

REPORT

**Stockyard Stormwater Treatment Upgrades-
Technical Paper Existing and Future Stormwater
Treatment Process Description**

Prepared for Lyttelton Port Company
NOVEMBER 2009

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LYTTELTON PORT COMPANY

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Executive Summary

The key outcomes expected of the Coal Stockyard stormwater treatment system upgrade are:

- Compliance with proposed consent conditions;
- Reduction in system manual operations and maintenance requirements;
- Reduction in system footprint to make way for additional stockpiling capacity;
- Integration of the new treatment components with existing controls as seamlessly as possible;
- Treatment of all stockyard stormwater runoff from the expanded coal stockyard facility.

This report outlines the proposed treatment upgrades and control philosophy. It does not include any assessment of effects of the discharge on the receiving environment. It should be noted that the design is only at pre-feasibility level and aspects could change as detailed design is completed and system optimisation is carried out.

The design treatment rate of the proposed stockyard stormwater treatment system is 100L/s for the fully expanded stockyard. LPC has advised that the expanded coal stockyard will be designed and managed to retain stockyard stormwater in excess of this flow.

The treatment process will be sourced from competent contractors that are experienced in this field, such as those approached for this report, namely Metso Minerals and Veolia to design and install a treatment system based on the proposed conditions of consent for the ocean outfall. These performance parameters are listed in **Table 4-1**, namely for pH and turbidity and are median values of 4.5 – 9 and 80 NTU respectively.

The proposed treatment system at the Lyttelton coal stockyard will include:

- New pipework to extend the rising mains to the new treatment site and to convey the particulate and clarified suspended solids back to the stockyard;
- Particulate removal system to remove larger particles, including all mechanical and electrical equipment;
- Chemical dosing to aid coagulation and flocculation and flow monitoring to control dosing;
- Lamella clarifier to provide flocculation and settling of finer particles, including two feed pumps and one solids pump and associated power;
- New pipework to connect the clarifier to the existing outfall chamber and extend outfall (and/or a new harbour outfall); and
- Replacement of the existing switchboard to incorporate controls for the new equipment and instrumentation.

1 Scope of Report

1.1 Background

The existing coal stockyard runoff treatment system, referred to as the “Stockyard Stormwater Treatment System”, utilises primary separation at the stormwater pump station inlets and within the pump station, while additional separation is provided in a secondary settling cell to remove entrained solids. The stockyard stormwater containing colloidal suspensions is then dosed with PAC coagulant and passes through a rapid mix chamber and into flocculation tanks. From here, it passes into a settling pond. The treated stormwater is piped from the pond directly to the outfall into Te Awaparahi Bay, Lyttelton Harbour.

MWH has been engaged by LPC to provide a preliminary design for a replacement to the existing system that will service the expanded coal stockyard in a way that integrates well into current operations while providing treated stormwater to the point of discharge of a quality that complies with the proposed resource consent conditions.

The key outcomes expected of the Coal Stockyard stormwater treatment system upgrade are:

- Compliance with proposed consent conditions;
- Reduction in system manual operations and maintenance requirements;
- Reduction in system footprint to make way for additional stockpiling capacity;
- Integration of the new treatment components with existing controls as seamlessly as possible;
- Treatment of all stormwater runoff from the expanded coal stockyard facility.

It should be noted that the design is only at pre-feasibility level and aspects could change as detailed design is completed and system optimisation is carried out.

1.2 Excluded from Scope of Work for the Treatment System

The scope of the proposed works described in this report is limited to the receipt of stockyard stormwater pumped from the pump stations (see **Figure 2-1**) and ends at the connection to the existing pipe feeding to the ocean outfall. It does not include any assessment of effects of the discharge on the receiving environment. This has been covered by a separate assessment carried out by the Cawthron Institute.

The report will be limited to the treatment process and associated operational aspects. Assumptions of the current stockyard management and stormwater collection system performance will be described based on the Opus Stormwater Report and it has been assumed that the current performance and management approach will be maintained in the expanded coal stockyard. This is both with regard to processes, practices and the quality characteristics of stockyard stormwater delivered to the treatment system.

2 Description of Existing Treatment System

2.1 Overview

The existing stormwater treatment system comprises stockyard stormwater pump stations, primary treatment, secondary settling, coagulant dosing and mixing, flocculent settling, and discharge to the harbour via an outfall pipe (see plans C02 and C03 in Appendix A for details of the treatment plant layout).

The existing stormwater treatment system is depicted by those processes shaded grey in the block flow diagram in **Figure 2-1** below.

