KAWANA STP UPGRADE: USING BIM FOR DESIGN, CONSTRUCTION AND OPERATION

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Kawana STP Upgrade Future-proofing the Sunshine Coast region

- Built in 1980 and located on the Sunshine Coast, QLD, Australia
- One of Unitywater's largest and key sewage treatment facilities
- Plant upgrade is needed to increase capacity from 90,000 EP to 150,000 EP, contract accepted for 200,000 EP
- Ultimate capacity 600,000 people – over six times its current capacity.

Existing 90,000 EP plant

Upgraded 200,000 EP animation

BIM overview

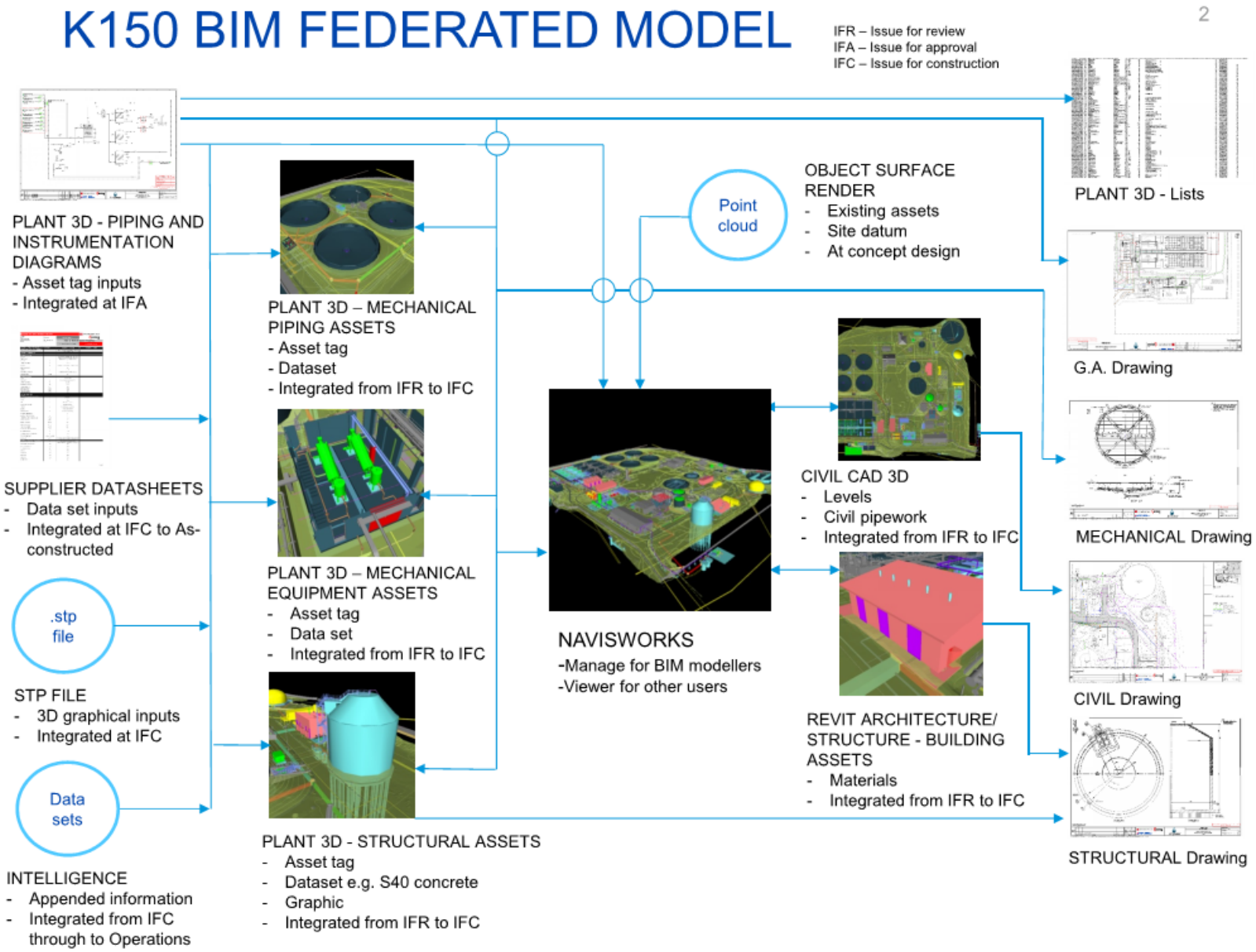
Unitywater’s objectives for the adoption of BIM

- Reduce project cost and duration
- Reduce the occurrence of project defects and the need for rework
- Improve plant operability and maintainability
- Improve project quality and safety

