# Contract No. 3458
# Operation and Maintenance of the Nelson Regional Sewerage System

# Odour Management Plan v7

# July 2017

NELMAC
TAKING CARE OF YOUR ENVIRONMENT™

MWH
BUILDING A BETTER WORLD

**NELSON**
Level 1, 66 Oxford Street, Richmond, Nelson 7020
PO Box 3455, Richmond, Nelson 7050
TEL +64 3 546 8728, FAX +64 3 548 2016

# NRSS Odour Management Plan

## TABLE OF CONTENTS



## LIST OF FIGURES



## Appendices

Appendix A: Discharge to Air Consent

# 1 Introduction

This is an Odour Management Plan for the Nelson Regional Sewage Business Unit (NRSBU). Its purpose is to define how the Nelson Regional Sewerage System (NRSS) will be managed and operated to minimise odours so that discharges to air comply with the resource consent.

This plan should be read in conjunction with the Pond Management Plan also created to fulfil the requirements of resource consent NN000541.

## 1.1 Scope

This is an Odour Management Plan. It covers procedures for management of odours from the NRSS including reticulation and at the Bell Island Wastewater Treatment Plant (Bell Island WWTP).

The ultimate goal of this plan is to minimise odours so that discharges to air comply with the resource consent and so that any adverse environmental effects are minimised.

In practical terms, the potential for odour from the NRSS reticulation is apparent only at the pump stations so this plan addresses only those sites in the reticulation.

A separate Pond Management Plan covers management of the Facultative Oxidation Ponds (F1, F2, and F3) at Bell Island WWTP, and to a certain extent, the Activated Sludge (AS) treatment stream. Control of odour from these systems is best achieved by proper management of them. This being the case, there is little need for specific odour management in addition to the Pond Management Plan. This Odour Management Plan reflects that and refers to and relies on the Pond Management Plan to a certain extent.

This is not an Operations and Maintenance (O&M) Manual. O&M aspects will be covered separately under those specific manuals.

This plan will cover general operation of the bio-filters.

# 2 Nelson Regional Sewerage System Description

## 2.1 NRSS Reticulation

The following is a broad overview of the NRSS reticulation system only, sufficient to inform the Odour Management Plan. For detail, refer to the separate O&M Plan(s) for the system.