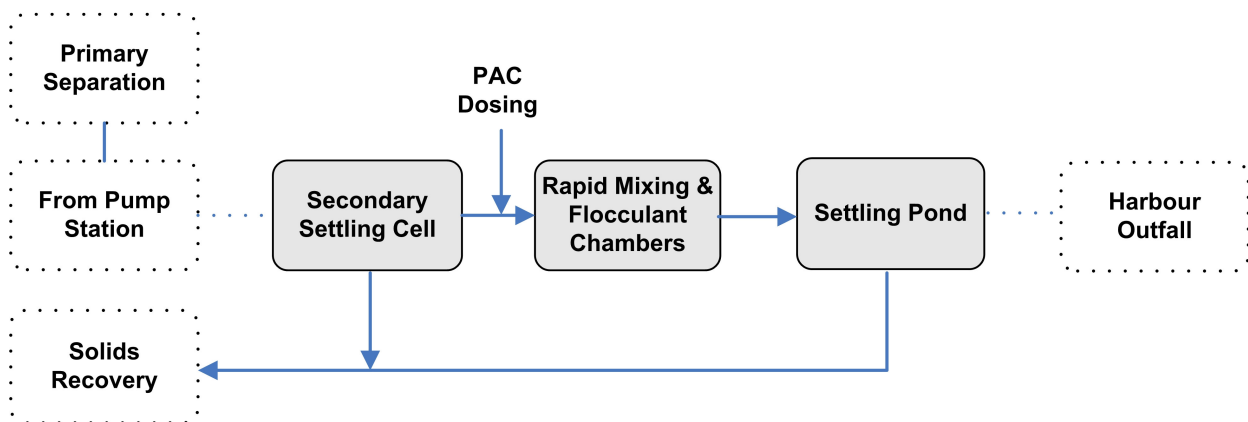


Figure 2-1: Process Flow Diagram of Existing Treatment System

2.2 Contaminated Stormwater Pump Stations

There are five pump stations around the perimeter of the coal stockyard, which collect runoff from the stockyard and pump it to the treatment system at the eastern end of the stockyard.

2.3 Settling Separation

The secondary separation cell (SSC) is a long trapezoidal shaped concrete channel (30m x 6m x 1.1m deep). The pumped flow from each pump station enters the secondary separation cell, where the coarser coal particles settle out of the stormwater flow. The settled coal particles are periodically removed by excavator and deposited back onto the coal stockyard.

The SSC is currently cleaned out every 8 to 9 months, which supports the assumption that the coal stockyard management has occurred successfully (i.e., more frequent cleaning would have implied poor performance of the pump station aprons).

2.4 Chemical Treatment

PAC dosing is flow paced based on the flow into the mixing chamber measured by a flow meter on the gravity line from the secondary separation cell.

The treatment process is comprised of nine 2.5 m diameter circular tanks, arranged in a three by three square. The stockyard stormwater (containing fine coal dust) flows from the secondary separation cell into the first corner circular tank that acts as a rapid mixer and is dosed with PAC. The circular tanks are connected together via a series of overflow weirs. The second chamber acts as a flocculation chamber and flow control structure directing low flows to the third chamber or bypassing higher flows to the remaining six tanks to provide adequate retention for floc development.

There are separate flow paths for dry and wet weather flows. The dry weather flow path is through three of the circular tanks and then into the pond. During wet weather, flows in excess of the normal dry weather flow overflow through a high level culvert and pass through eight chambers in total, thereby increasing contact time prior to entering the settling pond.

The hydraulic performance of this system has been tested and performs well under the varying flow conditions, with no mechanical equipment required to handle the control of flocculation at higher flows.

2.5 Settling Pond

The settling pond comprises a long, shallow pond (1.2m deep). Flow from the mixing chambers enters the settling pond where the coagulated particles settle and the clarified treated stormwater flows into the outfall chamber. The settling pond is cleaned out annually, typically in summer.

2.6 Harbour Outfall

The harbour outfall comprises a chamber and outfall pipe. Flow from the settling pond flows by gravity to the chamber and then into the outfall pipe, which discharges into Te Awaparahi Bay, Lyttelton Harbour.

2.7 Treatment of Low Flows

During dry periods, there is a relatively constant, but small, volume of stormwater generated from the dust suppression irrigation system at the coal stockyard. This flow is currently being pumped from the stormwater collection sumps around the stockyard and into the secondary separation cell, before gravitating into the mixing structure. From there, it flows into the settling pond and out through the outfall to the harbour. During extended periods of dry weather, there is often no flow into the outfall because of the very low flows and evaporation from the pond.

The upgrade will incorporate an improved storage and control system to ensure that low flows are adequately controlled to provide steady state treatment conditions and hence efficient chemical dose.

2.8 Clarified Suspended Solids Management

The primary constituent in the clarified suspended solids is exportable coal particulate, which can be discharged back onto the coal stockyard.

3 Expansion of the Coal Stockyard

3.1 Treatment System Location

LPC is proposing an increase in area of the stockyard by reclaiming land along the existing coastal boundary of the stockyard and possibly excavation of the hillsides surrounding the coal stockyard.

The development will include relocation of the stockyard stormwater treatment system further to the south-east to make room for the expansion of the stockyard operations. The existing treatment system structures will be demolished after a new system had been constructed at the new location. The existing outfall(s) will need to be extended to the expanded edge of the stockyard as shown on Opus drawing 98-R5 (and/or a new harbour outfall constructed) for the discharge of treated stormwater.

Some of the existing mechanical and electrical equipment could be used at the new site if appropriate. It should be noted that the existing system must be operational up until the new treatment system is successfully commissioned, which makes reuse of any existing equipment difficult. However, some items may be able to be shifted to the new site if temporary connection to the existing site is feasible (e.g. switchboard, dosing pumps).

The area required for the proposed system will be of the order of about 40m by 20m (800m²) and can be accommodated adjacent to the existing building near Battery Point.

3.2 Stormwater Flows from Proposed Expanded Stockyard Areas

The design of the proposed stormwater treatment system is based on the ability of the management within the coal stockyard to achieve stormwater attenuation to minimise peak flows through the treatment system.

The expanded coal stockyard will be designed to incorporate passageways between coal stockpiles to form areas that allow for stormwater storage to provide the attenuation required. The stormwater attenuation will allow the stockyard stormwater treatment system to be designed with a maximum capacity of 100L/s.

In addition, the treatment capacity could be installed in stages, with the capacity increased when required by ensuring additional units can be readily incorporated into the treatment system, both in terms of installation of additional structures and additional control systems.