BIM use and outcomes for the project

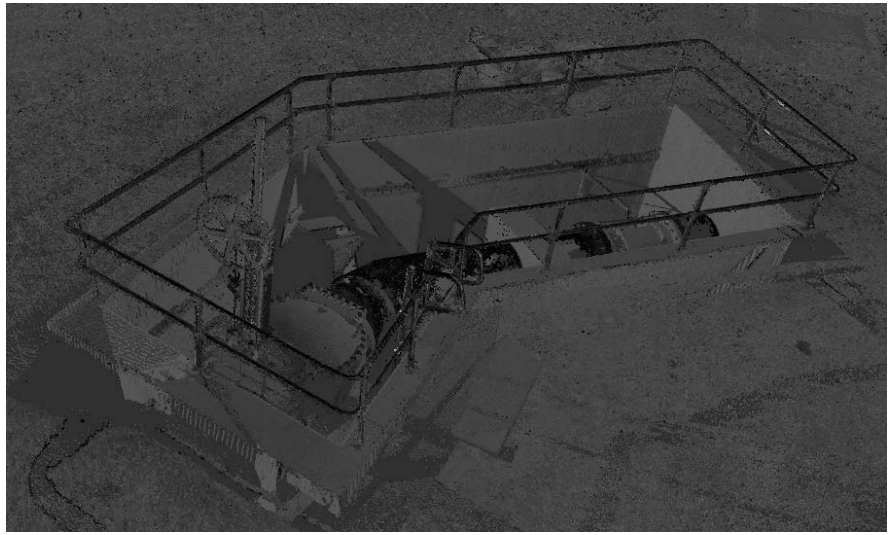
BIM PROJECT USES	OUTCOMES
Integrated, concurrent design coordination	Improve design coordination and design decisions by conducting design review workshops in an accurate 3D environment and providing all project team members with access to a regularly updated and federated BIM.
Design documentation	Improved documentation accuracy by generating 2D drawing views and associated element tagging and quantities directly from the model
Clash detection	Minimise construction costs by detecting clashes and clearance issues before construction proceeds
Integrated, concurrent safety in design and operational reviews	Improve constructability and safety, operability and maintainablility
Client engagement and review	Improve clients understanding of design progress, design direction/constraints and enable informed client feedback at milestone reviews.
Federate procurement, commissioning and operational asset data into BIM	Utilise the as-built BIM for ongoing asset management and future upgrades

Design tools

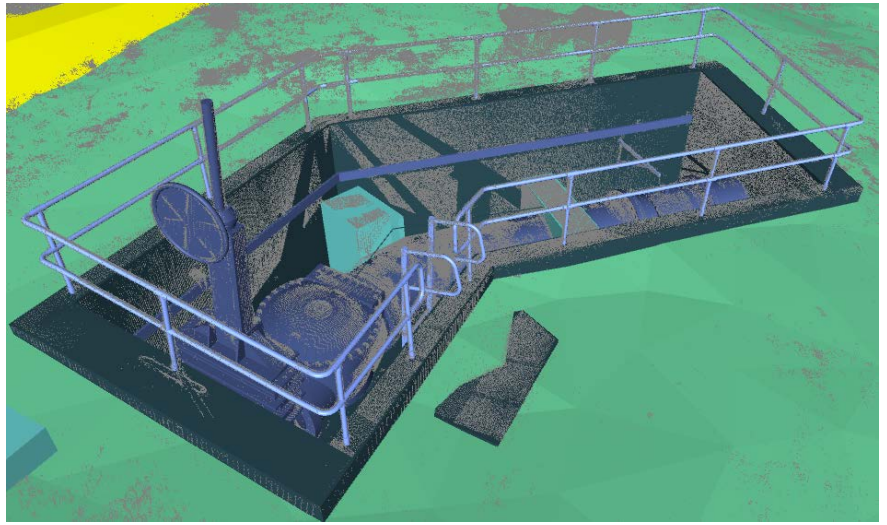


Scan to BIM of existing above ground plant

- Point cloud survey capture of above ground assets
- Point cloud used to generate and validate 3D models of existing plant
- Verification status added to BIM elements



