



ASSESSMENT REPORT

Proposed Land Rehabilitation using Dynamic Compaction Penrith Lakes Scheme

1. BACKGROUND

The Penrith Lakes Scheme (the Scheme) supplies 55% of Sydney's sand and gravel requirements and covers approximately 2,000 hectares of the Penrith Castlereagh floodplain in the Penrith Local Government Area (see Figure 1). Extractive operations at the Scheme are anticipated to cease by 2011, with the land expected to be rehabilitated for residential and recreational use by 2020.

The Scheme's extraction and rehabilitation operations are governed by the *Sydney Regional Environmental Plan No 11 – Penrith Lakes Scheme* (SREP 11) and coordinated by the Penrith Lakes Development Corporation (PLDC) (the Applicant). Among other things, SREP 11 governs the geotechnical standards to which land within the Scheme should be rehabilitated, to ensure its suitability for planned future land uses.



Some of the land in the older parts of the Scheme does not meet the geotechnical standards of SREP 11 as it was extracted and rehabilitated prior to the gazettal of SREP 11 in 1986.

The Applicant has considered a range of options for rehabilitating these already re-instated sites to SREP 11 standards, and determined that 'dynamic compaction' would be the most suitable for this purpose, on both economic and environmental grounds.

The Applicant is nearing completion of a successful trial of the dynamic compaction process on a 10.8 hectare site within the Scheme area (see Figure 1).

The Applicant is now seeking approval to extend the area of dynamic compaction to an additional 39 hectares of land.

