EXTENDING SAP FROM FINANCIAL REPORTING TO AN OPERATIONAL TOOL

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ABSTRACT (500 WORDS MAXIMUM)

For the past 20 years, Christchurch City Council (CCC) has used the internationally recognised software program known as SAP. (SAP is a product from a German software company whose products allow businesses to track customer and business interactions.) CCC primarily uses SAP as a financial transaction tracking tool. For the Christchurch Wastewater Treatment Plant (CWTP), this includes linking operational costs to assets. In 2016, an informal feasibility study identified that SAP could be a cornerstone of a two year 'Effective Operations & Maintenance' (EO&M) program.

A review of the asset database within SAP identified only 1455 individual assets at the CWTP. This number was deemed very low, particularly as the CWTP is the second largest in NZ and has a replacement value of ~$0.9 billion. A desktop study found that this data base had captured approximately 90% of the assets at the CWTP when based on asset value. This is because the granularity of asset breakdown was at a high level (e.g. an asset identified simply as 'Sludge Digester' included not only the digester structure, but also all the sludge/gas pipework, handrailing, level sensors, valves, flow meters etc.).

Capturing 90% of the total value of CWTP assets allows CCC to accurately depreciate assets and forecast of capital expenditure (CAPEX). This provides a robust foundation for planning of CAPEX projects, especially those of larger value. However, for planning and timing of regular preventative maintenance and small CAPEX projects, it makes it much more of a challenge. This is because operational and maintenance activities cannot be assigned to individual assets (i.e. individual valves, flow meters, pumps). The EO&M program subsequently identified and uploaded into SAP an additional 4,625 individual assets (a 76% increase in the number of assets).

This means that 76% of the assets were not included in the maintenance and spares program and can be considered essentially "invisible" the systems and process in place. CCC must rely on the knowledge and experience of plant operators and the maintenance engineers to independently schedule maintenance and assess essential spare requirements. This make forecasting of operational expenditure (OPEX) difficult to achieve and, at best, is inconsistent

The specific issue was that lower value assets can have a critical function. Thus it is important that such assets are included in a program of planned maintenance and, where appropriate included in the critical spares. Such a program would facilitate the accurate planning of OPEX on a daily, weekly, annual, bi-annual and 5 yearly basis.

CWTP's approach was to embark on a project to capture the maintenance requirements of all the assets on site, with a priority of identifying assets with a critical function, regardless of capital value. This involved a series of four facilitated workshops to explore the operation and maintenance of the CWTP. A multidisciplinary team was formed for the workshops which included representatives from operations, maintenance, CWTP management, process engineering, maintenance planning and CCC asset planning. The aim of the

workshop was to identify all assets regardless of value and capture the criticality of each asset.

The project has realised significant improvements to CCC in the OPEX planning for CWTP. This has included an increase in preventative maintenance, driven by both scheduled maintenance and operational checks. The operation of the CWTP has become more consistent and as a result the treatment process has shown improved stability. The methodology applied in this case study project is relevant to WWTPs across Australia and New Zealand and provides a platform for consistent operation and preventative maintenance that is targeted.

KEYWORDS

SAP, OPEX,

PRESENTER PROFILE

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1 BACKGROUND AND INTRODUCTION

For the past 20 years, Christchurch City Council (CCC) has used the internationally recognised software program known as SAP. (SAP is a product from a German software company whose products allow businesses to track customer and business interactions.) CCC primarily uses SAP as a financial transaction tracking tool. For the Christchurch Wastewater Treatment Plant (CWTP), this includes linking operational costs to assets. In 2016, an informal feasibility study identified that SAP could be a cornerstone of a two year 'Effective Operations & Maintenance' (EO&M) program.

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Capturing more of the number of assets in SAP, was expected to realise the following benefits:

- Optimise assets and treatment processes
- Improved preventative & pro-active maintenance
- Reduced power and chemical usage
- Optimise operating parameters
- Review alternative technologies & equipment
- Improve reliability and consent compliance

2 METHODOLOGY

On an initial review, there are approximately 1455 assets identified in SAP asset database however, it was originally estimated that there are 5000 to 7000 assets on at the CWTP site. To increase the number of assets captured CCC embarked on a staged investigation process; Initially documenting all assets, followed by a structured assessment to optimise the operation and maintenance of the assets, and finally collation of knowledge held by CWTP maintenance and operations staff. A two-year timeframe was identified to undertake the projects, with the requirement to assist in the development of the EO&M Program contained in the individual Personnel Development Plans of key operational staff.