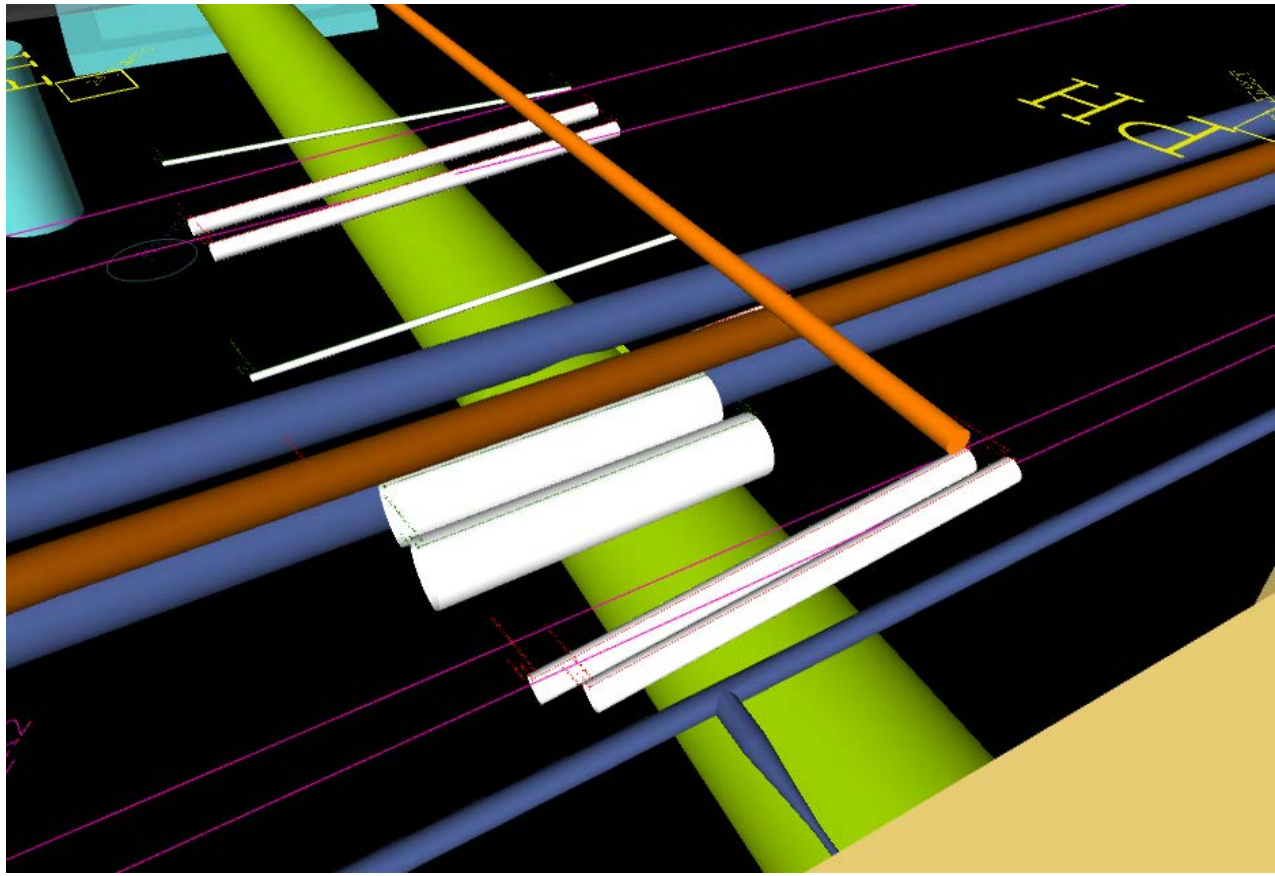
Point cloud survey



Point cloud overlain on the 3D model

Existing underground assets in BIM

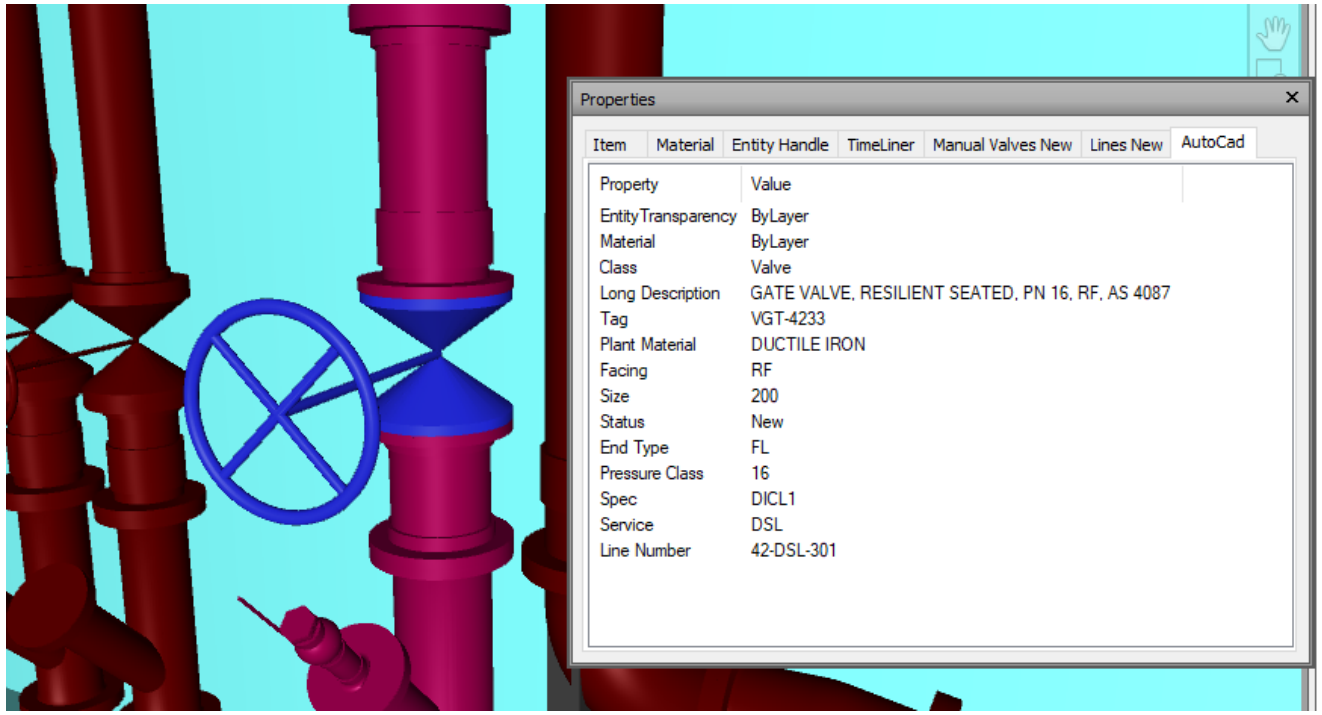
- Extensive potholing of underground assets
- Potholing data used to validate 3D models of existing pipework
- Verification status added to BIM elements



