

Operational Report (Attachment-4-8-1)

Irish Distillers Pernod Ricard
IDL Midleton Distillery Expansion
IE0313231-22-RP-0024, Issue: A



Document Sign Off

Operational Report

Irish Distillers Pernod Ricard
IDL Midleton Distillery Expansion
IE0313231-22-RP-0024, Issue A

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CURRENT ISSUE					
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1 Introduction

The following Operational Report provides information as per required within Section 4.8 of the EPA's Licence Application Form Guidance (Issue 2.1, 8th June, 2021) with regards to unit operations at Irish Distillers Ltd., Midleton (herein after referred to as IDL). In addition the report provides information on associated process controls, aspects that can cause emissions to the environment, details of internal capacity and throughput for each unit operation where relevant.

Updated Process Flow Diagrams (PFD's) within the report provide an overview of all site processes along with brief descriptions. Where appropriate, the PFD's cover both the existing distillery and the proposed expansion related processes where the key distillery related steps remain the same.

Environmental emissions that are associated with each process (i.e. air emissions, wastewater, waste etc.) and associated abatement where relevant are identified within Section 7 of the IE Licence Review Application.

2 Site Processes

2.1 Site Production Process Overview

Global growth in the demand for Irish whiskey has resulted in IDL seeking to sustainably increase its output from approximately 70 million litres of alcohol per annum (MLA) to 133 MLA over the next two decades.

This proposed increased output and expansion will support IDL's ambitious roadmap, already underway, which will see Scope 1 & 2 energy emissions reduced across distilling operations in the Midleton distillery.

There are 2 types of distillation processes, Pot Still Whiskey distillation and Grain Whiskey distillation. Pot Still Whiskey is distilled in a batch process in pot stills from a mash of barley and malted barley. Grain Whiskey is distilled in a continuous process in distillation columns from a mash of corn (maize) and malted barley. In its simplest form, the barley/malted and malted/corn is first brewed and fermented with yeast to make beer and the beer is then distilled to extract the alcohol. The component parts of the overall whiskey making process are outlined in Figure 2.1 with the proposed new distillery expansion included.

Within the proposed new distillery expansion, IDL intend to replicate the specialist brewing and distilling technologies and processes already being used at the existing distillery. To this effect many of the process descriptions provided in the following sections also apply to those as now proposed within the new distillery.

As outlined within Section 1 of the IE Licence Review Application the expansion project will consist of a number of new process buildings within a new greenfield area of the site south of the Dungourney River linked back to the existing site with a road bridge crossing the Dungourney River. A pipe bridge will also link back to the existing site that will transfer utility services, thin stillage, fusel oil, organic waste and distilled spirit from new tank farms back to the existing Vat House area for subsequent transfer in casks to the existing maturation warehouses both on and off site in Dungourney.

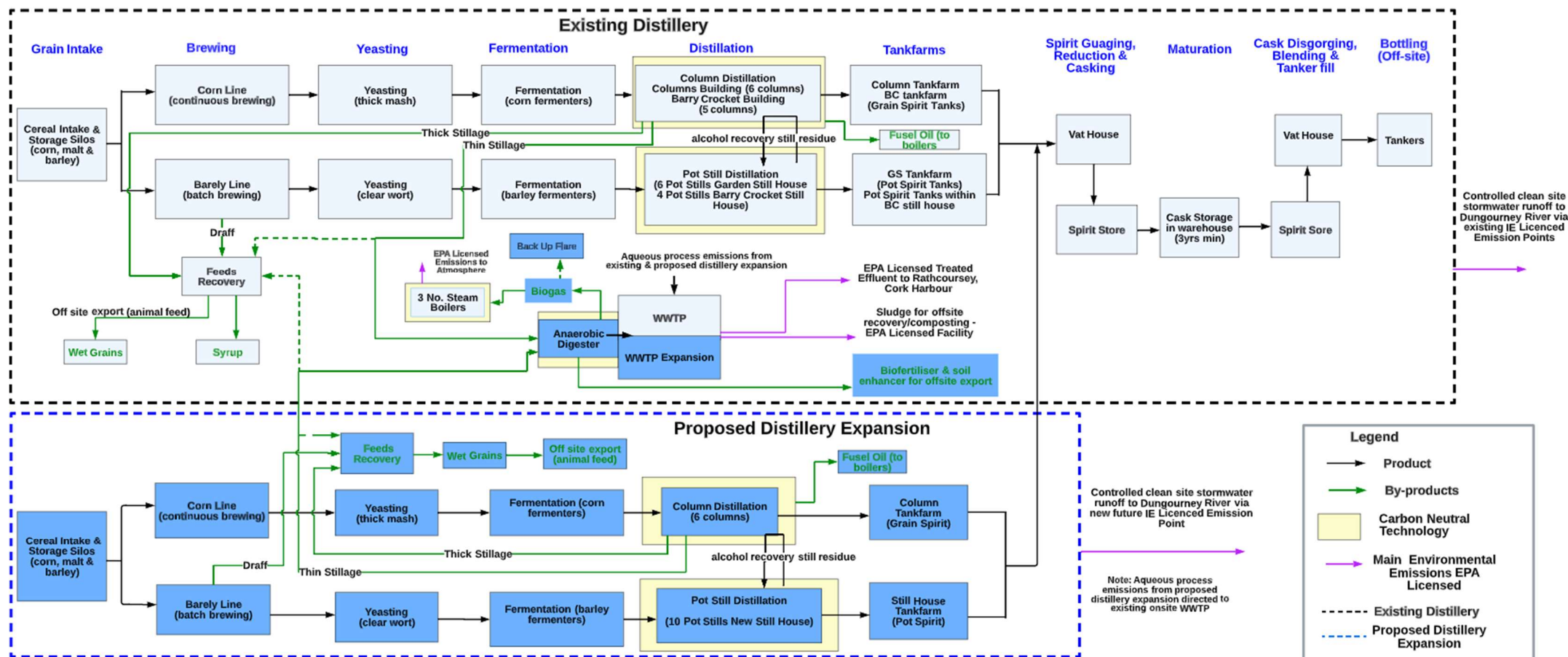


Figure 2.1 Overall PFD of on-site production processes existing (pale blue blocks) and proposed (dark blue blocks)

A list of the existing and future phase individual site processes is provided below in Table 2.1. A description of these processes is provided throughout the remainder of this report with accompanying process flow diagrams (PFDs) as provided by IDL where relevant. Table 2.2 includes legends applicable to IDL PFDs within the report.

Table 2.1 Summary of Site Processes – Existing and Proposed

Section	Site Process + Area	Proposed Changes	PFD No.
2.1	Overall site production processes	Distillery expansion	2.1
2.2	Grain Intake & Storage – Existing	No planned changes on existing site	2.2
	New Grain Intake & Storage on expansion site, north west side of the new Brew House	Additional new designated grain intake and daily storage area within new Brew House	2.2
2.3	Batch Brewing (Barley Line) – Existing Brew House	No planned changes on existing site	2.3
	Batch Brewing (Barley Line) – Proposed New Brew House on Expansion Site	Additional new barley line replicating batch brewing process on existing site	2.3
2.4	Continuous Brewing (Corn Line) – Existing Brew House	No planned changes on existing site	2.4
	Continuous Brewing (Corn Line) – Proposed New Brew House on Expansion Site	Additional new corn line replicating continuous brewing process on existing site	2.4
2.5	Yeasting & Fermentation – Existing Brew House	No planned changes on existing site	2.5
	Yeasting & Fermentation – Proposed New Brew House on Expansion Site	New yeast storage and new fermenters replicating yeasting & fermentation on existing site	2.5
2.6	Pot Still Distillation (Barley line) – Barry Crockett Still House (4 pots)	No changes apart from MVR installation 2023	2.6.1, 2.6.2, 2.6.3
	Pot Still Distillation (Barley Line) – Garden Still House & External Tank Farm (6 pot stills)	No planned changes apart from MVR installation 2023	2.6.1, 2.6.2, 2.6.3
	Pot Still Distillation (Barley Line) – Proposed New Pot Still Building (10 Pot Stills) & External Tank Farm	New Still House building and external tank farm on expansion site	2.6.1, 2.6.2, 2.6.3
2.7	Continuous Distillation	See Sections 2.7.1 & 2.7.2 below	-
2.7.1	Grain Column Plant - Continuous Distillation (Corn line) – Barry Crockett Still House (3 Columns)	No planned changes on existing site - MVR installation proposed for 2024	2.7.1
	Grain Column Plant (Corn Line) – Distillation Column Building (3 Columns) & External Tank Farm	No planned changes on existing site - MVR installation proposed for 2024	2.7.1
	Grain Column Plant (Corn Line) – Proposed New Distillation Column Building & External Tank Farm	New Distillation Building on-expansion site with 3 grain columns (will include MVR technology) and external tank farm	2.7.1
2.7.2	Wash Column Plant (Barley Line) – Distillation Column Building (3 Columns)	No planned changes on existing site - MVR installation proposed for 2024	2.7.2

Section	Site Process + Area	Proposed Changes	PFD No.
	Wash Column Plant (Barley Line) – Proposed New Distillation Column Building (3 Columns)	New Distillation Building on-expansion site with 3 wash columns (will include MVR technology) and external tank farm	2.7.2
	Wash Column Plant (Barley Line) – Existing Barry Crocket Still House (2 Columns)	No planned changes on existing site apart from MVR installation in 2023	2.7.3
2.8	Vat House & Spirit Store - Alcohol Reduction / Alcohol Blending, Cask Filling / Cask Disgorging (New Make Spirit & Mature Spirit)	Recent changes include additional Vats added adjacent to Vat House in 2022/23.	2.8.1 2.8.2
2.9	Feeds Recovery – Existing Feeds Recovery	Driers and Feeds recovery stack being decommissioned	2.9
	Feeds Recovery – Proposed New Feeds Recovery	New Feeds Recovery within the new Brew House Building	2.9
2.10	Micro Distillery: Gin Distillation and Whiskey Distillation	No changes planned	-
3.0	Utilities and Support Processes		
3.1	Anaerobic Digestion Plant	New AD plant to treat process thin stillage from existing and proposed continuous distilling operations to generate biogas for use within on site boilers.	3.1
3.2	WWTP Expansion	Expansion to existing WWTP to facilitate AD and distillery expansion	3.2
3.3	Overview of Advance Heat Recovery System – Concept Design Phase	Currently at Concept Design Phase – As part of Scope 1 & 2 energy emissions reduction strategy, it is proposed to recover waste heat from chillers and cooling towers in an advanced heat pump system to deliver heat for various process users in the expansion site.	3.3
3.4	Overview of Water Recovery Plant	2 new RO units to be installed as part of expansion	3.4
3.5	Water Treatment Plant	Existing treatment plant south-east area of site, no changes proposed.	3.4 & 3.5
3.6	Cooling Water	No changes to existing system, closed loop cooling will be used for expansion site	3.6
3.7	Mechanical Vapour Recompression (MVR)	MVR technology to be incorporated as part of the expansion & Scope 1 & 2 energy emissions reduction strategy. A closed loop system that captures, compresses and recycles steam generated in the distilling process.	3.7
3.8	Steam Boilers	Burner retrofit to allow for 100% biogas fuel option	3.7
3.9	Cleaning-In Place (CIP)	CIP regime on existing site to be replicated within expansion site.	3.8
3.10	Central Laboratory	Located behind main offices, no planned changes.	NA

Table 2.2 Legends Applicable to IDL PFDs within the report

	Step/Stage in the PFD relevant to the existing and new distillery
	Step/Stage in the PFD relevant to the existing distillery only
	Hot process water
	Cold process water
	Process additions
	Waste

By-products associated with the existing and proposed expansion are outlined in Table 2.3. Where relevant these by-products are identified in the PFDs.

Table 2.3 Distillery By-products – Existing and Proposed.

By-products	
Existing Distillery	Distillery Expansion including Anaerobic Digester and WWTP Expansion
1. Fusel Oil from distillation process for use as a fuel in the existing on-site boilers – EPA Approved Article 27 Notification January 2013	Additional quantities of fusel oil
2. Animal feed i.e. syrup and wet grains from the feeds recovery process. EPA Article 27 Notification approved in May 2013 (Note distillers dark grains were also approved, however the onsite drier and associated stack (air emission point A2-1) were decommissioned in 2023).	Additional quantities of animal feed (syrup and wet grains)
	3. Phosphate biofertiliser from the biogas generation process – by-product notification to be submitted
	4. Digestate solids / soil enhancer from the biogas process- by-product notification to be submitted
	5. Biogas for use in the on site boilers (to be confirmed if biogas falls under the remit of by-product Article 27)

2.2 Grain Intake & Storage

Grain intake at the facility will double due to the proposed expansion with a new additional dedicated grain intake and storage area proposed within the expansion site that will be located to the north west side of the new Brew House. In addition to Grain Intake, the new Brew House will also house Batch Brewing, Continuous Brewing, Yeasting and Feeds Recovery within the building.

2.2.1 Brief Process Description

A process flow diagram of this activity (existing and proposed) is provided below.

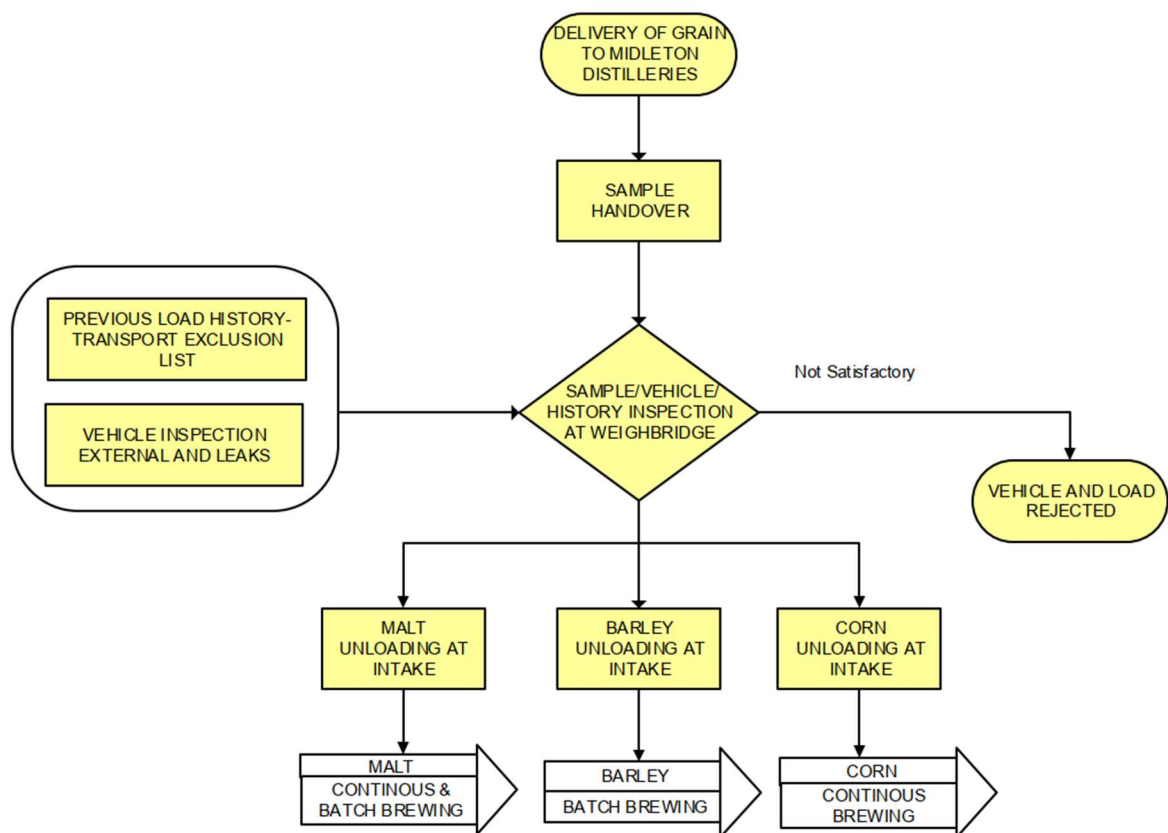


Figure 2.2: PFD for Grain Intake and Storage – Existing & Proposed

Following the relevant site quality inspections, grain is discharged from trucks into unloading hoppers – one each for corn, malt and barley. From the hoppers, corn, malt and barley are brought by bucket elevator / conveyors into separate storage bins located at the top of the Grain Intake building.

Similar to the existing site, within the expansion site three raw materials, corn, malt and barley will be delivered to the new distillery site in trucks and tipped from the truck into a separate intake hopper for each of the three grain types and conveyed to dedicated storage bins (2 no. for each grain type), all located at grade within the north west side of the new Brew House. Storage bins are represented accordingly in subsequent PFDs presented in Figures 2.3 and 2.4.

There are four grain storage bins within the existing site:

- Malt Storage Bin: 110 tonnes
- Barley Storage Bin: 140 tonnes
- Primary Corn Bin: 125 tonnes
- Secondary Corn Bin: 20 tonnes

Six new grain storage bins are proposed for the expansion site:

- Two Malt Storage Bins: 130 tonnes each
- Two Barley Storage Bins: 130 tonnes each
- Two Corn Bins: 240 tonnes each

The location of the existing and proposed grain intake and storage areas are shown in Drawing No.s IE0313231-22-DR-0007 and IE0313231-22-DR-0008.

2.2.2 Internal Capacity / Throughput

The total quantity of grain utilised during 2022 was:

Maize:	36,600 tonnes
Barley:	25,400 tonnes
Malt:	110,700 tonnes
Total:	172,700 tonnes per annum

Following full completion of the expansion at the Distillery, it is expected that the total grain requirement will be in the order of 350,000 tonnes per annum.

2.2.3 Process Control

All grain bins are fitted with high level alarms. The entire system is automated and controlled by an on-site SCADA (Supervisory Control and Data Acquisition) system with a 24 hour operator presence.

2.2.4 Emissions During Normal Operations

Table 2.4 Grain Intake and Storage Emissions During Normal Operations

Emission Type	Description
Atmospheric	Emission points associated with this activity have been included in Attachment-7-4-1 and Attachment-7-4-2. The locations of the existing and proposed main and minor emission points are identified on Drawing No.s IE0313231-22-DR-0010 and IE0313231-22-DR-0021.
Sewer	None
To Waters	None
Waste	Non-Hazardous: Potential spills around unloading hoppers Rejected grain load
Noise	There are no specific noise sources associated with this activity that may impact on off site noise sensitive locations (NSLs)

2.3 Batch Brewing – Existing and Proposed

The brewing process entails milling the grain feedstock into a fine flour called grist. Water is added to the grist and the temperature is raised to solubilize the starch. The process of conversion (saccharification) of the starch to "fermentable sugars" (primarily glucose and maltose) takes place at controlled temperatures. Brewing at Irish Distillers is carried out at atmospheric pressure in either a **batch or continuous process**.

Within the Batch Brewing process, barley and malt are brewed and fermented with yeast to make a beer called "wash" prior to the distillation process. There are no changes planned for the Batch Brewing process within the existing site, however a new dedicated Brew House is planned within the expansion site. Batch Brewing within the expansion site will essentially mirror the Batch Brewing process philosophies carried out within the existing site.

2.3.1 Brief Process Description

The existing and proposed barley line brewing incorporates:

- Barley Screening / Weighing
- Malt Screening/ Weighing
- Malt Milling
- Barley Milling
- Mash Production
- Mash Filtration
- Spents Grain (Draff) Handling
- Wort Cooling / Handling

A process flow diagram of the existing and proposed Batch Brewing process is provided in Figure 2.3 overleaf.

Barley Screening

Separate combi screens screen, classify and de-stone the barley grain particles taken from the barley storage bins. They include magnets to remove any metal foreign objects. The screened barley is then passed through hopper scales to weigh the material before being conveyed to storage hoppers. Stones, metal, sand, etc. removed from the combi screens are discharged in a rubble bin and sent for offsite waste disposal / recovery in accordance with IE Licence conditions.

Abatement System: Air emissions from the combi screens are passed through cyclones with high pressure filtration to remove dust and other waste material before discharging to atmosphere through vents in the side wall.

