Tonkin+Taylor

Job No: 1010577.3000
12 April 2024

Auckland Council
Private Bag 92300
Victoria Street West
Auckland 1142

Attention: Doug Fletcher; Jonathan Clarke

New Zealand Steel – Glenbrook Steel Mill Reconsenting
Response to Request for Further Information (Council Ref: BUN60380974)

Introduction

We write to provide a response to the matters raised pursuant to section 92 of the Resource Management Act 1991 (RMA) in relation to New Zealand Steel's (NZ Steel) Glenbrook Steel Mill water reconsenting application (BUN60380974).

Consolidated response approach

Similar to Auckland Council's (Council) letter dated 29 May 2023, this letter provides a consolidated response to the original request for further information (of 21 October 2021) together with additional requests for further information and / or clarification detailed in Council's correspondence in two letters and in emails as listed below.

Original section 92 request:

- Letter from Jonathon Clarke to Jennifer Carvill dated 21 October 2021 (Items 1 to 61, shown in black text in Council's consolidated request letter dated 29 May 2023 – referred to throughout this document as 'Council's request letter');

Full list of further clarifications sought:

- Council's request letter from Jonathon Clarke to Jennifer Carvill dated 29 May 2023 (Items 1 to 68 shown in red text in that letter);

Subsequent amendments:

The list of section 92 requests has subsequently been amended and refined with confirmation of the amendments being:

- Email from Doug Fletcher to Sara McMillan dated 23 March 2023 (Items 2A, 3G, 3I, 3J, 3K, 3L and 5 relating to Industrial and Trade Activities (ITA) shown in red text in Council's request letter);

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- Email from Doug Fletcher to Mikayla Woods dated 14 April 2023 (Items 69 to 71 relating to water quality (items omitted from letter 27 January 2023 in error), shown in red text in Council's request letter); and
- Email from Doug Fletcher to Mikayla Woods dated 26 May 2023 (Items 1A to 1F relating to avifauna, shown in red text in Council's request letter).

As confirmed in the email correspondence, some matters that were included in the original request for information (21 October 2021) and the letter with requests for further clarifications (27 January 2023) have already been resolved, or the Council team has agreed that the information is not required prior to notification of the application. These matters are identified as "Resolved" or "Deleted" respectively.

The section 92 requests have largely been addressed by way of updates and amendments to the application documents. This letter provides a table that sets out the original s92 request and cross references to the updated sections of the application materials/reports, which have been amended to address the section 92 requests. Where further clarifications have been sought, written responses have been provided as appendices to this letter. Other consequential amendments have been made in the reports where applicable also.

Inclusion of the Electric Arc Furnace

In May 2023, NZ Steel announced it was investigating the construction and operation of a new $300M Electric Arc Furnace (EAF) at Glenbrook as part of the move to lower carbon production in partnership with the New Zealand Government. The suite of application documents has been updated as part of this consolidated response to incorporate a potential EAF into the Proposal (as an alternative process for the primary steel making activities and any resulting ancillary changes on the Site). Therefore, each technical assessment, and the AEE, has assessed the actual and potential changes in effects as a result of an EAF, comparative to the current Site activities.

Summary

This response therefore provides a 'one stop shop' for all amendments made to the application documents since the lodgement of the initial application for notification purposes and ease of digesting information for potential submitters. This includes:

- All requests for further information;
- All further clarifications sought; and
- The inclusion of the Electric Arc Furnace (and its ancillary changes on Site) as part of the Proposal.

As such, attached to this letter is a full set of amended application documents, to replace the suite of documents originally lodged. For reference this is comprised of the documents listed in the following table.

Document		Author	Date	Amended since lodged version?
Assessment of Effects on the Environment– Glenbrook Steel Mill Water Discharge Permit Replacement (AEE)		Tonkin & Taylor Ltd	April 2024	Yes
Appendix A	Forms	N/A	22 June 2021	No
Appendix B	Existing Consents	N/A	N/A	Yes
Appendix C	Records of Title	N/A	2021	No
Appendix D	Planning Maps	N/A	2021	No
Appendix E	Figures	Tonkin & Taylor Ltd	Various	Yes
Appendix F	Activity Standards Assessment	Tonkin & Taylor Ltd	June 2021	No
Appendix G	*Water Discharges and Industrial or Trade Activity Assessment* (ITA Report), Glenbrook Steel Mill	Tonkin & Taylor Ltd	April 2024	Yes
Appendix H	*Freshwater Ecological Values and Effects Assessment* (Freshwater Ecological Assessment)	Tonkin & Taylor Ltd	March 2024	Yes
Appendix I	*Marine Ecological Effects Assessment* (Marine Ecological Assessment)	Tonkin & Taylor Ltd	April 2024	Yes
	Appendix E to the Marine Ecological Assessment - *NZ Steel Waiuku Discharge Assessment* (DHI Modelling Report)	DHI	October 2022	Yes
	Appendix F to the Marine Ecological Assessment – *Environmental Monitoring of Discharge Receiving Environments 2020-2021* (Bioresearches Environmental Monitoring Report)	Bioresearches	22 August 2022	Yes
	Appendix G to the Marine Ecological Assessment - *Biodiversity Compensation Model – Coastal Birds (Coastal Birds BCM Report)*	Tonkin & Taylor Ltd	XX	Yes
Appendix J	Outfall Structures	Tonkin & Taylor Ltd	June 2021	No
Appendix K	Water Quality Management Plan, Draft Rev 2	New Zealand Steel Ltd	April 2024	Yes
Appendix L	Closed Landfill Management Plan	Tonkin & Taylor Ltd	June 2021	No
Appendix M	Economic Statement	Berl	2021	No

Document		Author	Date	Amended since lodged version?
Appendix N	Mana Whenua Correspondence	N/A	N/A	Yes
Appendix O	Other consultation records	N/A	N/A	No
Appendix P	Relevant objectives and policies	Tonkin & Taylor Ltd	June 2021	No
Appendix Q	Ecological Guide and Methodology	Tonkin & Taylor Ltd	June 2021	No
Appendix R	Proposed Conditions – Glenbrook Steel Water Permits Replacement Application	Tonkin & Taylor Ltd	April 2024	Yes
Appendix S	Indicative Draft – Coastal Birds Management Plan (CBMP)	Tonkin & Taylor Ltd	April 2024	New
Appendix T	Draft Wetlands Management Plan (WMP)	Tonkin & Taylor Ltd	April 2024	New

Table 1: List of section 92 requests and subsequent clarifications and cross references to where the requested information can be found in the application documents.

No.	Section 92 request (21 October 2021)	NZ Steel's response and cross references to relevant sections of the AEE and accompanying reports (25 November 2022)		Council confirmation / further clarification sought set out in Council's request letter (29 May 2023)	Response to further clarification sought – this consolidated response letter (12 April 2024)
		Report updates	AEE updates		
	Avifauna				
1	Please provide a draft Coastal Bird Management Plan that describes the management and monitoring practices and procedures to be implemented to compensate for residual effects on coastal birds.	An indicative draft Coastal Birds Management Plan (CBMP) has been prepared and is now included as Appendix S to the AEE. The supporting Coastal Birds Biodiversity Compensation Modelling (BCM) Report is now included as Appendix G to the Marine Ecological Assessment.	Consequential updates to refer to the draft CBMP and Coastal Birds BCM Report, including Section 7.4.6.	A. They have not shown how the proposed methods of compensation (of which there are three options) will compensate for the increase in sedimentation and heavy metals in the environment. Proposed compensatory methods aim to increase the size of the areas of roosting for the coastal birds, however they will not decrease the amount of heavy metal bioaccumulation that is likely to occur from this discharge, as well as the increase in sediment and ongoing mangrove removal that would be required for their proposed methods due to the increase in sediment. The report is not clear on how the proposed package compensates for the effects of the proposed activity, and I suggest they go through each of Tim's points and directly address each one.	See Appendix A to this letter.
				B. The increase in mangrove cover is the result of upstream / catchment issues which will continue; therefore, mangroves will likely re-establish. Removal of mangroves does not automatically mean that the shell banks will return or that there will be more food abundance. In my opinion the applicant should provide research that indicates this to be true. From our site visit it was discussed that any future consent for mangrove removal would need to be 35 years in duration (same as the discharge consent) so that clearance is kept of top of.	See Appendix A to this letter.
				C. They have not decided on one particular option of compensation, they advise that "The below are indicative compensation actions that may each individually or collectively be proposed and outlined in the final BCP." To be able to review whether the effects of the proposed activity are appropriately compensated for, their proposed method of compensation needs to be confirmed. Can the applicant please respond with which action they are proposing to take forward in to the BCP.	See Appendix A to this letter.
				D. The three proposed options of compensation are likely to require resource consent both under the AUP, as well as the NES-FM (e.g., for mangrove or exotic tree removal). Removal of these habitats would be confounding and may not necessarily compensate for the effects of the discharge on coastal birds' diet. Whilst they are not guaranteed to get consent for any of the activities, they would need to apply for consent for their proposed method of compensation before the granting of this consent, as well as providing alternative compensation measures shall these consents not be granted. It should be noted that the area of mangrove is now considered wetland under the NES-FM and therefore removal of this habitat will in-turn require mitigation or offsetting for any loss. Please ask the applicant to update their application for all AUP/NES-F standards that are being infringed and provide an assessment of effects.	See Appendix A to this letter.
				E. They have not demonstrated that through these proposed measures of compensation that there will be a no-net loss in effects [preferably there would be a net gain]. They also have not addressed how they would demonstrate success of any of these compensation measures, or what the course of action will be if the new roosting areas are not a success. Tim Lovegrove mentioned in his s92 request that it is not always likely that a	See Appendix A to this letter.

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				new/changed roosting area will be successful, hence he asked for suggestions of several areas. However, if these areas are not successful, the report has not discussed how the applicant will address failures and what other actions would then be put forward (noting additional consents may be necessary). The report should be clear on how the activities will be monitored, for how long, and the measures of success.	
				F. A spring tide survey of the Kahawai roost has not been carried. This would inform where the birds go at a spring tide, as this would inform the locations of extending the roost sites to where the roost sites may/more likely be used.	See Appendix A to this letter.
	Stormwater and Industrial and Trade Activities				
2	The Resource Consent Limits to the receiving environment for many parameters have not been included in Tables 3 to 5 (Schedule 1 as attached to the proposed consent conditions) when compared to the consent limits specified in the 2003 consents. Why has this less prescriptive approach been taken considering the significant amount of historical monitoring data that is now available that would enable the site to develop robust consent limits to the receiving environment?	A discussion of the historical and proposed monitoring programme is outlined in the amended Section 11 of the ITA Report. The proposed monitoring programme is set out in the draft WQMP (Appendix K to the AEE) and the Proposed Consent Conditions (Appendix R to the AEE). Draft Trigger Investigation Levels have also been developed which are attached to the Monitoring Data Review (Appendix C of the ITA Report) and included in the WQMP.	Amendments to Section 12.3.1	A. Council supports the use of trigger investigation levels at the site but still has ongoing concern at the limited number of parameters with consent limits when compared to the previous consents. Even though past sampling may have demonstrated that many of the consent limits were in excess of actual sampling results the use of consent limits in conjunction with trigger investigation levels provides greater confidence to Council (and public/community) in ensuring adverse effects are appropriately managed. Please consider addition of further consent limits for key parameters of concern to the receiving environment.	See Appendix B to this letter.
3	Trigger levels applicable to the consent application were not provided with the application and will only be developed for inclusion in the WQMP and submitted to Council six months after consent is granted. More certainty is required by Council in reconsenting, as such please provide a draft WQMP that provides the framework and outlines the process to be taken to develop the proposed trigger levels, indicative trigger levels, use of any 'tiered' trigger level approach and associated incident reporting.	Draft Trigger Investigation Levels are now included in the draft WQMP (Appendix K to the AEE): Section 11.1.2 sets out how they are to be set, Attachment 3 contains the proposed Trigger Investigation Levels and monitoring frequency, and the Trigger Investigation Level incident response and reporting is in Section 15.3 (with accompanying flow chart in Attachment 4). Refer also to Sections 5.3, 11.1 and 11.2 of the updated ITA Report.	Amendments to Section 12.3.2	A. [Deleted] B. [Deleted] C. [Deleted] D. [Deleted] E. [Deleted] F. [Deleted] G. S4.6.1, pg 58 of the AEE states that once the MCY area is reinstated discharges will cease, however it is also stated that a vegetated filter strip will be constructed to provide treatment for any future ITA discharges. Is it intended that ITA discharges will recommence to the Kahawai Stream at a later time? Please provide further detail. H. [Deleted]	See Appendix B to this letter.
				I. The method for establishing the proposed Trigger Investigation Levels is based on the previous 2 years of monitoring data (2019-2021). Please consider whether impacts of any reduced production at the site as a result of the COVID-19 pandemic through these two years means that the calculated Trigger Investigation Levels may not be representative of normal conditions at the site. i.e. has reduced production at the site during these two years meant that the average concentration of contaminants discharging from the site was lower than normal? Does this also have any bearing on water quality trends and comparisons discussed in the draft WQMP and throughout other application documents?	See Appendix B to this letter.

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				J. Appendix F of the ITA report indicates that discharge system improvements/ additional treatments were implemented at the Steel Mill during the time of collecting data (2019-2021) for development of the draft trigger investigation levels. If production was lower/altered as a result of the COVID-19 pandemic during this time what evidence is there to demonstrate that these additional improvements/treatments made at the site during this time are working to improve discharge quality?	See Appendix B to this letter.
				K. In NZ Steel's drive to demonstrate continual improvement in its activities and processes to reduce adverse effects further over time, it is noted that the proposed draft Trigger Levels (as per Attachment 5, Table 12 of the draft WQMP) for ITA monitoring sites are actually less stringent than existing trigger levels for several parameters. For example the proposed trigger level for Aluminium (total) is higher at seven out of eight sample locations when compared to the existing trigger level. Other parameters where sample locations have less stringent draft trigger investigation levels than existing trigger levels are boron (total), iron (total) and lead (total). Please demonstrate how these less stringent trigger levels are a move towards continual improvement in discharge quality.	See Appendix B to this letter.
				L. Please consider and provide discussion on whether the following other potential contaminants could be contained within ITA runoff and/or process water discharging from the site - sulphates, PAH, PFAS (PFOS), solvents?	See Appendix B to this letter.
4	The older dewatering plant consent requires the slurry pipeline to be shut down if turbidity in the Northside Stream exceeds an average of 50NTU in any 30 minute period but this detail is now to be included in the draft WQMP. Please ensure details of any such thresholds for plant shutdowns across the site are covered in the draft WQMP to be provided as per request 4.	Section 7.6 of the draft WQMP outlines the procedure for shutting down the Dewatering Plant slurry pipeline in the event that the discharge exceeds an average of 50NTU for a 30 minute period. The specific standard operating procedure (controlled document) for shutdown is listed in Table 7.2 (IP−1245.051: Dewatering Plant Shutdown Sequence). Other Plants at the Site discharge to water treatment plants, so when thresholds are exceeded there are mechanisms to divert process water rather than the Plant shutdown. For example, Acid Regeneration Plant process water discharges can be diverted to the Southside Ponds (for treatment and recycling via the Ruakohua Dam) when the threshold is exceeded, to avoid discharge to the environment.	N/A	M. [Resolved]	N/A
5	A draft Water Quality Management Plan (based on existing controls and procedures) is appended to the application (Appendix K). This plan does not appear to cover pump failure	It is not possible for ITA water to "build up" on the site. Water from treatment plants and ponds gravity feed to outfalls.	N/A	A. What about in abnormal times when trigger and/or consent limits are exceeded, and ITA water needs to be diverted elsewhere on the site? Can manual, mobile contingency pumps be brought in? Or are there sufficient back up pumps already in place?	See Appendix B to this letter.

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	events e.g., recycling pumps, dewatering plant pumps. What procedures are in place to deal with pump outages and address potential build-up of ITA discharge / process water? Please include details in the draft management plan to be provided as per request 4.	Contingency responses are set out in Sections 6.7, 7.6, 8.7, 9.4 and Attachment 4, of the draft WQMP. Maintenance technicians are available 24/7 to respond to equipment or instrument failure.			
6	A draft Water Quality Management Plan (based on existing controls and procedures) is appended to the application (Appendix K). This plan does not appear to cover procedures to be taken due to failure of instruments that record and monitor ITA discharges from the site e.g. automatic samplers/devices, turbidity, pH and flow meters etc. Please include details of backup monitoring systems in the draft management plan to be provided as per request 4.	Contingency responses are set out in Sections 6.7, 7.6, 8.7, 9.4 and Attachment 4, of the draft WQMP. Section 10 outlines the NZ Steel maintenance system which includes response to breakdowns. Maintenance technicians are available 24/7 to respond to equipment or instrument failure.	N/A	[Resolved] – repeat of request 5	N/A
7	Operation and maintenance matters that were addressed by specific conditions in the Northside, Southside and Dewatering Plant permits are proposed to be included in the WQMP. Please ensure the draft WQMP, to be provided as per request 4, includes this detail including pond maintenance details.	Pond maintenance requirements are set out in Conditions 3.2 of Existing Permits 21575 and 21576 (Northside and Southside Outfalls, respectively), and Condition 3.3 of Permit 21577 (Dewatering Plant). These requirements are addressed in Section 10 of the draft WQMP, which outlines the maintenance program for the settling ponds and specific procedures (that provide detailed instruction to operators) are listed in Table 10.3. Condition 3.1 of Existing Permit 21575 (Northside Outfall) requires stormwater from the Northside catchment to be recycled as much as practicable; this is addressed in Section 6.3 of the draft WQMP. This is now an inherent part of Site water systems, particularly since NZ Steel has recently accepted a reduced water take volume from the Waikato River. Condition 3.1 of Existing Permit 21577 (Dewatering Plant) requires the diversion or shutdown of discharges when thresholds are	N/A	[Resolved]	N/A

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		exceeded; this is addressed in Section 7.6 of the draft WQMP.			
8	Please consider suggested wording for transitional conditions to require continuation of current water management following the granting of the new consent, prior to implementation of the new approved WQMP.	N/A	Addition of Condition 14 to the Proposed Consent Conditions (Appendix R to the AEE), which sets out the transitional	[Resolved]	N/A
9	Why has incident response reporting conditions been excluded from the proposed conditions (in comparison to the conditions provided in the 2003 and 2014 consents)? Incident reporting is now covered within the scope of the WQMP but this will not be submitted until 6 months after consent is granted. Is the intent for Council to be notified when there is a breach of consent limit and/or trigger investigation level? Please explain the intended approach to be taken during this time.	The draft WQMP (Appendix K to the AEE) has been updated to reflect the current Proposal, including incident response. NZ Steel has an existing, well established incident response and reporting system (including notification/ reporting processes to Council) and therefore does not consider a specific condition relating to incident reporting is necessary. However, proposed Condition 9(d) (Appendix R to the AEE) ensures that incident reporting procedures will be detailed in the WQMP.	The existing incident reporting system will continue to be in place prior to certification of the WQMP and an additional proposed condition (Condition 14, Appendix R to the AEE) has been included relating to transitional operational measures to clarify this.	[Resolved]	N/A
10	Discharge volumes (m3/day per calendar month) have been removed from the proposed consent conditions for the northside and southside outfalls as it is reported that the combination of limiting concentrations and daily load limits will in effect limit the discharge volumes. Please explain this further and provide sample calculations of how this will work.	Discussion has been added to Section 11.8 of the ITA Report, including an example calculation of discharge volume.	Addition to Section 12.3.1.	[Resolved]	N/A
11	The leachate discharge to the Northside Pond was consented pre AUP(O-P) so may warrant further assessment. Apart from discharge to the North Stream what other options have been considered for landfill leachate disposal that does not involve discharge to the ITA pond e.g., disposal to land? Please outline what alternative options have been considered for leachate disposal and provide sound reasoning for/against each option.	Addition of Section 10.5.1 ('Landfill leachate alternatives') to the ITA Report.	Addition of paragraph on landfill leachate to Section 8.1.2	[Resolved]	N/A
12	The AEE states key contaminants of concern associated with the leachate	Aluminium and Boron have been added to Schedule 1 of the Proposed	N/A	[Resolved]	N/A

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	include aluminum and boron. If the intent is to continue to discharge the landfill leachate via the Northside Pond why were these parameters not included in Schedule 1?	Consent Conditions (Appendix R to the AEE).			
13	What was the outcome of the wetland trial that is referenced in condition 3.3(a) to (g) in the Northside outfall 2003 consent (#21575)?	The 'wetland trial' in the Existing Consents refers to the installation of surface gravel filter beds that receive some of the flow from the Northside Ponds. These beds are still operational. Commentary is included at Section 10.5 of the ITA Report.	N/A	[Resolved]	N/A
14	To identify why the activity is non-complying under the NES-F 2020 please clarify which of the natural wetlands are specifically within 100m of each ITA /process water discharge. Assessment under NES-F for applicable wetlands would generally include, but is not limited to the following: a. Confirmation of the location and extent of the natural wetland(s) and the minimum separation distance between the discharge to each wetland (show on a plan). b. Assessment of the effects of the discharge on ecological values including any water quality effects on the wetland(s) (from a freshwater ecologist). c. Assessment of the effects of the discharge on the seasonal and annual hydrological regime of the wetland(s), and flood risk (from a hydrologist). d. Measures proposed to avoid/minimise/remedy the potential for any discharge impacts on wetland water quality, ecology and hydrology.	a. The wetland figures (Figures W-FWE3 to W-FWE6 in Appendix E to the AEE) have been updated to include a 100 m radius from discharge points. b. The Freshwater Ecological Assessment assesses the effects of the discharges on the ecological values of inland wetlands, including water quality effects (Section 6.3). c. Water quantity changes from the discharges to the North Drain are described in updated Section 6.2.1.2 of the Freshwater Ecological Assessment. Section 6.3.1.1 has been updated to provide more detail on the hydrological change in the Lower North Stream at different flow events, and the effect this is assessed as having on wetlands. Of note, the exclusion of the Dewatering Plant discharge would result in a reduction of extent and biodiversity value of wetlands in the Lower North Stream. All other discharges reaching inland wetlands are of ITA stormwater only, not process water. With regard to flood risk, a hydrological assessment is not deemed necessary as all discharges are existing, and no nuisance, damage, erosion, scouring flooding or inundation is occurring or anticipated. d. No updates required; refer to Section 6.3.2 of the Freshwater Ecological Assessment.	a. Amendment to Table 6.7 in Section 6.3, which includes an assessment of the Proposal against the relevant Freshwater NES regulation. b. No updates required. c. No updates required. d. No updates required.	[Upon commencement of NES-F amendments, these questions are no longer applicable] – [Resolved and Deleted]	N/A

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15	A future provisional ITA area has been delineated on the site plans. What is this estimated ITA activity area (in m2)? Council can not authorize this ITA discharge without preliminary design details (nature of activity, structural/procedural controls, mitigation measures etc). However, this can be conditioned (with applicants approval) so that prior to construction the design details are submitted to Council for review and approval, as well as completion details, as-built plans, amendments to relevant plans - EMS, WMP etc. As such please confirm that applicant agrees to this condition and provide an estimate of the ITA activity area (in m^2).	The North Drain Future ITA sub-catchment has an area of approximately 25 ha (approximately 243,500 m^2), and the Ruakohua Future ITA sub-catchment (included in the Proposal since lodgement) has an area of approximately 5 ha (approximately 50,040 m^2). The current and potential future ITA uses are described in Sections 4.4.6 and 4.5 of the ITA Report, respectively. In addition, NZ Steel agrees to include a condition relating to the establishment of any activities within the Future ITA Areas, as set out in proposed Condition 13 (Appendix R to the AEE).	Section 4.4.1 and 4.5.1 of the AEE. See also proposed condition provided at Condition 13 (Appendix R to the AEE).	[Resolved]	N/A
	Streams				
16	Please provide ecological descriptions of the reference catchments (Waitangi and Mauku).	Addition of Section 5.1.1 to the Freshwater Ecological Assessment (Appendix H to the AEE) (Section 5.1.1.1 addresses the Waitangi Stream catchment and Section 5.1.1.2 addresses the Mauku Stream catchment). A cross reference has also been added at the overview of Section 5.1.	N/A	[Resolved]	N/A
17	Please provide SEV assessments of the potential state of each stream system to allow for quantitative comparisons analysis, additionally, can the SEV calculators and assumption tables be provided also.	Addition of Section 3.2.1.2.1 to the Freshwater Ecological Assessment.	Cross reference added at Section 7.3.1.	[Resolved]	N/A
18	Please separate out the effects of the dewatering plant and ITA stormwater discharges on the lower North stream. Specifically assess the effects of the contaminants being discharged and the effects of the flow alterations, including variability of flows given that the dewatering plant does not operate 24/7. We are of the understanding that there is a position being put forward that advocates that the dewatering plant discharge has a positive effect on the downstream receiving "freshwater" environment.	Amendments at Section 4.1.2 and 6.2.1.2 of the Freshwater Ecological Assessment.	Addition at Section 4.4.3.2.	[Resolved]	N/A

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19	Please provide hydrological evidence that supports the position presented that the dewatering plant discharge flows result in the "formation" of the wetlands identified along the lower North stream.	Amendment to Section 6.3.1.1 of the Freshwater Ecological Assessment.	Addition at Section 2.6.7 and 7.3.3.	[Resolved]	N/A
20	Please provide further clarification on how the magnitude of effects pertaining to the discharge of contaminants between the North drain and the lower North stream given that, when examining appendix D table 3 the contaminant levels do not appear to differ significantly. Therefore, it is questionable how the magnitude of effects between the North drain and the lower North stream differ given very similar contaminant loads.	Addition of Section 6.2.1.2.3 of the Freshwater Ecological Assessment.	Amendments to Section 7.3.2.	[Resolved]	N/A
21	Please provide further justification as to the statement relating to The Receiving Environment for the Kahawai Stream "Receiving Environment macroinvertebrate communities would be similar in terms of species compared to the Current Environment" given that the evidence indicates that the discharge is having an effect on the macroinvertebrate community.	Addition of Section 3.2.1.4.1. and amendments to Section 6.2.2.1 of the Freshwater Ecological Assessment.	N/A	[Resolved]	N/A
22	Please provide plans showing location of wetlands, the discharge points, and distances between these wetlands and discharge points to identify how the NES:F 2020 relates to this application. Advice Note: This request is similar request 15, the response for this request can be combined with the response for request 15.	Amended figures are included in Appendix A of the Freshwater Ecological Assessment.	Amended figures are included in Appendix E to the AEE.	[Resolved]	N/A
	Health				
23	Please provide a health risk assessment report, which include but is not limited to the following aspects: • details of the sources of contaminants, potential exposure pathways including air, land and water (surface water, groundwater and marine), and potential receptors;	Health Risk Assessment Report has been prepared and is provided at Appendix B to NZ Steel's Section 92 Response.	Health Risk Assessment Report has been prepared and is provided at Appendix B to NZ Steel's Section 92 Response.	A. Contaminants of concerns: i. The HRA has not fully justified the contaminants of potential concern (CoCs) chosen for the human health risk assessment and the CoCs appear not to be used consistently for the relevant exposure pathways. e.g. arsenic, cadmium, lead were included in the assessment of contaminants in airborne dust, while only cadmium was tested in roof- collected drinking water to assess the potential impact of airborne dust deposition. The routine monitoring (discharges/sediment/shellfish) appears to be largely focused on assessment of potential ecological environmental effect rather than human health effect. Table 4.1 of the HRA shows that the shellfish monitoring in 2020 included an extended	See the updated HRA contained at Appendix C to this letter.