Pot holing survey

Intelligent P&ID’s and piping models

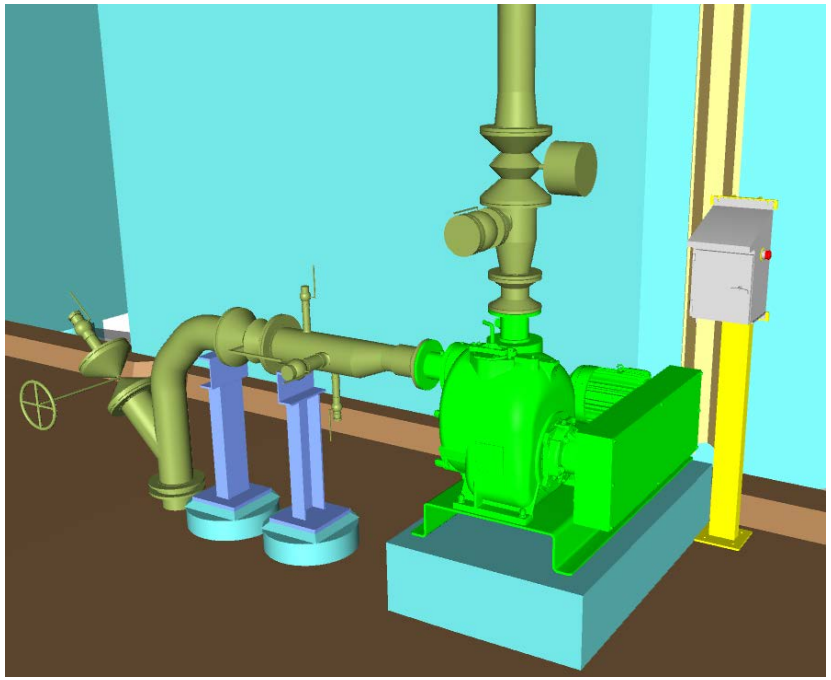
- Central database of plant assets populated by P&ID’s
- P&ID’s validated with Plant 3D model
- P&ID database federated into BIM



