

Appendix 5

Summary of Submissions and Proponent's Response to Submissions

Response to Submissions - CSBP Final Remediation Works for the Former Cresco Site, Bayswater

Submission 1: Conservation Council of Western Australia

Issue #1

Stripping of contaminants by means of water containment basins on the site, and utilising appropriate monitoring needs to occur until contaminants are reduced to levels that are satisfactory to the EPA (World Health Organisation drinking water and irrigation standards?) and for a minimum of ten years. Appropriate rehabilitation and containment needs to occur until contaminants are reduced to levels that are satisfactory to the EPA (World Health Organisation) prior to any new land use of the site, including industrial subdivision.

Proposed rehabilitation needs to be strengthened as follows: -Water leaving the site needs to meet World Health Organisation (WHO) drinking water and irrigation standards. As it will eventually enter the Swan River, and lower standards may result in impacts to the river and its biota, including fish; and human health could be affected-given that recreational fishing commonly occurs in this part of the river.

Response

CSBP is committed to ensuring that the remediation of the site will be undertaken in a manner to minimise impacts on the surrounding biophysical and social environments.

Western Australia is party to the *National Water Quality Management Strategy* and the accompanying *Australian Drinking Water Guidelines* and *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (being Volumes 6 and 4 of the strategy, respectively). As such, these guidelines have primacy over other national and international-based criteria as these have been derived specifically for Australian conditions. Indeed, the DoE's own Assessment Levels for Soil, Land and Water (DoE, 2003) refer to these guidelines and associated trigger values. Accordingly, while the significance of WHO guidelines are acknowledged they remain sub-ordinate to the Australian guidelines in terms of any inconsistencies between the two.

CSBP has committed to undertaking the remediation project using a risk based management approach and has set trigger values that are appropriate for the site. CSBP will use the risk management approach to evaluate the performance (and ultimately the cessation) of the remediation project and does not advocate the need for an arbitrary time frame for monitoring (e.g. 10 years) necessarily to be imposed. Rather, CSBP advocates the use of performance monitoring to appraise the impacts of remediation on soil and water quality and attainment of agreed endpoints for the project.

Given the future land use of the site is general industrial, the Western Australian Department of Environment's Health Investigation Levels for commercial industrial sites (HIL F) are considered to be the most appropriate endpoint for soil contaminants. Therefore, CSBP has committed to conducting remediation of the Bayswater site until the soils meet health and environmental guidelines applicable to its existing zoning of industrial/commercial landuse (HIL 'F').

Issue #2

Excavation or works that could expose either sub-soil or groundwater should not be undertaken at any time. Proposed rehabilitation needs to be strengthened as follows: -All contamination needs to be treated and rectified onsite.

Response

CSBP is undertaking a remediation project that will, by necessity, involve exposing contaminated materials prior to removal. CSBP has considered the potential for the exposure of pyritic cinders to cause increased chemical solubility and contaminant mobilisation and for a 'slug' of contaminants to occur as a result of soil-disturbing activities. Accordingly, CSBP has obtained approval under section 38(1) of the *Environmental Protection Act, 1986* to construct and operate a groundwater interception field near the south-west corner of the site to abstract contaminated groundwater and treat this through a lime dosing plant located onsite.

CSBP has publicly committed to not pursue onsite "cap and containment" as the permeable nature of the soils; future end landuse; proximity of the watertable and the Swan River (and associated ongoing liability) is not conducive to this method of disposal. These considerations have been detailed within the PER.

Further, CSBP has committed to monitoring and reporting the performance of the lime dosing plant prior to any offsite discharge. The groundwater interception and lime dosing treatment systems are a core component of the broader groundwater remediation strategy for the site. The system uses lime dosing to correct (neutralise) the pH and has been demonstrated to consistently remove over 92% of the heavy metal contamination in the abstracted groundwater. CSBP has also detailed a contingency strategy to prevent the migration of contamination to downstream receptors including the installation of a semi-permeable membrane barrier which permits the selective transmission of certain molecules, but not contamination.

Further details regarding performance of the lime dosing plant is regularly posted on the CSBP website (www.csbp.com.au).

Issue #3

An appropriate and adequate portion of the site should be permanently set aside for optimal treatment of water flowing through the site, prior to its release into the Bayswater Main Drain.

Response

CSBP anticipates remediation of the site to commence in late 2005 and has already commissioned a groundwater abstraction and treatment system (as referred to the EPA under section 38 of the Act).

