Chapter 3

Strategic Urban Redevelopment Planning, The Philippines

Table of Contents

Chapter Summary ................................................................. 1
Assessed Sites ........................................................................ 3
Baseline Study ....................................................................... 17
General Evaluation and Analysis of Remediation Alternatives .......... 36
Key Considerations in Pursuing Remediation of the Pilot Site ............ 39
Remediation Costs .................................................................. 45
Alternative Livelihoods ............................................................ 46
Redevelopment Plans .............................................................. 46
Development Costs .................................................................. 51
Revenue Generation .................................................................. 52
Funding Mechanisms .............................................................. 54
Action Plan for Implementation ................................................ 55

CHAPTER SUMMARY

1. This is chapter three of the Final Report for The Technical Assistance Project: Mitigation of Hazardous Waste Contamination in Urban Areas: Supporting Inclusive Growth, TA8458. Other chapters of this report addressed the challenges of hazardous waste management and redevelopment of contaminated sites in general. They also provided recommendations from the project team on inclusive development, hazardous waste oversight, remediation and redevelopment of a contaminated site, and a completed pilot project in Indonesia. This chapter addresses the pilot project conducted in The Philippines as a demonstration of...
addressing hazardous waste contamination through inclusive growth and urban redevelopment.

**Site Selection**

2. Five candidate sites were selected for review by the project team to nominate a Pilot Site for mitigation of hazardous waste contamination and a strategic urban development plan under the TA. Site visits were conducted between January 27 and 31, 2015. In addition, the team heard from national, provincial and municipal officials regarding public policy and the current status of hazardous waste mitigation within their jurisdictions at the Inception Workshop held on January 30, 2015. Municipal officials accompanied the team on site visits in the cities of Meycauayan and Valenzuela. During a meeting with the Planning Department in the City of Meycauayan, officials discussed policies and plans regarding several sites in their jurisdiction and provided links to pertinent planning documents, including a 2014 socioeconomic profile of the city. Likewise, officials of the City of Valenzuela provided helpful links to planning and socioeconomic data, including its Comprehensive Land Use Plan, 2009-2018.

3. To help evaluate the redevelopment potential of the candidate sites and assist the team in selecting a Pilot Site, the international land use and economic consultants developed a matrix that rates each candidate site according to 17 criteria that are essential for successful urban redevelopment. The criteria, which were presented and discussed at the Inception Workshop, focus the evaluation on four principal factors that are intrinsic to redevelopment in urban areas, including:

   - Physical characteristics of the site
   - Socioeconomic characteristics of the local population, business and industry in addition to fiscal considerations that may influence investment decisions
   - Public policy (national, provincial and municipal) regarding hazardous waste contamination and management
   - Land use patterns and zoning regulations that permit or constrain development, particularly with regard to open space
4. The matrix rates how well each site meets each of the 17 urban redevelopment criteria on a sliding scale from 1 to 4, with 1 indicating that site characteristics would constrain or limit redevelopment and 4 indicating that the site substantially meets the criteria and would strongly support redevelopment. Not all criteria are equally important to the redevelopment potential of a site, so the criteria themselves are rated 1, 2 or 3 with 1 being the least important and 3 being the most important. The score for each criterion is achieved by multiplying the criterion rating by the importance of the criterion. The 17 scores for each site were summed to provide an overall evaluation for each site. This analysis highlights the redevelopment potential of each site from a land-use and urban planning viewpoint.

ASSESSSED SITES

Site One: Border of Punturin Creek, Valenzuela

5. Site 1 is located in Barangay Punturin. The land-use of Punturin is categorized as agriculture and is part of the city’s 89.7 hectares of land allotted for agricultural production (approximately 2% of the city’s total land). However, there are still remaining areas allotted for agro-industrial uses. Based on the existing land use classification of the City (2009), Punturin has 28.39 hectares allotted for industries. Green Planet Management, Inc., a DENR accredited treatment, storage and disposal (TSD) facility is nearby. Other local industries include steel, metal and plastic manufacturing.

6. Punturin Creek flows near the industrial area. Downstream, approximately 10 to 20 informal residences are located along the east bank of Punturin Creek, at the end of a narrow road. A gated single-family residential community known as...
Maraming is also located nearby. Houses here are typically two stories and contain approximately 100 to 200 square meters of space. Several vacant lots were also observed within the Maraming community. A cinder block wall separates an adjacent industrial area from Maraming and the informal housing on Site 1.

7. When the team performed the assessment in Punturin on November 6, 2014, the water body changed in color over a brief period of time: from light orange, to green, then to black. According to the residents, this is typical; sometimes the water is white, blue or red. The residents also noted that there are times when it smells like oil. Out of the 18 points assessed XRF analysis, one sampling point exceeded internationally cited standard for As, Cd and Pb. Another point exceeded the standard set for Cd. The water sample from the creek, on the other hand, yielded 0.09 mg/L or 90 ppb of Cr, which is above the standard level for drinking water (WHO 50ppb) and a little below the standard level for irrigation water (FAO 100ppb). According to the residents, they do not use creek water. They have a dug bore well for domestic water use.

8. While there is a small community of informal settlers, there is an expectation that the informal residences will be relocated in conformance with the Philippine Water Code stipulating the following: “The banks of rivers and streams and the shores of the seas and lakes throughout their entire length and within a zone of three (3) meters in urban areas, twenty (20) meters in agricultural areas and forty (40) meters in forest areas, along their margins are subject to the easement of public use in the interest of recreation, navigation, floatage, fishing and salvage. No person shall be allowed to stay in this zone longer than what is necessary for recreation, navigation, floatage, fishing or salvage or to build structures of any kind.”

9. Site 1 itself is extremely narrow and offers little to no redevelopment potential. It has the lowest score on the Evaluation Matrix, with a total of 50 out of a maximum 124. However, the relocation of the informal residents and removal of the informal housing could result in some land use benefits by providing an opportunity for new open space and greening of the river bank.
Site Two: Caingin dumpsite, Meycauayan

10. Site 2 is privately owned by Jamar Corp. It’s a former open dumpsite located inland in Barangay Caingin, adjacent to a tributary of the Meycauayan River. To the east is the neighboring Barangay Lawa and across a narrow inlet to the south is the City of Valenzuela. Barangay Caingin has a land area of 54.72 hectares and a population of 4,763.

11. Until recently the city used Site 2 as a municipal landfill for household garbage and refuse. Both the Environmental Management Bureau Region III and the City Government of Meycauayan report that the landfill, which covers approximately 4 hectares, was officially closed in 2010. However, field observations from the site visit indicate that the site’s borders are uncontrolled and remain largely open. There is potentially ongoing illegal dumping, scavenging and open burning on the site. In addition, substantial amounts of the landfill’s contents have spilled into the river, which moves slowly as it curves around the site, so that the surface of the waterway is completely filled with refuse. There are also about 15 informal houses at the site. Two XRF surface soil sampling points registered 25.5 and 30.1 ppm of Cadmium which are both above the recommended level of 1.4 ppm for agriculture areas and 14 ppm for residential areas but below the industrial limit of 192 ppm.

12. As noted in the evaluation matrix, the size of Site 2 makes it attractive for redevelopment. The site scored highly in several other land-use and redevelopment criteria, including transportation access, recent investment, the potential to support uses similar to those in the surrounding area, and the potential to improve neighborhood character. For example,
the site is only 6 kilometers from the N. Luzon Expressway. In addition, a review of a 2014 Socioeconomic Profile prepared by the City of Meycauayan shows significant recent public and private investment close to the landfill. The Meyland Homes subdivision located in the adjacent Lawa Barangay includes 557 units of government or social housing. Another 663 homes were developed in the Ciudad Grande North subdivision in Lawa. The Villa Samantha subdivision located partially in Caingin and Lawa contains 536 homes. Overall, investment in the area since 2010 has resulted in 277,926 sq. meters (68.7 acres) of residential development containing a minimum of 1,820 housing units. In terms of services and utilities, Caingin has a health center, schools, potable water supply, telecommunications and electricity.

13. The major sources of livelihood in the area are: leather tanning, jewelry making, trading, piggery and services employment. The investment activity, along with several other evaluation criteria, resulted in a score of 83 for the Caingin landfill site, the fourth highest among the five candidate sites in the Metro Manila-Bulacan regions, indicating comparatively high redevelopment potential.

Site Three: RAMCAR, Meycauayan

14. The RAMCAR site is a former used lead-acid battery recycling (ULAB) plant occupying 13.7 hectares in Barangay Bancal. The lead recycling facility operated from 1978 to 2000. The building that housed the recycling operation has been demolished, though the contaminated soil from the battery recycling inside and adjacent to the facility compound as well as the areas where slag is likely buried has not been remediated. Although the facility closed and was sold off in parcels to several private owners, the property is being guarded to prevent access to the interior, though it appears that local residents are still gaining

Figure 3: RAMCAR
entry.