The design of the treatment process is based on modular design-build packages so if treatment of inflows greater than 100L/s proves necessary additional modules could be installed.

4 Proposed Stormwater Treatment Upgrade

4.1 Overview

An earlier assessment of system upgrade options recommends the use of preliminary screening and vortex type particulate removal systems as a pre-treatment process before chemical treatment. This process provides an effective method of handling particulates, automatically disposing the settled particulates back to the stockyard.

The chemical treatment process utilising lamella settling is used in other coal mining operations in New Zealand and is proven to provide the performance required to meet the desired effluent quality.

A similar process, namely the Actiflo[®] process offered by Veolia is designed to handle the type of inflow experienced at the coal stockyard. It utilises a sand particle as a seed to generate large flocs that settle well and achieve the required removal rates. An offer for supply and installation from Veolia was requested in 2008 as part of a previous investigation.

4.2 Proposed Resource Consent Conditions

The proposed consent conditions require sampling of the treated stormwater once every calendar month that discharge takes place, with analytical determinants and their acceptable median values as shown in the table below.

Table 4-1: Proposed Resource Consent Conditions for Treated Stormwater Quality

Analytical Determinant	Acceptable Median Concentration
Suspended Solids	No limit specified
Turbidity	80 NTU
pH	4.5-9 pH units

4.3 Design Criteria

The design criteria are:

- Achieving the proposed treated stormwater consent conditions by controlling pH, reducing suspended sediment and reducing turbidity;
- Treating a range of flows from 0 to 100L/s;
- The proposed treatment system will comprise particulate removal, using vortex degritters, coagulant and flocculant dosing to achieve the suspended solids removal and turbidity reduction and chemical dosing to maintain a target pH within the consented limits.

There are four key process changes proposed for the new stormwater treatment system:

1. Installation of a particulate removal unit to remove the larger coal particles, and reduce footprint required for treatment. This will replace the existing SSC to provide a smaller footprint and improve particulate handling efficiency, i.e. the settling pond will no longer be required;
2. Installation of a lamella clarifier to improve flocculation and settling, and reduce the footprint area required for final treatment, and facilitate the ready handling and disposal of settled suspended solids within the coal stockyard;

3. Automation of clarified suspended solids removal from the particulate unit and the lamella clarifier to improve particulate management;
4. Reconfiguration of the chemical dosing system to dose coagulant directly upstream of the new clarifier, and addition of a flocculent dosing system to improve solids settling, and pH monitoring and control to effect correction to ensure compliance with the resource consent.

The objective of these process changes is to meet discharge water quality requirements as per the proposed consent conditions.

The proposed treatment system is depicted in **Figure 4-1** below, showing the scope of the stormwater treatment system shaded in grey.

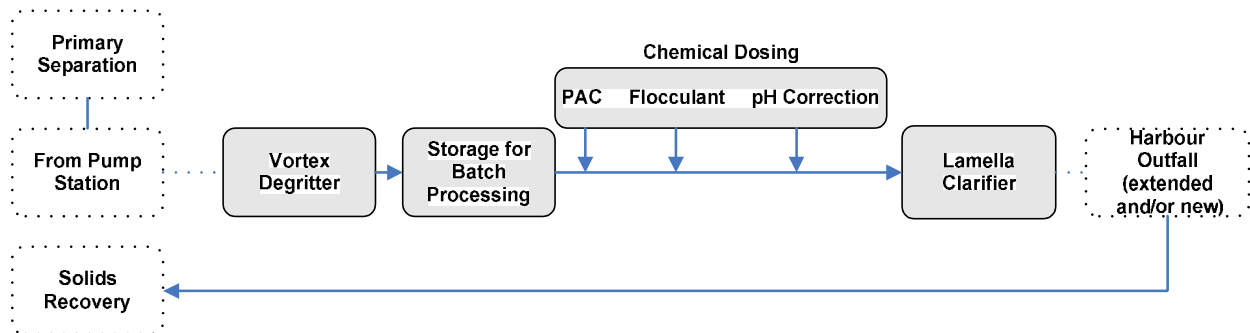


Figure 4-1: Process Flow Diagram of Proposed Treatment System

4.3.1 Design Flow to Treatment

A modular treatment system may be selected to manage a sufficiently wide range of flows to be installed in the first phase of the upgrade. Once the stockyard is expanded, the second module would then be installed to handle higher flows up to 100L/s as currently treated by the system.

The choice of the size of the module can be defined at the procurement stage of the upgrade as offers for smaller modules can be obtained from suppliers to assess the capital costs of the various options and optimise the system.

4.4 Stormwater Pump Station Management

The pump stations are equipped with a concrete apron in front of the stormwater inlet. The coal stockyard runoff accumulates in front of the pump stations, where coal fines are settled. The stormwater then gravitates into the pump station sump.

The Front End Loaders (FELs) are utilised to clean the coal sediment in front of the pump stations to limit the transportation of particulate coal to the treatment process. The operation of primary separation has worked effectively and it is proposed that this would continue in the expanded coal stockyard.

4.5 Particulate Removal

4.5.1 Process Description

A vortex particulate removal system is proposed to remove the larger coal particles from the stormwater runoff as a preliminary treatment process prior to chemical dosing and clarification. Particles of coal pumped to the treatment system will range in size from approximately 3.5mm down to approximately 50

micron. Removal of the larger particles in the initial stage of treatment reduces the solids load on the downstream treatment units.

