CHAPTER 4

RESULTS AND DISCUSSION
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4.1 Introduction

The results and discussion of the study are presented in two sections. Firstly, the environmental audit results of the site, which include site observation, interview with personnel, environmental compliances audit and monitoring and checking of the implementation. Secondly, the management review exercise, which was to establish proper mitigation measure to encounter or to resolve the environmental concerns highlighted during the audits. As a result, a preliminary EMS that is confirming to the ISO 14001 principles was designed and prepared, as discussed in the Chapter 5.

4.2 Environmental audit results of site

The results of the site environmental audit are based on the findings and the topics outlined in the site environmental audit interview checklist, site observation findings, compliances audit results and monitoring programs results conducted by the Project Environmental Management Consultant (EMC) and site Independent Environmentalist.

4.2.1 Interview (pre-audit)
The site environmental interview is conducted on three different management levels, as mentioned earlier in Chapter 3. This interview would enable identification of the detailed information of the project and existing management system, before implementing the ISO 14001. The findings of the interview were summarized in Table 4.1.

<table>
<thead>
<tr>
<th>Level of management person</th>
<th>Findings of the interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Project Manager</td>
<td>Overall of project management • Project background • History of project site  • DOE Terms and conditions • Operation activities of project site • Manpower involved for the project • Current management structure • Current Environmental Policy</td>
</tr>
<tr>
<td>Construction manager</td>
<td>Overall of project operation management • Current river water quality management • Current hazardous materials management • Current waste management • Current wastewater management • Current Air quality management • Current noise and vibration quality management • Current transportation and machinery management</td>
</tr>
<tr>
<td>Safety and Environmental Manager</td>
<td>Overall of project safety and training • Current safety and training management</td>
</tr>
</tbody>
</table>

Details of the findings of the interview are presented in the following sections.

4.2.1.1 Overall project management

4.2.1.1a Project background/information

The audited project site, which was the re-aligned road of Federal Route 55 (KKB to Frasers Hill) located approximately 4 km from Kuala Kubu Town towards to Frasers Hill
and 1.5 km west of the proposed dam site to reach Frasers Hill (refer to Figure 1.1 in Chapter 1). It is part of the parcel of development of the Selangor River Dam. The total stretch of the proposed re-aligned road is about 7.7 km. Syarikat Pengeluar Air Sungai Selangor Sdn Bhd, in short “SPLASH” is the project proponent of this road project. Meanwhile, Gamuda-KDEB-TSWA JV, in short “GKTJV” was appointed as the turnkey contractor to carry out the construction works of the re-aligned FR55.

4.2.1.1b History of project Site

The project site was originally a secondary logged forest. All the commercial logs have been logged over before the site was handed over to the project proponent. The project proponent, SPLASH, when constructing the re-aligned FR55, cleared the required land in accordance to the EIA Report that was approved by the DOE, Malaysia.

4.2.1.1c DOE terms and conditions stipulated for the re-aligned road FR55

Besides the Environmental Quality Act 1974 as mentioned earlier in Chapter 1, The Department of Environment Malaysia (DOE) also stipulated additional terms and conditions to the project proponent, prior to approval of the development of Selangor River Dam. The project proponent was required to comply with all the terms and conditions imposed by the DOE during the construction stage of the re-aligned road. These terms and conditions are listed in Table 3.1 in Chapter 3.
4.2.1.1d Operation activities of project site

Some major activities involved in the construction of the re-aligned road of FR55, are:

- Land clearing and earth works

The construction of the re-aligned road of FR55 (KKB – Frasers Hill) involved a significant extent of land clearing and earth works. Cutting and filling of earth along the road alignment were the major process involved in this activity. This activity involved a lot of heavy machinery such as excavator, bulldozer, motor grader and trucks, as well, to transport the earth. For the slope cutting, the hill terrain would be cut down berm by berm until the designed road level was achieved. However, for the slope filling, the lower valley area would be filled up and well compacted until the designed road level was attained. Soil erosion and sedimentation were the major environmental problems associated with these processes.

- Construction of Bridge

The constructions of two bridges were necessary to connect the re-aligned road FR55 over Selangor River and Luit River at Ch 1300 and Ch 6400, respectively. The length of both bridges is about 200m, which involved construction of six piers and five spans. The associated major activities are micro piling for the foundation of the piers, civil and structure works for bridge columns and piers, insitu cast of concrete “I” beams and beam

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launching. In addition, a tower crane was installed at the riverbank of the Selangor River to aid in the construction activities, especially during concreting of the column and pier.

- Drainage works

Construction of permanent interceptor drain at the cutting and filling slopes, roadside drains and culvert across the re-aligned road were carried out progressively. Several types of drainage works will be implemented at the project site such as pre-cast concrete drains & culverts, insitu cast concrete drains, cascade drains, rubber pitching and earth drains.

- Quarrying at borrow area and quarry sites

Construction materials and aggregate for concrete are needed for road construction and its associated structures. A granite rock quarry was set up at the northern end of the project site to support the construction needs. The following are the major activities involved in rock quarrying works:

a) Removal of overburden (excess earth on the top of the solid rock) to exposed solid rock,

b) Drilling of blasting borehole by special drill rig,

c) Rock blasting,

d) Mobile rock crusher machine to crush blasted rock into the required standard sizes of aggregates,

e) Temporary stockpile of rock and aggregates,
f) Transportation of aggregates or rocks to the designated project area, and

g) Maintenance yard of heavy machinery and trucks.

□ Concrete Batching plant

A concrete batching plant was set up to support the construction activities. The batching plant was located about 500m to the north of Ch 2200 of the re-aligned road FR55. The following are the major activities implemented at the concrete batching plant:

a) Temporary stockpile of aggregate and sand,
b) Loading aggregate and sand into concrete mixer hopper,
c) Loading bulk cement from cement truck into the cement silo of batching plant,
d) Washing concrete truck after unloading concrete to the project site, and
e) Transportation of concrete to the designated project site.

□ Machinery maintenance center

The Megah Sewa Sdn Bhd is the main machinery support to the project site. The said company set up a machinery maintenance yard at the project site, sited beside the concrete batching plant. All the heavy machinery such as excavators, bulldozers, compactors, back pushers, water trucks, motor-graders and mobile cranes were maintained at this maintenance yard.
2.1.1e  Manpower

During the construction period, Gamuda Engineering Sdn Bhd (GESB), Dunia Epik &
Spring Energy –JV (DESEJV) and Megah Sewa Sdn Bhd (MSSB) are the three major sub-
contractors for this road project. GESB acts as the main contractor for road construction,
meanwhile DESEJV and MSSB were involved in rock quarrying works and supplying
heavy machinery to the project site respectively. There are approximately 100 to 120
Malaysian staff and 500 foreign workers involved at this road project. For security reason,
all the foreign workers such as Indonesians, Bangladeshhi etc. are required to stay in the
Central Labour Quarters (CLQ).

4.2.1.1f  Management structure

The current management structure for this re-aligned road FR55 project is as shown in
Figure 4.1. The group is headed by the Project Director assisted by the Senior Project
Manager, who was supported by the Construction Manager and Safety and Environmental
Manager in carrying out the works and manage environmental matters for the project.
Figure 4.1: Organization chart of the re-aligned road project

4.2.1.1g Environmental policy

The project does not have a site environmental policy. However, quality management and safety policies were introduced instead.
I. Construction of silt trap

SMHB (Syed Muhammad Hooi & Binnie) Sdn Bhd is the consultant responsible for the design of silt traps at the project site. Approval from the Drainage and Irrigation Department (DID) was based on one general design of silt trap (Appendix 3). This approved general silt trap design was applied for the construction of all silt traps within this project site. Currently, 24 number of silt traps have been constructed at strategic location selected by the site supervisor based on topographic to mitigate the siltation problem in the river system. Re-designing of the silt trap that failed was not practiced at the site. However, the site supervisor was responsible in carrying out the maintenance works or upgrading works of the silt trap regularly.

In addition, the Environmental Management Consultant (EMC) and site full-time independent Environmentalist carried out monitoring on the discharge of silt trap within the project site on a monthly and daily basis, respectively, to ensure its compliance with DOE requirements.

II. Turfing on the exposed slope

The contractor has implemented the turfing works on the completed slope to minimize the erosion process. Four types of turfing were implemented at the project site: such as (i) spot turfing, (ii) close turfing, (iii) hydroseeding and (iv) planting with vetiver grass, but
the standard turfing criteria for selection of turfing methods are not provided at the site. In addition, monitoring of growth of turfed area was not implemented at the site.

III. Cover the temporary exposed area with plastic sheets

Plastic sheets were used to cover the exposed slope as a temporary measure at the project site for those non-active areas.

4.2.1.2b Existing hazardous materials management

There are three types of hazardous materials being stored and handled within this project site, such as fuel (diesel), explosive for quarry and cement for concrete batching plant.

There are no proper procedure, guidelines and inventory for materials management to ensure improvement to overall environmental performance that specific in storage, labeling and handling procedures are not provided except explosive materials at quarry site. In addition, proper layout plan showing the storage location of this hazardous materials and scheduled inspection of the storage and handling facilities are also not implemented at the project site.

Generally, the hazardous materials management at the site was insufficient and not according to the DOE’s requirements. The contractor practiced typical common storage and handling methods for the said materials as follows:
I. Fuel (Diesel)

The diesel is meant to fuel heavy machines, site vehicles, site trucks and other related equipments. The total quantity of diesel consumption at this project site is approximately 250,000 liters a month. The entire diesel was stored in a proper diesel skid tank with capacity 18,000 liters. The contractor does not install any automatic trigger alarm system for skid tank if oil spillage occurred at the site. They only strictly prohibit smoking within this area due to the flammable substances.

II. Explosive

Only authorized personnel (licensed chargeman) are allowed to handle the explosives at the project site. Storage of explosives at the project site is strictly prohibited. Normally, explosive were collected from the authorized factory early morning and collection and delivery to site must be accompanied by a policeman. The maximum amount of explosive materials used at the project site is limited to 200kg a day. The procedure for handling the explosive was conducted according to safety procedure.