15. During a 2008 assessment, community interviews revealed that scavengers collected scraps from inside the site from which they could still extract lead. According to some community members, scavengers paid P 10-20 pesos and even P 100 pesos to get inside the facility. The nearby informal settlers also used battery casings as flooring and around their homes.

16. A section at the border of the site is currently occupied by informal settlers, posing a grave health danger to the residents, particularly children. The informal settlers are part of Barangay Tugatog, which borders Bancal. In a 2010 study, a total of 103 people resided in the area. There were 22 families with an average household size of four to six. A majority of the residents were female (60.20%) and more than one-third were children aged 0 to 12. The Department of Health (DOH) and University of the Philippines – National Poison and Management Control Center (UP-NPMCC) in partnership with Blacksmith Institute conducted a health assessment study to determine the Blood Lead Level (BLL) of children living near the site in 2010. Out of 76 children ages 6-7 years old tested, 12 children had a BLL of more than 10 μg/dL, with some as high as 65 μg/dL, the upper limit of detection for the Lead Care II analytical device. The Center for Disease Control (CDC) advises chelation therapy for BLLs 45 μg/dL and higher and is concerned if children’s BLL reaches 5 μg/dL or higher. In addition to this, a Blood Lead Level monitoring of people living adjacent to the site was conducted in July 2010. A total of 20 female and 10 male residents were tested. Twenty-four of those tested were children younger than 12 and six were adults. A majority (75%) of the children were underweight while half of the adults who participated in the assessment were undernourished. Half of the children showed enlarged lymph nodes. All of the patients had upper respiratory infections and dental caries. Two of the adult patients reported fatigue and lethargy. The BLLs were determined using an FDA approved Lead Care device. The soil sample readings at that time registered as high as 76,000 ppm tested via X-Ray Fluorescent Analyzer and 25,000 ppm via Atomic Absorption Spectroscopy Analyzer.
17. In 2014, within the context of the planned North Luzon Railway Project, RAMCAR in coordination with the Environmental Management Bureau of Region III completed a remediation just outside of the walled property that is part of the North Luzon Railway Corporation (NLRC) property. The site was re-assessed under this TA and results showed fourteen of forty-four points exceeded the soil screening criteria for lead, arsenic, cadmium and chromium.

18. Environmental and health risks are more pronounced in this site than in several of the other sites assessed. However, if it were remediated, the site would have excellent redevelopment potential based on its size, location and the land use characteristics in the surrounding area. The site encompasses approximately 14 hectares (34 acres), occupying about 20 percent of the barangay, and represents the largest single under-developed property in the barangay. Like the Caingin landfill, the RAMCAR site is located near recent large-scale residential developments and is very accessible. Overall the site earned a score of 100 out of 124 in the land use and economic development evaluation.

19. The barangay itself is densely developed with residential, commercial, industrial, and institutional uses, primarily due to its location along MacArthur Highway, one of two major north-south transportation routes serving Manila. Among the important institutional uses is Meycauayan Doctors Hospital, a full-service medical center located within a few hundred meters of the former main gate of the RAMCAR facility and several educational facilities. Not far from the site is the Meycauayan City branch of STI College. A wide range of commercial uses are also present in the vicinity of the RAMCAR site including a branch of Puregold Price Club, a major supermarket and general merchandise retailer in the Philippines. In addition, there are several banks, auto dealerships, business services, pharmacies, and restaurants nearby. One of the principal industries in the barangay is leather tanning. C.G. Lejano Leather, a major supplier to Hickok Leather, maintains a facility within a few hundred meters of the site.

20. The southern edge of the site borders the planned North Luzon Railway. Construction activities would likely remediate any contaminated areas immediately adjacent to the
RAMCAR site. However, operation of the railroad could constrain redevelopment opportunities in the southern portion of the site, particularly for potential residential development by creating a barrier to access and possible noise, vibration, and visual impacts.

21. Assuming the effective remediation of the RAMCAR property, the site is well situated for redevelopment. The property offers a strategic mix of assets to support redevelopment, including adequate size to accommodate one or more compatible land uses, a regular configuration and excellent transportation access. In summary, the site is in the midst of a highly developed urban core that brings together a residential population with prominent commercial, institutional and industrial uses that would make the site decidedly attractive for urban infill development.

**Site 4: Lingunan Landfill, Valenzuela**

22. The Lingunan landfill site occupies approximately 13 hectares of the 11,590 hectares in Barangay Lingunan within the City of Valenzuela. The Lingunan Controlled Dumpsite was opened in 1998 to process about 60% of the entire city's waste with land filling, recycling, segregation, and resource recovery services. The dumpsite used rice hull ash as daily cover and odor control material. In 2006, the dumpsite was closed per MMDA order and was subsequently converted into a sanitary landfill as directed by RA 9003.

23. Like the Caingin landfill, this site is adjacent to the Meycauayan River. Residential areas appear to border the site on the east and northeast, while industrial uses and a large open area border the site on the south. Major
industrial uses located nearby include the Plastic City Corporation, Bestank, Ginebra San Miguel (non-alcoholic bottling facility), and the Splash Corporation, which manufactures health products distributed internationally. There is a vibrant commercial district close by with a concentration of retail food stores, general merchandise stores, clothing stores, paint and hardware stores, banks, auto parts retailers and suppliers, and motorcycle sales. The site is also close to the recent residential developments in Lawa and Caingin Barangays in the City of Meycauayan, and is approximately 5 kilometers from the N. Luzon Expressway.

24. The Lingunan landfill scored third highest among the five sites compared in the land use and redevelopment evaluation, a total score of 98 out of a maximum score of 124. Some of the significant characteristics that support redevelopment of the site include its size, nearby recent investment (both residential and industrial), access, and proximate land uses similar to those that might be developed on the site, including residential and commercial. But perhaps the most important asset for the Lingunan landfill site is consistency with public policy. The City of Valenzuela has already closed part of the landfill and stands ready to meet the challenge and opposition from the current private landowner to close the remaining portion of the landfill.

Site 5: Pandacan Depot, Manila

25. The Pandacan Petroleum Depot occupies 33 hectares along the south bank of the Pasig River in south Manila. It is an extraordinary urban development site given its size (about 74 acres or 3.2 million square feet), proximity to major upscale commercial and residential developments in central Manila, relatively clean condition, 51% public ownership, ongoing relocation and abandonment of
storage tanks, and apparent public support for the policy to close the remaining petroleum storage facilities.

26. The site is occupied by the three major petroleum industry players: Shell, Chevron, and Petron. Its existence in a densely populated area is considered to be in non-compliance with the prescribed buffer zone separating industrial areas and residential and commercial areas.

- Reported incidents caused by the depot include the following:
  - 1997, two Shell oil tankers exploded inside the oil depot complex
  - 1999, a pipeline leak was the source of fires in Muntinlupa City with one fatality
  - 2008, a tanker caught fire at the Nagtahan fly-over, killing one and wounding another
  - 2010, the FPIC underground pipeline leaked oil into West Tower Condominium in Barangay Bangkal, Makati

27. Health effects of the depot have also been studied. “In 2005, the University of the Philippines College of Medicine conducted the study, *A Cross-Sectional Study on the Neurophysical Effects of Exposure to Refined Petroleum Products Amongst Adult Residents in Three Barangays near the Pandacan Oil Depot.*” Among the study’s findings is that the number of cases of neurophysical disorders in the area have been progressively increasing. In the same year, a health survey found high levels of benzene in the air surrounding the oil depot, problematic because benzene is a known carcinogen that affects the nervous, respiratory, and immune systems.

28. Water sampling was performed in Estero dela Reina, one of the Pasig River tributaries near the Pandacan site. The analysis confirmed 15,200 ppb of lead, though the presence of other industries, establishments and informal SMEs in the area make it difficult to attribute this finding directly to the oil depot.

29. The Pandacan Depot scored 101 out of a maximum score of 124 on the evaluation matrix. Despite the high score, there are a few key considerations the team should take into account when considering the Pandacan Depot as a potential pilot site. As a very large,
industrial site run by international corporations, this site differs from the other individual, small-scale, or medium-scale enterprises considered under the TA that are more likely to serve as models for low- and middle-income countries in the region. Additionally, it is such a large site that the redevelopment and remediation would take additional time to complete and to show an impact. Therefore, it was determined that this site was not ideal for the TA, as it should be remediated by the private companies responsible for the contamination. Taking all of the findings into account, the team with approval from DENR-EMB chose RAMCAR (Site 3) as the pilot site for the Philippines.
Selected Pilot Site, RAMCAR

30. The pilot site chosen in The Philippines for this TA is a 13.7 hectare former used lead-acid battery recycling plant located in Barangay Bancal, just at the border with Barangay Tugatog, in Bulacan. The site borders the railroad right of way owned by the Philippine National Railroad (PNR) that is to be developed in the expansion of the North Luzon Railway Project. The area where the site is located is zoned for residential and industrial use. The site is located along busy MacArthur Highway, with shopping, commercial establishments and the successful ITC Woodlands housing development. The site’s size and location make it an ideal redevelopment planning site. The site is shown in the Figure 6 below.