The particulate removal process can be designed to remove particle sizes to range between 100 and 250 micron depending on the design criteria required. It is envisaged in this proposal that removal of particles to 200 micron would be appropriate. Particles below 200 micron would assist in forming a seed for coagulated particles in the downstream chemical precipitation process.

Vortex particulate removal uses a spiral flow path similar to a cyclone separator to settle particles out of the flow of water.

Figure 4-2 shows an example of a typical configuration from Hydro International. Flow enters the circular structure tangentially and a paddle maintains rotational velocity, which allows coarse particles to settle into a collection chamber.

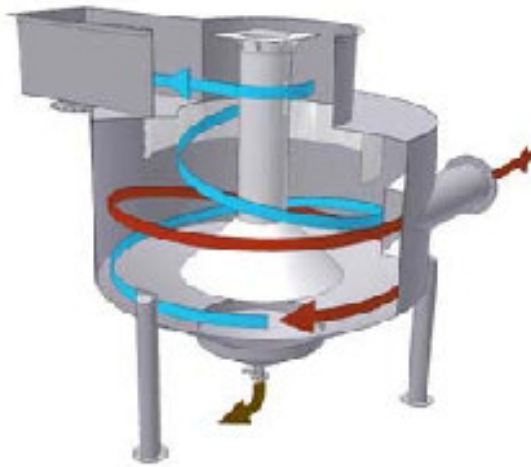


Figure 4-2: Typical Vortex Particulate Removal Chamber

The advantages of a vortex particulate removal system over the existing settling channel are:

- Small footprint;
- Low headloss: a headloss of 100mm is normally required across a vortex particulate removal system;
- Efficient particulate removal over a range of flow rates.

4.5.2 Particulate Unit Capacity

The particulate unit will provide sufficient capacity to accommodate the expected flow to the treatment system. The modular configuration of the unit will allow a phased increase in treatment capacity to match stockyard expansion by providing for a future connection of additional particulate units.

The preferred configuration is to provide a duty and assist design, where one unit could provide treatment during dry weather, while both would operate during wet weather. Some further investigation into the capacities readily available in New Zealand is required to determine the optimal configuration and size module of the particulate removal units.

A modular configuration of the particulate removal process also allows for adequate redundancy for maintenance of the equipment under most operating conditions.

4.5.3 Particulate Pumps

Removal of the accumulated particulate is achieved through periodic pumping of the particulate from the bottom of the collection chamber. The particulate typically requires fluidisation by injection of water, or air (for air lift pumps).

The frequency of pumping should be controlled by the volume of water treated to ensure that the particulate in the bottom of the chamber is managed effectively by avoiding excess build-up by not pumping often enough, and avoiding removing water by pumping too frequently.

4.6 Chemical Dosing

4.6.1 Process Description and Removal of Turbidity

Chemical dosing is required to enhance particle setting in the clarifier and to correct the stormwater pH to ensure compliance with the proposed resource consent conditions for discharge to the harbour.

Chemicals would be dosed upstream of the clarifier, with the dose continuously adjusted based on the flow and pH of the stormwater as measured by online sensors.

4.6.2 Coagulation and Flocculation

Experience with the existing treatment system shows that dosing PAC only is inadequate to provide the final water quality, in terms of suspended solids and turbidity, required by consent. The results of tests confirmed that a flocculant in the form of an organic polymer is also required to remove suspended solids into an aggregate mass of particles, which can then settle in the clarifier.

Therefore, it is proposed that the upgraded treatment process will incorporate dosing of both PAC and a flocculant directly into the pipe prior to the flow entering the clarifier. pH correction is included in the treatment process.

The proposed dosing is suitable for use in the lamella system offered by Metso Minerals or for the Actiflo® process.

4.6.3 pH Control and Performance Monitoring

Dosing of a suitable base is required to increase the pH to within the proposed consent limits for discharge to the harbour and to ensure that the pH is within the optimum range for effective functioning of the coagulant and flocculant.

The installation of permanent pH monitors would allow the treatment system to respond to any changes in the coal composition in the future.

pH monitors could form part of a permanent, real-time performance monitoring system, which could also include turbidity and flow meters. The benefits of having such a monitoring system include:

- ensuring the installed treatment system is appropriate for the stockyard stormwater and site conditions;
- ensuring that the operating regime for the equipment is correct (e.g. correct dosing rates);
- ensuring that the treatment equipment is optimised for the range of flow regimes that occur;
- providing a credible record of system performance relative to proposed consent conditions, should such evidence be required to verify the treatment system operation and level of compliance.

The stockyard contains a mixture of coal types from various sources. This requires that the treatment process be designed to handle the variability of the runoff with respect to chemical characteristics including pH and flow. The proposal described takes this situation into account.

Details of the performance monitoring system will be considered and finalised as part of the detailed design phase. In summary, the instrumentation, control and automation process will monitor incoming pH and flow and monitor the treated stormwater pH, turbidity and suspended solids. The data from the treated stockyard stormwater will be used to adjust the chemical dosing system to ensure that the system performance is controlled between defined set points.

The seasonal nature of the runoff from the stockyard lends itself to doing preventative maintenance before the wet weather season, followed by reporting of the performance at the start of the dry weather season. This approach would ensure that the reliability of the equipment is maintained and that review of the performance is undertaken.

4.7 Lamella Clarifier

4.7.1 Process Description

It is proposed that a lamella clarifier (**Figure 4-3**) be used to promote settling of floc before the treated stormwater is discharged to the outfall.

The lamella clarifier has a series of inclined plates, closely spaced, as shown in **Figure 4-4**. Water enters the unit near the bottom of the clarifier and flows upwards through the plates. The plates provide a very large settling surface area, and, with the short vertical distance between each inclined plate, entrained solids readily settle on the plates.

