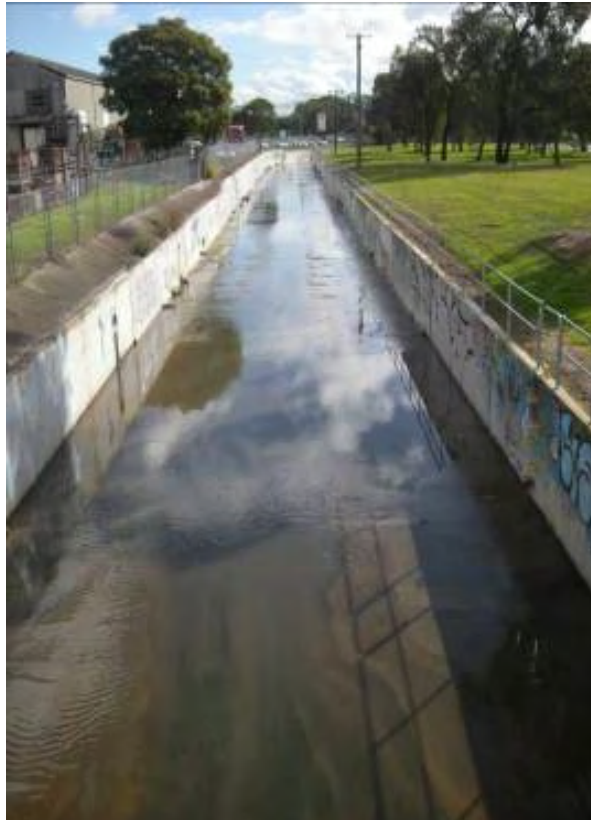


# Plates

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**Plate P1: Byrnes Creek channel – near northern end of Shaddock Avenue looking downstream**



**Plate P2: Byrnes Creek channel - near northern end of Shaddock Avenue looking upstream**

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AECOM new



**Plate P3: Byrnes Creek channel north side – east of Shaddock Avenue**



**Plate P4: Byrnes Creek channel – east of Shaddock Avenue**

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**Plate P5: Byrnes Creek channel – junction with second channel looking upstream**



**Plate P6: Byrnes Creek channel – east of second channel**

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**Plate P7: Byrnes Creek channel north side – east of second channel**



**Plate P8: Byrnes Creek channel – section between Shaddock Avenue & Miller Road looking downstream**

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**Plate P9: Byrnes Creek channel – section between Shaddock Avenue & Miller Road looking upstream**



**Plate P10: Byrnes Creek channel – section between Shaddock Avenue & Miller Road**

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**Plate P11: Byrnes Creek channel – view from north of Christina Road crossing looking downstream**

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## Appendix A

# DECCW Remediation Order

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Department of  
Environment and Conservation (NSW)

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Our reference : HOF59610  
Contact : Andrew Mitchell (02) 9995 5620

*Service: By Registered Mail to Place of Business*

Mr Bill Crowe  
Manager, Legacy Projects  
Orica Australia Pty Ltd  
1 Nicholson Street  
MELBOURNE VIC 3001

Dear Mr Crowe

**Orica Villawood Site – Remediation Order**

I refer to our letter dated 11 July 2005 with a proposed remediation order for the above site, your response dated 4 August 2005 and the subsequent discussions and meetings that we have had. Further to this, we have finalised the remediation order under s.23 of the Contaminated Land Management Act (CLM Act). The order is enclosed with this letter.

In accordance with s.58 of the CLM Act a copy of the order has been made available on our website at <http://www.environment.nsw.gov.au/clm/aboutregister.aspx> and in accordance with s.59 of the CLM Act a copy of the order has been provided to Bankstown Council for noting on certificates issued under s.149 of the Environmental Planning and Assessment Act.

Please note that the timeframes listed at item 4P of the order are a key requirement. If you believe that Orica may not meet any of these timeframes, you should notify us and we will consider issuing a variation notice or taking enforcement action.

You may contact Andrew Mitchell on (02) 9995 5620 with any questions on this matter.

Yours sincerely

**CAROLYN STRANGE**  
**Director Contaminated Sites**

Enclosure: Remediation Order

- 2 NOV 2005

**Environment Protection Authority**

**Remediation order**

(Section 23 of the Contaminated Land Management Act 1997)

Remediation Order Number 23019; Area Number 3200

*Service: By Registered Mail to Place of Business*

Orica Australia Pty Ltd (ACN 004 117 828)  
1 Nicholson Street  
MELBOURNE VIC 3000

Attention: Mr Bill Crowe, Manager Legacy Projects

**1. Land to which this order applies (“the site”)**

2 Christina Road, Villawood, NSW comprising Lot 1 in DP 634604 in the local government area of Bankstown.

**2. Nature of contamination affecting the site:**

The Environment Protection Authority (“EPA”)\* has found that the site is contaminated with the following substances (“the contaminants”):

- Total Petroleum Hydrocarbons (TPHs);
- Benzene;
- DDT (and its degradation products DDD and DDE);
- 1,2-dichloroethane (1,2-DCA);
- Trichloroethene (TCE);
- Chlorobenzene;
- 1,4-dichlorobenzene
- Hexachlorobenzene (HCB);
- Lindane;
- Polycyclic Aromatic Hydrocarbons (PAHs), including Benzo(a)pyrene; and
- Cyanide.