More recently CSBP has demonstrated that, although the lime dosing plant reduces metal contaminants to acceptable levels, residual ammonia concentrations require further consideration. CSBP has therefore proposed to utilise the existing natural attenuation of groundwater across the site to reduce these concentrations to acceptable levels in accordance with the DoE's guideline on Monitored Natural Groundwater Attenuation. Currently, groundwater attenuation across the site sees ammonia reduced from ~70mg/L to less than 0.5 mg/L in proximity to the Bayswater Main Drain.

CSBP acknowledges that future development of the site for light industrial/commercial uses would require preparation of a suitable stormwater and drainage management plan to appropriately manage surface water discharge and infiltration at the site. However, this is beyond the scope of the project as referred to the EPA at this time.

Issue #4

It needs to be determined if pollution of the Bayswater Main Drain will be caused by entry of water from the site, including during or subsequent to future subdivision of the site. If so, it is strongly suggested that the proponent provides appropriate contributions to remediate this pollution, and the upkeep of the Bayswater Main Drain.

Response

CSBP acknowledges that future development of the site for light industrial/commercial uses would require preparation of a suitable stormwater and drainage management plan to appropriately manage surface water discharge and infiltration at the site. However, this is beyond the scope of the project as referred to the EPA at this time.

CSBP understands that the Bayswater Main Drain is vested in, and that upkeep of the drain remains the statutory responsibility of, the Water Corporation. Drainage rates are applied to landowners by the Water Corporation for the purpose of maintaining this (and other) drainage systems.

Submission 2: Department of Environment

Issue #1

Groundwater treatment before discharge

Lime dosing treatment processes are not always effective in removing aluminium and zinc from acidic water (depending on its chemical composition, retention time etc). Both of these metals are very sluggish in precipitating out of a neutralised solution, and aluminium is most toxic at near-neutral pH values just as it is about to precipitate. There needs to be sufficient testing to ensure that treatment is effective and that deviation from trigger levels in treated water will be detected before discharge to the Bayswater Main Drain.

Response

CSBP has installed a lime dosing plant to remove heavy metals from groundwater abstracted via interception bores which lie across the south-west corner of the site (already approved under Part IV of your Act). The groundwater interception and lime dosing treatment system is part of a broader remediation strategy for the site as outlined in the PER.

CSBP has been undertaking performance monitoring and adjustments to the dosing regime during the commissioning period to optimise the operational, mechanical and chemical performance of the plant. The plant became operational in October 2004 and has been effective by neutralising the pH of the acidic groundwater and precipitating in excess of 96% of Al and Zn (Table 1).

Table 1: Lime Dosing Plant Performance for October and November, 2004-

Month	Feed Water, mg/L			Clear Water Tank, mg/L			Removal efficiency, %	
	pH	Al	Zn	pH	Al	Zn	Al	Zn
October	2.31	81	9.49	8.22	1.98	0.225	97.8	99.7
November	2.67	72.2	12.2	8.36	2.99	0.205	95.9	98.3

CSBP remains committed to monitoring the performance of the treatment system and reporting to the DoE prior to any direct discharge from the site. The system has been designed to contain and

cycle the extracted water between the lime dosing plant and solids ponds until sufficient water quality is achieved to discharge to the Bayswater Main Drain.

Issue #2

Change in climatic / groundwater conditions

Management of the groundwater interception system - has worked reasonably well because of low rainfall. Has CSBP considered a contingency in the instance the Perth metropolitan area experiences very high rainfall and the watertable rises considerably (i.e. is there sufficient freeboard to allow for variation in rainfall)?

Response

The groundwater interception system was designed following analysis of pump test data and groundwater gradients observed across the site. The design of the system was based upon a generous maximum flow rate estimation of 4.5 L/sec. The interception system has been operational for some 12 months during which time peak flows of 2 L/sec have been observed. The interception system was deliberately over-designed, and is currently running at approximately half the design capacity of the system and thus has sufficient freeboard to allow for the variation caused by increased rainfall events.

Issue #3

Assessment criteria for groundwater / BMD and discharge to Swan River

In liaison with the Swan River Trust (SRT), it was noted that the water quality criteria used to assess the acceptability of treated groundwater discharging to the Bayswater Main Drain and the Swan River was not that of a freshwater system.

Firstly, the Swan River in the vicinity and downstream of the Bayswater Main Drain may be described as a freshwater system, with salinity ranging from 3-4 parts per thousand. In the summer months it is fresh-brackish. The PER references marine ecosystem values as being appropriate for the water discharged from the BMD outfall, and treated water quality (following remediation) is to be assessed against these values. Could the proponent comment on whether freshwater ecosystem trigger values would be more relevant¹ for the assessment of concentrations of heavy metals and chemicals and that for physical and chemical stressors such as total nitrogen and total phosphorus, estuarine ecosystem values².