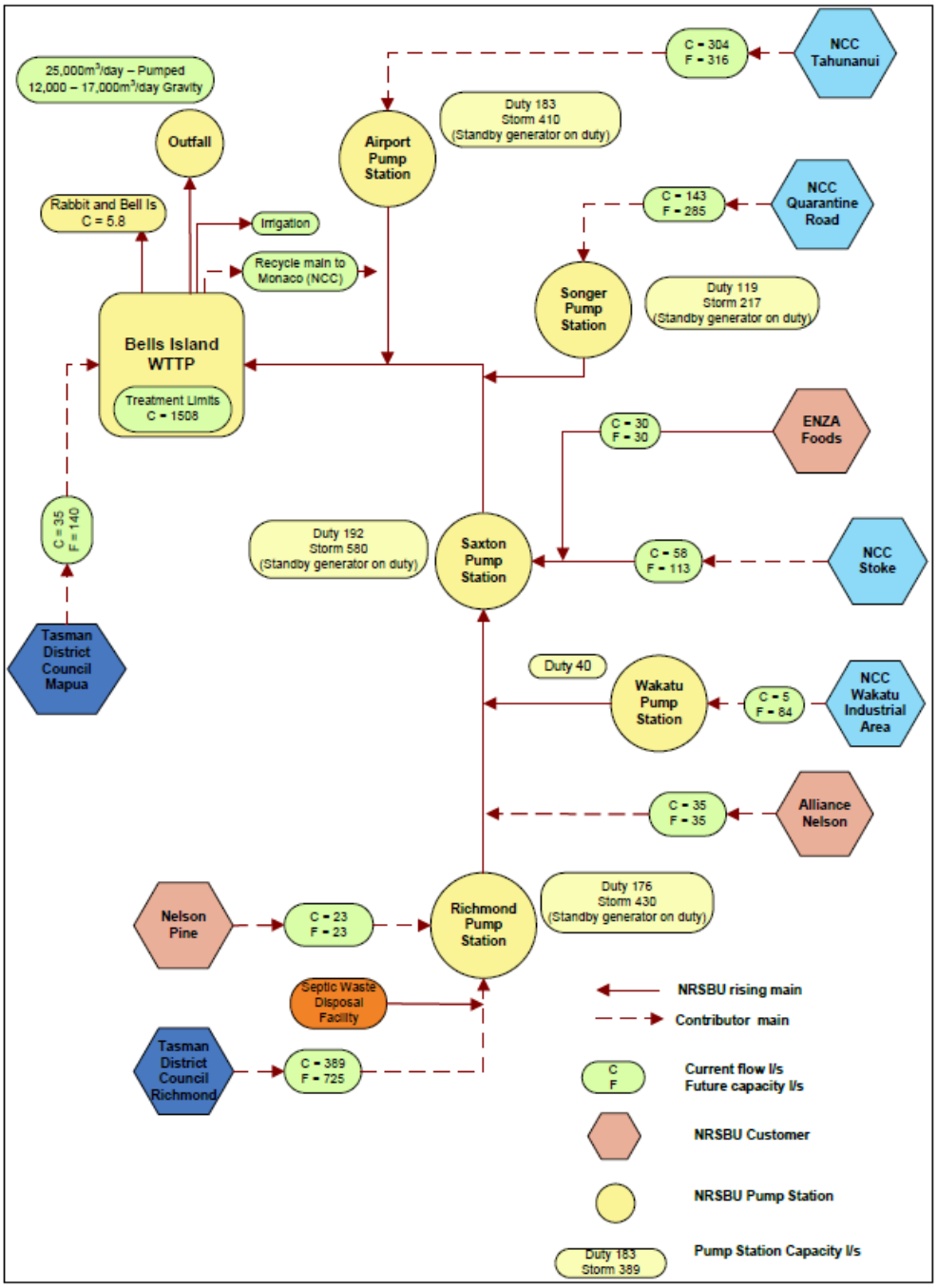


**Figure 2-1: NRSS Schematic Network Plan[1]**

[1] From: Request for Expressions of Interest, Nelson Regional Sewerage System Operation and Maintenance; Nelson Regional Business Unit; September 2012.

Wastewater from Tasman District Council is joined by industrial flow from Nelson Pine (MDF board processor) at the Richmond pump station and is pumped to the Saxton pump station.

The Saxton pump station receives flow from:

- Richmond pump station
- Nelson City Council, Wakatu Industrial area, via the Wakatu pump station
- Nelson City Council Stoke
- Alliance Nelson (meat processor)
- ENZA Foods (fruit processor).

The Saxton pump station rising main feeds directly to the Bell Island WWTP. Prior to entering the Bell Island WWTP, flow is joined by:

- Nelson City Council, Quarantine Road, via the Songer pump station
- Nelson City Council, Tahunanui, via the Airport pump station.

Flow from Tasman District Council, Mapua, arrives directly at Bell Island WWTP.

## 2.2 Bell Island WWTP Plant Description

The following is a broad overview of the Bell Island WWTP, only sufficient to inform the Odour Management Plan. For details, refer to the separate O&M Manual(s) for the plant.

