



渠務署

Drainage Services Department





Shek Wu Hui Effluent Polishing Plant, Hong Kong





Shek Wu Hui Effluent Polishing Plant, Hong Kong





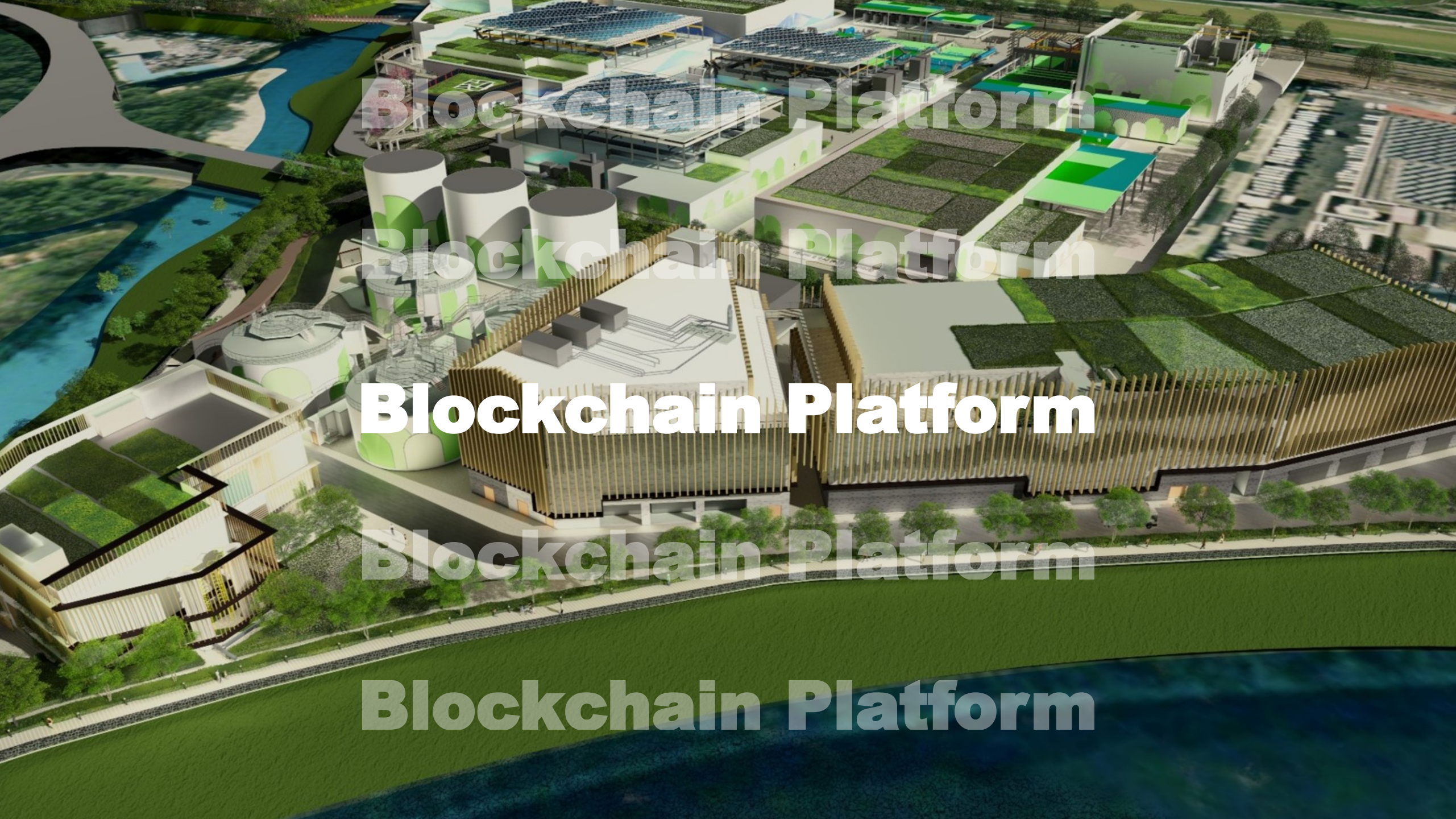
Shek Wu Hui Effluent Polishing Plant, Hong Kong





**Blockchain Platform**





Blockchain Platform

Blockchain Platform

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A background network diagram consisting of a complex web of thin, light blue lines connecting various circular nodes. The nodes are of varying sizes and are scattered across the light blue background, creating a sense of interconnectedness and data flow.