Monitoring pressure drop and alarm settings: the pressure drop across the filters is monitored by a pressure switch which is integrated in the abatement unit. The device triggers one single alarm in case of high pressure (filter clogged) or low pressure (filter damaged or missing) or wiring defect.

Malt Screening

The malt is fed from the storage bins and passed through hopper scales to weigh the material. Separate combi screens screen, classify and de-stone the malt grain particles. They include magnets to remove any metal foreign objects. Malt is then conveyed to the storage hoppers. Stones, metal, sand etc. removed from the combi screens are discharged in to a rubble bin and sent for offsite waste disposal / recovery in accordance with the site's IE Licence conditions.

Abatement System: Air emissions from the combi screens are passed through cyclones to remove dust and other waste material before discharging to atmosphere through vents in the side wall.

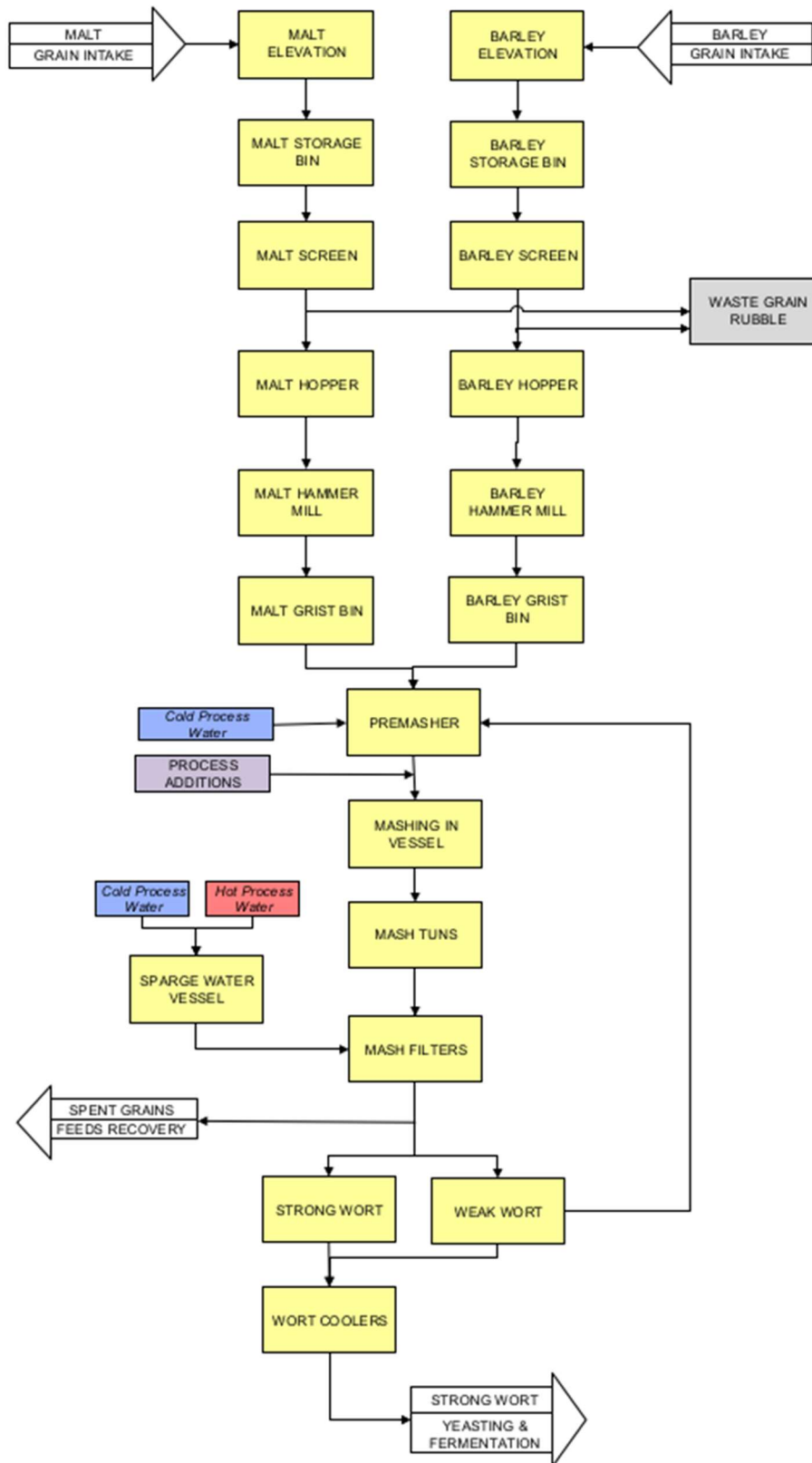


Figure 2.3 PFD for Batch Brewing Process – Existing and Proposed

Malt Milling

Malt from the malt storage hoppers is fed into a hammer mill. Here, the malt grain is crushed and hammered to turn it into a product called “Grist”.

Abatement System: The milling equipment is fitted with filters and cyclones to remove the grist from the air flow that is used throughout the milling process. The air exhaust from the cyclones is passed through dust filters before discharging to atmosphere. The separated grist material is then discharged into grist storage bins.

Barley Milling

This is the same as the malt milling process. The barley grist is discharged into dedicated storage vessels. Barley from the barley storage hoppers is fed into the barley hammer mill where the Barley grain is crushed and hammered to turn it into “Grist”.

Abatement System: On one existing barley mill, the air exhaust from the cyclone is passed through dust filters before discharging to atmosphere. On the other existing barley mill, the milling equipment is not fitted with a cyclone but is fitted with its own sock filter system to remove the grist from the air flow that is used throughout the milling process. The air exhaust from the mill and grist bin is passed through a dust filter before discharging to atmosphere. The separated grist material is then discharged into a designated grist storage bins.

Similarly for the expansion site one malt and two barley mills with integral grist bins and associated filters will be installed to produce the required grist.

Mash Production

The barley and malt grist is then transferred from their respective storage hoppers through a premasher where process water / weak wort is supplied at a pre-set water / grist ratio and temperature. This wet material is then fed into a mechanical masher to a set volume. Additional water is added to the masher during the process for both rinsing purposes and to achieve the correct density. The mash pump pumps the mash mixture to the mashing-in vessel until the correct amount of barley grist / malt grist and water have been added.

The purpose of the next few process steps is to convert the starch in the crushed grains into fermentable sugars. This is completed by increasing the temperature of the mixture and holding at different set-points for specified time periods.

Mashing-In Vessel

The purpose of this vessel is to ensure that there will be a uniform mash transferred to the Mash Tuns. The temperature of the mixture is maintained through the use of direct clean steam. The mixture is constantly agitated within the vessel ensuring uniform heating throughout. Minor emission points associated with these tanks, venting steam to atmosphere are outlined in Attachment-7-4-2.

Mash Tuns

This heated mixture is then transferred by pump from the “Mashing-In” vessel to any of the respective “Mash Tuns”. Heating, mixing and temperature holding of the mash mixture takes place in the Mash Tuns before the material is transferred to any of the respective mash filters. Minor emission points are associated with each Mash Tun vessel again venting steam to atmosphere.

Mash Filters

A Mash transfer pump pumps the material from the “Mash Tuns” to one of the designated “Mash Filters”. The filters are used to separate the liquid from the solids in the mash material. The filtration process also entails the use of “sparging” water which is preheated in order to maximise wort extraction from the filters. The clear liquid from the filters is called wort (strong and weak) while the solid material is referred to as “Spent Grains or Draff”. There are no external air emission points associated with the mash filters.

Spent Grains

The spent grains from the mash filters is discharged into storage hoppers and then conveyed from here to the respective "Feeds Recovery" process (Refer to Section 2.9).

Strong Wort

Strong wort is stored in a separate tank which acts as a buffer tank between the mash filter and wort coolers. The strong wort is then pumped from the storage tank through the wort cooling process where the wort will be cooled from 77°C down to 27°C. The cooling process is designed with heat exchangers that provide the hot water required for the Brew Houses thereby saving energy.

The cooled strong wort is then sent to the yeasting and fermentation process.

Weak Wort

Weak wort is reused in the process back at the Pre-masher stage.

Both the strong wort and weak wort storage tanks vent to atmosphere.

2.3.2 Internal Capacity / Throughput

In the existing site Batch Brewing has the capacity to process 585 tonnes of malt and 975 tonnes of barley a week, producing 6,100m³ of wash for the fermentation stage, this capacity will essentially be doubled by the expansion site.

2.3.3 Process Control

Temperature and residence time are the critical parameters of control in the batch brewing process. Direct steam, cold and hot process water are used for temperature and mixing requirements.

Cavern cooling water is used for final coolers on the existing system. A closed loop cooling water system will be used for the expansion site.

The entire process is controlled by the site's SCADA system and is overseen by production personnel on a 24 hour basis.

2.3.4 Dust Suppression System**Existing Malt Mill and Barley Mill No. 1**

Each milling unit is fitted with a reverse jet filter and cyclone to remove the grist from the air flow that is used throughout the milling process. The air exhaust from the cyclones is passed through a dust filter before discharging to atmosphere. Fine dust particles are retained by the bag filters.

Monitoring pressure drop and alarm settings: the pressure drop across the filters is monitored by a pressure switch. For the hammer mill cyclones two differential pressure switches are installed on each mill cyclone. One differential switch on each cyclone releases an alarm in the control system for a blocked bag (high pressure across the bags). The second differential pressure switch installed on each cyclone is used to indicate a torn or missing filter bag (low pressure). This switch releases an alarm in the control system for a low pressure under the specified trip setting.

Existing Barley Mill No. 2

The newest barley hammer mill within the existing Brew House includes a Meura high separation efficiency filter which is integral to the milling process. The filter equipment for the barley mill consists of a Bag Filter Dust Extraction Unit with a design flow rate of 4,500 Nm³/hr which is directly mounted on to the mill and grist bin system. The subsequent filtering of the dust laden air by the filter elements produce a very high purity of the cleaned air through the atmospheric emission point (99.95 % removal efficiency) and maximizes the percentage of dust (barley flour)/raw material for use in the process.

Performance of the filter is guaranteed by monitoring vacuum within housing, differential pressure across the filter and alarming to ensure filter failures are captured by the SCADA system. The filters are replaced every year.

Similarly for the expansion site, the proposed new malt and two barley mill systems will be similar in function to the above described existing Barley Mill No. 2 Meura high separation efficiency filter units ensuring 99.95% removal efficiency and maximising the percentage of flour for use in the process.

2.3.5 Emissions During Normal Operations

Table 2.5 Batch Brewing Emissions During Normal Operations

Emission Type	Description
Atmospheric	There are a number of main (particulates i.e. flour dust only) and minor emission points (steam and product vapours) associated with the Batch Brewing process. These are identified in Attachment-7-4-1 and Attachment-7-4-2 of the IE Licence Review Application. The locations of the main and minor emission points are identified on Drawing No.s IE0313231-22-DR-0010 and IE0313231-22-DR-0021. There are pressure relief panels located on the grain elevators and these are included under Potential Emissions within Attachment-7-4-2.
Sewer	There are emissions to the WWTP drainage system from floor washings and the on-site Cleaning In Place (CIP) regime. The CIP process is detailed later on under a separate process activity. Treated effluent from the WWTP is discharged to the public sewer at IE Licenced emission point (SE2), which ultimately outfalls at Rathcoursey Point, Cork Harbour. CIP in this area is typically completed once every 7-10 days.
To Waters	Cavern cooling water is used for non-contact trim cooling on the strong wort coolers and returned to the Dungourney River via IE Licenced emission point SWE1 with continuous TOC & temperature monitoring and control. A closed loop cooling tower water system will be used for the expansion site, with no resultant emissions to waters.
Waste	Spent grains are sent to feeds recovery for offsite use as animal feed – i.e. an EPA approved by-product) Dust collected in dust suppression units Waste grain rubble Minimal waste from floor spillages, process line blockages.
Noise	There are no major noise sources identified with the Batch Brewing process as all equipment is and will be located indoors with minimal impact at off site noise sensitive locations. Clean air from the mills is and will be ducted to atmosphere via silencers.

Emissions associated with the various brewing processes existing and proposed were included in the air dispersion modelling exercise undertaken and discussed in Chapter 11 of the EIAR, included as Attachment-6-3-6 to the IE Licence Review Application Form.

2.4 Continuous Brewing - Existing and Proposed

As outlined previously, the brewing process entails cooking of the milled grain in water to solubilize the starch; the process of conversion (saccharification) of the starch to "fermentable sugars" (primarily glucose and maltose). Cooking is carried out at atmospheric pressure in either a **batch** or **continuous process**.

There are no changes planned for the Continuous Brewing process within the existing site, however a new dedicated Brew House is planned within the expansion site whereby Continuous brewing within the new Brew House will replicate the same brewing process as that conducted within the existing site.

2.4.1 Brief Process Description

A process flow diagram of the existing and proposed Continuous Brewing process is provided in Figure 2.4.

Corn is passed through a corn screen (existing site only, corn will be pre-screened arriving to the expansion site) before being discharged into storage bins. Screened corn from the storage bins is weighed and conveyed into a hammer mill with its associated dust extraction system (further details on dust extraction system provided below). From here, the milled corn is discharged into a Corn Slurry Tank where it is mixed with hot water and process additives.

Hot Mash is subsequently pumped to the low temperature cooker where the temperature is increased by the addition of steam. The Liquefaction stage liquefies the starch from the milled corn. This tank's contents are circulated and agitated and the viscosity of the contents is reduced before it is forwarded to the primary energy recovery system.

Mash is pumped to a multi-stage flash vessel No. 1 where the temperature is reduced. Condensable vapours from the vessel are recovered within the hot water recovery system for reuse in the corn slurry tank.

In parallel with this, screened malted barley from the storage bins is weighed and milled via a hammer mill and fed to the malt slurry tank where it is mixed with process water and additives. Mash exiting flash vessel No.1 is mixed with malt slurry and pumped to the cooker convertor tank where the conversion to fermentable sugars begins.

The outlet from the cooker convertor tank is pumped to the secondary energy recovery system (flash cooling vessel 2). Mash exiting Flash Vessel No. 2 is routed to the beer/corn fermenters. Condensable vapours from the vessel are recovered within the hot water recovery system for reuse in the corn slurry tank. Non-condensable gases from flash vessels 1 and 2 are routed to atmosphere as minor emission points.

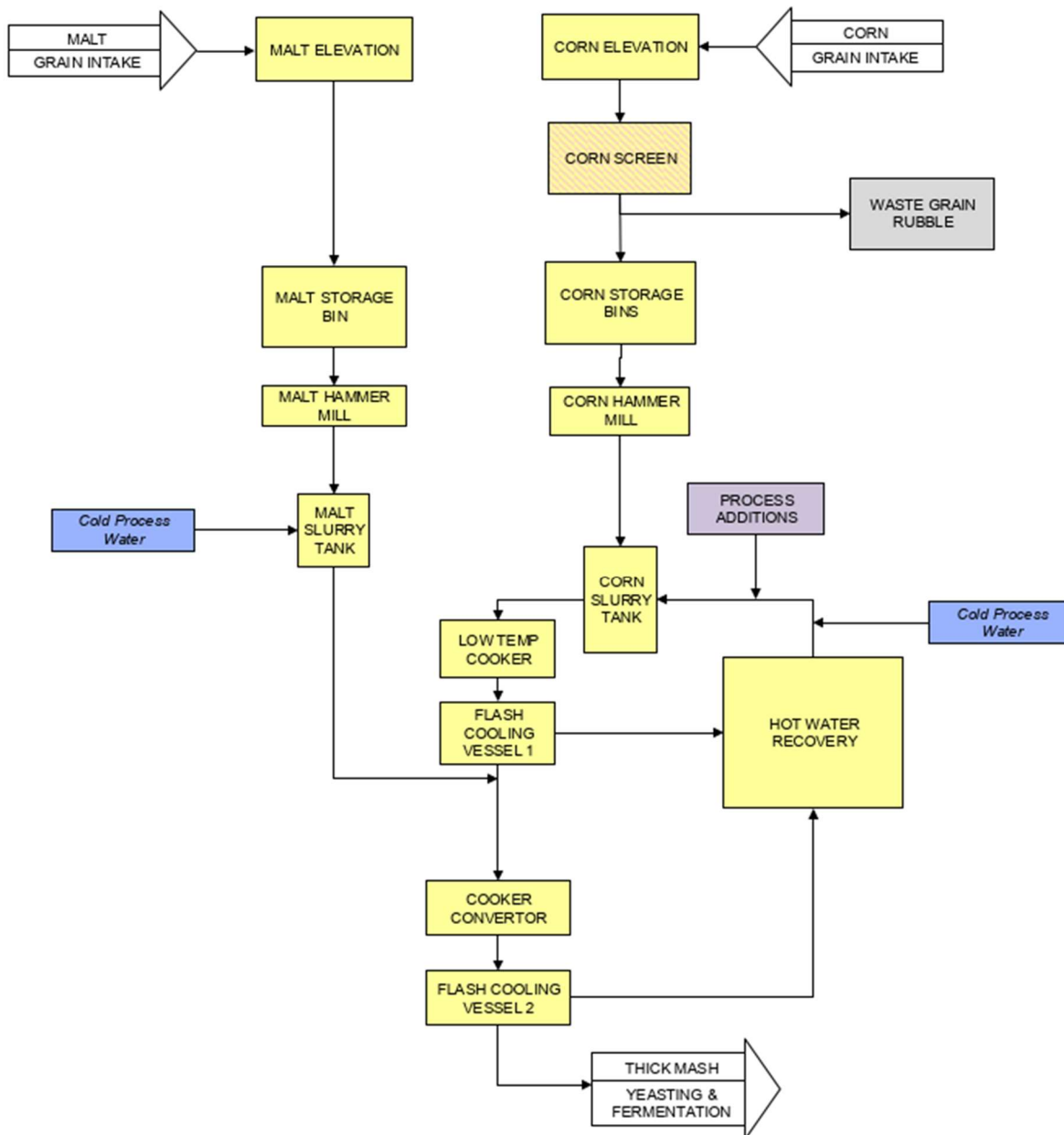


Figure 2.4: PFD for Continuous Brewing Process – Existing and Proposed

2.4.2 Internal Capacity / Throughput

In the existing site Continuous Brewing has the capacity to process 1,400 tonnes of corn and malt a week, this capacity will essentially be doubled by the expansion site.

2.4.3 Process Control

Temperature, vacuum control and residence time are the critical parameters of control. Direct steam is used and cold process water is used for temperature and mixing requirements. Exchanging heat by condensing flash vapours is the principle of the primary and secondary heat and water recovery systems. Cooling water is also used for final coolers. The entire process is

controlled by the site's SCADA system and is overseen by production personnel on a 24 hour basis.

2.4.4 Dust Suppression System – Existing Site

The objective of the dust suppression system is to maximize the percentage of dust material (grain flour) for use in the process, however as part of this system the purity of the air emissions discharged to atmosphere are also guaranteed.

Corn Milling

The continuous brewing system includes corn hammer mills and associated high separation efficiency filters, which are integral to the milling process. The filter equipment for the corn mills consists of a high-pressure filter with a design flow rate of 6,000 Nm³/hr which is directly mounted on to the mill under the hopper. Initial dust separation within the units is by centrifugation, the subsequent filtering of the dust-laden gas by the filter elements produces a very high purity of the cleaned gas (99.95 % removal efficiency) and maximizes the percentage of dust (corn flour/raw material) for use in the process.

Performance of the filters is guaranteed by monitoring differential pressure across the filters and the inclusion of alarms for high and low differential pressure to ensure filter failures are captured by the SCADA system and uncontrolled emissions to atmosphere are prevented.

Malt Milling

The malt milling system is connected to the Donaldson dust suppression unit. The purpose of the Donaldson system is to minimise the risk of a dust explosion in the Brew House by removing dust from the grain handling and conveying systems. The Donaldson extraction system functions by removing dust from the malt system in addition to the three cereal conveyors. It works using an extraction fan which draws air through a filter unit which is mounted on the suction side of the fan. The filter unit, in turn, is connected to various items of equipment such as conveyors and the malt mill.

The dust extracted by the fan is captured by the filter unit, while the air is vented to atmosphere. Compressed air is pulsed into the filter unit releasing the dust from the filter. The dust leaves the base of the filter unit and is conveyed to the Rubble Bin, where it joins the rubble (stalks, chaff, stones, etc.) which has been screened within the process from the cereals.