III. Cement

Cement is needed for the concrete batching plant to produce concrete for all the related construction activities of the road. The total quantity of cement consumption at this project is approximately 100 metric tons a month. Two 100 metric tons capacity cement silos
have been set up at concrete batching plant for the storage purpose. Filter bags at the top of the cement silo are used to control air pollution from its silo especially during loading process.

4.2.1.2c Existing waste management

The road construction activities generated a large quantity of waste material either directly or indirectly. The waste generated at the project site and the designated disposal sites are shown in Table 4.2 below:

### Table 4.2: The summary of types of waste generated from the project site

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Quantity</th>
<th>Quality</th>
<th>Disposal sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction waste</td>
<td>NA</td>
<td>Disused tyres, formworks, empty drums, construction materials and etc.</td>
<td>Landfill at Kerling</td>
</tr>
<tr>
<td>Domestic waste</td>
<td>500kg per day</td>
<td>Food packaging, general garbage's, foods, used paper and etc. that</td>
<td>Municipal garbage centers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>generated from CLQ and site office.</td>
<td></td>
</tr>
<tr>
<td>Scheduled waste</td>
<td>NA</td>
<td>Used oil and others machinery lubricant generated from machinery</td>
<td>To be collected by licensed contractor and disposed of.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>maintenance yard</td>
<td></td>
</tr>
<tr>
<td>Biomass waste</td>
<td>NA</td>
<td>Biomass such as trees, branches, bushes and etc. generated from site</td>
<td>Control burning into ash by Air curtain incinerator at site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>clearing activities</td>
<td></td>
</tr>
</tbody>
</table>

Note: NA = not available

The project site does not produce any solvents, paints, asbestos, CFC, halons and other waste.
Generally, the existing waste management at the site was inadequate, where the facilities for on-site treatment of wastes are not provided at the project site. There is only one on-site waste disposal system for biomass waste that is an Air Curtain Incinerator (ACI). DOE has approved the usage of ACI before commencing the project. The ACI was able to burn the entire biomass generated from the site clearing activities to ash without any unenvironmental friendly gas emission. The burning capacity of the ACI is about 16 metric tons per hour. Otherwise, the private landfill located at Kerling is used as an off-site disposal facility.

Reuse, recycle or waste segregation approach was not implemented at the project site. Most of the wastes such as construction wastes and domestic waste were removed from the project site at the end of the day’s activities or in the early working hours of the next morning. Only scheduled waste will be stored at the site before being collected by a licensed contractor and whilst biomass waste was burnt using air curtain incinerator. Therefore, a specific storage area is provided for scheduled waste at Megah Sewa Workshop. The biomass waste will be temporarily stockpiled at the site before burning.

Transportation of waste is required internally and externally to transport biomass waste to the ACI site and scheduled waste to outside treatment area respectively.

4.2.1.2d Existing wastewater management
Constructions of roads do not generate much wastewater. Washwater from the concrete batching plant and sewage effluent from the toilet's septic tank are the only sources of liquid effluent flowing out of the project site. The site office, Central Labour Quarters (CLQ) and canteen are equipped with appropriately designed septic tanks. The contractor does not implement any monitoring of the sewage discharge quality within the project site as contribution minimum and the license to discharge is not required. In addition, there is no maintenance schedule such as desludging schedule provided by the contractor.

4.2.1.2e Existing air quality management

There are some activities at the project site associated with road construction, which can contribute some impacts to the ambient air quality. The related activities are as follows:

- Carbon monoxide emission from the entire heavy machinery and transportation at the project site,
- Dust pollution from the site vehicle movement,
- Dust emission from drilling rig at quarry site,
- Rock crushing at quarry site,
- Cement silo from concrete batching plant, and
- Earth works activities along the road construction.

Currently, there are some mitigation measures in place to control the air pollution associated with the above-mentioned activities, as follows:

- Spraying water on the dusty haul road to control dust pollution,
• Maintenance of the public road by using motor pusher to clean and remove the soil pastes on the road,
• Installation of dust vacuum system for drill rig machines at quarry to control dust emission during drilling process,
• Maintenance of filter bag cement silo to prevent dispersion during operation, and
• Regular maintenance of site vehicle and machinery to reduce gas emission.

However, the contractor does not provide any vehicle-washing bay for site vehicle before leaving the project site. In addition, there is no provision of safety apparatus such as masks and mouth caps for the workers at site.

The Environmental Management Consultant (EMC), will carry out the air quality monitoring at strategic locations within the project site on a monthly basis to ensure the compliance of air quality standard stipulated by DOE.

4.2.1.2f Existing noise and vibration management

The rock quarrying activities are the major contributor to the noise and vibration quality at the project site. The associated activities at quarry site such as drilling bore hole for installation of explosive by “down to hole hammer method”; rock crusher machine to crush rock into aggregate; rock blasting; transportation of rock and etc. are expected to generate noise and vibration level higher than the ambient. Currently, the delay system method for
rock blasting is implemented at quarry site as a mitigation measure to minimize the impacts of noise and vibration at the quarry site.

4.2.1.2g Existing transportation and machinery management

The management of transportation and machinery for this project site is inadequate, in particular lack of inventory, training etc. The findings of the interview are as follows:

- Inventory of transportation and machinery devices operating at the project area are not provided,
- Maintenance programs for all the vehicles and machinery are not in place at the project site,
- The contractor does not provide any formal policy and guideline on spillage prevention and disposal of fleet maintenance waste such as engine oil, disused tyres, refrigerant, damaged parts and etc,
- Construction of oil trap at the vehicle maintenance yard is not in place,
- The contractor does not carry out any monitoring program for the air and noise emission from site vehicles and machinery to effect appropriate corrective maintenance as required, and
- The contractor did not conduct any training or instill awareness to the drivers and operators in order to improvise the fleet’s environmental performance such as, turn off idle engines, minimize number of trips, reducing consumption of fuels and etc.
4.2.1.3 Existing safety and training management

4.2.1.3a Emergency response procedure

The contractor does not prepare any emergency response procedure for site accident, fire, oil spillage, and other related accident. Therefore, training and drill associated with emergency response procedure were also not implemented at the project site. The contractor only put in placed a few units of fire extinguisher at strategic locations such as the skid tank area, site office, CLQ, canteen and workshop.

4.2.1.3b Staff awareness and training

I. Staff awareness

The contractor conducted the safety meeting on a monthly basis, emphasizing on the environmental and safety matters. This meeting involved most of the main sub-contractors at the project site. However, the staff awareness programs provided at the project site was inadequate. The contractor never participated in discussion on specific environmental management issues in the office or project site such as campaigns on reduction of paper, energy usage, environmental friendly week, recycling week etc.

II. Training
It is compulsory for all the staff and worker at the project site to attend the safety induction-training course conducted by the CIDB. In addition, the contractor also conducted a few general environmental awareness courses for the selected staff. The Environmental Management Consultant (EMC) handles this course at the site, but the EMC does not review its training content regularly to ensure the effectiveness of the training program. It is not possible to gauge the level of awareness amongst the workers. Other specific training courses such as handling the hazardous materials, ERP, waste management and etc. are not provided.

4.2.1.3c Community relations

The project proponent set up an information center in Kuala Kubu Bahru town to allow public to get some information about the project. The center has not received any public complaints since the project commenced in January 2000. Staffs on duty are responsible for environmental information and responding to the public complaints. However, the project proponent did not conduct any training programs to its staff on public inquiry and complaint response. In addition, the formal procedure and program to review adequacy of publicity materials and to ensure the publicity materials are correct and up to date are not fully provided.
4.2.2 Site observation (site audit)

The site audit, based on observation, has been carried out from 01 November 2000 to 15 November 2000, along the construction site of re-aligned road of FR55, from Ch 0.00 to Ch 7700, where the increasing chainage is towards Frasers Hill. The 7.7 km stretch of the re-aligned road was divided into 64 sections/locations based on their earth works activities cutting or filling sections as shown in Appendix 2. The following are the findings of the site observation, associated with the road construction activities and its associated impacts and environmental performance:

4.2.2.1 Cutting and filling slope along the re-aligned road

The major activities along the construction of the re-aligned road are cutting and filling slope, and 34 sections required cutting, where the hilly terrain was cut down from the top (berm by berm) until the required level. Meanwhile, 30 sections of the road required filling, where the excess soil from the cutting area would be filled in the filling section until the required level. Based on the results of observation, most of the completed cutting berm was hydroseeded immediately but this is not applicable for filling slope. The construction of permanent berm drain and interceptor drains was carried out at the completed hydroseeded berm.
The major environmental impacts for this cut and fill activities are soil erosion and silting into the nearby waterway such as Selangor River, which located at the lower most terrain. Dust pollution is minimum during the audit due to the current wet season.

4.2.2.2 **Spoil tip area**

The excess soil from cutting area is identified as spoil tip materials. Few locations along the road construction were identified as a spoil tip disposal area such as Ch 900 (LHS), Ch 1450 (RHS), Ch 2200 (RHS), and Ch 4100 (RHS). The said identified spoil tip disposal areas did not compact to the standard requirement. As a result, the formation of gully erosion was observed at most of the spoil tip areas. The major environmental impacts for this spoil tip disposal area are soil erosion and may potential leading to slide down later due to the areas are not well compacted, for examples, spoil tip at Ch 900 (LHS) and Ch 2200 (RHS).

4.2.2.3 **Construction of berm drain and interceptor drain**

The construction of berm drains and interceptor drain on completed cut slope are on going at Ch 1000, Ch 1500, Ch 3400Ch 4200, Ch4700, Ch 6100 and Ch 7000 of the project site. This activity will not bring a serious impact to the environment. However, is the contractor did not handle properly the construction waste such as cement bags, formwork etc. Therefore, the construction wastes were scattered around the working area.
4.2.2.4 Construction of bridges

The constructions of two bridges over the Selangor River and Luit River for the re-aligned road are at Ch 1100 and Ch 6400 respectively. Based on site observation, there are some major associated environmental issues in the valley below these bridges namely:

- Foundation piling works for the column of bridge at the riverbank of Luit River is in progress during the audit. Cement slurry was not handled properly and discharged directly into Luit River,
- Inadequate safety measures for workers working at high altitude when constructing the bridge column, and
- Inadequate siltation control at the exposed area of the abutment A and abutment B for both bridge construction sites; silt traps are not provided due to site constraint.