**Blockchain Platform**

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# 2023

# Blockchain Platform

## For Construction Workflow Collaboration

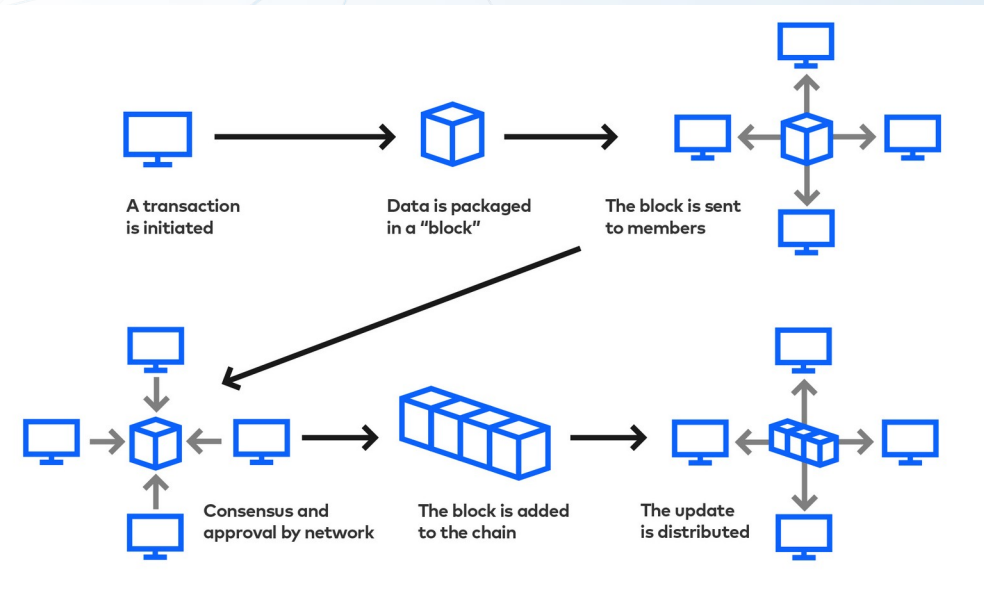
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# What is **Blockchain** ?

A Blockchain is a distributed database or ledger that is shared among the nodes of a computer network and collects information together in groups, known as **blocks**, that hold sets of information.

Blocks have certain storage capacities and, when filled, are closed and linked to the previously filled block, forming a chain of data known as the **Blockchain**. Each block contains a hash, hash of the previous block, a timestamp, and transaction data.





# What is **Blockchain** ?

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Block -> Chain

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Open

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Ledger

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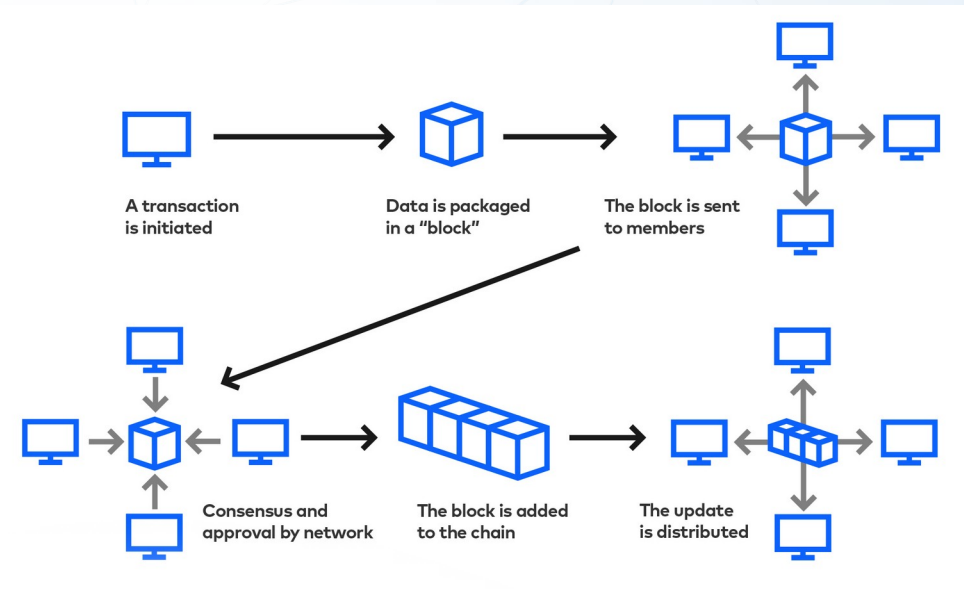
Peer-to-Peer Network

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Decentralised

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Consensus





# Storing Data & Documents

## Metadata as text on Blockchain

## Documents as files on Inter-Planetary File System (IPFS)

- Every file added to IPFS is given a unique address derived from a hash of the file's content. This address is called a Content Identifier (CID) and it combines the hash of the file and a unique identifier for the hash algorithm used into a single string.
- If a document content is modified, the original CID will no longer be valid. The original CID stored on the Blockchain will not point to a valid document. In other words, if a CID on Blockchain can return a document, the document is proof to be the original.





# Benefits of Blockchain

## Shared & Distributed

Blockchain technology offers a shared and distributed ledger that is open for all users

## Increase Network Capacity

Much more capable than the traditional network

## Immutable

The transaction cannot be undone if already on the Blockchain

## Faster Settlement

Way faster than manual process of validation

## Decentralised

Not dependable on server based technology and no one has authority over the system

## More Secured

More secured than the traditional methods





# Problems in Construction Industry

## Poor Traceability

- Numerous workflows and paper forms
- Difficult to “traceroute” the accountability
- Easy to lose the file
- Hard to search for information

## Poor Data Management

- Many stakeholders e.g., client, design consultants, supervising officers, main contractor, sub-contractors, suppliers and maintenance authorities
- Construction supervision in discrete processes
- Lack of a common data management platform





# Problems in Construction Industry

## Every stakeholder has their own system and dataset

- Single point of failure
- Data Integrity
- Lack of data transparency

## Every contract has its own system policy and data format

Lack of common data standard for communication and collaboration





# Blockchain in Construction Industry

## Digital Transformation for High Productivity

Published the ICE report in December 2018 to explore Blockchain application in construction industry

## Potential Application Areas

- Smart Contracts
- Project Collaboration
- Procurement
- Supply Chain Management
- Smart Asset Management





# SWHEPP Blockchain Project Background

- First innovative project applying Blockchain technology to construction site for operation monitoring in Hong Kong
- Taking the Shek Wu Hui Effluent Polishing Plant (SWHEPP) project as a pilot
- Phase 1 commenced in June 2020 - Collaboration with HKU, UST and CityU for more in-depth study and research on the science behind Blockchain and its application to digital construction workflow
- Phase 2 commenced in April 2021 - Under the support of DSD, AECOM and Chun Wo partnered up to further develop the Blockchain Platform for 4 Contracts to be used in SWHEPP





# Features of SWHEPP Blockchain Platform

## Data Traceability

Process data from different contracts like Request for Inspection & Survey Check (RISC) forms can be **traced for inquiry and inspection at any time**, also **prohibited from amendment and deletion**.