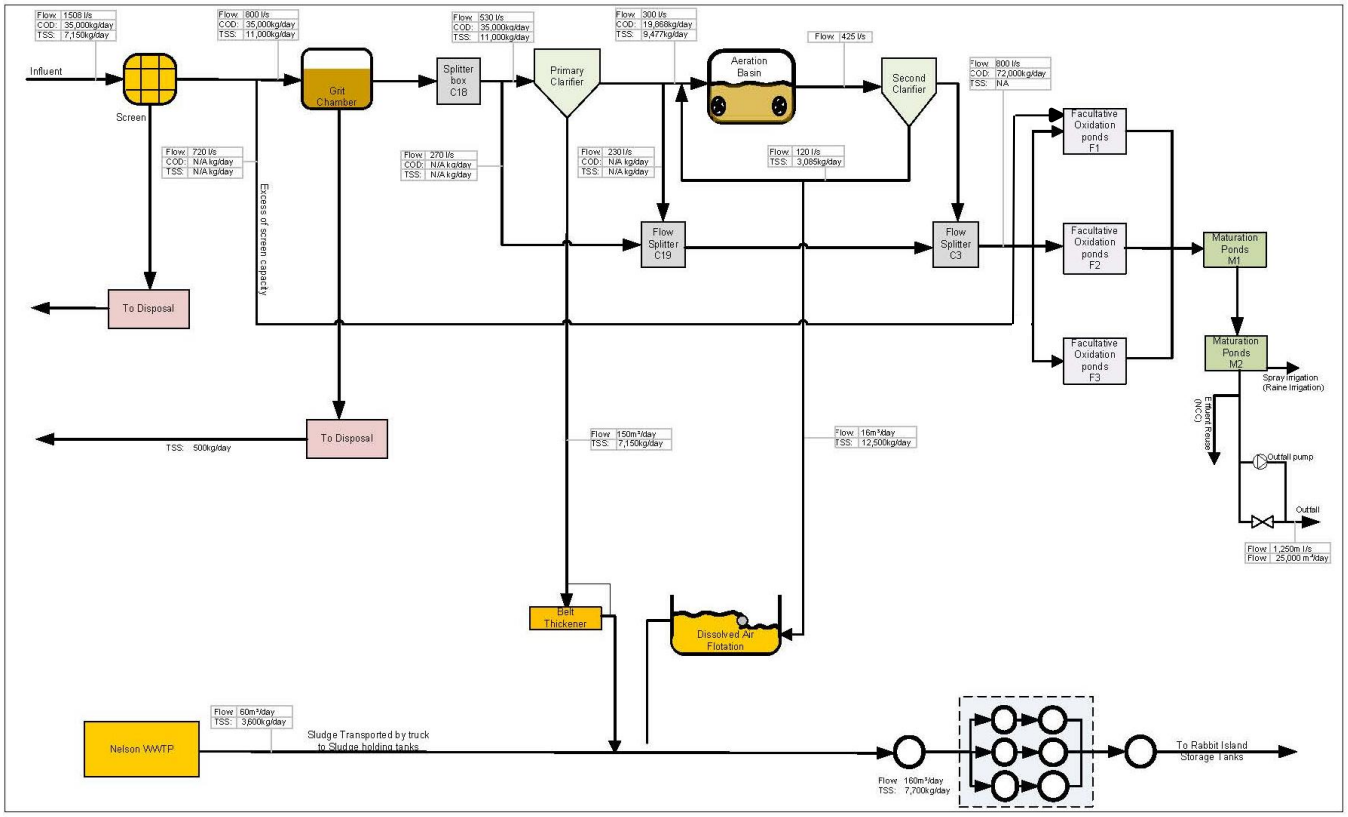


**Figure 2-2: Treatment Flow at Bell Island WWTP[2]**

[2] From: Request for Expressions of Interest, Nelson Regional Sewerage System Operation and Maintenance; Nelson Regional Business Unit: September 2012.

- Flow entering the Bell Island WWTP passes through inlet screens and a grit chamber.
    - Flow in excess of grit chamber capacity bypasses directly to Pond F1.
- After the grit chamber, flow is split either directly to F1, F2, and F3 or through an Activated Sludge (AS) Treatment stream.
- The AS stream comprises a primary clarifier, an activated sludge aeration basin and a secondary clarifier.
- A bypass line is provided to F1, F2 and F3 after the primary clarifier.
- An emergency bypass from the primary clarifier to F1 is provided.
- Flow to the F1, F2, and F3 is split, by manual stop-logs, to three ponds in parallel. Flow exiting F1, F2, and F3 passes through two maturation ponds (M1 and M5) in series, then on to the outfall discharge (with a fraction consented for discharged to the Bell Island farm land).
- Solids removed by the screens and grit chamber are sent to landfill disposal off Bell Island.
- Sludge from the primary clarifier passes either through a belt thickener or is discharged directly to the sludge holding tanks from where it is fed to the ATADs.
- Activated sludge from the clarifier is split into Return Activated Sludge (RAS), returned to the aerator basin and Waste Activated Sludge (WAS).
- WAS is thickened by a Dissolved Air Flotation (DAF) system and combined with the primary sludge in the sludge holding tanks.
- Thickened sludge if produced at the Nelson North WWTP is tankered to Bell Is and stored in dedicated tanks before being combined with PC and DAF sludges in the sludge holding tank.
- Sludges are fed, via buffer storage to Autothermal Thermophilic Aerobic Digester (ATAD) units and into further buffer storage for disposal on Rabbit Island.