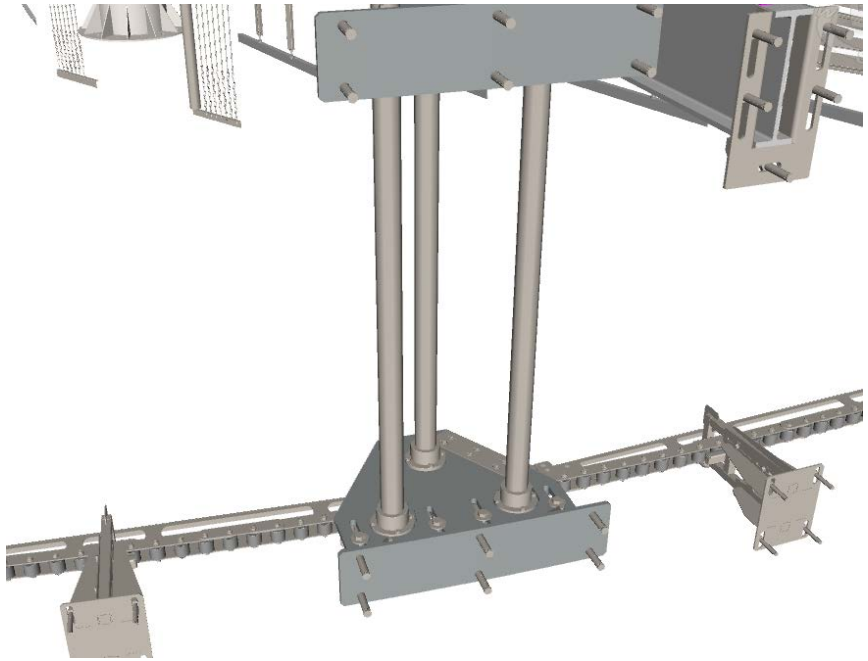
Element properties within BIM

LOD – Level of Development

- LOD300 adopted for balance of plant design
- Simplified geometry of generic pipeline items used to reduce BIM size and improve drawing production
- LOD400 vendor models of major equipment federated into BIM where available



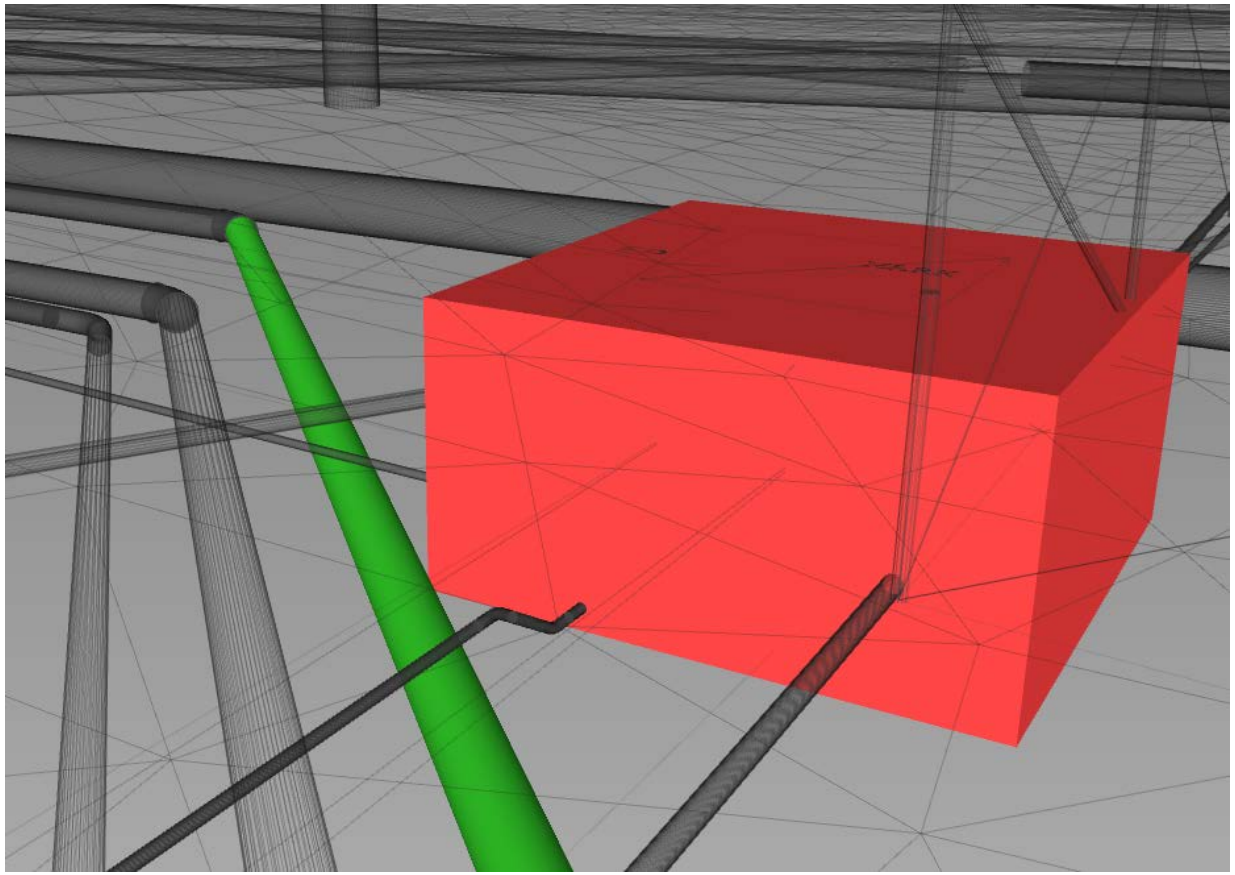
Generic valve model with detailed pump vendor model