When the level switch in the bottom section of the dust collector is activated, it automatically stops the main extract fan and a warning tag appears on the operator control screen showing 'Unblocking' and the unit starts to try and unblock the filter by purging air into it. Once the maximum number of cycles has been reached the unit goes into alarm and displays 'Blocked' on the operator screen and the main fan remains stopped. The system has to be manually unblocked and reset.

2.4.5 Dust Suppression System – Expansion Site

Corn and Malt Milling

Similar to the existing site, the continuous brewing system within the expansion site will include a corn hammer mill and malt hammer mill with associated high separation efficiency filters which are integral to the milling process.

The filter equipment for the two mills will consist of Buhler supplied high pressure type filters the design of which is expected to be similar to the above described corn mill filter producing a very high purity of the cleaned gas (99.95 % removal efficiency) and maximizing the percentage of dust (corn flour/raw material) for use in the process.

Performance of the filters will be guaranteed by monitoring differential pressure across the filters and the inclusion of alarms for high and low differential pressure to ensure filter failures are captured by the SCADA system and uncontrolled emissions to atmosphere are prevented.

2.4.6 Emissions During Normal Operations

Table 2.6 Continuous Brewing Emissions During Normal Operations

Emission Type	Description
Atmospheric	There are a number of main (particulates i.e. flour dust only) and minor emission points (steam and product vapours) associated with the continuous brewing process. These are identified in Attachment-7-4-1 and Attachment-7-4-2. The locations of the main and minor emission points are identified on Drawing No.s IE0313231-22-DR-0010 and IE0313231-22-DR-0021. There are pressure relief panels located on the grain elevators and these are included under Potential Emissions within Attachment-7-4-2.
Sewer	Emissions to the WWTP drainage system from floor washings and the on-site Cleaning In Place (CIP) regime. Treated effluent from the WWTP is discharged to the public sewer at IE Licenced emission point (SE2), which ultimately outfalls at Rathcoursey Point, Cork Harbour. CIP in this area is typically completed once every 7-10 days.
To Waters	None
Waste	Dust collected in dust suppression units Waste grain rubble Minimal waste from floor spillages, process line blockages.
Noise	No main noise source equipment associated with the continuous brewing system as all equipment will be located indoors with minimal impact at off site noise sensitive locations. Clean air from the mills are and will be ducted to atmosphere via silencers.

2.5 Yeasting and Fermentation – Existing and Proposed

There are no changes planned for the existing yeast system and fermenters within the existing site, which contains a dedicated yeasting system. The new yeast system located within the new Brew House for the distillery expansion will be a similar system.

A process flow diagram of the existing and proposed system is provided in Figure 2.5.

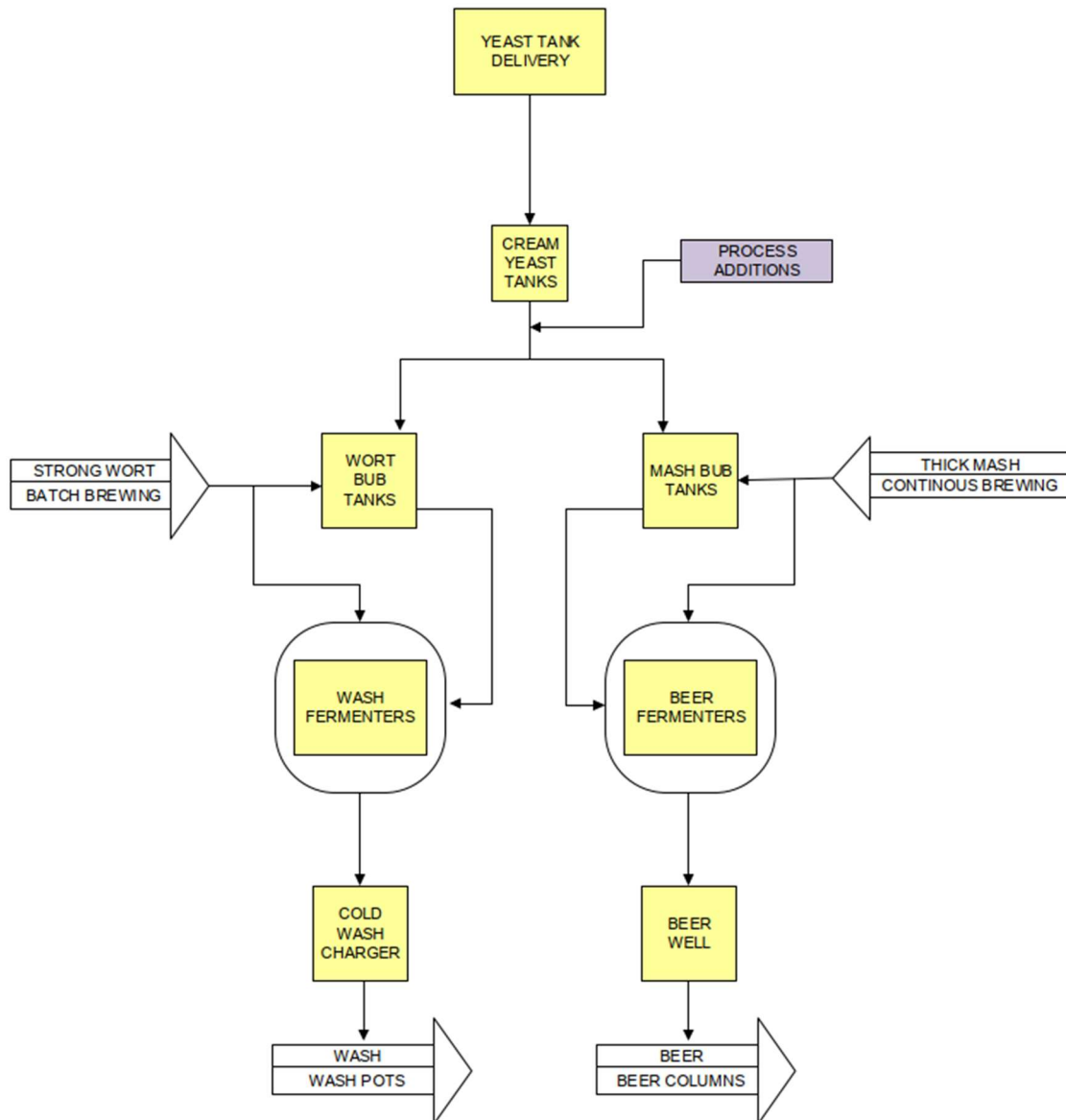


Figure 2.5 PFD for Yeasting & Fermentation – Existing and Proposed

2.5.1 Existing and Proposed Process Description

The existing Brew House contains a liquid yeast facility whereby two dedicated yeast tanks receive liquid yeast via road tanker on a weekly basis, these tanks are cooled via cooling jackets and an associated refrigeration plant. The tanks are regularly cleaned using the Brew House CIP system. The yeast system for the proposed expansion will be similar to this existing system.

Yeast slurry is added to the strong wort bub tanks (batch brewing process) and the thick mash bub tanks (continuous brewing process). The mixtures in the bub tanks are used to kick start the fermentation process in the fermenters. Wort from the wort bub tanks is added to the wash fermenters (barley line). Thick mash from the thick mash bub tanks is added to the beer fermenters (corn line). Typical capacity of an existing fermenter is 232m³, typical capacity of the new fermenters will be approximately 263m³.

The fermentation process is carried out over a 60 to 100 hour period. The fermenters are temperature controlled (cavern cooling water for the existing system and closed loop chilled water (glycol/ammonia) system for the distillery expansion throughout the fermentation process.

The wash fermenters discharge into the cold wash charger prior to being sent on into the pot distillation process. The beer fermenters discharge into the beer well prior to being sent on into the continuous distillation process.

2.5.2 Process Control

Cooling of the bub tanks is automated to keep them between 27-28°C. Fermenter cooling is also automated, based on the demand of each individual fermenter. The entire process is automated and controlled by the site's SCADA system and is overseen by operators on a 24 hour basis.

2.5.3 Emissions during Normal Operations

Table 2.5 Yeasting and Fermentation Emissions during Normal Operations

Emission Type	Description
Atmospheric	Vents from the bub tanks are combined together and CO₂ is emitted through a minor emission point. Each fermenter has a tank vessel vent associated with it. The main atmospheric emission from each vent is CO₂ released during the fermentation process. In the original IPPC licence application for P0442-01 and IE Licence Review 2012 P0442-02, the CO₂ emissions from the fermentation tank farm were considered as one main emission point (A2-2). This logic has been continued for this review application with all existing fermentation tanks (45 tanks in total: 18 wash fermenters (barley line) and 27 beer fermenters (corn line) considered as one CO₂ emission point (A2-2) and all future fermentation tanks on expansion site (38 no. in total: 15 wash fermenters (barley line) and 23 beer fermenters (corn line)) considered as one CO₂ emission point (A2-600). Refer to Attachment-7-4-1 and Attachment-7-4-2 for further detail. The locations of the main and minor emission points are identified on Drawing No.s IE0313231-22-DR-0011 and IE0313231-22-DR-0021.
Sewer	There are emissions to WWTP drainage system from floor washings and the on-site Cleaning In Place (CIP) regime. Treated effluent from the WWTP is discharged to the public sewer at IE Licenced emission point (SE2), which ultimately outfalls at Rathcoursey Point, Cork Harbour. The CIP process is detailed later on under a separate process activity.
To Waters	Cavern cooling water/groundwater is used on the existing bub tanks and the fermenters for once through cooling water purposes and returned to the Dungourney River via IE Licenced Emission Point SWE1 via the Tail Race with continuous TOC and Temperature monitoring and control in place. The proposed expansion will use a closed loop cooling system with no emissions to surface water.
Waste	Waste material from clearing of blocked process lines.
Noise	There are no major noise sources identified with the yeasting process. Pumps, agitators and sprayballs associated with the fermenters – these noise sources were included in the noise assessment completed as part of the EIAR – Chapter 10.

2.5.4 Fermentation Capacity

There are currently 45 fermenters on site (18 wash fermenters and 27 beer fermenters). The typical capacity of each existing fermenter is 232 m³. The capacity of the existing beer well and the cold wash charger is 285 m³ each. However, this capacity is never utilised, the beer fermenters are filled with 210 m³ of thick mash and the wash fermenters are filled with 200m³ of clear wort.

There will be 15 new wash fermenters and 23 new beer fermenters installed on the expansion site to the west of the new Brew House on a phased basis, which will bring the total number of fermenters within the distillery to 83. The typical capacity of each fermenter will be 263 m³. There will also be 2 new beer well vessels and 2 cold wash vessels installed with the new fermenters.

The bunding of these fermenter tanks has been designed in accordance with EPA requirements.

2.6 Pot Distillation (Existing and Proposed) (Barley Line – Pot Spirit)

The Still House is where the core process in the distillery takes place, producing a range of Pot Still Whiskeys. The existing Barry Crockett Still House houses four pot stills, whilst the Garden Still House houses six pot stills. As part of the proposed expansion, a new Still House will be installed with ten new pot stills to provide the required capacity for the Pot (Barley) Line distillation process.

The processes described in the following pages describe the production of intermediate distillate and eventually Pot Spirit through the wash pots, feint stills and spirit stills sequence. The pot distillation process within the Garden Still House and Barry Crockett Still House are identical and the PFDs as described below will also represent the pot distillation process within the proposed new Still House (PFDs 2.6.1 Wash Pots, 2.6.2 Feints Stills & 2.6.3 Spirit Stills).

The Garden Still House stills and the Barry Crockett Still House stills include heat recovery facilities to enhance the energy efficiency of the pot distillation process. The new Still House will incorporate similar heat recovery technology, further detail on this mechanical vapour recompression (MVR) technology is provided in Section 3.

In simple terms, the process entails purifying fermented product through the removal of impurities and then increasing the alcohol content over a number of different distillation steps. Nearly all of the material generated in the process is reused on-site or sent to the Feeds Recovery building or will be diverted to the proposed Anaerobic Digester.

A process flow diagram is provided in Figure 2.6.1 for the Wash Pot step.

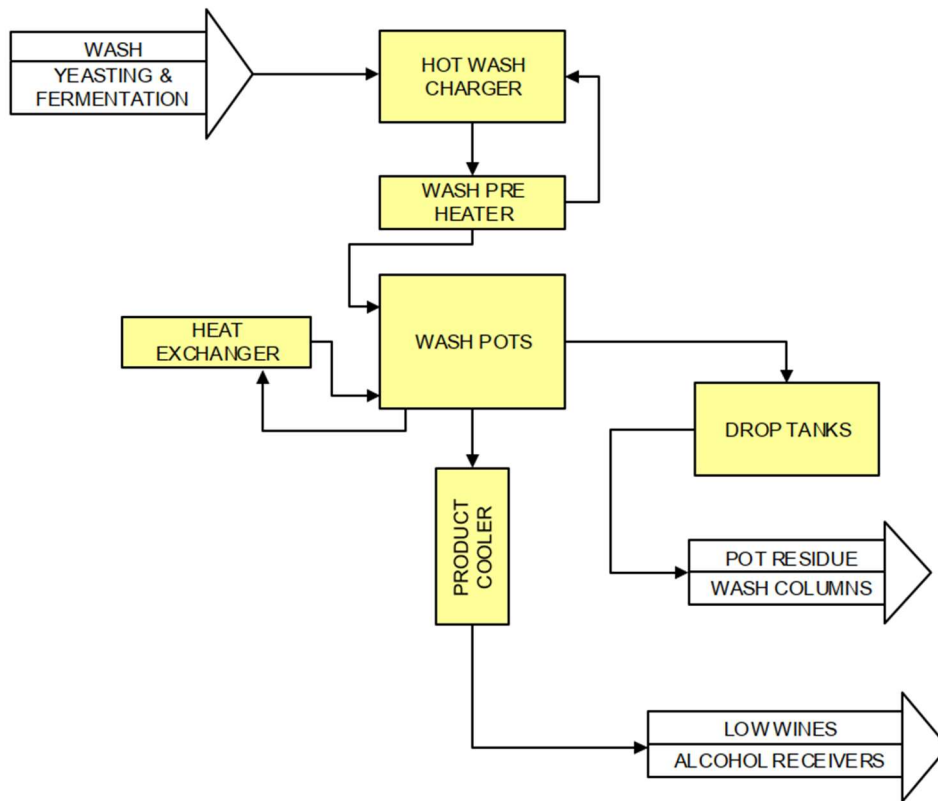


Figure 2.6.1 PFD for Wash Pots – Existing and Proposed

The main purpose of the pot still process is to take fermented wash from the cold wash charger from the wash fermenters (barley line) and to distil it into Pot Spirit (85% alcohol) for transfer to the Vat House.

Fermented product from the cold wash charger is passed through a hot wash charger in order to preheat the material before it enters the Wash Pot. The mixture is heated further in the wash pot and the alcohol vapours generated are passed through condensers and then directed through product coolers before entering the Low Wines receiver vessels.

The spent wash residue from the wash pots is directed to a drop tank from where it can be discharged to the wash column plant (Continuous distillation), where the residual alcohol is removed by subsequent distillation.

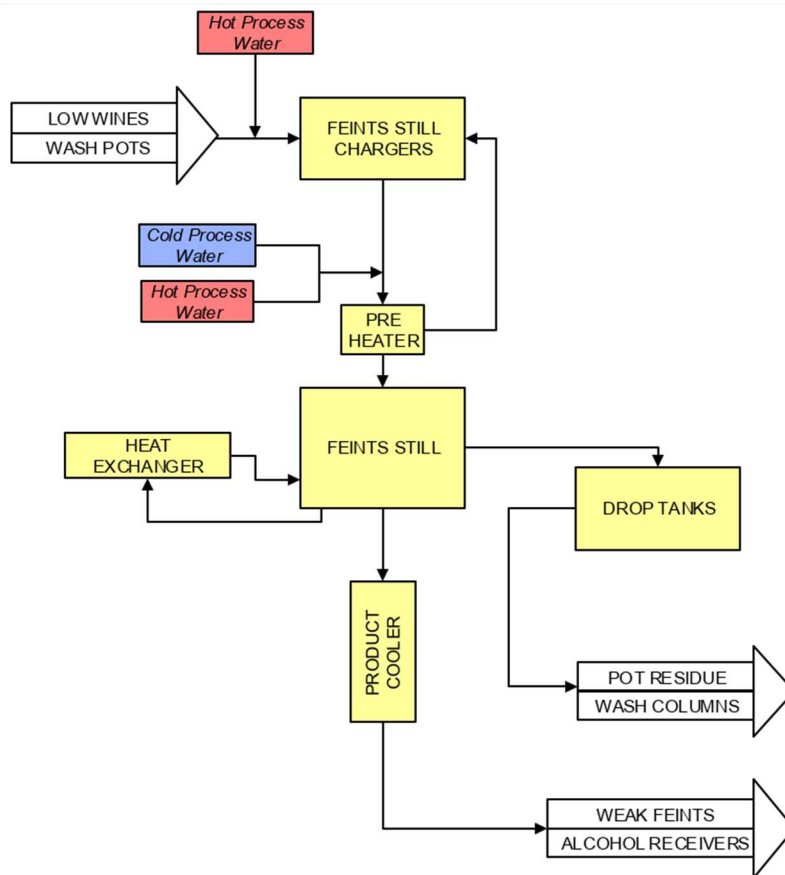


Figure 2.6.2 PFD for Feints Still – Existing and Proposed

The charge volumes for the feint still (i.e. low wines from wash pot) are collected in the charger and then sent to the feint still for distillation. The purpose of this process step is to produce a secondary distillate termed weak feints for collection in the weak feints receivers. The feint still residue is pumped to the drop tank as for the wash pot still distillation step.

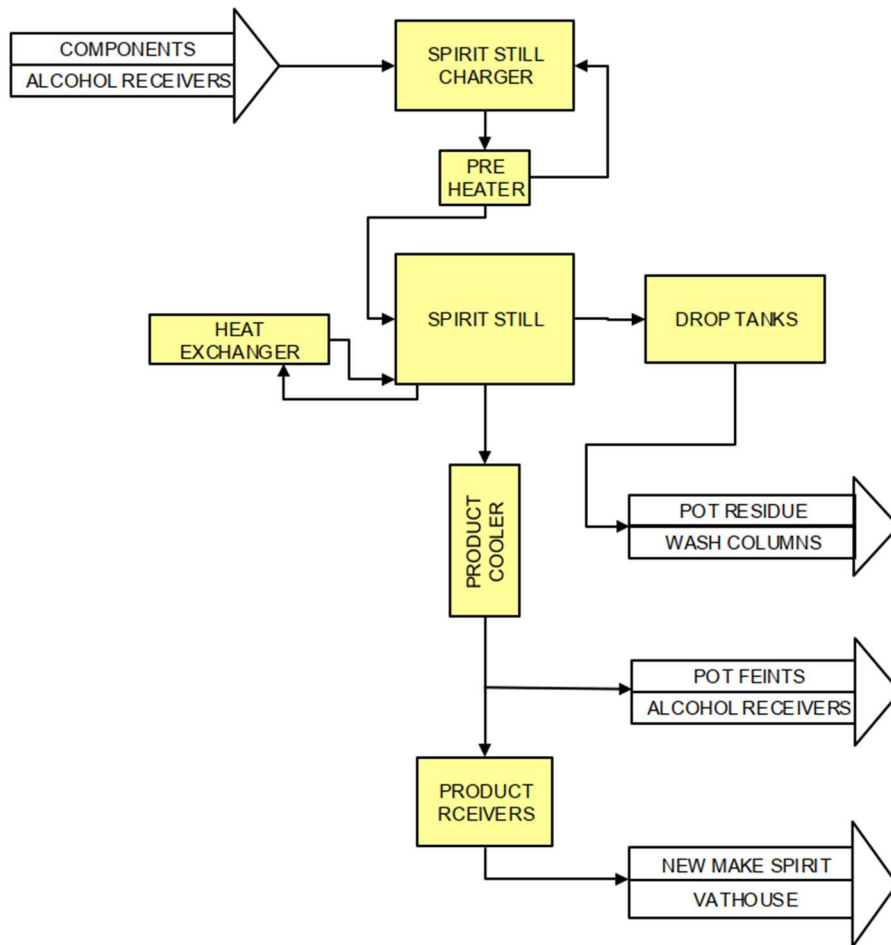


Figure 2.6.3 PFD for Spirits Still – Existing and Proposed

The charge volumes from the alcohol receivers for the spirit still are selected according to a specific formulation in the spirits still charger. The mixture is heated in the still and the resultant alcohol vapours are condensed and cooled before entering one of the product receivers in the tank farm. The spirit still residue is pumped to the drop tank as for the wash pot still.