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	• contaminants of concern (relevant to human health) and concentrations in the exposure environment (based on real data or modelling), identification of information gaps • exposure assessment including cumulative exposure risk characterisation and discussions on uncertainties			suit of metals (aluminium, arsenic, cadmium, chromium, cobalt, lead, manganese, mercury, molybdenum, nickel and vanadium) at sites N6A, N10 and TC (control site) in addition to zinc and copper, which are routinely monitored to support this HRA. The contaminants of potential concern (CoCs) in shellfish were selected where concentrations measured in the mixing zone are higher than at the control site. The CoCs were identified in the HRA as zinc, copper, vanadium, aluminium and cobalt for shellfish. However, the data (except for zinc and copper) is considered very small (only providing a snap-shot of the time of sampling) to reach a conclusion. Please also refer to comments in point 6. ii. It is understood that Table 4.10 of the HRA only includes the contaminants (aluminium, vanadium and zinc) that exceed a ratio of 0.1 when comparing with relevant screening level for any exposure pathway and are identified as a contaminant of potential concern for more than one pathway. As commented previously, it appears that the HRA report has not fully justified the selection process to determining the contaminant of potential concern (CoCs) for each of the exposure pathways. For the purposes of assessment of the potential cumulative health effect, it is considered that the CoCs should be chosen consistently across the exposure pathways and the common contaminants of health concern should be included as long as they are part of the discharges from the source of concern. For completeness, Table 4.10 should also include other contaminants assessed in the exposure pathways. This will provide a clearer picture of any potential issues and identify the information gap for improvement in future monitoring. B. Exposure pathways: i. Consumption of vegetables were not included as part of the exposure pathways since the HRA considers that it is unlikely to be consumed as per homegrown produce due to the produce being for commercial distribution. The site visit and the Council's Geomaps show that the adjacent land is commonly used for horticultural activities. It is considered logical to consume own produces even though they are for commercial purposes. Therefore, in addition to the impact of the potential soil contamination, which has been assessed in the HRA, the impact of dust deposition on leafy vegetables and irrigation from contaminated North Stream should be assessed and home produce consumption (25%) in a rural residential setting should be considered as a potential exposure pathway in the assessment of the cumulative health risk. The HRA shows that the Lower North Stream is periodically used for irrigation, but details have not been provided. This is of a particular concern. Even if the produce from the horticultural land are for commercial distribution, it is important to know that the produce are safe for public consumption (meeting the maximum levels in the Australia New Zealand Food Standards Code -Standard 1.4.1 – Contaminants and natural toxicants (FSANZ Code 2022). C. Guidelines/Standards: i. The HRA states there are no food standards for shellfish, therefore it uses tolerable upper intake levels derived from international guidelines for screening level assessment of contaminants in shellfish for aluminium, chromium, cobalt, coper, nickel, vanadium and zinc. However, Schedules 19 of the Australia New Zealand Food Standards Code -Standard 1.4.1 – Contaminants and natural toxicants (FSANZ Code 2022) contains maximum levels of metal contaminants including arsenic (total and inorganic), cadmium, lead, mercury (also mean	

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		Report updates	AEE updates		
				levels) for molluscs, which is understood including oysters. Please provide the assessment results when these standards are used for assessment. D. Assessment methods: i. It is noted that a mean or average level was used across the technical reports including the HRA report with little consideration of the background of the assessment criteria/standards. For example, the drinking water standards set up maximum acceptable values (MAVs) for determinants including metals. Non-compliance is confirmed if only one exceedance of the MAV is identified over a 12-month period. The FSANZ Code 2022 (Schedule 19) also set up maximum levels for metals (also mean for mercury) which must not be exceeded. FSANZ Code 2022 (Schedule 19) shows that the mean level standard for mercury is much lower than the maximum level standard (0.5 mg/kg vs 1.5 mg/kg). Therefore, the approach to use average or mean levels appear to be inappropriate for the HRA and is likely to underestimate the health risk. A 95th percentile estimate of contaminant concentrations at a site quantifies the relevant assessment criteria that is only exceeded 5% of the time. In addition, the 95th percentile estimate approach is used for assessment of long-term microbiological recreational risk for both marine and freshwater as well as used in the DHI modelling report. It is considered appropriate to also use this approach in the HRA to understand the worst scenario. ii. It is noted in the Appendix A Table 2 and 3 of the HRA that arsenic concentrations in 6 out of the 12 shellfish samples at N10 exceed the FSANZ Code 2022 (1 mg/kg) and the levels in other 4 samples are rounded to be at the maximum level of standard. However, the HRA does not consider that arsenic is a potential contaminant of concern simply because the mean concentration at N10 is lower than that detected in the Control site (TC) (both means exceed the MAV). It is understood that the Control site was selected recently. Due to the limited data, it is considered that further data is required to assess the potential sources of the elevations of contaminant (arsenic) in shellfish and whether the TC site is an appropriate control site. iii. The DHI modelling report shows the modelling water column concentrations for zinc and copper decrease with distance from the Northside and Southside outfall discharges. However, this does not appear to be the same when comparing the contaminant levels in sediment or shellfish. The contaminants in OZ are higher than in SZ (Table A1.2 of Bioresearch Report) requiring further investigation as stated in the Marine ecology report. In addition, Table 4.1 of the HRA shows that except for zinc, the contaminant levels in shellfishes appear to be similar or slightly higher with distance from the discharge outfalls. The locations of the shellfish monitoring locations may require review. In addition, the HRA shows that the measured metals concentrations in shellfish samples collected from site N6 (50 m from the point of discharge from the Northside Pond) have been adopted for the screening-level assessment. The report considers this is a very conservative approach as it is unlikely that shellfish would be harvested at this location, due to access issues and the obvious presence of the Steel Mill discharge. However, it is noted some of the contaminants in samples from N10 (approximately 500 m north of Northside Outfall) are slightly higher than that from N6 (50 m from the point of discharge from the Northside Pond). iv. The DHI (2022) modelling predicts there will be small increases in sediment zinc concentrations over the 35 year consent period across much of the wider ZOI	

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		Report updates	AEE updates		
				with the ongoing operation of the Steel Mill that contributes to cumulative effects across the ZOI. Fluctuations of contaminants levels are noted in the long-term monitoring data included in the freshwater and marine ecology reports. Please comment on the potential changes in the levels of contaminants of health concern that may affect the HRA conclusions over the 35 year consent period. v. Please address the above matters including any proposed conditions.	
	Coastal				
24	The Marine ecological report (T&T) states that the mixing zone for the existing discharge consent is 44 ha, and the mixing zone for the discharge of this application is 11ha (10ha from north outfall & 1ha from south outfall). Please provide the reasons/justification for the reduction in the mixing zone for this application compared to the existing discharge consent.	The mixing zone for the existing discharge consent was based on dye tracer studies undertaken in the 1980s rather than modelling and is likely to be overly conservative. Addition to Sections 5.4 and 7.2 of the Marine Ecological Assessment (Appendix I to AEE).	Addition to Section 2.9.2	[Resolved]	N/A
25	The ZOI has been estimated as 2500ha, it covers Waiuku and Taihiki estuaries. Please provide the residence time predicted for these ZOI estuaries in relation to key contaminants in the discharge including inside and outside the mixing zone. Has the residence time been considered in assessing the effects on the receiving environment effects? Please clarify?	Addition to Section 5.4 of the DHI Modelling Report (Appendix E to the Marine Ecological Assessment) to assess the proportion of time the guidelines are exceeded, which is akin to residence time. Addition of a subsection to Section 5.4.2 of the Marine Ecological Assessment titled "Percentage of time above guideline thresholds".	N/A	[Resolved]	N/A
26	There have been some monthly limit exceedances in the discharge quality standards in relation to consent limits for the existing consent occurred (TSS & temperature, Zn, flow volume), does this application propose any additional treatment compared to the existing discharge for achieving the effluent quality standards of key contaminants? If lower consent limit for Zn is proposed compared to the existing limit, please clarify how the proposed limit would be achieved, and what additional level of treatment is proposed for this reduction in Zn level?	Amendment to Section 5.7 of the Marine Ecological Assessment to clarify that with regard to long term trends, dry weight zinc concentrations in oyster flesh in all mixing zone sites have been stable or declining, and additions to Sections 5.7, 6.4 and 7.2 of the Marine Ecological Assessment that there has been a marked improvement in discharge quality in the last two years. The proposed conditions (Appendix R to the AEE) specify lower Consent Limits for zinc for the Northside and Southside Outfall discharges compared to the Existing Permits. Although the Proposal does not include any additional treatment for discharges from the Northside and	N/A	[Resolved]	N/A

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		Report updates	**AEE updates**		
		Southside Outfalls, NZ Steel's commitment to continual improvement and the proposed use of Trigger Investigation Levels will ensure discharge quality will continue to improve over the duration of the consents. This is evidenced by the substantial improvements outlined in Appendix F of the ITA Report, as well as the reduction in the proposed zinc consent mass load limit from 1.8 to 1 kg/day, and the concentration from 0.2 mg/L to 0.11 mg/L, representing a 45% reduction.			
27	Please provide the treated discharge quality standards for all key contaminants (related to existing condition 11) and provide a comparison of these standards with the existing consent standards if they differ.	The proposed monitoring programme is outlined in Section 11 of the ITA Report, including proposed consent limits. This section includes a discussion on the proposed monitoring programme and the basis for proposed changes from the existing programme.	N/A	[Resolved]	N/A
28	The marine ecological assessment did not consider the contaminants from the leachate of landfills. Please clarify.	Leachate quality data is now included in Section C9 (in Appendix C) of the ITA Report, and historical water quality monitoring results for the Northside Outfall discharge (which includes leachate) is now in Section 6.3.1 of the ITA Report. The contaminants of concern from the discharges (which includes leachate) are assessed in the Marine Ecological Assessment.	N/A	[Resolved]	N/A
29	The consented volume of discharge from north outfall is 9,000m3/day and south outfall is 2,000m^3/day, please confirm the volume for this application and clarify the plants/process used to achieve this volume have enough buffer not to exceed the target volumes on a routine basis over the duration of consent?	The Northside and Southside Outfall discharges include combined process water and stormwater runoff. It is not usual to include a flow limit for stormwater discharges as the volume depends on rainfall and runoff. Flows from the Northside and Southside Outfalls above the consented limits occur as a result of rainfall events, not process water discharges. It is therefore proposed to manage the key contaminant (zinc) through a concentration and load limit, rather than a volume limit. The proposed metals load limits will constrain	N/A	[Resolved]	N/A

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		Report updates	**AEE updates**		
		volume to target the effect (i.e., from the contaminant) rather than water volume. This approach aligns with other stormwater discharge consents where flows are dependent on rainfall and runoff. The focus is on monitoring and improving the discharge quality by using Trigger Investigation Levels rather than having a volume limit that can act as a target. Note that freshwater flows from other catchments under rainfall events contribute much more freshwater to the estuary, so the receiving environment is naturally used to reductions in salinity during rainfall events. Removal of the volume limit should therefore not affect ecological outcomes if metal load and concentration limits are being met and these will also limit volume by proxy. Addition made to footnote 44 in Section 6.4 of the Marine Ecological Assessment. Section 5.4 of the WQMP has also been amended.			
30	Please explain how the discharge to the CMA will occur. Is that continuous discharge (24 hrs) or is there any mechanism to control the flow of the discharge to the CMA?	Addition to Section 3.1 of the Marine Ecological Assessment. Refer also to Sections 4.2 and 4.3 of the ITA Report which provides further explanation of the operation of the Northside and Southside systems.	Addition to Sections 4.1 and 4.2.2.	[Resolved]	N/A
31	Marine ecological report (T&T) provides (Section 7.1, p64) contaminant contribution from the proposed discharges in percentages. Please provide loads (in grams not in percentage) of all key contaminants in the discharge to the CMA and please explain how the percentage provided for the contaminants have been justified in the wider context.	The concentration and load information is in Table 4-12 in Section 4.3 of the DHI Modelling Report. Footnote 55 has been added to Section 7.1 of the Marine Ecological Assessment referencing this.	N/A	[Resolved]	N/A
32	T & T report states that mixing zone for Zn extends a maximum of 400 m from the northside outfall and 100 m from the southside outfall. How does this	Amendment to Section 7.2 of the Marine Ecological Assessment to explain how the modelled mixing	N/A	[Resolved]	N/A

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		Report updates	AEE updates		
	distance relate to the estimated mixing zone of 11ha?	extent has been defined. Refer also to the DHI Modelling Report.			
33	ITA report or one of the technical report states that 95th percentile excess temperature of 20 degC may occur at the northside. Does this mean exceedance by 20C may occur or is this a typo? If this is a possibility, how long this exceedance would occur at the discharge site?	Temperature excess is discussed in Section 5.4.2 of the Marine Ecological Assessment and Section 5.5 of the DHI Modelling Report.	N/A	[Resolved]	N/A
34	The marine ecological report concludes that bird values in the ZOI is moderate where as benthic health index/value is low. While I note that the assessment used the modified criteria developed for terrestrial ecology, to categorise the ecological values within the ZOI, please clarify how the moderate ecological values of birds will be maintained or justified at the site when there is a potential for more degradation of benthic ecology from the proposed discharge at the site over the duration of consent?	Bird values will be managed through the coastal birds compensation package; refer to the draft CBMP (Appendix S to the AEE).	N/A	[Resolved]	N/A
35	The marine ecological assessment uses the terms low, moderate and high in relation to ecological values of the site, and for the magnitude of discharge effects to the receiving environment. Please clarify how these terms relate to the RMA terms of less than minor, minor and more than minor.	N/A – no report updates required. The AEE uses RMA terminology for effects. Effects on Marine Ecology are assessed in Section 7.4 of the AEE, and are summarised as follows: • Effects on estuarine habitats, fish and marine mammals and coastal saline vegetation are assessed as being no more than minor, after reasonable mixing. Discharges to the CMA are assessed as having a more than minor adverse effect on coastal birds, which is translated from an assessed EcIAG overall level of effect of Moderate. The Moderate effect is due to impacted foraging habitat that may be used by Threatened or At Risk species. It is not practicable to avoid or further mitigate the effect and residual effects are proposed to be addressed through ecological compensation.	N/A	[Resolved]	N/A
36	Bioresearches report summary states that "Sediments from the Northside	N/A – no report updates required.	N/A	[Resolved]	N/A

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		Report updates	**AEE updates**		
	settling zone and outer zone increased in the proportion of silt, clay and fine sand, while all other grain size proportions either stayed the same or decreased". What is settling zone and how this relates to mixing zone or ZOI?	The glossary of the Marine Ecological Assessment includes the definition of "Settling Zone", "Zone of Influence (ZOI)" and "Zone of reasonable mixing": • Settling Zone is defined as "the area where the majority of sediment and associated contaminants discharged from a catchment settles out in the coastal marine area." 1 Zone of Influence or ZOI is defined as "the areas/resources that may be affected by the biophysical changes caused by the Proposal and associated activities." Zone of reasonable mixing is defined as "The area within which 'reasonable mixing' of contaminants from discharges occurs in receiving waters and within which the relevant water quality standards do not apply."			
37	Bioresearchers report states (Section 7.2, p98 Benthic community health) that the current model represent the health of the benthic biota and is limited in predicting any ecosystem improvement as it is used only when zinc, copper or lead exceed a threshold concentration. Please clarify: (i) Has this issue been considered and resolved for this application during modelling? (ii) What is threshold concentration? How is it defined?	Section 5.6 of the Marine Ecological Assessment amended to reflect revised Bioresearches Report (Appendix F to the Marine Ecological Assessment), including new BHMmud and Traits-Based Index (TBI) analysis. The threshold concentration is in the ERC 'Red' band for zinc.	N/A	[Resolved]	N/A
38	Bioresearches report results for shellfish quality (section 7.3, p98) states that "The Northside Outfall site (Northside 6a) had the highest mean dry weight concentration of zinc in Pacific oysters at 8,017 mg/kg dry weight, which was significantly higher than at all other an outfall effect of increased zinc in oysters in the vicinity of the Northside Outfall within the mixing zone. The effects of the Northside outfall seem to be confined to a small area relatively close to the discharge point of the Northside	Wet weight trigger level comparisons are included in Section 4.2.4 of the revised Bioresearches Report and addressed in the updated Section 5.7 of the Marine Ecological Assessment. Dry weight trigger levels are not currently set or required and are not considered useful from a human health perspective. However, they can be more useful for tracking trends as they are less susceptible to fluctuations in wet weight condition and moisture content and are	N/A	[Resolved]	N/A

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		Report updates	AEE updates		
	outfall". Please explain how the dry weight of zinc (8,017mg/Kg) compared to the previous result of dry weight of zinc (8,017mg/Kg) in the oyster samples at this site, how this concentration compared to mean concentrations of Zn recorded at this site. Based on these comparisons, please provide an estimation of accumulation rate of Zn in Pacific oysters. Note that the alert levels agreed to in the existing consent are related to wet weight, not related to dry weight of Zn concentration. What was the wet weight of Zn in these samples where the highest dry weight of (8,017mg/Kg) recorded at the site. What was the condition index of oysters of this sites where the highest dry weight of zinc (8,017mg/Kg) in the oyster samples recorded? Was there a correlation between condition index and dry weight of Zn concentration?	therefore included in the Bioresearches monitoring and discussed in Section 5.7 of the Marine Ecological Assessment.			
39	How did the alert wet weight concentration of 1000mg/Kg for Zn was determined? What was the rationale behind this threshold of alert level inside and outside the mixing zone (500mg/kg)? As noted above, there is a relatively significant reduction in the mixing zone for this application compared to the existing consent. Please comment on the change in mixing zone in relation to the alert level for wet weight of Zn concentration. As part of your response, it would be useful to know how the alert wet weight concentration of 1000mg/Kg for Zn was determined? And what was the rationale behind this threshold of alert level inside and outside the mixing zone (500mg/kg)?	Alert weights were set based on worldwide data and emetic human consumption guidelines developed in the Stanley Associates (1988) Report. These are discussed further in the Larcombe Report (Bioresearches 1998), which reviewed the harbour environmental monitoring programme and carried out an assessment of effects of the discharges for NZ Steel's discharge reconsenting at the time. Addition to Section 5.7 of the Marine Ecological Assessment that summarises the findings of the Stanley Associates and Larcombe reports and the Health Risk Assessment (Appendix B to the Section 92 Response).	N/A	[Resolved]	N/A
40	Bioresearches report notes that (Section 3, P 26, Benthic community health) "Benthic biota at the Northside sites are only collected when contaminants (notably zinc) are in high concentrations, therefore there is no record of the benthic biota with less contaminants in the sediment	A benthic control site has now been established (since August 2021), against which any changes at the ecology sites adjacent to the Steel Mill discharges could be assessed. The Benthic Health Model (BHM) for mud and the Traits Based Index (TBI) are applied to the data, to allow the	Benthic control site 'CD' added to Figure 1 in Schedule 1 to the proposed conditions (Appendix R to the AEE).	[Resolved]	N/A

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		Report updates	AEE updates		
	rendering difficult the assessment of the influence of metals on benthic communities at the New Zealand Steel sites". The Bioresearches report proposes a number of recommendations for the existing monitoring programme, however please clarify/explain how the issue of collecting a benthic community baseline or benthic community information with less contaminants will be considered to assess the discharge effects on the benthic health from this application?	effects from sedimentation and sediment metal accumulation to be better separated out. Refer to amendments made to Sections 5.6 and 8.5 of the Marine Ecological Assessment. Control site 'CD' added to Figure W-ME1 (Appendix E to the AEE). Refer to the updated WQMP for details of the proposed monitoring programme, including benthic ecology monitoring.			
41	Please provide a comprehensive monitoring programme to assess the discharge effects on the coastal environment including a baseline survey. This should include sampling design, locations & variables proposed to monitor the effects from the proposal.	A comprehensive monitoring programme is included in the application documents. Refer to Section 8.3 of the Marine Ecological Assessment (Appendix I to the AEE), the revised Bioresearches Report (Appendix F to the Marine Ecological Assessment), proposed conditions (Appendix R to the AEE), draft WMP (Appendix T to the AEE), and draft CBMP (Appendix S to the AEE). Proposed monitoring includes the establishment of a sediment contaminant and benthic ecology 'control' site, and sampling of benthic ecology at all sediment contaminant monitoring sites in the next monitoring round in 2022 or 2023 regardless of contaminant concentration status (the Benthic Health Model (BHM) for mud and the Traits Based Index (TBI) will be incorporated in the ecological scoring system).		[Resolved]	N/A
	Planning				
42	The following triggers for resource consent could also apply to the resource consent application: • F2.19.7(A65) Discharge of ITA into the CMA (Has the same activity status as that acquired under chapter E33) – Discretionary • F2.19.7(A70) Discharge of leachate from landfills, being Discharges not	N/A	to include triggers under F2.19.7(A65) and F2.19.7(A70).	[Resolved]	N/A

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		Report updates	**AEE updates**		
	otherwise authorised by a rule in the Plan – Discretionary Please provide rationale as to why they have not been applied for as part of this application.				
43	[Deleted]	N/A	N/A	N/A	N/A
	Coastal modelling				
44	Mike21 model setup and calibration. Model grids and resolution are only described briefly. Please provide more clarity and detail on the model grid, including vertical grid/layer distribution, particularly in areas of discharge and very high currents.	Updates to Section 2 of the DHI Modelling Report.	N/A	[Resolved]	N/A
45	Mike21 model setup and calibration. Please clarify how the Northside and Southside outfall discharges were applied into the model grid (e.g. single grid cell source, surface cells only, vertically distributed, etc)	Updates to Section 2 of the DHI Modelling Report.	N/A	[Resolved]	N/A
46	Mike21 model setup and calibration. It is not clear whether currents were simulated as depth averaged or fully three-dimensional. If depth averaged, clarify how the model accounted for potential separation between buoyant discharge surface flows driven by wind, and at-depth flows resulting from tidal currents. This query arises across several sections of the modelling study.	Updates to Section 2 of the DHI Modelling Report to clarify that the sediment transport model does not include a wave model. The rationale behind this is provided in Appendix E to the DHI Modelling Report.	N/A	[Resolved]	N/A
47	Model input data and simulation periods. No detail is provided on the model simulation period or forcing. What time period was simulated with the hydrodynamic model? This is not explained. Did it overlap with 2008, the year selected for the input flows? Was a full year of hydrodynamics simulated, or were selected periods cycled?	Updates to Section 2 of DHI Modelling Report.	N/A	[Resolved]	N/A
48	Model input data and simulation periods. Please provide a summary of the forcing/boundary conditions. What checks were done on the representativeness of the forcing conditions?	Updates to Section 2 of DHI Modelling Report.	N/A	[Resolved]	N/A
49	Model input data and simulation periods. Section 6 Sediment Transport Model indicates the sediment transport model was run for all of 2008. Does this	Updates to Section 2 of DHI Modelling Report. The rationale	N/A	[Resolved]	N/A

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		Report updates	AEE updates		
	mean that the model was also driven with the full hydrodynamics and forcing from all of 2008?	behind this is provided in Appendix E to the DHI Modelling Report.			
50	Model boundary. The model result plots show only the Waiuku Estuary. Present selected model results of the larger model domain (South-East Manukau model?) to demonstrate that, for example, predicted temperatures (Figure 5.32) are not affected by the model northern boundary at the estuary entrance.	Updates to Section 2 of DHI Modelling Report.	N/A	[Resolved]	N/A
51	Modelling process. The relevance of Section 5.3 is not clear. Were the Plume Dynamics simulations used to derive the dissolved metals dispersion? I.e. were the dissolved metals (Section 5.4 results) simply scaled from conservative tracer simulations? Please clarify, as it is not clear in the report.	Addition at Section 5.3 (Plume Dynamics) of DHI Modelling Report.		[Resolved]	N/A
52	Section 5.5 Excess Temperature Modelling indicates that only one month was used for each of the summer and winter conditions, being February 2008 and August 2008 respectively. In what way were these specific months representative of summer and winter conditions? Provide an analysis to demonstrate their representativeness.	Addition at Section 5.5 (Excess Temperature Modelling) of DHI Modelling Report.		[Resolved]	N/A
53	What were the wind and tide conditions during the simulation period? Please demonstrate whether these were representative of typical conditions. Was solar radiation explicitly included, e.g. from weather station measurements?	Updates to Section 2 of DHI Modelling Report.	N/A	[Resolved]	N/A
54	Clarity of results. Please clarify whether the results presented in Section 5.5 (for example Figures 5.34 and 5.35) represent depth averaged, or surface/bottom water results. Provide model validation data (measurements) to show that water was well mixed (or stratified) to support the model setup that was used. Refer earlier query about Mike21 model setup and calibration.	Updates to Section 2 of DHI Modelling Report 'Model Used' for setup and calibration. Addition of Appendix D to the DHI Modelling Report, providing detailed rationale for using a depth-averaged model.	N/A	[Resolved]	N/A
55	Clarity of results. With reference to, for example Figure 5.34, please clarify how	Addition to Section 5.2 (Salinity) of the DHI Modelling Report.	N/A	[Resolved]	N/A