Secondly, although aluminium is naturally prevalent in waters within the metropolitan region due to the geology, it is thought that using up-gradient background concentrations for this substance (especially within the Bayswater Catchment) is not appropriate as these drainage systems are

¹ Freshwater ecosystem values as presented in Assessment Levels for Soil, Sediment and Water, DoE, November 2003.

² As presented in Table 3.3.6 of the ANZECC Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

influenced directly by point source pollutants. The use of background concentrations is more suitable for river, streams and estuaries systems where there is more dispersion of pollutants. These systems are not generally heavily impacted upon by point source discharges.

Thirdly, could the proponent comment on the use of freshwater ecosystem trigger levels for an urban drainage system (Bayswater Main Drain) that discharges to the Swan River.

Response

(1) The Swan River Estuary in the vicinity of Bayswater is (at the very least) seasonally tidal, exhibits a variable salinity regime and is subject to riverine and tidal influences. Clearly, the 'river' at this point clearly meets the definition of an 'estuary'.

Under the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000), an ecosystem classification decision tree (Figure 3.1.3, see below) is applied such that toxicants are split into one of two aquatic ecosystem types - marine and/or freshwater ecosystems. Importantly, the decision tree does not differentiate estuarine ecosystems, but rather sees these 'lumped' with marine ecosystems.

Under the above agreed national framework (upon which DoE's draft Assessment Levels for Soil, Sediment and Water is based), toxicants in estuarine ecosystems are to be appraised using marine trigger values.

It should also be mentioned that in a recent study of water, sediment and fish quality in the Bayswater Main Drain and the adjacent Swan River (DoE 2003), the Department of Environment itself considered this section of the river to be a marine dominated estuary. The report identified salinities of approximately 24‰ and applied marine trigger values (95 percentile) for the purpose of assessing potential toxicant effects on the Swan River ecosystem. The report was prepared by the Department of Environment with the assistance of the Swan River Trust.

In terms of physical and chemical stressors (including total nitrogen and total phosphorus), the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) differs from that for toxicants in as much as trigger values specific to estuarine systems may also be applied. CSBP concurs with the Swan River Trust's view that for physical and chemical stressors, estuarine trigger values should be applied (in accordance with the decision tree, see below).

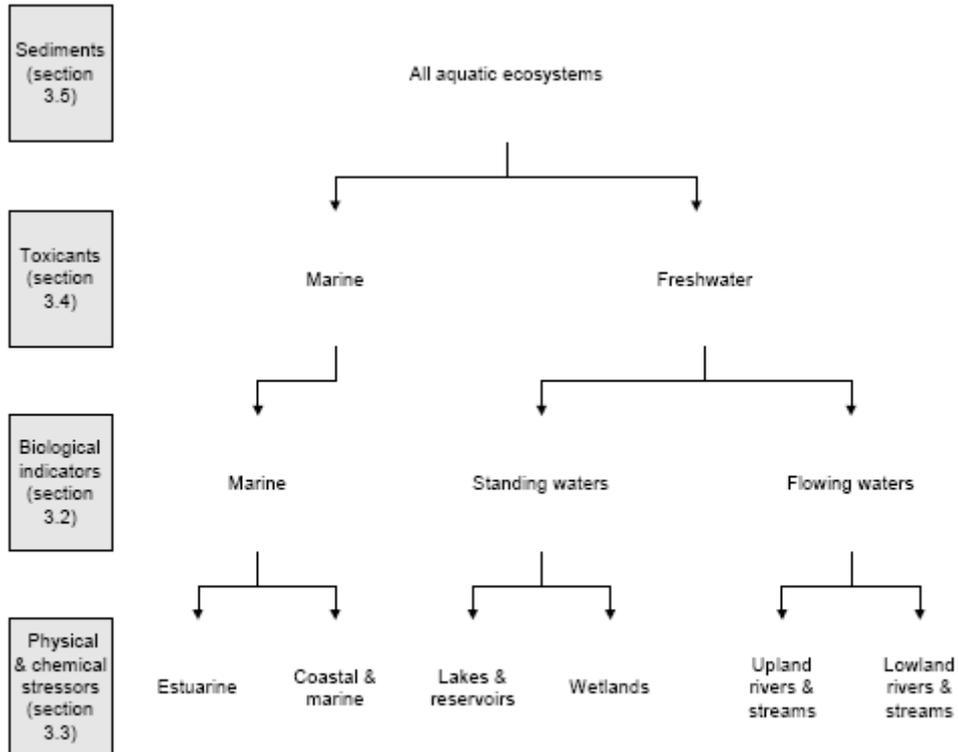


Figure 3.1.3 Classification of ecosystem type for each of the broad categories of indicators (in grey boxes at left of the diagram)

(2) All urban drainage systems are influenced by diffuse and point sources of pollution to some extent or other. Baseline monitoring undertaken by DoE and SRT over a number of years clearly shows that urban drainage systems discharging to the Swan River rarely, if ever, meet marine trigger values for aluminium (and other toxicants). This is to be expected because the drainage systems themselves are not ecosystems, but rather it is the effects that these loads and concentrations may have on the receiving waterway (the river) that is paramount and which requires management.