Although CWTP operations and maintenance staff were key to development of the EO&M Program, external expertise was required to provide engineering input into the processes undertaken at CWTP, co-ordinate the data collection, and articulation of the EO&M Program across CCC.

The project was divided into two discrete portions:

- Asset identification and data collection
- Optimisation assessment of asset operation and maintenance

Within this framework 13 discrete activities were identified and these are discussed in detail below. Currently activity six is in progress.

ACTIVITY 1 - BREAK DOWN CWTP OPERATION INTO PROCESS STAGES

The CWTP process was broken down into a series of processes which formed the basis of the project (see Figure 1). This was carried out in a series of multidisciplinary workshops involving CWTP operations and maintenance staff as well as technical specialists. A key output from these workshops was the identification of interfaces between the treatment process stages.

ACTIVITY 2 - DEFINE CRITICALITY CRITERIA ASSESSMENT PROCESS

Three elements of criticality were considered for each process and criticality matrix developed for the CWTP process:

1. Process Criticality -Process Criticality defines the main processes and utilities within CWTP and their relative priority within the overall function of the wastewater treatment process. Each process stage is rated on a scale 5-1

2. Functional Criticality -Each of the main process stages is then be broken down into sub-processes and functions. The functional criticality is the relative importance of each function within a process stage. Rated on a scale 5-1

3. Asset Criticality -The risk associated with the assets failure to performing its intended functions. This risk rating is based on the factors of –Safety, Environmental, Operational, and / or Economic impact. Rated on a scale 5-1