4.2.2.5 Locations of silt traps

The contractor has constructed 24 silt traps at strategic locations within the project site. The location of each silt trap are shown in Table 4.3 as below:
Table 4.3: The locations of constructed silt traps at the road project site

<table>
<thead>
<tr>
<th>No</th>
<th>Silt trap No:</th>
<th>Location</th>
<th>No</th>
<th>Silt trap No:</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T14</td>
<td>Inlet Portal</td>
<td>13</td>
<td>T34</td>
<td>Ch 5200</td>
</tr>
<tr>
<td>2</td>
<td>T2</td>
<td>Quarry #1</td>
<td>14</td>
<td>T38</td>
<td>Ch 5200</td>
</tr>
<tr>
<td>3</td>
<td>T1</td>
<td>Quarry #1</td>
<td>15</td>
<td>T13</td>
<td>Ch 5900</td>
</tr>
<tr>
<td>4</td>
<td>T9</td>
<td>Ch 900</td>
<td>16</td>
<td>T19</td>
<td>Ch 6100</td>
</tr>
<tr>
<td>5</td>
<td>T11</td>
<td>Ch 1600</td>
<td>17</td>
<td>T17</td>
<td>Ch 6300</td>
</tr>
<tr>
<td>6</td>
<td>T16</td>
<td>Ch 1750</td>
<td>18</td>
<td>T36</td>
<td>Ch 6600</td>
</tr>
<tr>
<td>7</td>
<td>T22</td>
<td>Ch 3260</td>
<td>19</td>
<td>T35</td>
<td>Ch 6600</td>
</tr>
<tr>
<td>8</td>
<td>T20</td>
<td>Ch 3450</td>
<td>20</td>
<td>T37</td>
<td>Ch 6600</td>
</tr>
<tr>
<td>9</td>
<td>T18</td>
<td>Ch 3650</td>
<td>21</td>
<td>T25</td>
<td>Ch 6700</td>
</tr>
<tr>
<td>10</td>
<td>T30</td>
<td>Ch 4100</td>
<td>22</td>
<td>T32</td>
<td>Ch 7100</td>
</tr>
<tr>
<td>11</td>
<td>T26</td>
<td>Ch 4300</td>
<td>23</td>
<td>T31</td>
<td>Ch 7400</td>
</tr>
<tr>
<td>12</td>
<td>T33</td>
<td>Ch 5000</td>
<td>24</td>
<td>T30</td>
<td>Ch 7700</td>
</tr>
</tbody>
</table>

Based on site observation, some of the silt traps such as T22, T16, T11, T38 and T37 are located at an active zone, where a minor tributary flows directly through the silt trap. The contractor did not provide proper temporary interceptor drain to divert surface runoff into the retention pond of the silt trap. In addition, some of the silt traps are not functioning well during the audit, as the retention ponds were silted up, geotextile layer clogged and there was seepage or leakage from the gabion structure etc. No corrective actions have been carried out by the contractor. To quote examples; silt trap T31 (silted up), T20 (overflow), T19 (silted up) and T39 (leakage or seepage).

4.2.2.6 Rock blasting works
The contractor carried out rock blasting works at Ch 2250 to Ch 2800 to excavate the area until the designated road level. The blasting generated additional noise and vibration to the surrounding area. Meanwhile, the delay system method, similar to the method adopted at the quarry site was implemented here to reduce or minimize noise and vibration level during blasting process. The drilling process for installation of explosive was also observed to effect the air quality within the working area.

4.2.2.7 Other environmental issues related to the activities

Dust pollution was generated from the transportation of materials such as earth, blasted rock and other construction materials within the project site. However, the impact was very low, as regular spaying of water on the haul road to control the dust pollution.

Construction and domestic waste such as used cement bags, disused tyres, used diesel drum, food packages and etc. was disposed of at the site. Proper management of these generated wastes was not properly implemented at the work site.

4.2.3 Compliance audit

The SIE had conducted two compliance audits within the project site to ensure the compliance status of the project. First compliance audit was carried out in November 2000. During this audit, 11 Non-compliance records (NCRs) were identified. The second
audit was carried out in February 2001 and 9 NCRs were identified. The results of both compliance audits are summarized in Table 4.4 and Table 4.5, as follows:

Table 4.4: Non-compliance records (NCRs) raised during the first compliance audit on November 2000

<table>
<thead>
<tr>
<th>NCR Reference</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCR no : 1CA-1</td>
<td>Exposed Slopes not protected from erosive rain.</td>
</tr>
<tr>
<td>DOE Condition 4</td>
<td></td>
</tr>
<tr>
<td>Ch 6100 (T19)</td>
<td>Exposed slope not protected from erosive rain</td>
</tr>
<tr>
<td>Ch.6750</td>
<td>Exposed slope not protected, some plastic sheets not covering slope properly.</td>
</tr>
<tr>
<td>Ch.6900</td>
<td>Slope exposed without erosion protection measures.</td>
</tr>
<tr>
<td>T9 downstream</td>
<td>Erosion from slope discharging downstream of T9. Minor slope failure &amp; patchy turf growth on slope.</td>
</tr>
<tr>
<td>Selangor River Bridge</td>
<td>Plastic sheets used for slope protection displaced leaving some slopes exposed.</td>
</tr>
<tr>
<td>Ch.1200</td>
<td>Exposed slope, downstream of culvert 4 exposed to erosion, September silt monitoring results exceeding specifications.</td>
</tr>
<tr>
<td>NCR no : 1CA-2</td>
<td>Slopes cleared without definite plan for immediate site preparation and earthwork activities and left exposed to erosive rain.</td>
</tr>
<tr>
<td>Access to Quarry #1</td>
<td>Slope along access to Quarry #1 was cleared and exposed since September 2000.</td>
</tr>
<tr>
<td>NCR no : 1CA-3</td>
<td>Suspended solids content of silt trap discharge in sample taken during audit exceeded 100mg/L by using Calorimeter method</td>
</tr>
<tr>
<td>DOE Condition 6</td>
<td></td>
</tr>
<tr>
<td>T31</td>
<td>Evidence of silt flows over silt trap gabion. TSS recorded 113mg/l</td>
</tr>
<tr>
<td>T20</td>
<td>Evidence of silt overflow over gabion. Site upstream being actively filled. Sample collected. TSS recorded 131mg/l</td>
</tr>
<tr>
<td>T19</td>
<td>Evidence of overflow of silt over silt trap gabion. TSS recorded 106mg/l</td>
</tr>
<tr>
<td>CR Reference</td>
<td>Issue</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>NCR no : 1CA-4</td>
<td>Inadequate mitigation measures to effectively control erosion and siltation</td>
</tr>
<tr>
<td>Ch.7500</td>
<td>Earthworks commenced before mitigation measures for siltation and erosion put in place.</td>
</tr>
<tr>
<td>Ch.000 Spoil Tip area</td>
<td>No silt control measures downstream of spoil disposal area.</td>
</tr>
<tr>
<td>NCR no : 1CA-5</td>
<td>Management of scheduled waste, i.e. waste oil, not managed in accordance with Environmental Quality (Scheduled Wasted Regulation) 1989</td>
</tr>
<tr>
<td>Quarry #1</td>
<td>Spent oil leaked from the generator and discharge into water ponding area</td>
</tr>
<tr>
<td>Quarry #1 (opposite workshop)</td>
<td>Scheduled wastes (spent oil) not stored in accordance to the requirements, spillage / overflow from plastic containers that were not covered</td>
</tr>
<tr>
<td>Quarry #1 weigh bridge</td>
<td>Fuel contaminated on ground at gen-set location.</td>
</tr>
<tr>
<td>Megah Sewa Workshop</td>
<td>Drums containing spent oil, used oil filters and parts were not store, labelled in accordance to Environment Quality (Scheduled Wasted Regulation) 1989</td>
</tr>
<tr>
<td>Project Office</td>
<td>Scheduled waste consignment note available but Part III Disposal facility section not signed.</td>
</tr>
<tr>
<td>NCR no : 1CA-6</td>
<td>Mosquito larvae found in water ponding in discarded tyers on site</td>
</tr>
<tr>
<td>Quarry 1 w/shop(opposite)</td>
<td>Discarded tires not covered. Water stagnant in tires.</td>
</tr>
<tr>
<td>A-3670 / workshop</td>
<td>Mosquito larvae in tires at temporary workshop.</td>
</tr>
<tr>
<td>NCR no : 1CA-7</td>
<td>Workers in noise hazard areas not using personal protective equipment during the audit. Similar findings reported in previous audit.</td>
</tr>
<tr>
<td>Quarry #1</td>
<td>Drilling rig operator not equipped with protective apparels.</td>
</tr>
<tr>
<td>A-3670</td>
<td>Workers carrying out drilling for blasting works not using proper personal protective equipment for noise &amp; dust.</td>
</tr>
</tbody>
</table>
Table 4.4 continued

<table>
<thead>
<tr>
<th>CR Reference</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR no: 1CA-8</td>
<td>There was evidence of open burning on site</td>
</tr>
<tr>
<td>DOE Condition 10</td>
<td></td>
</tr>
<tr>
<td>Quarry #1 Weight-bridge</td>
<td>Evidence of open burning behind weight-bridge.</td>
</tr>
<tr>
<td>CR no: 1CA-9</td>
<td>Sprinkler system of crusher not operational during the audit</td>
</tr>
<tr>
<td>DOE Condition 12</td>
<td></td>
</tr>
<tr>
<td>Quarry #1</td>
<td>Sprinkler system for primary / secondary crushers not observed during the time of audit.</td>
</tr>
<tr>
<td>CR no: 1CA-10</td>
<td>Drilling rig did not have dust control system</td>
</tr>
<tr>
<td>DOE Condition 12</td>
<td></td>
</tr>
<tr>
<td>Quarry #1</td>
<td>Dust suppression for drilling rig is absent. However, dust collectors are functioning well.</td>
</tr>
<tr>
<td>CR no: 1CA-11</td>
<td>Construction trucks washing tyres and plying through Gerachi River. Tyre wash facility not in place</td>
</tr>
<tr>
<td>DOE Condition 9</td>
<td></td>
</tr>
<tr>
<td>And washing Weighbridge</td>
<td>Trucks tyre washing in Gerachi River / trucks plying through Gerachi River.</td>
</tr>
</tbody>
</table>