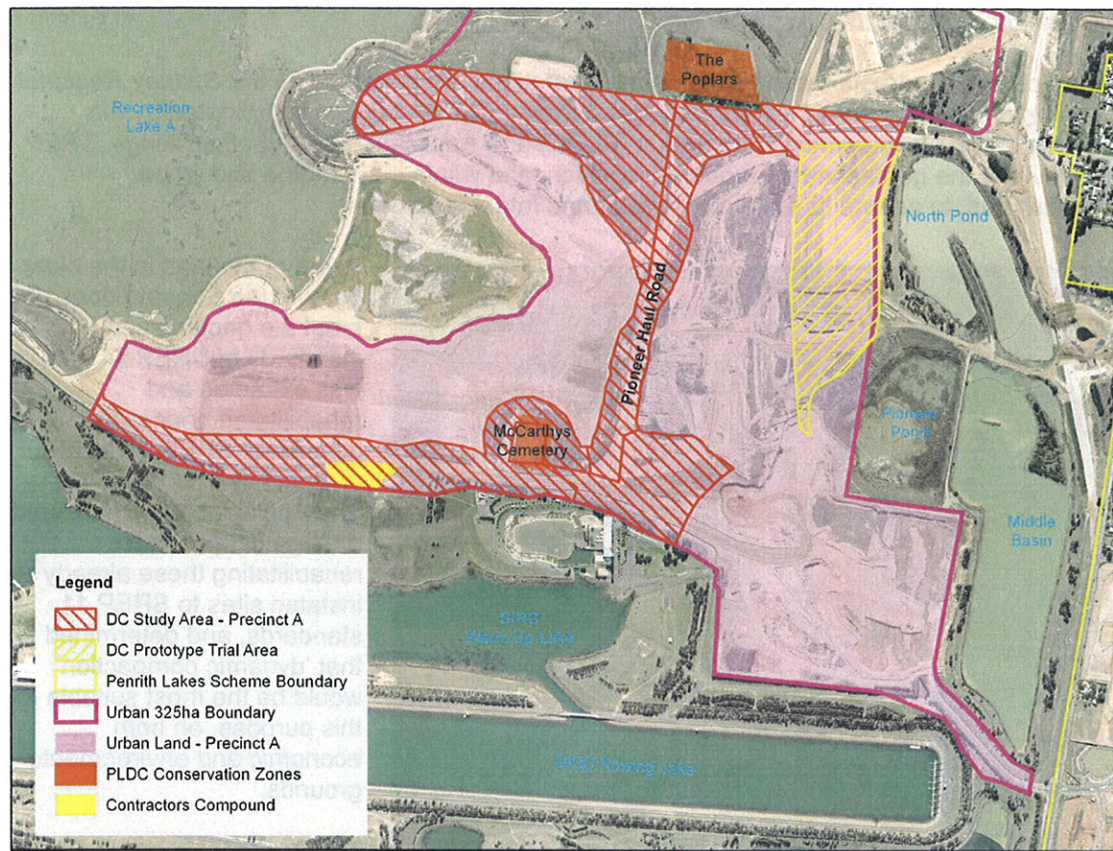
Figure 1 – Penrith Lakes Scheme Site

2. PROPOSED MODIFICATION

On 9 October 2006, the Applicant lodged an application to modify DA2 under section 96(1A) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to undertake dynamic compaction (DC) within a 39 hectare site (the DC extension area) within the Scheme area (see Figure 2).

The proposal involves:

- stripping and stockpiling approximately 100mm of topsoil from the site;
- placing approximately 500-600mm of fill sourced from other areas within the Scheme over the site's exposed surface;
- flattening the site's surface with a dozer;
- establishing erosion and sediment controls;
- compacting the site to specified geotechnical standards using a 20 tonne weight that would be dropped from a height of up to 25 meters at specified locations (see Figures 3 & 4); and
- spreading the topsoil and re-seeding the site.



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Aerial photograph captured 1 September 2006

Figure 2 – DC Extension Area (red hatching)

The proposal is anticipated to take approximately 2 years to complete and would be restricted to daytime operating hours (7am to 7pm Monday to Saturday, and no work on Sundays and public holidays).

The use of dynamic compaction would alleviate the need for the subject site to be rehabilitated via more intrusive means such as the re-excavation, re-filling and layered compaction of land, which would generate considerable additional noise and dust impacts. The Applicant has also determined that dynamic compaction would be considerably more cost-effective than other non-intrusive forms of land rehabilitation such as stone column ground improvement.



Figure 4 – Ground Treated by Dynamic Compaction



Figure 3 – DC Rig

3. STATUTORY CONTEXT

3.1 Permissibility

The site is located on land to which *Sydney Regional Environmental Plan No 11 – Penrith Lakes Scheme* (SREP 11) applies. Under SREP 11, rehabilitation of land for the purposes of future urban use is a permissible land use with the Minister's consent.

3.2 Consent Authority

Under section 96(1A) of the EP&A Act, a consent authority may modify a development consent if it is satisfied that:

- a) *the proposed modification is of minimal environmental impact, and*
- b) *the development to which the consent as modified relates is substantially the same development for which consent was originally granted and before that consent as originally granted was modified (if at all) under this section.*

The Department has assessed the potential impacts of the proposal (see Section 5) and is satisfied that the proposed modification would be of minimal environmental impact, and that the development (as modified) would remain substantially the same development for which consent was originally granted.

The Minister was the consent authority for the original development application, and is consequently the consent authority for this application. On 5 April 2006, the Minister delegated his powers and functions as a consent authority to modify development consents under section 96(1A) of the EP&A Act to the Executive Director, Major Project Assessments. Consequently, the Executive Director may determine the application under delegated authority.

4. CONSULTATION

The Department is not required to exhibit applications under section 96(1A) of the EP&A Act. However, the Department forwarded a copy of the modification application and accompanying Statement of Environmental Effects (SEE) to the Department of Environment and Conservation (DEC), the NSW Heritage Office and Penrith City Council (Council) for review and comment. The Department's view is that no further consultation is necessary regarding the proposed modification.

Penrith City Council raised concerns regarding the potential noise, vibration and heritage impacts of the proposal. The Department has assessed the potential impacts of the proposal on noise, vibration and heritage (see section 5 and Appendix A), and is satisfied that the environmental impacts of the proposal can be managed and/or mitigated to an acceptable standard.

The **Department of Environment and Conservation** was satisfied with the Applicant's assessment of noise in accordance with *NSW Industrial Noise Policy* (INP) and has provided its requirements for the proposal. The Department has incorporated these requirements into its recommended conditions.

The **NSW Heritage Office** was concerned about the potential vibration impacts of the proposal on McCarthy's Cemetery, an item of environmental heritage listed under Schedule 3 of SREP 11, and the Poplars Heritage Complex, an item of local heritage significance. The Department has incorporated the Heritage Office's recommendations for protection of these heritage items into its recommended conditions.