## Workflow Collaboration

Information in different systems like Digital Works Supervision System (DWSS) can be exchanged via Blockchain Standard **Application Programming Interface (API)**, systems become connected and multidimensional.

## File System Performance

By using peer-to-peer solution (IPFS) enabling users to access and share files without relying on centralised server, it can transfer 71.6% faster than traditional client-server approach in large size file transmission.





# Features of SWHEPP Blockchain Platform

## Data Transparency

Process data includes raw data, history, documents, key person, related parties on the Blockchain can be viewed by all the stakeholders in a more transparent and trustable way.

## High Scalability

The Blockchain application and approach can be applied in other DSD projects or even other construction projects.

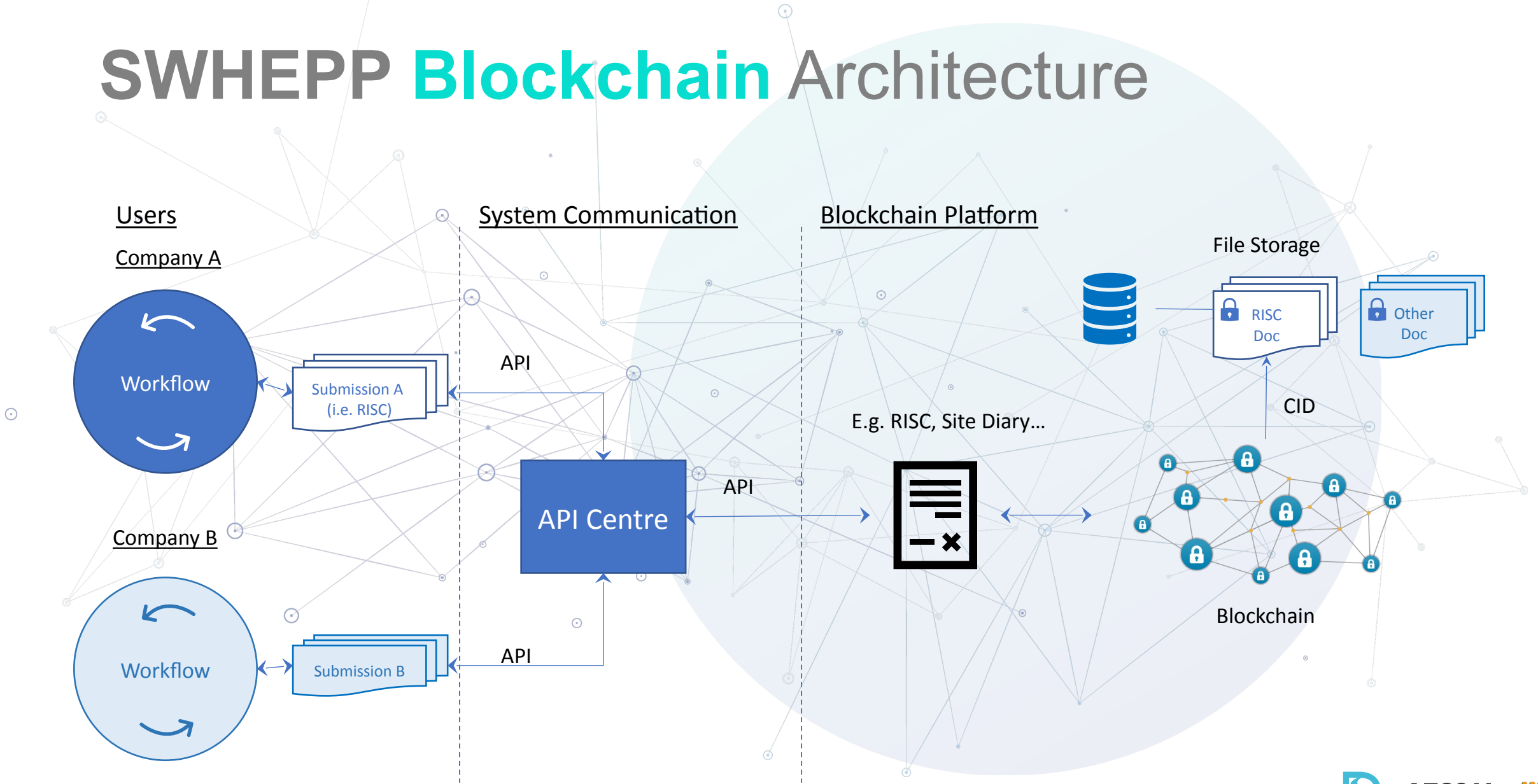
## A Centralised Platform

A centralised Blockchain Platform with distributed private infrastructure is provided to stakeholders to view the Blockchain data according to their permissions and roles in the Blockchain. The Blockchain Platform is able to consolidate different data sources for different contracts.