CSBP has investigated contaminant concentrations in both the water column and riverine biota in the vicinity of the Bayswater Main Drain outfall. These studies found no significant bioaccumulation of metals in the vicinity of the outfall and that the mixing zone was of limited spatial extent (suggesting effective mixing). These findings accord with those associated with recent investigations undertaken by the DoE. CSBP contend that remediation of the Bayswater site will significantly diminish the already minimal impact the site may be having on the river.

CSBP does not believe that as a constructed urban stormwater system, the Bayswater Main Drain should be recognised as an aquatic ecosystem and afforded a level of ecosystem protection *per se*. Notwithstanding, the potential for discharge from the drain to adversely impact the river is recognised by CSBP and is a key area of focus for the PER and the remediation strategy for the site.

Section 8.3.5.5 of the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000) recommends actions for determining ambient water quality at particular reference sites (for water quality comparisons) as follows:

- Determine a reliable background level for the study chemical at a reference site, equivalent to the specific site;

- If the trigger value is less than the reliable background figure, the 80th percentile of the background becomes the site-specific guideline; and/or
- Users may wish to undertake direct toxicity assessment on acclimatised species relevant to the local environment.

Therefore, CSBP considers it inappropriate to compare the water quality of an urban stormwater drainage system with that of the downstream estuarine ecosystem. CSBP, however, remains committed to ensuring that water quality in the Bayswater Drain is no worse than that already evident from upstream sources by using ambient upstream background water quality as water quality remediation targets.

Notwithstanding the above, CSBP is currently undertaking a program of ecotoxicological testing to ascertain the potential for adverse environmental impacts. The testing will involve derivation of site specific trigger values for aluminium and fluoride for the Swan River and direct toxicity assessment (DTA) using drain water to ascertain whether adverse effects are likely at observed toxicant concentrations. The project will be subject to peer review by a nationally-recognised expert and all chemical analyses conducted through a NATA accredited laboratory. However, recent mussel sampling near the outfall suggests the potential for impacts are currently likely to be low (PB April 2004). In designing and undertaking the above works, PB is liaising with the DoE regarding target species and proposed test procedures.

(3) In accordance with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2000), the Bayswater Main Drain has not been assigned a level of ecosystem protection because it constitutes a stormwater system and is not an ambient (receiving) waterway. Therefore the application of marine and freshwater ecosystem protection trigger values to the drain is inappropriate. However, CSBP has assigned aesthetic and cultural values to the drain as the BMD flows through open channels near residential properties. Accordingly, the landscape and aesthetic values of the drain have been recognised within the PER such that unsightly slicks, scums, foams or turbidity should be avoided.

CSBP does not believe that as a constructed urban stormwater system, the Bayswater Main Drain should be recognised as an aquatic ecosystem and afforded a level of ecosystem protection *per se*. Notwithstanding, the potential for discharge from the drain to adversely impact the river is recognised by CSBP and is a key area of focus for the PER and the remediation strategy for the site.

Issue #4

Remediation to Ecological Investigation Levels (EILs) / Health Investigation Levels (HIL-Fs)

³

The PER reports that the concentration of arsenic, copper and lead exceed HIL-F criteria on the former Cresco site. It was stated that aluminium did not have a published EIL or HIL-F with which to compare concentrations levels. The Assessment Levels for Soil, Sediment and Water, (DoE 2003) guideline clearly states that where assessment levels are not included in the DoE published guidelines, then alternative assessment levels should be used. The reasons for, or for not, using assessment levels from other sources should be documented.

Response

³ Ecological Investigation Levels (EILs) and Health Investigation Levels "F" (HIL-F) as documented in the Assessment Levels for Soil, Sediment and Water, November 2003.

There are no published EIL or HIL-F for aluminium within the Assessment Levels for Soil, Sediment and Water, (DoE 2003) guidelines. Similarly the Dutch guidelines (Dutch 1994) do not contain soil target values or intervention levels for aluminium. Aluminium is naturally prevalent in soil minerals and is assumed to be the reason target values are generally not prescribed.

Due to its geochemical complexity and the minimal impact the site now exerts on the river (as demonstrated by in-river sampling by Parsons Brinckerhoff and DoE), CSBP has adopted a risk-minimisation approach where the priority has been placed on removing a significant quantity of the source material from the site. Residual soil contaminant levels at the site will also meet appropriate HIL-F levels (as outlined in the PER) such that the site will be suitable for commercial end uses.