Highly detailed vendor supplied model

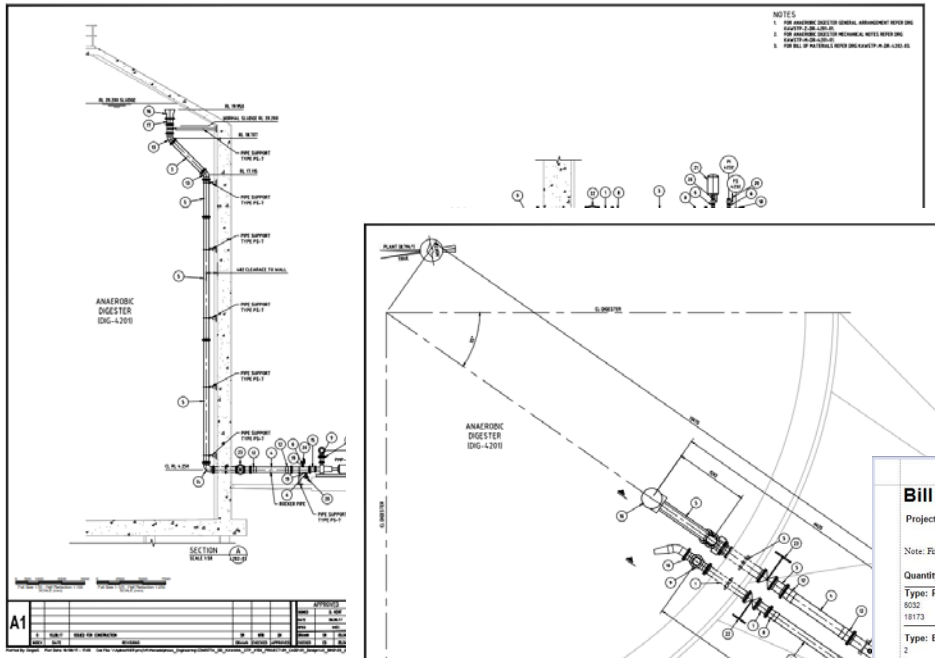
Clash Detection

- Automated process
- Visualise clashes between disciplines and existing plant
- Early detection of clashes prior to construction to void costly rework