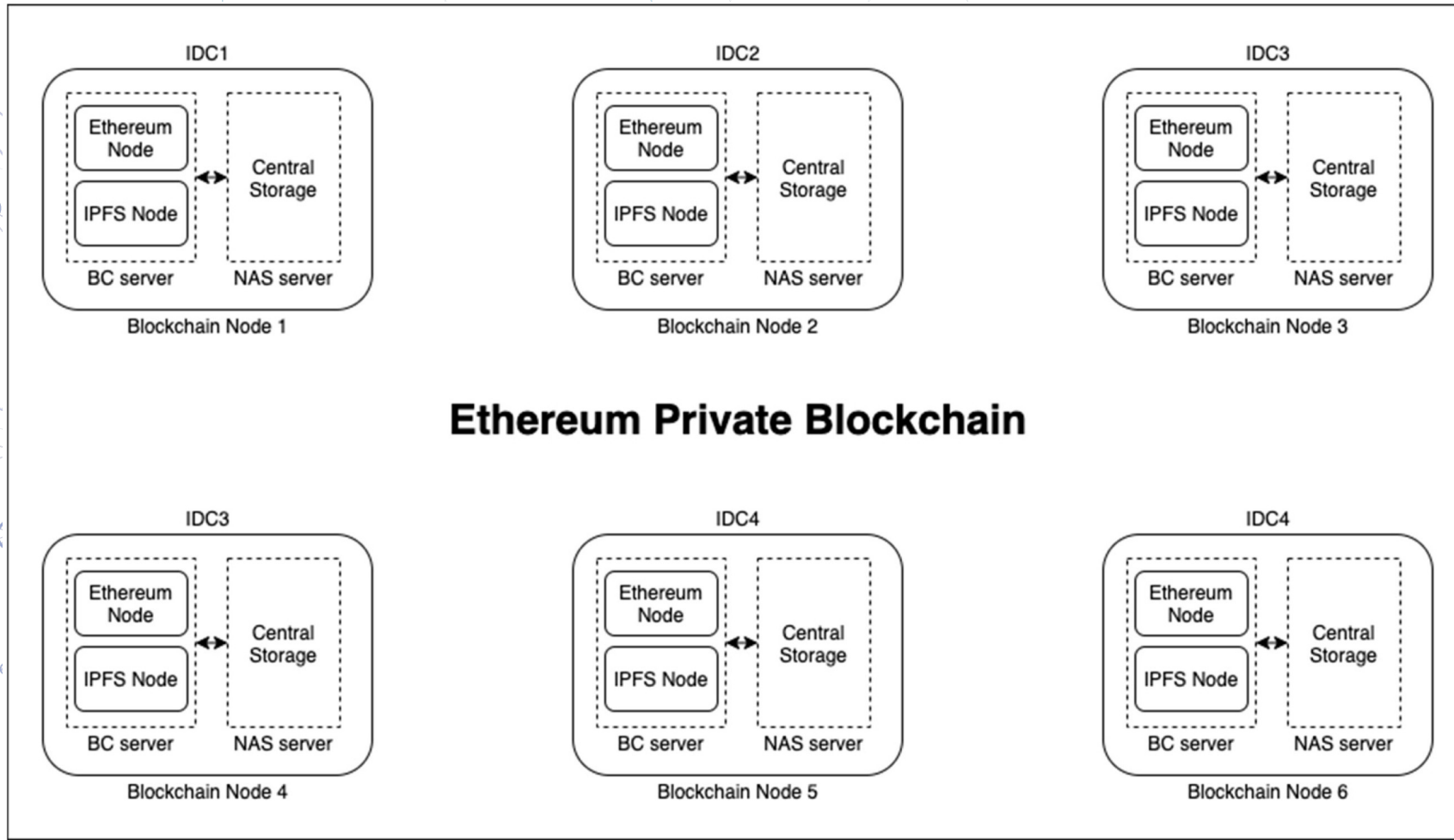


# SWHEPP Blockchain Architecture



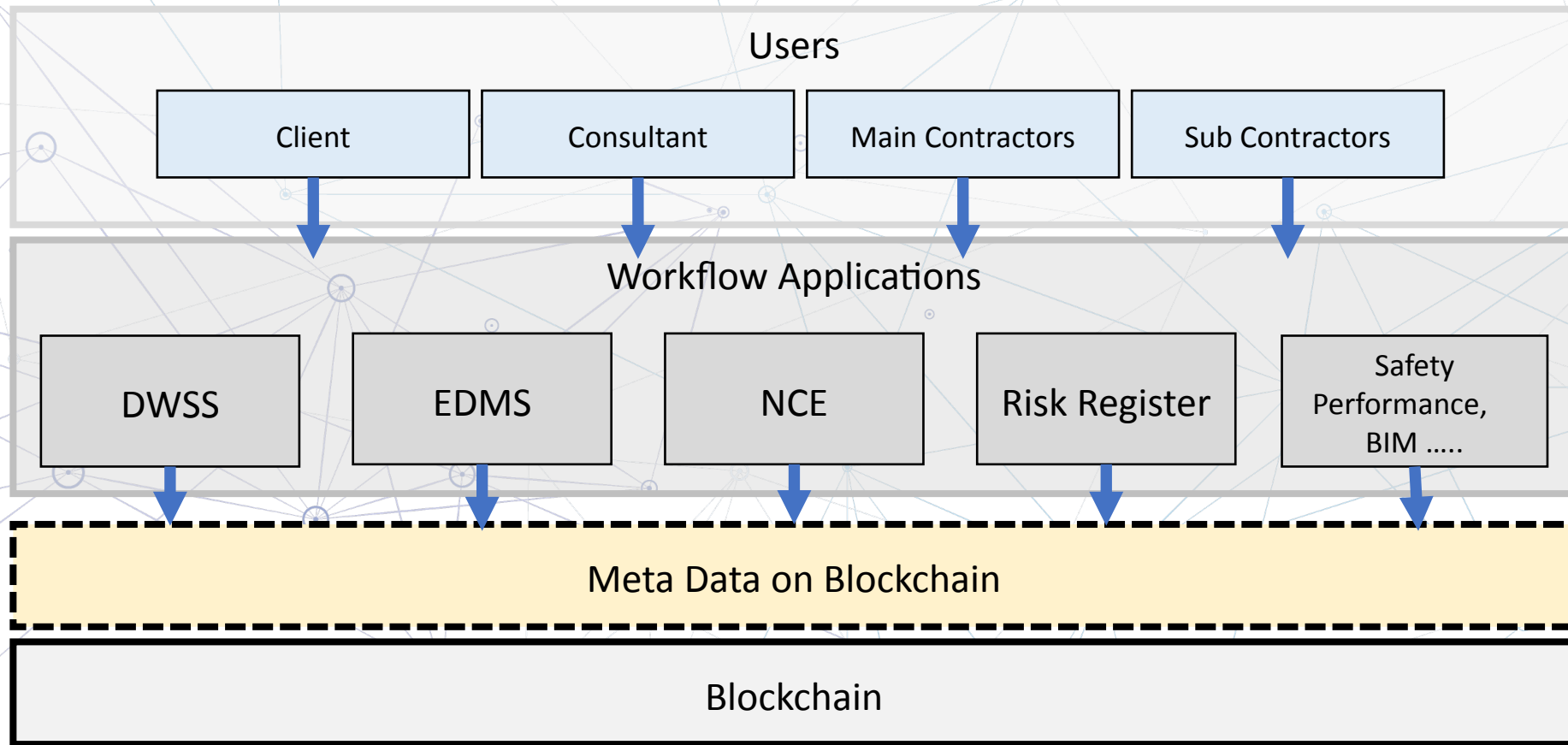


# SWHEPP Blockchain Architecture



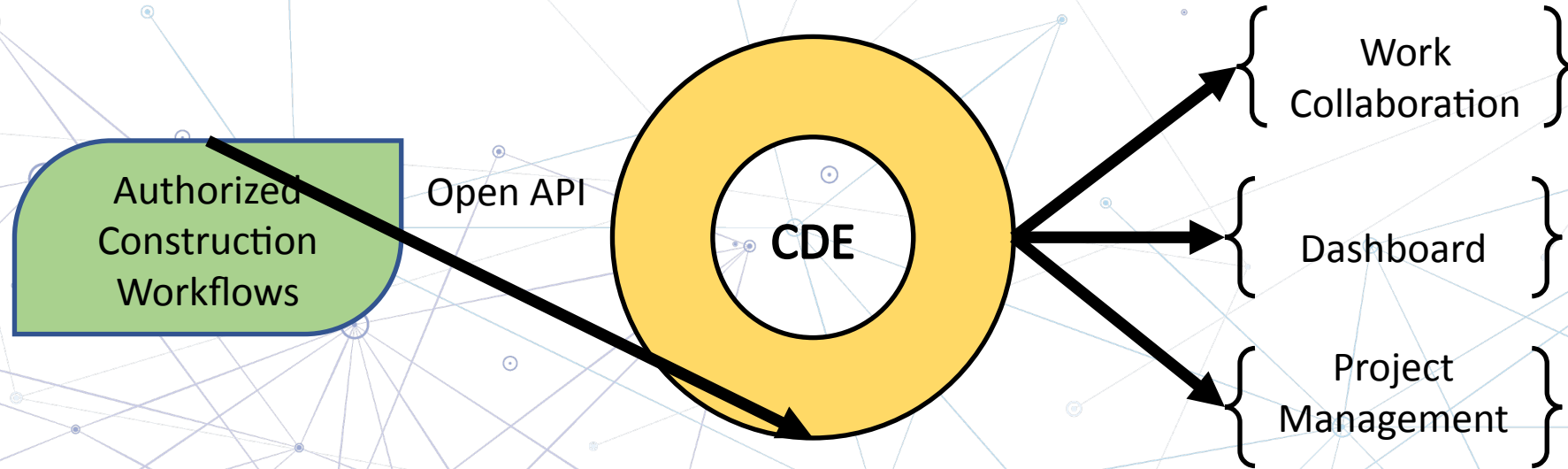


# Construction Workflow on **Blockchain**





# Blockchain as Common Data Environment



- The Open API design in the Blockchain solution allows authorized systems from client, consultant, contractors and sub-contractors to submit and share data among each others
- Data set is defined for each workflow. They combine and serve as “Common Data Environment”
- CDE can act as the single source of truth for work collaboration, dashboard and project management

# SWHEPP Blockchain Platform User Interface

Welcome back, re9@swh-aecom.hk

DE/2018/03  
Title: Shek Wu Hui Effluent Polishing Plant – Main Works Stage 1 – Sidestream Treatment Facilities and E&M Works for Sludge Treatment Facilities  
Location: Shek Wu Hui  
Contractor: JEC

DE/2018/04  
Title: Shek Wu Hui Effluent Polishing Plant – Main Works Stage 1 – E&M Works for Sewage Treatment Facilities  
Location: Shek Wu Hui  
Contractor: Bestwise

DC/2018/06  
Title: Shek Wu Hui Effluent Polishing Plant – Main Works Stage 1 – Civil Works for Sludge Treatment Facilities and 132kV Primary Substation  
Location: Shek Wu Hui  
Contractor: KL-CW JV

DC/2018/07  
Title: Shek Wu Hui Effluent Polishing Plant – Main Works Stage 1 – Civil Works for Sewage Treatment Facilities  
Location: Shek Wu Hui  
Contractor: KL-CW JV

DWSS | EDMS | EW & Risk | NCE | Safety Performance | Site Progress Photo | BIM

RISC | Site Diary | Safety Inspection | Cleansing Inspection | Labour Return

Contract DE/2018/03 <b>1405</b>	Contract DE/2018/04 <b>534</b>	Contract DC/2018/06 <b>11332</b>	Contract DC/2018/07 <b>13407</b>
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Welcome to DSD Blockchain Web Portal

Sign In

Email Address \*

Password \*

Keep me signed in on this device Need to find your password?