In terms of potential residual impacts on the river, CSBP has commissioned studies to determine appropriate marine trigger values for aluminium or fluoride for the Bayswater section of the Swan River and will gauge success of site remediation against these and other data.

Issue #5

Post remediation monitoring and validation programme

It is proposed to develop a *Remediation and Validation Programme* to implement and monitor the planned activities. The proposed programme should be provided to the LWQB for review prior to soil and groundwater remediation commencing, with a progress report and then a final Remediation and Validation Report provided upon completion of the remediation works.

Post remediation water quality monitoring is proposed for a period of 1 year once remediation is completed. It is requested that this monitoring period be extended to two years as a minimum, to cater for seasonal fluctuations and provide a greater quantity of monitoring data in which to assess whether remediation has been successful.

Response

CSBP has been previously granted approval to establish and operate a groundwater interception system and lime dosing plant under Part IV of the *Environmental Protection Act*. This system is now operational. It is therefore not possible to develop a *Remediation and Validation Programme* prior to commencing groundwater remediation. However, CSBP has provided commitments within the PER to provide performance monitoring and reporting associated with remediation of the site. CSBP will submit a *Remediation and Validation Programme* prior to commencement of soil remediation works at the site.

It appears unlikely that remediation will be completed within 12 months of the commencement of soil remediation works, largely due to the seasonal nature of the receiving landfill site. Accordingly, CSBP agrees to the DoE request to continue monitoring and reporting for a period of 2 years once remediation has completed and will appraise the need for further monitoring at the conclusion of this period.

Submission 3: Department of Health WA

Issue #1

The PER provides only summary and statistical data from the sampling and analysis of the soil at the site. Although this gives a reasonable conceptual model of the site it is difficult for the DoH to

determine the accuracy of summary information without the raw data, data collection and analysis process.

Response

CSBP decided not to include raw data within the PER, but instead include summaries of this data in order to improve the readability of the document. CSBP, recognising the differing needs of the various regulatory authorities, commissioned an independent consultant (Parsons Brinckerhoff) to tabulate the extensive surface and groundwater monitoring data and prepare reports for the area. Copies of these reports will be provided to DoE, and DoH, and are available from CSBP upon request.

Soil and water sampling has been conducted in accordance with the *Contaminated Sites Act* (2003) and the data and its interpretation is subject to independent peer review by the CSIRO. Copies of this independent peer review will be made available upon the CSBP website when it is completed and will be provided to the EPA for referencing in preparing its Bulletin on this proposal.

Soil contamination at the site was analysed using 3D modelling software (commonly used in the mining industry) to enable visualisation of the site and to verify estimates of the quantity of soil to be removed. CSBP would be pleased to arrange for an inspection and explanation of the 3D model if required (Contact Adam Speers on 9 411 8777).

Issue #2

The exposure of off-site human receptors to potentially contaminating dusts has not been considered under section 4.2.4 of the PER. Given the proximity to residential areas and the extensive period of remediation, this potential exposure pathway should have been addressed in the report. The risks from exposure to contaminated dusts should have been considered in the risk assessment in addition to being addressed in the outline of the dust management plan described in section 7.1.1.

Response

CSBP accepts that Section 4.2.4 did not specifically mention exposure of residents to contaminated dust, but the issue was nevertheless addressed in section 7.1.1, Table ES1 and is a core component of the recently completed Dust Management Plan (DMP). The full set of Environmental Management Plans (EMPs) will be forwarded to the DoE for approval, consistent with commitments provided by CSBP within the PER. The DMP in draft form will be provided to DoH for comments as well.

There is no evidence of adverse environmental or public health issues associated with the soils or dust to date, and with the implementation of a thorough dust management strategy (through the Dust Management Plan), CSBP does not consider that remediation activities will appreciably increase this risk.

CSBP will detail (in its Dust Management Plan) dust minimisation strategies and air quality monitoring to be conducted during the remediation process to ensure activities do not pose a significant risk to nearby residents or workers.

Should separation and reuse of iron oxides prove viable, then any treatment activity will be undertaken inside one of the existing storage sheds at the site which would further reduce any potential dust impacts.

Issue #1

CSBP have explored many options with regard to soil and groundwater remediation, however, the final methods have yet to be finalised. It would have been preferable if these issues could have been decided upon prior to the release of the PER as the methods chosen will affect the content of future management plans.