5. SECTION 79C CONSIDERATION

Section 96 of the EP&A Act requires a consent authority to consider the matters listed under section 79C(1)(a)-(e) when it determines a modification application. The Department's consideration of these matters is presented below.

5.1 Environmental Planning Instruments

The following planning instruments and policies are relevant to the proposal:

- *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development;*
- *State Environmental Planning Policy No. 55 – Remediation of Land;*
- *Sydney Regional Environmental Plan No. 11 – Penrith Lakes Scheme; and*
- *Penrith Local Environmental Plan 1991 (Environmental Heritage Conservation).*

The Department has assessed the proposal against the requirements of the above planning instruments (see Appendix A), and is satisfied that the proposal complies with and is otherwise consistent with the requirements of these planning instruments.

5.2 Environmental Impacts

The Department believes that the key environmental issues associated with the proposed modification are:

- noise;
- vibration; and
- protection of heritage items (exclusively related to potential vibration impacts).

5.2.1 Noise

Noise from the proposal has the potential to impact on residential receivers at Cranebrook Village, located approximately 375 to 900 metres to the east of the site, the Poplars Heritage Complex immediately to the north of the site (see Figure 2), and the Upper Castlereagh Uniting Church residence, about 600 metres to the west of the site. The Poplars heritage complex is owned by this Department, and has one occupied residence (Poplars residence).

The SEE included a noise impact assessment undertaken in accordance with INP requirements. The assessment predicted (see Table 1) that noise resulting from the proposal under a range of operating conditions (1, 2 or 3 DC rigs operating simultaneously), would:

- comply with INP Project Specific Noise Levels and Environmental Protection Licence (EPL) criteria at:
 - Cranebrook Village;
 - South Cranebrook residences; and
 - the Upper Castlereagh Uniting Church residence with 1 rig operating; and
- slightly exceed INP criteria at the Upper Castlereagh Uniting Church residence with 2 or 3 rigs operating;
- exceed INP criteria and EPL criteria at the Poplars residence; and
- exceed INP criteria at the Whitewater Stadium (when in use).

| Sensitive Receiver | Predicted Noise Level L_{Aeq} dB(A) 1 DC Rig – 3DC Rigs | INP Intrusive Criteria (Project Specific Noise Level) L_{Aeq} dB(A) | Existing EPL Criteria L_{A10} dB(A) |
|----------------------------------|---|---|--|
| Cranebrook Village | 40 – 45 | 48 | 55 |
| South Cranebrook residences | 34 – 39 | 55 | 55 |
| Poplars residence | 67 -72 | 43 | 55 |
| Upper Castlereagh Uniting Church | 46 - 51 | 47 | 55 |
| Whitewater stadium (when in use) | Not Provided - Exceedance predicted (when in use) | 48 | 60 (when in use) |

Table 1 - Noise Levels Predicted by the Applicant

Under the conditions of the consent and the site's EPL, activities occurring for periods less than 2 years must meet a noise criterion of L_{A10} 60 dB(A). The Applicant argued this criterion should apply to the proposal as all activities are planned to be completed within 23 months. The DEC believes that, since DC activities on the site (in the DC trial and DC extension area) would occur for about 3 years, the criterion applicable for activities occurring for more than 2 years, (L_{A10} 55 dB(A)), should apply to the proposal. The Department supports the DEC view that the L_{A10} 55 dB(A) criterion is the more appropriate assessment criterion for the proposal under the conditions of the existing consent and EPL.

In assessing noise impacts, the Department recognises that there is a significant difference between the noise criteria under the Applicant's EPL and the more stringent intrusive criteria under the INP. Strictly speaking, the contemporary INP criteria apply to the proposed modification. However, the Department notes that the proposal represents an alternative to an activity (land rehabilitation) that is already approved by the existing consent. That is, the Applicant is able to rehabilitate the site via traditional methods (i.e. earthworks) under the existing consent, in which case the criteria would apply.

