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PROJECT

ERF CONSTRUCTION WORKS FOR THE NORTH LONDON HEAT & POWER PROJECT

ORIGINATOR

EMPRESARIOS AGRUPADOS

DOCUMENT TITLE

WASTE WATER SYSTEM FUNCTIONAL DESCRIPTION

NLWA Code						
Project – Originator – Zone – Level – Document Type – Role – Work Type and Number						[QR]
NPE7-EAI-41MX-XXX-RP-XA-000016						
Contractor Code						
Project	Group	Discipline	Doc. Type	Originator	Serial Number	
NLHP	41XX	PE	PD	EAI	0016	
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ERF CONSTRUCTION WORKS FOR THE
NORTH LONDON HEAT & POWER PROJECT

EMPRESARIOS AGRUPADOS

WASTE WATER SYSTEM FUNCTIONAL DESCRIPTION

DOCUMENT CHANGES LOG

Revision	Remarks	Paragraph
P01	Not applicable. First issue.	-

Please take into consideration the recommendations and notes from Hazop sessions.

Please consider the comments done by NLWA in the attached below and provide answer.

It was noted on P&ID revisions and Hazop sessions that several subsystems associated to Waste Water System will suffer significant changes from P&ID Rev. P03, so this Functional Description Rev. P01 will not be exhaustively reviewed.

TABLE OF CONTENTS

1 PURPOSE

The purpose of this document is to describe the main functions, define the basic control of the system, its interfaces with other systems of the **Waste Water System** for the Energy Recovery Facility (ERF) that North London Waste Authority (NLWA) will install at the Edmonton EcoPark Site.

2 REFERENCE DOCUMENTS

The following are the reference documents for the system:

- Flow diagrams:
  - NPE7-EAI-41MX-XXX-PD-XA-000016 - Waste Water System – P&ID
  - NPE7-EAI-41XX-XXX-PD-XA-000004 - Service & Potable Water Distribution System – P&ID
  - NPE7-EAI-41XX-XXX-PD-XA-000017 - Chemical Dosing System - P&ID
  - NPE7-EAI-41AC-XXX-PD-XA-000005 - Boiler Blow-Down System – P&ID
  - NPE7-EAI-41XX-XXX-PD-XA-000018 - Demi Water Storage & Distribution System – P&ID
  - NPE7-EAI-41XX-XXX-PD-XA-000019 - Process Water System – P&ID
  - NPE7-EAI-41XX-XXX-PD-XA-000007 - Closed Cooling Water System - P&ID
  - NPE7-EAI-41XX-XXX-PD-XA-000014 - Sampling System - P&ID
  - NPE7-HZI-41AI-ZZZ-PD-XA-0001 - Bottom Ash Extractor 1 System – P&ID
  - NPE7-HZI-41AI-ZZZ-PD-XA-0002 - Bottom Ash Extractor 2 System – P&ID

EAI

- EA documentation:
  - ~~NPE7-EAI-41XX-XXX-PC-XA-000005 - Component Identification System~~
  - NPE7-EAI-41XX-XXX-MS-XA-000001 - Mechanical Design Criteria
  - NPE7-EAI-41XX-XXX-MS-XA-007501 - I&C Design Criteria
  - NPE7-EAI-41XX-XXX-FM-XA-000001 - Water Balance - Flow Diagram & Design report & Calc.
  - NPE7-EAI-41XX-XXX-SP-XA-000101 - Piping Class Technical Specification
  - NPE7-EAI-41XX-XXX-ME-XA-000005 - Waste Water System - O&M Manual

- Equipment documentation:
  - NP-RUK-41XX-XXX-SP-TA-090001_IChemE - Schedule 1: Description of the Works.
  - NP-RUK-41XX-XXX-SP-TA-090028_IChemE - Schedule 22.1.7: General Technical Requirements.
  - NLHP-00-EC-LT-HZI-0001 - Battery Limits List.
  - NPE7-EAI-41XX-XXX-RG-XA-000001 - Mechanical Equipment List
  - NPE7-EAI-41AX-XXX-CA-XA-000012 – Waste Water System - Calculation Note

Please note that the document applicable for KKS is NPE7-ACC-41XX-ZZZ-ME-WA-000002 KKS Manual. Amend this reference in the applicable documents.

- NPE7-EAI-41XX-XXX-DS-XA-000068 - Auxiliary Horizontal/Closed Cooling Pumps – Datasheets
- NPE7-EAI-41XX-XXX-DS-XA-000059 - Auxiliary Vertical Pumps – Datasheets
- NPE7-EAI-41XX-XXX-DS-XA-000065 - Auxiliary Vertical Sump Pumps - Datasheets
- NPE7-EAI-41XX-XXX-DS-XA-000062 - Workshop Tanks - Datasheets

All reference documents are to be considered in their last revision.

It seems that only a datasheet document with all auxiliary pumps has been issued.

3 GENERAL DESCRIPTION

3.1 FUNCTIONS

The Waste Water System collects waste water from different points of the plant (rain water from roofs, water from ash extractor, clean water from boiler areas, etc.) and supply this water to the final disposal point.

There are different points where water is supplied, depending on the servide, so there are different disposal points and consumers.

3.2 FUNCTIONAL DESCRIPTION

3.2.1 General

Repeated above.