The settled suspended solids then slide down the inclined surface before dropping into the clarifier base. This can be compared to a standard clarifier, where the settling distance is significantly longer (i.e. potentially the depth of the clarifier). The shorter settling distance means smaller particles are more likely to come into contact with a surface where zero velocity conditions exist. This allows suspended solids to floc with other settled solids, forming a floc with sufficient mass to gravitate down through the flow.

4.7.2 Process Performance

Lamella clarification systems incorporated with chemical dosing are widely used in industrial water treatment applications. Veolia's Actiflo® is one of the examples and has been used to demonstrate the applicability of the process.

Metso Minerals has installed similar systems without the addition of micro-sand to assist clarification.

4.7.3 Clarifier Feed and Solids Pumps

Two feed pumps and a solids pump for the clarifier unit will be proposed for both the incoming water to the clarifier and handling of the solids from the clarifier.



Figure 4-3: 3D Illustration of a Lamella Clarifier



Figure 4-4: View into top of Lamella Clarifier showing inclined plates and overflow channel

With the solids settling out as the water passes up through the plates, clarified water then overflows into a channel at the top of the unit and discharges into the outfall pipe, as shown in **Figure 4-5**.

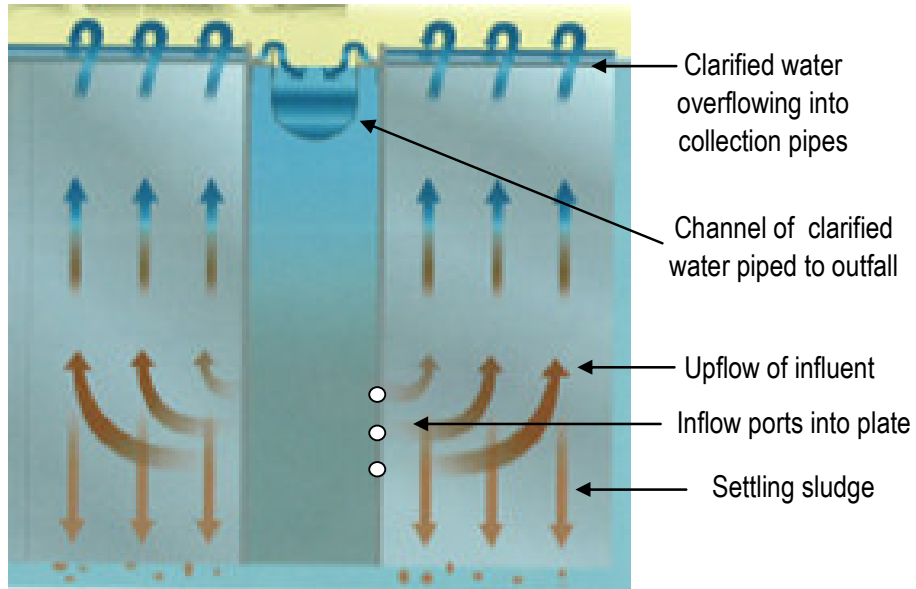


Figure 4-5: Schematic of settling process within lamella plates

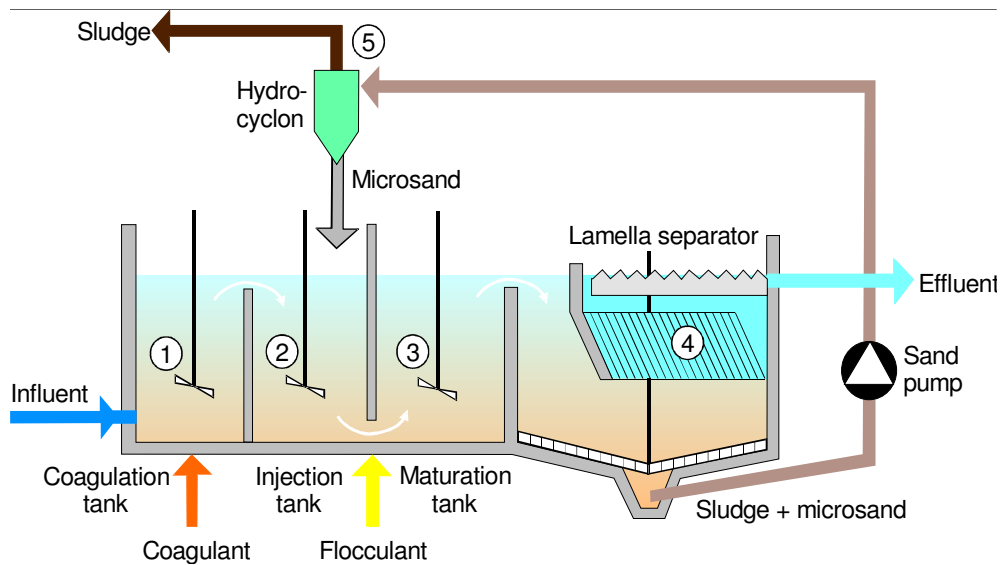


Figure 4-6: Schematic of Actiflo® Process

The advantages of a lamella clarifier over the existing settling pond are:

- Small footprint;
- More efficient solids removal over a range of flow rates;
- Ability to automate solids removal.

4.7.4 Clarifier Capacity

In sizing the lamella clarifier, it is proposed that the system is upgraded using modular process units, using the same rationale as for the particulate removal units. At the procurement phase of the project, the suppliers can be requested to offer options for modular units of varying size, after which a choice can be made as to the most efficient unit size. A modular configuration of the particulate removal process also allows for adequate redundancy for maintenance of the equipment under most operating conditions.