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		Report updates	AEE updates		
	results for different tide states were aggregated to account for drying of the intertidal mudflats. It would be useful to show plots of excess water temperature at distinct states of the tide in the vicinity of the outfalls.				
56	Persistence. Plots showing persistence of a parameter above a threshold can aid interpretation of ecological effects. For example, the maximum time that (temperature/Zn/Cu) persist above a certain level above ambient, can improve understanding of impact. Please provide spatial plots of persistence.	Additions at Section 5.4 and 5.5 of DHI Modelling Report and Section 5.4.2 of the Marine Ecology Assessment to address percentage of time above guideline thresholds.	N/A	[Resolved]	N/A
57	Section 6 Sediment Transport model. Do the erosion thresholds (e.g. 0.05 N/m2) account for all forcing events, including energy dissipation from locally generated wind waves on the shallow inter-tidal areas? If not, explain why these were not considered.	Addition of Appendix E to the DHI Modelling Report to detail rationale for not including a wave model in the sediment transport model.	N/A	[Resolved]	N/A
58	Simulation of events. What forcing events (wind, tides) would lead to resuspension and were such events simulated in the models? (relevant to Sediment Transport model and Metal Accumulation modelling). Demonstrate that the selected period of hydrodynamics is representative of resuspension events.	Addition of Appendix E to the DHI Modelling Report to detail rationale for not including a wave model in the sediment transport model.	N/A	[Resolved]	N/A
59	Metal Accumulation Model. Please provide further explanation of the calibration process. What starting values were used for surface sediment Zinc concentrations, for example, and what time period was simulated to obtain the results presented in Figure 7.1? This is not clear and has a bearing on the interpretation of the predicted results.	Addition to Appendix A to the DHI Modelling Report 'Metal Accumulation Model'.	N/A	[Resolved]	N/A
60	A 35 year consent period is sufficiently long that climate change effects, sea level rise in particular, are relevant. Provide, at minimum, a discussion on potential effects of sea level rise on the hydrodynamics and resulting temperature and metal dispersion.	Additions to Section 2 of DHI Modelling Report 'Model Used'.	N/A	[Resolved]	N/A
	Contamination				

No.	Section 92 request (21 October 2021)	NZ Steel's response and cross references to relevant sections of the AEE and accompanying reports (25 November 2022)		Council confirmation / further clarification sought set out in Council's request letter (29 May 2023)	Response to further clarification sought – this consolidated response letter (12 April 2024)
		Report updates	**AEE updates**		
61	Please provide an updated version of the ITA report, which includes, but is not limited to the following information: a. A summary of the key waste sources relevant to the landfill leachate generation	Section 2.3.5 of the ITA Report describes the landfills, including the materials that have been/ are disposed of. Key waste streams contributing to the active East Landfill are now also set out in Appendix C Table 3.	N/A	[Resolved]	N/A
	b. An estimate of the average landfill leachate volumes (prior to dilution) generated per year	Addition of Section C9.2.1 ('Yearly leachate volumes generated', in Appendix C) to the ITA Report.	N/A	[Resolved]	N/A
	c. The monitoring data on the landfill leachate contaminant composition and relevant concentrations (prior to dilution) and loadings (in kgs per year).	Addition of Section 8.8 ('Landfill leachate') to the ITA Report. Addition of Section C9 ('Leachate discharges from East and West landfills', in Appendix C) to the ITA Report.	Amendment to Footnote 59 and amendment of leachate paragraph in Section 8.1.2.	[Resolved]	N/A
	d. Information on the contribution of the landfill leachate to the overall contaminant discharges to the CMA on an annual comparative basis.	Leachate quality is presented in Section C9 (in Appendix C) of the ITA Report. Section 4.2 of the ITA Report describes the treatment systems of the Northside Catchment while Section 6.4.1 presents the removal efficiencies of the Northside Ponds based on contaminant loads in the incoming and outgoing flows Contribution on an annual comparative basis is included in Section C9 in Appendix C.	N/A	[Resolved]	N/A
	e. The identified potential environmental effects of the landfill leachate fraction of the combined contaminant discharges to the CMA.	The environmental effects of the combined discharges to the CMA are assessed in the Marine Ecological Assessment and ITA Report. It is not considered necessary to assess the effects of the individual discharges (ITA stormwater, process water, or leachate).	N/A	[Resolved]	N/A
	f. Consideration of alternative leachate disposal options (such as irrigation, recirculation, etc. within the landfill boundaries) and the feasibility of such methods.	Addition of Section 10.5.1 ('Landfill leachate alternatives') to the ITA Report.	Addition of paragraph on landfill leachate to Section 8.1.2	[Resolved]	N/A
	Additional s92 further information requests (does not stop the clock) – 20/01/2023				
62				Please provide a flow diagram to show drainage patterns around the coal yards and dewatering plant.	See Appendix B to this letter.
63				Please provide photos of the reinstatement works at the Metal Cutting Yard.	See Appendix B to this letter.

No.	Section 92 request (21 October 2021)	NZ Steel's response and cross references to relevant sections of the AEE and accompanying reports (25 November 2022)		Council confirmation / further clarification sought set out in Council's request letter (29 May 2023)	Response to further clarification sought – this consolidated response letter (12 April 2024)
		Report updates	AEE updates		
64				Re Table 6, Appendix C of the ITA Report: The Zn concentrations do not seem to be included in the summary of the monitoring results for the West LF leachate, while there is a summary statement confirming Zn exceeds the relevant ANZ WQG (2018) criterion for the protection of 80% of marine water species. Would you please include Zn results in Table 6 of Appendix C. Also, would you please confirm whether the metal concentrations presented in Tables 5 and 6 in Appendix C are actually the 'total recoverable' results for the avoidance of doubt.	See Appendix B to this letter.
65				We understand the composition of the landfill leachate discharge is generally similar to the Steel Mill treated process water and the ITA stormwater discharge. However even though there is a comparatively small volume of landfill leachate discharging via the Northside Outfall (as discussed in C9.2.1 of the ITA report), as much as 55.3% of the annual contribution of aluminium to the Northside Outfall is attributed to the landfill leachate, so the discharge composition in this regard is significantly different. The high aluminium concentration must therefore be relevant to the ongoing use of aluminium (in a form of poly-aluminium chloride or other forms?) at the Wastewater Treatment Plant. Would you please clarify the inferred sources of aluminium within the landfill leachate discharge? Also, would you please provide a comment on the consideration of the use of alternative coagulation/flocculation agents (such as ferrous sulphate or others). Lastly, would you consider any remedial options aimed at reducing the total aluminium loading in the Northside Ponds and ultimately in the discharge to the receiving environment?	See Appendix B to this letter.
66				Would you consider the change of the title of the ITA Report from 'Glenbrook Steel Mill – Water Discharges and Industrial or Trade Activity Assessment' into: 'Glenbrook Steel Mill – Water Discharges, Landfill Leachate Discharges, and Industrial or Trade Activity Assessment', or something along those lines. That way it would be more representative of its quality content, covering all those three aspects.	See Appendix B to this letter.
67				We understand there is the potential for the off-site environmental receptors in the Waiuku Estuary and Manukau Harbour to receive PFAS (PFOS) contamination from the remaining residual (secondary) sources on site on the ongoing basis. Would you please provide clarification on the potential for PFAS contamination to affect the leachate originating from any of the landfills on site. And if PFAS contamination is inferred to affect the quality of the landfill leachate discharges, would you please consider incorporating relevant testing into the ongoing monitoring programme, which covers the untreated leachate from the East and West Landfills, as well as the combined discharge from the Northside Outfall. Additionally, would you please include PFAS in Section 9 ('Assessment of Effects') and Section C10.5 (Appendix C) of the ITA Report.	See Appendix B to this letter.
68				[Deleted]	N/A
69				No sediment sampling has been undertaken (e.g. in Ruakohua or Kahawai Streams, or other freshwater locations where sediment quality could be impacted). Applicant's freshwater ecologist is to provide their opinion on whether the freshwater environment could be included (not just marine sediments). Sediment monitoring could be used to reduce frequency of water quality monitoring for metals in future.	See Appendix B to this letter.

No.	Section 92 request (21 October 2021)	NZ Steel's response and cross references to relevant sections of the AEE and accompanying reports (25 November 2022)		Council confirmation / further clarification sought set out in Council's request letter (29 May 2023)	Response to further clarification sought – this consolidated response letter (12 April 2024)
		Report updates	AEE updates		
70				Samples are typically analysed on-site at NZ Steel lab (IANZ), but if the on-site lab is not accredited for certain tests samples are sent off-site to Hill Labs. Applicant is to provide a table showing the current detection limits and historical limits along with when they changed, and summarise which (if any) of the parameters were most affected (including discussion of how this impacts on compliance assessment/AEE findings).	See Appendix B to this letter.
71				Applicant has confirmed that discharge potentially containing leachate only goes to the marine environment. The NPS-FM may still apply due to Part 1.5 which states "This National Policy Statement applies to all freshwater (including groundwater) and, to the extent they are affected by freshwater, to receiving environments (which may include estuaries and the wider coastal marine area)." At minimum the applicant needs to include further discussion to either make the suggested assessment, or to justify not completing the assessment (in which case, they will need to demonstrate that the marine environment where the discharge occurs is not affected by the freshwater environment).	See Appendix B to this letter.

Yours sincerely

Jennifer Carvill
Technical Director - Planning

12-Apr-24
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Appendix A Coastal Birds Further Clarification Letter

Alliance Ecology™

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New Zealand Steel
Private Bag 92121
Auckland 1142

Attn: Amy Hill

Dear Amy,

This letter sets out my response to the matters raised pursuant to section 92 of the Resource Management Act 1991 (RMA) in relation to NZ Steel's Glenbrook Steel Mill water discharge reconsenting application (BUN60380974). Specifically, items 1A to 1F in respect of avifauna as stated in the letter from Jonathon Clarke to Jennifer Carvill 29 May 2023.

Question 1A:

They have not shown how the proposed methods of compensation (of which there are three options) will compensate for the increase in sedimentation and heavy metals in the environment. Proposed compensatory methods aim to increase the size of the areas of roosting for the coastal birds, however they will not decrease the amount of heavy metal bioaccumulation that is likely to occur from this discharge, as well as the increase in sediment and ongoing mangrove removal that would be required for their proposed methods due to the increase in sediment. The report is not clear on how the proposed package compensates for the effects of the proposed activity, and I suggest they go through each of Tim's points and directly address each one.

Response to Question 1A

- Efforts to avoid or minimise the increase in sedimentation and heavy metals in the environment that are associated with the proposed water discharges are set out in the Water Discharges and Industrial or Trade Activity Assessment (ITA Report)[1]. There are also proposed consent limits set out in the proposed conditions and NZ Steel has a continuous improvement philosophy. In accordance with the effects management hierarchy, ecological effects associated with the increase in sedimentation and heavy metals that cannot be avoided, minimised, or remedied must be offset where possible, or else compensated for.
- Residual effects associated with sedimentation and heavy metals cannot be quantitatively offset in an exact like-for-like manner because reducing sedimentation and/or heavy metal inputs elsewhere is not a feasible option. More specifically, the potentially "Moderate" effects on coastal birds cannot be quantitatively offset because:

[1] Tonkin & Taylor Ltd (2023) Water Discharges and Industrial or Trade Activity Assessment. Prepared for NZ Steel Ltd, March 2023. Appendix G to the Assessment of Environmental Effects.

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  - The impacts of sedimentation or heavy metal increase on ecological values is most likely to be sub-lethal and therefore very difficult to quantify; and
  - The most notable effect associated with the increase in sedimentation and heavy metals is on the local coastal bird assemblage, for which adverse effects are assessed as potentially 'Moderate'.
  - The degree of future benefits associated with the proposed habitat restoration and enhancement measures are also difficult to accurately quantify. In particular, coastal birds are highly mobile species and the outcomes will therefore be confounded by other factors occurring outside the compensation sites.
- Because effects on coastal birds cannot be quantifiably offset, residual effects on coastal birds are proposed to be managed by compensation. The compensation programme focusses on restoration and enhancement of foraging and roosting habitats for the same assemblage of coastal birds that is potentially impacted. Accordingly, all roost sites in close proximity to discharges, including from the Kahawai Stream, are proposed to be restored, and open sandflat/ mudflat foraging habitat maintained.
- Further details on how the proposed package compensates for effects of the proposed activity is set out in Section 8 of the Marine Ecological Effects report: 'Recommended Residual Effects Management and Monitoring'[2]. Further details on project impacts and expected compensation benefits are set out in Table 3.1 of the Draft Coastal Bird Biodiversity Compensation Model report (Appendix G of the Marine Report). This report and the application of a Biodiversity Compensation Model (BCM) was used to sense check and provide transparency on the type and quantum of compensation proposed.

Tim Lovegrove's points as referenced in Question 1A above were discussed with him on 15 September, 2021[3] with Dr Lovegrove's original memo and the follow up minutes to that meeting provided in Appendix A below. Dr Lovegrove's points/questions and our response to them are as follows:

- *s92 Question 1 from Dr Lovegrove: Do the 'Moderate' ecological effects and the 'Very High' EcIAG values allocated for coastal birds in the modelled mixing zone and wider zone of influence reflect the small proportions these birds form of wider Manukau Harbour shorebird populations?*

  S92 Question 1 Response: The 'Very High' EciAG values for coastal birds reflect the fact that some of the coastal birds are classified as nationally 'Threatened' as well as the overall diversity and threat status of birds present in the area. The small proportions of birds affected relative to the wider Manukau Harbour shorebird populations is addressed in the magnitude of effects assessment and is one of the reasons why the magnitude of effects has been assigned as 'Low', resulting in an

[2] Tonkin & Taylor Ltd (2024) Marine Ecological Effects Assessment. Prepared for NZ Steel Ltd, April 2024.
[3] Attendees included Tim Lovegrove, Matt Baber and Susan Jackson

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overall level of effect of 'Moderate', i.e., 'Very High' Ecological Value x 'Low' Magnitude of Impact.

- *S92 Question 2 from Dr Lovegrove: s92: The three counts at the Kahawai Stream roost (Bioresearches 2020) were all made on neap high tides. Apart from one mention of birds forced to move elsewhere on a 3.9m tide (Tonkin & Taylor 2021), are there any further observations of this roost on spring tides along with information on exactly where displaced birds go? This is relevant to the compensation package for providing alternative roosts and where they might best be located.*

  S92 Question 2 Response: We note that the question is addressed in Section 8.3 of the Marine Ecological Effects Assessment which states: "During a site visit on 15 April 2021 (high tide of 3.9 m), significant numbers of South Island pied oystercatchers and pied stilt were present at the Kahawai roost prior to high tide. Closer to high tide the birds were displaced and flew to grazed paddocks on the opposite side of the Waiuku Estuary." Additionally, on 10 March 2023 Matt Baber was onsite with a coastal engineer and a geotech engineer scoping options for the landward based Kahawai roost site. During a mid to mid-high tide around 160 godwits and approx. 210 oyster catchers (mostly South Island Pied Oyster Catchers) and 3 Caspian terns were present on the Kahawai roost. This was a Neap tide though it is key to note that the Kahawai roost site is not a high tide roost as it becomes inundated prior to most high tides and thus the birds must ultimately move to a higher tide roost on most if not all high tides. Matt Baber witnessed the birds flying off in groups and heading North-West. It was unclear where the birds were flying to with options including high-tide roost sites to the north or cropland/farmland areas and it is challenging to confirm where the birds go if they re-locate to far away areas. Taken together these observations indicate that there are currently no functional high-tide roosts in the immediate vicinity of Kahawai Roost now that the Waipipi roost is covered in mangroves and that restoration of Waipipi as a functional roost site and enhancement of the Kahawai roost is highly likely to benefit coastal birds. We consider the proposed landward roost site is also warranted based on both roost site potential and proximity.

- *s92 Question 3 from Dr Lovegrove: Is a draft of the Coastal Bird Management Plan available?*

  S92 Response: Yes this has now been prepared and is submitted with this S92 response.

- *s92 Question 4 from Dr Lovegrove: Will the Coastal Bird Management Plan recommend simultaneous provision of a range of roost options and what other alternative options have been considered?*

  S92 response. A range of roost restoration and enhancement options have been considered as well as mangrove management of intertidal mudflat/sandflat

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habitat; this is documented in Section 8.3 of the Marine Ecological Effects Assessment. The rationale around type and quantum of proposed compensation is set out in the draft Coastal Bird Management Plan and Biodiversity Compensation Model Report - Coastal Birds that has now been provided.

Question 1B:

The increase in mangrove cover is the result of upstream / catchment issues which will continue; therefore, mangroves will likely re-establish. Removal of mangroves does not automatically mean that the shell banks will return or that there will be more food abundance. In my opinion the applicant should provide research that indicates this to be true. From our site visit it was discussed that any future consent for mangrove removal would need to be 35 years in duration (same as the discharge consent) so that clearance is kept on top of.

Response to Question 1B:

- We agree that mangrove removal needs to occur for the same duration as the discharge permit authorises discharges, due to the potential for re-establishment. A 35-year consent has been sought for water discharges, accordingly, mangrove management is proposed for 35 years (or until the expiry of the water discharge consents – whichever occurs first).
- Existing shell banks will be exposed and therefore re-appear when mangroves are removed. This is based on site visits, available studies, and historic data in which shell banks were confirmed as still present underneath the mangroves that had recently colonised.
- There is a lack of definitive evidence of the effects on coastal avifauna of mangrove removal because to date, larger-scale mangrove removals have centred around improving recreational and amenity values in coastal environments. Assessments on the impacts and benefits for avifauna of mangrove removal have seldom been undertaken and where outcomes for avifauna have been considered, they have seldom been informed by scientifically rigorous monitoring. This issue was highlighted in a recent review by de Satgé, J.[4]. That said, it is evident that coastal birds that utilise open sand/mudflats for foraging do not use those habitat types once colonised by mangroves so on this basis we consider it highly likely that the proposed mangrove management will benefit coastal birds.
- Despite the lack of evidence focussed on avifauna effects, studies have indicated the restoration of open inter-tidal habitats, i.e., sandflats/mudflats is expected to benefit coastal wading birds. For instance, formal surveys in Pahurehure Inlet, Papakura (Don 2015)[5] found increases in both the abundance and diversity of

[4]De Satgé, 2021. Mangrove Management in Aotearoa New Zealand. A Birds Eye Review. Report prepared in association with the Office of the Prime Minister's Chief Science Advisor (OPMCSA) and the Human-Wildlife Interaction Research Group (HWIRG) at Massey University.

[5]Don, G.L. (2015). 2015 coastal bird survey of Pahurehure Inlet no. 2, Papakura. Bioresearches Group Limited.

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coastal bird species after clearance of some 27 hectares of mangrove forest, with species richness increasing from 16 species before clearance to 21 species after clearance. Notable species recorded only after mangrove clearance were kuaka (bar-tailed godwits; *Limosa lapponica*), and kōtuku ngutupapa (royal spoonbill; *Platalea regia*). However, in this study banded rail abundance was lower following mangrove removal. For the current project, the impacts associated with the loss of mangrove foraging habitat for banded rail is expected to be low given that mangrove management will be focused on younger mangrove habitat that are less important for banded rail. (This effect will be assessed in a separate mangrove management consent application).

- For this project there is good historical data on the abundance and composition of birds prior to mangrove encroachment, which strongly supports the conclusion that the birds would respond positively to mangrove management.
- As set out in the draft CBMP, a coastal bird monitoring programme is proposed that will help address the current information gap on the effects/benefits of mangrove management on coastal birds. This monitoring programme is therefore expected to provide benefits beyond this project.

Question 1C:

They have not decided on one particular option of compensation, they advise that "The below are indicative compensation actions that may each individually or collectively be proposed and outlined in the final BCP." To be able to review whether the effects of the proposed activity are appropriately compensated for, their proposed method of compensation needs to be confirmed. Can the applicant please respond with which action they are proposing to take forward in to the BCP.

Response to Question 1C:

Since providing the initial compensation options, further consultation with stakeholders has taken place, which include Iwi, DOC and members of the Ornithological Society of New Zealand (OSNZ). NZ Steel and its consultant team has also undertaken further geotechnical and coastal engineering work in relation to the proposed land-based coastal bird roost site that is currently being taken to concept design. Based on this further consultation, the compensation actions have been refined and updated as per the CBMP.

A separate resource consent application will be lodged with Council (anticipated before mid-2024) for the mangrove removal activities associated with the compensation package. The intention is that this separate resource consent application will be progressed in advance of the hearing for the reconsenting (the application to which this section 92 response relates), and will confirm the compensation proposal, with the intention that it aligns with the draft CBMP submitted with this response. The following are the compensation actions for which NZ Steel proposes to seek consent:

- Enhancement of the Waipipi and Kahawai roost sites through mangrove removal.

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- Mangrove removal within the wider intertidal foraging habitats that have experienced recent mangrove encroachment.
- Ongoing maintenance comprising semi-regular mangrove removal/seedling removal to maintain these areas as mangrove free.
- Creation of a land-based king high tide roost site within NZ Steel owned land directly adjacent to the coast.

Question 1D:

The three proposed options of compensation are likely to require resource consent both under the AUP, as well as the NES-FM (e.g., for mangrove or exotic tree removal). Removal of these habitats would be confounding and may not necessarily compensate for the effects of the discharge on coastal birds' diet. Whilst they are not guaranteed to get consent for any of the activities, they would need to apply for consent for their proposed method of compensation before the granting of this consent, as well as providing alternative compensation measures shall these consents not be granted. It should be noted that the area of mangrove is now considered wetland under the NES-FM and therefore removal of this habitat will in-turn require mitigation or offsetting for any loss. Please ask the applicant to update their application for all AUP/NES-F standards that are being infringed and provide an assessment of effects.

Response to Question 1D:

- Removal of mangroves and creation of a king tide roost site (which will require the removal of pine trees) are proposed as forms of compensation for the effects of the discharge on coastal bird's diet and improving roosting habitat in close proximity of foraging habitat.
- We acknowledge that aspects of the compensation package (e.g., mangrove and exotic tree removal) will require resource consent. An application for the compensation package is anticipated to be lodged before mid-2024. It is anticipated that this consent will be secured prior to the hearing of the current applications.
- The wetland provisions in the NES-FM were amended in January 2023 so they no longer apply in the Coastal Marine Area (CMA). As the area of mangrove is below MHWS (and wholly in the CMA), it is no longer considered wetland under the NES-FM.

Question 1E: They have not demonstrated that through these proposed measures of compensation that there will be a no-net loss in effects [preferably there would be a net gain]. They also have not addressed how they would demonstrate success of any of these compensation measures, or what the course of action will be if the new roosting areas are not a success. Tim Lovegrove mentioned in his s92 request that it is not always likely that a new/changed roosting area will be successful, hence he asked for suggestions of several areas. However, if these areas are not successful,

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the report has not discussed how the applicant will address failures and what other actions would then be put forward (noting additional consents may be necessary). The report should be clear on how the activities will be monitored, for how long, and the measures of success.

Response to Question 1E:

- Under the NPS IB 'Net Gain' is only relevant to biodiversity offsetting rather than biodiversity compensation. The current enhancement proposal is deliberately a compensation proposal rather than an offsetting proposal because the net loss/gain calculation required to establish offsetting cannot be determined with adequate precision (see the reasons stated in response to Question 1A above).
- The programme has been designed taking into account the NPS IB's biodiversity compensation principles (set out in Appendix 4 of the National Policy Statement for Indigenous Biodiversity (gazetted 7 July 2023)), which are similar to but differ from the biodiversity offsetting principles (Appendix 3)
- The key difference between biodiversity offsetting and biodiversity compensation principles in the NPS IB is that while the offsetting principles require the demonstration of net gain outcomes, the compensation principles instead require that the '*values to be lost through the activity*'…. '*are addressed by positive effects to indigenous biodiversity*'…'*that outweigh the adverse effects*'.[6]
- As set out in the draft CBMP (Section 5.3) monitoring is required to assess the effectiveness of the proposed compensation measures once implemented. This proposed monitoring will identify whether the compensation measures have successfully resulted in improvements to roosting areas and coastal bird species composition and abundance.
- If monitoring indicates that birds are not responding positively to the proposed compensation actions and if the reference monitoring indicates that this is due to factors that sit outside project related impacts, no contingency measures are proposed. Conversely, if monitoring indicates that expected net positive outcomes are due to issues with the proposed compensation, then a suitably qualified ornithologist will propose contingency recommendations and actions to be included in an updated CBMP for review by Auckland Council.
- The comment in Dr Lovegrove's memo that the presence of a roost site does not guarantee birds will come back, was in reference to a previously suggested landward roost site that is no longer being put forward. In response to Dr Lovegrove's inputs, roost site compensation efforts now comprise:
    - Formerly high value roost sites (Waipipi roost site - such value having been evidenced by historical data);
    - Existing but compromised roost sites (Kahawai mid-tide roost); and

[6] New Zealand Government, 2023. National Policy Statement for Indigenous Biodiversity

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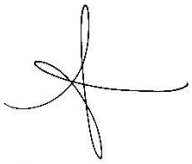
- A potential king tide roost site on the coastal edge and immediately adjacent to/within line of site from the Kahawai mid-tide roost, which would likely have been a roost site prior to colonisation by pine trees.

Ngā mihi | Kind regards,



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Appendix A: Tim Lovegrove's S92 questions and associated meeting minutes

Memo		30/7/2021
To:	Tracey Grant, Principal Project Lead, Premium Resource Consents	
cc:	Kala Sivaguru, Senior Coastal Specialist, Resource Consents	
From:	Tim Lovegrove, Senior Regional Advisor Fauna, Natural Environment Design	

Subject: **Assessment of effects on avifauna of renewal of consents to discharge stormwater and process water from Glenbrook Steel Mill to the CMA**

Background

New Zealand Steel Ltd operates the Glenbrook Steel Mill near Waiuku. NZ Steel holds resource consents that authorise the discharge of stormwater and process water from the Steel Mill to surface water and the Coastal Marine Area. The existing discharge permits expire on 31/12/21. NZ Steel is seeking to replace the discharge permits that authorise stormwater and process water discharges from the Steel Mill to freshwater and the CMA.