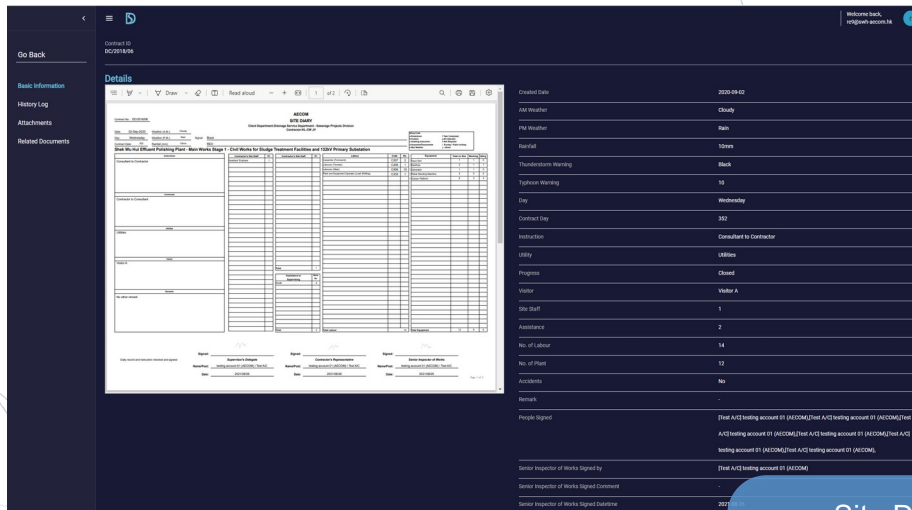
**SIGN IN**

Centralised Platform for 4 contracts on ONE graphical user interface to consolidate different records for different contracts

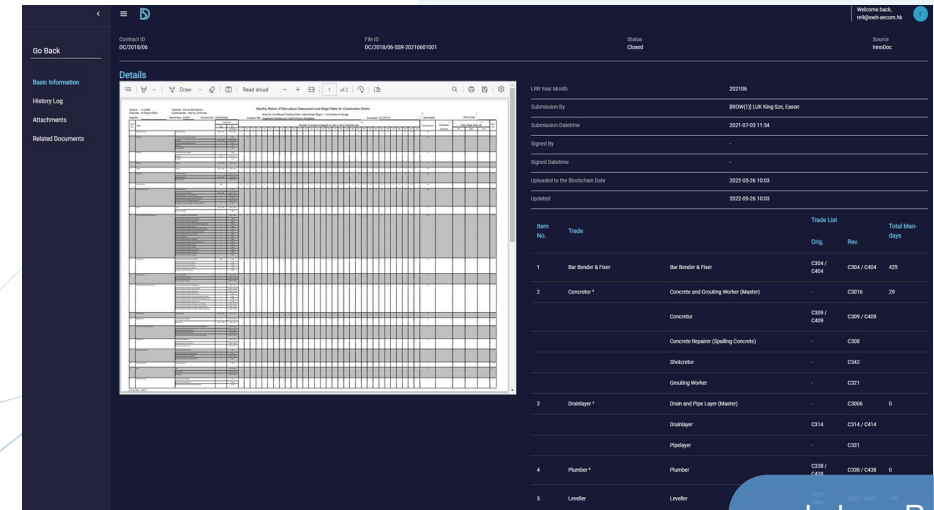




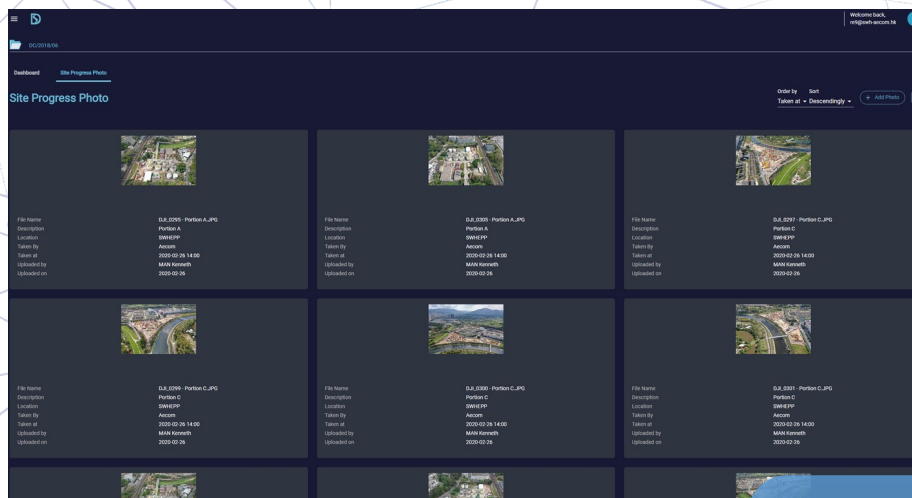
# SWHEPP Blockchain Platform User Interface



Site Diary



Labour Return



Site Progress Photo

Data are immutable with timestamp on Blockchain Platform and access records at any time to increase data traceability



# SWHEPP Blockchain Platform User Interface

**Risk Register**

**Risk Reduction Meeting #38**

Risk ID: EW078 | Date of Entry / Closure of CR: 2021-07-14 | Issued by (EEO / AECOM / Contractor (Ref No.)): KLCM/JV/9661/WN/0201-0001 | Incident No.: | Project: | Affected Work Section: Section 2 | Affected Key Date: REDA | Status: Open

**Description:** External Pipes of the CR Interceptor at Portion A. (External Interceptor and its access). Insufficient information for the external pipes of the CR Interceptor of 120kV Primary Substation.