The existing receivers (storage tanks) associated with the pot stills are located in a bunded still house tank farm located to the west of the Garden Still House. In total, 26 No. receivers ranging in capacity from 30 m³ to 100 m³ are located here. There is also a number of small receivers (2.5m³ and 5.0m³) located within the Barry Crockett Still House. A total of 38 still receivers are proposed for the expansion site, ranging in capacity from 30m³ to 100m³ all of which will be located within a bunded still house tank farm. All receivers vent to atmosphere through a flame arrestor.

2.6.1 Process Control – Pot Still Operations

All operations within the pot distillation area are carried out by computer controlled systems which are continuously overseen by production operators. Temperature, pressure and level controls are the main control parameters required during the distillation process.

2.6.2 Emissions During Normal Operations

Emission Type	Description
Atmospheric	Minor and potential emission points for the existing and proposed expansion are identified in Attachment-7-4-1 and Attachment-7-4-2 of the IE Licence Review Application. The locations of the minor emission points are identified on Drawing No.s IE0313231-22-DR-0012, IE0313231-22-DR-0017 and IE0313231-22-DR-0044.
Sewer	There are emissions to the WWTP drainage system from floor washings and the on-site Cleaning In Place (CIP) regime. Treated effluent from the WWTP is discharged to the public sewer at IE Licenced emission point (SE2), which ultimately outfalls at Rathcoursey Point, Cork Harbour. The CIP process is detailed later on under a separate process activity.
To Waters	Cavern / cooling tower water is used on the product coolers and cooling tower water is used on the condensers. The cavern cooling is returned to the Dungourney River via IE Licenced Emission Point SWE1 via the Tail Race with continuous TOC and Temperature monitoring and control. A closed loop cooling tower will be used on the product coolers for the expansion site, with no resultant emissions to surface water.
Waste	Minimal waste produced from this stage of the process.
Noise	External pumps, steam vent and building louvers all contribute to existing noise levels from the site, however they will not impact on offsite noise sensitive locations.

2.7 Continuous Distillation

Continuous distillation has two functions:

- Grain Column Plant: Taking fermented beer from the beer well from the corn line, and distilling it in dedicated grain columns through several process steps that are temperature, pressure and level controlled, into grain spirit for transfer to the Vat House; and
- Wash Column Plant: Taking residue from the wash, feints and spirit stills, and recovering alcohol in dedicated wash columns through several process steps that are temperature, pressure and level controlled for transfer of recovered alcohol back to the pot stills.

Spent grains from the grain columns is removed as 'thick stillage' to the Feeds Recovery system and residue in the wash columns is removed as 'thin stillage' which will be sent to the new Anaerobic Digester system with the option to also divert to the Feeds Recovery system.

There are no planned changes to the existing continuous distillation process which includes 6 distillation columns within the existing Distillation Column building (3 grain columns and 3 wash columns) and 5 distillation columns within the existing Barry Crocket Building (3 grain columns and 2 wash columns).

Similar to the existing continuous distillation process, the proposed new Column Distillation building will incorporate 6 new distillation columns (3 grain columns and 3 wash columns) and will include associated pumps, heat exchangers, condensers, tanks and vacuum pumps required for the distillation process.

Process flow diagrams of existing and proposed continuous distillation for the Grain Column Plant and Wash Column Plant are provided as follows.

2.7.1 Grain Column Plant

Figure 2.7.1 Continuous Distillation – represents Grain Column Plant within the Barry Crocket Still House, Columns Building and New Columns Building. The three column extractive distillation unit, is used to produce grain spirits from beer for whiskey blending.

Fermented beer from the beer well is passed through a “Beer Column” where spent grain is stripped out and sent as thick stillage to the Feeds Recovery plant. The distilled alcohol is passed through a condenser where it is condensed and taken off the column and transferred to the beer column high wines tanks.

There are two existing beer column high wines tanks (30m³ and 190m³). The 30m³ tank is used for this process while the 190m³ tank is used as a recycle tank.

The alcohol from beer column high wines tank is directed through the “Extractive Distillation (ED) Column”. Dilution water is added to the ED column in order to wash the alcohol and remove unsuitable alcohols. The unsuitable alcohols are passed through a decanter where “Fusel Oil” is decanted off and sent to a separate storage tank for subsequent use as an EPA approved by-product in the onsite plant boilers.

Alcohol from the ED column is then passed through the Extractive Distillation Rectification (EDR) column in order to increase the percentage alcohol by driving off additional water. The water that is removed from the alcohol is directed back to the dilution water tank where it is joined by material from the base of the ED Column and the Wash Rectification Column. The alcohol (grain spirit) is sent through a product cooler, before discharging into various product receivers located within the Barry Crocket Still House, Distillation Columns Tank Farm and proposed Distillation Columns Tank Farm.

There are currently 22 No. grain spirit receivers associated with this process, ranging in capacity from 40m³ to 190m³. An additional 10 new grain spirit receivers will be allocated within a new bunded Distillation Column tank farm ranging in capacity from 100m³ to 190m³. All receivers vent to atmosphere through flame arrestors as minor emissions.

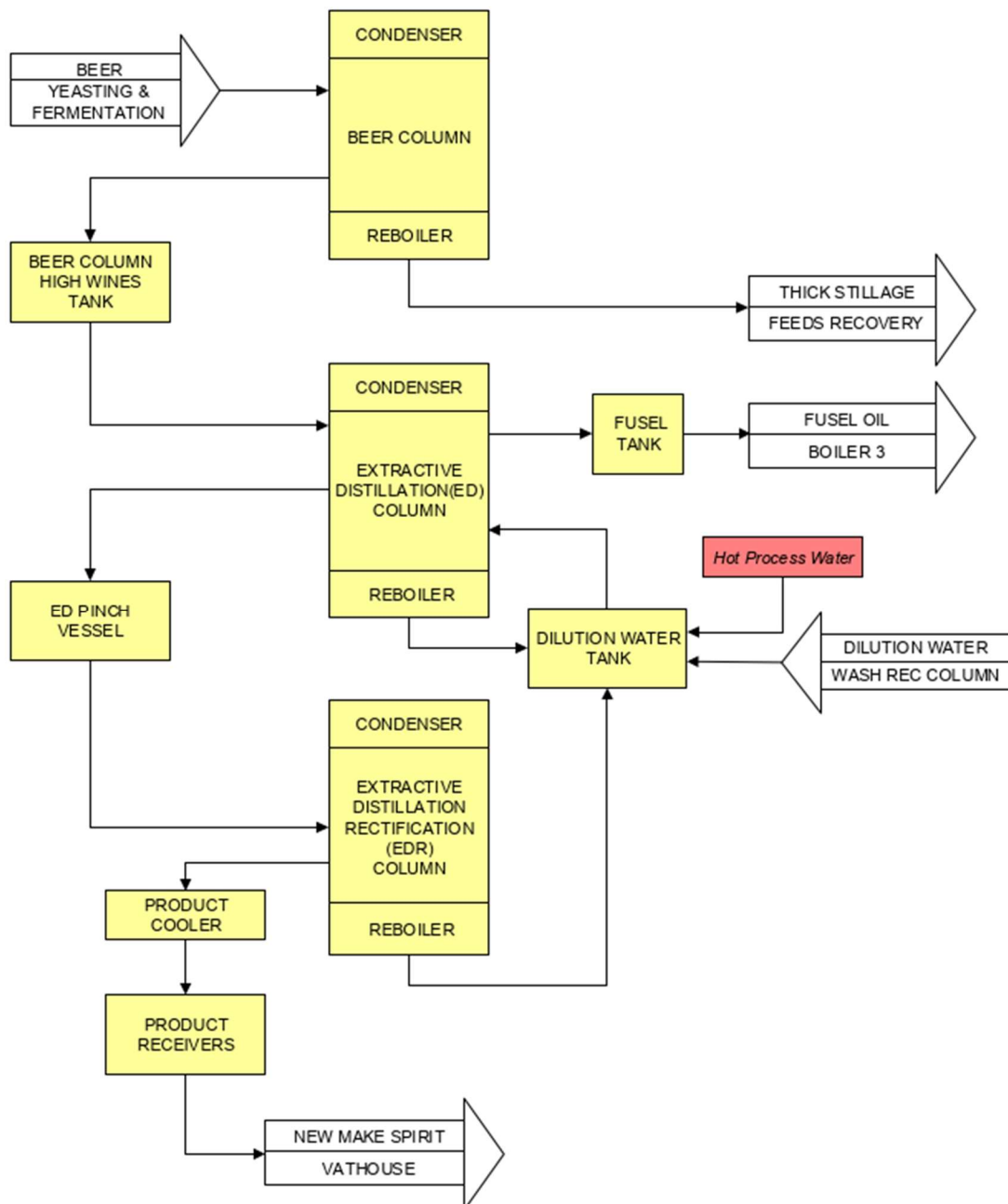


Figure 2.7.1 Grain Column Plant - Existing and Proposed

2.7.2 Wash Column Plant – Distillations Column Building

The wash column plant is housed within the existing Distillation Column Building and will be within the new Distillation Column Building.

One of the functions of the wash column and wash rectifying column is to enable the energy efficient recovery of any residual alcohol remaining on completion of the pot still distillations. The resulting residual alcohol is subsequently distilled further in the pot stills.

A process flow diagram is provided overleaf.

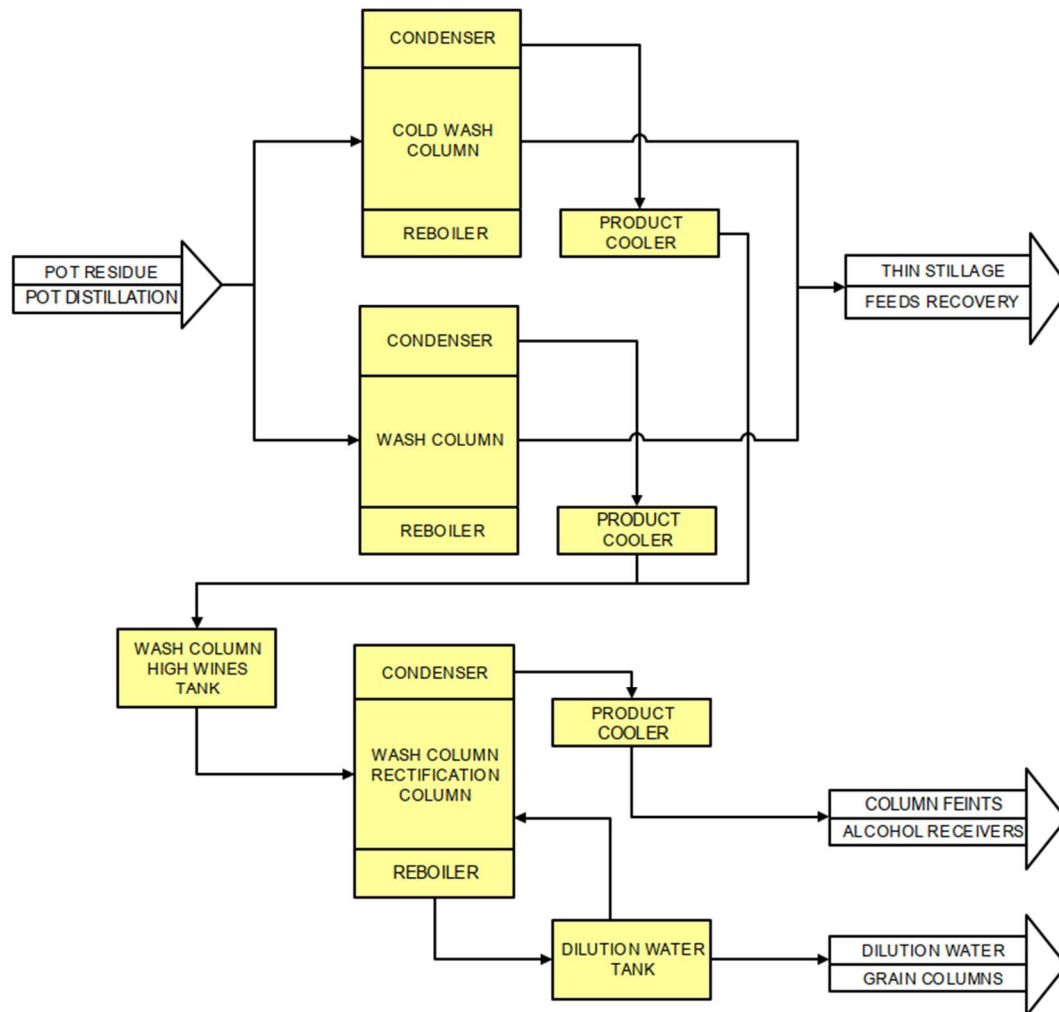


Figure 2.7.2: PFD for Wash Column - Existing Columns Building and Proposed Columns Building

The wash / product residue located in the Drop Tank can be fed into either wash column 1 or 2. Wash column 1 operates under vacuum while wash column 2 operates at atmospheric pressure and at a higher temperature. The heat from the Rectifier Column is used to preheat the material entering Wash Column No. 2 and then the material from this column pre-heats the material entering Wash Column No. 1.

The contents from the base of the wash column (Thin Stillage) will be sent to the Anaerobic Digester (AD) or if the AD is not available the Feeds Recovery unit, while the base of the wash rectification column is discharged to the dilution water tank used in the continuous distillation process.

2.7.3 Wash Column – Barry Crocket Still House

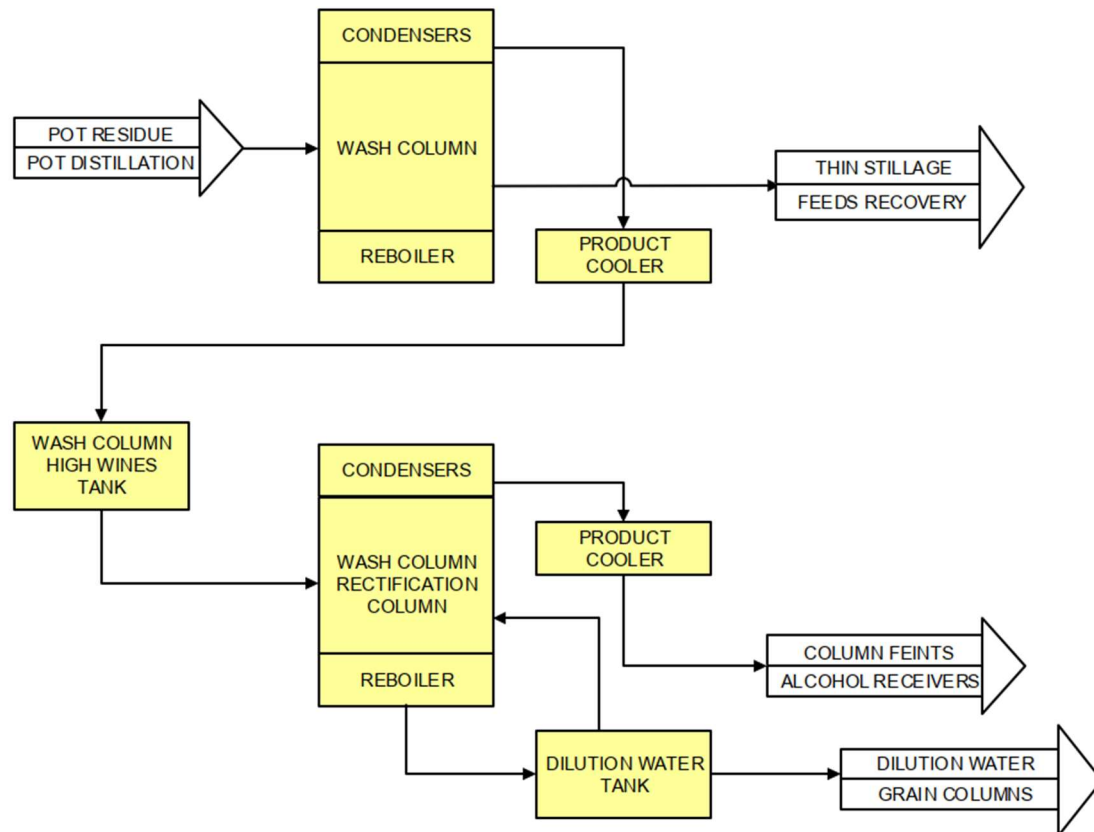


Figure 2.7.3 PFD for Wash Column & Wash Rectification Column – Barry Crocket Still House

The functions of the wash column and wash rectifying column is to enable the energy efficient recovery of any residual alcohol remaining on completion of the pot still distillations. The resulting alcohol may be subsequently distilled in the pot stills (refer to PFDs 2.6.1, 2.6.2 and 2.6.3).

The alcohol / water mixture from the wash columns will then be fed through a rectifying column which is operated under high pressure and temperature. The alcohol which is separated from the water is condensed and sent to product receivers.

The base of the wash column (thin stillage) is currently sent to feeds recovery but will be sent to the Anaerobic Digester (AD) once it is commissioned, with the feeds recovery then acting as a backup in the event the AD is not available. The base of the rectification column is discharged to the dilution water tank used in the continuous distillation process.

Spirit Receivers

Throughout the continuous distillation process both indirect and direct steam is used for boiling and flashing off the alcoholic mixtures. Cooling water is used for condensing processes. Cavern water is used for product cooling within the Barry Crockett Building, whilst cooling tower water is used for

the plants within the Distillation Columns Building and will be used within the proposed Columns Building in the expansion site.

2.7.4 Process Control

All operations within the distillation area are carried out by SCADA controlled systems which are continuously overseen by production operators. Temperature, pressure and level controls are the main control parameters required during the distillation process.

The receivers (storage tanks) associated with the distillation columns are located in a bunded tank farm adjacent to the Distillation Column Building, similarly for the expansion site the tank farm for the new Distillation Column Building will be bunded in accordance with EPA requirements.

2.7.5 Emissions During Normal Operations (New Process)

Emission Type	Description
Atmospheric	Minor and potential emission points for the existing and proposed expansion are identified in Attachment-7-4-1 and Attachment-7-4-2 of the IE Licence Review Application. The locations of the minor emission points are identified on Drawing No.s IE0313231-22-DR-0012, IE0313231-22-DR-0017 and IE0313231-22-DR-0043.
Sewer	Emissions to the WWTP drainage system from floor washings and the on-site Cleaning In Place (CIP) regime. Treated effluent from the WWTP is discharged to the public sewer at IE Licenced emission point (SE2), which ultimately outfalls at Rathcoursey Point, Cork Harbour. The CIP process is detailed later on under a separate process activity.
To Waters	Cavern / cooling tower water is used on the product coolers and cooling tower water is used on the condensers for the existing process. The cavern cooling is returned to the Dungourney River via IE Licenced Emission Point SWE1 via the Tail Race with continuous TOC and Temperature monitoring and control. A closed loop cooling tower will be used on the product coolers for the expansion site, with no resultant emissions to surface water.
Waste	Minimal, however there are and will be by-products and fusel oil produced.
Noise	External pumps, steam vent and building louvers will all contribute to existing noise levels from the site however they will not result in an impact off site at noise sensitive locations.

2.8 Vat House and Spirit Store

There are no proposed changes to the Vat House and Spirit Store as a result of the proposed expansion, there is sufficient installed capacity to cater for the expansion project. Recent changes to the existing Vat House and Reverse Osmosis Building (planning exempt -Section 5) included the addition of 8 new vats, 4 new make and 4 new mature, each vat with a capacity of 180m³ which have the ability to service both the existing and proposed new distillery distillation tank farms.