# 3 Discharge to Air Consent

A copy of consent number NN000541, “to discharge contaminants to air” is contained in Appendix A. It applies to the Bell Island WWTP site.

Special Condition 9 requires that the plant is managed to prevent or minimize the discharge of odours.

Special Condition 10 requires that there shall be no discharges to air that are objectionable or offensive, beyond the boundary of the plant.

Special Condition 13 requires the preparation of an Odour Management Plan that shall cover amongst other things:

- Operation of the aeration basin.
- Operation of ATAD units.
- Operation of biofilters.
- Operation of oxidation ponds.

This Odour Management Plan and the associated Pond Management Plan collectively meet the special condition requirements.

# 4 Odour Sources

Potential odour sources from the NRSS include.

- Five pump station sites within the reticulation system.
- Inlet screen.
- Grit chamber.
- Splitter boxes.
- Primary clarifier.
- Aeration basin.
- Secondary clarifier.
- RAS / WAS system.

- Facultative Oxidation ponds.
- Maturation ponds.
- Belt thickener.
- DAF unit.
- Sludge holding tanks (includes receipt of Nelson WWTP sludge).
- ATAD units.
- Treated biosolids storage (including removal from site).
- Inlet biofilter.
- ATAD biofilter.
- De-watering room activated carbon scrubbers.

The odour emissions are generally derived from anaerobic conditions in the wastewater and sludge. Inadequate cleaning of plant areas, for example greases and solids in the screenings area can also cause the release of odours.

# 5 Odour Management

## 5.1 Pump Stations and Reticulation

This Plan specifically addresses only the pump stations in the NRSS reticulation network.

Network connections and faulty mains are covered by standard design and operating factors such as vents. Rising mains terminate at pump stations or at Bell Island WWTP, where most potential odour will be discharged.

Air release valves on rising mains are not considered to be an odour issue as discharges are infrequent and of low volume.

There is one designated site for discharge of septic tank waste, at the septage reception facility at Fittal Street next to Beach Road pump station. During discharge, odour can be released. A portion of this may be from the tankers themselves and is outside the control and responsibility of NRSBU. However, a further portion can be emitted from displacement of air from the receptor, and arguably NRSBU has some responsibility for this. At present, there is no mitigation for these effects. A potential solution is to discharge at pump stations making use of the active odour control at these sites.

Pump stations include:

- Richmond
- Wakatu
- Saxton
- Songer
- Airport.

### 5.1.1 Odour Mitigation

Each pump station is equipped with either an Aarcon activated carbon filter or a biofilter. The Aarcon AC odour filters are maintained according to the O&M plans for the pump stations. Currently the following pump stations utilise Aarcon AC units for odour control:

- Richmond
- Saxton Rd
- Songer St

The biofilters are operated to standard practice, the details of which are incorporated in the O&M Plans for the pump station sites overall. The biofilters are generally operated as for the Bell Island WWTP biofilters described below. Currently the following pump stations utilise biofilters for odour control:

- Wakatu
- Airport

Pump stations are fitted with alarms to enable early response to power failures, pump failures, high levels and overflows.

Each pump station is equipped with a standby generator (except Wakatu) this will automatically start to power the pump station and biofilter fans.

Pump stations are regularly cleaned, as detailed in the O&M Plans, including hosing of wet wells on a weekly basis.