Brief summary of avifauna and assessment of effects

The Waiuku and Taihiki Estuaries adjacent to Glenbrook Steel Mill provide habitat for shorebirds including four 'Threatened' and nine 'At Risk' (Robertson *et al*. 2017) endemic and migratory species (Tonkin & Taylor 2021). The significance of this part of the Manukau is recognised in the Auckland Unitary Plan with a number of SEA-M1 and M2 overlays located in the Waiuku and Taihiki Estuaries. These include significant areas for wading birds, which provide foraging and roosting habitat for shorebirds, of which the most numerous are pied oystercatcher, bar-tailed godwit, lesser knot, pied stilt and white-faced heron. Other species occurring in smaller numbers include waterfowl, shags, variable oystercatcher, plovers, gulls and terns. Fringing mangroves and salt marshes provide habitat for banded rail and kingfisher.
Over the 35-year consent term within the mixing zone in the Waiuku and Taihiki Estuaries, the level of effect on coastal birds is 'Moderate' to 'High' due to their 'Very High' ecological value (Tonkin & Taylor 2021). The effects on birds are expected to be mainly due to longer term impacts on foraging habitat quality, driven by small increasing concentrations of zinc, and to a lesser degree copper, suspended sediment, and sedimentation rates (Tonkin & Taylor 2021).

s92 questions and general comments

<u>Weighting of key Threatened and At Risk species in the context of the wider Manukau</u>

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A reasonably diverse range of shorebirds comprising 20 species was observed in the zone of influence of the Steel Mill discharges in the Waiuku and Taihiki Estuaries (Bioresearches 2020). These included four Threatened and nine At Risk species (Tonkin & Taylor 2021). It is informative to place the numbers of Threatened and At Risk species observed here into context with the numbers that occur in the wider Manukau Harbour. Of the four species with the highest conservation status (i.e. Threatened), maximum counts in the intertidal zone near the Steel Mill were three wrybill, one banded dotterel, two Caspian terns and 140 knots (Bioresearches 2020).

A sample of Ornithological Society of New Zealand (OSNZ) shorebird count data over a 10-year period from 2009-2018 across the wider harbour shows the Manukau regularly supports an average of 1,929 (1,015-2,709) wrybills, 520 (147-1,076) banded dotterels, 147 (91-187) Caspian terns and 9,120 (6,477-11,513) knots. While not overlapping with the timing of the 2020-21 Bioresearches counts in the Waiuku and Taihiki Estuaries, these data provide a useful longer-term baseline for comparison. The Waiuku and Taihiki Estuaries are clearly of only minor importance for wrybill, banded dotterel and Caspian tern and they hold only about 1.5% of the Manukau's knot population. These four Threatened species all scored "Very High" EcIAG values (Tonkin & Taylor 2021), but these values don't reflect how small these counts are in the context of the Manukau Harbour as a whole. Larger numbers of At Risk bar-tailed godwit (290) and pied oystercatcher (320) were observed seasonally at the Kahawai Stream roost, and smaller numbers of these two species were observed feeding on the intertidal zone. The roost totals probably included birds from the wider Waiuku and Taihiki Estuaries, because they would have converged on the one available roost. From 2009-2018 in the wider Manukau Harbour, godwit counts averaged 13,856 (8,951-21,110) and pied oystercatcher 22,889 (15,926-27,692) (OSNZ shorebird count data). The numbers counted at the Kahawai Stream roost represent c.2% of godwits and c.1.4% of pied oystercatchers in the Manukau Harbour. As above for Threatened species, the two most common At Risk species counted in the Waiuku Estuary formed only a small proportion of the total of these species in the Manukau.
s92 Question: Do the 'Moderate' ecological effects and the 'Very High' EcIAG values allocated for coastal birds in the modelled mixing zone and wider zone of influence reflect the small proportions these birds form of wider Manukau Harbour shorebird populations?

<u>High tide roost at Kahawai Stream</u>

A significant shorebird roost exists on raised rock platforms on the point west of

the Kahawai Stream mouth. Up to 10 species were observed during three surveys at the roost including up 290 bar-tailed godwit, 80 knot, 100 pied stilt and 320 pied oystercatchers (Bioresearches 2020). The numbers using this roost suggests that birds converge on this site from the wider Waiuku and Taihiki Estuaries, and it is clearly an important roost in this part of the Manukau Harbour. Secure high tide roosts are scarce resources for shorebirds. Threats to roosts include human disturbance, domestic dogs, predatory mammals, invasive weeds, expansion of mangroves and coastal processes.

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While it is a valuable roost on smaller high tides, the Kahawai Stream roost does not appear to be tenable during big spring tides because birds were forced to move elsewhere on a 3.9m tide (Tonkin & Taylor 2021).

s92 Question: The three counts at the Kahawai Stream roost (Bioresearches 2020) were all made on neap high tides. Apart from one mention of birds forced to move elsewhere on a 3.9m tide (Tonkin & Taylor 2021), are there any further observations of this roost on spring tides along with information on exactly where displaced birds go? This is relevant to the compensation package for providing alternative roosts and where they might best be located.

Coastal bird compensation package

Measures to compensate for the effects of the Steel Mill discharges on coastal birds will be identified in a Coastal Bird Management Plan (CBMP), which is proposed as a condition of consent (Tonkin & Taylor 2021).

s92 Question: Is a draft of the Coastal Bird Management Plan available?

Provision of alternative roosts

As part of the compensation package (Tonkin & Taylor 2021), a range of options to be outlined in the Coastal Bird Management Plan for alternative roosts have been suggested:

- A land-based high tide roost sited on NZ Steel land
- A site in the Waiuku Estuary in the CMA
- Enhancement of the Kahawai Stream roost by clearing mangroves
- Supporting planned mangrove clearance projects around existing shell bank roosts at nearby Waipipi and Pollok Spit
- Alternative opportunities that may arise through further consideration

On the Mangere foreshore, a range of artificial roosts were created as part of coastal and foreshore restoration under consents for the Mangere Wastewater Treatment Plant Upgrade (Watercare Services Ltd. 2008). Despite high success with artificial roosts at former Ponds 3 & 4 of the Mangere Wastewater Treatment Plant, constructed roosts at former Pond 2 have been unsuccessful. There is no guarantee that all artificial roosts will be successful. Therefore, an adequate compensation package should include a range of roost options provided simultaneously. This will increase the chances that the birds will use one of them.

The highest chances of success are likely to be achieved at existing roosts enhanced by clearing surrounding mangroves. To ensure long term success, existing planned mangrove clearance by community groups at Waipipi and Pollok Spit (Beca Ltd 2021) should be supported by contract labour, and areas of mangroves already identified for clearing could be enlarged.

A land-based high tide roost site on NZ Steel land, ideally placed as close as possible to the Kahawai Stream roost, would be highly experimental with no guarantee that the birds would use it. Care will be needed in the choice of a suitable site. A terrestrial artificial roost

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will need to be large, the surface kept mown to c. 50mm or coated with a suitable substrate kept weed-free, have open sightlines and ongoing predator control, and minimal human disturbance.

A constructed roost in the CMA would be very expensive and would have engineering and long-term maintenance challenges. There is also no guarantee that consent would be granted for a new structure in the CMA.

s92 Question: Will the Coastal Bird Management Plan recommend simultaneous provision of a range of roost options and what other alternative options have been considered?

References

Beca Ltd. 2021. Manukau Harbour and Tāmaki Estuary Mangrove Removal. Ecological Impact Assessment prepared for Auckland Council. 8 June 2021.

Bioresearches Ltd. 2020. New Zealand Steel Limited. Environmental Monitoring of Discharge Receiving Environments 2020. Report for New Zealand Steel Limited.

Robertson, H.A.; Baird, K.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Miskelly, C.M.; McArthur, N.; O'Donnell, C.F.J.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2017. Conservation status of New Zealand birds, 2016. New Zealand Threat Classification Series 19. Department of Conservation, Wellington.

Tonkin & Taylor Ltd. 2021. Glenbrook Steel Mill Discharges. Marine Ecological Effects Assessment. Prepared for NZ Steel Ltd. June 2021.

Watercare Services Ltd. 2008. Project Manukau: Mangere Wastewater Treatment Plant bird roost management plan. Watercare Services Ltd, Auckland.

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From: Susan Jackson <SJackson@tonkintaylor.co.nz>
Sent: Friday, 24 September 2021 9:49 am
To: Tim Lovegrove <Tim.Lovegrove@aucklandcouncil.govt.nz>
Cc: Sara McMillan <SMcMillan@tonkintaylor.co.nz>; Matt Baber <MBaber@tonkintaylor.co.nz>; Tracey Grant <Tracey.Grant@aucklandcouncil.govt.nz>; Jonathon Clarke <jonathon.clarke@aucklandcouncil.govt.nz>
Subject: Summary and follow up from NZ Steel meeting - coastal birds

Mōrena Tim,

Thanks for the catch up with Matt and I last week.

As a brief summary and an FYI for the planning team I have made the following notes.

1. We covered the application of the EIANZ EcIA guidelines and the 'moderate' effect on coastal birds. As discussed, we will be updating our report to include contextual data on bird numbers in relation to the wider Harbour. While we do not expect this to change the overall level of effect, it will provide helpful context.
   Tim *– please can you forward through the details for the person to contact to request Manukau Harbour census data?*
2. We looked at the roost sites in the Waiuku Estuary, including the mid-tide roost adjacent to the Site (the Kahawai roost), Waipipi roost and Pollok Spit. We looked at aerials of the fields adjacent to Waipipi roost where birds were observed roosting at high tide when forced from the Kahawai roost.
3. We considered coastal bird compensation actions including high tide roost options and selective mangrove removal (young mangroves and seedlings). You also mentioned some low cost high tide roost options on NZ steel land including placement of mulch or ploughing the surface soil.
   As mentioned, we cannot include as compensation any actions (i.e. mangrove removal) that are already scheduled or currently taking place – this is additionality under biodiversity offsetting guidance.
   Tim *– please can you forward through a map of the mangrove sites currently scheduled for removal as part of the AC roost enhancement project.*
4. T+T have drafted a Coastal Bird Management Plan (CBMP) with limited details on the proposed compensation actions. We anticipate adding to the plan over the coming months in consultation with AC and NZ steel as we get further clarity on the actions most appropriate for the site and with higher confidence of success.

If you had any further notes or thoughts following the meeting please do send them through, or alternatively you can call Matt or I.

All the best,

Susan

Ngā Mihi | Kind regards,

Susan Jackson | Senior Aquatic Ecologist
MSc (Marine), MEIANZ
Tonkin + Taylor - *Exceptional thinking together*

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Appendix B ITA Further Clarification Letter

12 April 2024
Job No: 1010577.2000

New Zealand Steel
Private Bag 92121
Auckland 1142

Attention: Claire Jewell

Dear Claire

NZ Steel section 92
Responses to Further Clarification Questions

This letter sets out the responses to the matters raised pursuant to section 92 of the Resource Management Act 1991 (RMA) in relation to NZ Steel's Glenbrook Steel Mill water discharge reconsenting application (BUN60380974).

Table 1 below provides responses to the following questions as shown in red in the letter from Jonathon Clarke to Jennifer Carvill 29 May 2023 (Council's request letter):

- Questions 2A, 3G, 3I, 3J, 3K, 3L and 5A of the Industrial and Trade Activities (ITA) questions in Council's request letter[1].
- Questions 69, 70 and 71 related to water quality questions in Council's request letter[2].
- Questions 62, 63, 64, 65, 66 and 67 which are additional s92 further information requests as set out in Council's request letter.

We welcome the opportunity to discuss these responses with the appropriate specialists.

This letter has been prepared for the exclusive use of our client New Zealand Steel Limited, with respect to the particular brief given to us and in accordance with the scope of work set out in our letter of engagement dated 17 June 2019 and associated variations. We understand and agree that this letter will be used by Auckland Council in undertaking its regulatory functions in connection with the applications for water discharge replacement resource consents.

[1] As refined by email from Doug Fletcher to Sara McMillan dated 23 March 2023.
[2] As refined by email from Doug Fletcher to Mikayla Woods dated 14 April 2023.

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Tonkin & Taylor Ltd

Letter prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
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Principal Environmental Engineer	Project Director

12-Apr-24
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Table 1: Response to s92 further clarification questions as set out in Auckland Council's letter dated 29 May 2023.

Question		Response
Industrial and Trade Activity (ITA) Questions		
2(A)	Council supports the use of trigger investigation levels at the site but still has ongoing concern at the limited number of parameters with consent limits when compared to the previous consents. Even though past sampling may have demonstrated that many of the consent limits were in excess of actual sampling results the use of consent limits in conjunction with trigger investigation levels provides greater confidence to Council (and public/community) in ensuring adverse effects are appropriately managed. Please consider addition of further consent limits for key parameters of concern to the receiving environment.	Following on from the meeting with Council specialists and the updated S92 request relating to consideration by NZ Steel for a greater number of consent limit parameters, we have undertaken a review of possible effects-based consent limits that could be considered for the Northside and Southside outfalls. This sets out the basis for establishing consent limits for discussion. The approach proposed in the consent application uses lower trigger investigation levels as a tool to drive on-going improvements, in favour of higher consent limits which are set at a level that they are never or very rarely exceeded. While the trigger investigation level approach is still preferred and will be retained, we have considered whether establishing additional upper consent limits could be included alongside the proposed trigger investigation levels. The original application documents included consent limits for the Northside (NS) outfall discharge for Zinc concentration (total), Zinc load, TSS and pH, and a consent limit for pH for the Southside outfall discharge. To develop effects-based consent limits, we have evaluated the difference between the zinc levels in the NS outfall discharge and zinc levels in the outside extent of the mixing zone. The modelling undertaken by DHI has determined that the maximum extent of the mixing zone is linked to the zinc discharge (being the ANZ DGV 95th SPL (species protection level) for zinc), with the effects of other contaminants being lesser at that location. In other words, the maximum extent at which the concentration of other parameters would meet the 95th percentile SPL will be less than that for zinc. Applying the level of dilution for zinc will provide a conservative approach to setting upper consent limits for other parameters. Based on the Marine report, there is 13 fold difference between the discharge concentration and the ANZ DGV 95th SPL for zinc. Adding a further level of conservativeness, setting the upper consent limit for other contaminants at 80% of the zinc dilution factor would give a buffer between an exceedance of the upper consent limit and any actual effects on the receiving environment. This would equate to applying a 10 fold dilution factor to the 95Th Percentile SPL for other contaminants where there is a published ANZ DGV. For parameters for which there is no published ANZ DGV, there is no effects-based basis in setting an upper consent limit, and therefore limits are not proposed (but trigger levels will still apply). A summary of the different contaminants included in the proposed revised monitoring programme and the proposed upper consent limit where applicable is outlined in Table 1 below. As both the DHI Modelling and the basis of the ANZ DGV is associated with longer term chronic effects, we propose that the consent limits would be evaluated based on a 90-day average, as is currently proposed for zinc.

In addition to the proposed upper consent limits, we have evaluated the monitoring data for the period included in the ITA Assessment (from 2019 to 2021) to identify if the proposed upper consent limits are achievable. Where the limit is complied with over this data period, the cell is highlighted green. Based on the reporting period, the consent limits would be met for all contaminants (i.e., there would have been no consent limit exceedances).

Table 1: Summary of additional proposed upper consent limits

Contaminant	Proposed Additional Consent Limits (as a three monthly flow weighted average)	NS Mean (monitoring period 2019-2021)	SS Mean (monitoring period 2019-2021)
Aluminium	No DGV so no upper consent limit proposed		
Boron	No DGV so no upper consent limit proposed		
Cadmium	NS and SS: 0.055 mg/L	0.0035 mg/L	0.0035 mg/L
Chromium (CrIV)	NS and SS: 0.044 mg/L	0.0033 mg/L	0.0032 mg/L
Copper	NS and SS: 0.013 mg/L	0.0025 mg/L	0.0022 mg/L
Iron	No DGV so no upper consent limit proposed		
Lead	NS and SS: 0.044 mg/L	0.0098 mg/L	0.0098 mg/L
Nickel	NS and SS: 0.7 mg/L	0.0037 mg/L	0.0036 mg/L
TSS	SS: 15 mg/L	8 mg/L	4 mg/L

			Note: consent limit of 15 mg/L proposed in application at time of lodgement for NS, this remains unchanged. The same limit has been proposed for SS.		
		Zinc concentration	SS: 0.08 mg/L Note: consent limit of 11 mg/L proposed in application at time of lodgement for NS, this remains unchanged.	0.1 mg/L	0.008 mg/L
		Zinc load	Consent limit of 1 kg/day proposed in application at time of lodgement for NS only, this remains unchanged.		N/A
		pH	Consent limit of 6-9.5 proposed in application at time of lodgement for both NS and SS, this remains unchanged.		
		Note: Grey shading indicates information relating to parameters where consent limits were proposed in the application at the time of lodgement.			
3(G)	S4.6.1, pg 58 of the AEE states that once the MCY area is reinstated discharges will cease, however it is also stated that a vegetated filter strip will be constructed to provide treatment for any future ITA discharges. Is it intended that ITA discharges will recommence to the Kahawai Stream at a later time? Please provide further detail.	The remediation of the Metal Cutting Yard (MCY) has been completed with historical contaminated fill removed. There are no immediate plans for this area, however it is possible that the MCY will be used as an ITA area in future. Consequently, this area is identified in the application documents as potential Future ITA Area with the same approach to seeking approval for activities to be undertaken in the area as the other Future ITA Areas (see proposed Condition 13). Any potential controls and treatment will be determined based on the nature of the activities undertaken.			
3(I)	The method for establishing the proposed Trigger Investigation Levels is based on the previous 2 years of monitoring data (2019-2021). Please consider whether impacts of any reduced production at the site as a result of the COVID-19 pandemic through these two years means that the calculated Trigger	The draft triggers have been developed based on the monitoring period 2019 to 2021. During this time there was one partial shut down due to COVID-19. This was a 3-week shutdown during the first Level 4 lockdown in 2020 which was limited to the Steel Plant and finishing plants. However, operation of the Iron Plant continued (including iron plating) during this period. Given the Iron Plant Water Treatment Plant is one of the key process water sources, there were no periods within the 2019-2021 period where process water discharges ceased. In addition, discharges associated with stormwater runoff continued to occur during rain events. Consequently,			

	Investigation Levels may not be representative of normal conditions at the site. i.e. has reduced production at the site during these two years meant that the average concentration of contaminants discharging from the site was lower than normal? Does this also have any bearing on water quality trends and comparisons discussed in the draft WQMP and throughout other application documents?	NZ Steel considers that the 2019-2021 period provides data that is representative of normal plant operations and is appropriately representative to establish robust trigger investigation levels. Further, the draft conditions proposed by NZ Steel require the trigger investigation levels to be based on the previous two years of monitoring and therefore they would be updated on an ongoing basis during the life of any consent granted, which is consistent with NZ Steel's ongoing focus on continued improvement.
3(J)	Appendix F of the ITA report indicates that discharge system improvements/ additional treatments were implemented at the Steel Mill during the time of collecting data (2019-2021) for development of the draft trigger investigation levels. If production was lower/altered as a result of the COVID-19 pandemic during this time what evidence is there to demonstrate that these additional improvements/treatments made at the site during this time are working to improve discharge quality?	The improvements were primarily associated with the operation of the Iron Plant during operation and not due to COVID-19 shutdowns. This is confirmed with results continuing to be reduced even with the plant at full production. As outlined above, there was only a partial shut-down of three weeks with the site operating as normal throughout the remaining period.
3(K)	In NZ Steel's drive to demonstrate continual improvement in its activities and processes to reduce adverse effects further over time, it is noted that the proposed draft Trigger Levels (as per Attachment 5, Table 12 of the draft WQMP) for ITA monitoring sites are actually less stringent than existing trigger levels for several parameters. For example the proposed trigger level for Aluminium (total) is higher at seven out of eight sample locations when compared to the existing trigger level. Other parameters where sample locations have less stringent draft trigger investigation levels than existing trigger levels are boron (total), iron	The existing trigger levels for the current ITA Consent are set at 10 times the ANZECC 80% DGV. This was not based on any actual or site-specific data or effects-based criteria. For the new ITA consent that is sought, it is proposed that the trigger levels be based on the actual monitoring results and that the monitoring is focused on identifying elevated or high results to seek opportunities to reduce the peaks over time. The new approach allows for the lowering of the trigger levels over the consent period, as the peaks are reduced, the mean + 2SD will also reduce with a gradual reduction in the trigger levels (i.e., capture improvements within the trigger levels). While a number of parameters have higher trigger levels, the effects at existing levels have been assessed as less than minor and focusing on peaks is considered appropriate to achieve reductions over time.

	(total) and lead (total). Please demonstrate how these less stringent trigger levels are a move towards continual improvement in discharge quality.	
3(L)	Please consider and provide discussion on whether the following other potential contaminants could be contained within ITA runoff and/or process water discharging from the site - sulphates, PAH, PFAS (PFOS), solvents?	The activities at the site and potential contaminants have been identified in the ITA Report. In terms of the other potential contaminants raised in the question, we comment as follows: **Sulphates**: Sulphates may be present within the slags primarily in the form of Aluminum Sulphate, Calcium Sulphate and Magnesium Sulphate although they will be bound within the slag with no potential leaching. Therefore, it is not considered that sulphates are a key contaminant for the site. **PAHs:** The key sources of PAHs at steel mill sites are generally linked to the use of recycled scrap steel, where residual contaminants including PAHs maybe present. PAH's have now been included in the assessment with the introduction of external scrap associated with the proposed installation of an electric arc furnace (EAF). **Solvents:** In terms of potential solvents, the main sources of solvents would be from maintenance activities or small amounts of paint residue on recycled steel except for the paint line. Any waste solvent is taken off-site and stored securely. Any discharge of solvents would be negligible in terms of the overall volumes discharged from the site. **PFAS:** The main sources of PFAS from industrial sites is through the use of fire-fighting foams. The site does not currently use fire-fighting foams that contain PFAS. In terms of historic uses, this has been considered in the application for passive discharges which is currently being processed by Council (Council ref DIS60419815).
5(A)	What about in abnormal times when trigger and/or consent limits are exceeded, and ITA water needs to be diverted elsewhere on the site? Can manual, mobile contingency pumps be brought in? Or are there sufficient back up pumps already in place?	All ITA discharges from the site drain via gravity systems to the receiving environments. Pumping of water across the site is undertaken to both reduce the amount of water needed for the process (recycle systems) and to allow for pumping of water between different ponds on-site although the majority of movement of water around the site is focused on maximising water reuse. This is achieved via a combination of fixed systems as well as portable systems where required. In the event of a pump failure, there is a full-time engineering team on-site who can repair or replace pumps if necessary.
Water Quality Questions		
69	No sediment sampling has been undertaken (e.g. in Ruakohua or Kahawai Streams, or other freshwater locations where sediment quality could be impacted). Applicant's freshwater ecologist is to provide their opinion on whether the freshwater environment could be included (not just	An assessment of metal concentrations in superficial sediments (the top 20 mm) has historically been completed within the Lower North, Kahawai, and Ruakohua Streams. The result from this assessment provides a characterisation of the metal concentrations at the point in time of sampling and assisted in determining the likely level of effect from metals bound in sediment on the freshwater receiving environment (at that point in time). Results for this assessment are available and discussed within the freshwater report (see Sections 3.2.1.6, 5.3.5, 5.4.5 and 5.5; and associated appendices).

<table>
<tr><td></td><td>marine sediments). Sediment monitoring could be used to reduce frequency of water quality monitoring for metals in future.</td><td>On-going continual sampling of sediments within the receiving streams is not considered appropriate in determining what (if any) changes to the freshwater environment result from the discharges. Sampling of sediments is not fully representative of current discharges due to sediment readily moving through the system. Therefore, sampling of sediment may not provide a true representation of the state of metal concentrations derived from the current discharges in the sediment. In addition, the inclusion of a high-quality water quality sampling network will provide better resolution to any potential effects from the discharges than that achieved through sediment sampling.</td></tr>
<tr><td>70</td><td>Samples are typically analysed on-site at NZ Steel lab (IANZ), but if the on-site lab is not accredited for certain tests samples are sent off-site to Hill Labs.
Applicant is to provide a table showing the current detection limits and historical limits along with when they changed, and summarise which (if any) of the parameters were most affected (including discussion of how this impacts on compliance assessment/AEE findings).</td><td>Please find below a summary table showing the parameters monitored, the current and historical detection limits and the date the detection limit changed.

<table>
<tr><th>Contaminant</th><th>Current detection limit</th><th>Previous detection limit
(NC = No change)</th><th>Date detection limit changed.
(NC = No change)</th></tr>
<tr><td>Aluminium</td><td>< 0.1</td><td>NC</td><td>NC</td></tr>
<tr><td>Boron</td><td>< 1.0</td><td>NC</td><td>NC</td></tr>
<tr><td>Cadmium</td><td>< 0.0053</td><td><0.01</td><td>August 2020</td></tr>
<tr><td>Chromium</td><td>< 0.003</td><td><0.01</td><td>August 2020</td></tr>
<tr><td>Copper</td><td>< 0.003</td><td>NC</td><td>NC</td></tr>
<tr><td>Iron</td><td>< 0.02</td><td>NC</td><td>NC</td></tr>
<tr><td>Lead</td><td>< 0.02</td><td>NC</td><td>NC</td></tr>
<tr><td>Nickel</td><td>< 0.005</td><td><0.01</td><td>August 2020</td></tr>
<tr><td>Zinc</td><td>< 0.002</td><td>NC</td><td>NC</td></tr>
</table>

As shown in the table, the changes are limited to cadmium, chromium and nickel. As the changes reflect a reduction in the detection limit for these parameters, there is no impact on the assessment. Any analysis of data prior to August 2020 would have resulted in higher average and mean concentrations being reported due to the higher detection limit (with non-detect results reported as half the detection limit).</td></tr>
<tr><td>71</td><td>Applicant has confirmed that discharge potentially containing leachate only goes to the marine environment.</td><td>While the NPS-FM applies to the coastal marine area as a receiving environment where it is affected by freshwater, in this case the leachate discharge is direct to the marine environment and there are no discharges to any freshwater environments prior to the discharge. In addition, a full assessment of effects of the discharge</td></tr>
</table>

	The NPS-FM may still apply due to Part 1.5 which states "This National Policy Statement applies to all freshwater (including groundwater) and, to the extent they are affected by freshwater, to receiving environments (which may include estuaries and the wider coastal marine area)." At minimum the applicant needs to include further discussion to either make the suggested assessment, or to justify not completing the assessment (in which case, they will need to demonstrate that the marine environment where the discharge occurs is not affected by the freshwater environment).	from the Northside Outfall to the receiving environment has been undertaken including modelling of the discharges into the marine environment. See the Marine Ecological Effects Assessment (Appendix I to the AEE). As outlined in the application, leachate discharge originates from the two landfills which receive industrial wastes from the site. The landfill leachate contaminants are the same as those present in both process water and stormwater discharges from the site. In terms of the activity and discharges from the landfill, ammonia is the key contaminant included in the NPS-FM related to municipal landfill leachate but is not a contaminant that is associated with the New Zealand Steel landfill activities and therefore there will not be discharges of ammonia from the landfill leachate. While ammonia is a key leachate contaminant in municipal landfill, the nature of the material at a municipal landfill is significantly different to the steel mill wastes disposed of at the on-site landfills.
Additional s92 further information requests (does not stop the clock) – 20/01/2023		
62	Please provide a flow diagram to show drainage patterns around the coal yards and dewatering plant.	A hand marked up plan was provided to Auckland Council staff at the meeting on site on 14 March 2023 which we understood addressed this query. For the record, the following is a basic diagram based on that hand marked up plan which is intended to roughly replicate the plan that was discussed at the meeting.