Rehabilitation via traditional methods would likely generate greater noise impacts than the proposed dynamic compaction method. Accordingly, the Department recognises that the proposal represents an improvement in absolute terms, and has taken the existing noise criteria into consideration in its assessment of noise impacts.

To address the exceedence of the INP noise criteria, the Applicant has proposed a number of mitigation measures, including:

- restricting the hours of operation to the daytime period (7am to 7pm Monday to Saturday, and no work on Sundays and public holidays); and
- keeping the nearest sensitive receivers informed about the works.

In consideration of these feasible and reasonable noise mitigation measures, the DEC has determined that it is willing to licence the development as modified by the proposal, and has set noise criteria based on the Applicant's worst-case predictions of 3 DC rigs operating concurrently in the same area (see Table 2). The DEC has not set criteria for the Poplars residence, recognising that the residents have provided a letter stating that they have no objection to the continuation of dynamic compaction work in the vicinity of their home.

The Applicant has a close working arrangement with the operators of the Whitewater Stadium and is confident that an agreement to accept the predicted impacts of dynamic compaction works can be obtained. It is important to note that the Whitewater Stadium is infrequently used on week days and noise criteria only apply to the stadium when it is in use. Noise impacts at the stadium are therefore limited to Saturdays and occasional week days.

| Sensitive Receiver | DEC Noise Impact Limits 3DC Rigs operating L_{Aeq} dB(A) |
|----------------------------------|--|
| Cranebrook Village | 45 |
| South Cranebrook residences | 39 |
| Poplars residence | No limit set |
| Upper Castlereagh Uniting Church | 51 |
| Whitewater Stadium | No limit set |

Table 2 - DEC Noise Limits

The DEC has also recommended that the Applicant establish a Noise and Vibration Management Plan (NVMP) for the development that includes:

- operational practices that would be employed to achieve the proposed noise limits;
- measures to monitor and report noise impacts;
- measures to calibrate and validate the noise prediction methodology;
- measures to cease DC activities or establish offset distances from sensitive locations outside the Scheme's boundaries if noise criteria are approached or exceeded; and
- community contact details.

The Applicant has an approved NVMP for the DC trial area. This plan would need to be reviewed and updated to ensure that it considers the potential noise and vibration impacts of the larger DC extension area.

The Applicant has advised that it would be able to meet DEC criteria at Cranebrook Village, South Cranebrook and the Upper Castlereagh Uniting Church residence, as they have been set by the consideration of the impacts of the worst case of 3 DC rigs operating concurrently in the same area.

However, the Applicant has advised that it would not be able to meet the 43dBA criterion at the Poplars residence, or the 48dB(A) criterion at the Whitewater Stadium (when in use). However, the tenants of the Poplars residence have provided a letter stating "*we have no objection to the continuation of dynamic compaction work in the vicinity of our house*" (Appendix G of SEE). In the event that a suitable noise agreement is not in force for either of these properties, the Applicant would be required to operate the DC works so that the relevant INP noise criterion would be achieved.

In summary, the Department is satisfied that the predicted exceedences of the INP noise criteria are justified given:

- that the predicted noise levels for the proposal at sensitive receivers located external to the Scheme's boundaries would comply with the Applicant's existing EPL criteria (L_{A10} 55dB(A));
- that the predicted noise impacts at sensitive receivers under the current proposal, are likely to be lower than those generated by alternative methods of rehabilitation (i.e. earthworks), which would have been undertaken under the existing consent and EPL criteria;
- the finite nature of the proposed works (i.e. 2 years for the project, but with impacts on any single receiver certain to be much less than 2 years); and
- that the proposal would enable the site to be rehabilitated to SREP 11 standards, and thereby facilitate its subsequent development for urban landuse.

However, the Department believes that the Applicant should be required to:

- comply with the strict hours of operation;
- comply with DEC's proposed noise criteria - or ensure that a written agreement exists between the Applicant and the relevant affected landowner(s) and/or tenants to accept the predicted noise impacts;
- revise its approved Noise and Vibration Management Plan to apply to the DC extension area; and
- conduct a noise compliance assessment of the DC operations within one month of their commencement within the DC extension area.