The key considerations in determining the most appropriate clarifier regime for the stormwater treatment system are:

- Its ability to treat low and peak flows efficiently;
- The intended level of treatment (i.e. the range of flows to be treated, including consideration of flows and performance requirements);
- Cost effectiveness – including the costs of pipework, pumps and electric controls associated with each unit;
- Sourcing and availability – there are likely to be significant costs involved in importing units that are not stocked in New Zealand.

The optimal capacity of unit will be determined during the tendering process by considering the stockyard stormwater collection, transfer, pumping and discharge parameters as a whole. Consideration of all factors in an integrated manner will also ensure the optimal and most practical definition of parameters related to the consented discharge water quality.

4.8 Particulate Management

4.8.1 Particulate Solids

The solids settled in the particulate removal chamber could be disposed of back onto the coal stockyard. The solids will contain coal particles only and is therefore suitable for disposal onto the stockyard. There are three options to handle the particulate, namely:

1. Pump fluidised particulate back to stockyard;
2. Dewater and collect particulate in a skip for return to the stockyard; or
3. Dewater and collect particulate in a skip and transported to an approved landfill.

Pumping the particulate back to the stockyard directly has advantages in that a fully automated process reduces the amount of equipment and staff supervision required. Collection of dewatered particulate in a bin is an advantage as it prevents recycling of water, however it requires more equipment (particulate classifier and storage bin) and manual removal of the bin to deposit the particulate in the stockyard or to an approved landfill.

4.8.2 Clarified Suspended Solids

The suspended solids removed by the clarifier contains coal solids, PAC and flocculant and, as such, may be acceptable for disposal back on the coal stockyard. If the coal mixture removed is acceptable for disposal back onto the coal stockyard, this options allows a “closed loop” approach to suspended solids management, where no off-site disposal is required.

However, should disposal back onto the coal stockyard be unacceptable, then the clarified suspended solids will be disposed of to an approved landfill.

5 Construction Considerations

5.1 Construction Sequence

The construction must be sequenced to avoid a situation where there is no treatment system available. The new treatment system should be constructed and commissioned before the existing system is decommissioned. In addition it is preferable to undertake the works during the summer, as minimal stormwater flows will be generated.

Initially, the new structure and treatment equipment should be installed, followed by the new pipes connecting to the existing system, including the extension of rising mains from pump stations and connection to the existing outfall pipe. This work can all be done taking into account of the stockyard construction activities and programme while the existing stockyard stormwater collection and treatment remains fully operational.

The new system will need to be checked and tested up to wet commissioning phase prior to connection to the existing system. While the new connections are made any stormwater will need to be held in storage until the work is complete. The coal stockyard can provide this buffering, as the stockyard has a sacrificial layer, which is porous above an impermeable layer and has the ability to absorb water and is likely to be dry over the summer period. The system can be closed down by switching off the four pumps stations around the stockyard. Incorporating appropriate details into the design of new elements and their interfaces with existing elements will enable efficient integration of the proposed and existing systems and minimise the length of shutdowns.

While the new treatment system is being commissioned and tested, the existing system should be available to treat stormwater if required on a manual basis with a temporary power supply, if necessary.

Electrical controls for the new system will be pre-commissioned before the new system is connected, while the control changes will need to be defined prior to the start of the upgrade work. The final integration will then need to occur during commissioning of the upgrades.

5.2 Stormwater Management During Construction

As the existing treatment system will be operational during construction of the upgrades, full treatment will be available. Where shutdown of the system is required to connect the new system to the existing pipelines, any stockyard stormwater should be stored in the stockyard.

It is proposed that the change-over from the existing system to the proposed upgraded system be undertaken during a dry weather period to mitigate against any problems during the change-over from one treatment process to another.

If the construction programme requires the change-over to occur during a higher rainfall period, the contract could incorporate the inclusion of a temporary dosing system, such as used previously in pilot tests to mitigate exceeding the proposed consented limits for the discharge to the ocean outfall.

6 Instrumentation, Control and Automation (ICA)

6.1 Overview

The feed rate to the existing treatment system from the stormwater collection sumps around the stockyard is typically low and includes runoff from water sprayed onto the coal stockyard for dust control. However, during a heavy rain event, the infeed rate can increase considerably and rapidly. Therefore, the controls for the treatment system will need to be able to manage a wide range of inflows.

The stockyard stormwater will be pumped through the treatment system, from the outlet of the particulate removal system to the clarifier, by two pumps operating in duty assist mode. As the stormwater is pumped to the clarifier, it will be dosed with PAC for coagulation and flocculation for pH correction. The PAC and flocculant dosing systems will be set up to provide dosing to match the clarifier feed rate.

As the operation of the clarifier feed pumps is not continuous, the clarified suspended solids will be pumped out only when the measured volume is pumped out of the pre-dosing tank

Manual operation of the solids pump can be initiated by an operator to further reduce the solids volume in the clarifier.

The use of ICA in the operation of the treatment process ensures that the process performance is controlled within predetermined limits, thereby reducing operator supervision. The installed instrumentation provides confidence that the water quality will be achieved, and records the performance data for LPC purposes and for reporting as required by the proposed consent.

6.2 Power Requirements

The two clarifier feed pumps have been sized to deliver a flow of approximately 50L/s each, and are driven by 11kW motors. Both pumps operate at variable speed.

The solids pump has been sized to deliver a flow of approximately 50L/s, and is driven by an 11kW motor, operating at fixed speed.

