Finance and Performance Committee
ATTACHMENTS - ADDITIONAL DOCUMENTS

Date: Thursday 28 April 2022
Time: 9.30am
Venue: Council Chambers, 53 Hereford Street

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Replacement Attachment A: Timeline of events

Date	Description
01 Nov	Fire event
	Independent fire investigator appointed
02 Nov	Fire continues to burn and smoulder within the trickling filters – Firefighting efforts continue
	WorkSafe New Zealand formally notified of event
	Environment Canterbury formally notified of increased risk of breaching wastewater discharge and air discharge consent conditions – water quality and odour concerns
03 Nov	Fire continues to burn and smoulder within the trickling filters
	Fire and Emergency NZ (FENZ) leave site
	Rapid assessment for structural safety
	Polymer Dosing of Wastewater Begins to reduce solids load
05 Nov	Fire continues to smoulder within the trickling filters
	Water suppression spray activated to manage persistent hotspots
	Technical process consultant support appointed – options generation and assessment for recovery of treatment effectiveness
9 Nov	Fire continues to smoulder within the trickling filters
	Hydrogen Peroxide dosing started in the ponds
14 Nov	Fire continues to smoulder within the trickling filters
	Started trialling sending contaminated sludge to digesters
17 Nov	Fire continues to smoulder within the trickling filters
	Engineers appointed to conduct damage assessments
22 Nov	Fire continues to smoulder within the trickling filters
	Claim accepted by insurer
25 Nov	Fire confirmed out by FENZ
29 Nov	Water suppression ends
	Interim payment received from insurers
02 Dec	Trial removal of filter media
03 Dec	Overland Sludge pipe installed and in use to remove the contaminated sludge
16 Dec	Plant reconfiguration solution finalised – convert two clarifiers to aeration basins
15 Dec	Odour pipework modifications complete – screen room back into system and TF's isolated
17 Dec	Aerator equipment ordered for clarifier conversion
26 Jan	Contractor for clarifier conversion works appointed
28 Jan	Contractor on site for clarifier conversion works
03 Feb	Planning for further pond aeration capacity begins
28 Feb	Aerator equipment on site for assembly

Date	Description
04 Mar	WorkSafe New Zealand formally notifies Council that they will not be carrying out an investigation
10 Mar	Concrete sample extraction begins for damage assessment
16 Mar	Aerators lifted in clarifier basins for installation
25 Mar	Confirmation from insurer that removal of filter media can begin
06 Apr	Aerators switched on in converted aeration basins
12 Apr	Fast track appointment of contractor to remove filter media approved
Late April - Early May	Contractor appointed and methodology confirmed Contractor begins establishing on site
Mid May	Aeration basins expected to have stabilised under new process
Late May	Monitoring begins of oxidation pond water quality to determine if further aeration units are required within the ponds
Late May - mid June	Filter media removal works underway
December 2022	Filter media removal complete

Replacement Attachment B: Odour Removal and Management Options

NOTES:

1. Consultants were asked to identify and provide a preliminary assessment of effectiveness, risk, environmental management and hazardous materials compliance for odour control measures. The consultants have advised that solutions for odour control measures would be uniquely challenging due to open air environment and large Tricking Filters structures. The scale of these filters are over 55 metres in diameter and eight meters tall, although these would be effective in small contained environments.
2. The filter media within the Trickling Filters is classified as hazardous material – The media material contained in the trickling filters was used to treat sewage and wastewater, therefore meet the threshold of a Class 6 Dangerous Good under the Land Transport Act 1998: Dangerous Goods 2005 Rule that require special care when transporting. The media will also meet the classifications under Hazardous Substances under the Hazardous Substances Regulations 2017, Hazardous Substances and New Organisms Act 1996
3. The options that were considered to manage odour from the Trickling Filters are grouped below by treatment type; Chemical Treatment, Cover, Cap and Air Extraction. It is noted that covering creates the containment of gases that are highly dangerous for both residents and workers on site alike. All of the chemical treatment options identified are by their nature hazardous with the potential to create further hazardous gases and create a even higher health risk.
4. The top layer of the plastic filter media and the roof material that collapsed and melted in the fire has formed a permeable and impermeable media layer across the surface. This means that any spray application of chemical treatment will not reach all areas of the filter media and pockets of biomass will remain active and emit odour.
5. Removing the material remains the best, most effective options. We are currently working with options of removing and/or deconstructing structures. Once the material is removed, the odour being emitted from the Trickling Filters will be gone.