5.2.2 Vibration

The dynamic compaction process would require weights to be dropped at a rate of up to one drop each 30 seconds when 3 DC rigs are in operation. According to the DEC's "*Assessing Vibration: a technical guideline*", vibration of this type is classified as "*intermittent vibration*".

Receivers potentially affected by the proposal include the Poplars Complex (a heritage item listed in the Penrith LEP), residences at Cranebrook Village, the Whitewater Stadium and McCarthy's Cemetery (a heritage item listed under SREP 11 and Penrith LEP). Vibration impacts on the Upper Castlereagh Uniting Church were not specifically addressed by the Applicant due to the distance (600 metres) from the proposed works.

A vibration impact assessment was carried out for the proposal by Arup Pty Limited. Potential impacts were assessed against the ground vibration limits set in relevant Australian and international standards.

The Applicant has been able to utilise measurements made of vibration impacts from the operation of the DC trial area to predict vibration impacts in the DC extension area. This site-

specific data and the conservative worst-case approach used provide a high degree of confidence in the vibration predictions made by the Applicant.

In its assessment of vibration impact, the DEC utilised its recent guideline “*Assessing Vibration: a technical guideline*” (April 2006). This guideline is based on British Standard *BS 6472 -1992: Human exposure to vibration in buildings (1-80Hz)*. DEC's long-standing practice has been to reference this standard. Accordingly, the DEC has maintained a consistent approach to its assessment of human comfort vibration impacts for the DC trial and DC extension areas.

The assessment (see Table 3) indicated that the proposal is:

- unlikely to have any impact on buildings/structures at Cranebrook Village, South Cranebrook residences and the Upper Castlereagh Uniting Church residence;
- likely to exceed building damage criteria at the Poplars Complex, but would meet the criteria at a buffer distance of about 95 metres;
- likely to exceed building damage criteria at the Whitewater Stadium, but would meet the criteria at a buffer distance of about 50 metres;
- likely to exceed human comfort standards for 'low probability of adverse reaction' at the Poplars Complex, but would meet the criteria at a buffer distance of about 360 metres.

| Sensitive Receiver | Building Damage | | Human Comfort Buffer Distance (metres) |
|-----------------------------|---|---|--|
| | Vibration Criteria (peak particle velocity) | Buffer Distance to Meet Criteria (metres) | |
| Whitewater Stadium | 10 mm/s- | 50 | N/A |
| Cranebrook Village | 5 mm/s | 72 | 360 |
| Poplars Heritage Complex | 3 mm/s | 95 | 360 |
| McCarthy's Cemetery | 3 mm/s | 95 | N/A |

Table 3 - Vibration Criteria and Buffer Distances

To mitigate the potential for human discomfort, and the potential structural impacts at the Poplars Complex and damage to structures in McCarthy's Cemetery, the Applicant proposes to:

- monitor vibration at the Poplars residence, the Whitewater Stadium and the boundary of McCarthy's Cemetery throughout the works;
- undertake regular visual monitoring of the Poplars Complex structures;
- adopt vibration management zones (buffer zones) as shown in Figure 5, in which dynamic compaction activities would be based on real-time vibration measurements;
- stabilise headstones and other unsound structures within McCarthy's Cemetery, prior to works entering the buffer zone;
- cease works upon any exceedence of the building damage criteria, and undertake mitigation measures including engineering works (such as excavating a trench between the works and the sensitive receiver), or adopting increased buffer distances; and
- cease works upon complaints being received, and undertake mitigation measures including consulting with residents, implementing engineering works (such as trenching), restricting hours of operation, or carrying out dilapidation surveys.

The DEC determined that it is willing to licence the development as modified by the proposal and has recommended vibration limits to be set at the level of 'low probability of adverse comment' (as defined in “*Assessing Vibration: a technical guideline*”(2006)), and has recommended that a comprehensive vibration management plan be prepared and implemented by the Applicant.

With regard to building damage, the Department is satisfied that the proposal is unlikely to have any impacts on buildings and structures at Cranebrook Village, South Cranebrook residences, the Upper Castlereagh Uniting Church and is unlikely to significantly inconvenience the users of the Whitewater Stadium. However, the proposal has the potential to impact upon the heritage-listed Poplars Complex structures and McCarthy's Cemetery.