Table 4.5: Non-compliance records (NCRs) raised during the second compliance audit on February 2001

<table>
<thead>
<tr>
<th>CR Reference</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR No: 2CA -1</td>
<td>Washing from Megah Sewa cement batching plant discharging directly into Selangor River at the time of audit.</td>
</tr>
<tr>
<td>(Condition 6)</td>
<td></td>
</tr>
<tr>
<td>Megah Sewa Concrete Batching Plant</td>
<td>Cement washing water from Megah Sewa concrete batching plant was directly discharging into Selangor River.</td>
</tr>
<tr>
<td>CR No: 2CA -2</td>
<td>Inadequate protective measure for exposed slope</td>
</tr>
<tr>
<td>(DOE Condition 4)</td>
<td></td>
</tr>
<tr>
<td>Luit River Bridge</td>
<td>Temporary plastic sheets at Luit River Bridge displaced leaving slope exposed to erosion and at risk to slope failure.</td>
</tr>
<tr>
<td>NCR Reference</td>
<td>Issue</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>NCR No: 2CA –3</td>
<td>Slope beside piers of abutment A &amp; B of Selangor River Bridge exposed to erosion</td>
</tr>
<tr>
<td>(DOE Condition 4)</td>
<td>Selangor River Bridge Inadequate protective measures in place. Evidence of gully erosion on abutments.</td>
</tr>
<tr>
<td>NCR No: 2CA –4</td>
<td>Slope exposed and with inadequate protective measures to arrest erosion. Evidence of previous mudflow and gully formation at Ch2200</td>
</tr>
<tr>
<td>(DOE Condition 4)</td>
<td>NCR No: 2CA -5 Management of Scheduled waste. i.e. Waste oil not managed in accordance to Environmental Quality (Scheduled Waste) Regulation 1989.</td>
</tr>
<tr>
<td>(Schedule Wasted Regulation) 1989</td>
<td>Quarry #1 Waste oil storage not in accordance with DOE requirements: I) Hole / valve in secondary containment left open. II) Oil drums not effectively sheltered from rain. III) No inventory of quantity generated and stored at site</td>
</tr>
<tr>
<td>NCR No: 2CA -6</td>
<td>Spent oil from vehicle maintenance exposed to rain, evidence of spillage on soil at:</td>
</tr>
<tr>
<td>(Schedule Wasted Regulation) 1989</td>
<td>I) main workshop II) lorry maintenance area opposite workshop</td>
</tr>
<tr>
<td>NCR No: 2CA -7</td>
<td>Spent oil not sheltered from rain at Batching Plant</td>
</tr>
<tr>
<td>(Schedule Wasted Regulation) 1989</td>
<td>NCR No: 2CA –8 Evidence of fuel spillage at gen-set fuel storage.</td>
</tr>
<tr>
<td>(Schedule Wasted Regulation) 1989</td>
<td>Quarry #1 workshop No secondary containment.</td>
</tr>
<tr>
<td>NCR No: 2CA –9</td>
<td>There was evidence of minor open burning on site</td>
</tr>
<tr>
<td>(DOE Condition 10)</td>
<td>Quarry #1 Evidence of open burning behind vehicle workshop.</td>
</tr>
</tbody>
</table>
4.2.4 Monitoring results (post audit)

4.2.4.1 Environmental management consultant monitoring results

The Environmental Management consultant (EMC) carried out the comprehensive monitoring programs at the project site on a fortnightly basis, focusing on river water quality, air quality, noise & vibration and silt trap discharge quality. The monitoring program for this study spent over a period of 5 months, from October 2000 to February 2001. The purpose of this monitoring program is to check the compliance status of environmental management standards and to ensure the compliance of the project in accordance with the Environmental Quality Act 1974.

The results for each parameter for river water quality, air quality, noise & vibration quality and silt trap discharge quality are presented in the following paragraphs:

4.2.4.1a River water quality

a) pH

In general, the pH values for all the stations within the project site (DW1 to DW9) were within the range of baseline data (6.0 - 9.0), hence complying with the standard pH requirement. The average pH levels over the 5 months for each sampling station are shown in Figure 4.2.
Figure 4.2: The average pH level over the 5 months for each sampling station within the project site

b) Dissolved oxygen

Dissolved oxygen values at all the river water sampling stations were in the range of 6.13 – 6.54mg/l. This value was higher than the baseline requirement of 5.6mg/l. This showed that all the water samples are in compliance with the standard DO requirement. This also indicated that the oxygen content in the rivers was not significantly affected by the construction activities. The average DO values over the 5 months for each sampling station are shown in Figure 4.3.
c) Biological oxygen demand (BOD)

Biological Oxygen Demand (BOD) values at the river water sampling stations were in the range of 0.74 – 1.56 mg/l. This value is much lower than the baseline value of 2.3 mg/l. This showed that all the water samples complied within the standard requirement of BOD value and an indication that the biotic lives are not affected by the construction activities. The average BOD values over the 5 months for each sampling station are shown in Figure 4.4.
Figure 4.4: The averages BOD values over the 5 months period for each sampling station within the project site

d) Total suspended solid (TSS)

Sampling station DW3 exhibited high value of TSS compared to the other sampling stations. The average value of 465 mg/l recorded for DW3 was very significantly higher than the baseline data of 50 mg/l and 134 mg/l for dry and wet season, respectively. The source of this high TSS level originated from the upstream landslide area, outside the project boundary. In addition, silt trap T25, which was not functioning well worsened the water quality at sampling station DW3. The rest of the sampling stations recorded values below the baseline data during dry season except DW5, DW8 and DW9, which recorded slightly higher levels than the dry season baseline although still lower than the wet season baseline. This is due to inadequate maintenance works at silt trap T9, T14, T34 and T38. The average TSS values over the 5 months for each sampling station are shown in Figure 4.5.
e) Ammonia nitrogen

The concentrations of ammonia nitrogen values at all the river water sampling stations were in the range of $0.11 - 0.35$ mg/l. This value is lower than the baseline value of $0.57$ mg/l. This showed that all the water samples have complied with the standard requirement for Amm-N value. The average Amm-N value over the 5 months for each sampling station are shown in Figure 4.6.
Figure 4.6: The average Amm-N values over the 5 months for each sampling station within the project site

f) Total coliform (E.coli)

Total Coliform (E.coli) values at all the river water sampling stations within the project site were in the range of 822 - 2066. This value is lower than the baseline value of 4000. That implies that all the water samples complied with the standard requirement of E.coli count value. Figure 4.7 shows the average E.coli values over the 5 months for each sampling.
Figure 4.7: The average E.coli values over the 5 months for each sampling station within the project site.

4.2.4.1b Air quality

Figure 4.8 shows the average Total Suspended Particulate (TSP) values over the 5 months period for each sampling station within the project site. The values of TSP in the air at all the sampling stations were in the range of 130.5 – 194.43 μg/Nm³. Most of the suspended particulate were generated from the rock quarrying activities and earth work activities, especially at station DA7, which was located near the quarry site. However, all the recorded values of TSP within the project site were lower than the limiting value of 260 μg/Nm³. This showed that all the air samples were in compliance with the limiting standard.
Figure 4.8: The average TSP values over the 5 months for each sampling station within the project site

Figure 4.9 shows the average PM10 values over the 5 months period for each sampling station within the project site. The values of PM10 in the air at all the sampling stations were in the range of 75.5 – 132.56 μg/Nm³. Most of the PM10 generated from the quarry site and earthwork activity were similar to TSP, where station DA7 recorded the highest value of PM10 due to quarrying activity. However, all the recorded values of PM10 within the project site were lower than the limiting value of 150 μg/Nm³. This showed that all the air samples were in compliance with the standard requirement of PM10 value.
Figure 4.9: The averages PM10 value over the 5 months for each sampling station within the project site

4.2.4.1c Noise quality

The noise levels at all the sampling stations (corridor site) were in the range of 60.0 – 66.8 dBA. This showed that all the sampling stations are in compliance with the standard requirement of noise level except DA7, located at the quarry site, which a slightly higher level than the limiting value of 65 dBA. Most of the noise was contributed from the rock quarrying activity such as rock blasting, rock crushing and rock transportation. Figure 4.10 shows the average noise levels over the 5 months period for each sampling station within the project site.
Figure 4.10: The average Noise level over the 5 months period for each sampling station within the project site.