**Mitigation Measures / Decisions / Updates**

Date of Risk Reduction Meeting (D)	Action to be taken to avoid / reduce the risk	Letter Reference	Party to Follow up	Target Due Date / Deadline	Status (Open / Closed)	Date of Closure of CR	Remark	Last Updated Date	Last Updated User
2021-07-21	AECOM stated that the materials and specifications of steel, valves and steel pipes of CR Interceptor shall be SI according to the contract drawing. The revised details of the CR Interceptor will be provided by KLCM/JV on 29 July 2021.		AECOM		Open		Final Revised details of the CR Interceptor was provided to KLCM/JV on 29 July 2021.	2022-03-15	Admin

**Risk ID: EW081** | Date of Entry / Closure of CR: 2021-04-19 | Issued by (EEO / AECOM / Contractor (Ref No.)): KLCM/JV/9661/WN/0189-0001 | Incident No.: | Project: | Affected Work Section: Section 2 | Affected Key Date: REDA | Status: Open

**Description:** Existing Pedestrian Crossing at San Pao Street near San Wan Road at Portion A. (External Interceptor and its access). The existing pedestrian crossing at San Pao Street might increase the total of the Project.

**Mitigation Measures / Decisions / Updates**

Date of Risk Reduction Meeting (D)	Action to be taken to avoid / reduce the risk	Letter Reference	Party to Follow up	Target Due Date / Deadline	Status (Open / Closed)	Date of Closure of CR	Remark	Last Updated Date	Last Updated User
2022-02-27	AECOM intended that the excavation permit of San Pao Street would expire on 28 February 2022 and all CRD materials and TRM shall be removed. KLCM/JV was also reminded to submit completion notification on time through SPMIS.		KLCM/JV		Open				

Blockchain Platform covers the workflows used in the project from different parties such that workflow collaboration can be facilitated via Blockchain for construction data exchange

Risk Register

**SI List**

SI No.	Contract Covered	Issue Date	Create Date	Subject	Location	Commerce Date	Completion Date	Reason for SI	Created By	Checked By
0990P-00081	Yes	2022-04-08	2022-04-08 13:58	Package No. 275: Provision of Structural Works, including Concrete, Formwork and Rebar for Whole Portion C (including UV no. 1, TRP and Plant Service Water System)	Portion C				ChurWuAdmin	AECOMAdmin

**Attachment**

#	Upload Date	Description	Attachment Type	Upload By	AECOM Comment	No Comment	Record Only	Checked On	Checked By	Main Cont Comment	Replied On	Replied By
1	2022-04-08 13:59	SI		ChurWuAdmin		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2022-05-03	AECOMAdmin			
2	2022-08-11 16:16	Supporting		ChurWuAdmin	comment	<input type="checkbox"/>	<input type="checkbox"/>	2022-08-11	AECOMAdmin			

Notification of Compensation Event

**Contractor's Monthly Report on Safety Performance**

**A. Contract Details**

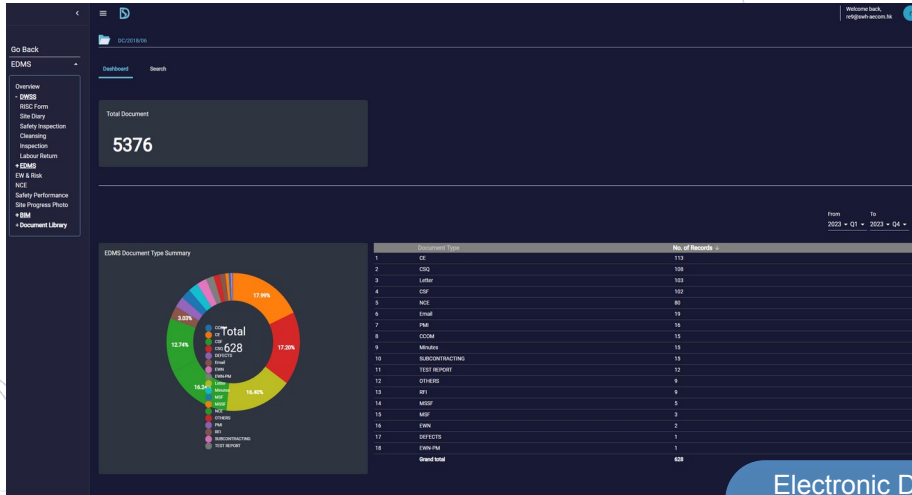
Department: Drainage Services Department  
 Contract No. and Title: Shau Kei Mei (Shau Kei Mei) Sewerage Treatment Facilities and Effluent Works for Stage 1 Treatment Facilities  
 Name of Contractor: Resourcing Assets (Singapore) Pte Ltd  
 Reporting Period (YYYYMM): 01/01/2023 to 31/03/2023