Figure 6: Pilot Site Location, Philippines
History of Operation

31. The lead recycling facility operated from 1978 to 2000. There were little to no emissions or discharge prevention systems in place when the plant was operating. According to an interview with a former plant manager, battery acid and liquid wastes from the facility were poured directly into the MacArthur Highway drainage system and slag and other lead-filled waste were dumped into wetlands at the rear of the property without proper pre-treatment or solidification practices to prevent spread of contamination. The building that housed the recycling operation has been demolished, but no remediation or cleanup was conducted. The locations of former operations are indicated in the image below:

Figure 7: RAMCAR Operations
32. Although closed, the facility is still being guarded by the previous owner and is privately owned by new owners who do not have access to the site. The image below shows the parcels that make up the site.

**Figure 8: Site Parcels**

33. The RAMCAR facility in Meycauayan City operated as a battery and used lead-acid battery recycling center for 25 years. RAMCAR was founded in 1919 as an automotive electrical shop in Manila. The original used lead-acid battery recycling plant was in Gen Luis St. Novaliches, Quezon City and later moved to Bancal, the Meycauayan site in the 1980s. In 1989, the Meycauayan plant reached its maximum capacity rate of 12,000 tons of lead recovered per annum. The recycling facility was later transferred to Marilao to cover the increasing demand for soft lead bullion and hard lead alloys (Table 1). In 1997, two of the
biggest motor battery manufacturers in the Philippines, C.C. Unson Company that manufactures Motolite battery, and RAMCAR Inc. that produces Oriental battery, merged to become Oriental and Motolite Corporation (OMC). C.C. Unson started as an importer of motor batteries mainly from States Battery Parts of Seattle, Washington.

34. In 1991, RAMCAR renamed itself Philippine Recyclers, Inc. (PRI) and later transformed into Green Planet, bought out First Metal Specialists, Inc. (FMSI) and took on the latter’s battery recycling operations. This ended the dependence of the company on imported primary lead. In addition, local and international pressures for stricter control of hazardous wastes and materials was adopted in 1989 and enforced in 1992 through the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. The Philippine Recyclers, Inc. (PRI) became the largest secondary lead smelter in the Philippines. The company also implemented several Corporate Social Responsibility (CSR) projects such as Balik Baterya in partnership with Philippine Business for Social Progress (PBSP) and Bantay Baterya with Bantay Kalikasan of the ABS-CBN Foundation, Inc. (AFI). Both programs center on requesting private companies to donate their ULABs for proper handling and recycling, the equivalent amount or proceeds of which go to PBSP’s and AFI’s development projects (i.e. electrification of classrooms, rehabilitation of watersheds, etc.).

**Figure 9: RAMCAR Recycling Plants**

<table>
<thead>
<tr>
<th>Year</th>
<th>Lead Production (tons/annual)</th>
<th>Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>39.7,200</td>
<td>Meycauayan Plant</td>
</tr>
<tr>
<td>1989</td>
<td>42.12,000 (maximum capacity)</td>
<td>Meycauayan Plant</td>
</tr>
<tr>
<td>1990</td>
<td>45.36,000</td>
<td>Marilao Plant</td>
</tr>
</tbody>
</table>
BASELINE STUDY
47. The site was assessed for this project using a Conceptual Site Model to review the contamination, source, estimated extent, exposure paths, and potential remediation techniques.

Contamination Source
48. Site contamination was first investigated when Blacksmith Institute conducted an assessment of heavy metals in surface soil at selected locations in Meycauayan City in 2008. Soil lead levels near the RAMCAR site where informal settlers live ranged from 1,500 – 200,000 ppm, which is above the permissible level of lead in residential soil of 400 ppm (according to USEPA standards). The discovery of the lead contaminated site led to a joint 2010 project between Blacksmith Institute, RAMCAR represented by Leelin Corporation, and the Environmental Management Bureau Region III. Results of the assessment showed that several points near the wall and the railroad where the informal settlers reside had lead levels exceeding the permissible level of 400 ppm. The lead levels on surface soil during that time ranged from 12.10 to 76,033.20 ppm. Levels in front of the facility ranged from 400.01 to 1,000 ppm. The surface lead measurements are presented in the map below.

Figure 10: Surface Lead Measurements, RAMCAR
49. Sampling went as deep as 1.0 m. Results showed that lead levels outside the facility decrease as sampling depth increases. This indicates that contamination outside the wall and near the former railroad is mainly concentrated on the surface from deposition. However, samples collected in front of the facility showed increasing levels of lead with deeper increments from surface to 0.50 meters. This is indicated in the image below. This is attributed to a number of highway renovations since 2000 where clean soil has been dumped to elevate the area due to flooding. It is anticipated that there are also several areas where waste was buried and the contamination would be much deeper.

**Figure 11: Depth Measurements, RAMCAR**
50. Leelin Corporation conducted a parallel assessment inside the RAMCAR facility. Assessment results showed that lead levels after the Toxicity Characteristic Leaching Procedure (TCLP) range from 254 to 1,677 ppm. Results are shown in the map below.

Figure 12: TCLP results, RAMCAR
In 2010 the joint project accomplished the removal and proper disposal of battery plastic casings that had been used as house flooring and furniture by the informal settlers near the site. Remediation of the informal settlers’ site was emphasized as an urgent course of action because there were children who were found to have blood lead levels (BLL) exceeding 10 ug/dL. Planned remediation of the area where the informal settlers live was not implemented however because the funds were not provided. It was also recommended that the interior of the site be remediated and initial discussions regarding the remediation options were undertaken. In 2014, within the context of the planned North Luzon Railway Project, RAMCAR, in coordination with EMB Region III and based on reconfirmed findings of the 2010 project, implemented remediation just outside of the walled property in the area owned by the North Luzon Railway Corporation (NLRC) property. The figure below shows the lead levels on soil surface at the railroad property adjacent to RAMCAR where
remediation was completed in July 2014. The total area excavated covered 3,800 sq. m. at 0.6 m depth with an estimated volume of 2,280 m$^3$. The contaminated soil was excavated and dumped inside the walls of the RAMCAR property. Clean soil was then used to backfill the site. Officers from DENR-EMB Region 3, Leelin Industrial Corporation and Blacksmith Institute conducted a post-assessment analysis in August 2014. Results of the post-assessment revealed that eight out of the twenty sampling points still had lead levels above 400 ppm. The range of lead levels above 400 ppm was 412.9 to 2540.56 ppm. These data are shown below in Figure 12.

**Figure 13: Baseline Lead Levels**

![Baseline Lead Levels](image)

**Figure 14: Post-Remediation Assessment**

![Post-Remediation Assessment](image)
52. Under this TA, the area along the RAMCAR perimeter was reassessed in November 2014. Fourteen of the forty-four points exceeded the soil screening criteria for lead. Arsenic, cadmium and chromium also exceeded limits in some points. Sampling data is shown below.

**Figure 15: Sampling Data**

**Exposure Pathways**
53. Lead is the main contaminant at the RAMCAR site. The adverse health effects of lead include neurological impairment in children, neurobehavioral damage, and decrease in perceptual reasoning, working memory indices and processing speed indices. Lead is also associated with increased rates of cardiovascular disease and kidney damage in adults.

54. Based on interviews with local officials and community members, informal settlers in Daang Bakal (the community at the site of the railroad) who are residing outside the RAMCAR wall, retrieved lead slag and battery materials from inside the RAMCAR property. These materials were processed informally and sold to junkshops within the cities of Meycauayan and Valenzuela. Battery casings were also retrieved from the former facility and were used for flooring and construction. These activities spread lead dust and expose the community members via inhalation and ingestion of lead particles.

55. The Department of Health (DOH) and the University of the Philippines – National Poison and Management Control Center (UP-NPMCC) researched community exposure in Daang Bakal in 2010. Blood Lead Levels (BLL) of children living near the former ULAB site were analyzed in April and May 2010. Results showed that out of the 76 children ages 6-7 years, 12 had BLLs of more than 10 µg/dL, some as high as 65 µg/dL, the upper limit of detection for the Lead Care II analytical device. The United States Center for Disease Control (CDC) uses 5µg/dL as the level of concern for a child’s BLL. At 45µg/dL, the CDC recommends treatment, typically chelation therapy.

56. Another toxicant, chromium (III and VI) was found in the area. Chromium, which is used in tanneries can expose a receptor through inhalation, dermal absorption or ingestion of contaminated soil, food and water. In 2014, three out of the 43 sampling points near the site exceeded the permissible chromium levels in soil for a residential area, which is 220 ppm. The highest reading was 1,110.53 ppm. The effects of hexavalent chromium include ulcers, asthma, chronic bronchitis, chronic rhinitis and chronic pharyngitis. It also produces allergic contact dermatitis and kidney or liver diseases among exposed workers. There are several tanneries in the area and one is located nearby the informal settlement area. It is possible that contamination from former operations has spread over the railroad and
informal settlement area through flooding or spillage. Further investigations must be completed to determine the extent and levels of concern of any potential chromium contamination.