4.2.4.1d  Vibration

The vibration level at the two sampling stations within the project site area (corridor) were recorded below the limiting value of 5 mm/s. Station DN7, located at quarry site indicated vibration value of 2 mm/s, which was attributed to the rock blasting activity. Meanwhile, station DN11, located at the Kg. Gerachi Jaya of aboriginal village indicated no vibration at all. This indicates that the blasting activity did not affect the aboriginal villagers at Kg. Gerachi Jaya. Figure 4.11 shows the average vibration levels over the 5 months for each sampling station.
Figure 4.11: The averages Vibration level over the 5 months for each sampling station within the project site

4.2.4.1e Silt traps discharge quality

Silt traps T25 and T31 exhibited very high values for Total Suspended Solid (TSS) compared with other silt traps, with the values of 292 mg/l and 347 mg/l, respectively. This is attributed to inadequate maintenance works. Meanwhile the silt traps such as T1, T2, T9, T14, T19, T34 and T38 recorded with TSS values slightly higher than the limiting value of 100mg/l. These sites obviously failed to comply with the DOE requirement. Based on the site daily observation, the findings of the non-compliance of these silt traps are summarized in Table 4.6.
<table>
<thead>
<tr>
<th>Silt trap</th>
<th>Findings of non-compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>T25</td>
<td>• The silt trap located at an active minor tributary,</td>
</tr>
<tr>
<td></td>
<td>• Silt contributed from the filling slope of Ch 6725 and outside the project boundary, where natural landslide occurred at the upstream of river sampling station of DW3 and DW3a, and</td>
</tr>
<tr>
<td></td>
<td>• Inadequate of maintenance works being carried out.</td>
</tr>
<tr>
<td>T31</td>
<td>• Lack of maintenance as its retention pond silted up, where evidence of silt overflowed from its gabion structure was observed during the time of first compliance audit.</td>
</tr>
<tr>
<td>T1</td>
<td>• Source contributed from its incompact spoil tip area, located at the upstream of T1.</td>
</tr>
<tr>
<td></td>
<td>• The silt trap located at an active minor tributary</td>
</tr>
<tr>
<td></td>
<td>• Inadequate storage and retention capacity</td>
</tr>
<tr>
<td>T2</td>
<td>• Source contributed from the exposed slope along the acces road to quarry site.</td>
</tr>
<tr>
<td></td>
<td>• Inadequate storage and retention capacity</td>
</tr>
<tr>
<td>T9</td>
<td>• The silt trap located at a active minor tributary</td>
</tr>
<tr>
<td></td>
<td>• Source contributed from the slope cutting and filling from Ch550 to Ch 1100, where large volume of earth was required to cut and fill.</td>
</tr>
<tr>
<td></td>
<td>• Inadequate maintenance works being carried out.</td>
</tr>
<tr>
<td>T14</td>
<td>• The silt trap located at a active monitor tributary</td>
</tr>
<tr>
<td></td>
<td>• Inadequate storage and retention capacity due to large catchments areas contributed to this silt trap, from Ch 3000 to Ch 4200, where silt traps T20, T22, T18 and T30, located upstream are discharging into this silt trap.</td>
</tr>
<tr>
<td>T19</td>
<td>• Lack of maintenance as its retention pond silted out, where evidence of silt overflowed from its gabion structure was observed during the time of first compliance audit.</td>
</tr>
<tr>
<td></td>
<td>• Source contributed from the earthwork activity at Ch 6100.</td>
</tr>
<tr>
<td>T34</td>
<td>• Inadequate of maintenance works being carried out.</td>
</tr>
<tr>
<td>T38</td>
<td>• The silt trap was constructed across the Sg. Ganggor due to the site constraints as land acquisition matter.</td>
</tr>
<tr>
<td></td>
<td>• Source contributed from the earthwork activity at Ch 4100.</td>
</tr>
</tbody>
</table>
The rest of the silt traps such as T13, T11, T16, T17, T32, T33, T35, T36, T37 and T39 complied with the limiting value of 100 mg/l. The average TSS value over the 5 month period for each silt trap are shown in Figure 4.12.

![Figure 4.12: The average TSS values over the 5 months period for each silt trap within the project site](image)

2.4.2 Site Independent Environmentalist (SIE) Monitoring Results

The Site Independent Environmentalist conducted an independent monitoring program of the river water and silt trap discharge qualities using a portable instrument, calorimeter ACH Model 890 (Plate 4.1). The purpose of this separate monitoring program is similar with the EMC that is to regularly counter check the compliance status for all the silt trap and river water quality within the project site. The monitoring program was carried out on
a daily or alternate day basis, which is more frequent compared with the EMC’s fortnightly monitoring program. In this monitoring program, total suspended solid (TSS) is the only parameter being monitored using calorimeter. This monitoring program also provides early indication of any environmental violations for instance, silt traps exceeding the DOE’s limiting value of 100mg/l.

Plate 4.1: Portable calorimeter HACH Model 890 for river water quality and silt traps discharge quality monitoring (TSS parameter only)

The average of TSS levels for river water and silt trap discharge quality are presented in the following paragraphs:

4.2.4.2a TSS Level of River Water Quality (using calorimeter Model DR890)

The average TSS values over the 5 months period for each sampling station, were monitored by using calorimeter, Model DR890. Generally, the trend of TSS values by SIE
and EMC were almost similar, where sampling stations DW3 and DW3a (upstream of the Sg. Peretak, before entering the project area) exhibited high values for Total Suspended Solid (TSS) compared to the other sampling stations. These values were 484 mg/l and 434 mg/l, much higher than the baseline data of 50 mg/l and 134 mg/l during dry and wet seasons, respectively. The major silt contribution was from the upstream landslide area, which is outside the project boundary. The rest of the sampling stations recorded values below the baseline data for dry season except DW5, DBW and DW9 which recorded slightly higher value than the dry season baseline although still lower that the wet season baseline. The contribution of silt for sampling stations DW3, DW5 and DW9 was explained earlier. Meanwhile, the development of Kg. Gerachi Jaya and its access road was the major silt contribution to the sampling station DBW, located downstream of the development. The average TSS values are shown in Figure 4.13.

![Figure 4.13: The average TSS values by using calorimeter model DR890 over the 5 months for each sampling station within the project site](image-url)
4.2.4.2b TSS Results From Silt trap Discharge (using Calorimeter Model DR890)

Silt traps T18, T25, T37 and T1 exhibited high value of Total Suspended Solid (TSS) compared with other silt traps, with its values of 414, 425, 230 and 265 mg/l, respectively. Meanwhile silt traps T34, T38, T39, T14, T2 and T9 recorded TSS values slightly higher than the limiting value of 100mg/l. The mentioned sites failed to comply with the DOE requirements. The rest of the silt traps, examples T22, T20, T30, T26, T33, T13, T19, T17, T36, T35, T32, T31, T11 and T16 complied with 100 mg/l. Generally, the non-compliance of silt traps reported by SIE is almost similar with the EMC, except for silt traps T18, T37 and T39. The findings of these three silt traps are summarized in Table 4.7 and the rest of the non-compliance silt traps were explained earlier. Figure 4.14 shows the average TSS values over the 5 months periods for each silt trap, monitored using calorimeter, Model DR890.

Table 4.7: Addition non-compliance of silt traps (Calorimetric method)

<table>
<thead>
<tr>
<th>No</th>
<th>Silt trap</th>
<th>Findings of non-compliance</th>
</tr>
</thead>
</table>
| 1  | T18       | • Inadequate maintenance works being carried out, where its retention pond was silted up  
     |            | • EMC did not monitor this silt trap as it is part of the multiple cell of T14, located further downstream of T18. |
| 2  | T37       | • The silt trap located at a active minor tributary and outside of the project boundary  
     |            | • Most of the source was contributed from the upstream landslide area, similar with river sampling station DW3 |
| 3  | T39       | • The embankment of gabion structure was eroded and as a result, surface runoff by-pass its filter layer.  
     |            | • Source contributed from the earthworks activity at Ch 7700 |
Figure 4.14: The average TSS values by using the calorimeter Model DR890 over the 5 months period for each silt trap within the project site

4.3 Summary of results

In summary, the current environmental management implemented at the project site was inadequate to fulfill the DOE's requirements, especially on the scheduled waste and safety and health management. For the monitoring program, the results generally showed that all river water quality, air quality, noise and vibration were recorded within the limiting value and complied with the DOE's requirements. However, with respect to water quality, there were silt traps from T1, T25, T31, T18, T37, T39 and river water sampling stations
RESULTS AND DISCUSSION

DW3, DW5, DWB with recorded TSS results above the limiting value stipulated by the DOE.