North Drain
To NS Ponds

63	Please provide photos of the reinstatement works at the Metal Cutting Yard.	The photo below was taken 14 June 2023 demonstrating remediation works at the Metal Cutting Yard (MCY).  The MCY has been fully remediated (completed July 2023) and there are no ITA discharges currently to the Kahawai Stream. The photo below demonstrates that grass cover has established. 

64	Re Table 6, Appendix C of the ITA Report: The Zn concentrations do not seem to be included in the summary of the monitoring results for the West LF leachate, while there is a summary statement confirming Zn exceeds the relevant ANZ WQG (2018) criterion for the protection of 80% of marine water species. Would you please include Zn results in Table 6 of Appendix C. Also, would you please confirm whether the metal concentrations presented in Tables 5 and 6 in Appendix C are actually the 'total recoverable' results for the avoidance of doubt.	Table 6 has been updated to include zinc results. We confirm that all metal concentrations reported in Tables 5 and 6 are 'total recoverable'.
65	We understand the composition of the landfill leachate discharge is generally similar to the Steel Mill treated process water and the ITA stormwater discharge. However even though there is a comparatively small volume of landfill leachate discharging via the Northside Outfall (as discussed in C9.2.1 of the ITA report), as much as 55.3% of the annual contribution of aluminium to the Northside Outfall is attributed to the landfill leachate, so the discharge composition in this regard is significantly different. The high aluminium concentration must therefore be relevant to the ongoing use of aluminium (in a form of poly-aluminium chloride or other forms?) at the Wastewater Treatment Plant. Would you please clarify the inferred sources of aluminium within the landfill leachate discharge? Also, would you please provide a comment on the consideration of the use of alternative coagulation/flocculation agents (such as ferrous sulphate or others). Lastly, would you consider any remedial options	The assessment has focused on the overall effects of the discharges to the receiving environment from the Northside Outfall. In terms of the assessment, the key contaminants for marine effects have been identified as sediment, zinc and copper. This is due to both the high contribution from the site in terms of catchment loads and the large contribution from other sources into the receiving environment. As noted in the question, one of the key sources of aluminium in the discharges will be from the use of aluminium-containing flocculants to reduce discharges of sediment and heavy metals (including zinc and copper) from the site. Therefore, any measures intended to reduce aluminium (i.e. reduction in the use of flocculants) would likely result in an increase in other loads discharged from the site (and therefore increased effects within the marine environment). The other key source of aluminium will be from the iron sand itself which has naturally high levels of aluminium, meaning aluminium will be present in both raw materials (Primary Concentrate) and within the slags and wastes disposed to the landfill. At present, there is no marine guideline value for aluminium reported in the ANZ Guidelines due to the limited marine data and the fact that aluminium is a common and naturally occurring mineral within the marine environment. There was previously an interim low reliability number included in the 2000 ANZECC guidelines of 0.5 mg/L. The mean and median discharge from the northside ponds is 0.34 mg/L and 0.33 mg/L respectively which are both below the previous interim number. Therefore, there is no evidence that aluminium concentrations are at a level that would require investigation into additional remedial options and measures to reduce aluminium would have the potential to result in increases in the concentrations of other key contaminants including copper, zinc and suspended solids.

	aimed at reducing the total aluminium loading in the Northside Ponds and ultimately in the discharge to the receiving environment?	
66	Would you consider the change of the title of the ITA Report from 'Glenbrook Steel Mill – Water Discharges and Industrial or Trade Activity Assessment' into: 'Glenbrook Steel Mill – Water Discharges, Landfill Leachate Discharges, and Industrial or Trade Activity Assessment', or something along those lines. That way it would be more representative of its quality content, covering all those three aspects.	The application for consent relates to both the discharge of stormwater from Industrial and Trade Activity areas and from process water from a wide range of areas on site after mixing including the landfill leachate. It is not considered appropriate to specifically include Landfill Leachate Discharges within the title as the activity for which consent is sought does not include any direct discharge of landfill leachate (i.e. it is mixed with water from other sources prior to discharge). The report title as it stands therefore appears to be a better representation of its content.
67	We understand there is the potential for the off-site environmental receptors in the Waiuku Estuary and Manukau Harbour to receive PFAS (PFOS) contamination from the remaining residual (secondary) sources on site on the ongoing basis. Would you please provide clarification on the potential for PFAS contamination to affect the leachate originating from any of the landfills on site. And if PFAS contamination is inferred to affect the quality of the landfill leachate discharges, would you please consider incorporating relevant testing into the ongoing monitoring programme, which covers the untreated leachate from the East and West Landfills, as well as the combined discharge from the Northside Outfall. Additionally, would you please include PFAS in Section 9 ('Assessment of Effects') and Section C10.5 (Appendix C) of the ITA Report.	The main source of PFAS identified at the site is from historic use of firefighting foams (which are no longer used). No on-going activities have been identified as potential sources of PFAS, including the wastes going to the landfill, with the landfill comprising industrial wastes from the site as outlined in the assessment. At municipal landfills, PFAS are typically present in leachate as a result of PFAS in the incoming waste streams and incoming contaminated soils from sites contaminated with PFAS. Neither of these wastes are being received (or have been received in the past) at the NZ Steel landfill, with the waste originating from the steel and iron plants only and there being no specific sources of PFAS associated with those activities. Therefore, we do not consider that there is potential for new or additional PFAS contamination within the landfill leachate and therefore monitoring of PFAS is not required. As there are no sources of PFAS from the activity for which consent is sought, it would also not be appropriate to include an assessment of PFAS within either the ITA Report or the AEE report. These reports are focused on the key contaminants known to be present within the discharges from the site, rather than addressing contaminants that are not expected to be present. NB: the above response was also provided to Council (Andrew Kalbarczyk) on 27 January 2023.

Appendix C Updated HRA (2024) in response to Further Clarification Questions

REPORT

Tonkin+Taylor

Glenbrook Steel Mill Discharges

Screening Health Risk Assessment

Prepared for
New Zealand Steel Limited
Prepared by
Tonkin & Taylor Ltd
Date
April 2024
Job Number
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New Zealand Steel Limited	1 electronic copy
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Table of contents

Glossary of terms and abbreviations

Term	Definition
Air Consent, and Air Consenting Process	The term Air Consenting Process used throughout this HRA relates to an application to replace existing air discharge permits for the Glenbrook Steel Mill that was lodged on 23 April 2021 and granted by an Auckland Council hearing panel on 13 March 2023. This resource consent is referred to throughout this HRA as the Air Consent, and it is currently subject to an Environment Court appeal on the wording of conditions. Draft orders resolving this appeal by consent are currently being considered by the Environment Court.
AEE	Assessment of Effects on the Environment
COPC	Contaminant of Potential Concern
FSANZ	Food Standards Australia and New Zealand
HQ	Hazard quotient
IARC	International Agency for Research on Cancer
ITA	Industrial and trade activities
ITA Area	The ITA Area is the area of the Site from which the ITA stormwater is discharged. It includes all ITA activities and stockpiling landholdings, including provisional areas for potential future expansion. The area is bound to the north by Brookside Road and to the east by Mission Bush Road and to the west by the Waiuku Estuary. The ITA Area is depicted on Figure W7.
ITA stormwater discharges	Rainfall runoff from the ITA Area.
JECFA	Joint Food and Agriculture Organisation of the United Nations/WHO Expert Committee on Food Additives
Maximum Acceptable Value (MAV)	Allowable concentrations of contaminants in water that may be used by all members of the population all day, every day, for a lifetime without adverse effects on health.
NHMRC	Australian National Health and Medical Research Council
NZ TDS	New Zealand Total Dietary Survey
OEHHA	California Office of Environmental Health Hazard Assessment
Operational Area	Area within the wider NZ Steel landholdings that is used for Steel Mill operations. This area does not include areas that are farmed, or the area currently used as a landfill for waste materials generated at the Site.
PPRTV	Provisional Peer-Reviewed Toxicity Values - toxicity values derived by the US EPA for use in health risk assessments (primarily for the EPA's 'Superfund Program')
Reference Dose (RfD)	An estimate of a daily dose of a chemical for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Site	Includes all NZ Steel landholdings in relation to the Steel Mill at Glenbrook, which includes the Steel Mill, industrial landfills and farming activities as well as the adjoining coastal esplanade strip owned by Auckland Council.
Tolerable Upper Intake Level (UL)	The highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals in the general population.
US EPA	United States Environmental Protection Agency
WHO	World Health Organisation

1 Introduction

New Zealand Steel Limited (NZ Steel) currently holds a suite of resource consents that authorise the discharge of stormwater and process water[1] associated with the operation of the Glenbrook Steel Mill (Steel Mill). In June 2021, NZ Steel applied to Auckland Council to replace its existing consents to allow for the ongoing operation of the Steel Mill. This report has been prepared in response to the following request for further information from Auckland Council in relation to NZ Steel's application (letter dated 21 October 2021):

> *23. Please provide a health risk assessment report, which include but is not limited to the following aspects:*
>
> > *a. details of the sources of contaminants, potential exposure pathways including air, land and water (surface water, groundwater and marine), and potential receptors.*
> >
> > *b. contaminants of concern (relevant to human health) and concentrations in the exposure environment (based on real data or modelling), identification of information gaps.*
> >
> > *c. exposure assessment including cumulative exposure; and*
> >
> > *d. risk characterisation and discussions on uncertainties.*

2 Purpose

The purpose of this report is to set out a screening-level health risk assessment (HRA), using very conservative assumptions, to determine whether exposure to contaminants of potential concern associated with the discharges from the Steel Mill, via any individual exposure pathway or cumulatively, is likely to exceed acceptable levels. The outcome of this screening level assessment will determine whether a more detailed HRA is warranted.

Many of the contaminants of potential concern in the discharges from the Mill are also present in the receiving environment from other activities (for example stormwater run-off from roads) or because they are naturally occurring. The purpose of this assessment is to evaluate the individual and cumulative exposure effects of discharges from the Mill. It does not include an assessment of contaminants from other sources in the wider area.

The Council's request for information is specifically in relation to the application for consents related to the discharge of stormwater and process water. Discharges to air are not the subject of these applications and have been assessed through a separate consenting process. The effects of emissions of gaseous pollutants (such as oxides of nitrogen) and fine particulate matter via inhalation have been assessed through the Air Consenting Process. The one aspect of discharges to air that has been considered in this HRA (as well as in the Air Consenting Process) is exposure to metals that are bound to particulate matter discharged to air. This particulate matter can deposit onto soils and roofs and subsequently be ingested; therefore, it is necessary to consider the potential for cumulative effects with the same contaminants discharged to water. Potential exposure pathways related to discharges of metals to air (e.g. deposition onto roofs used to collect drinking water or soils used to grow vegetables) have been considered and the results are set out in Appendix B.

[1] The term 'process water' includes waste process water and landfill leachates.

3 Methodology

A diagram outlining the key elements of a health risk assessment is shown in Figure 3.1 (reproduced from enHealth, 2012).

The key elements of a health risk assessment are addressed in this report as follows:

- Identification of the key issues for the risk assessment based on the nature of discharges and the potential exposure pathways and potential receptors (Section 4);
- Identifying the Contaminants of Potential Concern (COPC) (relevant to human health) and appropriate toxicity factors (Section 5);
- Estimating the concentrations and exposure to contaminants (including cumulative exposure) via each of the potential exposure pathways, including the identification of information gaps and uncertainties (Section 6); and
- Characterising the overall risk associated with potential exposure to contaminants (Section 6).

As this is a screening HRA, screening toxicity factors (such as drinking water standards or reference dose concentrations for ingestion (RfDs)) have been used to assess the potential for health effects associated with each individual exposure pathway. For each COPC, the ratio of the concentration in the relevant media and the screening toxicity factor has been calculated. This is known as a hazard quotient (HQ). Internationally it is accepted that if a HQ is less than 1 it is considered an acceptable risk and less than 0.1 a negligible risk (WHO, 2010; enHealth, 2012).

In addition to non-cancer effects, some of the COPCs for this assessment are known to cause cancer. The risk of carcinogenic effects has also been considered in this screening HRA.

This report draws from NZ Steel's Assessment of Effects on the Environment (AEE) and technical assessments prepared to support NZ Steel's 2021 consent application, in particular:

- Water Discharges and Industrial or Trade Activity Assessment (Appendix G to the AEE for Discharges to Water);
- Freshwater Ecological Values and Effects Assessment (Appendix H to the AEE for Discharges to Water);
- Marine Ecological Assessment (Appendix I to the AEE for Discharges to Water); and
- Air Quality Assessment (Appendix F to the AEE for Discharges to Air)[2].

[2] The Air Quality Assessment was prepared for a separate resource consent application, which was approved by a Hearing Panel and is currently subject to an Environment Court appeal on the wording of conditions. Draft orders resolving this appeal by consent are currently being considered by the Environment Court. Consideration of exposure via air-related pathways are considered in this screening HRA for completeness.

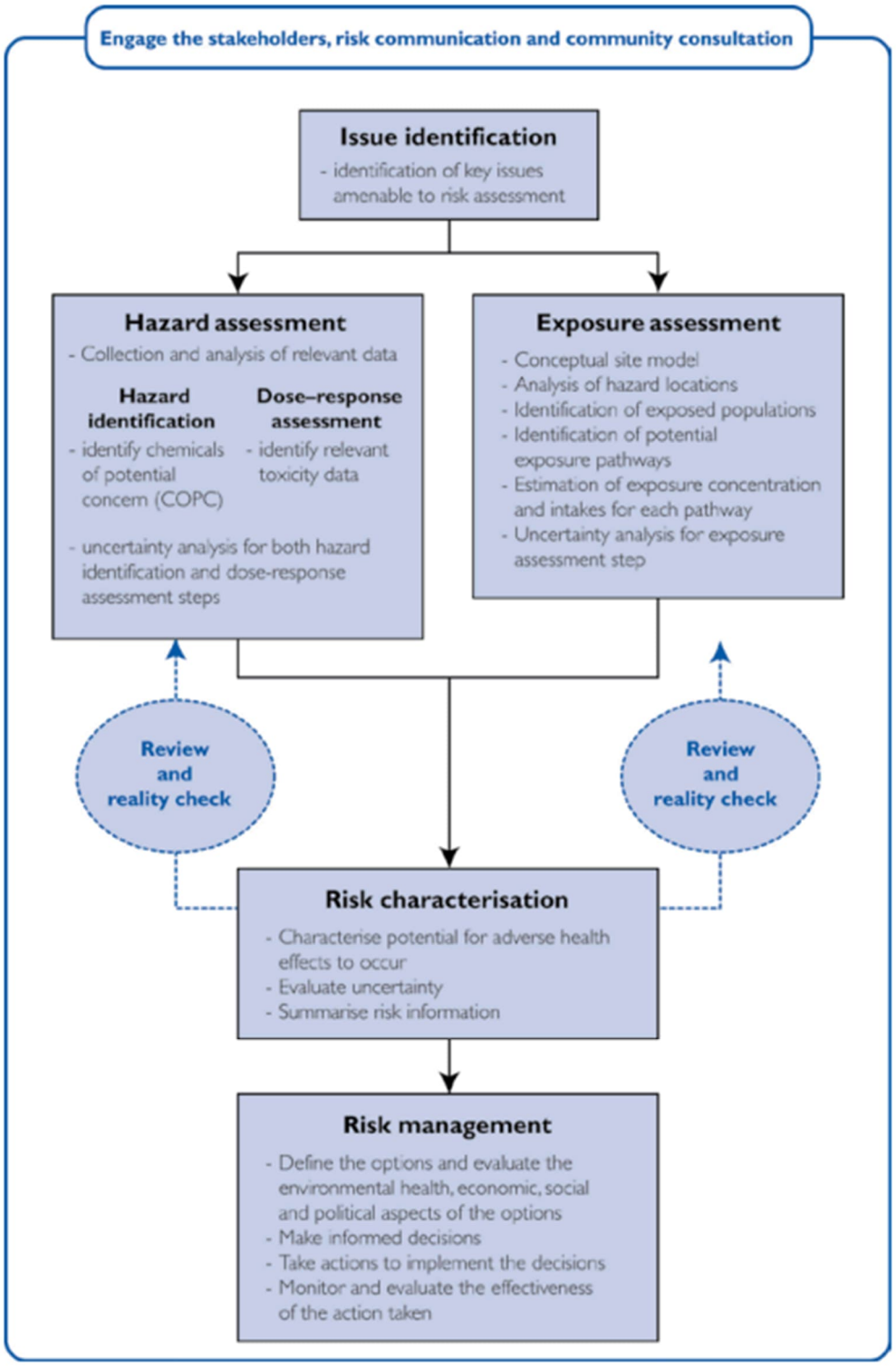

Figure 3.1: Environmental health risk assessment model (source: enHealth, 2012).

4 Conceptual site model

4.1 Introduction

This section describes the location and setting of the Steel Mill and the potential pathways of exposure and potential receptors for contaminants from the Steel Mill. These are also illustrated diagrammatically in the conceptual site model (CSM) shown in Figure 4.1.

It is noted that the CSM includes potential exposure pathways related to air discharges and inhalation. As discussed in Section 2, exposure to gaseous pollutants and fine particulate matter via inhalation were the subject of the Air Consent and are not considered further in this HRA, apart from cumulative effects with metals bound to particulate matter (see Section 6.3).

4.2 Site location and setting

The Steel Mill is located on the eastern bank of the Waiuku Estuary, at 131 Mission Bush Road, Glenbrook, Auckland (Site). The Steel Mill commenced operation at the Site in 1968 and, through various expansions, was operating as a fully integrated Steel Mill producing flat steel products by 1987. NZ Steel currently holds resource consents (Existing Consents) for the use of land and discharge of contaminants from an Industrial and Trade Area (ITA) and the discharge of ITA stormwater and process water from the Northside and Southside Outfalls and the Dewatering Plant.

NZ Steel owns approximately 550 ha of land at Glenbrook. The Steel Mill occupies an area of approximately 190 ha (see Figure W1, Appendix E of the Assessment of Effects on the Environment (AEE) and reproduced in Figure 4.2 below). NZ Steel's land to the north, east and south of the Steel Mill includes an operational landfill (the East Landfill) and two closed landfills (the North and West Landfills) with the remainder of the land grazed.

The area surrounding the Site is predominantly rural, comprising pastoral farming (particularly dairy farming), lifestyle blocks and horticultural activities (including kiwifruit orchards). The nearest township to the Steel Mill is Waiuku, which is approximately 2.3 km south of the Site. The Waiuku River is a long and relatively narrow tidal arm (estuary) of the Manukau Harbour (hereafter referred to as the Waiuku Estuary).

4.2.1 Site discharges - overview

The discharges from the Site include:

- Process water discharges from the Northside ITA Catchment to the Waiuku Estuary, which includes the Iron Plant, Steel Plant, (including the proposed EAF) and part of the Finishing Plants;
- Process water discharges from the Southside ITA Catchment to the Waiuku Estuary which includes the Rolling Mills and part of the Finishing Plants;
- Water discharges from the Dewatering Plant to the Lower North Stream;
- Discharges from ITA Areas, including stormwater, to the Waiuku Estuary, the Ruakohua Stream and North Drain (referred to as ITA stormwater discharges); and
- Leachate from the East and West Landfills.

The discharges from the operational and closed landfills are authorised separately under landfill-specific consents, apart from the leachate from the East and West Landfills which is pumped to the Northside Ponds.

4.2.2 Electric Arc Furnace

NZ Steel has secured co-funding from the NZ Government to enable the installation of an electric arc furnace (EAF) at the Site. The EAF is currently in the feasibility assessment stage, but if it goes ahead, it is anticipated that the EAF will be fully operational by 2027. The EAF will enable reduced use of virgin steelmaking materials (including ironsand and coal) and instead enable the production of steel by recycling of externally sourced scrap. Once the EAF is fully operational, only one of the current two ironmaking process lines will operate at any one time. Based on initial information, it is expected that contaminant loads, particularly for metals, in water discharges from the Site will generally reduce once the EAF is fully operational. However, to remain conservative (and given the consent applications seek to consent two scenarios being (a) the existing operations and (b) the operations with the EAF operating), any potential improvement in discharge quality has not been factored into this screening HRA.

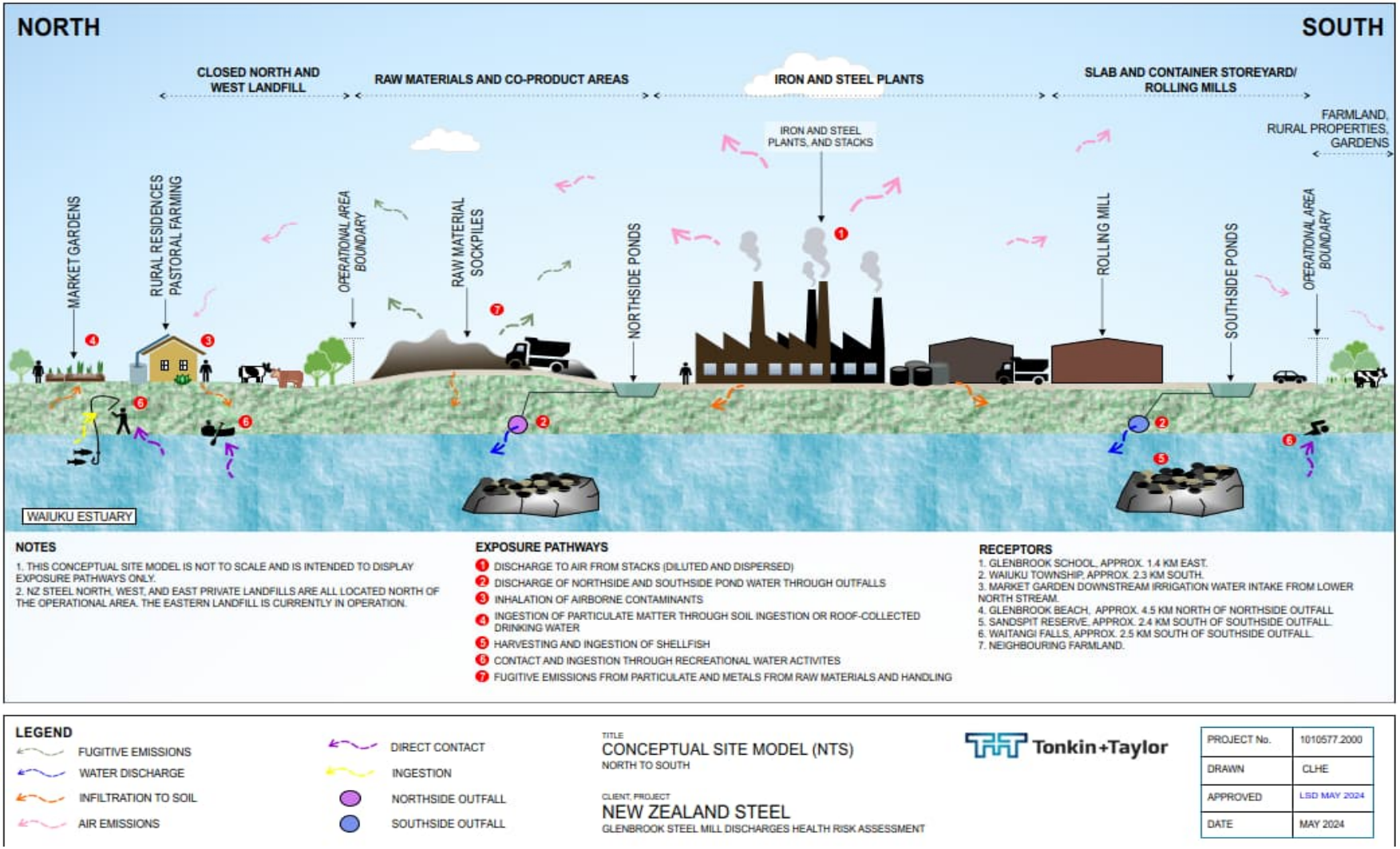

Figure 4.1: Conceptual Site Model for Discharges from NZ Steel Plant.

Figure 4.2: NZ Steel site location and wider context (reproduced from Figure W1 of the AEE Report).

Figure 4.3 Indicative Steel Mill Plant and Process locations (reproduced from Figure W7 of the AEE Report).

4.3 Potential exposure pathways for contaminants released to surface water

4.3.1 Sources of contaminants

The discharges of contaminants to water from the Site are described in detail in the various water-related technical reports of the AEE for Discharges to Water, particularly the Water Discharges and ITA Assessment (Appendix G of the AEE). NZ Steel undertakes regular water quality monitoring as required by its existing resource consents. The main discharges of stormwater and process water from the Steel Mill to the Waiuku Estuary are from the Northside and Southside Ponds. The Northside and Southside Ponds receive pre-treated process water and stormwater from areas where industrial and trade activities (ITA) are carried out. The ponds provide final polishing of process water prior to it being discharged. These treatment processes are described in detail in the ITA Assessment.

There are several other minor discharge points that direct stormwater from smaller areas within the Operational Area to streams, which ultimately discharge to the Waiuku Estuary. The North Drain (which drains to the Lower North Stream), and the Ruakohua Stream all receive stormwater from the ITA Area of the Site. The North Drain also receives the Ironsand Dewatering Plant process water discharge, which contains water abstracted from the lower Waikato River at Waikato North Head mine (Maioro).