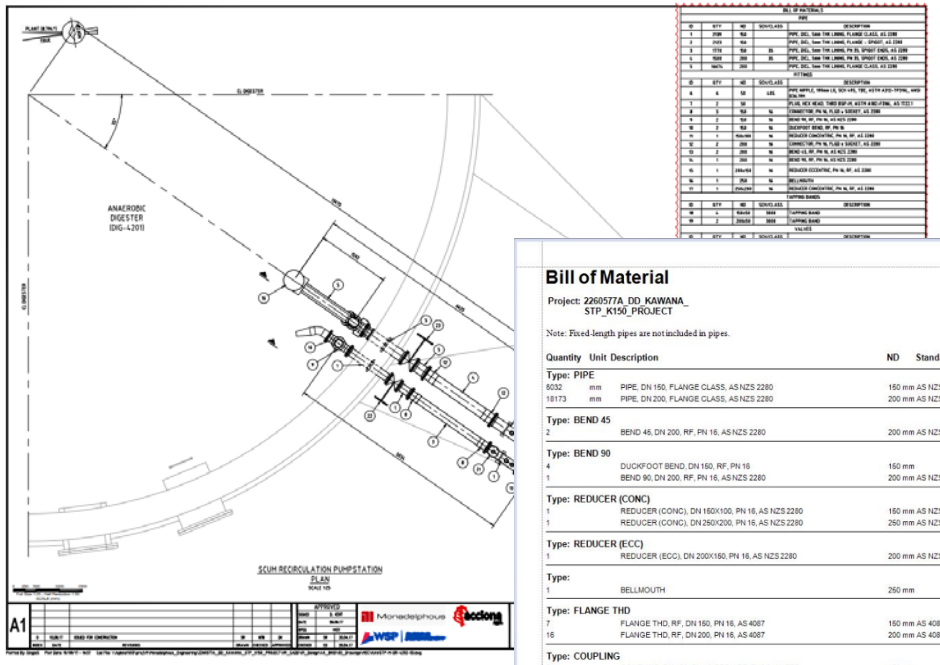


Existing underground pipe and new electrical pit clash

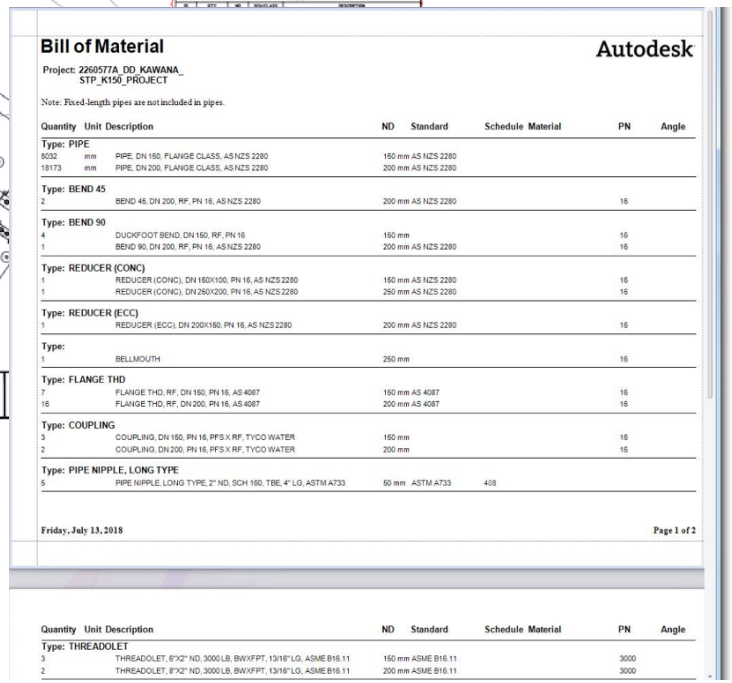
Design documentation



Drawing sections



Drawing plan



Bill of Material

Autodesk

Project: 2260577A_DD_KAWANA_STP_K150_PROJECT

Note: Fixed-length pipes are not included in pipes.

Quantity	Unit	Description	ND	Standard	Schedule	Material	PN	Angle
Type: PIPE								
6032	mm	PIPE, DN 150, FLANGE CLASS, AS NZS 2280	150 mm	AS NZS 2280				
18173	mm	PIPE, DN 200, FLANGE CLASS, AS NZS 2280	200 mm	AS NZS 2280				
Type: BEND 45								
2		BEND 45, DN 200, RF, PN 16, AS NZS 2280	200 mm	AS NZS 2280			16	
Type: BEND 90								
4		DUCKFOOT BEND, DN 150, RF, PN 16	150 mm				16	
1		BEND 90, DN 200, RF, PN 16, AS NZS 2280	200 mm	AS NZS 2280			16	
Type: REDUCER (CONC)								
1		REDUCER (CONC), DN 150X100, PN 16, AS NZS 2280	150 mm	AS NZS 2280			16	
1		REDUCER (CONC), DN 250X200, PN 16, AS NZS 2280	250 mm	AS NZS 2280			16	
Type: REDUCER (ECC)								
1		REDUCER (ECC), DN 200X150, PN 16, AS NZS 2280	200 mm	AS NZS 2280			16	
Type:								
1		BELLMOUTH	250 mm				16	
Type: FLANGE THD								
7		FLANGE THD, RF, DN 150, PN 16, AS 4087	150 mm	AS 4087			16	
16		FLANGE THD, RF, DN 200, PN 16, AS 4087	200 mm	AS 4087			16	
Type: COUPLING								
3		COUPLING, DN 150, PN 16, PFS X RF, TYCO WATER	150 mm				16	
2		COUPLING, DN 200, PN 16, PFS X RF, TYCO WATER	200 mm				16	
Type: PIPE NIPPLE, LONG TYPE								
5		PIPE NIPPLE, LONG TYPE, 2" ND, SCH 160, TBE, 4" LG, ASTM A733	50 mm	ASTM A733	408			

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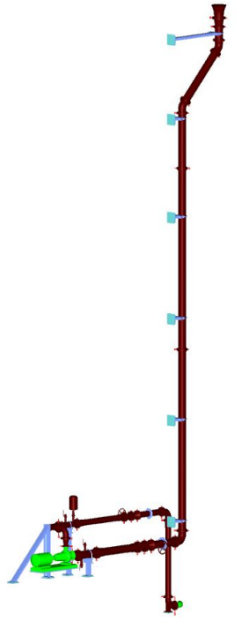
Quantity	Unit	Description	ND	Standard	Schedule	Material	PN	Angle
Type: THREADOLET								
3		THREADOLET, 6"X2" ND, 3000 LB, BWXFPT, 13/16" LG, ASME B16.11	150 mm	ASME B16.11			3000	
2		THREADOLET, 8"X2" ND, 3000 LB, BWXFPT, 13/16" LG, ASME B16.11	200 mm	ASME B16.11			3000	