The purpose of the Vat House area is to reduce the strength of the spirit produced in the various distillation processes down to approximately 64% v/v, suitable for casking.

Towns (main) water supply is passed through a reverse osmosis water treatment plant located next to the Vat House. This process step is necessary to achieve the purity level required for mixing the

water with the spirit product. This purified water is stored in a separate storage tank before it is combined with the spirit material inside mixing vats.

Purified water is mixed with immature spirit that is pumped over from the distillation processes (existing and future expansion site) within the 100 Series Vats. Once mixed, and the correct alcohol concentration level is achieved, the blended mixture is pumped over to the Spirit Store for cask / butt filling.

Once the cask/butts are filled, they are transferred to either on or offsite warehousing for maturation. The legal minimum period for maturation is 3 years however some premium whiskey products can be aged for 20 years and longer.

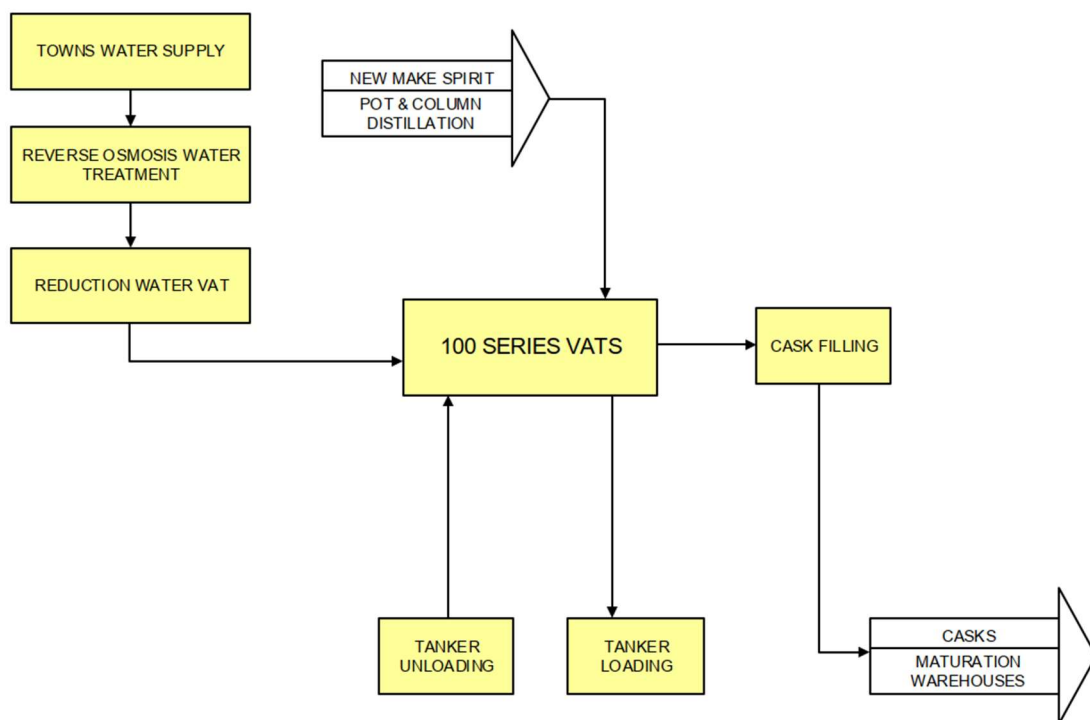


Figure 2.8.1 New Make Spirit

Following maturation, the casks are brought back to the Spirit Store where they are opened up and the spirit product is discharged through a filtration system to remove solid material (i.e. timber pieces from the casks/butts) before discharging into the 200 Series blending vats. The used casks are either returned for refilling or rejected for sale offsite.

This material can then be pumped directly to the tanker loading bay or sent for further blending with other spirits in the 500 Series vats. The 300 Series vats hold the different spirit products before being blended in the 500 Series vats. All of the blended product is then pumped to the tanker loading bay and transported offsite to Dublin "Fox and Geese" bottling plant or elsewhere to a separate bottling plant.

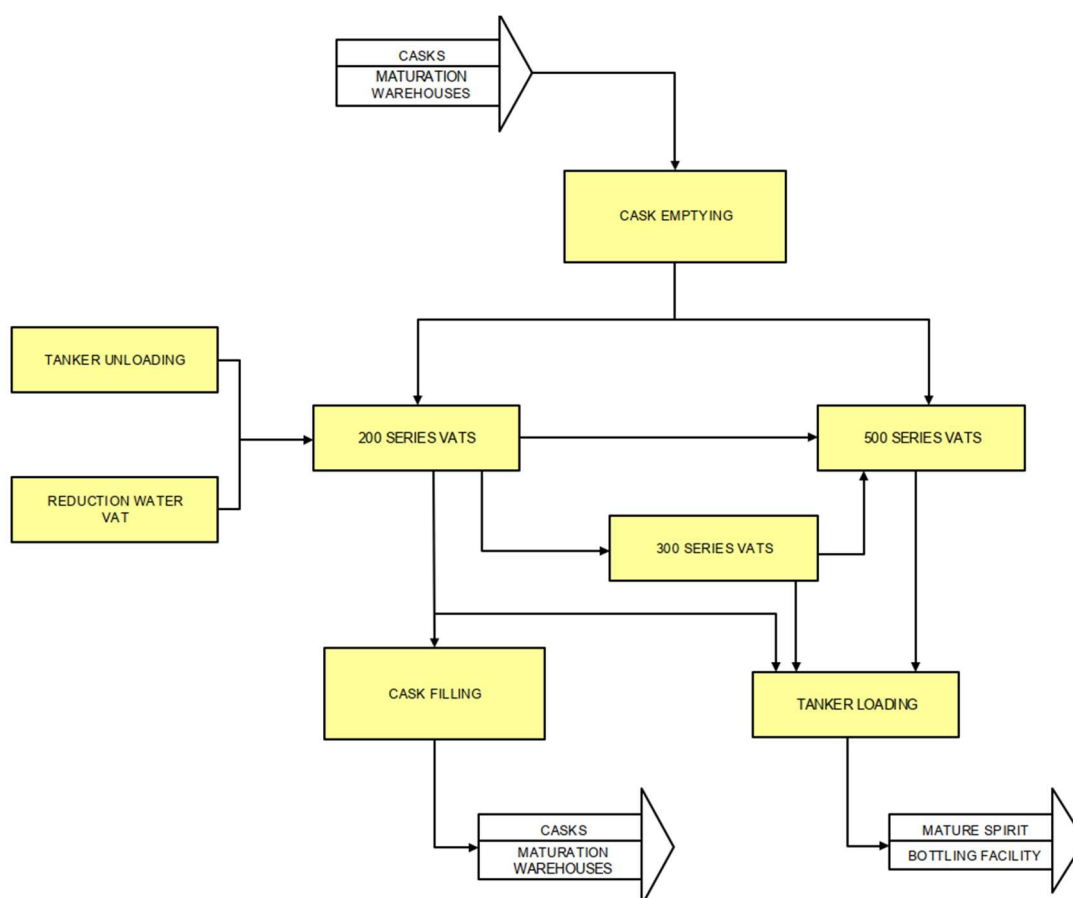


Figure 2.8.2 Mature Spirit

2.8.1 Process Control – Vat House

All operations within the Vat House / Spirits Store areas are carried out by computer controlled systems which are continuously overseen by production operators. Level controls on the various vat vessels are the main control parameter required during the blending process.

2.8.2 Emissions During Normal Operations

Emission Type	Description
Atmospheric	Minor and potential emission points for the existing and proposed expansion are identified in Attachment-7-4-1 and Attachment-7-4-2 of the IE Licence Review Application Form and summarised below. Locations of the minor emission points are identified on Drawing No.s IE0313231-22-DR-0014.
Sewer	There are no emissions to sewer from this process step.
To Waters	Not Applicable
Waste	Wood shavings from cask coring. Waste from reverse osmosis plant.
Noise	Minimal

2.9 Feeds Recovery

There are no planned changes to the existing Feeds Recovery process. A new dedicated Feeds Recovery System will also be installed in the expansion site adjacent to the new Brew House, there will be no MVR evaporator in the new system. A PFD of the existing and proposed Feeds Recovery system is provided overleaf.

The purpose of the feeds recovery operation is to process Spent Grains/ Draff (grains from batch brewing), thin stillage from the wash column and thick stillage from the beer column into wet grains and syrup for use as an EPA by-product approved animal feed.

The material in the thick stillage storage tanks is sent through centrifuges to separate the solids from the liquid. The centrifuge liquor is directed into the thin stillage storage tanks (3 No.) and mixed with thin stillage from the wash column.

The solids from the centrifuges are discharged into the mixing conveyor. Also added to the mixing conveyor is syrup from the mechanical vapour recompression (MVR) units (2 No) and spent grains (Draff) from the draff tank.

The mixture from the conveyor is then directed to a wet grains silo through a grains transfer pump. The wet grains are sold as an EPA approved by-product for animal feed.

MVR Unit:

The evaporator takes residues from the wash column (thin stillage) and the liquor from the centrifuges and concentrates the dissolved organic solids into a syrup.

The syrup is sold off as an EPA approved by-product for use as an animal feed and is also used to produce wet grains in the above described mixing conveyor.

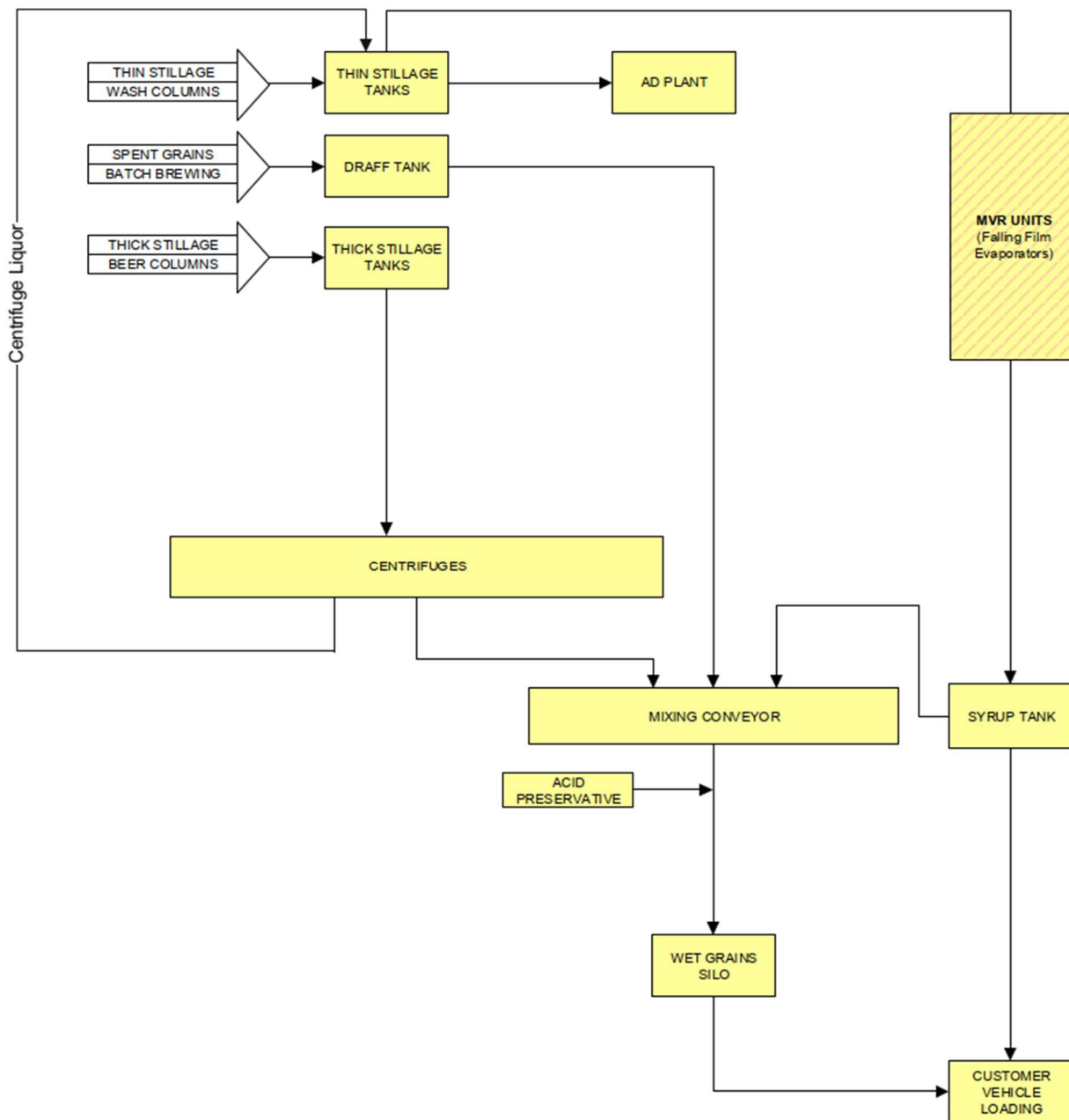


Figure 2.9 PFD for Feeds Recovery – Existing and Proposed

2.9.1 Production Throughput

In 2022, the following quantities of by-products were produced:

Moist Grains	118,424 tonnes
Syrup	<u>36,825 tonnes</u>
Total	155,249 tonnes

Following the site expansion the total quantity of Feeds Recovery by-product is expected to increase to approximately 300,000 tonnes per annum.

2.9.2 Process Control – Feeds Recovery Operations

Temperature, pressure and product levels within various equipment items are automatically monitored by the existing site SCADA system and the entire feeds recovery process is controlled from the Feeds Recovery control room.

2.9.3 Emissions During Normal Operations

Emission Type	Description
Atmospheric	Minor and potential emission points for the existing and proposed expansion are identified in Attachment-7-4-1 and Attachment-7-4-2 of the IE Licence Review Application. The locations of the atmospheric emission points associated with the Feeds Recovery / Utilities areas are shown on Drawing No.s IE0313231-22-DR-0013 and IE0313231-22-DR-0021. Note: Main emission point A2-1, the associated stack, driers and cyclones were decommissioned in 2023, as a result distillers dark grains (DDG) by-product is no longer produced on site.
Sewer	There are emissions to the WWTP drainage system from floor washings and the on-site Cleaning In Place (CIP) regime. The CIP process is detailed later on under a separate process activity. Treated effluent from the WWTP is discharged to the public sewer at IE Licenced emission point (SE2), which ultimately outfalls at Rathcoursey Point, Cork Harbour. The condensate from the MVR process, which is highly organic, is conveyed separately to the inlet of the WWTP.
To Waters	Cooling tower water is used on the evaporating process in the existing Feeds Recovery System and is returned to the Dungourney River via IE Licenced Emission Point SWE1 via the Tail Race with continuous TOC and Temperature monitoring and control.
Waste	Minimal waste from floor spillages, process line blockages
Noise	Building noise breakout through ventilation louvers. Vehicle collection of by-products.

2.10 Micro Distillery

A micro-distillery was installed within the grounds of the Midleton Distillery Experience (MDE) visitor centre in 2016 for which a Technical Amendment B (TA) was granted to facilitate a revised IE Licence boundary that incorporated the micro-distillery. The micro-distillery's aqueous waste streams, mainly residue from the pot and gin stills, is sent to either the on-site feeds recovery system or the on-site wastewater treatment plant. Condensate and washings are also sent to the WWTP for treatment prior to discharge to sewer. Recirculating cooling water and utilities are supplied from the main distillery and returned to the cooling tower.

2.10.1 Internal Capacity / Throughput

The capacity of the micro-distillery is approximately 65,000 litres of ethanol per year (whiskey and gin) and includes the following bundled vessels:

- Wash Pot 2,500L
- Two spirit stills each 1,500L
- Gin Charger Vessel 5,000L
- Gin Single Pot Still 1,000L
- Distilled Gin Vessel 3,000L
- Associated IBCs

2.10.2 Emissions During Normal Operations

Emission Type	Description
Atmospheric	Existing minor and potential emission points are identified in Attachment-7-4-1 and Attachment-7-4-2 of the IE Licence Review Application Form and shown on Drawing No. IE0313231-22-DR-0019.
Sewer	There are emissions to WWTP drainage system from washings and the Cleaning In Place (CIP) regime. The CIP process is detailed later on under a separate process activity.
To Waters	Not applicable
Waste	Botanicals are sent for composting.
Noise	Minimal

3 Site Utilities, Drainage and Support Processes

The main utilities and support services onsite include:

- New Anaerobic Digestion (AD) Plant
- Wastewater Treatment Plant (WWTP)
- Water Recovery Plant
- Water Treatment Plant
- Mechanical Vapour Recompression (MVR) Technology
- Boilers for steam production
- Cooling towers and cavern water for cooling water
- Clean in place (CIP) system
- Central Laboratory

3.1 Anaerobic Digestion Plant

Following the implementation of two major heat recovery projects and incorporating advanced heat recovery technologies in the proposed distillery expansion resulting in the range of 70% CO₂ reduction, the expected residual natural gas demand will be approximately 155,000 MWh per annum with the distillery operating at maximum design throughput. The proposed Anaerobic Digestion (AD) plant is intended to service this energy demand and facilitate IDL's goal of reducing Scope 1 CO₂ emissions from operations.

As part of the site's strategy to achieve reduced Scope 1 emissions, it is proposed to install an AD facility that will produce biogas (renewable gas mixture of methane and carbon dioxide) from the site's liquid process residues (thin stillage). Biogas from the AD will replace natural gas used in the onsite steam boilers that will supply steam to both the existing site and proposed distillery expansion. The new AD and expanded wastewater treatment plant will be designed to treat all the existing and the expansion site's estimated thin stillage (inclusive of centrifuge liquors) and wash water.

The existing wastewater treatment plant system will be expanded to integrate the proposed anaerobic digestion plant as detailed in Section 3.2. The AD permeate liquors, combined with the site washwater, will be treated in the WWTP with a portion being re-used within the WWTP for chemical makeup. The remaining effluent will combine with the existing and new inorganic drains prior to discharging via SE2 for discharge to public sewer to Rathcoursey Point, Cork Harbour.

To ensure good connectivity to the existing WWTP, existing distillery, proposed distillery and associated utility systems, the AD plant will be installed within the existing site adjacent to the onsite WWTP, east of Warehouse No. 3 and south of Warehouse No. 4.

The proposed AD plant will comprise the following key unit operations:

- 2 no. thin stillage tanks (900m³ and 8.5m height)
- 1 no. high strength effluent tank (900m³ and 13.2m height)
- 4 no. air blast cooling units (to cool thin stillage from ~ 50 °C to 35 °C)
- 3 no. anaerobic digesters (~8,700 m³ each and 13.7 m height + 5m for biodome roof for gas capture) & 3 no. membrane units
- 6 no. anaerobic membrane bioreactor (AnMBR) ultra-filtration sets for solid/liquid separation of digestate (treated effluent from the AD tanks)
- 2 no. Biogas waste gas burner (enclosed gas flares for use when the boilers are offline)

- Phosphorus precipitation plant (to recover phosphorus as a by-product for offsite use as a fertiliser)
- A nutrient removal balancing tank (~1,000m³, height 13.2m)
- Ammonia removal plant (~1,500 m³, height 7 m) to reduce ammonia prior to aerobic treatment
- Chemical and micro nutrient dosing systems to optimise biological process will be stored in bunded tanks or IBCs and will include:
 - micro nutrients 1m³, caustic soda 15m³, enzyme 1m³, ferric chloride 15m³, magnesium oxide 15m³, citric acid 1m³ and sodium hypochlorite 1m³.
 - For the sludge dryer; sulphuric acid 1m³, caustic soda 1m³ and hydrogen peroxide 1m³.
 - For ammonia removal; caustic soda 15m³, enzyme 1m³ and nutrient 1m³.
- Sludge collection tank and sludge dewatering unit

As part of the design package, modifications will be made to the existing WWTP and Water Recovery Plant to support the AD and will include the following new and repurposed units in addition to the existing WWTP (Refer to Section 3.2):

- 2 existing equalisation tanks repurposed as a balance tank and anoxic tank
- 2 existing aeration tanks as aeration capacity
- Membrane filtration system
- Sludge system
- Water recovery plant: 4 no. reverse osmosis units (2 no. new and 2 no. existing)

3.1.1 Rationale for Application of the Water Framework Directive to the AD Plant

As per pre-submission communication as forwarded to the EPA in July 2023, it is deemed that the Waste Framework Directive¹ and the Waste Treatment CID² are not applicable to this AD plant for the following reason:

Thin stillage is an input to the Feeds Recovery unit which converts thin stillage into the approved by-product i.e. "syrup" after further processing within the evaporator. It is considered that the thin stillage residue or aqueous process liquid stream (>96% water) would in the absence of an evaporator on site be directed to the onsite wastewater treatment plant for further treatment.