~~As mentioned above, this system collects water from different points of the plant and supply this water to the final disposal point.~~

The Waste Water System consists of the following main equipment:

- One (1) Reused Rain Water Tank (B0GUA10BB001).
- One (1) Rain Water Pit (B0GUA15BB001).
- Two (2x100%) Rain Water Pumps (B0GUA11AP001 / B0GUA12AP001).
- Two (2x100%) Rain Water Overflow Pumps (B0GUA31AP001 / B0GUA32AP001).
- One (1x100%) Reused Rain Water Pressure Group (B0GUA20BU001).
- One (1) Bottom Ash Extractor Pit (B0GMH20BB001).
- Two (2x100%) Bottom Ash Extractor Pit Pumps (B0GMH20AP001 / B0GMH21AP001).
- One (1) IBA Bunker Pumping Pit (B0GMH40BB001).
- Two (2x100%) IBA Bunker Pit Pumps (B0GMH40AP001 / B0GMH41AP001).

Please update with the last systems arrangement.

- One (1) Boiler Waste Water Pit (B0GMH60BB001).
- Four (4x50%) Boiler Waste Water Pit Pumps (B0GMH60AP001 / B0GMH61AP001 / B0GMH70AP001 / B0GMH71AP001).
- Two (2x100%) Boiler Waste Water Pit Overflow Pumps (B0GMH91AP001 / B0GMH92AP001).
- One (1) Boiler Surface Water Attenuation Pond (B0GUA50BB001).
- Two (2x100%) Surface Water Attenuation Pumps (B0GUA50AP001 / B0GUA51AP001).
- One (1) Sewage Pond (B0GRB10BB001).
- Two (2x100%) Sewage Pumps (B0GRB11AP001 / B0GRB12AP001).

3.2.2 Reused Rain Water

The Rain Water from building roofs is storage in the rain water pit, from this pit it is pumped to the Reused Rain Water Tank (B0GUA10BB001) with the Rain Water Pumps (B0GUA11AP001 / B0GUA12AP001). From this tank the water is pumped to the flushing toilets using the Reused Rain Water Pressure Group (B0GUA20BU001).

The Overflow of the Rain Water Pit is pumped to de Surface Water Attenuation Pond with the Rain Water Overflow Pumps (B0GUA31AP001 / B0GUA 32AP001).

At the inlet of the Reused Rain Water Tank there is a fail close automatic valve (B0GUA13AA301). The function of this valve is offer flexibility for maintenance operations and control the water entrance from the Rain Water Pit.

The Rain Water Pumps are equipped with:

- One pressure gauges at discharge (B0GUA11CP501 / B0GUA12CP501).
- One Auto-clean filter at common discharge line (B0GUA13AT001)
- Minimum recirculation line (B0GUA13BR002).
- Common discharge header is equipped with a pressure transmitter (B0GUA13CP001).

There is no need to have auto-clean filter, as commented in P&ID. Please amend.

Check the necessity of installing this line, providing that pumps discharge in a tank.

The Rain Water Overflow Pumps are equipped with:

- One pressure gauges at discharge (B0GUA31CP501 / B0GUA32CP501).
- Common discharge header is equipped with a pressure transmitter (B0GUA31CP001).

3.2.3 Bottom Ash Extraction

The water from IBA Bunker Pumping Pit and Bottom Ash Extractor is collected in the Bottom Ash Extractor Pit, from this pit it is pumped to the Bottom Ash Extractor Lines using the Bottom Ash Extractor Pit Pumps (B0GMH20AP001 / B0GMH21AP001).

Before the Bottom ash Extractor lines terminal points there is a fail close automatic valve for each line (B0GMH30AA301 / B0GMH31AA301 / B0GMH32AA301 / B0GMH33AA301).

The Bottom Ash Extractor Pit Pumps are equipped with:

- One pressure gauges at discharge (B0GUA20CP501 / B0GUA21CP501).
- Common discharge header is equipped with a pressure transmitter (B0GUA20CP001).

3.2.4 IBA Bunker pumping

The water from IBA Bunker is collected in the IBA Bunker Pumping Pit, from this pit it is pumped to the Bottom Ash Extraction Pit using the IBA Bunker Pumping Pit Pumps (B0GMH40AP001 / B0GMH41AP001).

The IBA Bunker Pumping Pit Pumps are equipped with:

- One pressure gauges at discharge (B0GUA40CP501 / B0GUA41CP501).
- Common discharge header is equipped with a pressure transmitter (B0GUA40CP001).

3.2.5 Boiler Waste Water

The waste water from different points is collected in the Boiler Waste Water Pit, from this pit it is pumped to the Bottom Ash Extractor Lines using the Boiler Waste Water Pit Pumps (B0GMH60AP001 / B0GMH61AP001 / B0GMH70AP001 / B0GMH71AP001).

Update arrangement.

Before the Bottom ash Extractor lines terminal points there is a fail close automatic valve for each line (B0GMH80AA301 / B0GMH81AA301 / B0GMH82AA301 / B0GMH83AA301).

The Boiler Waste Water Pit Pumps are equipped with:

- One pressure gauges at discharge (B0GUA60CP501 / B0GUA61CP501 / B0GUA70CP501 / B0GUA71CP501).
- Common discharge header is equipped with a pressure transmitter (B0GUA60CP002).

3.2.6 Surface Water Attenuation

The water from surface water network and the overflow from the rain water pit is collected in the Surface Water Attenuation Pond, from this pond the water is pumped to Salmon's Brook using the Surface Water Attenuation Pumps (B0GUA50AP001 / B0GUA51AP001).

The Surface Water Attenuation Pumps are equipped with:

- One pressure gauges at discharge (B0GUA50CP501 / B0GUA51CP501).
- Common discharge header is equipped with a pressure transmitter (B0GUA50CP001).

3.2.7 Sewage Water

The Sewage Water of the plant is pumped to the Foul Sewage Discharge Point (Chingford Sewer) using the Sewage Pumps (B0GRB11AP001 / B0GRB12AP001).

The Sewage Pumps are equipped with:

- One pressure gauges at discharge (B0GRB11CP501 / B0GRB12CP501).

  Common discharge header is equipped with a pressure transmitter (B0GRB13CP001).