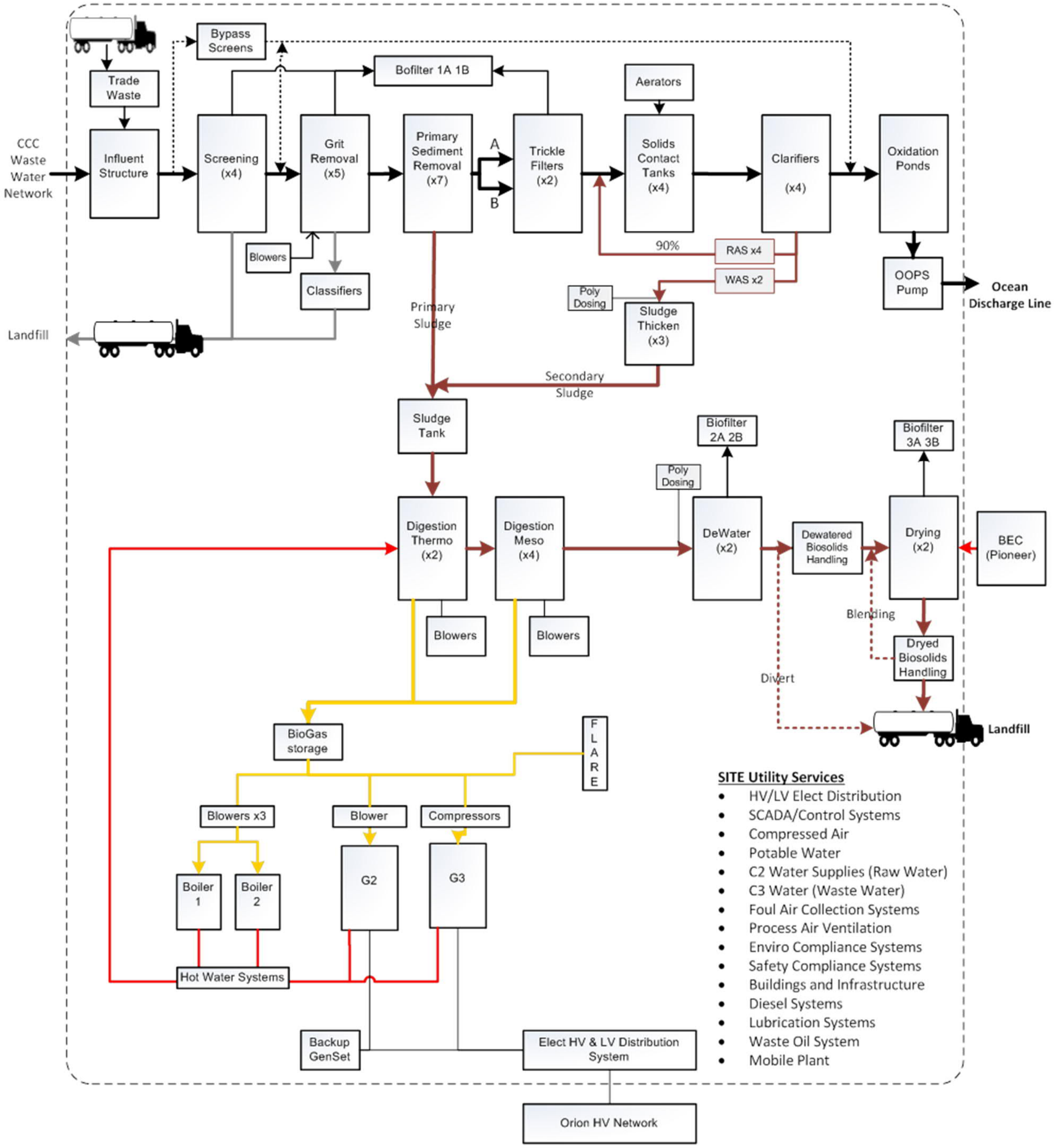


Figure 1: Block Flow Diagram Showing the CWTP Process

Main Process	Rating	Classification	Description
WW Network Intake Process	5	Critical (Very High)	Critical that CWTP can receive all network wastewater to avoid backlog and uncontrol discharges across network.
Trade Waste Process	1	Very Low	Very low criticality. Industrial waste intake can be bypassed or stopped.
Screening Process	5	Critical (Very High)	Critical –Removal of larger > 3mm non-biological matter is removed (screened) prior to processing or bypassing to ponds.
Treatment Bypass	5	Critical (Very High)	Critical to maintain Bypass as continguency for high flow events (inflows exceed processing capacity) or treatment stage constraints -essential to avoid over loading process stages and fouling, and avoid backlog and uncontrolled discharges
Grit Removal Process	3	Important (Medium)	Treatment Stage –Removal of grit / sand and other residual non organic solids (<=3mm) from the wastewater stream. Grit removal is required to minimise fouling / blockages through the downstream treatment processes
Sedimentation Process	4	Essential (High)	Treatment Stage -Segretaion of hydraulic and solids waste streams
Pumping Process	4	Essential (High)	Trickle filter process stage supply –Potential environmental impact on failure.
Trickle Filters Process	4	Essential (High)	Treatment Stage –Conditioning, Potential environmental impact on failure.
Clarification Process	2	General (low)	Treatment Stage –Conditioning, storage
Oxidation Ponds Process	4	Essential (High)	Treatment Stage –Conditioning, storage, and essential conduit stream to ocean outfall.
Ocean Discharge Process	5	Critical (Very High)	Critical conduit to ocean outfall
Digestion Process	4	Essential (High)	Treatment Stage –Biosolids conditioning, gas production, storage controls odour, key compliance KPI
BioGas Process	4	Essential (High)	Important secondary function –collection and use of biogas controls odour, key compliance KPI
Sludge Thickening Process	2	General (low)	Treatment Stage –Biosolids conditioning
Sludge Dewatering Process	2	General (low)	Treatment Stage –Biosolids conditioning
BioSolids Drying Process	2	General (low)	Treatment Stage, Biosolids conditioning
Utilities	**Rating**	**Classification**	**Description**
Electricity Reticulation	5	Critical (Very High)	Critical process utility
Foul air / Odor control	4	Essential (High)	Critical process utility
Power Generation	1	Minor (Very low)	Secondary function, economic benefits
Compressed Air	4	Essential (High)	Essential utility
Hot Water Generation	4	Essential (High)	Important utility for digestion process
C1 -Potable Water Supplies	1	Minor (Very low)	Not required for WW treatment
C2 –Bore Water Supplies	3	Important (Medium)	Important Utility – Wastewater processes, Cooling water for compressors and pump glands
C3 – Waste Water Supplies	1	Minor (Very low)	Not required for WW treatment

Table 1: CWTP Process Criticality Matrix

ACTIVITY 3 – IDENTIFY CWTP OPERATIONAL ASSETS

The key driver for this project was that not all the CWTP operational assets are identified in SAP system. Furthermore not all the CWTP assets which exist on CWTP are labelled and tagged. A list of all of the assets at CWTP was developed and GAP analysis was carried out between the SAP record and site assets. During this phase both operational and redundant assets were captured.