Option	Description	Effectiveness	Risks	Environmental Management & Hazardous Material
Treatment options to reduce odour emission until full removal of filter media achieved				
Chemical Treatment	Install deodorising spray / fog machines to mask odour	Quick to install Similar to water sprays installed immediately following fire so methodology is known Can adjust fogging for different weather conditions Steel distributor structure of Trickling Filters can remain and doesn't need to be removed Visual reinforcement that odour is being treated	Overall Risk: High Warnings of toxicity, environmental and health damage Unlikely to be highly effective and some odour likely to persist Easy access to large quantity of deodorising chemical required Effectiveness reduced on windy days due to wind dispersing deodoriser away from filter structures with increased risk to residential areas, the estary, oxidation ponds. Trickling filter not protected from wet weather which reacts with biomass and makes odour worse	Advice received from the Safety Data Sheet indicated the following Avoid release to the environment Causes skin irritation Causes serious eye irritation May damage fertility or the unborn child May cause damage to blood system through prolonged or repeated exposure Harmful to aquatic life with long lasting effects Harmful to soil environment Based on this information, the height of the trickling filters, atomising the product through misters and wind gusts, we believe this will not only put our staff at risk, but the surrounding residents.

Option	Description	Effectiveness	Risks	Environmental Management & Hazardous Material
	Spray filter media with Bleach/Chlorine solution	No real benefits as huge size of filter structures requires large amounts of chemicals which will increase the hazards already inside structure when chemicals are combined with already existing hazardous materials. Steel distributor structure of Trickling Filters can remain and doesn't need to be removed	Overall Risk: HIGH High concentration level of bleach including chlorine compounds required for such a huge volume in filter structures with resulting unstable compounds Bleach at high concentration levels is a hazardous chemical and sprayed into the air would create serious and direct physical health issues. Impossible to treat all filter media due to the burnt surface of the media, resulting in residual odour from untreated pockets Chemical reaction with biomass within the filter material will produce toxic gas hazardous to workers and residents Odour will return as bugs recolonise the biomass within the filter media – regular re-application required	Environmental Management Plan required for dealing with application and disposal of hazardous liquid Bleach/Chlorine solutions are often used as a disinfectant, not as a deodoriser and the reaction of chlorine with the organic matter may exacerbate the odour situation If the bleach/chlorine solution was to inhibit the bacterial action taking place now, the remaining organic matter may at a later time become more problematic as it decays or bacterial action resumes. Depending on the source, concentration and how the solution is handled and transported, there may be significant requirements to be complied with under the Hazardous Substances Regulations 2017. Bleach/chlorine has multiple classifications for Hazardous Substances and poses risk to human and environmental health, including but not limited to Toxic Gas and is Corrosive Bleach/chlorine in high quantities requires specialised training and certification for the handling for the product
	Spray filter media with lime solution	No real benefits as huge size of filter structures requires large amounts of chemicals which will increase the hazards already inside structure when chemicals are combined with already existing hazardous materials. Odour less likely to be produced as lime spray creates high pH conditions Steel distributor structure of Trickling Filters can remain and doesn't need to be removed	Overall Risk: HIGH Lime solution is corrosive and sprayed into the air could create health issues Likely to require regular re-application as rain will wash lime solution away Uneven surface means complete coverage of whole surface unlikely to be achieved, resulting in residual odour from untreated pockets Lime is a hazardous material and will require careful management	Application methodology needs to be developed Environmental Management Plan required for dealing with application and disposal of hazardous material Specialist Personal Protective Equipment required Leeching into ground water table toxic to marine life – considering is given to the Oxidation ponds which are a protected Wildlife Reserve Highly corrosive Odours produced harmful to human health if specific levels are met Requires compliance with • Hazardous Substances and New Organisms Act 1996 • Hazardous Substances Regulations 2017