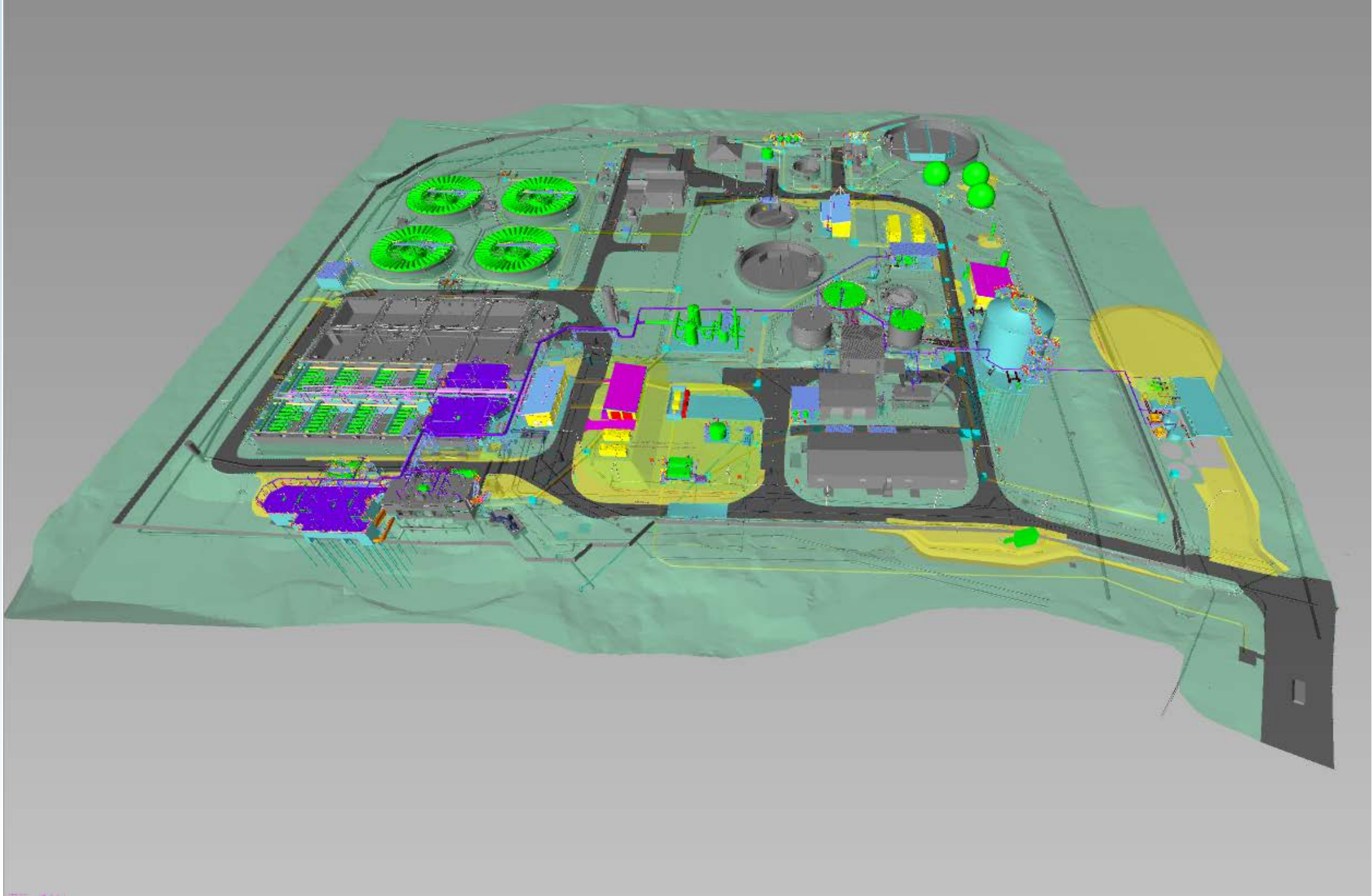
Linked database to 3D model

Virtual Reality

- Immersive review of BIM model
- Improves understanding of proportion by viewing in true scale
- Can provide ability to interact with the model

VR walk around of model using goggles

BIM fly through



Lessons Learned

— A client 2D CAD standard is not a BIM standard!

— Prior to design kick-off, a client BIM specification and project specific BIM plan (BEP) and supporting standards need to be provided and/or developed for the entire team to adopt. They should contain:

  - BIM purpose, uses and workflows
  - BIM deliverables required
  - LOD requirements and examples
  - Construction data requirements (if required) and owner asset data requirements in the BIM plan.
  - Software use and data/model exchange workflows and templates
  - Vendor model and data requirements

— Accurate and usable point cloud and potholing is essential for inclusion in and verification of the BIM

— Complete and accurate engineering specifications are required to ensure the BIM is accurate and software can be set up correctly.

— Reassess and change the BIM process if it is not working as intended

— Encourage the use of the BIM model to inform ALL project decisions!

Thank you

ACKNOWLEDGEMENTS

Unitywater, the owner and operator of Kawana STP.

Monadelphous, the constructor undertaking the upgrade work under a D&C contract.