57. In developing a remediation plan, it is important to take the following into account in planning the sampling method, locations, and protocols such as in the collection procedure, preservation, transport, and analyses of samples. (Source: Asante-Duah, 1996):

- Water solubility (fate and transport in surface water and groundwater systems)
- Dispersion/Diffusion (mobility, leachability, and biodegradation)
- Volatility
- Cross-media transfers, bioaccumulation, and sorption by organic matter
- The time it takes for degradation
- Characteristics of the surrounding area particularly, historical and present moisture, humidity, temperature, and wind speed
- Potential acute and chronic exposure through land use and anthropogenic activities
- Socio-economic and health profile of the community, including dietary practices
- Topography, climate-related, and geologic hazards of the area.

58. As part of the site investigation, the team reviewed the community poverty, economics, and health profile as well. The figure below outlines the key data collected by the team that may impact the exposures of the community.

**Figure 16: Community Poverty, Economic, and Health Factors**

<table>
<thead>
<tr>
<th>Community Health Status Parameter</th>
<th>Key Findings</th>
<th>Relationship to hazardous waste contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human/Biological</td>
<td>Children account for 50% of the population of Meycauayan</td>
<td>Children are vulnerable to the effects of hazardous wastes</td>
</tr>
<tr>
<td></td>
<td>Majority of children in Meycauayan are well nourished.</td>
<td>Children will be able to combat diseases. However,</td>
</tr>
</tbody>
</table>
However, 28.25% of children (0-7 years old) are malnourished. There are also children who are vulnerable because of their nutritional status.

Dietary preferences are vegetables and pork. Vegetables keep residents healthy. However, pork increases the risk to cardiovascular diseases.

Lifestyle preferences: 29.4% of Tugatog residents are smokers and 39.3% drink alcoholic beverages. Smoking and alcohol affect almost all organ systems which, in turn, can affect a person’s capacity to handle hazardous wastes; vices increase incidence of diseases.

Existing diseases: cardiovascular (hypertension) and respiratory (asthma). Existing diseases increase risk to effects of hazardous wastes.

Causes of mortality: cardiovascular (#1) and cancer (#3). A percentage of cardiovascular diseases and cancers is likely attributable to hazardous waste exposures.

Social

Majority of residents have some level of education. Residents can have better understanding on adverse effects of hazardous wastes on health.

¼ of the residents in Tugatog and Bancal have income below poverty threshold; 82.6% of The economic condition increases risk to toxic effects of hazardous wastes.
<table>
<thead>
<tr>
<th>Environment</th>
<th>Tugatog respondents have salaries &lt;Php 8,000/month</th>
<th>Majority of the residents are laborers and unskilled workers</th>
<th>Type of job exposes residents to effects of hazardous agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents</td>
<td>Residents are exposed to physical (81.2%), biologic (77.2%) and chemical agents (70%)</td>
<td>Majority of residents have accessed to sanitary toilets and. Almost everybody are able to avail of safe water</td>
<td>The possibility of agent interactions increases the risk to illness</td>
</tr>
<tr>
<td></td>
<td>These facilities protect person from exposure to hazardous substances</td>
<td>The exposure pathway may be complete, increasing risk to development of disease</td>
<td></td>
</tr>
<tr>
<td>Existing</td>
<td>Presence of lead in biologic and environmental samples</td>
<td>Trend of inverse relationship between blood lead levels of Bancal children and distance from the exposure site (ULAB)</td>
<td></td>
</tr>
<tr>
<td>exposure</td>
<td>Trend of inverse relationship between blood lead levels of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(legacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ULABin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bancal;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tannery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plants in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tugatog)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pure Earth**
| Medical/Technological/ Organizational/ | Bancal children and IQ  
Poor working environment in the tannery factories (OSHC study) | Doctor: patient ratio is 1:24,894  
Sixteen percent (16.4%) of Tugatog respondents identified unavailability of a doctor in the center as a problem when seeking consultation (2015 Tugatog survey)  
Fair utilization of government health services (5.4% among Tugatog residents, 28% among Bancal residents)  
Residents seek consultation only when they are sick (2015 Tagatog survey)  
Curative approach to health care is more favored than preventive care  
Fair accessibility of health facilities since residents still need to secure money before visiting the centers (2015 Tagatog) | Not all residents can avail of the services of a doctor. This can lead to environmental diseases not diagnosed at all and patients not provided with the appropriate treatment  
This increases the risk to development of illness  
This can lead to late diagnosis of environmentally-related illnesses which can have impact on clinical outcome and increase cost of health care  
This may exacerbate illness |
If programs are effectively implemented, exposure to hazardous wastes is reduced.

This increases the risk to exposure of residents to hazardous wastes.

---

**Figure 17: Household Reviews**

<table>
<thead>
<tr>
<th>Barangay</th>
<th>Population</th>
<th>HH</th>
<th>≤ 5 years old</th>
<th>Malnourished children (0-5 years old)</th>
<th>HH below the poverty threshold</th>
<th>HH below the food threshold</th>
<th>HH that are informal settlers</th>
<th>HH without access to improved water source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bancal</td>
<td>14,242</td>
<td>2,663</td>
<td>1,520</td>
<td>12</td>
<td>737</td>
<td>332</td>
<td>36</td>
<td>224</td>
</tr>
<tr>
<td>Tugatog</td>
<td>4,288</td>
<td>1,144</td>
<td>665</td>
<td>0</td>
<td>255</td>
<td>114</td>
<td>10</td>
<td>52</td>
</tr>
<tr>
<td>Banga</td>
<td>2,911</td>
<td>629</td>
<td>400</td>
<td>4</td>
<td>205</td>
<td>332</td>
<td>5</td>
<td>251</td>
</tr>
<tr>
<td>Veinte Reales (Valenzuela City)</td>
<td>22,198</td>
<td>2,579</td>
<td>1,116</td>
<td>13</td>
<td>843</td>
<td>539</td>
<td>163</td>
<td>251</td>
</tr>
<tr>
<td>Nature of Illness</td>
<td>Number</td>
<td>Percentage</td>
<td>Specific Illness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
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<td>----------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>97</td>
<td>49.5</td>
<td>Myocardial infarction (48); Hypertension (36); Congestive heart failure (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>34</td>
<td>17.3</td>
<td>PTB (17); Chronic obstructive lung disease (6); Pneumonia (3); Cancer (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematologic</td>
<td>17</td>
<td>8.7</td>
<td>Leukemia (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyes, ears, nose, throat</td>
<td>8</td>
<td>4.1</td>
<td>Cancer (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reproductive</td>
<td>8</td>
<td>4.1</td>
<td>Breast cancer (3); Complication of pregnancy (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurologic</td>
<td>7</td>
<td>3.6</td>
<td>Stroke (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>7</td>
<td>3.6</td>
<td>Gallbladder stone (2); Cancer (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genitourinary</td>
<td>6</td>
<td>3.1</td>
<td>Kidney disease (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>6</td>
<td>3.1</td>
<td>Cancer of the bone (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endocrine Skin</td>
<td>3</td>
<td>1.5</td>
<td>Diabetes mellitus (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>1</td>
<td>0.5</td>
<td>Psoriasis (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychiatric</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 18: Summary Health Data**

| Total | 43,639 | 7,0  | 3,700 | 29 | 2,040 | 1,317 | 214 | 778 |

Sources: PSA (2010) and CBMS (2005)
Remediation Alternatives

60. The team has identified 8 potential remedial alternatives for consideration:

- Excavation and off-site disposal at a toxic and hazardous waste landfill;
- Excavation and off-site stabilization and disposal (certified waste treater);
- Excavation and off-site encapsulation;
- Excavation and off-site solidification;
- Excavation and use in road-bed material or other solidification;
- Excavation and On-site encapsulation;
- Capping (on-site);
- Combination of methods depending on level of hazard and desired end use.

61. Because the plan is to redevelop the site, excavation in at least some areas will be required. The site is large and it is anticipated that the contamination levels will vary greatly between for example, areas that were formerly concrete floors of the buildings of RAMCAR and areas where slag was buried. Depending on redevelopment plans in various areas, different sections must be excavated, tested for contamination, and then dealt with appropriately and safely for the workers on site and the future residents or visitors to the site.

62. The most straightforward method of dealing with the contaminated materials is excavation and off-site disposal in a THW landfill. This alternative involves removal of the contaminated soils from the pilot site using conventional excavator and loader and transporting the same to an off-site landfill using dump trucks of a DENR-accredited waste transporter. The process would go through the waste transport manifest system prescribed by DAO 20014-36. Aside from the contact information of the waste generator, transporter and treater, the manifest or waste transport record will contain the following details:

- Class, sub-classification, and quantity of each hazardous waste;
63. The excavated area can then be backfilled with imported clean soil. This strategy is proven effective and is particularly favorable when maximum future use of the site is desired. The landfill owner ensures that the material is properly dealt with and the site owner is no longer responsible for any ongoing oversight regarding contaminated material.