**3. Background**

- A. On 29 July 2004, Orica Australia Pty Ltd (“Orica”) notified the EPA under section 60 of the *Contaminated Land Management Act 1997* (“CLM Act”) that the site is contaminated in such a way as to present a significant risk of harm. The notification also identified Orica as the owner of the site and the person whose activities have contaminated the land.
- B. The EPA has considered the matters in section 9 of the Act and for the following reasons has determined that the site is contaminated in such a way as to present a significant risk of harm to human health and the environment:
- Soil at the site is contaminated with significant concentrations of volatile and reasonably soluble contaminants (benzene and 1,2-DCA), semi-volatile and reasonably insoluble compounds (HCB and PAHs) and DDT (and its

degradation products). Some of these contaminants together with TCE (a volatile and reasonably soluble contaminant) and chlorobenzene (used during the preparation of DDT products) are also present in groundwater.

- The risk of harm arises principally from the interaction and mobilisation of these contaminants, resulting in the potential for off-site migration of contaminants via groundwater into adjacent industrial sites and nearby waterways. There is also some risk of direct exposure of workers to the contaminated soil although there are protocols in place to protect employees working with soil.
  - Some of the compounds that have the potential to migrate off-site include probable and possible human carcinogens.
  - Separate phase material has been detected in on-site groundwater monitoring wells.
  - It is reasonable to suggest that the concentration of contaminants in on-site groundwater monitoring wells near the site boundary indicate a high likelihood of off-site migration.
- C. Orica has submitted a number of documents in relation to a voluntary proposal for investigation and remediation of the site to the DEC, including:
- On 31 January 2005 Orica submitted a draft voluntary proposal for remediation of the site and investigation of the nature and extent of off-site migration of contaminated groundwater. This was revised, based on DEC's letter dated 1 March 2005, and resubmitted on 18 March 2005 by Orica.
  - On 23 May 2005 Orica submitted the document titled *Voluntary Investigation – Part 1 Groundwater and Soil*, dated 11 May 2005.
  - On 23 June 2005 Orica submitted a report on preliminary investigations into the off-site soil contamination.
- D. On 22 April 2005 the EPA declared the site to be a remediation site.
- E. Following the making of the declaration the EPA considered all submissions received as to whether a Remediation Order should be made.
- F. There are no other persons who are required to be served with a copy of this order for the purposes of s.23(4) and s.24(1)(b) of the Act.

#### **4. Action to be taken in remediating contamination on the site**

By this order the EPA directs Orica, being the owner of the premises and, based on information available to date, a person whom the EPA believes to have principal responsibility for the contamination of the premises with the substances referred to above, to do the following:

##### **Additional investigations**

- A. Carry out an investigation relating to soil and groundwater impacted by the site contaminants.
- B. The investigation referred to in condition 4A must include the following:

- i. Delineation of contaminated groundwater plumes, sources and migration pathways to the maximum extent practicable commensurate with what is necessary to evaluate the risk of harm to human health and the environment posed by the contamination.
  - ii. Delineation of dense non-aqueous phase liquid ("DNAPL") contamination and contaminant source zones to the maximum extent practicable commensurate with what is necessary to evaluate the risk of harm to human health and the environment posed by the contamination.
  - iii. Assessment of the fate and transport of contaminated groundwater and DNAPL contamination.
  - iv. Detailed description of the geological and hydrogeological conditions on and in the vicinity of the site.
  - v. Assessment of actual and potential on- and off-site impacts on human health and the environment.
  - vi. Detailed description of the sampling and analysis plan and methodology used in carrying out the investigation.
- C. Prepare a report on the investigation referred to in conditions 4A and 4B. The report must conclude, in specific terms, the following:
- i. Whether remediation of the site soil is required;
  - ii. Whether remediation of the on-site groundwater, or off-site groundwater, or both is required; and
  - iii. Whether any revision of the existing site management plan is required.
- D. Engage a Site Auditor accredited under the CLM Act to review the investigation report referred to in condition 4C. Orica must ensure that the Site Auditor comments on whether the investigation report has adequately addressed the significant risk of harm issues that have been identified by the DEC. Should the investigation report referred to in condition 4C conclude that remediation, whether of soil or of groundwater or of both, is required, Orica must ensure the Site Auditor also comments on whether or not the investigation is sufficient and suitable for preparation of the remediation action plans (RAPs) referred to in conditions 4K and 4L.