## 5.2 Bell Island WWTP

Odour control at Bell Island WWTP falls into two categories:

1. Odour control through proper operation of plant.
2. Specific odour control features.

Most of the Bell Island WWTP will not emit odours if the plant is operated and monitored effectively. Plant considered at a low risk of producing odours includes:

- the Activated Sludge (AS) stream comprising splitter boxes, primary clarifier, aeration basin, secondary clarifier and RAS/WAS system
- the Facultative Oxidation Ponds F1, F2, and F3
- the maturation ponds M1 and M5
- the flow splitter chamber, C3.

Specific odour control is provided by biofilters.

- Inlet works biofilter addressing odour emitted from inlet screen and grit chamber.
- ATAD area addressing odour emitted from the ATADs, and sludge storage.

Further specific odour control for processes in the dewatering room (belt thickener and DAF unit) is provided by activated carbon scrubbers.

### 5.2.1 Inlet Works

The inlet works have a high potential for odour emission and are comprised of:

- the inlet screen
- the grit chamber
- the grit chamber bypass splitter box.

Odorous gases can be produced in the rising mains leading to the site. It is then released in the high turbulence created at these plant items.

#### *5.2.1.1 Odour Mitigation*

The inlet area is covered and air is drawn off to the inlet biofilter, described below.

Extending biofilter treatment to include the primary clarification inlet and splitter box was assessed as not required by NRSBU.

Operational mitigation measures:

1. Inspect screens and mechanical equipment daily during working week.
2. Clean the screening systems (and, if necessary, the bar screen on the by-pass channel) by hosing down, on an as necessary basis, estimated at one to two times per week.

3. Empty the screenings skip on a weekly basis, or more regularly if warranted by an increased quantity of screenings.
4. Hose down and clean the screw press on a weekly basis.
5. Hose down and clean the skip pad area on a fortnightly basis.
6. Wash down the grit removal skip area weekly, and empty the skip will be fortnightly
7. Check bio-filter operation and pressure loss in the bio-filter on a weekly basis (see Section 7).

### 5.2.2 AS Stream

#### *5.2.2.1 Primary Clarifier*

The Primary Clarifier receives flows from the grit chamber, via the AS bypass splitter box.

Influent at the splitter box and clarifier should be sufficiently aerated, at the inlet screen and grit chamber, so that potential for odour is low.

##### *5.2.2.1.1 Odour Mitigation*

Operation of the Primary Clarifier is covered in its O&M Plan. This covers routine operator and maintenance procedures that will address potential odour. Specific items to control odour are:

1. Inspect and clean scum boxes weekly.
2. Inspect and clean the central stilling well daily.
3. Inspect overflow weir weekly and clean as required, at least monthly.
4. Scraper arms (sludge and scum) are fitted with fail alarms, for early response to failure.
5. Prevent excessive accumulation of primary sludge in the primary clarifier by managing the depth of the sludge blanket by controlling the rate and frequency of sludge withdrawal. . Rising sludge will result in odour emissions.

#### *5.2.2.2 Aeration Basin*

A portion of flow from the Primary Clarifier is delivered to the Aeration Basin. With the balance bypassed to the F1, F2, and F3. The splitter box for this purpose is not considered a significant odour source as primary effluent is sufficiently aerated at this point.

The Aeration Basin is operated according to the O&M Plan. Under normal and proper operation, the Aeration Basin presents a low risk of odour emission. However five main potential causes of odour are addressed here.

1. Toxic influent.
2. Trade waste “shock” load.
3. Seasonal high biological load.
4. Inadequate retention and / or recycling of biomass.
5. Insufficient aeration.
6. Extended power failure.

##### *5.2.2.2.1 Odour Mitigation*

Toxic influent may cause the biological process fail, leading to anaerobic conditions and potential odour emissions. This risk is mitigated by trade waste monitoring and the actions of trade waste contributors to control their discharges to the Trade Waste Bylaws.

All trade waste contributors have samples of their discharges collected on a daily basis, a random set of four consecutive daily samples are analysed once a month for BOD, COD, SS. The contributors are able to use this data to adjust their on-site processes and treatment approaches as necessary.

The Bell Island WWTP overall and the AS stream have capacity to deal with seasonal high load. The fact that load increases gradually enables control and appropriate load distribution to minimise overloading of unit processes. The pond management regime (refer to Pond Management Plan) provides for adjusting flow splits to the AS stream and direct to F1, F2, and F3.