64. In the case of the former ULAB recycling facility, the nearest and only toxic and hazardous waste landfill is the Metro Clark Waste Management Corp. Sanitary Landfill in Capas, Tarlac. Based on DAO 2004-36, it is classified as Category C TSD facility, which is a landfill that accepts hazardous waste for disposal or accepts only inert hazardous waste residues for final disposal.

65. Getting the materials to the Clark Hazardous Waste Landfill will entail excavation, loading, transport, gas, and tipping fees. It must be noted that there is a qualifier for the wastes this landfill accepts; it should be hazardous waste, “treated” with inorganic chemicals until its lead (Pb) concentration is less than 5 mg/L based on analysis of an extract (i.e., TCLP). This means that prior treatment should be done before the excavated Pb-contaminated soil can be disposed in this landfill if the soil TCLP shows lead levels greater than 5 mg/L. Cost therefore, not only of excavation, loading, transport, and tipping, but also of prior treatment is a major consideration for this remedial alternative.

66. A similar option for remediation is excavation and off-site stabilization and disposal. DAO 2004-36 defines stabilization as chemical immobilization of hazardous substances, through chemical bonds to an immobile matrix, or chemical conversion to immobile species, thereby reducing vaporization or leaching to the environment. It must be noted that this method may need to be performed before disposal at Clark as discussed above. The United States Environmental Protection Agency (USEPA) considers solidification/stabilization to be the Best Demonstrated Available Technology for non-wastewaters contaminated with leachable...
chromium and lead (USEPA, 1997). A number of Category E TSD facilities are located in Region III, where the pilot site is under the same jurisdiction. DAO 2004-36 specifies that these are facilities that immobilize, encapsulate, polymerize or treat hazardous wastes off-site. Hence, this may be applicable when there is no landfill available to accept the contaminated soil. But Category E also includes those that receive hazardous waste outside the premises and transform physical and/or chemical characteristics of the hazardous waste by physicochemical or thermal treatment in order to dispose of them into the facilities in Category C. For instance, Dolomatrix (a Category E TSD) provided the methodology and cost for treating Pb-contaminated soil with chemical fixation and stabilization of waste using Dolocrete Technology. As with the first alternative of off-site disposal in a toxic hazardous waste landfill, the major consideration for this technology is cost.

**Excavation and off-site disposal in an encapsulation structure.**

67. DAO 2004-36 defines encapsulation as physical immobilization of hazardous substances in a waste by enveloping the waste in a non-porous, impermeable material. Immobilization will prevent water run-off from spreading the contaminant down to the groundwater or off-site into creeks and rivers.

68. This remedial alternative could be applied in any of the following scenarios: there is no existing THW landfill, there is a THW landfill but the transportation costs are too high, or there is a THW landfill but cannot accept contaminated soil that is not pre-treated, stabilized or solidified. Having a nearer disposal site can clearly lower transportation costs and having a remote encapsulation structure may remove from the equation the pre-treatment costs, which is also likely to be really expensive. However, still, it bears the cost of constructing an encapsulation structure, which requires standard landfill engineering.

69. This alternative will require a remote area that will be excavated and built to standard landfill design using appropriate capping material (i.e., clay, HDPE plastic liner, clean soil, asphalt or concrete) depending on the contamination levels of the soil to be disposed. Controls such as leachate detection, collection, and management systems shall be put in place. All contaminated soil will be taken to this containment area and capped.
70. DAO 2004-36 does not have specific provisions for encapsulation. However, it outlines the following minimum considerations for siting TSD facilities:

- Consistent with the overall land use plan of the LGU
- Accessible from major roadways and thoroughfares
- Located in area where the TSD operations will not detrimentally affect sensitive resources, such as aquifers, groundwater reservoir or watershed area, by provision of the following special mitigation measures and additional criteria:
  - Shall not be constructed within 75 meters from a Holocene fault or known recent active fault
  - Shall not be located in areas where they are known to be habitat of listed endangered species
  - Shall not be located in a floodplain and/or reclaimed areas
  - Shall be located at least 50 meters away from any perennial stream, lake or river
  - Groundwater monitoring wells shall be placed at appropriate locations and depth for taking water samples that are representative of groundwater quality and for predicting groundwater flow
- A more detailed relevant guideline is that of landfills contained in Rule XIV of the Philippine Ecological Solid Waste Management Act of 2000 or RA 9003. Additional special mitigation measures specified herein are as follows:
  - The site shall be evaluated for presence of geologic hazards, faults, unstable soils, its foundation stability, and its hydrogeologic character.
  - It shall be provided with a composite base liner system consisting of a minimum 1.5 millimeter (mm) thick high density polyethylene liner (HDPE) underlain by a soil liner with a minimum thickness to 0.60 meter (m) and maximum permeability of $1 \times 10^{-6}$ centimeter/second (cm/sec).
  - A Geosynthetic Clay Liner (GCL) with a minimum thickness of 6.4 mm and permeability of $1 \times 10^{-9}$ cm/sec or less, may be substituted for the soil liner. Likewise, the design of the final cap shall be equivalent to its liner system in terms of permeability. The thickness of the final cover system shall be at least 1.5 m including a minimum 0.60 m thick soil foundation layer, its final cap, a drainage layer, and a vegetative layer of at least 0.30 m thick. If the thickness of the equivalent final cap makes the entire cover system less than 1.5 m thick, the deficiency shall be made up by increasing the thickness of the foundation layer.
o Strict liner and final cap construction quality assurance (CQA) and testing shall be performed by a third party experienced in earthwork, clay and geosynthetic liner installation, quality assurance supervision, testing and inspection.

o A separation of at least two (2) meters shall also be maintained between the top of the liner system and underlying groundwater. It can be summed up that the major considerations for this remedial alternative are cost, site availability and suitability and regular monitoring and evaluation.

**On-site encapsulation by building an encapsulation structure.**

71. This alternative is basically the same as alternative C except that it will utilize part of the pilot site’s total area to contain the contaminated soil. The “encapsulated area” will still have future uses but limited (i.e., parking). However, the cleaned area outside the encapsulation may have some construction or development. Given that there’s an estimated 39,000 m³ of contaminated soil, the at-source encapsulation would require a large portion of the pilot site. Additionally, the high groundwater levels and frequent flooding make on-site encapsulation infeasible.

**Capping**

72. This alternative involves constructing a cover over contaminated soil to minimize potential exposure to and contaminant migration. Typically, soil, asphalt or concrete is used. It is generally applicable to low-level contamination, when excavation and off-site disposal is not feasible, and when the desired future use has need for roads, parking spaces, building slab foundations, or other paved areas where the contaminated soil could be contained under. Capping prevents direct contact and exposure to windblown contaminated dust and rainwater infiltration. Even though lead is not very soluble, it could leach into groundwater and migrate to nearby streams/rivers. This could then be a risk to aquatic species and people who swim in the river, and/or eat contaminated fish.

73. Capping may also include a vegetative layer, a drainage layer, a geomembrane, or clay. When soil is used, ideally, a permeable barrier is placed in between the contaminated soil and the clean soil not only to inhibit contaminant migration but also to serve as a marker on how deep future digging can go. The design and material requirement would depend on
results of more in-depth assessment of the contamination levels and other critical factors like groundwater depth.

74. Capping is a more affordable alternative, has been a widely applied remedial alternative and has worked effectively in preventing environmental and human exposures. Limitations of this technology include long-term and regular cap maintenance and groundwater monitoring. The risks associated with this alternative relevant to environmental integrity are erosion and groundwater contamination due to infiltration. As such, this remedial alternative should be accompanied by drainage controls and an operations and maintenance (O&M) plan. Currently, shallow groundwater in the area is not pumped out and used for drinking, bathing, and cooking, so human exposure via pathways are not a concern. However, should future development require installation utilities in soil-impacted areas, this should be well taken into consideration. Also, it is best to employ stabilizing agents that will bind the contaminant to the soil and prevent it from being biologically available before capping.

75. This alternative requires periodic inspection and repair of the capping structure or material to ensure integrity, which would be described in the O&M plan. Further, a Soil Management Plan (SMP) should be developed, which describes procedures for proper handling of soil to prevent exposure of construction workers to contaminated soil in the case of future repair or construction beneath the capping (e.g., installation of underground utilities: water pipes, electrical lines, etc.). If soil beneath the caps are not cleaned up to residential standards, a “land use covenant” or “deed restriction” must be prepared and executed by the owner and local government authority. The purpose of this is if the land is sold in the future, the deed restriction states that subsurface contamination exists, and therefore, the property cannot be developed for residential use, and if developed, the soil would be managed properly, as described in the SMP.

76. Combination of off-site stabilization/disposal and capping. Depending on the level of economic and environmental considerations, combination of methods is often presented as another remedial alternative. For instance, in the case of the pilot site where completely off-site stabilization/disposal can be too expensive and where capping only proves to be risky
in terms of potential human and environmental exposure, combination may appear to be extra advantageous. “Hotpots” or areas of high contamination and areas where utilities and foundations will be built will be excavated and contaminated soil will be disposed in a THW landfill or sent to a treater that will do the stabilization and disposal. On the other hand, areas with low level contamination can be capped and used as parking or open space and roads.