**B. Safety Performance of the contract in the Reporting Period**

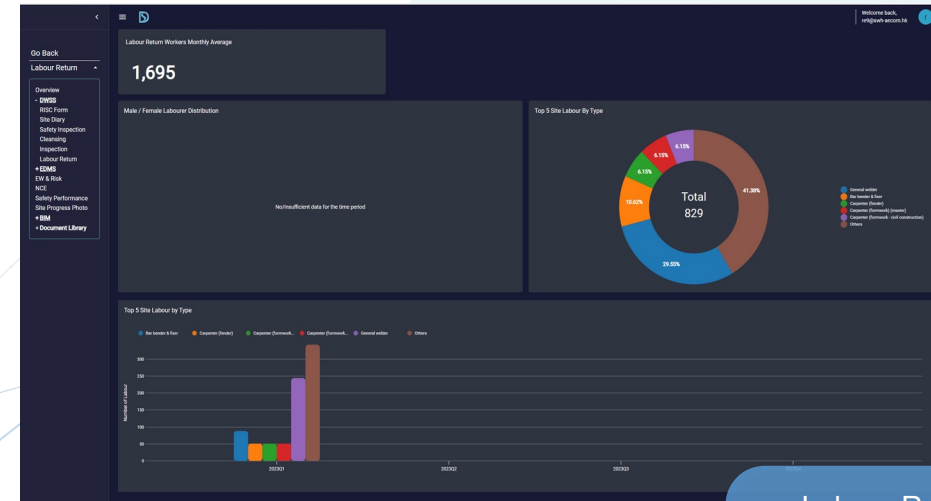
Performance achievements in this Reporting Month (to be reported by the Contractor)	Verified by the Supervisor	Counter verified by the Supervisor
1. No reportable accidents in the reporting month. Number of reportable accidents in this month: 0/0	<input type="radio"/> Agree <input type="radio"/> Disagree	<input type="radio"/> Agree <input type="radio"/> Disagree
2. No notice of safety or environmental prosecution in this month. Number of prosecution received in this month: Safety: 0/0 Environmental: 0/0	<input type="radio"/> Agree <input type="radio"/> Disagree	<input type="radio"/> Agree <input type="radio"/> Disagree
3. Safety Training (Safety Card) for specified trade workers compliance per month based on requirement to be trained 1% of their Card compliance (No. of workers holding their card = 1% on a date specified by the Project Manager during the month). Measurement Date: Number of skilled workers who are employed in the specified trade on the above date: Number of skilled workers who are employed in above who possess the above Safety Card: Percentage: %	<input type="radio"/> Agree <input type="radio"/> Disagree	<input type="radio"/> Agree <input type="radio"/> Disagree
4. Half yearly review of safety performance - reduce lost labour Department to 1% per year period. From: To: A full Part 1 inspection holds in half year: <input type="radio"/> Yes <input type="radio"/> No No of H1 Incident: 0/0	<input type="radio"/> Agree <input type="radio"/> Disagree	<input type="radio"/> Agree <input type="radio"/> Disagree

Safety Performance

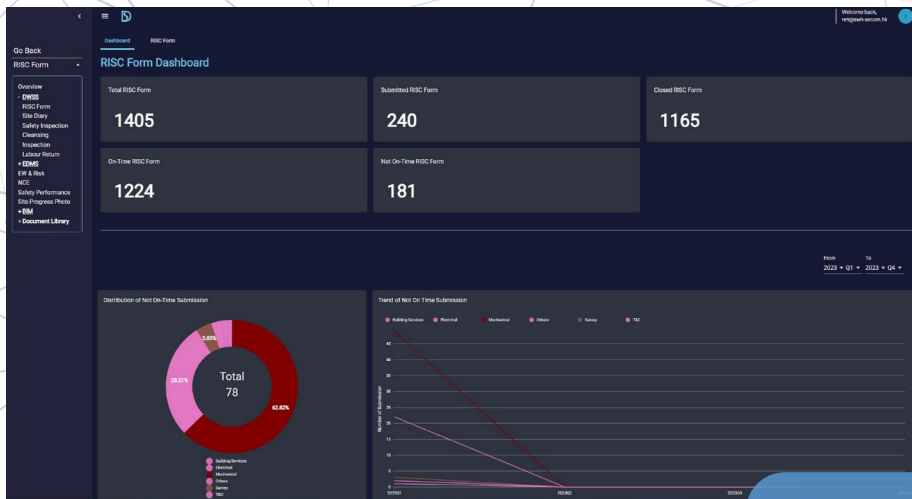
# SWHEPP Blockchain Platform User Interface



Electronic Document Management System



Labour Return



RISC

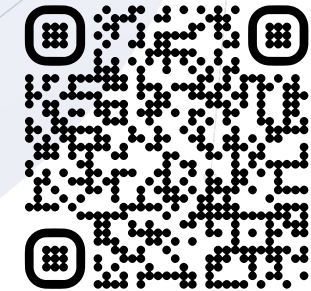
With dashboard and statistic on Blockchain Platform to enhance the efficiency of project management



# SWHEPP Blockchain Platform



- After the launch of Blockchain Platform, a series of trainings and user feedback survey have been conducted which give:
  - ✓ Understanding more on the users needs about the hands-on features of Blockchain Platform and
  - ✓ Identifying areas for improvement, in particular for user interface design and performance issue.
- Aim for setting up a standard for developing a similar platform to DSD as a guideline in other DSD's projects in the near future.







**THANK YOU**