The Northside and Southside Outfall discharges deliver a much greater water volume and contaminant load to the Waiuku Estuary than these other discharges.

In addition to the Steel Mill discharges, contributions to contaminant loads in the Waiuku Estuary include run-off from roads, earthworks, pastoral farming and horticulture, and discharges from the Waiuku and Clarks Beach Wastewater Treatment Plants.

4.3.2 Potential exposure pathways and receptors

There are a number of potential exposure pathways as shown in Figure 4.1 for contaminants discharged from site which are discussed below.

The downstream reaches of streams that receive ITA stormwater discharges are almost entirely within the boundary of the NZ Steel landholding. The exception is approximately 150 metres of the Lower North Stream which runs along the NZ Steel northern boundary with neighbouring farmland. There is no public access to the streams within the NZ Steel landholding and therefore there is minimal risk of members of the public coming into direct contact with the freshwater from the site.

Freshwater downstream of the NZ Steel discharges is not used for potable supply. The only potential downstream use that has been identified is the irrigation of the market garden on the NZ Steel landholding, which takes water from the Lower North Stream for irrigation. It is understood that most of the irrigation requirements for the market garden are met by water taken from a stormwater pond on the market garden site. Therefore, the use of water from the Lower North Stream for irrigation is likely to occur infrequently if at all.

An identified potential exposure pathway is via accumulation in soil and subsequent uptake by vegetables in the market garden. Contaminants may be present in soils in the market garden due to deposition of dust or from use of surface water for irrigation. A screening level assessment of exposure to contaminants in vegetables based on soil contaminant levels in the market garden is set out in Appendix B. Contaminant levels in soils at more distant rural residential receptors are expected to be lower than at the market garden because dust deposition rates will be lower and there is not the same potential for contaminants in irrigation water. Therefore, the assessment of soils at the market garden also addresses potential risks for exposure via homegrown produce at rural residential receptors.

Another potential exposure pathway is via marine water. The water-based activity with the greatest potential to result in ingestion of, or dermal contact with, water is swimming. The closest publicly accessible locations in the Waiuku Estuary to the discharge points of the Steel Mill where people are likely to swim are Sandspit Reserve (approximately 2.4 km south of the Southside Outfall), Glenbrook Beach (approximately 4.5 km north of the Northside Outfall) and Waitangi Falls (approximately 2.5 km south of the Southside outfall)[3].

The public could also be exposed to contaminants in marine water in the Waiuku Estuary through recreational activities, such as recreational boating, fishing and shellfish gathering (Mills, 2014). Different recreational activities have differing potential for contact with water. As there are no guidelines in New Zealand for chemical contaminants in recreational waters, the Australian recreational water quality guidelines are often used. The Australian National Health and Medical Research Council (NHMRC) classifies recreational activities by degree of water contact as follows (NHMRC, 2008, p 16):

- Whole-body contact (primary contact), where it is likely some water will be swallowed or inhaled, such as swimming, diving and surfing;
- Incidental contact (secondary contact), where only the limbs are regularly wet and swallowing water is unusual (e.g., occasional and inadvertent immersion), such as boating, fishing and wading;
- No contact (aesthetic uses), such as fishing from the shore or sunbathing.

According to the NHMRC it is unlikely that recreational water users will come into contact with concentrations of chemicals from industrial discharges high enough to cause adverse effects following a single exposure due to the dilution or attenuation of chemicals. They also consider that chronic exposure is generally unlikely to result in adverse effects at the concentrations in recreational water, and with the exposure patterns of most recreational water users. In this case, the nature of recreational activities in the vicinity of the Steel Mill (boating, fishing, wading, kayaking), has minimal risk of ingesting (accidentally drinking) appreciable amounts of water or significant dermal contact.

Historically, fish and shellfish were harvested from the Waiuku Channel. An area adjacent to the existing Steel Mill Southside Outfall, referred to as 'the Needles' by the Waitangi Tribunal, was designated as a Māori Oyster Reserve in 1901 (and still holds this designation). However, oyster populations in the Waiuku Estuary have reduced significantly over time (reports note that sedimentation processes were already affecting oyster beds in the 1940s prior to establishment of the Steel Mill). Evidence presented to the Waitangi Tribunal indicates that there is no longer a practice of collecting oysters from the Needles (Waitangi Tribunal, 1989. p 47). There is no harvesting of oysters for commercial purposes from this area. Therefore, any exposure to contaminants through the ingestion of oysters collected in the Waiuku Channel would be limited to recreational collection of the oysters. It should also be noted that access to the oyster beds is difficult and would be limited to low tides.

People can also be exposed through inhalation of contaminants discharged to air and deposition of dust affecting the quality of roof collected water. These have been addressed in the air discharge assessment and were considered through the hearing for the consent hearing for air discharges. For completeness, exposure to contaminants via these pathways have been included in the consideration of cumulative exposure to contaminants from the Steel Mill.

[3] The Waitangi Falls are in the lower reaches of the Waitangi Stream. Although the swimming hole is freshwater, the Estuary can be readily accessed.

4.4 Potential exposure pathways for contaminants released to groundwater

Since 1968, New Zealand Steel Limited (NZ Steel) has undertaken commercial operations and industrial activities at the Glenbrook Steel Mill. Soils containing elevated levels of contaminants can be a source of passive discharges (being longer term discharges from residual contaminants) to land and groundwater. NZ Steel carried out a Detailed Site Investigation which identified the potential that passive discharges at the site may exceed the permitted activity standards under Rule E30.4.1 (A6) of the AUP. NZ Steel applied for and was granted a resource consent to authorise passive discharge to land and diffuse discharge of contaminants to groundwater in November 2023[4]. The Assessment of Effects on the Environment (AEE) prepared for that consent application concluded that passive discharges from the Passive Discharge Site have no more than minor effects on the environment due to the relatively low levels of specified contaminants, and therefore, significant bioaccumulation is unlikely.

There is the potential for contaminants to be present in groundwater under parts of the Site. Groundwater under the Site will flow towards the Waiuku Estuary, there are no groundwater bores downgradient of the site and therefore no access of the public to potentially impacted groundwater. There are two groundwater bores on site that are used for potable water on site. These bores are located upgradient of the ITA and are not affected by site discharges. On site use for potable supply includes drinking water. NZ Steel has advised that they undertake testing to ensure the potable supply meets the Water Services (Drinking Water Standards for New Zealand) Regulations 2022 (*Regulations*)).[5] Therefore, although exposure to groundwater is a potential exposure pathway, the requirement that the water quality must meet the Regulations means that the risk to human health from exposure is minimal.

Deeper groundwater under the Site will discharge into the Estuary. Shallow groundwater will also flow into the Estuary but could also be intercepted by surface water. Any contaminants in groundwater will therefore form part of the contaminant concentrations measured in surface or marine water. As such, exposure to contaminants in groundwater is not considered to be a separate exposure pathway.

4.5 Uncertainties

Given the long-standing nature of the Steel Mill and the monitoring requirements of existing resource consents, NZ Steel has a comprehensive dataset of monitoring data, collected over decades. This includes the quantity and quality of discharges to water and air associated with the operations of the Steel Mill, including monitoring data in the respective receiving environments. Therefore, levels of contaminants in the receiving environment, that people could potentially be exposed to, are well-characterised, as outlined in the Assessment of Effects on the Environment.

5 Contaminants of Potential Concern

Discharges to water

As outlined in Section 9.4 of the ITA assessment, the key contaminants of interest in the discharges to water from the Site from a marine effects perspective have been identified as heavy metals, in particular copper and zinc, sediment, temperature and changes to salinity due to the volume of freshwater being discharged into the marine environment. Of those contaminants, the main contaminants of potential concern (COPC) from a human health perspective are metals.

[4] NZ Steel's resource consent authorising passive discharges (longer term discharges from residual contaminants) from contaminated land at the Steel Mill to land, air and water was granted on 20 November 2023.
[5] In accordance with the requirements set out in the Drinking Water Quality Assurance Rules 2022 (Taumata Arowai).

NZ Steel has been undertaking routine testing of the water discharges from the Site for the following metals:

- Aluminium
- Arsenic
- Boron
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Molybdenum
- Nickel
- Vanadium
- Zinc

These metals have been identified as being typical contaminants discharged to water from Steel Mill Operations. These metals have all been included as COPCs in this screening health risk assessment.

Mercury is also a COPC from iron and steel-making, principally in relation to discharges to air. The discharges from the site (to air and water) are not routinely monitored for mercury. To inform the applications for replacement resource consents for the Site, mercury levels have been measured in roof-collected drinking water in the vicinity of the Site, in soils used to grow food and in shellfish in the Waiuku Estuary. The assessment of roof-collected water and soils is presented in Appendix B of this report. The potential impact on shellfish and risk to human health through consumption are included in this HRA.

Electric Arc Furnace discharges to water

If installed, the EAF will reduce the use of virgin steelmaking materials (ironsand and coal) and provide for recycling of externally sourced ferrous scrap. Once fully operational, only one of the current two ironmaking streams would operate at any one time and this molten iron would be also fed into the EAF. Initial analysis suggests this change will result in the following changes when compared to current operations:

- Reduction of the amount of process water entering the Northside Pond by approximately 30 percent;
- Reduction of the associated contaminant load to the Northside Pond by approximately 40 to 50 percent; and
- Reduction of the process water discharge from the Dewatering Plant by up to 50 percent.

Based on the above, it is expected that metals contaminant loads and subsequent impacts on water quality and shellfish in the Receiving Environment will be considerably reduced from those adopted in this HRA once the EAF is fully operational. However, to remain conservative, any potential improvement in discharge quality has not been factored into this screening HRA.

The only new contaminant generating activity associated with the EAF will be stormwater runoff from the new external sourced ferrous scrap yards. The primary contaminants identified of interest for this discharge are Polycyclic Aromatic Hydrocarbons (PAHs), oils and grease. However, this runoff

will be treated through the installation of an at-source treatment train system which will remove and treat contaminants prior to discharge to the Northside Pond. Consequently, the ferrous scrap yard run off is not expected to increase the contaminant loads to the Northside Pond or impact on existing water quality. Further detail is provided in the ITA report (T+T 2024a, Appendix G of the AEE).

With the proposed treatment system, the discharge of PAHs is expected to be small. However, if consent is granted, it is recommended that PAHs be included in the monitoring of shellfish samples in the Waiuku Estuary. Monitoring for PAHs has been added to the stormwater monitoring programme which is discussed in detail within the Water Discharges and Industrial or Trade Activity Assessment Report. Such monitoring of PAHs in shellfish should be undertaken biannually over the first 2 years of operation – 3 samples per site. This sampling would provide information on the trends in PAH concentrations over time with the introduction of the EAF.

While there are no guidelines available in New Zealand or internationally that can be used to assess the potential health risk from ingestion of PAHs in food (and therefore an HRA for PAHs is not possible), the monitoring would enable the identification of any (albeit unexpected) PAH trends and support early detection and further assessment if necessary. The need for ongoing monitoring should be reviewed after the first 2 years. If the monitoring has not shown any increase in PAH concentrations over this period then monitoring could be stopped.

Discharges to air

As outlined in the Air Quality Assessment, the main contaminants of interest for discharges to air are fine particulate matter, gaseous combustion products and, to a lesser extent, metals and organic compounds (such as polyaromatic hydrocarbons). The effects of these discharges to air have already been comprehensively assessed in the Air Quality Assessment which supported the application for consent for discharge to air, which has been separately determined. However, because metals have been identified as COPC in the water discharges, they have also been considered in the screening HRA associated with discharges to air in Appendix B.

6 Exposure assessment

6.1 Introduction

This section describes the nature of exposure to contaminants in comparison with relevant screening-level assessment criteria.

6.2 Exposure to contaminants in water

6.2.1 Exposure concentrations

Water

Based on the magnitude of the discharge and potential for effects in the marine and freshwater environment, the main contaminants in the discharges to water are zinc and, to a lesser degree, copper. Both zinc and copper are essential trace nutrients and have a relatively low toxicity to humans at low concentrations. There is a range of other metals, present at lower concentrations in the discharges to water, that have higher toxicity and therefore a greater potential for effects on human health depending on the concentration in water.

NZ Steel collects and analyses daily grab and composite samples from the Northside and Southside discharges for a range of metals including those listed above. The Northside Outfall discharge generally contributes greater mass loads of contaminants to the Waiuku Estuary compared to the Southside Outfall discharge. The worst-case concentrations of contaminants at the point of

discharge have been estimated based on the 95th percentile of metals concentrations measured in the Northside Outfall (daily composite samples from 21 September 2019 to 31 August 2021).

Vanadium is a contaminant that is known to be associated with the steel-making process. It is not routinely monitored in the Northside and Southside Outfalls; however, it is monitored in the water discharges to the North Stream, which include the Dewatering Plant and ITA stormwater discharges. Monitoring was commenced at the North Stream site in July 2021. The worst-case concentration of vanadium at the point of discharge into the North Stream (Site 4) has been estimated based on the 95th percentile of data from the period July 2021 to July 2022.

As discussed in Section 4.3.2, the locations in the Waiuku Estuary where people are likely to swim are located some distance from the Site (over 2 km). To estimate worst-case concentrations of contaminants that people might be exposed to, the worst-case concentrations at the point of discharge have been divided by a factor of 10. This allows for a 10-fold dilution of the discharge with water in the receiving environment prior to the point of exposure (location where people might swim or undertake other water-based activities). This dilution factor is based on the AEE for Discharges to Water, which found that there was almost a 10-fold dilution between the point of discharge from the Northside Outfall and the edge of the 'zone of reasonable mixing' (300 m from the discharge point). Therefore, the actual dilution to locations where people are likely to swim will be significantly greater (i.e., contaminants will be more diluted) than assumed in this screening HRA.[6] As the Northside Outfall discharge contributes greater mass loads of contaminants to the Waiuku Estuary compared to the Southside Outfall discharge the risk estimates for the Northside Outfall discharge will represent the highest potential risk.

Shellfish

Shellfish collected from locations close to the Steel Mill discharges are considered to be the most sensitive indicator of potential contaminant exposure from harvesting and ingestion of seafood. Shellfish are not mobile and are therefore more likely to accumulate contaminants over time compared to fin fish species that are able to move in the environment.

NZ Steel undertakes annual shellfish monitoring for several parameters, including copper and zinc, at five monitoring sites around the Northside and Southside Outfalls, and a control site in the lower Taihiki Estuary (see Figure 6.1. This monitoring is described in Section 5.7 of the Marine Ecological Assessment (2021).

The five sites sampled around the Outfalls are:

- Site N6A approximately 50 m from Northside Outfall;
- Site N5 approximately 350 m south of Northside Outfall;
- Site N10 approximately 500 m north of Northside Outfall;
- Site S3A approximately 20 m from Southside Outfall; and
- Site S5A approximately 350 m south of Southside Outfall.

Sites N6A, N5, and S3A are within the existing consented mixing zone of the Northside and Southside Outfalls. Sites N10 and S5A are on the mixing zone boundary. The control site (site TC) is approximately 5.3 km north of the Steel Mill operational area in the Taihiki Estuary as shown in Figure 6.1. The control site is unlikely to be impacted by discharges from the Steel Mill due to its distance from the Site and location upstream of the Waiuku Estuary.

[6] This assumption of 10-fold dilution will be particularly conservative for the screening assessment of vanadium exposure, which is based on discharges into the North Stream. As such, for vanadium there will be initial dilution in the North Stream, followed by further dilution in the estuary before the point of exposure.

The samples collected by Bioresearches Ltd in 2020 at sites N6A, N10 and TC were analysed for an extended suite of metals to support this screening HRA (see Appendix A. The results are summarised in Table 6.1. Only copper and zinc monitoring data are available for sites N5, S3A and S5A (consistent with the monitoring requirements of the existing resource consent).

There is a range of potential sources that may contribute to levels of metals in shellfish in the Waiuku Estuary beyond the Steel Mill. As outlined in Section 2, the purpose of this screening HRA is to evaluate the potential health effects of discharges from the Steel Mill. To understand the extent to which the discharges from the Site impact on exposure to metals via shellfish ingestion, the concentrations in shellfish at N6A (and N10) have been compared to the concentrations at the control site, TC. All concentrations higher than the control site are highlighted in orange in Table 6.1. This highlights that discharges from the Site may increase exposure to zinc, cobalt, copper, vanadium and aluminium. Although cobalt is highlighted in Table 6.1 it is noted that cobalt concentrations are low and the concentration at N6A is only marginally higher than at the TC, possibly within the margin of error of the analyses.

The measured metals concentrations in shellfish samples collected from site N6A (50 m from the point of discharge from the Northside outfall) have been used in the screening-level assessment for ingestion. This is a very conservative approach to evaluating potential exposure as it is unlikely that shellfish would be harvested at this location for human consumption. This is due to fact that there is no easy access to the area for harvesting of the shellfish and the obvious presence of the Steel Mill discharge. Engagement with iwi and observations from NZ Steel have also not identified shellfish collection in this area.

Table 6.1: Contaminant levels in shellfish

Site ID [c]	Concentration (mg/kg, wet weight – average of 12 samples) [a]												
	Aluminium	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Vanadium	Zinc
N10	57.7	1.02[d]	0.10	0.30	0.04	28.4	0.04	3.33	0.03	0.07	0.24	0.19	248.6
N5						27.3							264.6
N6A [b]	36.2	0.80	0.09	0.28	0.05	27.7	0.03	2.88	0.02	0.06	0.22	0.29	587.3
S3A						31.0							242.4
S5A						30.2							261.9
TC (control)	53.6	1.49[d]	0.13	0.32	0.04	27.1	0.03	4.47	0.04	0.09	0.25	0.14	209.7

Notes:

a. All concentrations higher than the control site are highlighted in orange.

b. The average concentrations of chromium, molybdenum and nickel at N6A were skewed by a single outlier result. The values presented here, for all metals at N6A, are the average of the remaining 11 samples.

c. Sites N6A, S3A, and S5A were previously known as N6, S3 and S5 (in August 2010, Sites N6, S3, S5 and TC were moved and renamed).

d. The arsenic concentrations shown are for total arsenic. The FSANZ Maximum Level for arsenic of 1 mg/kg for shellfish applies to inorganic arsenic and not total arsenic. The NZ Total Dietary Survey (TDS) uses a value of 3% of total arsenic as inorganic arsenic in NZ Shellfish.

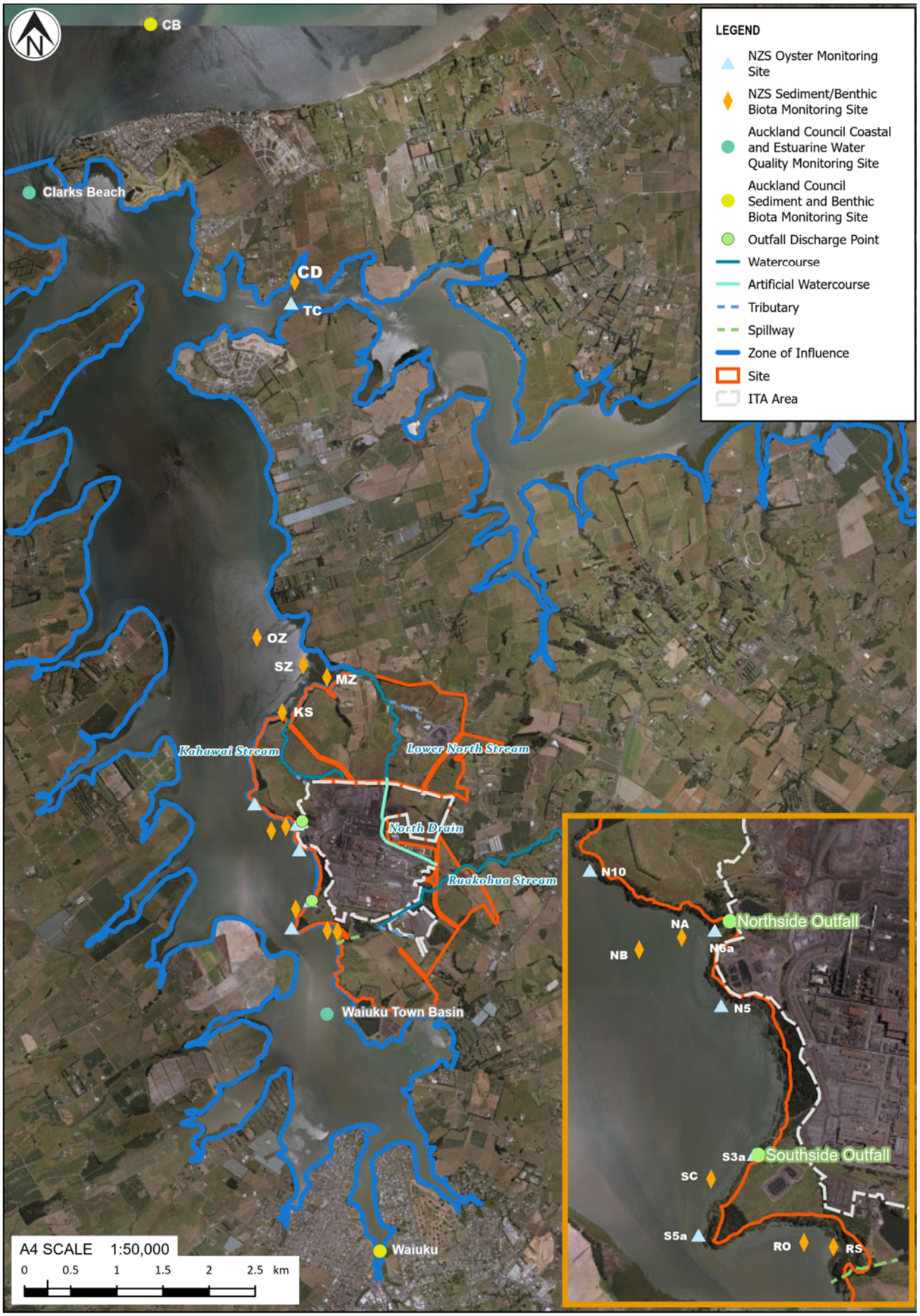

Figure 6.1: Location of shellfish monitoring sites (shown as pale blue).

6.2.2 Screening level assessment criteria

Water

As the potential direct exposure pathway for contaminants in water is during recreation, the most appropriate screening assessment criteria for concentrations in water in the Waiuku Estuary are recreational water quality guidelines. The New Zealand water quality guidelines for marine and freshwater recreational areas are only relevant to biological parameters such as E Coli and are not relevant to the contaminants of potential concern for the Steel Mill discharges. Screening criteria for recreational water quality have been determined by applying a 10-fold factor to the Maximum Acceptable Values (MAVs) set out in the Drinking-water Standards that are prescribed by the Water Services (Drinking Water Standards for New Zealand) Regulations 2022 (*Regulations*). This approach is in line with internationally recommended practice (NHMRC, 2008, p 150).

The MAVs prescribed in the Regulations are the highest concentration of a chemical in drinking-water that, on the basis of present knowledge, is considered not to cause any significant risk to the health of the consumer over 70 years of consumption of 2 litres per day of that water. Wherever possible, MAVs have been based on the latest World Health Organization (WHO) guideline values, adjusted to a body weight of 70 kg. The MAVs have been derived based on an assumed water intake of 2 L per day and therefore, the approach to deriving recreational water quality guidelines conservatively assumes that exposures during full contact recreational activities (swimming, diving) are 10 times lower (i.e., 200 mL per day every day, for a lifetime).

There are no New Zealand drinking water standards for iron or molybdenum. For this screening HRA the Australian Drinking Water Guidelines for these metals have been used. It should be noted that the iron drinking water guideline is based on aesthetics – taste and/or odour – rather than health. There are no health based drinking water guidelines from any international agencies for iron.

There are also no New Zealand or WHO drinking water guidelines for vanadium. For the purpose of this screening HRA, the notification level (investigative trigger level) of 0.05 mg/L set by the California Department of Public Health as part of their drinking water program has been adopted for this screening assessment.

Table 6.2 summarizes the adopted drinking water and recreational water screening criteria used in this screening HRA.

Table 6.2: Maximum Acceptable Values in drinking water and derived recreational water quality screening values

Contaminant	Maximum Acceptable Value (mg/L)	Source	Derived recreational water quality screening values (mg/L)[a]
Aluminium	1	WHO Drinking Water Guideline	10
Arsenic	0.01	Water Services Drinking Water Standards for New Zealand 2022	0.1
Boron	2.4	Water Services Drinking Water Standards for New Zealand 2022	24
Cadmium	0.004	Water Services Drinking Water	0.04

Contaminant	Maximum Acceptable Value (mg/L)	Source	Derived recreational water quality screening values (mg/L)[a]
		Standards for New Zealand 2022	
Chromium	0.05	Water Services Drinking Water Standards for New Zealand 2022	0.5
Copper	2	Water Services Drinking Water Standards for New Zealand 2022	20
[b]Iron	0.3	Australian Drinking Water Standard - Aesthetics	3
Lead	0.01	Water Services Drinking Water Standards for New Zealand 2022	0.1
Manganese	0.4	Water Services Drinking Water Standards for New Zealand 2022	4
[b]Molybdenum	0.05	Australian Drinking Water Guideline 2011, updated 2022	5
Nickel	0.08	Water Services Drinking Water Standards for New Zealand 2022	0.8
Vanadium	0.05 ‘	Californian Department of Public Health Notification Level	0.5
Zinc	3	Australian Drinking Water Guideline 2011, updated 2022	30

Notes:

a. Relevant source MAV x 10 as per NHMRC guidance.

b. No NZ MAV available. Have used the Australian Drinking Water Guideline.

Shellfish

The Food Standards Australia New Zealand (FSANZ) food standards are used as the default standards for exposure to chemical contaminants in foods.[7] For shellfish Maximum Limits (MLs) have been set for arsenic, lead, mercury and cadmium in shellfish. There are no FSANZ maximum limits applicable to zinc, copper, vanadium, aluminium, chromium, nickel and cobalt.

Two approaches have been used to assess the potential risk from exposure to metals in shellfish:

1 For lead, arsenic, mercury and cadmium, the metals for which FSANZ MLs are available, comparison of monitoring data with the MLs.

2 An assessment of dietary exposure through consumption of oysters for the metals that don't have FSANZ MLs.

The FSANZ MLs for lead, arsenic, mercury and cadmium in shellfish are show in Table.6.3.