GENERAL EVALUATION AND ANALYSIS OF REMEDIATION ALTERNATIVES
77. To provide a general review, evaluation and analysis of the above remediation alternatives for purposes of this preliminary discussion, the following considerations were applied:

- Risk reduction effectiveness
- Sustainability
- Risks during the work
- Community acceptance
- Construction/project time
- Logistical feasibility (space, getting materials/equipment to the site, geology, etc.)
- Regulatory compliance
- Conformance with internationally accepted practices

78. The tables below provide a general comparison of the possible remedial alternatives. The first table contains the results of the review and the second table contains the evaluation. Because each option received the highest possible marks for Risk Reduction and Compliance with International Standards, those columns were removed from this chart.
### Figure 19: Remediation alternatives

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excavation and off-site disposal in THW landfill</td>
<td>Very high</td>
<td>Very high - no future O&amp;M costs at site; depending on landfill capacity</td>
<td>Moderate – distance from source to landfill</td>
<td>Very high</td>
<td>4-6 mos</td>
<td>Moderate - High</td>
<td>Very high</td>
<td>Very high</td>
<td>Greatly reduced risk, maximized future site reuse</td>
</tr>
<tr>
<td>2 Excavation and off-site stabilization and disposal</td>
<td>Very high</td>
<td>Very high - no future O&amp;M costs at site; depending on available stabilization technology</td>
<td>Moderate – distance from source to stabilization site</td>
<td>Very high</td>
<td>10-12 mos</td>
<td>High – Very high</td>
<td>Very high</td>
<td>Very high</td>
<td>Greatly reduced risk, maximized future site reuse</td>
</tr>
<tr>
<td>3 Excavation and off-site disposal in encapsulation structure</td>
<td>Very high</td>
<td>High - O&amp;M costs to check and maintain the integrity of the encapsulation; depending on site availability and suitability</td>
<td>Moderate – distance from source to encapsulation site</td>
<td>Moderate to high – may have concerns over encapsulation integrity</td>
<td>10-12 months</td>
<td>Moderate - High</td>
<td>Moderate - High</td>
<td>Very high</td>
<td>Greatly reduced risk, maximized future site reuse</td>
</tr>
<tr>
<td>4 Encapsulation onsite? structure at source</td>
<td>Very high</td>
<td>High - O&amp;M costs to check and maintain the integrity of the encapsulation; depending on site availability and suitability</td>
<td>Moderate</td>
<td>Moderate to high – may have concerns over encapsulation integrity</td>
<td>10 – 12 months</td>
<td>Moderate - High</td>
<td>Moderate - High</td>
<td>Very high</td>
<td>Greatly reduced risk, may limit future site reuse</td>
</tr>
<tr>
<td>5 Capping</td>
<td>High</td>
<td>Moderate - O&amp;M costs to check and maintain the integrity of capping and monitor groundwater</td>
<td>Moderate</td>
<td>Moderate – may have concerns over cap integrity</td>
<td>6-9 mos</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Reduced risk, limited future site reuse</td>
</tr>
<tr>
<td>6 Combination - Excavation and off-site stabilization/disposal and capping</td>
<td>High – Very high</td>
<td>High – Very high - O&amp;M costs to check and maintain the integrity of capped portions and</td>
<td>Moderate</td>
<td>High – Very high – may have concerns over integrity of capped portions</td>
<td>5-8 mos</td>
<td>High – Very high</td>
<td>High</td>
<td>High to Very High</td>
<td>Greatly reduced risk, careful planning can still maximize future site reuse</td>
</tr>
</tbody>
</table>
### Figure 20: Remediation alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Overall Score</th>
<th>Sustainability</th>
<th>Risks during Work</th>
<th>Community Acceptance</th>
<th>Construction Time</th>
<th>Logistical Feasibility</th>
<th>Regulatory Compliance</th>
<th>*Cost</th>
<th>Community Advantage/Disadvantage</th>
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<tbody>
<tr>
<td>1 Excavation and off-site disposal in THW landfill</td>
<td>4.35</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3.5</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>2 Excavation and off-site stabilization and disposal</td>
<td>4.05</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>4.5</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3 Excavation and off-site disposal in encapsulation structure</td>
<td>3.65</td>
<td>4</td>
<td>3</td>
<td>3.5</td>
<td>3</td>
<td>3.5</td>
<td>3.5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>4 Encapsulation structure at source</td>
<td>3.55</td>
<td>4</td>
<td>3</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5 Capping</td>
<td>3.75</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3.5</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>6 Combination - Excavation and off-site stabilization/disposal and capping</td>
<td>4.5</td>
<td>3</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td></td>
<td>4.5</td>
</tr>
</tbody>
</table>

5 - very good 4 - good 3 - moderate 2 - poor 1 - very poor 0 - unacceptable

*cost is given 0-5 scores with 0 being the highest cost and 5 being the lowest cost
Based on this general technical evaluation, the favorable remedial alternatives at first pass are ranked as follows: 1) excavation and off-site disposal in a THW landfill; 2) excavation and off-site stabilization and disposal. These two are ideal however, the costs are too restrictive. The same can be said of the encapsulation options. Capping is affordable but may pose the greater human and environmental exposure risk. Hence, it is appropriate at this point to recommend a combination of remediation alternatives depending on the levels of contamination and the expected end use of each areas of the site.

A more comprehensive site assessment, particularly at the site of former operations and the suspected waste dump site, is required to put forth a final recommendation for remedial action. However, it is a must that remediation be undertaken seriously at the pilot site.

The remediation of the current informal settlers’ area should be prioritized to eliminate the pathway and exposure to the families in the area especially where there are children. Also, it is necessary to reduce exposures during the railroad construction and operation.

KEY CONSIDERATIONS IN PURSUING REMEDIATION OF THE PILOT SITE

Environmental Considerations:

The proposed cleanup and remediation of the site will render a number of potential positive environmental impacts namely:

- Mitigation of contamination
- Mitigation of public health risks due to THW contamination
- Control and mitigation of flooding must be addressed in the redevelopment plan
- Strategic location for a redevelopment project with large investment opportunities
- Generation of job opportunities due to redevelopment
Success story on remediating and redeveloping legacy sites

83. On the other hand, the potential threats that must be mitigated if the site is developed are:

- Possible increase in traffic congestion
- Increased waste generation (need for solid waste and sewage management)
- Temporary disruption of operations for immediately adjacent commercial and industrial activities during construction or remediation

**Regulatory Considerations:**

84. Baseline studies showed that while there are international and national legal instruments geared towards proper management of hazardous waste, local policies that support and strengthen the implementation of such up to the community level are minimal and lacking in infrastructure and training. The Bulacan Provincial Development and Physical Framework Plan, while providing the blueprint for development and some controls (i.e., flood and waste management), did not include reference to control of hazardous waste. In particular, the local government unit of Meycauayan, down to the specific Barangays of Bancal and Tugatog, does not have any local policy or program focused solely on THW management despite hosting several industries that utilize hazardous chemicals. In this context, the proposed clean-up and remediation will provide an opportunity for:

- Holistic planning perspective which will include THW considerations in local governance and development;
- Actual experience on toxic site identification, assessment, remediation and redevelopment;
- Developing and instituting local policies and programs on THW management, mitigation of THW contamination and public health risks, and redeveloping otherwise contaminated lands. In this particular case, a legacy lead contaminated site. Even the national government will benefit from this because there are no current laws pertaining specifically to remediation of lead contaminated sites including legacy sites;
- Increased tax generation when redevelopments investments materialize.

85. There are also regulatory barriers to consider in pursuing remediation and redevelopment:
The current ambiguity over authority in remediation and redevelopment of the site, a contaminated privately owned land has created a stall in addressing this contaminated site. The government, both at national and local levels, has sufficient legal instruments to demand cleanup but has not been able to do this for various reasons. However, another option is now possible, presented by using a redevelopment approach, engaging a private developer who would be willing to clean up the site in order to gain a return on their investment. It may be easier to look at the project from a redevelopment perspective rather than just remediation because remediation is seen as a punishment or an imposed cost but redevelopment is seen with potential profits and benefits, a worthwhile investment.

Lack of an incentives program for remediation and redevelopment projects has also been a barrier thus far but this can easily be changed. For instance in the New York State, there are tax credits available under the Brownfield Clean-up Program:

- Site Preparation and Onsite Groundwater Remediation - for remediation, demolition, excavation, fencing, security and other capital costs required to make the site usable for redevelopment: 25%
- Tangible Property Credit (“Redevelopment Credit”) - for buildings and improvements placed in service within 10 years of Certificate of Completion: 10%
- Brownfield Opportunity Area (BOA) – for sites located within designated BOA: 2%

Another approach is for the government to shoulder the preliminary studies and development plan and then private sector can invest in the actual clean-up and development and still avail of incentives (using this project as a model). This requires the willingness of the private land owner/s to cooperate in the remediation and redevelopment initiative either by heeding the directive to remediate or by selling their property to or entering into a partnership with government or a private developer.