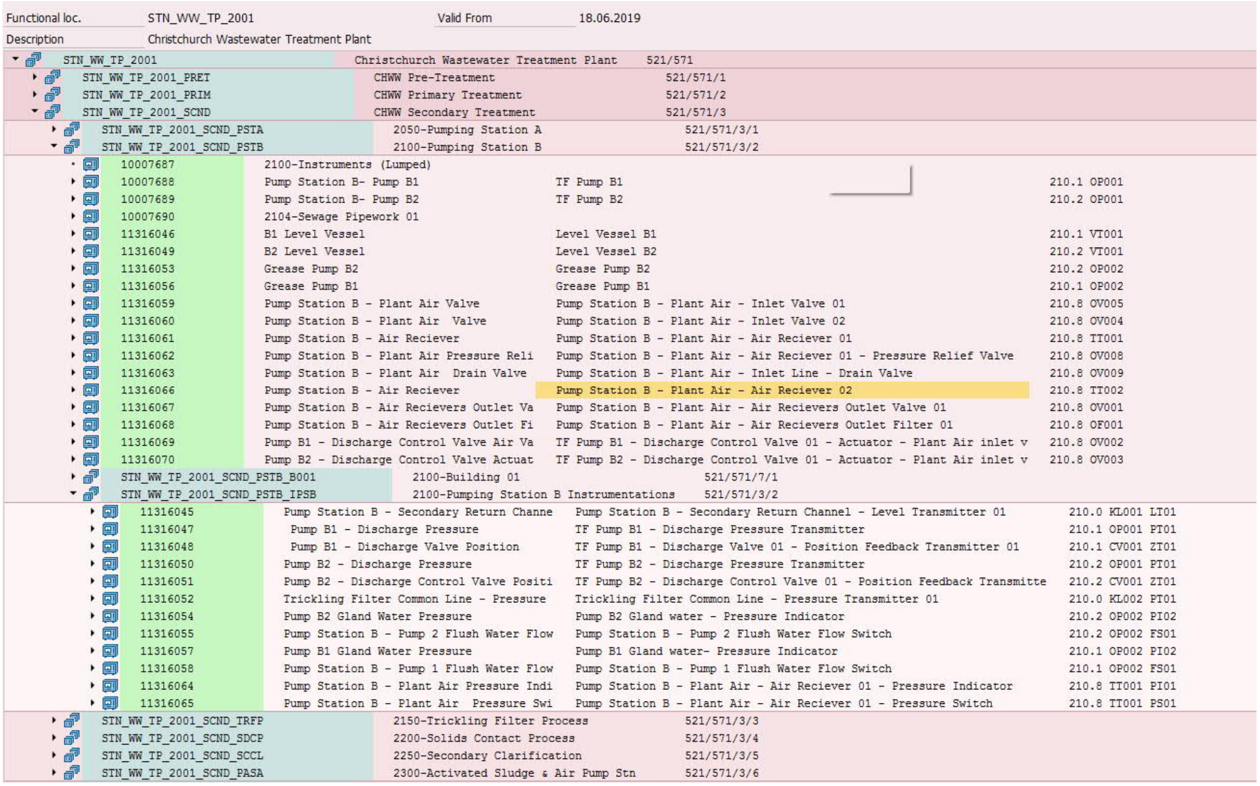
ACTIVITY 4 – CAPTURE ALL PHYSICAL OPERATIONAL ASSETS IN SAP

Site data was transferred to SAP to fill the gaps identified. An existing data capture app (the Fulcrum App) was used to capture site data and directly upload this into SAP. Additional data was provided by CWTP staff using paper records stored on at CWTP.

Figure 2: Data Entered Directly into SAP Using the Fulcrum App

ACTIVITY 5 & 6 – ESTABLISH LABELLING CRITERIA AND LABEL ALL OPERATIONAL ASSETS

The data in SAP had inconsistent labelling which makes recovering information difficult. Thus a standard set of criteria for SAP labelling was developed and a document developed to provide guidance on the type and method of installation of the labels/tags. This ensures that future SAP entries will be consistent making accessing data more straightforward.