Addressing inadequate retention and / or recycling of biomass is covered by aeration basin normal operations detailed in the O&M Plan.

Control of the RAS to the aerobic basin is the key to keeping residence times short and avoiding nitrification of ammonia.

If aerators fail or if excessive high loads are discharged into the WWTP anoxic/anaerobic conditions can occur in the aeration basin resulting in potential odour generation.
Specific steps are.

1. Sample plant influent daily and analyse for SS and COD.
2. Monitor SS of mixed liquor daily (Monday to Friday) to determine biological activity and aerator requirements. Monitor DO by *in-situ* meter and calibrate by daily grab samples.
    - Increase aeration if DO is below 0.5ppm continuously. Provide additional aeration capacity if DO cannot be raised in the aeration basin with current aerator capacity.
3. Monitor SS on a weekly basis by grab sampling at both the inlet and outlet of the aeration basin.
4. Monitor aerator equipment, particularly when an aerator plumes appear to have reduced strength.
5. A reduced plume indicates the need to inspect the aerator and potentially replace the channel ring or impellor.
6. Carry out inspections of all aerators at 12 monthly intervals.

If extended power failure occurs (> 6 hours) none of the aerators will operate which could result in anaerobic conditions in the aeration basin resulting in potential odour generation. There is no standby power generation for the aerators.

#### *5.2.2.3 Secondary Clarifier*

The secondary clarifier receives fully aerated mixed liquor from the aerator basin. The potential for odour emission is low.

However, if there are problems with aeration basin performance, leading to odour, this will transfer to the secondary clarifier also. Mitigation at the aeration basin, as previously discussed, is required.

##### *5.2.2.3.1 Odour Mitigation*

Operation of the secondary clarifier is covered in the O&M Plan for it. This covers routine operation and maintenance procedures that will address potential odour. Specific items to control odour are:

1. Inspect and clean scum boxes weekly.
2. Inspect overflow weir weekly and clean as required but at least monthly.
3. Scraper arms (sludge and scum) are fitted with fail alarms, for early response to failure.
4. Inspect and clean the central stilling well daily.

#### *5.2.2.4 RAS/WAS System*

The RAS/WAS splitter system is fully enclosed so emission of odour is not possible, except when the system is being serviced, and in those circumstances the volume of emission will be minor.

### 5.2.3 Facultative Oxidation Ponds

F1, F2, and F3 will not emit odour when properly managed. Management of the F1, F2, and F3 is detailed in the Pond Management Plan, one of the objectives of which is to avoid the emission of odours.

Odour emissions from F1, F2, and F3 are generally associated with the disruption of biological processes which can occur as a result of:

- Overloading of the ponds:
    - If the aeration basin is not operating properly or if solids are bypassing the clarifier and ATAD units and going directly to the ponds or if BOD loads in the influent to the STP are excessive, then the ponds will become overloaded.
- Fungal attack on algal populations:

- If a fungal attack occurs then the algal populations can completely die off or else be significantly reduced. This reduction can lead to inadequate oxygen formation and reducing conditions beginning to occur. This risk is now the main odour risk factor associated with the ponds and may lead to major odour events, both in magnitude and duration.

- Seasonal succession of algal species - this is a natural and inevitable occurrence and gives rise to periodic, relatively minor odour events which will be on-going. A variety of factors are significant, including weather conditions (particularly pond stratification via wind assisted turnover).
- Sludge build-up - leading to reduction of ponds capacity. Desludging of the ponds is a reactive maintenance requirement. Further information is contained in the pond management plan.

The Pond Management Plan is focused around load management and pond performance. Standard operating and maintenance procedures for the ponds are covered in a separate O&M Plan.

### 5.2.4 Maturation Ponds

The maturation ponds receive effluent from the F1, F2 and F3. Provided that F1, F2, and F3 are properly managed as described above, and in the Pond Management Plan, the maturation ponds are highly unlikely to emit odour.