Social Considerations

Significant discussions with the primarily affected stakeholders, informal settlers and land owners were conducted in 2012 as part of the pilot project conducted in the area. There were follow-up discussions with the same and the rest of the community under this TA.
Informal settlers

88. Another challenge for this project is that relocation of the informal settlers needs to be thoroughly evaluated. A number of options would be: provision of opportunity to acquire low-cost housing as part of the redevelopment plan, within the site; provision of a nearby in-city relocation site; or provision of a relocation site elsewhere if the community is amenable. This discussion should be facilitated by the local government unit and the National Housing Authority (NHA).

89. In 2012, the main concerns of the informal settlers were as follows: where would they stay during the remediation work; can they be hired as laborers; if yes, how much would they be compensated; and permanently, where would they be relocated. During the 2014 site assessment and follow-up visits in 2015, the informal settlers claimed that they paid for their parcels but that it was not made official due to a conflict between the owners. These concerns must be settled by the local government unit and the NHA.

Land Owners

90. In 2012, Leelin’s representative expressed that constructing a contained disposal site within the site seems to be the best option for remediation. However, this did not materialize and discussions ended. In 2015, Leelin was no longer willing to discuss remediation and redevelopment hence the lack of site access for actual assessment within the former facility. One other current owner was invited for project presentations and discussions but did not participate. Philippine Investments, one of the parcel owners, is fully supportive of the project but was limited by their own lack of access to the site. Family members related to the deceased owners of some of the sites are also willing to discuss the plans further. Complications around site access for investigators or government is understandable. It is one reason that a redevelopment rather than an environmental enforcement approach is preferred. The developers who are interested in making an offer for the site are more likely to be granted access or invited to a meeting than an environmental group looking to assess contamination.
Community

91. Community consultation was conducted with lot owners of the planned redevelopment site; school principals, hospital administrators, commercial building owners, along MacArthur highway; HOAs, and the Rotary Club. The consultation dwelt primarily on the preferred redevelopment option, the ideas of a pilot site, North and South side expansion, was selected for a mixture of commercial, institutional and residential development. Pursuing this development clearly requires prior remedial action in the pilot site.

Financial Considerations

92. The probable funding sources for the remediation are as follows:

93. Waste generator funding. In this case, the responsible party, Leelin/RAMCAR would shoulder the remediation cost. Leelin/RAMCAR may cite that guidelines and laws pertaining to hazardous waste generation, storage, treatment and disposal came after they have ended the Meycauayan operations and hence, do not hold them accountable. Also, they have changed their name and business several times since abandoning this property without properly cleaning it. However, despite non-operation, the legacy contaminated site they have left unremediated poses environmental and human health risks. The DENR EMB R3 and the LGU of Meycauayan, in accordance with their mandate to uphold environmental laws and constituency well-being, could require Leelin/RAMCAR to remediate. This was initially done in 2014 when DENR EMB R3 required Leelin/RAMCAR to clean up the contaminated areas which form part of the North Luzon Railway Corporation (NLRC) property.

Private land owners' funding

94. As per current records, the pilot site is divided into several plots with different owners. If these private land owners have intentions to either develop or sell the land, remediation should be addressed first. The project may be classified as environmentally critical given that the site is a legacy contaminated site and remediation itself is a project required to go through the Philippine Environmental Impact Statement (EIS) System. There are no current guidelines or laws espousing nor organized official records containing historical land use
description of titled properties to inform the due diligence transactions of would-be buyers. However, since the status of the site has been known to DENR EMB R3 and the LGU, the same should coordinate with the Land Registration Authority (LRA) to impose guidelines for the protection of would-be buyers. Depending on agreed arrangements, the land owners, the buyer or both may bear the remediation cost.

**Developer or private sector funding**

95. An interested developer may enter into negotiations with the private land owners for the acquisition of the site. Any planned development on the site will then go through the EIS and hence require remediation. For this option to prosper, a feasibility study should further research profitability and remediation costs. Several developers were consulted during this project to gain initial reactions to the plans and the site. When the redevelopment plans are complete, the government will be able to partner with the landowners to show the plans to potential developers and find an interested investor.

**Public-private partnership funding.**

96. This option is viable if the government (whether national or local) develops a program similar to the BOA where the government subsidizes preliminary studies and remediation – redevelopment planning and private sector makes an investment for the actual implementation.

**Grant funding the remediation.**

97. Grants for remediation are very limited. However, there is a current GEF UNDP project on “Reducing Environmental and Health Risks to Vulnerable Communities from Lead Contamination from Lead Paint and Recycling of Used Lead Acid Batteries” which is being implemented in Indonesia and the Philippines. In the case of the Philippines, the Executing Agency/Implementing Party, Blacksmith Institute, entered into a Memorandum of Agreement (MOA) with the DENR as the Responsible Party for the implementation of all project activities. This project has allotted $77,127 for pilot remediation of a Lead-contaminated site. The amount may not be sufficient to cover all costs but is significant enough to explore initial remediation or counterpart funding for complete remediation.
REMEDIATION COSTS

98. The team estimated the price per cubic meter for each of the 6 remediation alternatives as follows:

- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health, then transport it to the hazardous waste landfill – 1800 PHP/m³ ($37 USD/m³)

- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health then stabilize it and dispose – 48000 PHP/m³ ($1,000 USD/m³) based on a quote from Dolomatrix; a local hazardous waste certified stabilization and disposal company. The quote included stabilization only

- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health and then encapsulate or entomb off-site – 3200 PHP/m³ ($66 USD/m³) (exclusive of price for purchasing the encapsulation/entombment site if required)

- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health and then encapsulate on site – 2700 PHP/m³

- Capping contaminated soil that would be a risk to human health, grading, covering with a liner, adding clean fill on top, instituting controls to manage future land use and prevent someone from penetrating the barrier – 1200 PHP/m³

- Combination of methods – transport some of the material to the hazardous waste landfill, cap or pave some surfaces, stabilize some materials. Cost depends on developer’s decisions. This is the recommended remediation option as the costs can be managed by developing the site so that the highest contamination spots are paved to not come into contact with future residents or customers (cemented under a parking lot and roadways on the site for example)
ALTERNATIVE LIVELIHOODS

99. Because the pilot site is a legacy site and no livelihoods will be disrupted by the redevelopment, the team identified other informal workers in the surrounding barangays with the approval of ADB. The team worked with waste pickers at the local dumpsites (both shortlisted for the pilot project) and the residents of the informal settlement at the back of the RAMCAR site along the railroad right-of-way.

100. The informal waste pickers have an average weekly income of 300 to 2,300 PHP ($6-47 USD). Most of them have been collecting and selling recyclables like paper, cartons, PET bottles, tires, cans, and copper found in the dumpsite. To best understand the economics of the current livelihoods and the possibilities of developing new livelihoods for these groups, the team arranged several workshops with informal workers. A partner organization was identified to work with the stakeholders who would like job training and microfinance opportunities. Kabalikat sa Mauniad na Buhay, based in Valenzuela, has agreed to work with the local government and stakeholders to support the waste pickers and informal settlers in learning required job skills and identifying potential opportunities for employment. Providing these workers with business skills and access to capital can build on their experience in recycling and make it more profitable and formalized. The local partner organization and existing government programs will support these goals going forward.

REDEVELOPMENT PLANS

101. As part of this TA, the project team worked with local and international experts in redevelopment at contaminated sites. The team reviewed local strengths and potential, current population trends, and existing housing and retail developments in the area. The team researched the technical, environmental, legal, economic and social aspects of the site, considered its likely contamination level and required remediation and researched its potential for redevelopment.

102. After compiling data, interviewing local stakeholders, and working closely with the local community and government, the team collaborated on a redevelopment vision for the
RAMCAR site. The full strategic urban redevelopment plan is included with this report as Appendix G. the key components of that plan are highlighted below.

**Size and Location**

103. The size and location of the former RAMCAR site make it very desirable for development. There are many other successful developments in the area – businesses, housing developments, shopping centers, and schools. The site has limited frontage on MacArthur Avenue, which is a large thoroughfare, and is within walking distance of several colleges, a medical center, and several retail and food establishments.

104. The site is bordered by two fairly empty, large lots that if added to the plans would expand the site to 14 hectares and provide ample additional MacArthur Boulevard access. The figure below shows this expanded site option (with the initial site in gray and the expansion lots in blue and yellow.

**Figure 21: North and South Expansion**
SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats)

105. The team also did a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis.

Strengths:
106. Skilled workers located nearby (jewelry, gold, tanning); several trade organizations located nearby (the Tannery Association of the Philippines, the Jewelry Association of the Philippines); Good competition with existing strong businesses, strategic location for Metro Manila outgrowth, commuters, transportation, and local business.

Weaknesses:
107. Declining business in some industries (leather and jewelry), a need to upgrade technology and skills among the local employee base, slow political action to ensure industry compliance with environmental regulations, little industry compliance with environmental standards, and high acquisition costs of land.