Response

CSBP has explored a number of options for remediation of the former Cresco site and has outlined its preferred strategy in the PER. In accordance with the waste hierarchy, CSBP prefers to pursue the reuse of waste that involves the separation of high grade iron oxide from the cinders. However, the reuse option is unfortunately reliant upon third parties who are yet to decide whether to accept the separated iron oxide as feedstock for their industrial processes or for resale to others. CSBP will modify its environmental management plans, as appropriate, once it has determined the preferred final remediation strategy (reuse or landfill disposal). The remediation of this site outlined in the PER has been deliberately based on environmental outcomes, not specific technologies to allow CSBP flexibility to adapt to market conditions and improvements in technology and processing. CSBP remains committed to the outcomes proposed in the PER.

Issue #2

The City of Bayswater seeks a role in the approval of Management Plans that will be used to control environmental and social issues when the remediation process commences.

Response

The *Environmental Protection Act* (1986) is administered by the DoE, which assists the EPA in assessing the environmental acceptability of proposals under the Act and then recommend legally-binding conditions in relation to the project. CSBP has committed to submitting its Environmental Management Plans to the regulatory authorities for approval prior to commencing soil remediation works at the site. CSBP understands that the regulatory authorities will consult the City of Bayswater and the Town of Bassendean prior to approval of the Management Plans.

It is worth noting that the site does lie within the City of Bayswater and CSBP recognises the potential for offsite impacts to impact upon residents and workers within adjoining areas (for example, traffic management issues). Accordingly, CSBP is committed to consulting and reporting to both the City of Bayswater and the Town of Bassendean during preparation of the EMPs and throughout the remediation of the former Cresco site.

Submission 5: – Undisclosed Submitter

Issue #1

Figure 3.1 on page 43 shows the location of historical disposal areas and indicates that the cinders disposal pits encroach significantly onto the Tonkin Highway easement in two areas. Whilst much of the cinders contained in this road easement will be under road pavement there is still a quantity in the sandy area between the road and the CSBP boundary fence. This

contamination should be fully addressed by the proponent and be included as part of a prudent remediation of the site, regardless of the current ownership.

Response

Tonkin Highway, the easements and land bounded by the CSBP fence were resumed by the State Government and have never been owned by CSBP. Furthermore, as a proponent under the *Environmental Protection Act* (1986), it would be inappropriate for CSBP in the PER to imply liability or include management requirements for lands other than that which it owns or controls. .

Notwithstanding the above, CSBP agrees with the sentiment expressed and has previously approached MRWA regarding potential opportunities to remove contaminated soils from the easements and unpaved areas next to Tonkin Highway, while remediation of the former Cresco site is underway. This matter is beyond the scope of the PER itself and it may be more appropriate to redirect this question to MRWA for further comment.

Issue #2

Off-site monitoring program did not include areas such as the Brady's Ceiling site on the corner of the Tonkin Highway easement and Railway Parade. Were efforts made to ascertain the groundwater quality in this area?

Response

Groundwater monitoring bores were explicitly sited on public lands because of the potential for future changes in land ownership to restrict access to the monitoring bores. Accordingly, no bores were established on the Brady's property by CSBP (and in fact we understand the site was recently sold and may be subject to a further development proposal).

CSBP currently monitors groundwater both upstream and downstream of the Brady's site using bores located on CSBP and/or public lands which provide for unfettered access for monitoring.

Efforts were made to install monitoring bores along Tonkin Highway in the vicinity of Brady's boundary, however the steepness of the road side and traffic safety issues associated with gaining vehicular access from the highway itself led CSBP to dismiss this option (in consultation with MRWA).

CSBP understands the DoE has undertaken limited groundwater sampling in the vicinity of the Tonkin Highway and the Brady's property in particular, but has no specific information as to the outcomes of this monitoring.

Our reference: 825.cc

Wednesday 2 March, 2005

Greg Davis
CSIRO Land and Water
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Dear Greg

**Response to Independent Peer Review, Public Environmental Review (PER) for
Remediation of the Former Cresco Site Bayswater.**

Thank you for your comprehensive review of our proposed remediation works associated with the former Cresco site.

In consultation with Parsons Brinckerhoff, the following comments are offered on a 'without prejudice' basis and in response to issues you raised during your review. Obviously there were quite a number of deliberations between various parties during preparation of the PER to which CSIRO were not privy. The following may assist in understanding how these deliberations have influenced the material presented in the PER and where, for example, reference data relating to the site and remediation planning may be referenced.

General Comments

As you have observed, the remediation plan was prepared in light of the *National Environmental Protection (Assessment of Site Contamination) Measure 1999* and its mirror legislation within Western Australia. It is probably worth noting that Parsons Brinckerhoff has also reported some significant errors within the Contaminated Sites Management Series 'Assessment Levels for Soil, Sediment and Water' (DoE, 2003) and expressed concern that these levels be given primacy over the original source information (for example, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*). Aware of these inconsistencies, the PER was prepared with reference to the primary source information and legislative requirements, as appropriate.