3.3 EMERGENCIES AND TRANSIENTS

The events that can alter the normal operation of the system are listed here below:

- Very high level in Rain Water Pit (B0GUA10CL001A / B0GUA10CL001B).
- Very high level in Bottom Ash Extractor Pit (B0GUA10CL002A / B0GUA10CL002B).
- Very high level in Bottom Ash Extractor Pit (B0GMH20CL001A / B0GMH20CL001B).

Only one pit and 2 LTs are depicted in P&ID.

- Very high level in IBA Bunker Pumping Pit (B0GMH40CL001A / B0GMH40CL001B).
- Very high level in Boiler Waste Water Pit (B0GMH60CL001A / B0HMH60CL001B / B0GMH60CL002A / B0HMH60CL002B).
- Very high level in Surface Water Attenuation Pond (B0GMH40CL001A / B0GMH40CL001B).
- Very high level in Sewage Pit (B0GRB10CL001A / B0GRB10CL001B).
- Very low level in Rain Water Pit (B0GUA10CL001A / B0GUA10CL001B).
- Very low level in Bottom Ash Extractor Pit (B0GUA10CL002A / B0GUA10CL002B).
- Very low level in Bottom Ash Extractor Pit (B0GMH20CL001A / B0GMH20CL001B).
- Very low level in IBA Bunker Pumping Pit (B0GMH40CL001A / B0GMH40CL001B).
- Very low level in Boiler Waste Water Pit (B0GMH60CL001A / B0HMH60CL001B / B0GMH60CL002A / B0HMH60CL002B).

- Very low level in Surface Water Attenuation Pond (B0GMH40CL001A / B0GMH40CL001B).
- Very high level in Sewage Pit (B0GRB10CL001A / B0GRB10CL001B).
- High pressure in pump discharge lines
- Trip of any of pump.

"any of the pumps"?

Indicate the consequences associated to these emergencies and transients.

4 INTERFACES

The interfaces of the system with other systems or related equipment are described below. The interfaces are classified into those that are necessary for the system operation (support systems) and those that are supplied by the system and needed so that other systems con perform their function (dependent systems).

4.1 SUPPORT SYSTEMS

The following systems are required for the proper operation of the Waste Water System:

- Control System (CMS)
- Low Voltage System: for the operation of the pumps and the motor-operated valves.

The different systems downstream the terminal points defined for foul, sewage and surface water should be identified as support systems.

4.2 DEPENDENT SYSTEMS

The following systems require the Waste Water System to operate:

- Flushing Toilets
- Bottom Ash Extractors

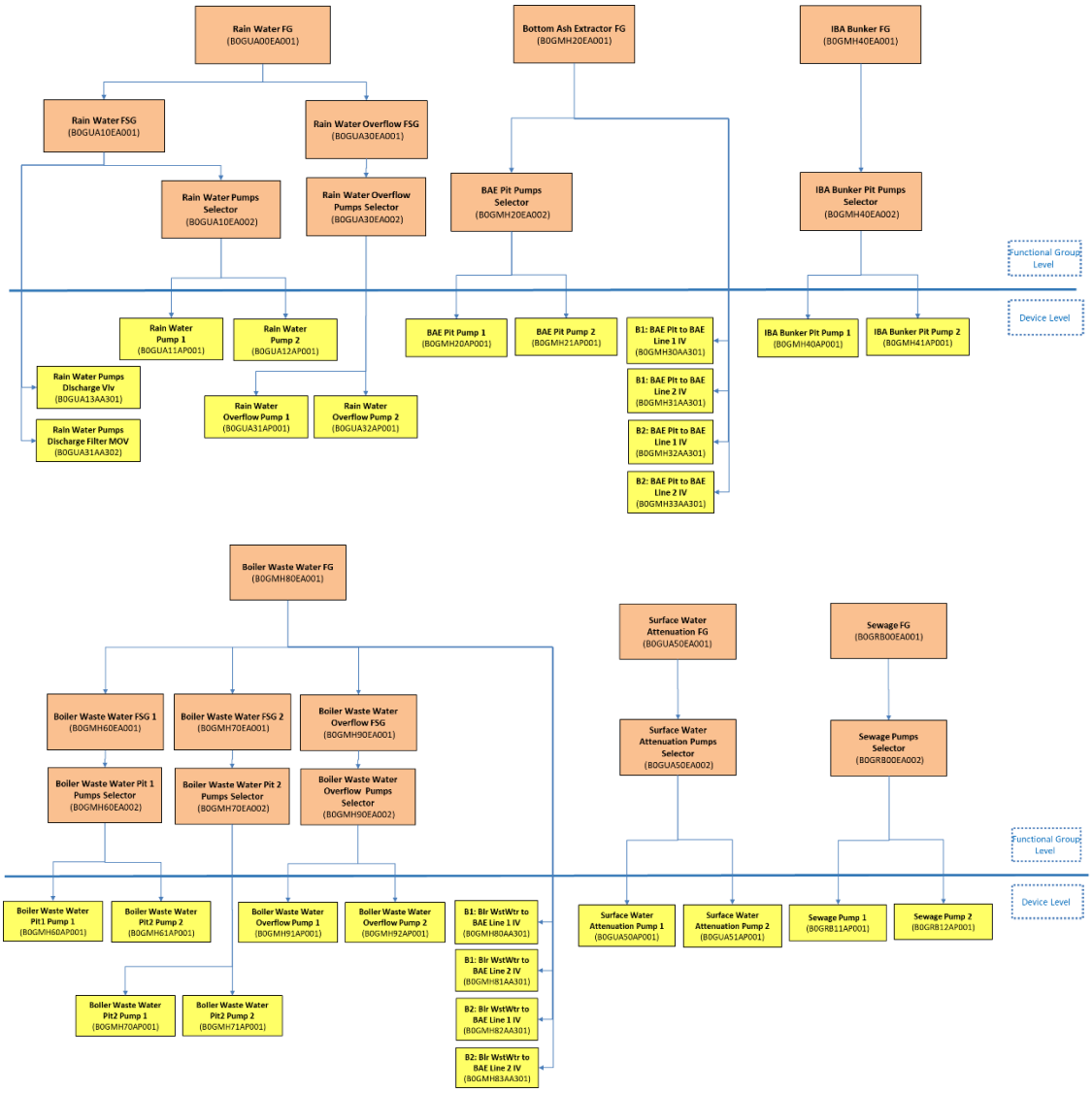
In fact, all the systems which need the waste water system in order to collect drains are dependent systems.