#### **Technology assessment**

- E. Carry out an assessment of technologies with potential to treat soil impacted by the site contaminants.
- F. Carry out an assessment of technologies with potential to treat groundwater impacted by the site contaminants.
- G. The technology assessments referred to in conditions 4E and 4F must include the following:
- i. An evaluation of the various treatment technology options, a short list of preferred options and reasons for those preferences.
  - ii. In relation to Schedule X Wastes, demonstration of conformance with ANZECC's *National Protocol Approval/Licensing of Commercial-Scale Facilities for the Treatment/Disposal of Schedule X Wastes 1994*.
  - iii. In relation to environmentally hazardous chemicals, indication of whether a review of the proposed technologies (under clause 12 of the *Environmentally Hazardous Chemicals Regulation 1999*) has been assessed, and if not, what actions in this regard are proposed.
  - iv. Outline of the physical, chemical and/or biological processes involved in the technologies.

- v. In relation to Schedule X Wastes, demonstrated conformance with approaches to determine air and water emissions standards in the National Management Plans for Schedule X Wastes, or describe alternative approaches.
  - vi. Proposed remediation criteria for soil and groundwater that ensure the remediated site will be suitable for its current and approved use(s) as defined in the CLM Act and to the maximum practicable extent for the proposed use(s) of the land.
  - vii. Demonstration that the proposed technologies will adequately meet the remediation criteria referred to in condition 4G(vi).
- H. Prepare a report on the assessment of technologies with potential to treat soil impacted by the site contaminants referred to in condition 4E.
- I. Prepare a report on the assessment of technologies with potential to treat groundwater impacted by the site contaminants referred to in condition 4F.
- J. Engage a Site Auditor accredited under the CLM Act to review the technology assessment reports referred to in conditions 4H and 4I. Orica must ensure that the Site Auditor comments on whether the technology assessments are sufficient and suitable for preparation of the RAPs referred to in conditions 4K and 4L.

**Remediation action plan**

- K. Prepare a RAP for soil impacted by the site contaminants.
- L. Prepare a RAP for groundwater impacted by the site contaminants.
- M. The RAPs referred to in conditions 4K and 4L must include the following:
- i. A summary of all investigations carried out in relation to the site contamination, including all investigations carried out in relation to the migration of contamination off the site.
  - ii. A clear statement of the scope of work to be undertaken.
  - iii. A re-evaluation of options to prevent the migration of contaminated groundwater off the site, the preferred option and reasons for that preference.
  - iv. A re-evaluation of options to remediate contaminated site soils that are providing a source of continued groundwater contamination, including reasons for choosing a preferred option.
  - v. A re-evaluation of options to remediate contaminated groundwater at the site, including reasons for choosing a preferred option.
  - vi. A re-evaluation of options to remediate contaminated soil and groundwater that has migrated off the site, the preferred option and reasons for that preference.
  - vii. A review and revision, if required, of the proposed remediation criteria for soil and groundwater referred to in condition 4G(vi) that ensure the remediated site will be suitable for its current and approved use(s) as defined in the CLM Act and to the maximum practicable extent for the proposed use(s) of the land.
  - viii. If site-specific remediation criteria are proposed, a risk assessment associated with the development of the criteria, being an assessment done in accordance with the NEPM with all site-specific assumptions used in the risk assessment clearly detailed.
  - ix. Detail of any environmental safeguards required to complete the remediation in an environmentally acceptable manner.
  - x. Detail of validation and ongoing site monitoring and reporting procedures.

- N. Engage a Site Auditor accredited under the CLM Act to review the RAPs referred to in conditions 4K and 4L. Orica must ensure that the Site Auditor comments on whether implementation of the RAPs will make the site suitable for its current and approved uses(s) as defined in the CLM Act and to the maximum practicable extent for the proposed use(s) of the land.
- O. Continue an open and transparent community consultation program that will include appropriate opportunities for the community and members of the National Advisory Body on Scheduled Wastes to comment fully on the proposal.

**Timeframe for submission of reports**

- P. The following reports must be submitted in writing to the Department of Environment and Conservation's ("DEC") Director Contaminated Sites by the deadlines specified below:

<b>Report</b>	<b>Deadline</b>
i. Report on current investigations being carried out by Orica in relation to the site.	30 December 2005
ii. Investigation report, including Auditor's review, required by conditions 4C and 4D.	14 August 2006
iii. Soil and groundwater remediation technology assessment reports required by condition 4H and 4I.	30 September 2006
iv. Auditor review of technology assessment reports required by condition 4J.	30 September 2006
v. Soil and Groundwater RAPs required by conditions 4K and 4L.	31 December 2006
vi. Auditor review of RAPs required by condition 4N.	31 December 2006
vii. Documentation of implementation of the community consultation program required by condition 4O.	1 December 2005 and then every 12 months for the duration of the investigation and remediation works

**Relevant guidelines**

- Q. All work must be undertaken in accordance with the guidelines made or approved by the EPA under section 105 of the CLM Act. A list of this guidelines is included as Appendix 1.