Contaminant Pathways

Extensive surface and groundwater data has been compiled and analysed during preparation of the PER. It was decided not to include this extensive body of data within the PER *per se*, but rather to focus on summarising this information and its implications upon remediation planning for the site.

It is recognised that regulatory authorities (such as DoE and the Health WA) will likely wish to scrutinise the original data, however it was felt that inclusion of this data within the PER would detract from its readability by the general public. In recognition of this, two additional reports are currently being finalised for both the surface (drain) and groundwater monitoring conducted to date which present chain of custodies, analytical results and their interpretation and inferred contaminant pathways. These reports are available upon request.

The actual percentage of groundwater captured by the BMD that emanates from beneath the site has been previously modelled using MODFLOW and reported within 'Numerical Modelling of Groundwater Recovery and Recycling' (Nield Consulting Pty Ltd, 2003). Parsons Brinckerhoff considers the model to be a reasonable reflection of groundwater and contaminant throughflow at the site (and hinterland). A further

degree of confidence in the model was gained when, upon commissioning, the yields from the groundwater interception system were found to closely match those predicted by the model.

Instantaneous flow and contaminant load data ('snapshots') have been collected at sites along the BMD upstream and downstream of the site. This information is presented within the report "Bayswater Main Drain Contaminant Flux Investigation" (PB, 2005) and provides a valuable insight into contaminant pathways, urban and upstream contaminant contributions and the seasonal groundwater accession to the regional drainage system.

In addition to analytical data, the report "Annual Groundwater Monitoring Review, June 2003 – June 2004, Former Cresco Site, Railway Parade, Bayswater" (PB, 2004) also includes borehole logs and stratigraphic profiles for the area.

Parsons Brinckerhoff in association with RSG Pty Ltd have developed a sophisticated 3D model of soil contamination for the purposes of developing a detailed soil remediation strategy for the site. This also has enabled 3D visualisation of the distribution of contaminants and their co-occurrence across the site.

Natural Attenuation

Parsons Brinckerhoff is currently finalising an assessment of natural attenuation of groundwater contaminants across the site using the DoE's corresponding Contaminated Sites Series guideline as part of its report "Assessment of Ammonia Removal Technologies for the Former Cresco Site, Bayswater" PB, in prep). This is being undertaken in concert with the abovementioned analysis of instantaneous flow and load data for the BMD as part of a study of ammonia removal and the discharge of effluent (ex lime dosing) from the site. Parsons Brinckerhoff estimates the travel time for groundwater to the BMD to be 5-7 years.

Sampling and Interpretation of BMD Data

Instantaneous flow and contaminant loads have been collected (flux surveys) within the regional drainage network over the last 12 months. Dilution and natural attenuation modelling has been based upon this data which is currently being collated and summarised within the summary drain flux report.

It was noted at an early stage of the investigations at the site that contaminant concentrations in the BMD were likely to peak during summer baseflow conditions and that upstream dilution and source of contamination could also be important factors. In addition, target water quality objectives for the BMD should be no more stringent than typical urban water quality. The flux surveys provide useful information regarding background contaminant levels in the area and water quality targets within the BMD.

CSBP has recently commissioned ecotoxicological studies in order to determine appropriate water quality objectives to protect the Swan River ecosystem. This will also include an investigation of possible synergistic toxicity effects associated with aluminium and fluoride upon the request of the DoE, and Dr Batley of CSIRO, the peer reviewer.

Sampling conducted in the Swan River in the immediate vicinity of the BMD outfall was undertaken which verified the Swan River Trust's earlier findings that metal concentrations in shellfish and sediments within the river at this location were acceptable.

An integrated monitoring plan (for air quality, groundwater, BMD and the river) is to be prepared and implemented in accordance commitments provided by CSBP within the PER.

Groundwater Chemistry and Dilution Factors

Groundwater remediation at the site has, more recently, been based upon contaminant concentrations observed from discharge from the groundwater interception field. As the field comprises 33 individual bores the contaminant concentrations are therefore likely to more closely reflect 'average' groundwater conditions from this portion of the site. As such, these concentrations have been used in preference to those from bore H10 and the PER was subsequently modified to represent this. The lime dosing system was designed upon test pumping of the interception field and is currently operating within design specifications.

The summary groundwater report, as describe above, provides a detailed analysis of long term groundwater data for the site. In addition to fluoride, the report also includes analysis of the distribution of other contaminants which given further support to the inferred extent of the contaminant plume and use of fluoride as a (relatively) conservative tracer.