4.4 Discussion and recommended mitigation measures

4.4.1 Environmental aspect and its associated impact

Based on the results obtained from the environmental audit and management review, the project proponent was able to identify the environmental aspects and evaluate the associated environmental impacts suitable for the road construction activities at the project site. The relationship between environmental aspects and environmental impacts is one of cause and effect. The identified environmental aspects and its associated environmental impacts associated with the construction activities are shown in Table 4.8.
<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Environmental Aspects</th>
<th>Environmental Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Land clearing and earthwork</td>
<td>• Change of landuse</td>
<td>• Degradation/Conservation of natural resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change of natural drainage system</td>
<td>• Deterioration of river water quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bare area will exposed to erosive rain</td>
<td>• Siltation and sedimentation in watercourses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Muddy runoff discharging into water courses</td>
<td>• Deterioration of river water quality and siltation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dust emission to air due to earth activity</td>
<td>• Air pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stability of slope where the cutting or filling slope potential to slide</td>
<td>• Deterioration of water quality, local mud flood and life hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improper storage and disposal of vegetation or biomass, such as disposal in watercourses and open burning</td>
<td>• Damming of watercourse, local flood and air pollution and contamination of water quality.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improper handle of loose excess soil (spoil tip) or unsuitable materials</td>
<td>• Siltation and sedimentation in watercourses and local mud flood</td>
</tr>
<tr>
<td>2.</td>
<td>Construction of Bridge</td>
<td>• Wash water and cement slurry from the micropiling activities at riverbank being discharged into watercourses</td>
<td>• Deterioration of river water quality and contamination of soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improper handling of cement at cement mixer of grouting works</td>
<td>• Air pollution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Workers work at height for constructing the column and pier of bridge</td>
<td>• Life hazard/risk and personal protection equipment (PPE)</td>
</tr>
<tr>
<td>No</td>
<td>Activity</td>
<td>Environmental Aspects</td>
<td>Environmental Impacts</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
|    |                           | • Beam lunching to over the piers  
• Consumption of woods and plywood’s for bridge construction formworks.                                                                                                                                     | • Life hazard/risk  
• Exploitation of natural resources                                                                                                                        |
| 3  | Construction of Drainage system | • Installation of culvert across the road for active tributary or waterway not handled in proper way.  
• Consumption of woods and plywood’s for bridge construction formworks.  
• Dust emission from its portable concrete mixer and temporary sand and aggregate stockpiled area.                              | • Deterioration of river water quality  
• Exploitation of natural resources  
• Air pollution                                                                                                                                            |
| 4  | Quarrying at earth borrow area | • Change of landuse  
• Change of natural drainage system  
• Bare area will exposed to erosive rain  
• Muddy runoff discharging into water courses  
• Dust emission to air due to earth activity  
• Stability of slope where the cutting slope potential to slide if not handle properly  
• Improper storage and disposal of vegetation or biomass such as disposal in watercourses and open burning | • Degradation/Conservation of natural resources  
• Deterioration of river water quality  
• Siltation and sedimentation in watercourses  
• Deterioration of river water quality and siltation  
• Air pollution  
• Deterioration of water quality, local mud flood and life hazard  
• Damming of watercourse, local flood and air pollution and contamination of water quality. |
<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Environmental Aspects</th>
<th>Environmental Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Quarrying at rock quarry site</td>
<td>- Land clearing will cause the change of landuse and natural drainage system</td>
<td>- Degradation/Conservation of natural resources and deterioration of water quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Removal and disposal of overburden to expose the solid rock leading to the soil</td>
<td>- Air pollution, sedimentation and siltation and deterioration of river water quality.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>erosion, emission of dust, muddy runoff being discharged into watercourses.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Drilling of bore hole for installing the explosive using “down to hole hammer”</td>
<td>- Air pollution and noise pollution impairing human hearing ability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>system would be generating high noise and dust dispersal.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Improper storage and handling of the explosive materials will lead to explosion.</td>
<td>- Life hazard/risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Improper handling of the blasting procedures and methods</td>
<td>- Life hazard/risk, noise pollution and ground vibration hazards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Crushing the blasted rock into difference sizes of aggregate will cause dust</td>
<td>- Air pollution and noise pollution leading to human hearing ability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>emission</td>
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<tr>
<td></td>
<td></td>
<td>- Stockpile of blasted rock and aggregate will cause dust emission</td>
<td>- Air pollution</td>
</tr>
<tr>
<td>6.</td>
<td>Concrete Batching plant</td>
<td>- Loading cement to the silo from bulk cement truck will lead to emission of</td>
<td>- Air pollution leading to human health hazard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suspended particles in the air</td>
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<tr>
<td>Environmental Aspects</td>
<td>Activity</td>
<td>No.</td>
<td></td>
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<tr>
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<tr>
<td>Maintenance schedule of filter bags at the top of the silo</td>
<td>Transportation and machinery</td>
<td>7.</td>
<td></td>
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<tr>
<td>Temporary stockpile of aggregate will cause dust emission</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Wash water from the batching plant and concrete trucks will discharge into watercourses</td>
<td></td>
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<tr>
<td>Consumption of water</td>
<td></td>
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<tr>
<td>Movement of vehicles and trucks to transport construction materials will generate dust emission</td>
<td></td>
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<tr>
<td>Exhaust emission from the vehicles, trucks and machines</td>
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<tr>
<td>Consumption of fuel</td>
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<tr>
<td>Leakage of oil from its engine</td>
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<tr>
<td>Speed limit of vehicles and trucks</td>
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<tr>
<td>Improper handling of lubricant or spent oil generated from the maintenance works including storage and disposal may cause oil spillage</td>
<td>Machinery</td>
<td>8.</td>
<td></td>
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<tr>
<td>The maintenance process will lead to oil dripping on the ground</td>
<td>Maintenance yard (Megah Sewa workshop)</td>
<td></td>
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</tbody>
</table>

- Air pollution during operation if the said filter bags are not well maintained
- Air pollution
- Deterioration of water quality
- Exploitation of natural resources
- Air pollution
- Deterioration of air quality
- Exploitation of natural resources
- Contamination of soil and water ways
- Life hazard and air pollution
- Soil contamination and deterioration of water quality
- Soil contamination and deterioration of ground water quality
<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Environmental Aspects</th>
<th>Environmental Impacts</th>
</tr>
</thead>
</table>
| 8. | Site Office, Center Labour Quarters (CLQ) and canteen | • Sewage discharge from the toilets  
• Domestic and solid wastes generated from the said building  
• Consumption of water and energy (electricity)                                                                                 | • Deterioration of water quality  
• Loss of aesthetic value and human health due to diseases and odor  
• Exploitation of natural resources                                    |
| 10. | Handling of hazardous materials such as fuel, cement and explosive | • Improper handling and storage of fuel will lead to oil spillage  
• Smoking within the fuel storage area has potential to cause fire due to flammable substances  
• Improper storage and handling of cement especially during loading cement to the silo or cement hopper will cause particles emission  
• Improper storage and handling the explosive materials will potentially lead to explosion. | • Soil contamination and deterioration of water quality  
• Fire accident leading to human hazard and air pollution  
• Air pollution  
• Life hazard/risk                                                   |
<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Environmental Aspects</th>
<th>Environmental Impacts</th>
</tr>
</thead>
</table>
| 11 | Waste disposal such as domestic waste, construction waste, scheduled waste and biomass waste | - Improper disposal of domestic waste will lead to odor emission, mosquito and pest breeding  
- Improper disposal of construction waste and biomass generated from site clearing in the watercourses  
- Stockpiling of construction waste such as formworks and disused tyres and biomass potential cause open burning  
- Improper disposal of disused tyre will cause mosquito breeding once stagnant water inside  
- Recycled and reused approach for construction waste such as steels bar, formwork and etc. and scheduled waste such as spent oil.  
- Improper disposal of scheduled waste such as spent oil potential leading to oil spillage | - Loss of aesthetic value and human health due to diseases and odor  
- Deterioration of river water quality  
- Fire hazard and air pollution  
- Human health and diseases  
- Conservation of natural resources  
- Soil contamination and deterioration of river water quality |
<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Environmental Aspects</th>
<th>Environmental Impacts</th>
</tr>
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</table>
| 12 | Health and safety  | • Personal Protection Equipment (PPE) such as safety helmets, boots, glove, mask, earplug, goggles and etc.  
• Workers working at high altitude  
• Workers working under high noise level  
• Diseases and pest control | • Human life hazard  
• Life hazard/risk  
• Impairing human hearing ability  
• Human health |
4.4.2 Recommended mitigation measures based on the site environmental audit results

As mentioned earlier, environmental aspects related to the road construction activities and their potential impacts on the physical environmental are soil erosion, water pollution, air pollution, noise and vibration, waste disposal and safety and health. The project proponent has recognized the need to adopt environment-friendly approach to the construction of the re-aligned road of FR55 in order to ensure compliance with the Environmental Quality Act (1974) and DOE conditions. Therefore, the following mitigation measures are recommended to augment the conservation of environment through which the re-aligned road of FR55 will traverse.

4.4.2.1 Recommended mitigation measures for soil erosion in line with site clearing and earthwork activities

Soil erosion is a major source of localized flood or mud flood, river water pollution and may lead to substantial changes in soil hydrology (Spencer, 1997). Therefore, the effectiveness of flood and river water pollution control depends largely on soil erosion control. Mitigation measures must be taken to protect the soil from raindrop impact, increase the infiltration capacity of the soil to reduce the volume of runoff, improve the aggregate stability of the soil, increase its resistance to erosion etc. The following mitigation measures are strongly recommended for implementation at the project site, in relation to the conditions stipulated by the DOE:

4.4.2.1a Minimization of working area
The working area for the road construction should be kept to a minimum to avoid excessive soil surface exposed to various erosive agents especially rain. A proper and standard marking to mark the boundary limits of site clearing to avoid occurrence of any over cleared area. The site clearing and earthwork activities were carried out in stages in line with phases of development as stipulated in the DOE condition No: 1. Close supervision is required to ensure that the activities were carried out in according to the requirements.

4.4.2.1b Cutting and filling of slope

It is important to consider sustainable development in the design of an appraisal framework for transport schemes (Bond, 1997). Therefore, the equalization of cutting and filling earth volume is essential during the design stage in order to minimize the excess soil generated from the slope cutting activity. The cutting slope and filling slope were constructed according to the design requirements; for example 1:1.25 gradient for cutting slope and 1:1.75 gradient for filling slope as of JKR’s standard requirement (JKR, 1995). In addition, the filling slope must be well compacted as per road designed requirements, to improve its aggregate stability and increase its resistance to erosion. A comprehensive soil and geotechnical study will be undertaken to prevent slope instability similar to that implemented in highway projects like the Pos Selim to Lojing’s. However, properly designed permanent interceptor drains and roadside drain must be in place prior to completion of each bench of cutting or filling slopes. Slope inventory should be
implemented at the project site on a regular basis depending on the criticality of each slope risk such as rank 1, 2, 3, and 4. All the results and findings from the inventory should be documented into a standard format in order to allow monitoring and checking works to be carried out on a regular basis (Appendix 4 - slope checklist and inventory list). This is to provide any early indication on the slope condition including instability of the slope, erosion, growth of turfed vegetation etc. Therefore the required action plan should be prepared ahead before any unforeseen impacts occur.

4.2.1c Method of handling the spoil tips

Unsuitable materials and surplus earth namely spoil tip should be disposed of at designated spoil tip area (Shamsuddin, 2002). The locations of spoil tip area should be established first prior to commencement of earthwork activity. The method of depositing the spoil tip must be properly designed, documented and approved by the site officer. The contractor or designer shall be responsible for identifying these disposal areas, which are to be finalized and approved by the site officer before commencing earthwork activities. The spoil tip area needs to be sufficiently graded, leveled, compacted and finally vegetated. No tipping is to be allowed.

4.2.1d Revegetation

Revegetation through close turfing, spot turfing, hydroseeding, sowing with cover crop and planting with vetiver grass, are some of the most effective methods for surface soil erosion
control where a rapid establishment of dense grass cover is required (DOE, 1996). However, the standard criterion for selecting the type of turfing works implemented at difference areas should be provided at the site. The details of the turfing criteria and its application are shown in Table 4.9.

