alert is a 'Permitted to enter confined space' button. An inset window shows a live AI CCTV feed of the worker, with a red circle highlighting an abnormal situation on the ground. The dashboard also includes navigation tabs for 'Projects / Site Map / STK', 'Site Map', 'Construction (New STW)', 'Operation (TSTP)', and a temperature indicator of 32°C. The main view has tabs for 'SIMple', 'CEMAR', 'Dasloop', 'Converge', 'GEOMON', 'DMS', 'Sewage Treatment', and 'Dashboard'.

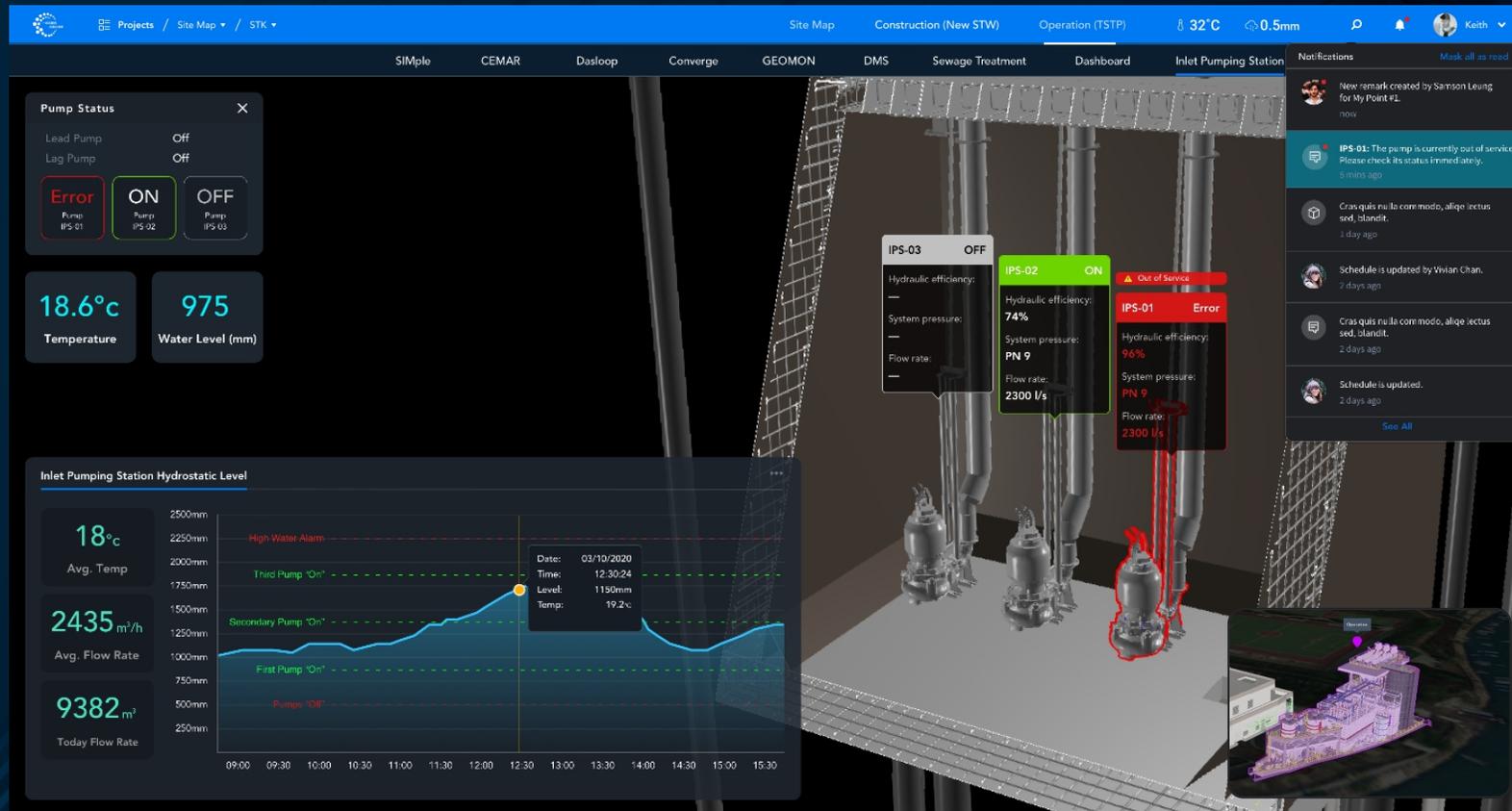
- Instant alert for workers' condition from Smart Helmet
- Livestream of AI CCTV targeting at the worker with abnormal situation
- More comprehensive analysis



Continuous Development Roadmap

Data Driven Decision Making & Predictive Analysis

Example: Application for More Efficient FM & AM



- Predictive insight with data from HKO (e.g. storm surge)
- Instant alert for invert water level (e.g. overflow)
- Prompt response to manipulate the plant operation
- Consistent information across all levels



Construction 2.0 Pilot Project for DSD

Project Based Platform Contributing to the Departmental Centralized Platform

Vision of the Future – Building a Departmental Centralized Platform

DSD SEWAGE TREATMENT WORKS
Projects / Site Map ▾

 Personal Summary Member Management 32°C 0.5mm Project Team ▾

View
Site Map
Site List

Site Overview

Water Quality

TSS
2
TSS (mg/L)
Last Update: 2020/12/01 13:30

NH₃⁺
7
Ammonium (mg/L)
Last Update: 2020/12/01 13:30

NO₃⁻
-
Nitrate (mg/L)

pH
3
pH (digits)
Last Update: 2020/12/01 13:30

TP
-
Total Phosphorus (mg/L)
Last Update: 2020/12/01 13:30

Effluent Flow

450m³/h
Current Effluent FLOW
Last Update: 2020/12/01 13:30

Total Power Consumption

123443kWh
Total Power
Last Update: 2020/12/01 13:30

Inlet Water Level

3.9m
Total Level
Last Update: 2020/12/01 13:30

Progress of Works

83.5%
Time Elapsed

68.8%
Weighted Grand Total

Financial Status

\$688.21M
Tendered Total of the Prices

\$1,122.41M
Forecast Tendered Total of the Price

\$131.66M/7.31%
Value of Compensation Events Implemented

\$135M
Shared Gain / Pain

Sections (0/5)

Work Period: 2020/11/01 - 2021/01/30

100%
Time Elapsed

50%
Preliminary Works

Work Period: 2020/11/01 - 2021/01/30

100%
Time Elapsed

50%
Temporary Sewage Treatment Plant

Work Period: 2020/11/01 - 2021/01/30

68%
Time Elapsed

50%
Expansion of Sha Tau Kok Sewage Treatment Works



DSD Commitment for Safety

Enhanced Safety by Innovative Robotic Application

Tunnel Monitoring Robot for Construction



Tunnel Monitoring Robot
“岩洞探哥”



- Make good use of 5G transmission technology
- One machine, multiple-purpose
- Accurate blasting profile with point cloud technology
- **Real time air quality readings to safeguard workers' safety**



DSD Commitment for Safety

Enhanced Safety by Innovative Robotic Application

Desilting Robots for Operation

The Big Bull
“大鐵牛”



Lung Mun Robot No. 1
“龍門一號”



The Mini Bull
“小鐵牛”

- Robots for different working environments (low visibility, confined space... etc.)
- **No man entry required and minimised confined space operations**
- High efficiency with enhanced safety

Together We Create a SAFER, SMARTER & MORE SUSTAINABLE Construction Practice with Digitalization

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- Centralized Management Platform

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