Table 6.3: FSANZ Maximum Limits for Metals in Shellfish (January 2024)

Metal	FSANZ Maximum Limits in Shellfish and Molluscs (mg/kg)
Lead	2
Arsenic (inorganic)	1
Cadmium	2
Mercury	Mean 0.5 (mean of 5 samples) Maximum (1.5)[a]

Notes:

a. Requires that (a) both of the following are satisfied:

(i) 10 or more sample units are available;

(ii) the concentration of mercury in any sample unit is greater than 1.0 mg/kg.

For the assessment of dietary exposure, guidelines on acceptable consumption of the metal under consideration are required. In the absence of Australasian guidance, the United States Environmental Protection Agency (US EPA) chronic oral reference doses (RfD) (published in the US EPA Integrated Risk Information System) or Provisional Peer-Reviewed Toxicity Values (PPRTV) have been reviewed for use in this screening HRA. An RfD is an estimate of a daily dose of a chemical for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfDs apply to the assessment of non-carcinogenic risk.

Although the majority of chromium in the discharges from the Site is expected to be in the form of Cr (III), there is the possibility that a small amount may be present as hexavalent chromium (Cr (VI)). Cr (VI) is the more toxic form of chromium. Therefore, for the purposes of a conservative screening-level assessment, the RfD for chromium (VI) has been used as a screening criterion. Table 6.4 summarises the RfDs used in this screening HRA.

[7] See: Australia New Zealand Food Standards Code – Schedule 19 – Maximum levels of contaminants and natural toxicants, pursuant to the Food Act 2014.

Table 6.4: Screening level criteria for ingestion of shellfish

Contaminant	Oral Reference Dose mg/kg/day	Source
Aluminium	1	US EPA PPRTV
Arsenic (inorganic)	0.0003	US EPA Integrated Risk Information System
Cadmium	0.001	US EPA Integrated Risk Information System
Chromium (VI)	0.003	US EPA Integrated Risk Information System
Cobalt	0.0003	US EPA PPRTV
[a]Copper	0.04	US Drinking Water Action Level
Manganese	0.14	US EPA Integrated Risk Information System
Molybdenum	0.005	US EPA Integrated Risk Information System
Nickel (Soluble Salts)	0.02	US EPA Integrated Risk Information System
Vanadium	0.00007	US EPA PPRTV
Zinc	0.3	US EPA Integrated Risk Information System

a. There is no RfD for copper. The recommended value for use in risk assessments is the oral RfD of 0.04 mg/kg body weight/day derived by EPA from their Drinking Water Action Level. This value is based on acute gastrointestinal effects but is further supported by broader analysis of copper deficiency and toxicity. (Taylor et al (2023) Recommended Reference Values for Risk Assessment of Oral Exposure to Copper, Risk Anal. Feb;43(2):211-218).

6.2.3 Screening level exposure assessment

Water

Table 6.5 presents a comparison of the estimated concentrations in water at the point of exposure, which are conservatively assumed to be 10 times lower than the concentrations measured in the Northside Outfall (see Section 6.2.1), with the screening-level criteria. The estimated concentration at the point of potential exposure has been used together with the derived recreational water criteria to assess the potential risk from accidental ingestion of water during recreational activities in the estuary.

According to the WHO, if the HQ, which is the ratio of the concentration of the contaminant to the health-based criterion, is less than 1 then the potential risks to human health from that exposure is considered to be acceptable. It is only when the ratio is greater than 1 that potential risks to human health may be of concern and a more detailed assessment of risk is warranted. If the HQ is less than 0.1 the risk is considered to be negligible.

From the data shown in Table 6.5 it can be seen that all HQs are significantly less than 1 indicating that the potential risks to human health arising from ingestion to estimated concentrations of metals in the water in the Waiuku Estuary are acceptable, as defined by WHO. All HQs are below the negligible risk criteria.

Table 6.5: Screening level assessment of exposure to contaminants in water in the Waiuku Estuary

Contaminant	Recreational water screening-level criteria (mg/L)	Concentration in Northside Outfall (mg/L)	Estimated concentration at point of exposure (mg/L)	Hazard Quotient (HQ) (ratio of concentration at point of exposure to screening health guideline value) [c]
Aluminium	10	0.55	0.055	0.006
Arsenic	0.1	0.02	0.002	0.02
Boron	24	16.9	1.69	0.07
Cadmium	0.04	0.005[b]	0.0005	0.013
Chromium	0.5	0.005[b]	0.0005	0.001
Copper	20	0.007	0.0007	0.000035
Iron	3	0.72	0.072	0.024
Lead	0.1	0.01	0.001	0.01
Magnesium	2000	12.5	1.25	0.00063
Manganese	4	0.074	0.007	0.0018
Molybdenum	0.5	0.117	0.012	0.017
Nickel	0.8	0.005[b]	0.001	0.0013
Vanadium	0.5	0.15[a]	0.015	0.03
Zinc	30	0.263	0.026	0.0009

Notes:

a. Based on measurements in the North Stream. See discussion in Section 6.2.1.

b. Limit of detection (all measurements below the limit of detection).

c. All HQs are rounded to two significant figures.

Shellfish

As noted in Section 6.2.2 two approaches have been used to assess the potential risk from ingestion of metals in shellfish. For lead, arsenic, cadmium and mercury, the comparison with the FSANZ MLs is shown in Table 6.6.

Table 6.6: Comparison of Metal Concentrations in Oysters with FSANZ Maximum Limits in Shellfish/Molluscs

Metal	Maximum concentration in oysters (mg/kg)	FSANZ Maximum Limits in Shellfish and Molluscs (mg/kg)
Lead	0.04 (control site) 0.05 (NZ Steel sites)	2
Arsenic (inorganic)	0.04 (control site) 0.02 (NZ Steel sites)	1
Cadmium	0.15 (control site) 0.1 (NZ Steel sites)	2
Mercury	Mean values 0.04 (control site)	Mean 0.5 (mean of 5 samples) Maximum (1.5)[a]

Metal	Maximum concentration in oysters (mg/kg)	FSANZ Maximum Limits in Shellfish and Molluscs (mg/kg)
	0.03 (NZ Steel sites)	

The values shown in Table 6.6 show that the concentration of the metals, both at the control site and NZ Steel sites, are well below the FSANZ MLs for consumption of shellfish and molluscs. This shows that the oysters would be safe to eat.

For the metals that do not have FSANZ MLs, to compare with the RfD screening criteria, the concentrations of metals in shellfish need to be converted to a daily intake based on the average amount of shellfish a person would be expected to eat each day over their lifetime.

The maximum value of the measured metal concentrations in the oysters collected from any test site in the estuary has been used. This is a highly conservative assumption.

There is limited and conflicting data on shellfish consumption rates in New Zealand. The daily average calculated from the most recent New Zealand National Nutrition Survey data (2008–2009) is 85.1 g/day (Cressey, 2013 cited in Guy et al., 2021). However, a more recent survey of shellfish consumption in Northland found an average consumption rate of 4.8 g/day and 95th percentile consumption of 17 g/day or 6.2 kg/year (Guy et al., 2021). An average daily consumption of 85 g shellfish equates to an annual consumption of 31 kg, which seems exceptionally high. For the purposes of this screening assessment, the 95th percentile of shellfish consumption from the Northland study has been used.

It is noted that these dietary studies consider consumption of all shellfish, not just oysters. However, to ensure this assessment is conservative, it has been assumed that the entire estimated shellfish consumption comprises oysters. No differentiation has been made between oysters collected through recreation and those obtained commercially. As there is no commercial collection of oysters, or known recreational or cultural collection of oysters, from the area near the discharge from the Steel Mill this will also lead to an overestimate of the metal concentrations ingested. This is consistent with the conservative approach taken throughout this screening HRA.

As the RfDs (as with all acceptable daily intakes) apply to the total dietary intake of the metals, estimates of baseline dietary intakes must be included in the screening HRA. These have been taken from the New Zealand Total Dietary Survey (NZ TDS) for the contaminants of concern for the discharges from the Steel Mill. Table 6.7 shows the percentage of the RfD from consumption of oysters from the Waiuku Estuary and total dietary intake sourced from the NZ Total Dietary Survey. In all cases the total intake from all other dietary sources is below the RfD. The contribution from consumption of the oysters is a small fraction of the RfD. In many cases the contribution from the sites near the discharge from the Steel Mill are very similar to those observed at the control site.

The data shown in Table 6.7 show that the cumulative risk for the COPC from all dietary sources, based on information from the NZ TDS together with consumption of oysters in the Waiuku Estuary, are within acceptable levels.

Table 6.7: Screening level assessment of contaminants in shellfish

Contaminant	Location	Concentration in shellfish (mg/kg)	Estimated chronic exposure (mg/kg/day)	RfD (mg/kg/day)	% of RfD[c]
Aluminium	Control site	53.6	0.061	1	6.1%
	Maximum concentration across all NZ Steel sites	57.7	0.066		6.6%
	Baseline (NZ TDS)	31.5	0.016		1.6%
Arsenic (inorganic)[a]	Control site	0.04	0.00005	0.0003	17%
	Maximum concentration across all NZ Steel sites	0.03	0.00002		6.7%
	Baseline (NZ TDS)	0.08	0.00004		13%
Cadmium	Control site	0.1	0.0002	0.001	20%
	Maximum concentration across all NZ Steel sites	0.3	0.0003		30%
	Baseline (NZ TDS)	1.3	0.0006		60%
Chromium (assumes all Cr VI)	Control site	0.19	0.00003	0.003	1.0%
	Maximum concentration across all NZ Steel sites	0.3	0.00005		1.7%
	Baseline (NZ TDS)		0.0007		24%
Cobalt	Control site	0.04	0.00001	0.0003	2%
	Maximum concentration across all NZ Steel sites	0.05	0.00001		3%
	Baseline (NZ TDS)		No data		
Copper	Control site	27	0.004	0.04	11%
	Maximum concentration across all NZ Steel sites	31	0.005		13%

Contaminant	Location	Concentration in shellfish (mg/kg)	Estimated chronic exposure (mg/kg /day)	RfD (mg/kg/day)	% of RfD[c]
	Baseline (NZ TDS)		0.03		80%
Manganese	Control site	4.5	0.00073	0.14	0.52%
	Maximum concentration across all NZ Steel sites	3.3	0.00054		0.39%
	Baseline (NZ TDS)		0.1		75%
Molybdenum	Control site	0.09	0.000015	0.005	0.30%
	Maximum concentration across all NZ Steel sites	0.08	0.000013		0.26%
	Baseline (US DS)		0.0013		26%
Nickel (Soluble Salts)	Control site	0.25	0.000041	0.02	0.2%
	Maximum concentration across all NZ Steel sites	0.3	0.000049		0.25%
	Baseline (NZ TDS)		0.0023		11.5%
Vanadium[b]	Control site	0.14	0.00002	10.00007	29%
	Maximum concentration across all NZ Steel sites	0.28	0.00005		71.0%
	Baseline (NZ TDS)		na		na
Zinc	Control site	209.7	0.034	0.3	11%
	Maximum concentration across all NZ Steel sites	581.5	0.095		32%
	Baseline (NZ TDS)		0.147		49%

6.2.4 Evaluation of carcinogenic COPC

Some of the COPCs for this assessment are known to cause cancer. The ability of the substance to cause cancer is dependent on the route of exposure. The following COPC are classified as known carcinogens by international agencies:

- Arsenic – inhalation and oral (OEHHA, US EPA and IARC);
- Cadmium – inhalation only (OEHHA, US EPA and IARC);
- Chromium (VI) – inhalation only (OEHHA, US EPA); not classifiable via oral route;
- Nickel – inhalation only (OEHHA, US EPA); IARC does not specify route of exposure.

The other COPCs considered in this screening HRA have not been classified as human carcinogens. Therefore, carcinogenic risk to human health is not relevant for these contaminants.

Oral exposure pathway

Only one of the COPC for this assessment (arsenic) has been identified to cause cancer through the oral ingestion exposure pathway and therefore requires consideration of exposure via ingestion of water, shellfish or produce. It is noted that the discharges from the Site do not appear to have a material impact on arsenic levels in shellfish and arsenic concentrations in soils near the Site were well within typical background levels in Auckland.

The maximum arsenic level measured in oysters (0.03 mg/kg) is well below the Maximum Level for inorganic arsenic in shellfish established by FSANZ of 1 mg/kg. The concentration of arsenic in soil near the Site (0.41 mg/kg) is well below the soil contaminant standard for rural residential soils (17 mg/kg) set in the NES Soil[8]. The FSANZ Maximum Level and the soil contaminant standard for arsenic are both derived based on carcinogenic risk. Consequently, exposure to arsenic via ingestion of shellfish or produce is expected to present negligible cancer risk.

The concentration of arsenic at the point of exposure has been conservatively estimated to be 0.002 mg/L (2 µg/L). The US EPA has adopted a drinking water unit risk of 5×10^{-5} per µg/L, which includes an assumption that a person drinks 2 L/day every day over their lifetime (730 L per year). The screening level assessment set out in Section 6.2.3, assumes that a person may accidentally ingest 200 mL of water during recreational activities in the Waiuku Estuary. Given the brackish, unpalatable nature of water in the Estuary and the likely frequency of recreational activities, a conservative calculation would be to assume that a person accidentally ingests 200 mL of water 50 times a year (10 L or approximately 1% of annual drinking water). Based on this, the cancer risk associated with accidental ingestion of water during recreation is estimated to be 1×10^{-7} (0.1 in a million). JECFA (2011) concluded that adverse effects of inorganic arsenic in water and food would be difficult to detect in human populations if the level in water is less than 50 µg/L.

There is general agreement by international agencies including the WHO and US EPA that acceptable risk levels fall between 1 in a million (1×10^{-6}) and 1 in 100,000 (1×10^{-5}). These values apply to the incremental increase in risk from exposure to a chemical/pollutant and not total risk from all other risk factors (e.g., smoking). Incremental risk levels below 1 in a million are considered negligible. These criteria are also used in New Zealand in the assessment of incremental risk from contaminated land (MfE, 2011) and in Australia (enHealth, 2012; NEPC, 2013).

Applying these risk criteria to this screening HRA assessment, the predicted incremental lifetime cancer risk attributable to arsenic via accidental ingestion of water during recreation is one order of magnitude below the negligible risk criterion of 1×10^{-6}.

[8] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011

Inhalation exposure pathway

Cadmium, chromium VI and nickel are only carcinogenic through the inhalation exposure pathway, therefore accidental ingestion of water in the estuary and ingestion of shellfish will not pose a cancer risk from these contaminants and do not need to be considered further. The same applies to the ingestion of roof-collected drinking water.

An assessment of cancer risk from inhalation exposure to cadmium and arsenic is set out in the Air Quality Assessment (Section 7.4.2.2) which was the subject of the separate air discharge consent application (and is reproduced in this report in Appendix B). Chromium (total) and nickel were not included in the detailed risk calculations as measured concentrations in suspended particulate were effectively zero. The estimated cumulative risk from inhalation exposure to cadmium and arsenic is 1.5×10^{-6}, which is well below the acceptable risk levels.

Adding the estimated risks for arsenic exposure via accidental ingestion of water during recreation and inhalation gives a cumulative risk estimate of 1.5×10^{-6}, which is well below acceptable risk levels.

6.3 Cumulative impacts

The cumulative non-cancer risks associated with the impacts of emissions to air and discharges to water from the Steel Mill can be estimated by summing the HQs for each contaminant. The Steel Mill -related HQs are shown in Table 6.8 and have been calculated as follows:

1 Inhalation exposure – the ratio of the measured concentration of the metals reported in the Air Quality Assessment (Tonkin & Taylor, 2022) to the adopted air quality health based guidelines (see Appendix A). The concentrations of chromium and nickel were effectively zero and were not included in the calculation of the HQs. Empty cells in this column indicate that metal was not included in the analytical suite.

2 Incidental ingestion of water during recreation – the ratio of the estimated concentrations in recreational waters to the recreational water quality screening assessment criteria.

3 Ingestion of roof collected drinking water - the ratio of the estimated concentrations in roof collected drinking water to the screening assessment criteria for contaminants. The concentrations in drinking water reflect contributions from all sources, including windblown dust, roofing and plumbing materials. Only vanadium and manganese have been considered in the cumulative assessment because these are the only metals where there appears to be an influence of discharges to air from the Steel Mill (based on spatial patterns in deposition and concentrations in roof-collected drinking water).

4 Ingestion of shellfish – the ratio of calculated dietary intake derived from measured concentrations of metals in oysters from the estuary to the oral RfD values. Empty cells in this column indicate there was no oral RfD for this metal.

The individual HQs and Total HQ are shown in Table 6.8. All values have been rounded to two significant figures. All cumulative HQs are well below the acceptable risk criteria of 1. This means that the discharges to air and water from the Steel Mill do not pose an unacceptable risk to human health.

Table 6.8: Screening level assessment of cumulative effects

Contaminant	Hazard Quotient (HQ)				Sum of HQ
	Inhalation	Ingestion of water during recreation	Ingestion of roof-collected drinking water	Ingestion of shellfish	
Aluminium		0.0061		0.066	0.07
Arsenic (inorganic)	0.18	0.020		0.067	0.27
Boron		0.12			0.07
Cadmium	0.002	0.013		0.30	0.31
Chromium VI	-	0.0010		0.017	0.018
Copper		0.000035		0.013	0.13
Iron		0.036			0.024
Lead	0.006	0.010			0.016
Magnesium		0.00063			0.00063
Manganese	0.062	0.0018	0.03	0.0039	0.098
Molybdenum		0.017		0.0026	0.02
Nickel	-	0.0013		0.018	0.02
Vanadium	0.025	0.03	0.19	0.050	0.3
Zinc	0.018	0.0009		0.32	0.34

6.4 Uncertainties

Given the long-standing nature of the Steel Mill and the monitoring requirements of existing resource consents, NZ Steel has a comprehensive dataset of monitoring data, collected over decades. This includes the quantity and quality of discharges to water and air associated with the operations of the Steel Mill, including monitoring data in the respective receiving environments. Therefore, levels of contaminants in the receiving environment, that people could potentially be exposed to, are well-characterised.

The main uncertainties in this screening-level HRA relate to the magnitude of potential exposure. To address this uncertainty, a conservative approach has been adopted, including:

- Using the 95th percentile of measured concentrations in the discharge to water to represent the long-term average concentration;
- Assuming a minimal (10-fold) level of dilution of the water discharges between the point of discharge and the point of potential exposure;
- Assuming a large (200 mL per day) rate of incidental ingestion of water while swimming in the Waiuku Estuary;
- Ingestion of 95th percentile volume of oysters (6.2 kg per year) collected from a location approximately 50 m from the Steel Mill water Northside discharge outfall; and
- Using airborne metals concentrations measured within the Site boundary to represent concentrations at more distant residential receivers.

Based on the above, this screening-level assessment is considered very conservative and would overestimate the magnitude of exposure. This conservatism more than addresses uncertainties, including in relation to the magnitude of exposure.

7 Conclusions

This report sets out an assessment of the potential for discharges to water and air from the Steel Mill to impact on human health, in response to a request from Auckland Council for further information.

The assessment uses a screening level approach that addresses the potential pathways for migration of contaminants and subsequent human exposure. No risk issues of concern relevant to the off-site community were identified on the basis that:

- All predicted (worst-case) concentrations in water and air, at the point of exposure, are below screening level guidelines protective of uses of water and air, respectively;
- Measured concentrations in shellfish and in roof-collected drinking water are below screening level guidelines for safe consumption; and
- Soils in areas of the Site that are used to grow vegetables commercially are considered safe for growing vegetables for household consumption in New Zealand.

As the screening assessment has shown that all contaminants are below acceptable guideline levels, a detailed HRA is not required. The screening assessment has used highly conservative consumptions that will lead to an overestimate of risk arising from discharges to water from the Steel Mill.

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9 Applicability

This report has been prepared for the exclusive use of our client New Zealand Steel Limited, with respect to the particular brief given to us under the terms set out in our letter of engagement dated 26 March 2019. It may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Auckland Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

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Appendix A Metals concentrations in shellfish

Table Appendix A.1 : Metal concentration in shellfish flesh at Site N5 (mg/kg wet basis)

Site	Vial No.	Cu	Zn
N5	040	30.40	328.00
N5	070	30.26	249.20
N5	064	21.56	269.50
N5	063	28.80	288.00
N5	043	26.35	229.50
N5	029	27.60	239.20
N5	021	28.38	275.20
N5	003	23.76	228.80
N5	044	37.20	306.90
N5	030	31.31	303.00
N5	049	22.68	260.40
N5	008	19.00	197.60
N5	Mean	27.28	264.61
N5	sd	4.98	37.98
N5	CL	3.16	24.13

Table Appendix A.2 : Metal concentration in shellfish flesh at Site N6A (mg/kg wet basis)[a]

Site	Vial No.	Al	As	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Vn	Zn
N6A	036	38.40	0.752	0.112	*0.272*	0.045	32.80	0.028	3.040		0.080	0.232	0.280	552.00
N6A	068	31.60	0.600	0.079	0.261	0.043	29.23	0.032	2.291	0.028	0.073	0.316	0.269	489.80
N6A	024	28.12	0.644	0.081	*0.274*	0.051	21.46	0.019	2.738		0.044	0.170	0.244	451.40
N6A	067	33.06	0.757	0.083	0.296	0.046	26.97	0.030	2.784	0.023	0.077	0.287	0.226	539.40
N6A	045	32.90	0.686	0.091	1.470[b]	0.062	27.30	0.021	2.940		0.259	1.190[b]	0.252	518.00
N6A	053	35.26	0.902	0.123	*0.238*	0.056	38.54	0.037	2.132	0.026	0.055	0.148	0.303	721.60
N6A	006	40.89	0.957	0.096	*0.270*	0.064	28.71	0.038	2.871		0.062	0.157	0.331	678.60
N6A	061	32.93	0.765	0.098	*0.240*	0.063	26.70	0.032	2.314	0.022	0.045	0.214	0.294	712.00
N6A	011	39.39	1.111	0.084	*0.293*	0.056	21.21	0.033	3.434		0.080	0.162	0.303	666.60
N6A	023	40.92	0.614	0.091	0.316	0.063	24.18	0.029	4.092	0.027	0.068	0.353	0.307	604.50
N6A	066	34.04	0.740	0.089	*0.222*	0.044	21.46	0.025	2.886	0.021	0.038	0.155	0.259	444.00
N6A	004	44.08	0.912	0.106	0.350	0.059	33.44	0.027	3.116		0.084	0.251	0.334	600.40
N6A	Mean	35.97	0.787	0.094	0.375	0.054	27.67	0.029	2.887	0.025	0.080	0.303	0.284	581.53
N6A	sd	4.71	0.155	0.013	0.347	0.008	5.34	0.006	0.532	0.003	0.058	0.288	0.034	97.76
N6A	CL	2.99	0.098	0.009	0.220	0.005	3.39	0.004	0.338	0.003	0.037	0.183	0.022	62.11
Average excluding outlier		36.24	0.796	0.095	0.276	0.054	27.70	0.030	2.882	0.025	0.064	0.222	0.286	587.30

Notes:

a. Values in grey italics are calculated from limit of detection.

b. This value is considered an outlier value as it is abnormally high compared to the other measurements for this contaminant.