Option	Description	Effectiveness	Risks	Environmental Management & Hazardous Material
	Spray filter media with an enzyme solution to reduce generation of odorous compounds	No real benefits as huge size of filter structures requires large amounts of chemicals which will increase the hazards already inside structure when chemicals are combined with already existing hazardous materials. Enzyme deactivates the chemical pathway that generates odour Steel distributor structure of Trickling Filters can remain and doesn't need to be removed *Further information on the specific enzyme solution is required to carry out further analysis of Environmental Management & Hazardous Materials	Overall Risk: HIGH Product may not be suitable for open vessels Likely to require regular re-application as rain will wash enzyme solution away Availability of enzymes in NZ uncertain due to volumes required. Sourcing from overseas and supply chain issues would likely result in delays Uneven surface means complete coverage of whole surface unlikely to be achieved, resulting in residual odour from untreated pockets	Application methodology needs to be developed Environmental Management Plan required for dealing with application and disposal of hazardous material Highly likely specialist training and personal protective equipment required. Requires compliance with • Land Transport Act 1998: Dangerous Goods Rule 2005 • Hazardous Substances and New Organisms Act 1996 • Hazardous Substances Regulations 2017 *Further information on the specific enzyme solution is required to carry out further analysis of Environmental Management & Hazardous Materials
Cover	Cover filter media with High Density Polyethylene (or similar) membrane (tarp) and connect exhaust fans and ducting to biofilter	Few real benefits as size of structure is extremely difficult to 'tarp" given dimensions of 55 metres in diameter. Keeps media dry during wet weather reducing likelihood of odour	Overall Risk: HIGH Creates a "confined space" beneath cover with specific health and safety requirements. This would create a hazardous atmosphere which would put staff at risk Steel distributor structure needs to be removed prior to installation Size of span required may make full cover difficult and cause issues in high winds Uneven surface of burnt media surface will result in ponding and additional weight on filter material – load bearing capacity unknown due to unknown extent of fire damage below surface Biofilter may not provide sufficient treatment for odour Construction methodology to be developed Implementation time – unlikely to be completed before removal of filter media commences	Covering would create hazardous atmosphere due to build-up of gases contained Emergency Response Plan and Specialist training required in the event of extraction fan failure Disposal of membrane post use due to exposure would be special waste and require compliance with the Land Transport Act 1998: Dangerous Goods Rule 2005 Potential dispersion of toxic gases for workers and across residential areas

Option	Description	Effectiveness	Risks	Environmental Management & Hazardous Material
	Install scaffolding and wrap High Density Polyethylene membrane (or similar) around entire Trickling Filter (full cover)	Few real benefits as size of structure is extremely difficult to 'tarp" given dimensions of 55 metres in diameter Keeps media dry during wet weather reducing likelihood of odour Steel distributor structure of Trickling Filters can remain and doesn't need to be removed	Overall Risk: HIGH Creates a "confined space" beneath cover with specific health and safety requirements. This would create a hazardous atmosphere which would put staff at risk Size of span required may make full cover difficult - structural design required Scaffold would need to be designed to hold full weight of the cover and wind loading Explosive atmosphere may form under membrane due to gasses given off from septic wastewater in bottom of tanks Construction methodology needs to be developed Implementation time – unlikely to be completed before removal of filter media commences	Covering would create hazardous atmosphere due to build-up of gases contained Emergency Response Plan and Specialist training required for removal of membrane due to high density build-up of gases. Release of high volume of gas to atmosphere at once may pose public health risk due to higher parts per million (ppm) than allowing natural venting uncovered Disposal of membrane post use due to exposure would be special waste and require compliance with the Land Transport Act 1998: Dangerous Goods Rule 2005 Potential dispersion of toxic gases for workers and across residential areas
Cap	Install a layer of bark media on top of Trickling Filter	Few real benefits as quantity required as well as using other methods to supplement will add to the amount of hazardous material to be removed Steel distributor structure of Trickling Filters can remain and doesn't need to be removed	Overall Risk: HIGH Dry bark would provide no treatment, so would require water sprays to keep the bark damp and treatment microbes alive Water spray would also wet the biofilter media, increasing odour generation from the trickling filter Uneven surface means uneven thickness of bark leading to odour emissions from low coverage areas Insufficient air flow to sustain growth of treatment microbes on bark Effectiveness low Requires use of large crane to allow correct placement - application / installation methodology needs to be developed	Disposal of bark post use due to exposure likely to be special waste and require compliance with the Land Transport Act 1998: Dangerous Goods Rule 2005