Opportunities:
108. Very accessible location, incentives for compliance could develop with local government, branding of products is already recognized, there is not a lot of affordable housing so if offered it could be quite popular, there is an opportunity for instituting flood controls that would benefit the whole area.

Threats:
109. That must be addressed in the area are frequent flooding, high levels of contamination, traffic issues, and few waste management systems in place. All of these issues could be incorporated into the redevelopment project in some way to combat flooding, reduce contamination, manage traffic flows, and create a plan for waste collection and disposal.

110. In addressing these strengths and opportunities and managing for the weaknesses and threats, the team proposed the following:

- Expanding the site by including the north and south parcels to allow for more frontage along the main thoroughfare
A phased development so that a Master Plan is followed, roads and utility systems are developed, the mall and BPOs are established early on as activators to draw others in, other BPO blocks and housing are built later based on demand.

Include a multi-story commercial building along MacArthur Avenue to capitalize on the location and generate significant rents based on office space availability in the area.

Include residential areas at the back and north of the site because direct access to the main thoroughfare is less important.

Include institutional or office space at the southern part of the site to generate rents.

Include open space to suit preferences of the local community and draw people inside the development.

Include a tricycle terminal and new entrance along Bancal extension to facilitate traffic flow.

Details of the plan are included in the figure below in figure 21.

**Figure 22: Development Options, RAMCAR site**
Illustrations of the type of development recommended for the site were presented at the community feedback meetings to allow attendees to see what the development could look like and inspire feedback. Some of those images are below.

**Figure 23: Renderings, Development Site**
DEVELOPMENT COSTS

113. The proposed project is comprised of three different income generating land uses – commercial rents (20% of the site), institutional rents (10% of the site), and housing sales (40% of the site). The project will require acquisition of the land. In order to estimate costs of buying the land, current market values were used. The total costs to purchase the land are estimated at 150,056,786 PHP ($3,105,409 USD). The details are included in the figures below. The development costs to construct the roads, utilities, and open spaces were estimated using the Construction Cost Handbook, Philippines 2016 by Langdon & Seah (www.LangdonSeah.com). The total estimated development costs were estimated to be about 1,000 PHP ($21 USD) per square meter. This includes the costs of remediation. Total development costs are 125,047,321 PHP ($2,587,840 USD).

Figure 24: Land Values and Effective Costs

<table>
<thead>
<tr>
<th>LOT NO.</th>
<th>LOCATION</th>
<th>CLASSIFICATION</th>
<th>AREA (SQM)</th>
<th>PRICE PER SQM</th>
<th>MARKET VALUE</th>
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<td>3,112,000</td>
<td>Ramcar</td>
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<td>Ramcar</td>
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<td>1,200</td>
<td>3,354,000</td>
<td>Ramcar</td>
</tr>
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<td>Industrial</td>
<td>4,056</td>
<td>420</td>
<td>1,703,100</td>
</tr>
</tbody>
</table>

Total: 13 acres | 49,399 | 1,063 | 52,503,420 | Ramcar |
REVENUE GENERATION

114. The detailed economic analysis for the redevelopment plan is included in Appendix G. Overall the development is expected to generate revenues through housing sales and commercial or business rents. While there are upfront costs of remediation, construction, and then ongoing maintenance, it is expected that the net income after taxes would be enough to pay back to the development costs within 10 years.

115. The redevelopment plan could accommodate fourteen low-rise apartment buildings with a total of 1,195 units with an initial average selling price of 65,000 PHP ($1345 USD) per square meters and a unit price of 2,184,000 PHP ($45,198 USD). There could also be about 294 duplex units with an average size of 100 square meters to cater to growing families. The initial average selling price for those units is suggested to be 52,000 PHP.
($1076 USD) per square meter with a unit price of 5,824,000 PHP ($120,527 USD). The total sales from apartments and houses would generate about 3,800,000,000 PHP (78,640,582 USD). The development costs for the housing would be 2,200,000,000 PHP ($45,528,758 USD). Operating expenses projected for the apartments and houses are calculated at 16% on average. Therefore, the net income after tax that is projected for the housing portion of the development is 692,300,000 PHP ($14,327,072 USD).

116. In addition to housing, the plan includes commercial space. The vision for the site is a lifestyle mall that can provide shopping, dining, and entertainment opportunities. Additionally, BPO and IT offices could be included to provide alternative workplaces that would allow residents to stay in Meycauayan who normally commute elsewhere to work. Finally, a government center could be included in the development, providing a new, accessible, technologically advanced location for government services that would be easily accessible to the public and officials.

117. The plan sets aside 2.8 hectares for the commercial space with a total leasable area of approximately 39,200 square meters. The initial basic rental per unit is projected at a minimum at 31,884 PHP ($660 USD) per month. The office space component of the project is comprised of five buildings with 5 floors of boutique space for BPO and IT companies with ground level retail – coffee shops, banks, fast food, and /or government offices. The space could accommodate a maximum of 100 tenants with an average unit size of 392 square meters and an initial average lease rate of 787,000 PHP ($16287 USD) per square meter. Taking development and operating costs into account, the net income projected for the commercial and office spaces over a 25-year period is 8,300,000,000 PHP ($171,767,587 USD). This means that within 10 years, the remediation and redevelopment costs would be completely paid back.
FUNDING MECHANISMS

118. There are potential institutional arrangements that could make a redevelopment opportunity at the pilot site even more attractive. In the capacity building workshops with the government, the TA team presented case studies of institutional arrangements that have been implemented in other countries to support redevelopment at contaminated sites. These are successful examples of improving the return on investment for developers and are typically very low cost or low effort for local government. A strong recommendation for the Philippines site is to consider public-private partnership, which would increase the return on investment above what is estimated in the redevelopment plan. Specifically, some form of tax relief or tax moratorium could improve net income after taxes, forming the "public" side of a partnership. This would be a desirable benefit for a developer who in return is willing to pay for remediation and redevelopment of the site, increasing business prospects in Meycauayan, attracting jobs, providing affordable housing, and bringing new business prospects and tax payers to the area.

119. Another funding mechanism that is recommended for consideration is the inclusion of equity partners. One or more "private" land owners could be included in the development. These land owners (such as the Origen family who own property bordering the site) could contribute some or all of the value of their land to a development partnership in which they would receive a portion of the Net Income After Tax (NIAT) based on the value of their land as proportion of the total development cost. This could provide equity to secure long term financing and improve the return on investment for development.

120. While institutional arrangements are suggested and would be an interesting way for the government to encourage development, the team does not believe that institutional arrangements are required for the success of the project. Given the many successful developments in the areas surrounding the site, the access to capital and the market for buyers seems very likely. Overall, there are very good prospects for the former RAMCAR site if it is remediated rather than sitting underutilized and contaminated.
ACTION PLAN FOR IMPLEMENTATION

121. The Technical Working Group, the stakeholder group that was established to support this project, will also support the implementation of the desired activities of the local and national government related to the recommendations of the TA. The local and national government representatives who made up the Technical Working Group will take the lead on the remediation and redevelopment of the former RAMCAR site if they so desire. They have been supportive of all of the work under this TA to date and their involvement will be required for the site to become something productive and safe. While there is some underlying hesitancy in getting involved at the contaminates site, the health risks faced by the local residents if the site is left polluted will likely lead to action on the part of the government. The key next steps as recommended by the team and discussed by the stakeholders at the final meeting are:

122. Persuade RAMCAR or other owners to allow access to the site to determine the extent of contamination and prepare more complete remediation estimates if possible. If this is not feasible, the project still can move forward and interested developers could ask for access. As mentioned previously, there is more likely to be cooperation when a potential investor gets involved with government support.

123. Meet with potential developers to show them the possibilities of the site and identify interested investors. This may require government incentives to complete a contract. Pure Earth has committed to participating in these meetings if the local government so desires.

124. Community education and clean-up as part of the remediation process and to protect residents from further exposures to hazardous materials. Pure Earth has provided templates and education materials on the project website that can be modified by local government or a hired consultant undertaking an education and health campaign.

125. Strengthen enforcement capabilities at the barangay level particularly in environmental monitoring and protection.
126. Establish a Toxicology Center in Region 3 to research and collect data, hold education and training sessions, and maintain open access data for government agencies and local, regional, and national stakeholders.

127. If desired, develop a program to support other redevelopment programs of other contaminated sites nationally and conduct a local inventory of contaminated sites in order to create additional potential redevelopment projects that can improve otherwise unproductive, under-utilized land. Pure Earth will continue to offer access to its Toxic Sites Identification Program site screening trainings to any interested government agency.

128. Find a safe, agreed upon location for the informal settlers who will need to relocated from the back of the site and the railroad right-of-way. These people are currently exposed to high levels of lead.

129. Support the alternative livelihoods work with the interested residents in the surrounding barangays through education and business training. These efforts will also be supported by the Alternative Livelihoods partner on the TA - Kabalikat sa Mauniad na Buhay.