Table Appendix A.3 : Metal concentration in shellfish flesh at Site N10 (mg/kg wet basis)

Site	Vial No.	Al	As	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Vn	Zn
N10	018	60.90	0.956	0.103	0.389	0.047	34.65	0.042	3.255	0.023	0.086	0.368	0.200	346.50
N10	050	72.80	1.098	0.123	0.246	0.047	31.36	0.045	3.920	0.029	0.048	0.157	0.202	268.80
N10	055	52.00	1.144	0.094	0.229	0.051	35.36	0.041	3.120	0.023	0.054	0.208	0.166	280.80
N10	012	57.12	1.120	0.123	0.302	0.049	31.36	0.039	3.360	0.039	0.072	0.246	0.213	268.80
N10	072	65.34	0.990	0.089	0.238	0.042	18.81	0.043	3.366	0.020	0.055	0.238	0.208	168.30
N10	015	84.00	1.128	0.106	0.300	0.056	32.40	0.052	3.720	0.036	0.054	0.276	0.228	252.00
N10	046	39.20	0.829	0.097	0.246	0.036	25.76	0.032	3.024		0.056	0.168	0.157	235.20
N10	020	42.57	0.990	0.098	0.446	0.032	19.80	0.026	2.574	0.022	0.109	0.366	0.188	188.10
N10	002	46.87	0.818	0.100	0.316	0.046	28.34	0.045	3.488		0.066	0.240	0.153	250.70
N10	069	71.68	1.120	0.100	0.258	0.044	33.60	0.049	3.584	0.021	0.049	0.224	0.258	268.80
N10	056	53.55	0.987	0.093	0.242	0.039	28.35	0.038	3.255	0.027	0.050	0.116	0.147	231.00
N10	058	45.92	1.019	0.083	0.370	0.036	21.28	0.032	3.248	0.026	0.088	0.291	0.179	224.00
N10	Mean	57.66	1.016	0.101	0.298	0.044	28.42	0.040	3.326	0.027	0.066	0.241	0.191	248.58
N10	sd	13.69	0.112	0.012	0.070	0.007	5.81	0.007	0.346	0.006	0.019	0.077	0.033	45.79
N10	CL	8.70	0.071	0.008	0.045	0.005	3.69	0.005	0.220	0.005	0.012	0.049	0.021	29.09

Table Appendix A.4 : Metal concentration in shellfish flesh at Site S3A (mg/kg wet basis)

Site	Vial No.	Cu	Zn
S3A	054	29.11	220.10
S3A	017	33.84	282.00
S3A	013	32.30	247.00
S3A	047	33.95	252.20
S3A	032	27.54	226.80
S3A	031	28.86	266.40
S3A	028	27.30	182.00
S3A	022	29.10	213.40
S3A	062	37.05	275.50
S3A	025	32.67	247.50
S3A	007	36.40	318.50
S3A	010	23.92	176.80
S3A	Mean	31.00	242.35
S3A	sd	3.98	41.24
S3A	CL	2.53	26.20

Table Appendix A.5 : Metal concentration in shellfish flesh at Site S5A (mg/kg wet basis)

Site	Vial No.	Cu	Zn
S5A	005	24.96	228.80
S5A	027	28.52	223.20
S5A	001	34.32	249.60
S5A	034	31.90	286.00
S5A	014	31.25	262.50
S5A	038	41.81	384.20
S5A	060	25.96	236.00
S5A	035	29.28	244.00
S5A	059	35.70	295.80
S5A	026	24.32	230.40
S5A	009	28.98	264.60
S5A	019	25.99	237.30
S5A	Mean	30.25	261.87
S5A	sd	5.12	44.75
S5A	CL	3.26	28.43

Table Appendix A.6 : Metal concentration in shellfish flesh at Control Site (TC) (mg/kg wet basis)

Site	Vial No.	Al	As	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Vn	Zn
TC	037	40.66	1.284	0.118	*0.300*	0.040	17.12	0.026	3.852		0.070	0.128	0.118	149.80
TC	042	51.84	1.512	0.102	*0.248*	0.040	20.52	0.033	4.752		0.064	0.162	0.130	162.00
TC	041	42.40	1.590	0.103	*0.297*	0.035	24.38	0.030	5.088		0.080	0.244	0.106	190.80
TC	052	55.80	1.302	0.149	*0.260*	0.047	34.41	0.032	4.185	0.031	0.072	0.140	0.140	288.30
TC	016	64.05	1.890	0.116	*0.294*	0.055	24.15	0.029	4.830	0.049	0.116	0.242	0.147	168.00
TC	033	43.70	1.140	0.162	0.295	0.044	25.65	0.024	3.800		0.105	0.247	0.152	199.50
TC	048	40.85	1.330	0.114	*0.247*	0.038	33.25	0.030	3.610	0.045	0.087	0.171	0.114	247.00
TC	039	66.12	1.392	0.197	0.348	0.049	29.00	0.045	5.220		0.080	0.290	0.186	255.20
TC	057	48.72	1.740	0.128	*0.278*	0.042	30.16	0.031	4.408	0.035	0.070	0.174	0.116	232.00
TC	051	66.08	1.792	0.123	*0.246*	0.048	33.60	0.040	4.928	0.037	0.071	0.157	0.157	268.80
TC	065	68.68	1.414	0.121	0.374	0.051	24.24	0.041	4.747	0.047	0.080	0.404	0.152	181.80
TC	071	54.06	1.530	0.122	0.622	0.046	28.56	0.037	4.182	0.026	0.163	0.663	0.133	173.40
TC	Mean	53.58	1.493	0.129	0.317	0.044	27.09	0.033	4.467	0.038	0.088	0.252	0.137	209.72
TC	sd	10.59	0.227	0.027	0.104	0.006	5.38	0.006	0.538	0.009	0.028	0.151	0.023	46.50
TC	CL	6.73	0.144	0.017	0.066	0.004	3.42	0.004	0.342	0.008	0.018	0.096	0.014	29.55

Appendix B Exposure to contaminants in discharges to air

B1 Sources of contaminants

The discharges to air from the Steel Mill are described in detail in the Air Quality Assessment (2021), which has been the subject of a separate consent application process.[9] The nature of emissions to air from the Steel Mill include those from point sources at the various manufacturing processes, which are principally particulate, metals, nitrogen oxides, sulphur oxides, hydrogen chloride, chlorine, with trace emissions of polycyclic aromatic hydrocarbons and dioxins. Fugitive emissions include particulate and metals from raw materials storage and handling, processing of steel production co-products, truck movements on sealed and unsealed roads; and emissions from slag tipping, commercial iron plating and other contingency operations (process iron plating and reduced primary concentrate and char tipping).

B2 Potential exposure pathways and receptors

The discharges of contaminants to air from the Site are diluted and dispersed and therefore the concentrations of contaminants in air reduce with increasing distance from the Site. Dispersed rural residential dwellings in the vicinity of the Site are identified as sensitive receptors to air discharges because people can be present continuously at these locations. Other, more distant, sensitive locations include the Glenbrook School (located approximately 1.3 km to the east of the Steel Mill's Operational Area), the Wymer Road Rest Home (located approximately 3.6 km east of the Steel Mill's Operational Area), the township of Waiuku (approx. 2.0 km to the south of the Operational Area) and the Glenbrook Beach settlement (approx. 3.8 km north of the Operational Area). Concentrations of airborne contaminants reduce with distance, therefore if exposure close to the Site is acceptable, exposure at other more distant locations will be lower and therefore also acceptable.

The main potential exposure pathway to airborne contaminants is via inhalation, and this is the only relevant pathway for gases and volatile organic compounds. Non-volatile contaminants that are present as particulate matter, such as metals, can deposit onto the ground and people could potentially be exposed through ingestion; either from small amounts of soil (for example attached to home grown vegetables) or from entrainment in roof-collected drinking water. As the closest dwellings to the Site may use roof-collected drinking water for potable water supply, this is the most sensitive exposure pathway for ingestion exposure.

The closest commercial food production activity to the Steel Mill is the market garden on land owned by NZ Steel north and east of the Steel Mill's Operational Area. Recent vegetable crops grown at the site are spring onions and bok choy. Vegetables grown in this location could take up contaminants from the soil or through their leaves (from aerial deposition). As leafy vegetables are typically washed before they are eaten, any dust particles containing contaminants that may deposit on leaves are unlikely to be ingested. As the vegetables are distributed and sold commercially, there is no likelihood that any individuals consume vegetables exclusively grown in this location (as would be the case with a residential garden serving a single household). Due to aggregation of commercial

[9] The Air Quality Assessment was prepared for a separate resource consent application, which was approved by a Hearing Panel and is currently subject to an Environment Court appeal on the wording of conditions. Consideration of exposure via air-related pathways are considered in this screening HRA for completeness.

supplies, vegetables from this site would only make up a small proportion of the vegetables eaten by any individual person.

B3 Exposure to contaminants via inhalation

The Air Quality Assessment sets out a comprehensive assessment of exposure to contaminants in air, which is briefly summarised in this section.

NZ Steel undertakes continuous ambient air quality monitoring at five locations in and around the Site (see Figure Appendix B.1). The contaminants in the ambient air quality monitoring programme are:

- Particulate – Total suspended particulate (TSP), particulate smaller than ten micron (PM_{10}) and particulate smaller than 2.5 micron ($PM_{2.5}$).

In addition, for the purpose of preparing the Air Quality Assessment, the following ambient monitoring was undertaken for several years:

- Sulphur dioxide (SO_2); and
- Oxides of nitrogen – total oxides of nitrogen (NOx), nitric oxide (NO) and nitrogen dioxide (NO_2).

The ambient monitoring site at 64 Glenbrook Beach Rd (Site 20) is broadly representative of exposure levels at the nearest residences on Reg Bennet Rd, Mission Bush Rd and Glenbrook Beach Rd. Concentrations at other, more distant, sensitive receivers will be lower. The ongoing ambient monitoring programme shows that the ambient levels of $PM_{2.5}$, NO_2 and SO_2 at the 64 Glenbrook Beach Rd (Site 20) monitoring site comply with all relevant NZ ambient air quality standards and guidelines.

Analysis of particulate filters for metals was also undertaken to inform the air quality assessment.

Figure Appendix B.1: Location of ambient air quality monitoring sites.

There are occasional exceedances (around two to four days per year) of the previous WHO guideline value for 24-hour average SO_2 (20 µg/m^3) at the monitoring site at 64 Glenbrook Beach Rd (Site 20). NZ Steel has sought the opinion of a public health specialist who concluded that "the overall pattern and distribution of the data support a conclusion that exposure to 24-hour average values is consistent with minimal effects".

The 24-hour average Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (NESAQ) value for PM_{10} is periodically exceeded at 64 Glenbrook Beach Rd (Site 20), with a peak of 12 exceedances observed in 2017. These exceedances are attributed to fugitive dust sources and NZ Steel has implemented a range of additional measures to reduce fugitive dust emissions, which has resulted in a reduction of exceedances at Site 20 in recent years. A review by a public health specialist concluded that the effects of infrequent and sporadic exposure to PM_{10} concentrations exceeding the NESAQ value of 50 µg/m^3 as a 24-hour average are minor.

For COPC where monitoring data is not available, exposure concentrations have been estimated using dispersion modelling. The predicted levels of these contaminants (carbon monoxide, mercury, hydrogen chloride and chlorine, and Volatile Organic Compounds) are shown to comply with the relevant health-based air quality guidelines. These results are documented in the air quality assessment (Tonkin & Taylor, 2022).

Additional air quality monitoring (not part of the routine monitoring programme) was undertaken for polyaromatic hydrocarbons, dioxins and metals (in suspended dust). The results of metals analysis were blank-corrected to remove the influence of the metal content of the borosilicate glass filters. Once the analytical results are adjusted for the metal in the filter media, the measured concentration of chromium and nickel in suspended particulate was effectively zero. Measured concentrations were well below the relevant long-term air quality criteria.

To support the assessment of potential cumulative effects Table Appendix B.1 reproduces the assessment of exposure to metals in airborne dust set out in Table 7.10 of the Air Quality Assessment (Appendix F to the AEE for Discharges to Air).

All of the ratios in the final column are substantially less than 1, indicating that the potential risks to human health arising from exposure to metals by inhalation are acceptable, as defined by WHO.

Table Appendix B.1 : Assessment of contaminants in airborne dust

Contaminant	Assessment Criterion (µg/m^3)	Averaging period	Estimated exposure level concentration (µg/m^3)	Hazard Quotient (HQ) (ratio of concentration at point of exposure to screening health guideline value)
Arsenic (inorganic)	0.0055	Annual average	0.001	0.18
Cadmium	0.005 [a]	Annual average	0.000011	0.002
Lead	0.2	3-month rolling average	0.0013	0.006
Manganese	0.15	Annual average	0.009	0.062
Vanadium	1	24-hour average	0.025	0.025
Zinc	2	Annual average	0.036	0.018

Notes:

[a] An assessment criterion of 0.3 µg/m^3 was used in the Air Quality Assessment. This has been changed to 0.005 µg/m^3 to reflect WHO (2000).

Cadmium and arsenic are both classified as carcinogenic by inhalation. The effects of exposure to these metals are expressed as the ''incremental lifetime cancer risk''. This is an estimate of the incremental (i.e., increased) risk of developing cancer over a lifetime from exposure to a substance continuously over a 30-year period. The incremental risk is calculated by multiplying the concentration in air by an assessment criterion expressed as the “unit risk” for that substance.

The unit risks for cadmium and arsenic are related to the air quality guidelines shown in Table 7.10. The New Zealand ambient air quality guideline for arsenic of 0.0055 µg/m^3 is based on a unit risk of 0.0015 (µg/m^3)$^{-1}$ (published by WHO) and an acceptable increased lifetime cancer risk of 1 in 100,000.

The WHO has not published a unit risk value for cadmium and the value US EPA value of 0.0018 (µg/m^3)$^{-1}$ has been adopted. For exposure to two or more substances at the same time, the incremental risks are added together.

An assessment of the risk from cumulative exposure to arsenic and cadmium is shown Table Appendix A.2. To make it easier to read, the risk from exposure to the measured concentration in air (fourth column) is expressed on a per hundred thousand basis. The cumulative risk from exposure to arsenic and cadmium is 1.52 per million, which is an order of magnitude below the acceptable risk level of 10 per million. This means that the levels of arsenic and cadmium measured in the air at sensitive receptors are not of concern with respect to cumulative exposure, even if a person were exposed continuously over a 30-year period.

Table Appendix B.2 : Screening-level assessment of contaminants that are carcinogenic by inhalation

Contaminant	Unit risk (µg/m^3)$^{-1}$	Concentration in air[a] (µg/m^3)	Incremental lifetime cancer risk (per 100,000)
Arsenic	0.0015	0.001	0.15
Cadmium	0.0018	0.000011	0.002
Cumulative risk (calculated)			0.152
Acceptable risk			1

Notes:

[a] This is the ‘blank adjusted’ concentration which is found by subtracting the metal mass reported when a blank unused filter is tested. This step removes the influence of the metal content of the borosilicate glass filters.

B4 Exposure to contaminants via deposition onto roofs used to collect drinking water

The Air Quality Assessment (Appendix I) evaluated the potential for exposure to metals via deposition onto roofs used to collected drinking water, and subsequent ingestion. Samples of roof-collected water were obtained from the water tanks at 4 houses in the vicinity of the Site (labelled as houses 1, 2, 4 and 5). Samples were also collected at a background location (house 3) and a shed located within the NZ Steel landholding (shed 6). The New Zealand drinking water MAVs were adopted as screening-level assessment criteria, with the exception of vanadium where the OEHHA notification level was adopted (see discussion in Section 6.2.2 of this report). It should be noted that the MAV used in the Air Quality Assessment is different from that used in this screening HRA. Although OEHHA recommended a notification level of 15 µg/L for vanadium it was not adopted by the Californian Department of Public Health as a maximum contaminant level for drinking water. The value used in California as a notification level for drinking water is 50 µg/L which has been adopted for this HRA. This is implemented by the California State Water Resources Board.

The concentrations in drinking water were evaluated by comparing the concentration (average of three samples) to the MAV (see Table Appendix B3). Where metals were reported below the detection limit, the detection limit value has been used in calculating the average concentration. It is important to note that these concentrations reflect the influence of all sources on metals concentrations in the tank water. These sources can include windblown dust, roofing materials and plumbing fittings.

Table Appendix B.3 : Screening assessment of roof-collected drinking water (see key to colour coding below)

Date	MAV mg/L	Concentration in drinking water as a percentage of the MAV					
		House 1	House 2	House 3 (background)	House 4	House 5	Shed 6
		1.5 km E	0.5 km S	8.6 km E	2.4 km NE	2.4 km NE	0.2 km E
Aluminium	1	<0.5%	1%	13%	2%	1%	1%
Arsenic[1]	0.01	11%	11%	12%	11%	11%	11%
Beryllium[2]	0.004	3%	3%	3%	3%	3%	3%
Boron	1.4	1%	1%	1%	1%	1%	1%
Cadmium	0.004	2%	2%	1%	1%	45%	1%
Chromium[2]	0.05	1%	1%	2%	1%	2%	1%
Cobalt[1]	0.07	<0.5%	<0.5%	<0.5%	<0.5%	<0.5%	<0.5%
Copper	2	<0.5%	11%	1%	<0.5%	<0.5%	<0.5%
Iron	2.0	1%	4%	4%	2%	1%	1%
Lead	0.01	2%	49%	44%	2%	15%	2%
Manganese	0.4	2%	3%	3%	1%	4%	6%
Mercury[2]	0.007	1%	1%	1%	1%	1%	1%
Nickel	0.08	1%	2%	1%	1%	2%	1%
Vanadium	0.05	14%	10%	3%	19%	9%	25%
Zinc	7	15%	4%	1%	1%	31%	21%

Notes:

1. Arsenic and cobalt detected at House 3 (background) only in the third round of sampling, not detected at any other sites or during any other sampling rounds.
2. Concentration below detection limit in all samples.

Key to colour coding

% of MAV	Colour
≥ 50 %	
≥ 25 %	
≥ 5 %	
≥ 0	

Cadmium, zinc and lead were noted to be elevated, compared to the background site, at some houses, but not at others and not in a consistent pattern that would suggest an influence of discharges to air from the Steel Mill. For instance, House 4 and House 5 are co-located and, while House 5 showed elevated zinc, House 4 shows similar zinc levels to the background site. These patterns were interpreted as indicating that the concentrations of cadmium, zinc and lead were likely to be due to the roof materials or pipework, or another source specific to the dwelling. In particular, the slightly elevated levels of cadmium and zinc at House 5 are attributed to the age of the roofing material.

Based on the analysis of spatial distribution in the metals deposition data (as set out in Section 9.2.2 of the Air Quality Assessment) and the spatial patterns in metals concentrations (particularly comparing the concentrations at Shed 6 and House 2 with the concentrations in House 3), the only contaminants where there appears to be a measurable influence of emissions from the Steel Mill are vanadium and manganese.

B5 Exposure to contaminants via deposition onto soil and subsequent uptake into vegetables

B5.1 Soil concentrations

A screening level assessment of the potential exposure to contaminants in commercially grown vegetables on the Site has been undertaken by comparing the levels of metals in soils with soil contaminant standards for rural residences[10], set in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES Soil). Where there is no relevant contaminant standard in the NES Soil, the Australian National Environment Protection Council (NEPC) Health Investigation Levels for standard residential land has been used (Table 1A (1)).

This approach is conservative as the soil contaminant includes conservative assumptions about the proportion of produce eaten that is homegrown. Due to aggregation of commercial supplies, vegetables from sites near the Steel Mill would only make up a small proportion of the vegetables eaten by any individual person.

Soil samples (from the top 10 cm of soil) were taken at four locations where vegetables are grown commercially within the Site boundary and one location where vegetables are grown commercially east of the Site. The sample locations are shown in Figure Appendix B.2 below.

[10] Values from *Table ES1 Summary of soil contaminant standards – SCSs(health) – for inorganic substances (mg/kg)* for "Rural residential / lifestyle block, 25% produce".

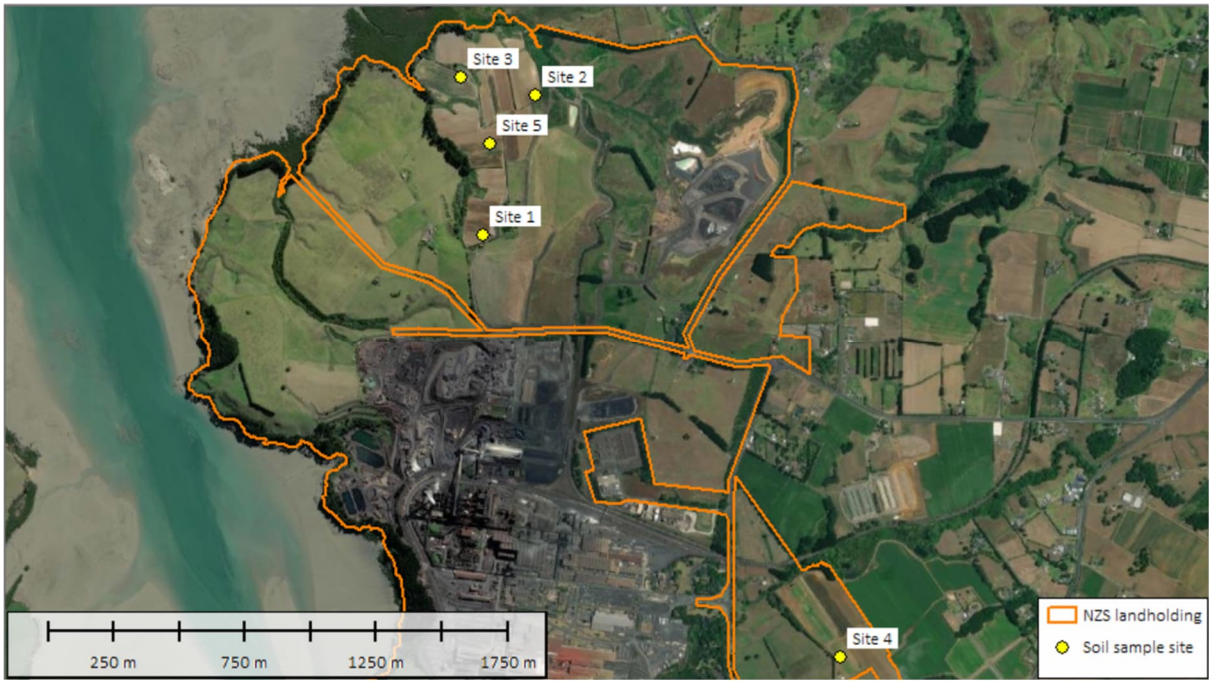

Figure Appendix B.2: Soil sample locations Source: Aerial imagery from LINZ.

The soil samples were tested for total recoverable metal content and the results are presented in Table Appendix A.5. For the purposes of identifying possible influences of the emissions from the NZ Steel site, the soil concentrations have been compared against the measurements at Site 3, which is the farthest soil sample location from the Operational Area boundary (980 m). This comparison suggests there may be influences on levels of cobalt, copper, lead and manganese associated with the Steel Mill. However, all of the measured concentrations in soil, including for these contaminants, were well within the range of reported background concentrations in the Auckland region[11].

[11] Auckland Regional Council. Background Concentrations of Inorganic Elements in Soils from the Auckland Region. Technical Publication No. 153. October 2001.

Table Appendix B.4 : Metals concentrations in soils (mg/kg dry basis) (see key over page)

Metal	Soil contaminant standard (mg/kg dry wt) (see Table 6.8)	Concentration in soil (mg/kg)					
		Site 1	Site 5	Site 2	Site 3	Site 4	Background (all Auckland)[a]
		370 m N	720 m N	923 m N	980 m N	590 m E	
Aluminium	NL	49,000	55,000	41,000	33,000	51,000	The typical range of aluminium in soils is 10,000 to 300,000 mg/kg[b]
Arsenic	17	7	7	6	5	9	0.4 – 12
Beryllium	60	0.4	0.3	0.2	0.2	0.4	
Boron	>10,000	< 20	< 20	< 20	< 20	< 20	<2 – 260 (volcanic)
Cadmium	0.8	0.25	0.29	0.29	0.22	0.41	<0.1 – 0.65
Chromium	>10,000	25	26	20	16	30	3 – 125 (volcanic)
Cobalt	100	5.4	4	5.7	1.8	9.4	10 – 170 (volcanic)
Copper	>10,000	18	23	18	11	29	20 – 90 (volcanic)
Iron	NL	46,000	46,000	38,000	32,000	51,000	The typical range of iron in soils is 20,000 to 550,000 mg/kg and concentrations can vary significantly even in localised areas[c]
Lead	160	22	21	22	12.7	30	1.5 – 65
Manganese	3000	470	470	1,350	280	1,650	10 – 2,500
Mercury (inorganic)	200	0.32	0.25	0.16	0.2	0.28	<0.03 – 0.45
Nickel	400	7	7	6	4	8	4 – 320 (volcanic)
Vanadium	NL	197	220	152	141	162	15 – 370 (volcanic)
Zinc	8000	63	48	54	33	59	54 – 1,160 (volcanic)

Table Notes:

a. Auckland Regional Council. (2001). Background Concentrations of Inorganic Elements in Soils from the Auckland Region. Technical Publication No. 153. Table 3, p 32.

b. US Environmental Protection Agency Office of Solid Waste and Emergency Response. (2003). Ecological Soil Screening Level for Aluminium. Interim Final.

c. US Environmental Protection Agency Office of Solid Waste and Emergency Response. (2003). Ecological Soil Screening Level for Iron. Interim Final

Key to colour coding:

Colour	% above concentration at Site 3	
	≤50%	Indicates no appreciable influence of NZ Steel activities
	>50 ≤100%	Indicates possible influence of NZ Steel activities
	>100%	Indicates some influence of NZ Steel activities but within reported background range

B5.2 Assessment criteria

Assessment criteria for concentrations of contaminants in soil have been adopted from the following sources, as summarised in Table Appendix B.6, below:

- Ministry for the Environment. (2011). Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington. Values for rural residential land use (NES Soil).
- Australian National Environment Protection Council (NEPC) Health Investigation Levels for standard residential land[12]. Values for 'Residential A' land use (NEPM HIL).

Where the NES Soil value is greater than 10,000 mg/kg, the NEPM HIL value has been used in the screening assessment to provide a numeric basis for the assessment. The NEPM HIL values for boron and chromium are conservatively low (less than half the NES Soil value of > 10,000 mg/kg). The NEPM HIL A is considered to be safe to grow home grown produce as well as direct contact with the soil for the most sensitive population (3-year old children).

Table Appendix B.5 : Assessment criteria for contaminants in soil used to grow vegetables

Metal	Soil contaminant standard (mg/kg dry wt)	Source
Aluminium	Not available	-
Arsenic	17	NES Soil
Beryllium	60	NEPM HIL
Boron	>10,000 4,500	NES Soil NEPM HIL
Cadmium	0.8	NES Soil
Chromium	>10,000	NES Soil
Cobalt	100	NEPM HIL
Copper	>10,000 6,000	NES Soil NEPM HIL
Iron	Not available	-
Lead	160	NES Soil
Manganese	3,800	NEPM HIL
Mercury (inorganic)	200	NES Soil
Nickel	400	NEPM HIL
Vanadium	Not available	-
Zinc	7,400	NEPM HIL

[12] National Environment Protection (Assessment of Site Contamination) Measure 1999. Table 1A(1). https://www.legislation.gov.au/Details/F2013C00288/Html/Volume_2#_Toc351712081.

B5.3 Screening level assessment of contaminants in soil

Table Appendix B.6 presents the ratio of the measured concentrations in soil and the soil contaminant standards. All of the ratios are substantially less than 1, indicating that the levels of contaminants in soil are considered safe for growing vegetables for household consumption in New Zealand.

While no assessment criteria are available for aluminium, iron or vanadium in New Zealand or Australian guidance, the measured concentrations in soils at all locations were within the expected range of background concentrations for volcanic soils in the Auckland Region (TP153, 2001).

Table Appendix B.6 : Screening-level assessment of contaminants in soil

Metal	Ratio of concentration to screening guideline value				
	Site 1	Site 5	Site 2	Site 3	Site 4
	370 m N	720 m N	923 m N	980 m N	590 m E
Arsenic	0.41	0.41	0.35	0.29	0.53
Beryllium	0.007	0.005	0.003	0.003	0.007
Boron	<0.004	<0.004	<0.004	<0.004	<0.004
Cadmium	0.31	0.36	0.36	0.28	0.51
Cobalt	0.05	0.04	0.06	0.02	0.09
Copper	0.003	0.004	0.003	0.002	0.005
Lead	0.14	0.13	0.14	0.08	0.19
Manganese	0.12	0.12	0.36	0.07	0.43
Mercury (inorganic)	0.002	0.001	0.001	0.001	0.001
Nickel	0.02	0.02	0.02	0.01	0.02
Zinc	0.009	0.006	0.007	0.004	0.008

B6 Conclusions with respect to discharges to air

A screening risk assessment has been undertaken for air discharges from the Steel Mill. The assessment considered the direct inhalation pathway as well as deposition into roof collected tank water and onto soils and homegrown produce and subsequent ingestion. The results of the screening assessment show that the predicted concentrations are below the NZ guidelines for air quality and soil as well as the NZ MAV for drinking water. On this basis the discharges to air do not pose an unacceptable risk to human health.

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