Refer to the below extract from the 2013 Animal Feeds By Product Notification to the EPA which refers to the liquid residues:

3. Is it the *primary aim* of the production process (item 1) to produce the material mentioned in item 2?

→ Yes / No

The primary aim of the Feeds Recovery Process is to process the residues into dark grains, wet grains and syrup. The production of this material is a technical choice by Irish Distillers Ltd rather than the sale of the solid fraction as wet grains and treatment of liquid residues in a wastewater treatment plant.

As part of the expansion project it is now proposed to divert the thin stillage aqueous stream away from the evaporation process in feeds recovery to the proposed anaerobic digester as part of the

¹ Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

² Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council

upgrade to the onsite wastewater treatment system to produce biogas to replace the use of natural gas and therefore reduce CO₂ emissions from the facility.

In this regard it is understood that the feedstock (i.e. process liquid residue >96% water) for the AD plant falls within the Scope of the Water Framework Directive and associated Regulations and not the Waste Framework Directive which specifically excludes “waste waters”.

It is on this basis IDL are progressing with inclusion of the AD to the onsite WWTP System and in turn with the IE licensing approach.

3.1.2 Feed Flow balancing

The existing thin stillage tanks will be utilised as per current filling operation with the stillage transferred to the AD plant instead of the feeds recovery evaporators (refer to Section 2.9). Redundancy will be in place where the feeds recovery evaporators can be brought into operation in the event the thin stillage cannot be processed through the AD plant.

Thin stillage and centrifuge liquors will be transferred from both the existing and new site thin stillage tanks. Feedstock will be screened using a rotary drum type screen and screenings will be collected in a designated storage container. 2 no. new thin stillage tanks will be installed at the AD plant to receive the screened thin stillage and centrifuge liquors. Thin stillage and centrifuge liquors have a typical temperature of 50°C. These tanks will provide buffer capacity, allowing incoming flows to be balanced to enable continuous operations of the AD plant.

1 no. high strength effluent tank will be provided to contain and store any potential high strength process effluent prior to treatment through the AD plant. The tank contents will normally be transferred gradually into the AD plant via the screen and thin stillage tanks, but may also be fed into the existing calamity tanks or the new WWTP balancing tank if the organic load is found to be < 1,000 mg/L chemical oxygen demand (COD).

3.1.3 Pre-treatment of the feed

Thin stillage and centrifuge liquors will be conditioned with caustic for pH correction (pH monitored in the digester), micro-nutrients and ferric chloride, before feeding into the AD reactor tanks. A closed water loop will be provided for the cooling/heating medium, with a forced air cooling system used for cooling, or steam (from the boiler house) to hot water heat exchanger used for heating. Normal operation will require cooling of the digester feed to maintain AD reactor temperature to 35°C.

3.1.4 Anaerobic Digesters and Anaerobic membrane bioreactor (AnMBR)

An anaerobic membrane bioreactor (AnMBR) combines anaerobic digestion with membrane filtration to maximise organic load reduction and biogas production. 3 No. anaerobic digesters will each discharge to combined membrane separation recirculation loop.

The process conditions of the anaerobic digesters will be controlled for efficient breakdown of COD. The digesters will operate at around 35°C and a minimum of 8 days hydraulic retention time will be provided by the working volume of the anaerobic system. The design Mixed Liquor Suspended Solids (MLSS) and Organic Loading Rate (OLR) for the digestion plant will be around 20g/l and 6.5kg COD/m³ day.

Biogas generated by the process will be stored in a double membrane biodome gasholder mounted on each digester vessel. An integral emergency pressure and vacuum relief system will be included at each digester to protect the tank against rupture from under or over-pressure conditions.

Each anaerobic digester will be coupled to the combined membrane recirculation loop, comprising four Ultra-Filtration (UF) separation systems. Separated sludge is recirculated back to the digesters via the return line of the membrane recirculation loop. Permeate, free of suspended solids, is forced through the membrane under pressure, while solids are retained. The feed to the membrane will be adjusted to maintain a high crossflow velocity to scour the membrane surface and maintain permeate flow rate. The cross-membrane pressure is monitored and used as a surrogate measure

of cleanliness, and each UF module on the membrane skid can be backwashed using the produced permeate stored in a Clean in Place (CIP) tank adjacent to the skid. A CIP system, utilising small volumes of cleaning chemicals (citric acid and sodium hypochlorite) is provided for infrequent chemical clean used to maintain performance and longevity of the membrane system.

The sludge rejected by the UF membranes will be continuously returned to the digester tanks via the combined membrane recirculation loop. The concentration of sludge in the AD system will be controlled by periodically discharging a portion of digestate (mixed liquor from the AD tanks) to the new anaerobic sludge storage tank. The anaerobic sludge will then be dewatered by 4 centrifuges. The effluent (permeate) from the UF membrane skids will be transferred to the phosphorous removal process prior to the ammonia removal plant.

3.1.5 Biogas Management

Biogas will be saturated and contain around 60% v/v methane, with the remainder being carbon dioxide (around 40%) and impurities such as hydrogen sulphide (H_2S). High levels of hydrogen sulphide can cause operational issues (such as corrosion) and therefore biogas will be passed through a biogas scrubber unit to remove hydrogen sulphide to ensure suitable quality prior to fuelling the onsite steam boilers. All the biogas generated will be used in the boilers as fuel to generate steam for the existing and proposed distillery expansion. A biogas waste gas burner / flare system will be installed as a backup if the boilers are not available due to malfunction or for maintenance purposes.

The biogas generated in the AD plant will be boosted to increase pressure from the digester head space of approximately 10 mbar to around 150 mbar prior to passing through the biogas scrubber unit or to the waste gas burner.

The biogas scrubber unit will clean the raw biogas to $< 200 \text{ mg/Nm}^3 \text{ H}_2\text{S}$ content and $< 70\%$ relative humidity for feeding the boilers to generate steam for the distillery. The biogas will initially pass through a dehumidification process dropping the biogas temperature to less than 6°C wet bulb temperature and reheated through a recuperator by the incoming biogas to achieve the above-mentioned relative humidity.

A biomethane import facility will be provided to provide biomethane for commissioning and supplementing peak distillery production demand as a result of production activities related to start-up and general distillery maintenance. The biomethane will meet the same specification as that of natural gas.

A biogas waste gas burner (flare) will be installed as the means of reducing the digester head space pressure, combusting excess biogas generated in the digester when not utilised by the steam boilers (e.g. during ramping down on production) to reduce the risk of relieving biogas to the environment through the digester pressure relief valves.

3.1.6 Phosphorus Precipitation

Permeate from the anaerobic membrane bioreactors will combine with return liquors from dewatering and feed into the phosphorus precipitation plant. Here either ferric chloride, magnesium chloride and or hydrated lime will be used to precipitate phosphorus to a level where it can be treated further in downstream ammonia removal and aerobic treatment in the WWTP to achieve the current effluent discharge limits.

Once the precipitation dose is complete, the flow will pass into a lamella settler where a small quantity of coagulant is added to help separate the precipitated solids from the flow. A downstream probe will control the precipitation dose to ensure sufficient nutrient content for downstream biological systems.

The settled sludge from the bottom of the lamella settler will be pumped to the digested sludge storage tank and dewatered in the dewatering system with the waste digestate.

3.1.7 Ammonia Removal

Due to expected ammonia concentration of ~ 800 mg/L in the anaerobic permeate, an additional ammonia removal system will be required to reduce the ammonia loads prior to the downstream aerobic treatment within the WWTP. A balancing tank will be provided prior to the ammonia reducing process, to act as a buffer tank. Permeate from the AnMBR will combine with return liquors from dewatering and feed into the phosphorous precipitation plant.

The selected ammonia reducing process (ANITA MOX) is an optimised shortcut process in the natural nitrogen cycle, with the advantages of lower oxygen demand, lower alkalinity consumption, no additional carbon source and reduction in sludge production when compared with a conventional system. The ammonia reducing process will consist of 2 no. reactors and 2 no. clarifiers to provide resilience to the process, operating as duty/ duty. Within the reactor, both the aerobic nitrification reaction and the anaerobic ammonia oxidation process take place simultaneously. Nitrification occurs mainly in the mixed liquor suspended solids, while the anaerobic ammonia oxidation reaction occurs in the biofilm layer on the media/ biomass granule. Aeration will be provided within the reactor, with dissolved oxygen controlled to maintain a good ratio of ammonia and nitrite to avoid the production of nitrate. Anammox bacteria will utilise the nitrite and the remaining ammonia and convert them to nitrogen gas (N₂) and a small amount of nitrate (NO₃-). Some organic content will also be consumed as part of the process.

As part of the nitrification process, alkalinity will be consumed, and additional alkalinity if needed will be added to the process in the form of caustic soda (NaOH). Nutrient dosing and antifoam dosing will also be allowed for within the design.

From the reactors the treated effluent flows into solids separation, where the solids are settled and either returned to the reactor or wasted from the system to the sludge holding tank. The treated effluent containing significantly reduced phosphorus and ammonia content and some reduction in the COD loads, will be discharged from the clarifiers and forwarded to the existing WWTP balance tank where it is combined with other site washwater and high strength effluent if required.

3.1.8 Sludge Management

Excess sludge wasted from the existing WWTP aerobic membrane filtration unit will be transferred into the 1 no. existing sludge tank and dewatered with the existing dewatering unit (belt press).

Within the AD plant, the membrane filter will separate the digestate into permeate and sludge. The sludge from the membrane filter will be continuously returned to the digesters, some of which will be periodically wasted and forwarded to 1 no. new sludge tank in addition to sludge from the ammonia and phosphorus removal systems, where it will be mixed to ensure homogenous sludge is fed for dewatering in a new centrifuge dewatering process.

The new centrifuge dewatering system (duty/assist) is designed to operate 14h per day maximum, 7 days a week. Sludge fed to the centrifuge will be conditioned with polymer (at 0.15% concentration) to facilitate the dewatering process. Treated effluent water will be used for polymer make-up, polymer dilution water and as centrifuge washwater.

Centrifuge dewatering uses the force from rapid rotation of a cylindrical bowl to separate the liquid (liquors) from the solids (cake). Liquors generated will be combined with the anaerobic membrane filtration effluent and fed into the phosphorus precipitation plant. Dewatered cake, at around 18-22% dry solids will be discharged into trailers used for storage and transport off site. IDL intend to apply for an Article 27 by-product classification for this material to be used as bio-fertiliser for arable land.

3.1.9 Odour Abatement

All potential sources of odour from the AD process have been identified and assessed by experienced process design engineers. The proposed solution is to treat the air flow from potential odour sources through a centralised odour control unit (OCU) located in warehouse 3. There will be one main emission point from this system. The OCU will be designed to treat the air flow from the phosphorous precipitation system (Multiflow Clarifier), Nutrient Removal Balance tank, ammonia

removal system (ANITA MOX), the anaerobic sludge holding tank and the digester membrane blower exhausts as illustrated in Figure 3.1. The main emission point from the OCU will be monitored twice a year in line with BAT^{3,4} for ammonia, hydrogen sulphide and odour concentration.

There will be a number of minor emission points from the existing WWTP along with new minor emission points from the thin stillage tanks and from forced ventilation points in warehouse 4.

Hydrogen sulphide and volatile organic sulphur compounds are the main odourous sources in biogas which will be suppressed to a low level by passing the biogas through a scrubber unit prior to combustion of the gas.

The anaerobic digesters and UF membrane systems will be enclosed to prevent air ingress and reduce odour and biogas emissions. Operation of the biogas waste burners/flare (for back up purposes only) at 850°C eliminates any potential for odour.

³ Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council

⁴ Whilst BATC for Waste Treatment deemed not applicable to this AD Plant as per outlined in Section 3.1.3 above, the monitoring requirements outlined within the BAT Conclusions for biological treatment will be referred to for guidance.

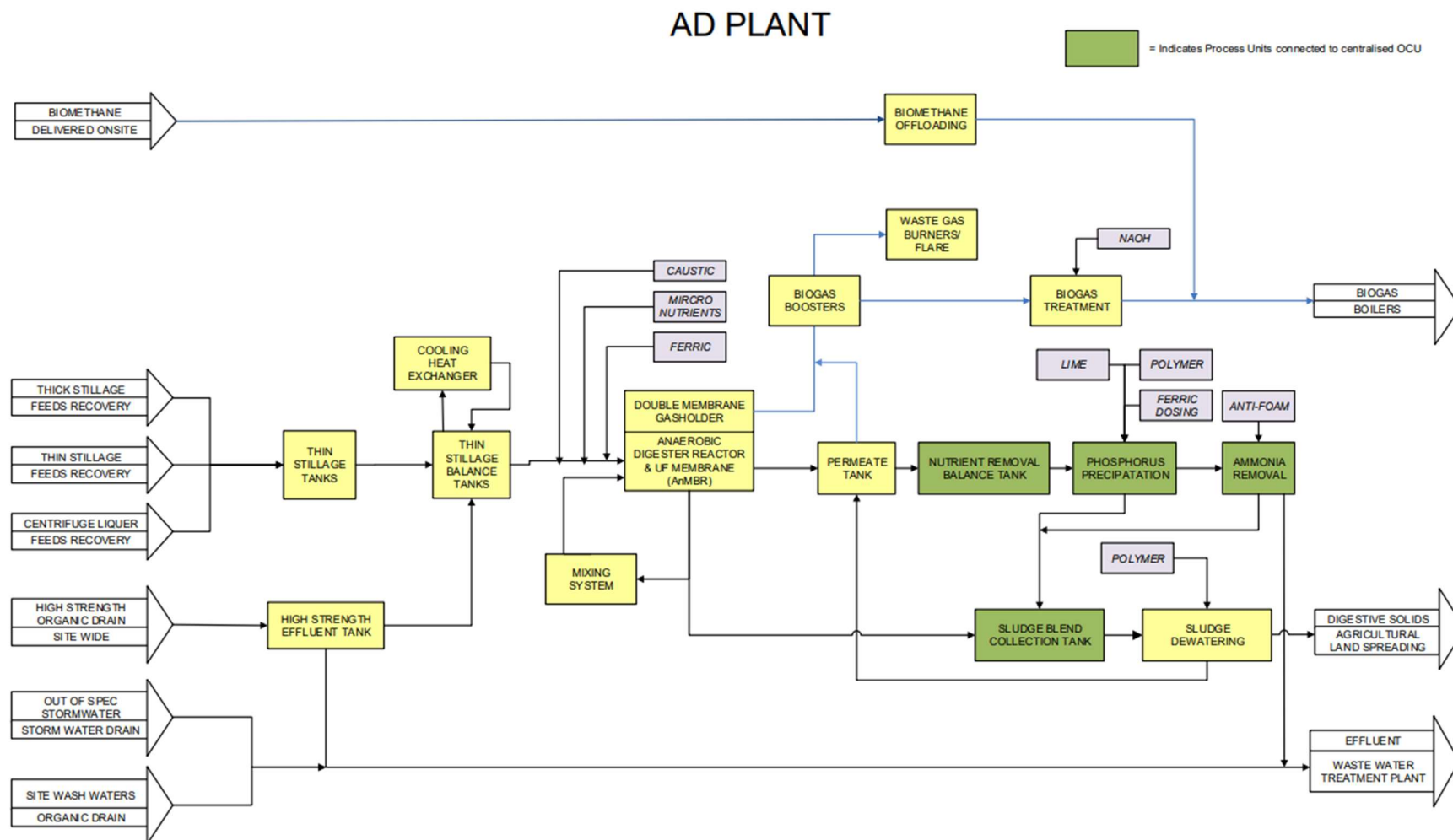


Figure 3.1 Overview of Proposed Anaerobic Digestion System

3.2 Wastewater Treatment Plant (WWTP) Expansion

The distillery will gradually increase its annual production capacity from 70 million litres to 133 million litres and as the new anaerobic digestion system is brought on line, the hydraulic and treatment capability of the wastewater treatment plant (WWTP) will be expanded and continue to comply with the site's current IE Licence discharge limits.

The on-site WWTP is a membrane bioreactor (MBR). The influent to the WWTP is degraded by microbes in the aeration tank resulting in biological oxygen demand (BOD), chemical oxygen demand (COD) & total organic carbon (TOC) removal. The treated wastewater is then separated from the Mixed Liquor Suspended Solids by means of ultra-filtration membranes. The capacity of the treatment plant will be expanded from 2500m³/day to treat a combined flow of 4,567m³ per day, with all discharge limits remaining within the limits as currently specified for SE Final in Schedule B.3, *Emissions to Sewer*, of the site's IE Licence P0442-02, whereby SE Final is renamed SE 2 within the current IE Licence Review Application.

The WWTP will treat the effluent from the AD plant and the 'organic' wastewater streams from both the current and new distillery sites. Poor quality stormwater that does not meet discharge consent can also be diverted to the WWTP for treatment.

The existing screen system and reception pit will remain as is. The effluent from the AD plant will be pumped directly to the existing equalisation tank. The organic drain from the expanded distillery will be screened at the new distillery site, prior to being pumped to the existing equalisation tank.

The expanded WWTP plant will utilise the 2 no. existing equalisation tanks. One of the existing WWTP equalisation tanks will be converted to an anoxic tank to increase the nitrogen removal/denitrification treatment capacity of the WWTP. All wastewater streams are combined in the equalisation tank. The combined wastewater streams are then mixed/aerated by a mixer and air blower.

From the equalisation tank, the mixed liquor is pumped to the anoxic tank. The flow is split between the two existing aeration tanks, used for BOD/COD oxidation and nitrification. A mixed liquor return stream is recirculated back to the anoxic tank, returning nitrate produced by the aerobic process back to the anoxic process.

The main biological treatment of the influent takes place within the activated sludge in the aeration tank. The activated sludge process consists of a mass of micro-organisms cultivated in the wastewater treatment process used to break down organic matter in the raw influent. These micro-organisms are contained within the aeration tank. In the presence of oxygen, these micro-organisms feed on the organic material in the raw influent, to produce carbon dioxide and other by-products, with a growth in biomass. Also, within this process, some phosphorus and nitrogen are used by the micro-organisms in their respiration and are accumulated within their cellular structures. An existing fine bubble diffused aeration system mounted on the base of the aeration tanks delivers air, providing oxygen required by the biomass to perform biological reactions. Existing blowers for the aeration systems are variable speed and will be controlled independently by a dissolved oxygen probe situated in each tank.

The membrane system facilitates solids separation and comprises existing trains 1-4. Train 3 and 4 will be expanded with an additional new train 5. The membrane filtration tanks, which house the ultra filtration membrane modules, will separate the treated effluent from the activated sludge discharged from the aeration tanks and produce a high quality final effluent that is very low in suspended solids content. The treated water will be either discharged via coolers to the outfall (previously SE Final, changed to SE2) or recovered via the WWTP RO plant for site use (refer to Section 3.3). The majority of the activated sludge will be returned to the aeration tanks, while a proportion of the sludge will be wasted and forwarded to the sludge holding tank. This sludge is dewatered on the existing belt press and sent off site for disposal.

An air scouring system is provided to each membrane tank to clear the biomass from the surface of the membrane modules. An automatic chemical cleaning (CIP) system is installed so that the membrane modules can be back flushed with permeate and soaked with cleaning chemicals (citric

The diagram illustrates the process flow of the proposed water treatment plant, showing the sequence of units and the sources of influent and effluent streams.