### 5.2.5 ATAD

The ATAD units and associated Nelson WWTP sludge reception, raw sludge storage, treated sludge storage and treated sludge removal are all potential emitters of odour. Odours can be caused by gases released during the digestion process inside the ATAD tanks or by emissions caused if foam builds up in excessive quantities.

If extended power failure occurs (> 6 hours) none of the aerators will operate which could result in anaerobic conditions in the ATADs resulting in potential odour generation. There is no standby power generation for the aerators

#### *5.2.5.1 Odour Mitigation*

The ATAD tanks are fitted with foam cutters to break up foam caused by aeration of the sludge. Aerator failure could lead to odour generation; as such they are fitted with odour alarms.

Air is drawn off the ATAD units and passed through a biofilter with the action as described below.

The biosolids tank is fitted with a high level alarm and a mixer to prevent a build-up of solids.

To minimise odour issues the operator is to:

- Monitor the ATAD temperature and Volatile solids destruction twice daily, five days per week. Should the VS destruction fall or the temperature reduce, undertake a review of the operations to check the cause (too thick sludge aeration difficulties, or poor quality feed sludge.)
- Hose down and clean the biosolids storage tank on an as-required basis.
- Promptly investigate alarms from either the foam cutters or aerators and will promptly investigate the cause of the alarm and initiate repairs or remedial action as necessary.
- If the biosolids storage tank level alarm is activated, investigate the cause and take appropriate action to repair the system or to divert biosolids if required.
- Annually inspect the aerators in the ATADs B and C trains with the channel ring and impellor replaced as required or annually.
- Annually inspect the ATAD A train aeration nozzles and clean out the air tubes annually
- Check that the feed sludge is a mixture of primary and secondary sludge, and that it is on average around 5% TS.
- Remove ATAD tanks from service on a rotational basis approximately every two years to assess the internal condition and remove accumulated sand.

### 5.2.6 Biofilters

The two biofilters servicing the inlet works and ATAD area are, for the purposes of this plan, essentially similar. The following covers management of both. The biofilters are bark media with fixed sprinkler systems. Operation of the biofilters is covered in detail in the O&M Plans for them. The following covers aspects critical to odour control.

Moisture content of the media is critical to biological activity. At present this is not monitored and operator judgement is relied on for moisture control. This can be improved by the use of hand held, moisture meters. A further enhancement could be permanent meters linked to automatic sprinkler control.

Checks for short circuiting of air through the media are made. Evidence can be visible vapour from cracks or around edges. This can be mitigated by turning media when a problem is observed, or on a regular basis. Installing flaps on the biofilter walls near the base of the media can prevent short-circuiting up walls.

Media effectiveness should be monitored regularly (monthly) and media should be replaced when ineffective or at least every three years.

Media must be maintained at the correct pH level, as sewerage gases are often associated with low pH. pH correction by the addition of granulated lime or similar is recommended. pH measurement of media or of irrigation water leachate is recommended every two months. A works order should be processed in Hanson to allow for this activity.

The above similarly applies to the biofilters at all pump stations in the Nelson Regional sewerage reticulation system.

### 5.2.7 Dewatering Room

The dewatering room houses the belt thickener that receives primary clarifier sludge and the DAF unit that receives secondary clarifier WAS. Both units are emitters of odour.

Mitigation is by ventilation of the rooms and treating the air in activated carbon scrubbers.

The activated carbon scrubbers operation is covered by their O&M Plan, which details proper operation for effective odour control. This requires regular inspection (monthly) to ensure that activated carbon is replaced when its absorption capacity is exhausted.

# 6 Response Procedures

The discharge to air consent (Appendix A) sets out the required information to be collected regarding odour complaints.

In practice, any complaints of odour are usually made directly to either the Tasman District Council or the Nelson City Council Customer Services desks. The complaint and relevant details are then passed on to the operator for further investigation.

This information is recorded in an Odour Complaints Log which is maintained by Nelson City Council. The operator investigates the incident and reports back for upgrading the Odours Complaint Log. Odour events are to be recorded by the contractor in Hanson and reported without delay to the NCC contract supervisor or NRSBU engineering rep.