In light of CSIRO's comments, CSBP commissioned Parsons Brinkerhoff to review a range of dilution factors within Table 6.1 as suggested. The outcome was that the range of dilutions had a minimal impact of COCs downstream (my memory is that CSBP has subsequently provided this information to CSIRO through Parsons Brinkerhoff)

Use of Representative Data Sets

The variability of groundwater quality and contaminant contours are described in greater detail within the summary groundwater report. This data was used as the basis for remediation planning contained within the PER.

Remediation Options

Assessment of soil volumes that may require excavation and remediation have been modelled using specialised 3D mining industry software. Depending upon actual excavation strategy, excavation volumes have been modelled for the site to realise HILF.

MODFLOW modelling was undertaken for the site which has, to some extent, been verified using data derived from operation of the groundwater interception field. The yield from the interception field has provided an indication of the volume of impacted water that may need to be captured and treated. However, CSBP and Parsons Brinckerhoff concur with the CSIRO's comments regarding residual impacts on groundwater following soil remediation and ongoing treatment requirements. Accordingly, CSBP has engaged CSIRO to investigate a number of possible options involving permeable reactive barriers. Most recently this includes a report titled "Laboratory Assessment of a Possible Remediation Method for Acidic Groundwater at the Former Cresco Site, Bayswater, WA" (CSIRO, 2004).

A rigorous investigation of possible remediation technologies was undertaken during development of a preferred remediation strategy. However, as mentioned, a summary of this work is presented in the PER. The investigative work also included laboratory and pilot-scale tests to verify treatment efficiencies for soil and groundwater remediation options.

Criteria for Remediation Success

Assessment of soil volumes that may require excavation and remediation have been modelled using specialised 3D mining industry software. Depending upon actual excavation strategy, excavation volumes have been modelled for the site to realise HILF.

Measurement of the remediation endpoint in the PER is to be conducted against data from bore H10. The representativeness of this bore in terms of groundwater at the site may be better gauged from the quality of water encountered during pumping of the groundwater interception field. This will be further investigated during development of the Environmental Management Plan and, in particaulr, the Site Remediation and Validation Plan for the site.

Other Minor Comments

The amendments as suggested have been generally accommodated within the PER prior to its publication.

CSBP has commissioned ecotoxicological studies to determine permissible concentrations in the river for chemicals of concern. Laboratory testing has been completed this week and CSBP is expecting to have a report on this testing within 2 weeks. The testing also included Direct Toxicity Assessment (DTA) as a means to appraise possible synergistic effects of the mixture of chemicals evident in drain water near the site. In particular, synergistic effects between aluminium and fluoride are being considered.

Dr Graeme Batley and Dr Jenny Stauber (CSIRO) have both kindly peer reviewed the proposed test procedures for the above toxicity testing program.

Thank you for your frank and thorough review of the PER, which I know has added considerable value to the document. These comments are provided to address areas of your peer review where CSIRO commented interalia that more information EPA could be required – as discussed I now intend to provide a copy of your peer review and this letter to the EPA for inclusion in its Bulletin on this project.

It is possible that I may ask CSIRO to meet with CSBP/Parsons Brinkerhoff and EPA in the next couple of weeks to discuss the peer review.

If you have any further queries regarding the above, please do not hesitate to call me on 9411 8234.

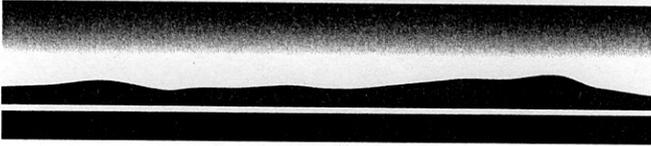
Yours sincerely

Cameron Schuster

Manager, Environment & Manufacturing Support



CSIRO LAND and WATER



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2/3/05

**CSIRO Land and Water
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17 March 2005

Cameron Schuster
Manager, Environment and Manufacturing Support
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PO Box 345
Kwinana, WA 6966

Dear Cameron,

**Re: Final comment on your Response to Independent Review, Public
Environmental Review (PER) for Remediation of the Former Cresco Site
Bayswater**

Grant Douglas and I have read your letter of response to our independent review of the PER, which was dated 2 March 2005.

Your letter of response addresses the range of comments we made. It is agreed that it would be difficult to show the large body of data in the main PER review.

As we could not source the modelling carried out by Simon Nield, it was difficult to assess the extent of groundwater captured by the Bayswater main drain. It is pleasing to hear that the modelling agrees with the field data. It seems that much of the data that we were interested in accessing is now in the later report in late 2004 and the early 2005 report.

Thankyou for the opportunity to contribute to the review of the PER.

Yours sincerely

Drs Greg Davis and Grant Douglas
CSIRO Land and Water