Table 4.9: Details of the turfing criterion and its application at the project site

<table>
<thead>
<tr>
<th>Type of turfing</th>
<th>Description and its application</th>
</tr>
</thead>
</table>
| 1 Close turfing | • Clumps of grass were planted nearer to each other  
• These forms of turfing were effective on bare level earthworked or exposed cutting or filling slope with low gradient.  
• Applied at the critical areas such as exposed slope facing to watercourses where the area is limited for constructing silt trap. |
| 2 Spot turfing  | • Clumps of grass were planted in spot on a bare area or slope area.  
The clumps of well-grown grass, about 150mm diameter and were planted about 100 –120mm apart and left to grow (DOE, 1996).  
• Applied at the normal areas such as road shoulder, flat platform and flat compound area. |
| 3 hydoseeding   | • Hydoseeding would be recommended for large and/or sloped areas.  
• Well-cut slope laid with the fibromat followed by hydoseeding with the selected seed variety.  
• The fibromat provided a conducive medium and anchor for germination of grass seeds on steep slopes after hydoseeding and its also protect the seeds from being washed away during rain or from birds (JAS, 1996). |
| 4 Vetiver       | • These forms of grass applied for slope protection and streambank erosion control due to it’s a tough bunch grass, which its roots able to grow up about 2.5 meter penetrating the soil profile.  
• The planting method of vetiver grass on steep slope followed its design criteria (Plate 4.2).  
• These grass is very hardy and fast grower but does not reproduce by seeds and has to be replanted using its tillers. |
Plate 4.2: Planting of vetiver grass on steep slope followed its design criteria

The project proponent established a monitoring program to monitor the growth of grass on a weekly basis to ensure the turfing area is growing well. Rehydroseeding or turfing would be implemented if the growth of the area were not successful growth within a month. In addition, frequent watering for the turfed areas is required especially during the dry season. Therefore, a proper schedule of watering program was planned to ensure the turfed areas are growing well (Appendix 5).

4.4.2.1e Plastic sheets
Plastic sheets laid on the bare slopes as temporary surface protection; are very effective against raindrop impact. This method is cost effective and simple to implement but limited to small area and only temporary surfaces. It is not practical for a large surface or exposed slope. The plastic sheet used to cover exposed slope was durable, strong and with specified thickness and embedded to the top part of the slope.

44.2.1f Construction of silt traps.

Silt trap is a small temporary ponding area, usually with an outlet or channel formed by excavation and/or construction of gabion wall. Its purpose is to collect and store sediment from site cleared and/or graded during construction, especially earthwork activities. Improper design and maintain the silt trap will lead to the non-compliances of its discharge quality, which exceeded the limiting value of 100mg/l as stipulated by the DOE (refer to Figure 4.12 and Figure 4.14). Therefore, it’s important for silt trap constructed at the site to be adequately designed and approved by the Drainage and Irrigation Department (DID) prior to implementation at the project site, as stipulated in DOE condition 7. The location and detailed design of all silt traps were carried out during the Environmental Management Plan design stage. None of the silt trap is allowed to be located at the active zone such as tributary or stream. The Consulting Engineer should take into account the perimeter drains, interceptor drains and the establishment of silt traps during the design stage. Redesign of a failed silt trap is required once the said silt trap is unable to function properly.
Regular maintenance was carried out to ensure the perimeter drains and silt traps are operating efficiently. Therefore, a proper maintenance schedule was planned for each silt trap and implemented at the project site according to its schedule (e.g. Appendix 6). In addition, the engineer was assigned for regular checking and monitoring using a standard silt trap checklist (Appendix 7). This is to ensure the measures are strictly adhered to. Strict compliance to the maintenance procedures is crucial and essential to ensure the effectiveness of the silt traps.

Water discharged from the silt traps was monitored using calorimeter Model DR890 for its content of total suspended solids (TSS) on a daily basis, where the water should not carry a suspended solid load exceeding 100mg/l. The results of the monitoring will give an early indication to the contractor to prevent the silt trap discharge exceeding the limiting value. However, if the water discharged exceeded 100 mg/l, an investigation was carried out to determine the problem, followed with a proper action plan to resolve or rectify the problem that can include redesigning of the silt trap, desilting works, maintenance and/or upgrading. A proper action plan and procedure should be prepared for rectifying those failed silt trap, for example silt trap T1 in Appendix 8. In addition, the EMC carried out the monitoring program for silt traps discharges on a fortnightly basis to ensure all the constructed silt traps were functioning properly.

A.2.2 Mitigation measures for river water quality management
Road construction activity often leads to increase in concentration of runoff, which compounds the sediment contribution into adjoining river systems (refer to Figure 4.5 and Figure 4.13). This will change the characteristics and water quality of the rivers downstream. The following mitigation measures are recommended for the project site to control the siltation to the rivers downstream and found to be effective.

4.4.2.2a  Maintenance of vegetation buffer strips.

Buffer strips are corridors of vegetation, which separate disturbed land from an adjacent watercourse. It is recommended that a 30 to 50 meter buffer strip of land is allocated along both banks for major rivers to control and filter sediment from overland runoff from the construction areas. Ten meters of buffers are applicable for minor tributary or stream (DOE, 1996: 1997). Generally, the buffer strips only trap coarse sediments, where the clay and fine particles will still pass through during rain. Therefore, additional measure like silt fences and diversion of runoff into silt traps or sediment basins were constructed to mitigate the problem. A general design of silt fence is listed in Appendix 9 by JKR in year 2002.

4.4.2.2b  Temporary culvert crossing.

A proper culvert (usually concrete pipe) was provided at the area where the road cross the tributary or stream. Rockfill at the embankment of temporary culvert was implemented to reduce erosion and sediments being washed out. This will give minimal disturbance to the
watercourse. If small tributary diversion is required, rock lined channel or geotextile lined channel was implemented where sized and graded rocks are placed over a geotextile layer along the bed and banks of the diversion channel (Plate 4.3). Rock lining of channels is one of the simplest kinds of surface treatment. In addition, all vehicles, trucks and machines are prohibited from plying through any watercourse to prevent any sediment being introduced into the watercourse.

Plate 4.3: Geotextile lined channel was implemented for a small tributary diversion

4.4.2.2c Waste disposal

The contractor was prohibited from discharging oil and grease to any watercourse. Other than this, the disposal of construction waste, domestic waste and biomass generated from site clearing activities were prohibited into any watercourse. In addition, wastewater (sewage and sullage) must be treated such that the effluent complies with all existing
regulations/legislation. The details of the handling and disposal method for the entire above-mentioned wastes was discussed in section 4.3.2.4.

4.4.2.2d River water quality monitoring.

The Environmental Management Consultant (EMC) engaged by the project proponent would carry out the river water quality monitoring on a fortnightly basis as usual. Parameter to be tested included pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Total Suspended Soild (TSS), Oil & grease (O&G), *E.coli* and flow velocity (fv). The results of the monitoring results need to be submitted to DOE once a month. Additional monitoring stations were established in due course at the project site to ensure better monitoring framework. All the additional monitoring stations were located at the upstream of each tributary or river before entering to the project site such as DW4a (Luit River upstream), DW3a (Peretak River upstream), DW5a (Ganggor River upstream) and DW7a (Gerachi River upstream). As a result, the contractor would be able to determine the actual source contributed to the Selangor River whether it was from the construction area or a source area outside the project boundary. The details of the river water monitoring stations are shown in Figure 4.15. The independent environmentalist meanwhile continued to monitor the river water quality on a daily basis using calorimeter Model DR890 until the end of the project. These will give early indication of river water pollution to the contractor.
Figure 4.15: The layout plan of river water quality monitoring stations within the re-aligned road project
The project contractor has established a comprehensive river water pollutant checklist associated with the construction activities and its effluent within the project site. The checklist assisted the contractor to determine the actual pollutant sources within the project site. This checklist was updated and reviewed every fortnight or on ad hoc basis if there were any changes to construction activities. An example of the said checklist was listed in Appendix 10.

4.4.2.3 Mitigation measures for hazardous material management

The storage of relatively large quantities of construction material on site was required for the construction of re-aligned road FR55. Some of these materials including fuel and lubricants, if not properly stored and handled, may result in adverse impacts on soil, air and water quality. Therefore, the proper method of storage and handling of hazardous materials such as fuel, explosive and cement should be implemented at the project site according to the DOE’s specifications and conditions.

4.4.2.3a Fuel (Diesel)

Diesel was stored in a standard skid tank complete with concrete bunker that provided 10% volume of the total capacity of the skid tank (ENSERCH, 1997) (Plate 4.4). The skid tank was located at least 100 meter away from any watercourse. Automatic trigger alarm system was installed inside the bunker as requested by the DOE, which trigger off if spillage from the skid tank occur (Plate 4.5).
Plate 4.4: Diesel was stored in a standard skid tank with concrete bunker, which provided 110% volume of the total capacity of the skid tank.

Plate 4.5: Automatic trigger alarm system was installed inside the bunker which will trigger off if oil spillage from the skid tank occurred.
The contractor strictly prohibits smoking within this area due to the flammable substance; a proper signboard or sticker was erected to warn the workers. The contractor has also established a standard procedure for loading the diesel into the skid tank to prevent any oil spillage and soil contamination from occurring. In addition, the layout plan of skid tank location was updated and reviewed frequently and displayed in the site office to ensure everybody is aware (e.g. Figure 4.16). The site supervisor or engineer regularly monitored and checked the skid tank to ensure that the diesel is handled according to the specification and no spillage occur (e.g. Appendix 11). In addition, the contractor also prepared and documented an Emergency Response Plan (ERP) for any oil spillage that may occur within the project site.

4.4.2.3b Explosive

Three types of explosives were used, namely Emulex 150, EZ-Det. Detonator Bulk Emulsion & Electric Detonator and ANFO. The Booster is high explosive with high detonation velocity of about 7,200 m/s. Detonator is an initiating device with high sensitivity that explodes easily and is used to start the detonation of high explosive, and Ez-Det. Form of Non-Elect detonator was selected in view of the high-tension wire. Both Cast Booster and detonators shall be stored in the approved magazine. Only authorized personnel’s (licensed shotfirer) were allowed to handle this explosive at the project site. Storage of explosive at the project site was strictly prohibited. Transporting of the explosives from the magazine to the blasting site was accompanied by an approved
Figure 4.16: The layout plan of skid tank locations within the re-aligned road project
security guard or policeman and records of all the explosives at the blasting site must be endorsed.