Occasionally it may be operationally necessary to plan for the wastewater flows to by-pass the AS treatment steps and be directed straight to the facultative oxidation ponds. This presents a risk of overloading of the ponds, which could lead to anaerobic conditions and the release of odours. Similarly, unforeseen or rapid changes within the plant could also lead to generation and release of odours.

In each case, the residents at Best Island would most likely be affected. In the event of any incident or activity that produces odour or is likely to produce odour, Best Island residents will be notified. Advance notification

will be given to Best Island residents of planned activities such as biosolids spraying on Bell Is or sludge /biosolids drying trials where significant odour release or rapidly changing conditions could lead to odours being produced.

For planned operational changes or foreseeable events the operator will advise the NRSBU with sufficient time, normally seven days minimum, so that the Best Island residents can be contacted, in person or by an advance letter drop, informing them of the impending problem, the likelihood of emission of odour and the estimated time and duration of the emission. It is the responsibility of the contractor to notify the residents and copy the NCC contract supervisor.

For unforeseen/rapid onset circumstances the operator shall immediately advise by telephone the Best Island contact person, Mr Arch Barclay on 03 544 8789 to inform him of the need to immediately alert the other residents of the potential odour event.

# 7 Contingencies

Hazards/risks associated with the AS stream and the operation of F1, F2, and F3 are covered in the Pond Management Plan and/or the respective plant O&M Plans. The mitigations proposed there effectively address potential odour emissions.

Faults in treatment systems covered by the biofilters or activated carbon scrubbers may generate odour above normal. However, the odour control plant will be able to cope with any extra intensity of odour.

Faults in the odour control systems themselves are addressed in the O&M Plan(s) for these systems. These include faults in fans, ducting, media, irrigation, drains etc. In addition, the integrity of buildings, covers etc. and the proper control of inlet air, to avoid rogue emissions, is covered in the O&M Plan(s).

Loss of power supply at the Bell Island WWTP will stop the AS stream and will prevent monitoring and flow control systems from functioning. Provided the pump stations in the network are still operational inflows will flow by gravity through the Bell Island WWTP to F1, F2, and F3, which will be able to cope for the likely short duration (six hours maximum) of power failure.

Emission of odour is possible on re-start of the AS stream and ATADs however this will be short-term and of limited volume.

Loss of power to biofilter and scrubber fans will simply mean no airflow through these systems. Odour may begin to emanate from buildings and enclosures. However, this will be minor and short-term given the likely duration of loss of power supply.

# 8 Plan Control and Revision

| Version | Status | Date | QA | Distribution |
|---|---|---|---|---|
| v2 | Draft for tender | March 2013 | Prepared by: A McGaughran<br>Checked by: R Lester<br>Reviewed by: Rainer Hoffmann<br>Approved by: Lindsay Bell | MWH proposal file<br>Nelmac<br>Contract 3458 Tender |
| v3 | For Client Comment | November 2013 | Prepared by: Celia Schofield<br>Checked by: Michael Tan<br>Reviewed by: Rainer Hoffmann<br>Approved by: Lindsay Bell | MWH file<br>Nelmac<br>NCC<br>Bell Is WWTP |
| v4 | Final | January 2014 | Prepared by: Avik Halder<br>Checked by: Avik Halder<br>Reviewed by: Rainer Hoffmann<br>Approved by: Lindsay Bell | MWH file<br>Nelmac<br>NCC<br>Bell Is WWTP |
| v5 | Update | July 2015 | Prepared by: Lindsay Bell<br>Reviewed by: Allan Jones<br>Approved by: Lindsay Bell | Nelmac file<br>MWH<br>NCC<br>Bell Is WWTP |
| v6 | Update | June 2016 | Prepared by: Lindsay Bell<br>Reviewed by: Allan Jones<br>Approved by: Lindsay Bell | Nelmac file<br>MWH<br>NCC<br>Bell Is WWTP |
| V7 | Update | July 2017 | Prepared by: Lindsay Bell<br>Reviewed by: Allan Jones<br>Approved by: Lindsay Bell | Nelmac file<br>MWH<br>NCC<br>Bell Is WWTP |

# Appendix A: Discharge to Air Consent