Influent Streams:

- ORGANIC FEED PROCESS DRAIN
- MVR CONDENSATE FEEDS RECOVERY
- WTP WASTE WATER TREATMENT PLANT
- FERRIC DOSING
- CAUSTIC
- SLUDGE AD AMMONIA REMOVAL PLANT (NEW)
- POLYMER
- INORGANIC FEED COOLING TOWER BLOWDOWN, STORM WATER, CAVERN WATER DIVERSION

Process Flow:

- RECEPTION CHAMBER** receives input from ORGANIC FEED PROCESS DRAIN and MVR CONDENSATE FEEDS RECOVERY.
- INTERMEDIATE PUMPING STATION** receives input from the RECEPTION CHAMBER and MVR CONDENSATE FEEDS RECOVERY.
- BALANCE TANKS** receive input from the INTERMEDIATE PUMPING STATION, AQUEOUS STREAM AD PLANT (NEW), and ORGANIC FEED PROCESS DRAIN (NEW).
- ANOXIC TANK** receives input from the BALANCE TANKS.
- AERATION TANKS** receive input from the ANOXIC TANK.
- AEROBIC MEMBRANE FILTERS** receive input from the AERATION TANKS.
- COOLERS** receive input from the AEROBIC MEMBRANE FILTERS.
- PERMEATE PUMPING STATION** receives input from the COOLERS.
- OUTFALL PUMPING STATION** receives input from the PERMEATE PUMPING STATION and INORGANIC FEED COOLING TOWER BLOWDOWN, STORM WATER, CAVERN WATER DIVERSION.
- DISCHARGE WATER VIA SE2 (FORMERLY SE FINAL) IRISH WATER SEWER** is the final effluent from the OUTFALL PUMPING STATION.

Sludge Handling Path:

- THICKENING** receives input from WTP WASTE WATER TREATMENT PLANT, FERRIC DOSING, and CAUSTIC.
- SLUDGE TANK** receives input from THICKENING, SLUDGE AD AMMONIA REMOVAL PLANT (NEW), and POLYMER.
- BELT PRESS** receives input from the SLUDGE TANK.
- SKIP** receives input from the BELT PRESS.
- SLUDGE WASTE OFF SITE DISPOSAL** is the final destination for sludge from the SKIP.

Other Units:

- CALAMITY TANKS** receive input from the RECEPTION CHAMBER and INTERMEDIATE PUMPING STATION.
- RO (Reverse Osmosis)** receives input from the PERMEATE PUMPING STATION and outputs **RO WATER PRODUCTION PLANT**.

Figure 3.2 Overview of onsite WWTP – Existing and Proposed

As part of IDL's carbon reduction delivery, the feasibility of installing an advanced heat recovery system for the expansion site is currently under review. Figure 3.3 provides an overview of the proposed system currently under design. The conceptual design includes a chiller system that delivers 12°C chilled water to provide for cooling of the fermentation process (2,590 kW). The concept also accounts for 6.363 kW of cooling tower load returning from the process at 31°C. The

waste heat (at ca. 25°C) of the chillers as well as the cooling towers acts as the heat source for the two-stage heat pump system that delivers heat at 93°C for various process users. This energy is either used to generate hot water at +93°C, or transferring its energy and producing steam in a vacuum (water boiling at +90°C) which is then compressed by a steam compression system to a pressure of 7 bara for use by users who need steam. In this way, steam will be generated from recycled heat which would otherwise be lost to the atmosphere via the cooling towers, consuming fan power, evaporating water and producing effluent.

The chillers, heat pump system and the steam system will align with IDL's Scope 1 & 2 energy emissions reduction programme. Further detailed design is to be completed.

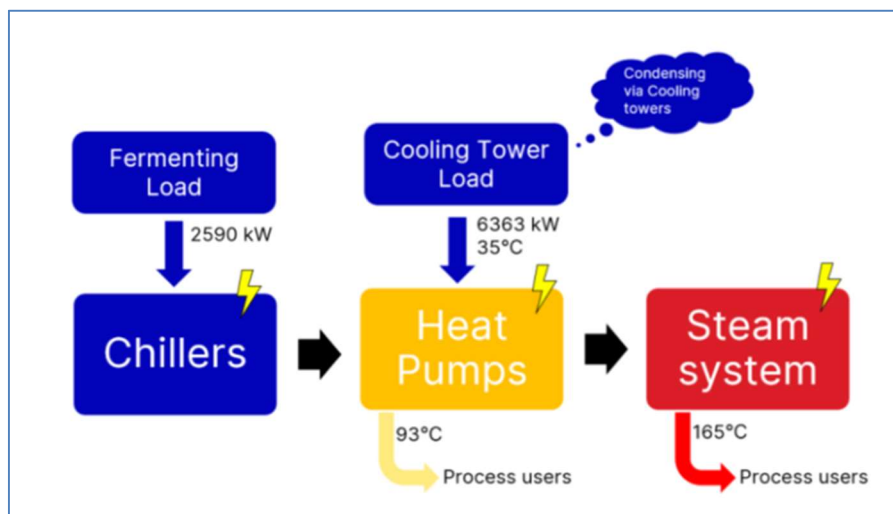


Figure 3.3 Overview of Heat Pump Carbon Reduction Project – Concept Design

3.4 Overview of Water Recovery Plant

The proposed expansion will tie into the site's existing permitted water supplies and water recovery plant system. Water reduction features associated with the expansion will include doubling the amount of water to be recycled from the treated WWTP effluent by the installation of additional RO units and the installation of closed loop chilled water systems, which will be independent of groundwater abstraction.

To reduce overall water consumption, a percentage of the WWTP treated liquid effluent is reconditioned/recycled in a Water Recovery Plant through the use of 2 no. reverse osmosis (RO) membranes and reused in the site's Cooling Towers, the option to send this recycled water to the recently installed replacement steam boilers or cooling tower as makeup water has also been implemented.

Currently ca. 18 m³/hr is treated within the two existing RO units which combines with towns water (municipal supply) (<10% v/v to increase conductivity) before being sent to the Cooling Towers, thereby reducing purified water demand.

As part of the expansion project, 2 no. new RO units will be installed after the aerobic membrane filtration units in the WWTP to produce additional purified water to the quality required for re-use within the distillery for cooling, boiler make up water and certain cleaning activities. 1 no. new RO feed tank will be provided upstream of the new RO plant for buffer storage.

Reverse osmosis is a water purification process, where pressure is applied to the solution on one side of a semi permeable membrane to concentrate the unwanted dissolved and suspended

molecules in the solution. Solute (reject) is retained on the pressurized side of the membrane and the water (permeate) is allowed to pass to the other side and collected for re-use on site. The reject water is discharged together with effluent bypassing the RO and the inorganic drains to the outfall at SE2 (formerly named SE Final in P0442-02), within the parameters of the IE Licence limits.

Regular cleaning of the membranes is and will be required to reduce fouling to maintain efficiency of the RO process. Potentially up to 40% of the total effluent treated from the WWTP plant could be recovered.

3.5 Water Treatment Plant

The proposed expansion will tie into the site's existing permitted water supplies and water treatment system. The purpose of the Water Treatment Plant is to produce potable water by treating mixed raw water from the Dungourney River, groundwater boreholes and spent fermenter cooling water. Note there are no changes proposed to the existing permitted water abstraction limits from the Dungourney River, cavern supply or 8 no. groundwater production wells as illustrated below in Figure 3.4 and as stipulated within Condition 6.12 of the site's existing IE Licence P0442-02.

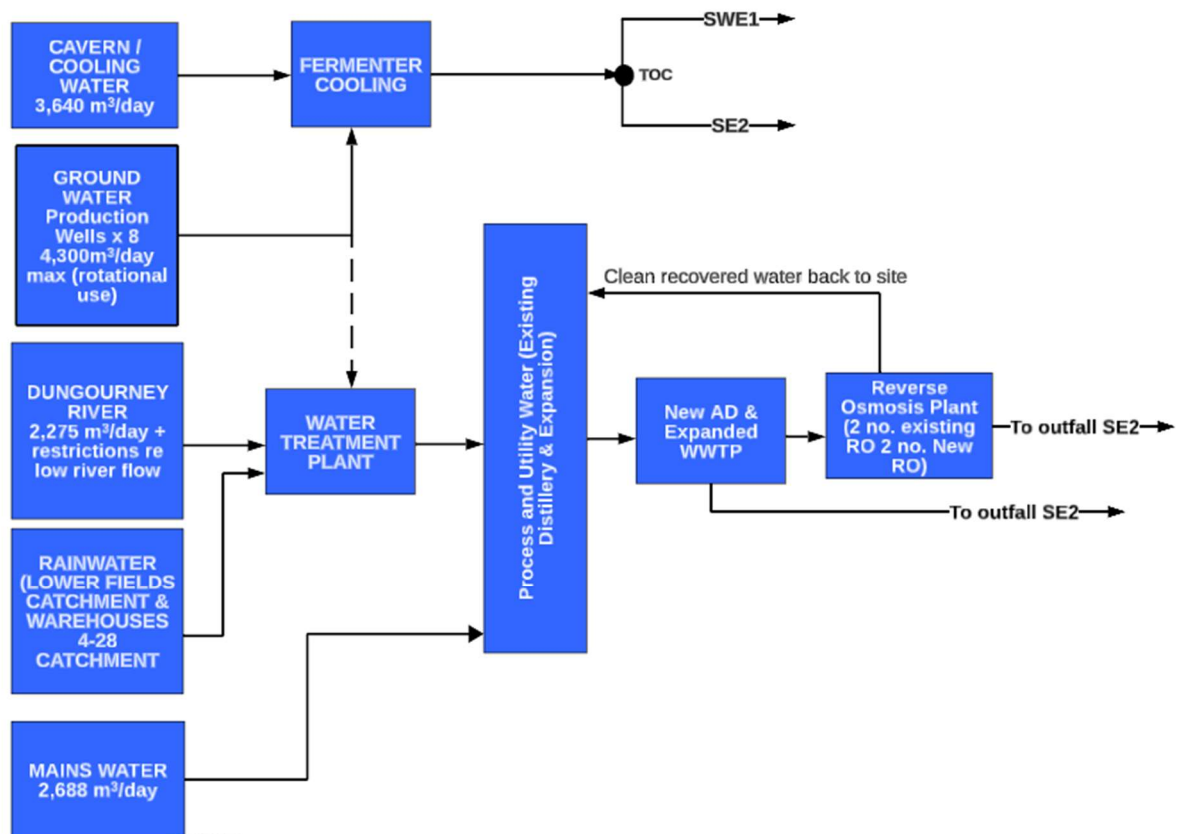


Figure 3.4 Overview of IDL's existing water supply, abstraction, water treatment and water recovery units

The following is an overview of the existing Water Treatment Plant on site which will also supply treated water to the expansion site:

1. The abstracted groundwater, river water, recycled washwater, harvested rainwater and spent fermenter cooling water intended for treatment is routed through a Veolia-designed Actiflo

- System, after a period of blending and coagulation; this enables the removal of suspended solids, colour, turbidity and dissolved organic material from water ensuring that clarified water low in solids is forwarded to the filtration stage.
2. The Actiflo System receives coagulated water which is then vigorously mixed with microsand and polymer to provide ideal conditions for collisions between individual microsand-ballasted flocs for the formation of robust, larger, higher density, settleable ballast flocs. The fully flocculated water then enters the clarifier where the microsand ballasted flocs quickly settle to the bottom while the clarified water rises to the lamella settling zone before being transferred to 2 clarified water troughs and into a weir where the water is then transferred to filtration tanks.
 3. A percentage of filtered water is treated for hardness in a dedicated Water Softener Unit using ion-exchange technology. The softened water is returned where it meets an oncoming portion of un-softened water and flows into a Treated Water Reservoir (vol. 1500 m³). Recently additional water softening capacity was installed in the water treatment plant (doubling from 50 to 100 m³/hr) to allow increased recovery of groundwater. Sludge from the treatment process is sent to the Waste Water Treatment Plant for further treatment and disposal.
 4. Bulk chemicals used in the process include Sulphuric Acid (50% H₂SO₄) and Sodium Hydroxide (25% NaOH, Caustic) for pH adjustment, ferric chloride as coagulant, and polymer (Flopam AN 910 SEP).
 5. The stored treated water is pumped to the production process from the Treated Water Reservoir via UV treatment to the cold process headers. Water is then available for brewing and for the boilers for the generation of steam to drive the distillation processes.
 6. Cold process water is also used for cooling seals of pumps throughout the plant; seal water is recovered and returned to a large storage tank. It is discharged once compliant with the IE Licence discharge limits; otherwise the water is treated in the WWTP.

Figure 3.5 provides an overview of the Water Treatment System on site.

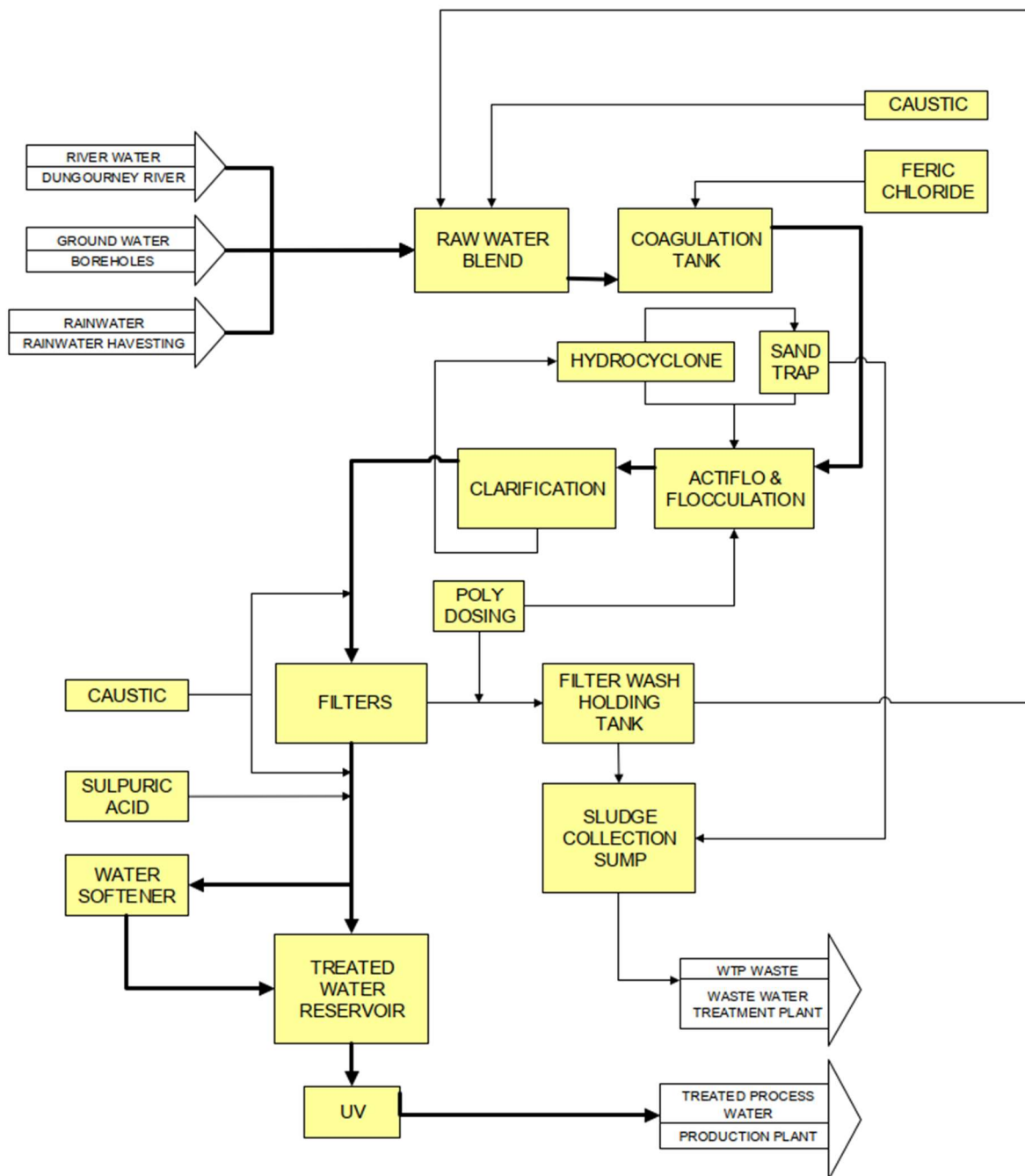


Figure 3.5 Overview of Water Treatment System

3.6 Cooling Water

3.6.1 Existing Site

Borehole and cavern water is used for indirect cooling throughout the existing site. A PFD of the existing water supply system is provided in Figure 3.6.

Cavern Water: Underground cavern water is used to provide cold water for cooling purposes in the Fermentation, Brew House and Still House areas. This water is primarily used on a once through

basis and as it does not come into contact with any product it can be discharged to either the Dungourney River (SWE1) or to Cork Harbour via the wastewater treatment plant SE2 (formerly SE Final) should TOC levels go outside of the acceptable range.

Borehole Water: Borehole water sourced from abstracted groundwater from 8 boreholes (PW 2 – PW 9) is primarily used for fermenter cooling and subsequently reused in the onsite water treatment plant for conditioning as process water (refer to Figure 3.5).

3.6.2 Expansion Site

The distillery expansion site will not use borehole or cavern water for indirect cooling purposes. In place of these existing water sources for indirect cooling a new closed loop chilled water system and cooling tower system will be installed. Make up water to these systems will be provided from the existing process water of the onsite water treatment plant.

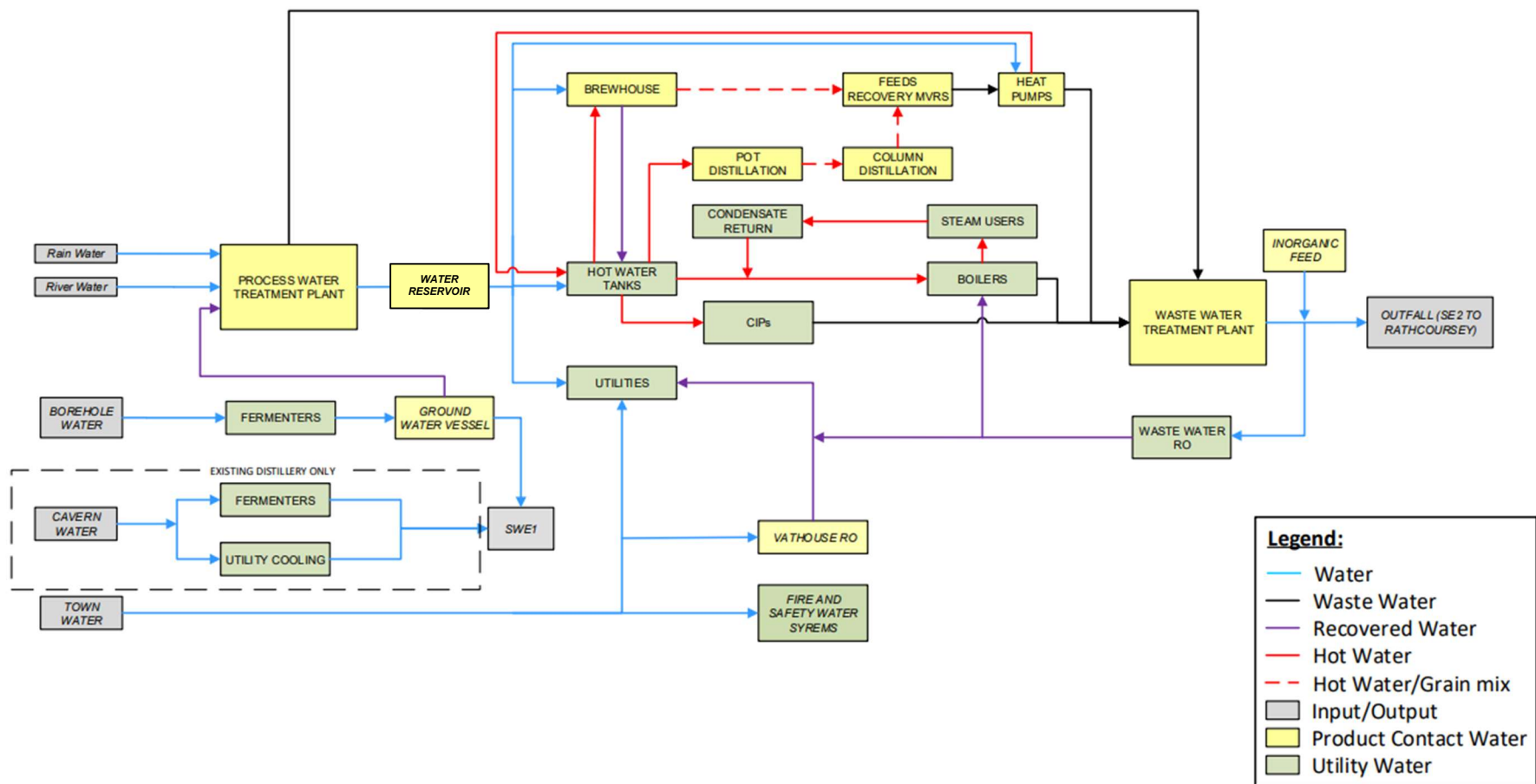


Figure 3.6 Overview of Site Water Map including Cooling Water

3.7 Mechanical vapour recompression (MVR)

Mechanical vapour recompression (MVR) is an innovative closed loop system that captures, compresses and recycles steam generated in the distilling process.