Functional loc. STN_WW_TP_2001 Valid From 18.06.2019

Description Christchurch Wastewater Treatment Plant

STN_WW_TP_2001	Christchurch Wastewater Treatment Plant		521/571
STN_WW_TP_2001_PRET	CHWW Pre-Treatment		521/571/1
STN_WW_TP_2001_PRIM	CHWW Primary Treatment		521/571/2
STN_WW_TP_2001_SCND	CHWW Secondary Treatment		521/571/3
STN_WW_TP_2001_SCND_PSTA	2050-Pumping Station A		521/571/3/1
STN_WW_TP_2001_SCND_PSTB	2100-Pumping Station B		521/571/3/2
10007687	2100-Instruments (Lumped)		
10007688	Pump Station B- Pump B1	TF Pump B1	210.1 OP001
10007689	Pump Station B- Pump B2	TF Pump B2	210.2 OP001
10007690	2104-Sewage Pipework 01		
11316046	B1 Level Vessel	Level Vessel B1	210.1 VT001
11316049	B2 Level Vessel	Level Vessel B2	210.2 VT001
11316053	Grease Pump B2	Grease Pump B2	210.2 OP002
11316056	Grease Pump B1	Grease Pump B1	210.1 OP002
11316059	Pump Station B - Plant Air Valve	Pump Station B - Plant Air - Inlet Valve 01	210.8 OV005
11316060	Pump Station B - Plant Air Valve	Pump Station B - Plant Air - Inlet Valve 02	210.8 OV004
11316061	Pump Station B - Air Reciever	Pump Station B - Plant Air - Air Reciever 01	210.8 TT001
11316062	Pump Station B - Plant Air Pressure Reli	Pump Station B - Plant Air - Air Reciever 01 - Pressure Relief Valve	210.8 OV008
11316063	Pump Station B - Plant Air Drain Valve	Pump Station B - Plant Air - Inlet Line - Drain Valve	210.8 OV009
11316066	Pump Station B - Air Reciever	Pump Station B - Plant Air - Air Reciever 02	210.8 TT002
11316067	Pump Station B - Air Recievers Outlet Va	Pump Station B - Plant Air - Air Recievers Outlet Valve 01	210.8 OV001
11316068	Pump Station B - Air Recievers Outlet Fi	Pump Station B - Plant Air - Air Recievers Outlet Filter 01	210.8 OF001
11316069	Pump B1 - Discharge Control Valve Air Va	TF Pump B1 - Discharge Control Valve 01 - Actuator - Plant Air inlet v	210.8 OV002
11316070	Pump B2 - Discharge Control Valve Actuat	TF Pump B2 - Discharge Control Valve 01 - Actuator - Plant Air inlet v	210.8 OV003
STN_WW_TP_2001_SCND_PSTB_B001	2100-Building 01		521/571/7/1
STN_WW_TP_2001_SCND_PSTB_IPSB	2100-Pumping Station B Instrumentations		521/571/3/2
11316045	Pump Station B - Secondary Return Channe	Pump Station B - Secondary Return Channel - Level Transmitter 01	210.0 KL001 LT01
11316047	Pump B1 - Discharge Pressure	TF Pump B1 - Discharge Pressure Transmitter	210.1 OP001 PT01
11316048	Pump B1 - Discharge Valve Position	TF Pump B1 - Discharge Valve 01 - Position Feedback Transmitter 01	210.1 CV001 ZT01
11316050	Pump B2 - Discharge Pressure	TF Pump B2 - Discharge Pressure Transmitter	210.2 OP001 PT01
11316051	Pump B2 - Discharge Control Valve Positi	TF Pump B2 - Discharge Control Valve 01 - Position Feedback Transmitte	210.2 CV001 ZT01
11316052	Trickling Filter Common Line - Pressure	Trickling Filter Common Line - Pressure Transmitter 01	210.0 KL002 PT01
11316054	Pump B2 Gland Water Pressure	Pump B2 Gland water - Pressure Indicator	210.2 OP002 PI02
11316055	Pump Station B - Pump 2 Flush Water Flow	Pump Station B - Pump 2 Flush Water Flow Switch	210.2 OP002 FS01
11316057	Pump B1 Gland Water Pressure	Pump B1 Gland water- Pressure Indicator	210.1 OP002 PI02
11316058	Pump Station B - Pump 1 Flush Water Flow	Pump Station B - Pump 1 Flush Water Flow Switch	210.1 OP002 FS01
11316064	Pump Station B - Plant Air Pressure Indi	Pump Station B - Plant Air - Air Reciever 01 - Pressure Indicator	210.8 TT001 PI01
11316065	Pump Station B - Plant Air Pressure Swi	Pump Station B - Plant Air - Air Reciever 01 - Pressure Switch	210.8 TT001 PS01
STN_WW_TP_2001_SCND_TRFP	2150-Trickling Filter Process		521/571/3/3
STN_WW_TP_2001_SCND_SDCP	2200-Solids Contact Process		521/571/3/4
STN_WW_TP_2001_SCND_SCCL	2250-Secondary Clarification		521/571/3/5
STN_WW_TP_2001_SCND_PASA	2300-Activated Sludge & Air Pump Stn		521/571/3/6