5 INSTRUMENT AND CONTROL

5.1 Operation Description

The Waste Water System instrumentation is shown in P&ID No. NPE7-EAI-41MX-XXX-PD-XA-000016, "Waste Water System - P&ID".

The system control diagram, document No. NPE7-EAI-41MX-XXX-PP-XA-007610 "Waste Water System – Control Logic Diagrams" details the control, protections and automatic devices of the system and includes a block diagram with hierarchical control structure level, so all the conditions to ensure that the system will start up automatically must be fulfilled.



Please update with the last systems arrangement.

Figure 1. Hierarchical Structure

The system can also be controlled from the lower hierarchical levels, actuating directly on the different drives. All drives are monitored and controlled from the operating displays (Human Machine Interfaces or HMI) of the operating stations of the CMS installed in the Central Control Room (CCR).

In order to control and supervise the regulating stations, the system includes Automatic-Manual Operating stations (A/M stations), used by the operator to select the control mode (automatic or manual), modify the setpoints and actuate manually on the demand to the final control element.

When a group or equipment item is in automatic mode, it is not possible to control it from the control faceplate located on the operating screen of each system, and it will only follow the automatic orders from a higher hierarchical level.

When a group or equipment item is in manual mode, the operator has the responsibility of the control. The group or equipment ignores any automatic order received from higher hierarchical levels and the control must be done by the operator from the control faceplate located on the operating screen of each system.

Whatever will be the control mode, the necessary startup permissives, protections and interlocks shall be programmed into the control system to prevent any type of actuation that could cause any damage to the system equipment or dependent systems. Any equipment, whose actuation depends on a measurement's value, will be immediately rejected to manual if that measurement turns to bad quality status. The plant operator will be warned by the corresponding alarm to solve the problem. In that way equipment improper actuations are prevented.

In case of redundant equipments, the selector appoints, through operator's selection, the main one and the standby one(s). If the designated main equipment has a problem that prevents it from operating correctly, the selector will automatically turn the standby equipment into main equipment (and start it if requested). Once the problem is solved in the equipment that was the main one and transferred to automatic mode, this equipment becomes the standby one, ready for any problem in the new designated main equipment.

The different controls developed for the system are described in more detail below.

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The different controls developed for the system are described in more detail below.

5.1.1 Normal Operation

During normal operation, main pumps are in charge of pumping the waste water to the final points.

- Rain Water Pit and Reused Rain Water Tank

During normal operation, Rain Water Pumps (B0GUA11/12AP001) are in charge of supplying water to the reused rain water tank, Rain Water Overflow Pumps (B0GUA31/32AP001) are in charge of delivering the overflow to the attenuation pond. Reused Rain Water Pressure Group (B0GUA20BU001) is in charge of supplying water to the flushing toilets.

It shall be mainly formed by two pumps assemblies with 2x100% rain water pumps, one pump in operation and the other as standby, and 2x100% rain water overflow pumps, one pump in operation and the other as standby as well.

Corresponding functional subgroups shall control de operation of the pumps through a redundant equipment selector switch.

The Rain Water Tank Discharge Valve (B0GUA13AA301) shall be opened or closed automatically depending of the Reused Rain Water Tank level.

This valve should not be required in a simple pumping system, from a reservoir to other reservoir.

This valve should not be required, considering that auto-clean filter is not required.

The Rain Water Pumps Discharge Filter MOV (B0GUA31AA302) shall be normally closed unless the filter is clogged, which will be detected by differential pressure above certain value, in this case the valve will open.

- Bottom Ash Extractor Pit

During normal operation, BAE Pit Pumps (B0GMH20/21AP001) are in charge of supplying water to the bottom Ash Extractor Lines.

It shall be mainly formed by a pump assembly with 2x100% pumps, one pump in operation and the other as standby.

Bottom Ash Extractor functional group shall control de operation of the pumps through a redundant equipment selector switch.

The BAE Lines IVs (B0GMH30/31/32/33AA301) shall be normally opened unless high level is detected in bottom ash extractor lines (HZI scope).

- IBA Bunker Pit

During normal operation, IBA Bunker Pit pumps (B0GMH40/41AP001) are in charge of supplying water to the BAE Pit.

It shall be mainly formed by a pump assembly with 2x100% pumps, one pump in operation and the other as standby.

IBA Bunker functional group shall control de operation of the pumps through a redundant equipment selector switch.

- Boiler Waste Water Pits

During normal operation, Boiler Waste Water Pits Pumps (B0GMH60/61/70/71AP001) are in charge of supplying water to BAE lines, Boiler Waste Water Overflow Pumps (B0GMH91/92AP001) are in charge of delivering the overflow to Chingford Sewer.

Update arrangement.

It shall be mainly formed by three pumps assemblies, two with 2x100% boiler waste water pumps, one pump in operation and the other as standby, one for each boiler waste water pit (2x50%), and 2x100% boiler waste water overflow pumps, one pump in operation and the other as standby as well.