The power requirement of the PAC and flocculant dosing pump system is approximately 1.5kW.

Power for the stormwater treatment system will be supplied from the nearby chemical dosing building switchboard. A new stormwater treatment Motor Control Centre (MCC) will be added to the chemical dosing switchroom. The capacity of the existing switchboard and its supply will be reviewed to ensure that it is capable of operating the upgraded stockyard stormwater treatment system.

The electrical supply for the treatment system will be equipped with connections that allow alternative power sources from a mobile generator to be connected to the treatment plant switchboards to ensure that during a power outage, the treatment system can continue to operate effectively.

6.3 Control Integration

The control and operation of the stormwater treatment system will be integrated into the existing site PLC and SCADA systems. The PLC in the dust control switchboard will be extended as necessary to provide sufficient I/O to monitor and control the level in the stormwater pre-dosing tank, PAC and flocculant dosing system and clarifier.

7 Summary

The key outcomes expected of the Coal Stockyard stormwater treatment system upgrade are:

- Compliance with proposed consent conditions;
- Reduction in system manual operations and maintenance requirements;
- Reduction in system footprint to make way for additional stockpiling capacity;
- Integration of the new treatment components with existing controls as seamlessly as possible;
- Treatment of all stockyard stormwater runoff from the expanded coal stockyard facility.

This report outlines the proposed treatment upgrades and control philosophy. It does not include any assessment of effects of the discharge on the receiving environment. It should be noted that the design is only at pre-feasibility level and aspects could change as detailed design is completed and system optimisation is carried out.

The design treatment rate of the proposed stockyard stormwater treatment system is 100L/s for the fully expanded stockyard. LPC has advised that the expanded coal stockyard will be designed and managed to retain stockyard stormwater in excess of this flow.

The treatment process will be sourced from competent contractors that are experienced in this field, such as those approached for this report, namely Metso Minerals and Veolia to design and install a treatment system based on the proposed conditions of consent for the ocean outfall. These performance parameters are listed in Table 4-1 namely for pH, turbidity and are median values of 4.5 – 9.0 and 80 NTU respectively.

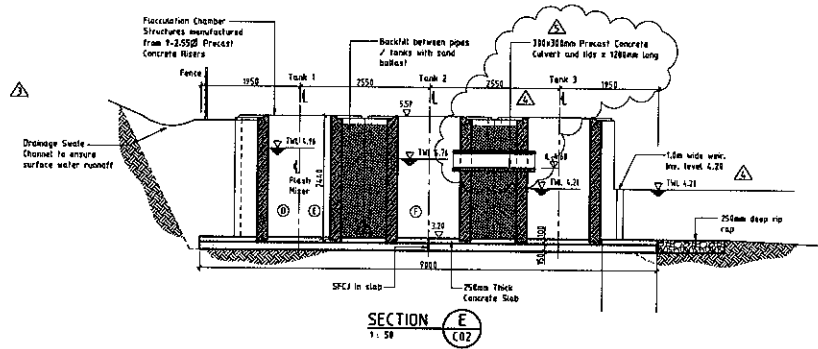
The proposed treatment system at the Lyttelton coal stockyard will include:

- New pipework to extend the rising mains to the new treatment site and to convey the particulate and clarified suspended solids back to the stockyard;
- Particulate removal system to remove larger particles, including all mechanical and electrical equipment;
- Chemical dosing to aid coagulation and flocculation and flow monitoring to control dosing;
- Lamella clarifier to provide flocculation and settling of finer particles, including two feed pumps and one solids pump and associated power;
- New pipework to connect the clarifier to the existing outfall chamber and extended outfall pipe (and/or a new harbour outfall); and
- Replacement of the existing switchboard to incorporate controls for the new equipment and instrumentation.

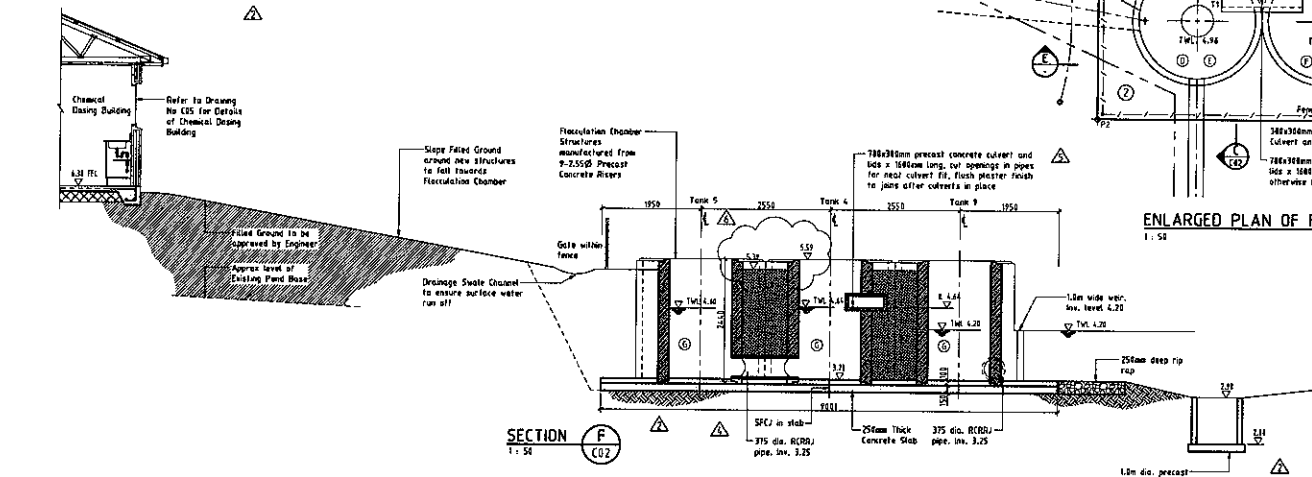
Appendix A: Plans of Existing Treatment System