Option	Description	Effectiveness	Risks	Environmental Management & Hazardous Material
	Install super water absorbance layer on top of Trickling Filter	Few real benefits as weight of absorbency layer will compromise structures and delay removal timeframe Steel distributor structure of Trickling Filters can remain and doesn't need to be removed	Overall Risk: HIGH Material will absorb water during wet weather - load bearing capacity of filter media unknown due to unknown extend of damage below surface Availability of material in NZ likely to be difficult Adequate coverage across surface may be difficult due to span required Difficult to install and this is not well documented Implementation time – unlikely to be completed before removal of filter media commences	*Further information on the specific super water absorbance solution is required to carry out further analysis of Environmental Management & Hazardous Materials
	Use sprayed concrete or foam concrete to encase top of Trickling Filter	Few real benefits as weight of spray concrete or foam concrete layer will compromise structures and delay removal timeframe Keeps media dry during wet weather reducing likelihood of odour Steel distributor structure of Trickling Filters can remain and doesn't need to be removed	Overall Risk: HIGH Weight of concrete may crush the media, placing pressure on the tank wall which is not designed to take this load Uneven surface means likelihood of ponding rainwater, which would be a breeding ground for mosquitos Would need large crane and/or concrete pump to allow correct placement	Disposal of concrete post use due to exposure would be special waste and require compliance with the Land Transport Act 1998: Dangerous Goods Rule 2005
	Use sprayed expanding foam to encase top of trickling filter	Few real benefits as foam is not waterproof and will need additional methods on top of this to which then will extend timeframe for removal Keeps media dry during wet weather reducing likelihood of odour Steel distributor structure of Trickling Filters can remain and doesn't need to be removed Lighter than concrete	Overall Risk: HIGH Uneven surface means likelihood of ponding rainwater, which would be a breeding ground for mosquitos Would also need to be covered with impervious layer to stop rain water ingress Requires use of large crane to allow correct placement	Disposal of expanding foam post use due to exposure would be special waste and require compliance with the Land Transport Act 1998: Dangerous Goods Rule 2005 Dangerous Goods classification of Flammable Harmful to Human Health and Harmful to aquatic life in event of spill or emergency response

Option	Description	Effectiveness	Risks	Environmental Management & Hazardous Material
	Install bentonite clay on top of media to create impervious layer	Few real benefits as weight of spray concrete or foam concrete layer will compromise structures and delay removal timeframe Keeps media dry during wet weather reducing likelihood of odour Steel distributor structure of Trickling Filters can remain and doesn't need to be removed	Overall Risk: HIGH Weight of clay may crush the media, placing pressure on the tank wall which is not designed to take this load Uneven surface means likelihood of ponding rainwater, which would be a breeding ground for mosquitos May be very difficult to install and compact sufficiently for completely impervious layer Clay will crack as it dries compromising the effectiveness of the cover Bentonite is classified as a contaminated material with associated handling requirements Implementation time – unlikely to be completed before removal of filter media commences	*Further information on the specific Bentonite clay is required to carry out further analysis of Environmental Management & Hazardous Materials
Air Extraction	Install air extraction hoses on surface of media to suck air away and discharge to biofilter	Few real benefits as complex and difficult to install and composition of air extracted unlikely to be less odorous Steel distributor structure of Trickling Filters can remain and doesn't need to be removed Effective air extraction would likely require new roof to create the vacuum required – construction of a new roof would exceed the timeline for removal of the media	Overall Risk: HIGH Very unlikely enough air will be able to be removed to mitigate odour Biofilter may not provide sufficient treatment Difficult to install over uneven surface of filter media Adequate cover of entire surface unlikely to be achieved No protection from wet weather	Potential dispersion of toxic gases for workers and across residential areas
	Reconnect air extraction fans at base of Trickling Filters to suck air away and discharge to biofilter	Few real benefits as complex and difficult to install and subject to wind variations creating more complexities. Steel distributor structure of Trickling Filters can remain and doesn't need to be removed Effective air extraction would likely require new roof to create the vacuum required – construction of a new roof would exceed the timeline for removal of the media	Overall Risk: HIGH Unlikely enough air will be able to be removed to mitigate odour Biofilter may not provide sufficient treatment Cross winds will generate more of a vacuum that the fans sucking odourous air out of the trickling filters can handle No protection from wet weather	Potential dispersion of toxic gases for workers and across residential areas