Corresponding functional subgroups shall control de operation of the pumps through a redundant equipment selector switch.

The BAE Lines IVs (B0GMH80/81/82/83AA301) shall be normally opened unless high level is detected in bottom ash extractor lines (HZI scope).

- Surface Water Attenuation Pit

During normal operation, Surface Water Attenuation Pit pumps (B0GUA50/51AP001) are in charge of supplying water to Salmon's Brook.

It shall be mainly formed by a pump assembly with 2x100% pumps, one pump in operation and the other as standby.

Surface Water Attenuation functional group shall control de operation of the pumps through a redundant equipment selector switch.

- Sewage Pit

During normal operation, Sewage Pit pumps (B0GRB11/12AP001) are in charge of supplying water to Chingford Sewer.

It shall be mainly formed by a pump assembly with 2x100% pumps, one pump in operation and the other as standby.

Sewage functional group shall control de operation of the pumps through a redundant equipment selector switch.

Include sequence for pumps auto change over, in order to avoid pumps damage due to long idle periods.

5.1.2 Start-Up

For start-up of all individual pumps, the selected as the main pumps shall start-up, while the other pumps shall remain on standby, awaiting actuation if any problem was detected in the main pumps.

How the operator can decide if the system manual shut-down can be carried out? Should it be an interlock or permissive?

5.1.3 Shutdown

When the maximum operating pressure is reached, the pumps stops automatically and when this value decrease enough the pumps will start if required.

When the system is not needed, it will be shutdown manually by the operator in the control room and it shall cause the automatic stop of all pumps in operation.

Indicate if there is any requirement to be considered in case of emergency shut-down or Plant black-out.

5.2 Analogue Control and Regulation

N/A

5.3 Logic Control and Protections

5.3.1 Rain Water Pumps (B0GUA11/12AP001)

The function of the pumps shall be to supply rain water from building roofs to the Reused Rain Water Rank.

- Start-up Permissives
  - Level above low level in the pit, measured with level transmitters (B0GUA10CL001A/B)
  - No very high level in the Rain Water Tank, measured with level transmitters (B0GUA10CL002A/B)
- Shutdown Permissives
  - The shutdown of the pumps is always permitted

Check instuments tagging according to last comments for redundant instruments.

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with level transmitters (B0GUA10CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

5.3.2 Rain Water Overflow Pumps (B0GUA31/32AP001)

The function of the pumps shall be to deliver the overflow from the rain water pit to the attenuation pond.

- Start-up Permissives
  - Level above low level in the pit, measured with level transmitters (B0GUA10CL001A/B)
- Shutdown Permissives
  - The shutdown of the pumps is always permitted

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with level transmitters (B0GUA10CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

This valve should not be required, considering that auto-clean filter is not required.

5.3.3 Rain Water Pumps Discharge Vlv (B0GUA13AA301)

The function of this valve is to isolate the Rain Water inlet to Reused Rain Water Tank.

- Opening conditions
  - The valve is permitted to open if no very high level is detected in the Reused Rain Water Tank, measured with the level transmitters (B0GUA10CL002A/B)
  - The valve will open in AUTO when the functional group (B0GUA00EA001) is ON
- Closing conditions
  - The valve is always permitted to close
  - The valve will close in AUTO when the functional group (B0GUA00EA001) is OFF or if the level of the Reused Rain Water Tank is higher than a certain value, measured with the level transmitters (B0GUA10CL002A/B)
- Forcing conditions
  - The valve is not forced to open
  - The valve will force to close when the level of the Reused Rain Water Tank is very high, measured with the level transmitters (B0GUA10CL002A/B)

5.3.4 Rain Water Pumps Discharge Filter MOV (B0GUA31AA302)

This auto drain should not be applicable.

The function of this valve is to allow the automatic cleaning of the filter at the common discharge line of the Rain Water Pumps.

- Opening conditions
  - The valve is always permitted to open
  - The valve will open in AUTO when the functional group (B0GUA00EA001) is ON and the differential pressure in the filter is higher than a certain value, measured with the differential pressure transmitter (B0GUA13CP002)
- Closing conditions
  - The valve is always permitted to close

- The valve will close in AUTO when the functional group (B0GUA00EA001) is OFF or the differential pressure in the filter is lower than a certain value, measured with the differential pressure transmitter (B0GUA13CP002)

- Forcing conditions
  - The valve is not forced to open
  - The valve is not forced to close

5.3.5 Bottom Ash Extractor Pumps (B0GMH20/21AP001)

The function of the pumps shall be to supply the water collected from IBA Bunker Pit and BAE to the Bottom Ash Extractor Lines.

- Start-up Permissives
  - Level above low level in the pit, measured with level transmitters (B0GMH20CL001A/B)
- Shutdown Permissives
  - The shutdown of the pumps is always permitted

What happens in the case that all the IV in the lines to the BAE are closed because of high level in the BAEs?

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with level transmitters (B0GMH20CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

5.3.6 BAE Pit to BAE Lines IVs (B0GMH30/31/32/33AA301)

The function of this valves is to isolate the water inlet to Bottom Ash Extractor lines.

- Opening conditions
  - The valve is always permitted to open
  - The valve will open in AUTO when the functional group (B0GMH20EA001) is ON
- Closing conditions

- The valve is always permitted to close
- The valve will close in AUTO when the functional group (B0GMH20EA001) is OFF or if the level of the corresponding BAE lines is higher than a certain value, measured with the level transmitters (B1/B2HDA10/20CL901) (signals coming from HZI system)

- Forcing conditions
  - The valve is not forced to open
  - The valve is not forced to close

5.3.7 IBA Bunker Pit Pumps (B0GMH40/41AP001)

The function of the pumps shall be to supply the water collected from IBA Bunker Pit to the Bottom Ash Extractor Pit.