ORIGINAL SIZE A1

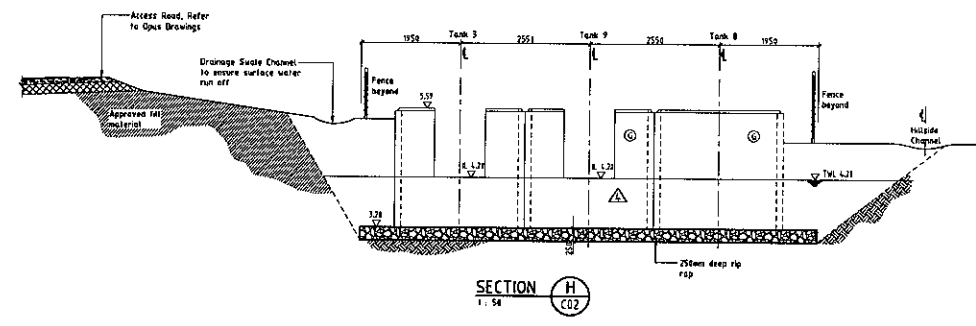
DO NOT SCALE - IF IN DOUBT, ASK



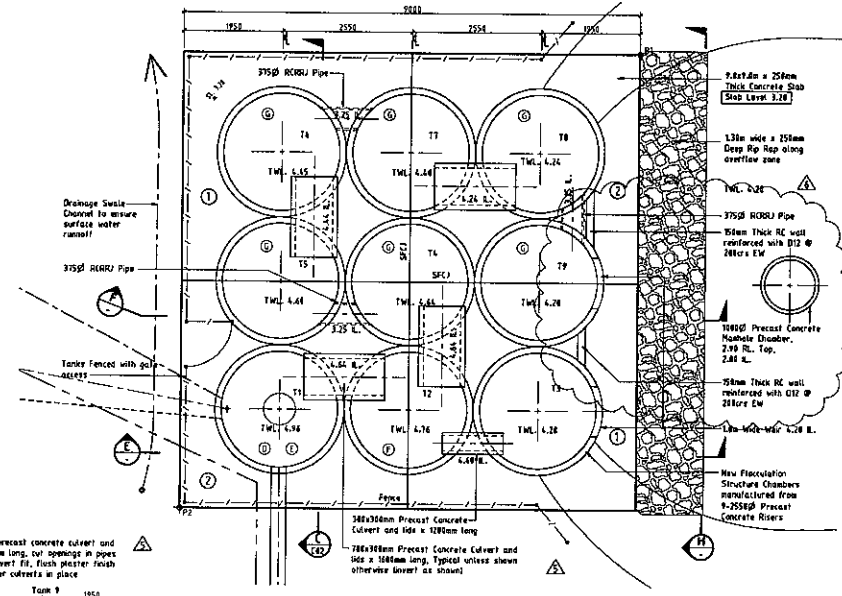
SECTION E
1: 50



SECTION F
1: 50



SECTION H
1: 50



ENLARGED PLAN OF FLOCCULATION STRUCTURE CHAMBERS
1: 50

- LEGEND**
- ① Primary Runoff Cell
 - ② De-watering Chamber
 - ③ 1344mm Ø Storage Tank
 - ④ Cleaning Chamber
 - ⑤ Rapid Mixer Chamber
 - ⑥ Flocculation Structure Chamber
 - ⑦ High Flow Flocculation Chamber
 - ⑧ Suggested slab pouring sequence
- ⑧¹ Set Out Point No P1 refer to sup. No. C02 for table

1	ISSUED FOR CLIENT APPROVAL	CH	26.09.03		
2	ISSUED FOR CLIENT APPROVAL	CH	11.07.03		
3	ISSUED FOR CLIENT APPROVAL	CH	27.05.03		
4	ISSUED FOR CLIENT APPROVAL	CH	26.05.03		
5	ISSUED FOR CLIENT APPROVAL	CH	17.05.03		
6	ISSUED FOR CLIENT APPROVAL	CH	15.05.03		
7	ISSUED FOR CLIENT APPROVAL	CH	15.05.03		
8	ISSUED FOR CLIENT APPROVAL	CH	15.05.03		
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10	ISSUED FOR CLIENT APPROVAL	CH	15.05.03		
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18	ISSUED FOR CLIENT APPROVAL	CH	15.05.03		
19	ISSUED FOR CLIENT APPROVAL	CH	15.05.03		
20	ISSUED FOR CLIENT APPROVAL	CH	15.05.03		

TAB/DWG	C03 / 49192-11_C01-C03.dwg
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XREFS	49192-11_C01-1_C01-2_Survey_xref
COPYRIGHT	©
MEMORANDUM	
CHECKED	APPROVED

SURVEYED	Name	Date
DESIGNED	CH	8/28/03
DESIGN CHECK	BW	05.02
DRAWN	PAP	9.08.02
DRAWING CHECK	K.M.W./CH	09.02
APPROVED		



COAL STOCKPILE STORMWATER TREATMENT SYSTEM

FOR CONSTRUCTION

DATE: 28.08.2003

SCALE: IAD A5 SHOWN

801/69192.11 **C03** 6

PROJECT NO: 49192-11