Figure 3: Example of Asset labels stored in SAP

Figure 4: Tag / Label – Major Asset

ACTIVITY 7 – DEFINE CRITICALITY FOR EACH ASSET & RECORD IN SAP

During this phase the criticality of each asset will be assessed and entered as a field into SAP. Criticality will be assed using the Criticality Criteria for each asset developed in activity two and expanding this to include the individual; assess

ACTIVITY 8 – DEFINE CRITICAL SPARE REQUIREMENT FOR EACH ASSET

Once the criticality is established the critical spares requirement will be assessed and a list developed of the required to be held in stores for each asset. Critical spares not currently held in the store will be identified and a procurement plan developed.

Figure 5: Existing Critical Spares Store

ACTIVITY 9 – DEFINE OPERATING PARAMETERS FOR EACH ASSET

Once information on the individual assets has been recorded in SAP, the data can then be used proactively.

The operating performance parameters for each asset will be identified and recorded. The purpose of gathering this information is to ensure that the assets are operated in a way that minimised early failure/maintenance issues. Potential hazards associated with the operation and routine maintenance activities on the assets will also be identified and relevant SOPs updated along with the site manual.

ACTIVITY 10 – DEFINE PREVENTATIVE MAINTENANCE REQUIREMENTS

Preventative maintenance requirements for each asset will be developed based on the criticality and entered into SAP. This will include the frequency of maintenance tasks.

ACTIVITY 11 – DEFINE OPERATING PARAMETERS FOR EACH PROCESS STAGE IN CWTP COMPONENT TREATMENT STAGE REPORT

The operating performance parameters for each process stage will be assessed. This will enable staff to get a wholistic understanding of the operation and make informed process decisions. The purpose of this activity is to keep the process operating within the parameters that prolong asset life, and whilst optimising maintenance requirements.

ACTIVITY 12 – ASSESS STATE OF OPTIMISATION FOR EACH PROCESS

During this activity the operation of the process will be optimised. Various operational criteria will be assessed including electrical and chemical use as well as operational and maintenance reliability.

ACTIVITY 13 – ASSESS FUTURE EFFICIENCIES

At the conclusion of the project opportunities for future efficiencies will be identified to support future CAPEX investment decisions.

3 OUTCOMES TO DATE

The project has realised significant improvements to CCC in the OPEX planning for CWTP. This has included an increase in preventative maintenance, driven by both scheduled maintenance and operational checks. The operation of the CWTP has become more consistent and as a result the treatment process has shown improved stability. The methodology applied in this case study project is relevant to WWTPs across Australia and New Zealand and provides a platform for consistent operation and preventative maintenance that is targeted.

The development of the EO&M Program using SAP has resulted in 6,080 operational assets being identified which included 4,625 new SAP asset and field labels, and 580 pipes have been labelled.

Whilst the project is currently at Activity Six, benefits have already been realised. One of the major benefits to come from the improved P&IDs and asset labelling will be the integrity of the Lockout/Tagout (LOTO) processes i.e. energy isolation points can be clearly identified in the P&IDs and in the field.

ACKNOWLEDGEMENTS

The operations and maintenance staff at CWTP have played an important role including: gathering the data, updating SAP, participating in workshops and sharing their knowledge.