- Start-up Permissives
  - Level above low level in the pit, measured with level transmitters (B0GMH40CL001A/B)
- Shutdown Permissives
  - The shutdown of the pumps is always permitted

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with level transmitters (B0GMH40CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

5.3.8 Boiler Waste Water Pits Pumps (B0GMH60/61/70/71AP001)

The function of the pumps shall be to supply the waste water collected to the Bottom Ash Extractor Lines.

Update arrangement.

- Start-up Permissives
  - Level above low level in the pit, measured with corresponding level transmitters (B0GMH60/70CL001A/B)

- Shutdown Permissives
  - The shutdown of the pumps is always permitted

What happens in the case that all the IV in the lines to the BAE are closed because of high level in the BAEs?

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with corresponding level transmitters (B0GMH60/70CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

5.3.9 Boiler Waste Water Overflow Pumps (B0GMH91/92AP001)

The function of the pumps shall be to deliver the overflow from the boiler waste water pit to the Chingford Sewer.

- Start-up Permissives
  - Level above low level in the pit, measured with level transmitters (B0GMH60/70CL001A/B)
- Shutdown Permissives
  - The shutdown of the pumps is always permitted

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with level transmitters (B0GMH60/70CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

5.3.10 Boiler Waste Water to BAE Lines IVs (B0GMH80/81/82/83AA301)

The function of this valves is to isolate the water inlet to Bottom Ash Extractor lines.

- Opening conditions
  - The valve is always permitted to open

- The valve will open in AUTO when the functional group (B0GMH80EA001) is ON

- Closing conditions
  - The valve is always permitted to close
  - The valve will close in AUTO when the functional group (B0GMH80EA001) is OFF or if the level of the corresponding BAE lines is higher than a certain value, measured with the level transmitters (B1/B2HDA10/20CL901) (signals coming from HZI system)

- Forcing conditions
  - The valve is not forced to open
  - The valve is not forced to close

5.3.11 Surface Water Attenuation Pumps (B0GUA50/51AP001)

The function of the pumps shall be to supply the water collected from Surface water network and the overflow from the rain water pit to Salmon's Brook.

- Start-up Permissives
  - Level above low level in the pit, measured with level transmitters (B0GUA50CL001A/B)

- Shutdown Permissives
  - The shutdown of the pumps is always permitted

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with level transmitters (B0GUA50CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

5.3.12 Sewage Pumps (B0GRB11/12AP001)

The function of the pumps shall be to supply the sewage water to Chingford Sewer.

- Start-up Permissives

- Level above low level in the pit, measured with level transmitters (B0GRB10CL001A/B)

- Shutdown Permissives

  - The shutdown of the pumps is always permitted

The pumps shall be tripped in case of the following conditions exist:

- Pit level very low, measured with level transmitters (B0GRB10CL001A/B)

The pumps are protected without the need for acknowledgment by the operator, and in automatic control mode, so that it can be restarted, when necessary, once the system restores the situation, by recovering the level in the pit.

5.3.13 Reused Rain Water Pressure Group

The reused rain water unit will be controlled by the package supplier and in the CMS will only be received two hardwired signals to monitor remotely the operational availability and fault of pressure unit.

The two pumps (2) are controlled and monitored by a microprocessor control unit. The first pump is started up when the pressure falls below the pre-set start-up pressure. Additional pumps are sequenced in automatically in line with actual demand. As demand decreases, the pumps are sequenced out again in accordance with the set after-run time. The pump that has been started up first will be stopped first.

The pumps are automatically started up in a different order for each new cycle to equally distribute the pump operating hours.

The reused rain water pressure unit is forced to stop when low level is detected in reused rain water tank, measured with B0GUA10CL002A/B.

5.4 System Automation

5.4.1 Rain Water Functional Group (B0GUA00EA001)

When the system is started up via its functional group by the operator from the control room or from a command coming from a higher hierarchical level, the following actions will be carried out automatically:

- All drives controlled by the functional group shall be switched to automatic control mode.

- FG Start-up Permissives:
  - Rain Water FSG (B0GUA10EA001) available
  - Rain Water Overflow FSG (B0GUA30EA001) available
  - Rain Water Pit level available (B0GUA10CL001A/B) (not in bad quality)
  - Reused Rain Water Tank level available (B0GUA10CL002A/B) (not in bad quality)

The functional group shall always have the stop permissive.

The shutdown of the system through the functional group, either by the operator from the control room or from a command coming from a higher hierarchical level, shall stop automatically the pumps in operation.

All the drives of the group will remain in automatic control mode unless express action by the operator.

5.4.1.1 Rain Water Functional Subgroup (B0GUA10EA001)

When the system is started up via its FG (B0GUA00EA001), the Rain Water FSG (B0GUA10EA001) will be set in auto and start. The following sequence will be initiated:

- All drives controlled by the functional group shall be switched to automatic control mode.
- A start-up command shall be sent to the Rain Water Pumps Selector (B0GUA10EA002). The pump previously selected as main pump shall start-up, while the other one shall remain on standby, awaiting actuation in the event any problem is detected in the main pump.

Rain Water Functional SubGroup Selector (B0GUA10EA002)

The control of the selector shall be identical and as following described. It will start-up the pump (B0GUA11/12AP001) selected as main as long as the following conditions are met:

- The functional subgroup is started-up (B0GUA10EA001)
- The level in the pit is high, measured with level transmitters (B0GUA10CL001A/B)

The selector will stop the pump that was running as long as any of the following condition is met:

- The functional subgroup is stopped (B0GUA10EA001)

- The level in the pit is low, measured with level transmitters (B0GUA10CL001A/B)

- FSG Start-up Permissives:

  - At least one Rain Water Pump (B0GUA11/12AP001) available

These two valves should not be required.