4.2.3c Cement

The bulk cement was stored in the specific cement silo with proper filter bag fitted at the top of the silo to control emission of cement particles. A proper maintenance schedule was planned and implemented accordingly for the filter bag to ensure it was functioning well. Maintenance records were properly documented for future reference. The plant manager has established a properly documented method for loading the cement from the tanker to the silo so as to minimize the cement dust emission.

4.2.4 Mitigation measures for waste management

As mentioned earlier in section 4.2.1.2c, the road construction activities generated a large amount of waste materials, which included construction waste, domestic waste, scheduled waste such as spent oil and biomass (refer to Table 4.2). Improper storage and handling of this particular waste could lead to air pollution (refer to NCR No: 2CA-9 of Table 4.5) and oil contamination (refer to NCR No: 1CA-5 of Table 4.4 and NCR No: 2CA-5 to 9 of Table 4.5) should open burning and oil spillage occur. The following are the recommended storage and handling methods of each type of waste at the project site.

4.2.4a Construction waste
All the entire construction wastes generated were properly stacked at the site to reduce visual impact. Waste minimization, waste separation and recycling approach (Dowie et al, 1998) could be implemented at the project site. For example:

- The construction formwork could be reused or recycled as much as possible to minimize generation of waste,
- Materials with recycle value such as steel bar, empty steel drums etc. could be sold to recycling companies, and
- Discarded tyres could be used to strengthen the riverbank to reduce its erosion.

Other construction waste materials (without any recycle value) were disposed of regularly at a local landfill or a designated approved dumping ground such as Kerling dumping ground. Open burning and disposal of waste into watercourse were prohibited at the project site.

4.2.4b Domestic waste

Reuse, recycle and waste segregation approach for domestic wastes should be implemented at the project site. Aluminium cans, glass bottle, plastic, used paper and etc, generated from the canteen and site office should be recycled and sold to the recycle companies. The project contractor should prepare proper dustbins within the project area especially at the office, canteen and Center Labour Quarters (CLQ) area. The garbage and solid waste was collected by Majlis Perbandaran Hulu Selangor (MPHS) on a daily basis and disposed of
Plate 4.6: Areas for storage of the containers were designed, constructed and maintained adequately to prevent spillage of leakage of scheduled wastes into the environment

4.4.2.4d Biomass waste

Biomass consisting of trees, branches and vegetation bushes generated from the site clearing activities were burnt using Air Curtain Incinerator (ACI) (Plate 4.7) at the site. The proper method statement for handling this equipment was documented to ensure the operator would handle the ACI according to the specification. Daily operation hours were limited from 8:00am to 10:00pm where the last loading of biomass into the burning pit is on 6:00pm. This was to ensure that burning was completed before the ACI was shutdown. Time of loading of biomass into the burning pit was properly recorded for future reference. Burning operation should be stopped immediately whenever there was breakdown of ACI
and should resume operation only when such a breakdown had been rectified. For safety purposes and emergency situations, fire-fighting equipment such as fire extinguisher was stored within this ACI area. All open stockpile of biomass was properly stacked to prevent occurrence of open burning that could lead to bush fire.

Plate 4.7: Air Curtain Incinerator (ACI) – control burning of biomass

4.4.2.5 Mitigation measures for wastewater management

Wash water from concrete batching plant and sewage effluent from the toilet’s septic tank were the only source of liquid effluent flowing out of the project area. Improper handle of the said wastewater could cause impact to the environment (refer to NCR No:2CA-1 of Table 4.5). Properly designed toilet septic tanks were installed at the site office, canteen and Central Labour Quarters (CLQ) to control the toilet effluent. The contractor had also scheduled the maintenance and desludging works for the septic tanks to contain the effluent quality to the standard stipulated Environmental Quality (Sewage and industrial effluents) Regulations, 1979. In addition, the contractor also prepared portable toilet
facility along the re-aligned road of FR55 during construction phase in order to prevent any sewage being discharge into the watercourse.

At the concrete batching area, the contractor constructed a sump pit to cater for all the wash water from the concrete plant. Water inside the sump pit was recycled and used for wetting the haul road to control dust pollution. The sump pit was well maintained and de-sludged regularly and disposed to a designated area.

4.4.2.6 Mitigation measures for air quality management

As discussed in section 4.2.1.2.e, the following mitigation measures should be recommended and implemented at the project site to ensure air pollution is minimized.

4.4.2.6a Emission from vehicles trucks and machines

All the vehicles, trucks and machines used at the project site were well maintained to ensure emission is within tolerable environmental friendly limit. The details of the mitigation measures for transportation will be discussed in the next section.

4.4.2.6b Movement of vehicles

Vehicular movement on the haul road will generate dust emission, leading to air pollution. Spraying water on haul road and construction areas that are dusty using mobile water
tankers was implemented at the project site to control dust pollution (Plate 4.8). The frequency of water spraying was fixed 2 to 3 times per day for normal weather conditions. The water spraying frequency was increased to about 4 to 6 times a day during dry and windy seasons. Zoning system was implemented to control the movement of the mobile water tankers, where each of the mobile water tanker will be responsible to certain zones. This zoning system and proper checklist will ensure the mitigation measures are proper implemented at the site (Appendix 13). The contractor should pave the junction between the public road and the construction access road for at least 30 meters (DOE, 1996), so that they can be regularly cleaned for the purpose of reducing the spread of soil debris into public roads. Maintaining the public roads using motor pusher or power broom to clean and remove all the soil debris on the public road were implemented at the site to ensure dust pollution is minimized. In order to reduce air pollution further, the contractor has constructed a proper vehicle washing bay area for the trucks and site vehicles before leaving the construction site.

Plate 4.8: Spraying water on hauls roads and construction areas that are dusty using mobile water tankers to control dust pollution at the project site
The EMC monitored air quality viz. suspended particulate matter at fortnightly intervals at the corridor of aborigine villages. The suspended particulate matter content in the air should not exceed the limiting value of 260 \( \mu g/m^3 \), whilst the PM\(_{10} \) content should not exceed 150 \( \mu g/Nm^3 \). The monitoring results would be submitted to DOE monthly.

4.4.2.7 Mitigation measures for noise and vibration management

For the entire quarry site, delay-blasting method was applied to reduce the noise and vibration level produced during rock blasting. Aborigine villages in the vicinity such as Kg. Peretak and Kg. Gerachi were informed earlier as a safety procedure to prevent any unnecessary complaints. Workers involved in the drilling works with "down to hole method" and blasting works at the quarry site were provided with earplugs to protect their eardrums. The quarry contractor monitored the noise and vibration level for every blast conducted at the quarry site to ensure compliance with the limiting value of 65 dBA and 3mm/s respectively.

Vehicular noise can be reduced by restricting traffic speed and imposing heavy vehicles to be fitted noise silencers conforming to the specification set by the environmental (Motor Vehicle Noise) Regulation 1987 (Environmental Quality Act 1974). The contractor should ensure that all the equipment and machinery are in proper working condition to minimize the amount of noise generated through irregular maintenance and services. Monitoring program should continue to be carried out as usual at the corridor of the Aborigine villages.
by EMC to ensure the noise levels were below 65 dBA at daytime and 55 dBA at
nighttime.

4.4.2.8 Mitigation measures for transportation and machinery management

The contractor prepared the inventory of transportation and machinery devices operating at
the project site to ensure maintenance works were carried out in accordance to the
schedule. Number of working hours for every transport and machinery device was
properly recorded and documented in order to assist the maintenance works. Proper oil
trap was constructed inclusive of perimeter drains at vehicle and machinery maintenance
yard to prevent occurrence of any soil contamination (Plate 4.9). This oil trap was well
maintained to ensure it is functioning well. Monitoring is required at the outlet of the oil
trap to ensure there was no oil being discharged out. The contractor was provided with a
formal policy and guideline on spillage prevention and disposal of fleet maintenance waste
such as engine oil, disused tyres, refrigerant, damaged parts and etc. Lastly, it is
recommended that the contractor should carry out monitoring programs on the
effectiveness of air and noise emission from vehicle and machinery to effect appropriate
arrangement for corrective maintenance.
Plate 4.9: Oil traps at vehicle and machinery maintenance yard

4.4.2.9 Mitigation measures for occupational safety and health management

4.4.2.9a Environmental and safety procedure

All workers and staff working at the project site are exposed to risks especially during rock blasting works at quarry site and road, beam launching for bridge construction, earthwork activities etc. Therefore, it is recommended that a proper safety procedure and guideline were established to ensure the working environment was safe and safety statutory requirements are adhered to. The following safety procedures were established and implemented at the project site:

- Personnel Protection Equipment (PPE) procedure
- Rock blasting works and explosive handling procedures
- Scheduled waste (spent oil) handling procedure
• Skid tank handling procedure
• Air curtain incinerator handling procedure
• Earthwork activity procedure
• Beam launching procedure

4.4.2.9b Emergency response procedures (ERP)

Occasionally some mishaps, emergencies and accidents may occur unexpectedly during construction activities. The possible mishaps that could effect the environment are slope failure, spillage of oil, fire accident, construction accidents etc. These mishaps would not only pollute the environment but could also cause injuries to personnel and perhaps damage to various utilities within the vicinity at the project site. The contractor should prepare an Emergency Response Plan (ERP) as required by the DOE outlining the proper and correct guidelines and actions that should be taken during an emergency. Various kinds of emergencies and/or accidents may arise during construction works, which can be minor or major and serious. Therefore, the contractor should establish and properly document the following ERPs at the project site, and carry out drills and exercise or training at regular interval.

i. ERP for oil spillage
ii. ERP for landslide
iii. ERP for accident
iv. ERP for fire accident

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