**Definitions**

"ANZECC" means the Australian and New Zealand Environment Conservation Council

"CLM Act" means the *Contaminated Land Management Act 1997*

"DEC" means the Department of Environment and Conservation (NSW)

"EPA" means the Environment Protection Authority (NSW)

"NEPM" means the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, National Environment Protection Council

"Orica" means Orica Australia Pty Ltd

"RAP" means remediation action plan

"The site" means the land at 2 Christina Road, Villawood, NSW comprising Lot 1 in DP 634604 in the local government area of Bankstown



**CAROLYN STRANGE**  
**Director Contaminated Sites**

Date: - 2 NOV 2005

**NOTE:**

**Breaches of this Order**

A person (other than a public authority that is not a person interested in the relevant land) who fails to comply with a remediation order issued under section 23 of the Act is guilty of an offence. Heavy penalties may be imposed where a person fails to comply with directions given in a notice issued under section 23 of the Act.

**Information recorded by the EPA**

Section 58 of the Contaminated Land Management Act 1997 requires the EPA to maintain a public record. A copy of this remediation order will be included in the public record.

**Information recorded by councils**

Section 59 of the Act requires the EPA to give a copy of this order to the relevant local council. The council is then required to note on its planning certificate issued pursuant to s.149 (2) of the Environmental Planning and Assessment Act that the land is currently subject to an investigation order. The EPA is required to notify council as soon as practicable when the order is no longer in force and the notation on the s.149 (2) certificate is removed.

**Site audits**

Section 24(1)(d) of the Act requires that the remediation concerned must be audited by a NSW accredited Site Auditor.

\*The EPA is part of the Department of Environment and Conservation (NSW)

# Guidelines made or approved by the EPA under section 105 of the Contaminated Land Management Act 1997

August 2005

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## Guidelines made by the EPA

- *Contaminated Sites: Guidelines for Assessing Service Station Sites*, December 1994.
- *Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land*, January 1995.
- *Contaminated Sites: Sampling Design Guidelines*, September 1995.
- *Contaminated Sites: Guidelines for Assessing Banana Plantation Sites*, October 1997.
- *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, November 1997.
- *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*, June 1998.
- *Contaminated Sites: Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report*, April 1999.
- *Contaminated Sites: Guidelines for Assessing Former Orchards and Market Gardens*, June 2005.

Note: All references in the EPA's contaminated sites guidelines to the *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC, November 1992) are replaced as of 6 September 2001 by references to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ, October 2000), subject to the same terms.

## Guidelines approved by the EPA

- *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, published by Australian and New Zealand Environment and Conservation Council and the National Health and Medical Research Council (NHMRC), January 1992.
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, October 2000.

## EnHealth (formerly National Environmental Health Forum monographs)

- *Composite Sampling*, by Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, Adelaide.
- *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards*, Department of Health and Ageing and EnHealth Council, Commonwealth of Australia, June 2002.

## **National Environment Protection Council publications**

### ***National Environment Protection (Assessment of Site Contamination) Measure 1999***

- The Measure includes a policy framework for the assessment of site contamination, Schedule A and Schedule B.

#### **(I) Schedule A**

- *Recommended General Process for the Assessment of Site Contamination.*

#### **(II) Schedule B -Guidelines**

- (1) *Guideline on Investigation Levels for Soil and Groundwater*
- (2) *Guideline on Data Collection, Sample Design and Reporting*
- (3) *Guideline on Laboratory Analysis of Potentially Contaminated Soils*
- (4) *Guideline on Health Risk Assessment Methodology*
- (5) *Guideline on Ecological Risk Assessment*
- (6) *Guideline on Risk Based Assessment of Groundwater Contamination*
- (7a) *Guideline on Health-Based Investigation Levels*
- (7b) *Guideline on Exposure Scenarios and Exposure Settings*
- (8) *Guideline on Community Consultation and Risk Communication*
- (9) *Guideline on Protection of Health and the Environment During the Assessment of Site Contamination*
- (10) *Guideline on Competencies & Acceptance of Environmental Auditors and Related Professionals*

#### **Other documents**

- *Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes*, NSW Agriculture and CMPS&F Environmental, February 1996.
- *Australian Drinking Water Guidelines*, NHMRC & National Resource Management Ministerial Council, 2004