  - Rain Water Pumps Discharge Vlv (B0GUA13AA301) available

  - Rain Water Pumps Discharge Filter MOV (B0GUA31AA301) available

  - Rain Water Pit level available (B0GUA10CL001A/B) (not in bad quality)

5.4.1.2 Rain Water Overflow Functional Subgroup (B0GUA30EA001)

When the system is started up via its FG (B0GUA00EA001), the Rain Water Overflow FSG (B0GUA30EA001) will be set in auto and start. The following sequence will be initiated:

- All drives controlled by the functional group shall be switched to automatic control mode.
- A start-up command shall be sent to the Rain Water Overflow Pumps Selector (B0GUA30EA002). The pump previously selected as main pump shall start-up, while the other one shall remain on standby, awaiting actuation in the event any problem is detected in the main pump.

Rain Water Overflow Functional SubGroup Selector (B0GUA30EA002)

The control of the selector shall be identical and as following described. It will start-up the pump (B0GUA31/32AP001) selected as main as long as the following conditions are met:

- The functional subgroup is started-up (B0GUA30EA001)

- The level in the pit is very high, measured with level transmitters (B0GUA10CL001A/B)

The selector will stop the pump that was running as long as any of the following condition is met:

- The functional subgroup is stopped (B0GUA30EA001)

- The level in the pit is low, measured with level transmitters (B0GUA10CL001A/B)

- FSG Start-up Permissives:

- At least one Rain Water Overflow Pump (B0GUA31/32AP001) available
- Rain Water Pit level available (B0GUA10CL001A/B) (not in bad quality)

5.4.2 Bottom Ash Extractor Functional Group (B0GMH20EA001)

When the system is started up via its functional group by the operator from the control room or from a command coming from a higher hierarchical level, the following actions will be carried out automatically:

- All drives controlled by the functional group shall be switched to automatic control mode.
- It will command the BAE Pit pumps (B0GMH20/21AP001) operation, through the respective selector (B0GMH20EA002), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time. During normal operation, there will be one pump in operation, if the operating pump trip, the standby pump shall start up immediately.

BAE Pit Pumps Selector (B0GMH20EA002)

The control of the selector shall be identical and as following described. It will start-up the pump selected as main as long as the following conditions are met:

- The functional group is started-up (B0GMH20EA001)
- The level in the pit is high, measured with level transmitters (B0GMH20CL001A/B)

The selector will stop the pump that was running as long as any of the following condition are met:

- The functional group is stopped (B0GMH20EA001)
- The level in the pit is low, measured with level transmitters (B0GMH20CL001A/B)

- FG Start-up Permissives:
  - At least one BAE Pit Pump (B0GMH20/21AP001) available
  - BAE Pit level available (B0GMH20CL001A/B) (not in bad quality)
  - The BAE Pit to BAE Lines IVs (B0GMH30/31/32/33AA301) are available

The functional group shall always have the stop permissive.

The shutdown of the system through the functional group, by the operator from the control room, shall stop automatically the pumps in operation.

All the drives of the group will remain in automatic control mode unless express action by the operator.

5.4.3 IBA Bunker Functional Group (B0GMH40EA001)

When the system is started up via its functional group by the operator from the control room or from a command coming from a higher hierarchical level, the following actions will be carried out automatically:

- All drives controlled by the functional group shall be switched to automatic control mode.

- It will command the IBA Bunker Pit pumps (B0GMH40/41AP001) operation, through the respective selector (B0GMH40EA002), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time. During normal operation, there will be one pump in operation, if the operating pump trip, the standby pump shall start up immediately.

IBA Bunker Pit Pumps Selector (B0GMH40EA002)

The control of the selector shall be identical and as following described. It will start-up the pump selected as main as long as the following conditions are met:

- The functional group is started-up (B0GMH40EA001)

- The level in the pit is high, measured with level transmitters (B0GMH40CL001A/B)

The selector will stop the pump that was running as long as any of the following condition are met:

- The functional group is stopped (B0GMH40EA001)

- The level in the pit is low, measured with level transmitters (B0GMH40CL001A/B)

- FG Start-up Permissives:

  - At least one IBA Bunker Pit Pump (B0GMH40/41AP001) available

  - IBA Bunker Pit level available (B0GMH40CL001A/B) (not in bad quality)

The functional group shall always have the stop permissive.

The shutdown of the system through the functional group, by the operator from the control room, shall stop automatically the pumps in operation.

All the drives of the group will remain in automatic control mode unless express action by the operator.

5.4.4 Boiler Waste Water Functional Group (B0GMH80EA001)

When the system is started up via its functional group by the operator from the control room or from a command coming from a higher hierarchical level, the following actions will be carried out automatically:

- All drives controlled by the functional group shall be switched to automatic control mode.

- FG Start-up Permissives:
  - Boiler Waste Water FSGs (B0GMH60/70EA001) available
  - Boiler Waste Water Overflow FSG (B0GMH90EA001) available
  - Boiler Waste Water Pit to BAE Lines IVs (B0GMH80/81/82/83AA301) available
  - Boiler Waste Water Pits level available (B0GMH60/70CL001A/B) (not in bad quality)

The functional group shall always have the stop permissive.

The shutdown of the system through the functional group, either by the operator from the control room or from a command coming from a higher hierarchical level, shall stop automatically the pumps in operation.

All the drives of the group will remain in automatic control mode unless express action by the operator.

5.4.4.1 Boiler Waste Water Functional Subgroups (B0GMH60/70EA001)

When the system is started up via its FG (B0GMH80EA001), the Boiler Waste Water FSGs (B0GMH60/70EA001) will be set in auto and start. The following sequence will be initiated:

- All drives controlled by the functional group shall be switched to automatic control mode.