The existing pot distillation process and wash column & wash rectifier within the Barry Crockett Still House has been modified to significantly reduce the energy usage associated with the process by reducing the site's steam requirements, which in turn reduces the site's natural gas usage.

The MVR system includes:

- 6 new Steam Generators installed in the Garden Still House (for each of 6 pot stills)
- 6 new Steam Generators installed in the Barry Crockett Still House (4 for the pot stills and 2 for the wash and rectifier column)
- 4 new MVRs installed in a new plant room (MVR Building circa 300m²) located between the Garden Still House and Barry Crockett Still House.

The basis of the system is that heat from the distillation vapour indirectly heats water flowing in a falling film condenser (or heat exchanger) known as a Steam Generator (SG). As the water flows from top to bottom in the SG, a low pressure steam (LPS) vapour is formed. This vapour is then passed through a series of MVRs where the vapour is compressed. The output is medium pressure steam (MPS) which is then used in a reboiler for heating in the distillation process as a substitute for plant steam (Refer to Figure 3.6). This leads to less steam being produced by the site steam boilers and less natural gas being used in the facility, thereby reducing CO₂ emissions and reducing the carbon footprint of the facility.

It is proposed that the continuous distillation process within the existing columns building will be modified with MVR technology in 2024 to significantly reduce the energy usage associated with the process again by reducing the site's steam requirements in turn reducing the site's natural gas usage.

As per outlined in Section 3.1 above, a key element of the new distillery will be that Scope 1 & 2 energy emissions are to be reduced across distilling operations and part of this proposed design will incorporate the use of MVR technology to recycle waste steam generated from the pot and column still process to ultimately heat the stills as per described above. IDL will employ this technology on all 10 new pot stills within the new Still House and on all 6 columns within the Columns Distillation Building.

3.8 Steam Boilers

As a result of implementation of significant energy reduction strategies on site such as the above described MVR technology, there is no requirement to increase the boiler capacity for the site to cater for the proposed distillery expansion.

In the 2012 IE Licence Review Application, the installed boiler capacity (aggregated rated thermal input) was 61.8 MW_{th} (3 x 20.6MW) falling within the Large Combustion Plant Regulations 2012, S.I. 566 of 2012. These boilers were replaced in 2023 with three new energy efficient replacement boilers with a reduced total combined capacity of 48.6 MW_{th} (3 x 16.2 MW_{th}) falling within the requirements of the Medium Combustion Plant Regulations 2017, S.I. 595 of 2017.

The 3 No. natural gas dual fuel replacement steam boilers located in repurposed Warehouse No. 2 were approved by the EPA via Technical Amendment D. Each boiler is rated at 22,500 kg/hr at 100 deg. C, giving a site total of 67,500kg/hr.

The majority of boiler make up water is recycled treated water from the wastewater treatment plant, refer to Section 3.2 for further details.

3.8.1 Fusel Oil

Fusel oil is a generic term for a suite of higher alcohols, principally amyl alcohols. The suite of higher alcohols is produced in small quantities at the fermentation stage of alcohol production on

site. The fusel oil by-product is removed in the Extractive Distillation Column during distillation. Fusel oil is used as a fuel in the on-site boiler system (Permitted via the existing IE Licence P0442-02). Whilst all three existing boilers will utilise biogas from the AD as their primary fuel with natural gas as a back up, Boiler No. 3 is fitted with an advanced burner to co-fire fusel oil with natural gas or biogas as and when necessary. The fusel oil is stored on-site in a dedicated storage tank. The fusel oil is burned in campaigns rather than on a continuous basis.

3.8.2 Biogas

Biogas will be produced from the onsite anaerobic digesters (AD) which will convert thin stillage and centrifuge liquors into biogas, suitable for use in the onsite steam boilers.

Biogas as produced on site will contain approximately 60% methane, with the remainder being carbon dioxide (around 40%) and other trace amount of impurities such as hydrogen sulphide. Refer to Section 3.1 for further details on the AD system.

There are three main emissions to air associated with the boilers, each 0.8m diameter flue gas stack is constructed to a height of 17.22m from ground level as follows:

- A1-1 (Production Boiler #1)
- A1-2 (Production Boiler #2)
- A1-3 (Production Boiler #3)

Attachment-7-4-1-Emissions-to-Air-Main and Fugitive has been completed in the IE Licence Review Application for each emission point, refer to drawing IE0313231-22-DR-0009 for location of the boiler emission points.

An Air Quality Impact Assessment as completed for the EIAR for the expansion project concluded that combustion emissions will remain in compliance with Directive 2008/50/EC (Air Quality Directive) and 2017 Medium Combustion Plant Regulations, demonstrating that no significant impact will occur off site as a result of the proposed expansion project.

3.8.3 Biomethane – Backup Support

As outlined in Section 3.1, a biomethane import facility will be provided to provide biomethane for commissioning and supplementing peak distillery production demand as a result of production activities related to start-up and general distillery maintenance. The biomethane will meet the same specification as that of natural gas and adhere to the same atmospheric discharge limits as for natural gas as per outlined in Attachment-7-4-1-Emissions-to-Air-Main and Fugitive.

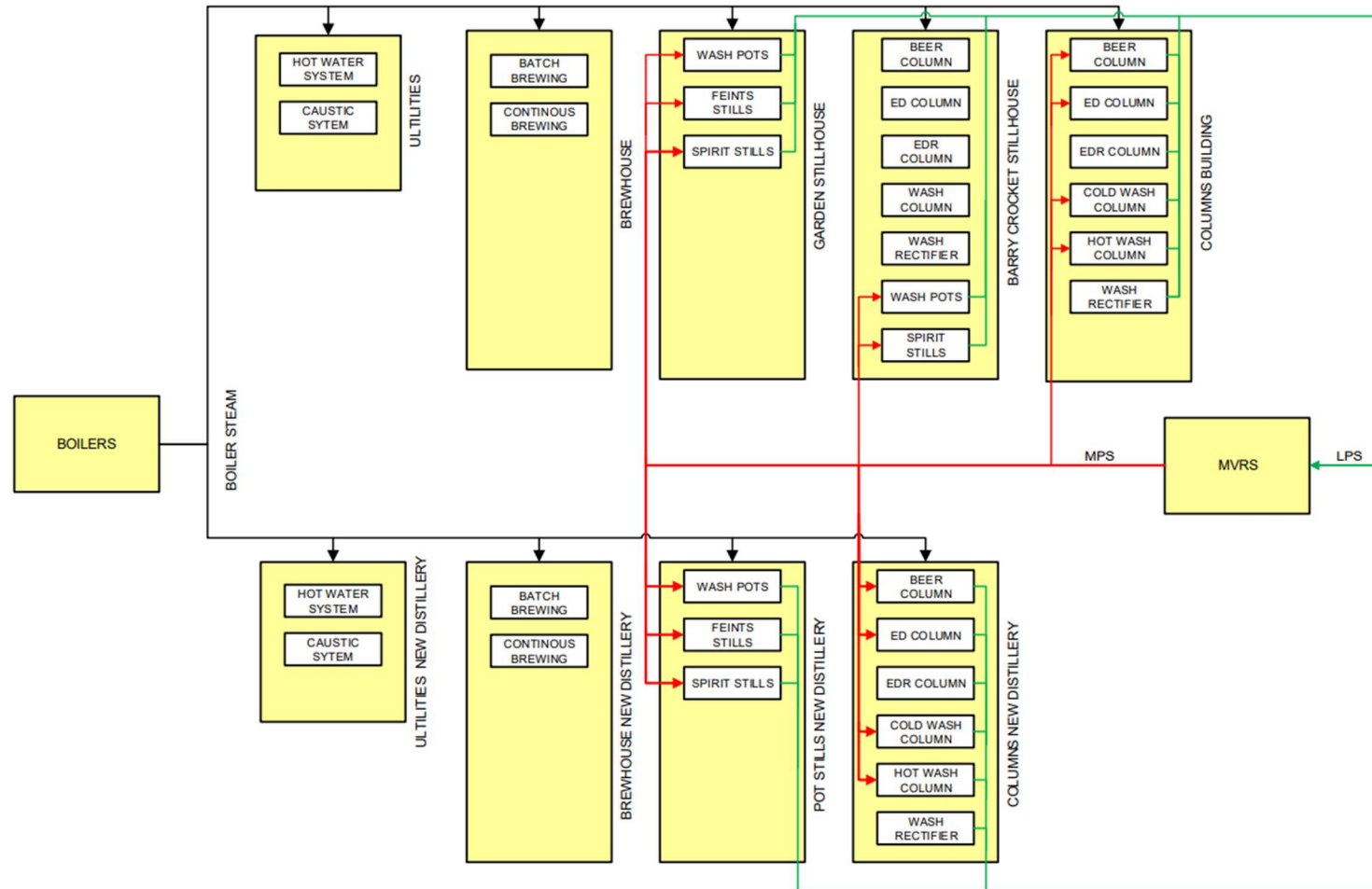


Figure 3.7 Steam Distribution System

3.8.4 Cleaning-In-Place

IDL operate various Cleaning-in-Place (CIP) programmes on-site. A process flow diagram of all CIP operations is provided in Figure 3.8.

Typically, there is a three step CIP process, as follows:

- Step 1 – a hot water pre-rinse is completed and the wastewater from this step can be either recovered or sent directly to the WWTP, depending on where the pre-rinse is being completed.
- Step 2 – a caustic wash is then completed and the dirty caustic can be either reused in the CIP process or bled to the WWTP. Typically, the caustic wash is at a set temperature and conductivity range.
- Step 3 – a final hot water rinse is then completed and most of this wastewater is directed to the WWTP.

IDL has refined its CIP programme over a number of years in order to reduce the volume of CIP wastewater being discharged to the WWTP and to reduce the site's water / caustic requirements. This has led to significant reductions of water consumption / wastewater generated. The following CIP regime is currently completed on-site and will be replicated within the expanded distillery:

Location	Equipment	CIP Programme
Brew House	All	7-10 days
Yeasting & Fermentation	All	7-10 days
Distillation	Beer Column Wash Column Wash Pots Hot Wash Charger	7-10 days 5-7 days 5-7 days 5-7 days
Feeds Recovery (Wet Grains & Syrup Area)	Wet Grains (Lines & Tank) Syrup Tanks	Once a month Every 6 months
Feeds Recovery	Centrifuges, Syrup lines, Finisher, MVR Evaporator, Syrup Transfer Lines	Every 14 days

The CIP regime for the new processes in the expansion site will be similar to those carried out for the existing site processes.

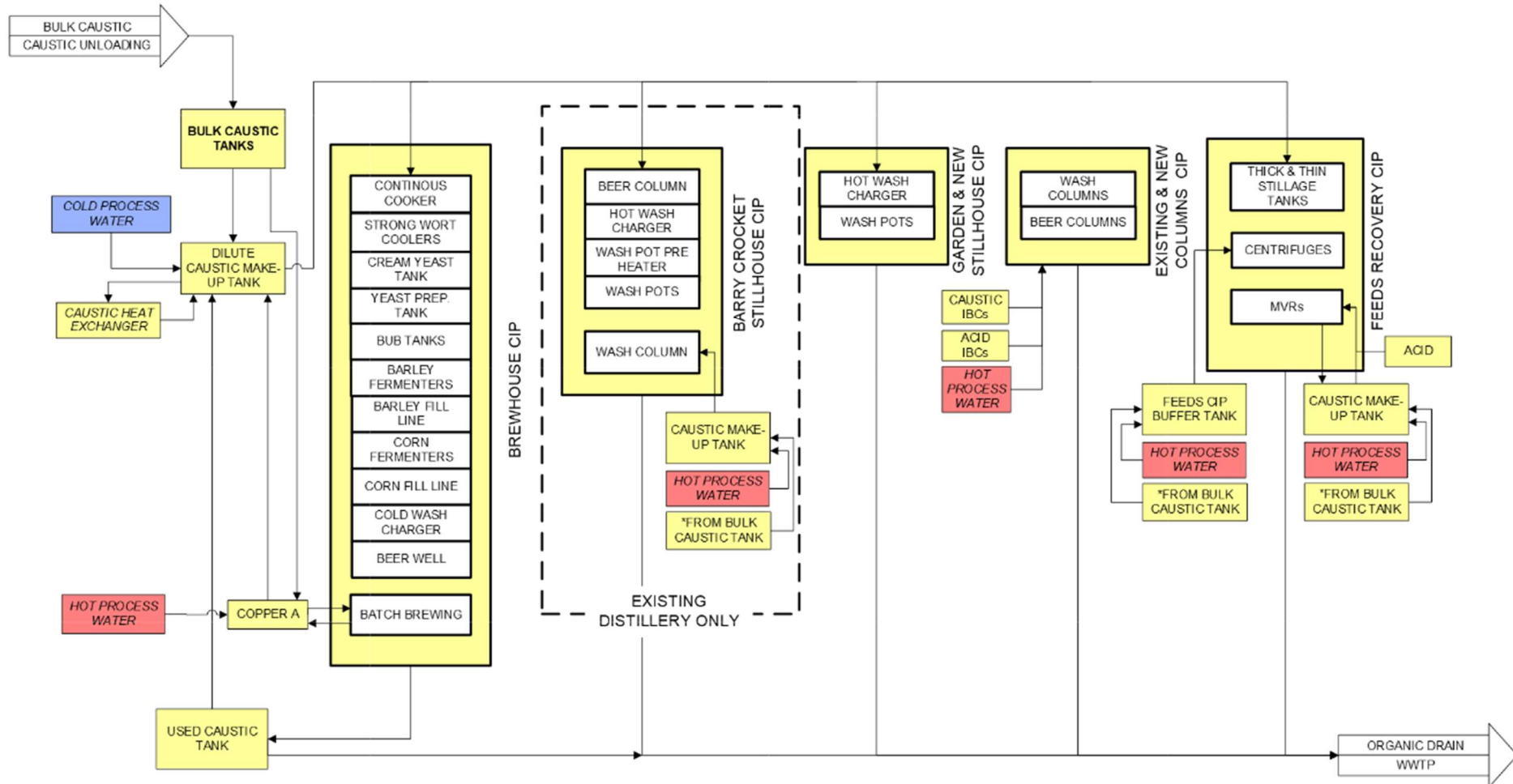


Figure 3.8 Overview of CIP System – Existing and Proposed

3.9 Central Laboratory

The main areas of responsibility within the Central Laboratory include:

- Product Quality Management Laboratory
- Provision of spirit standards
- Whiskey blending and formulations.
- Whiskey stock management and whiskey planning.
- Research & Development – distillation and maturation.
- New Product Development - Whiskey and other beverages.
- Co-Packer quality and technical management.

The atmospheric minor emission points associated with the Central Laboratory and the Office Block are identified in Attachment-7-4-2 of the IE Licence Review Application and minor emission point locations shown in Drawing No. IE0313231-22-DR-0015.

4 Overview of Emissions

Following the above description of site processes, utilities and support processes, the following schematic (Figure 4.1) represents all aqueous discharges from the site's above described activities. The schematic serves to outline the extensive management, treatment, control and monitoring in place for aqueous emissions from the existing activities and those that are proposed for the expansion project.

Further specific details on all emissions from the above activities are provided within the Attachments in Section 7 of the IE Licence Review Application Form.

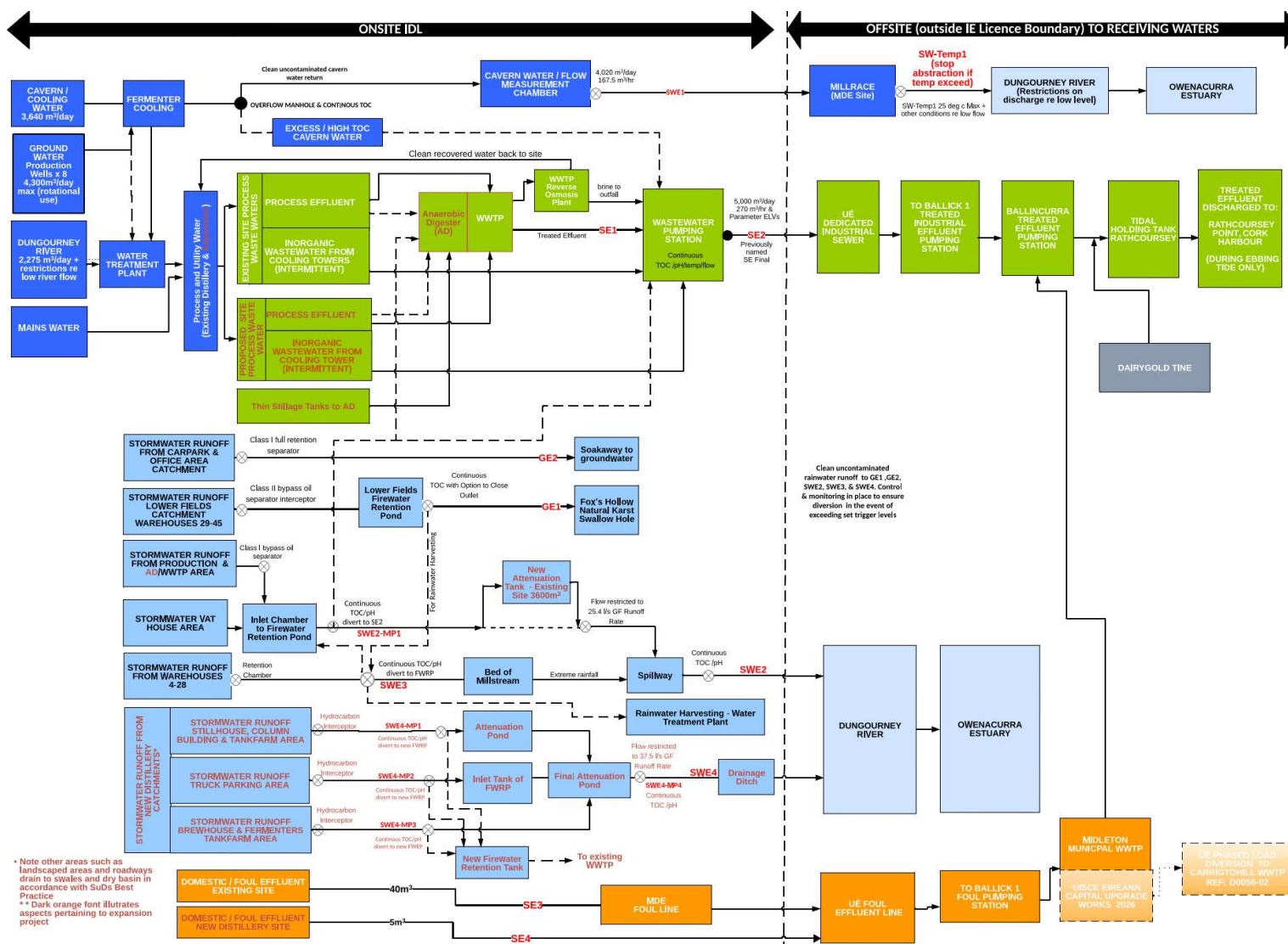


Figure 4.1 Overview of Management and Control of Aqueous Emissions - Existing Site and Proposed Expansion