- A start-up command shall be sent to the corresponding Boiler Waste Water Pumps Selector (B0GMH60/70EA002). The pump previously selected as main pump shall start-up, while the other one shall remain on standby, awaiting actuation in the event any problem is detected in the main pump.

Boiler Waste Water Functional SubGroup Selector (B0GMH60/70EA002)

The control of the selector shall be identical and as following described. It will start-up the corresponding pump (B0GMH60/61/70/71AP001) selected as main as long as the following conditions are met:

- The corresponding functional subgroup is started-up (B0GMH60/70EA001)
- The level in the corresponding pit is high, measured with level transmitters (B0GMH60/70CL001A/B)

The selector will stop the pump that was running as long as any of the following condition is met:

- The corresponding functional subgroup is stopped (B0GMH60/70EA001)
- The level in the corresponding pit is low, measured with level transmitters (B0GMH60/70CL001A/B)

- FSG Start-up Permissives:
  - At least one of the corresponding Boiler Waste Water Pump (B0GMH60/61/70/71AP001) available
  - Boiler Waste Water Pits level available (B0GMH60/70CL001A/B) (not in bad quality)

5.4.4.2 Boiler Waste Water Overflow Functional Subgroup (B0GMH90EA001)

When the system is started up via its FG (B0GMH80EA001), the Boiler Waste Water Overflow FSG (B0GMH90EA001) will be set in auto and start. The following sequence will be initiated:

- All drives controlled by the functional group shall be switched to automatic control mode.
- A start-up command shall be sent to the Boiler Waste Water Overflow Pumps Selector (B0GMH90EA002). The pump previously selected as main pump shall start-up, while the other one shall remain on standby, awaiting actuation in the event any problem is detected in the main pump.

Boiler Waste Water Overflow Functional SubGroup Selector (B0GMH90EA002)

The control of the selector shall be identical and as following described. It will start-up the pump (B0GMH91/92AP001) selected as main as long as the following conditions are met:

- The functional subgroup is started-up (B0GMH90EA001)
- The level in the pit is very high, measured with level transmitters (B0GMH60/70CL001A/B)

The selector will stop the pump that was running as long as any of the following condition is met:

- The functional subgroup is stopped (B0GMH90EA001)
- The level in the pit is low, measured with level transmitters (B0GMH60/70CL001A/B)

- FSG Start-up Permissives:
  - At least one Boiler Waste Water Overflow Pump (B0GMH91/92AP001) available
  - Rain Water Pits level available (B0GMH60/70CL001A/B) (not in bad quality)

5.4.5 Surface Water Attenuation Functional Group (B0GUA50EA001)

When the system is started up via its functional group by the operator from the control room or from a command coming from a higher hierarchical level, the following actions will be carried out automatically:

- All drives controlled by the functional group shall be switched to automatic control mode.
- It will command the Surface Water Attenuation pumps (B0GUA50/51AP001) operation, through the respective selector (B0GUA50EA002), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time. During normal operation, there will be one pump in operation, if the operating pump trip, the standby pump shall start up immediately.

Surface Water Attenuation Pumps Selector (B0GUA50EA002)

The control of the selector shall be identical and as following described. It will start-up the pump selected as main as long as the following conditions are met:

- The functional group is started-up (B0GUA50EA001)

- The level in the pond is high, measured with level transmitters (B0GUA50CL001A/B)

The selector will stop the pump that was running as long as any of the following condition are met:

- The functional group is stopped (B0GUA50EA001)

- The level in the pond is low, measured with level transmitters (B0GUA50CL001A/B)

- FG Start-up Permissives:

  - At least one Surface Water Attenuation pump (B0GUA50/51AP001) available

  - Surface Water Attenuation Pond level available (B0GUA50CL001A/B) (not in bad quality)

The functional group shall always have the stop permissive.

The shutdown of the system through the functional group, by the operator from the control room, shall stop automatically the pumps in operation.

All the drives of the group will remain in automatic control mode unless express action by the operator.

5.4.6 Sewage Functional Group (B0GRB00EA001)

When the system is started up via its functional group by the operator from the control room or from a command coming from a higher hierarchical level, the following actions will be carried out automatically:

- All drives controlled by the functional group shall be switched to automatic control mode.

- It will command the Sewage pumps (B0GRB11/12AP001) operation, through the respective selector (B0GRB00EA002), so that it can manage the start-up and the stop of these pumps depending on the state of the system at any time. During normal operation, there will be one pump in operation, if the operating pump trip, the standby pump shall start up immediately.

<u>Sewage Pumps Selector (B0GRB00EA002)</u>

The control of the selector shall be identical and as following described. It will start-up the pump selected as main as long as the following conditions are met:

- The functional group is started-up (B0GRB00EA001)
- The level in the pit is high, measured with level transmitters (B0GRB10CL001A/B)

The selector will stop the pump that was running as long as any of the following condition are met:

- The functional group is stopped (B0GRB00EA001)
- The level in the pit is low, measured with level transmitters (B0GRB10CL001A/B)

- FG Start-up Permissives:
  - At least one IBA Bunker Pit Pump (B0GRB11/12AP001) available
  - IBA Bunker Pit level available (B0GRB10CL001A/B) (not in bad quality)

The functional group shall always have the stop permissive.

The shutdown of the system through the functional group, by the operator from the control room, shall stop automatically the pumps in operation.

All the drives of the group will remain in automatic control mode unless express action by the operator.

5.5 Set points

Set point values are included in the NPE7-EAI-41XX-XXX-RG-XA-007524 Set Point List.

5.6 Interlocks and Alarms

Waste Water system interlocks and alarms are included in the NPE7-EAI-41XX-XXX-RG-XA-007525 Interlocks & Alarms List.