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UPDATED MASTER PLAN FOR THE CLOSURE AND REHABILITATION OF UNCONTROLLED DUMPSITES THROUGHOUT THE COUNTRY OF LEBANON

Volume A

JUNE 2017

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UPDATED MASTER PLAN FOR THE CLOSURE AND REHABILITATION OF UNCONTROLLED DUMPSITES THROUGHOUT THE COUNTRY OF LEBANON

Volume A

JUNE 2017

Consultant

ELARD

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LIST OF ACRONYMS

CD	Conceptual Design
CDR	Council for Development and Reconstruction
COED	Cost of Environmental Degradation
CoM	Council of Ministers
CDW	Construction and Demolition Waste
EIA	Environmental Impact Assessment
ELARD	Earth Link and Advanced Resources Development
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphical User Interface
MoE	Ministry of Environment
MSW	Municipal Solid Waste
OMSAR	Office of the Minister of State for Administrative Reform
PDT	Prioritization Decision Tool
QA/QC	Quality Assurance/Quality Control
RDT	Rehabilitation Decision Tool
RSI	Risk Sensitivity Index
SCF	Site-Characterization Form
SWM	Solid Waste Management
SWMF	Solid Waste Management Facility
UNDP	United Nations Development Programme
UNHCR	United Nations High Commissioner for Refugees

EXECUTIVE SUMMARY

INTRODUCTION

In 2011, the Ministry of Environment (MoE) and the United Nations Development Programme (UNDP), with the technical assistance of Earth Link and Advanced Resources Development s.a.l. (ELARD), prepared a Master Plan for the Closure and Rehabilitation of Uncontrolled Dumps in Lebanon.

Since then, two major events triggered the need to update the 2011 Master Plan, namely:

- The armed conflict in Syria that has been on-going since 2011 and which forced reportedly more than one million persons to seek refuge in the Lebanese territory; and
- The solid waste collection and disposal crisis that started in July 2015 with the closure of the Naameh Landfill which served the most densely populated regions of Beirut and Mount Lebanon (except the Jbeil caza).

The 2016 Updated Master Plan for the Closure and Rehabilitation of Open and Uncontrolled Dumpsites throughout the Country of Lebanon aims to:

- Provide an understanding of the status, pattern and dynamics of open dumping activities since the latest survey undertaken as part of the 2011 Master Plan, taking into consideration the two events mentioned above;
- Pinpoint areas of concern;
- Identify the dumpsites of highest priority for closure and rehabilitation plans in light of potential impacts on the environment as based on a Prioritization Model developed for this purpose; and
- Propose rehabilitation options for each dumpsite based on a Rehabilitation Decision Tool (RDT).

The present report describes the methodology followed for the Updated Master Plan and summarizes its main findings and proceedings in three volumes, as shown below.

Updated Master Plan Components

Volume	Title
Volume A	Updated Master Plan for the Closure and Rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon
Volume B	Environmental Assessment of Uncontrolled Dumpsites
Volume C	Background Note on the Cost Assessment of Dumpsites in 2016

This executive summary is for Volume A: Updated Master Plan for the Closure and Rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon.

SURVEY METHODOLOGY

The surveyed dumpsites are divided into two types: Municipal Solid Waste (MSW) and Construction and Demolition Waste (CDW) dumpsites. These are also further divided into two main groups: operational and non-operational. The following definitions were generally adopted throughout the survey:

- Municipal Solid Waste (MSW) Dumpsite: a dumpsite containing over 85% of MSW. This might include, in addition to MSW, hospital waste, CDW and industrial waste.
- Construction and Demolition Waste (CDW) Dumpsite: a dumpsite containing over 85% of CDW. These include rubble, green waste, construction and demolition debris.

The field survey, which forms the backbone of the Updated Master Plan, was conducted between July 2016 and March 2017. The Lebanese territory was divided into four survey areas:

Area 1: Akkar and North Lebanon

Area 2: Beirut and Mount Lebanon

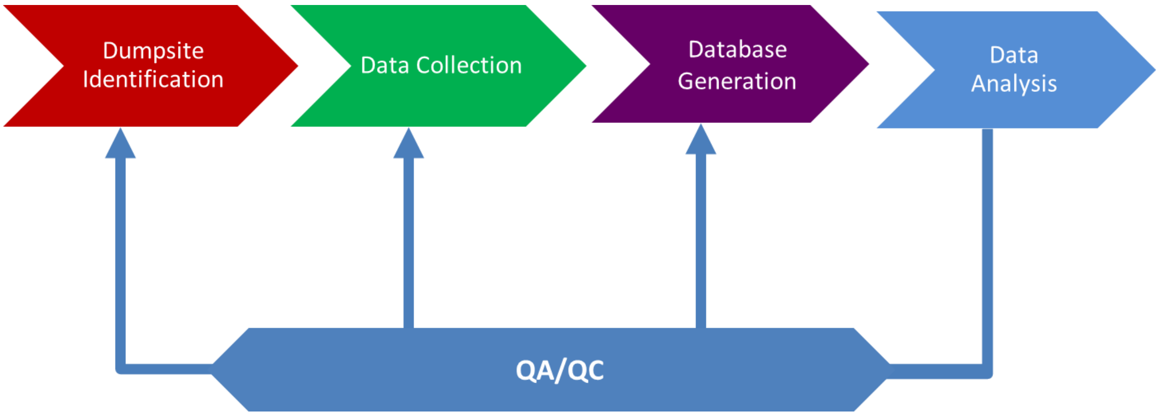
Area 3: Nabatieh and South Lebanon

Area 4: Beqaa and Baalback/Hermel

Geographical Distribution of Survey Teams

The survey implementation process started with the identification of dumpsites followed by field data collection by surveyors. A Site Characterization Form (SCF) was prepared and converted into a mobile application to facilitate the field work. The SCF includes the data fields which allow information to be collected about the dumpsite itself and the concerned municipality.

The collected data was then logged into the mobile application that automatically stores and transfers the data to ELARD's server. Following Quality Assurance/Quality Control (QA/QC) of the reported data and preliminary analysis of the data, follow-up visits were carried out to bridge gaps and verify the findings for the final database.



Survey Implementation Process

Several challenges were encountered by the surveyors during the data collection phase. These include:

- The nature of the solid waste management activities that is random and unorganized. Tracking of such activities is challenging and can be grossly inaccurate as information is not formally recorded.
- The methodology used to estimate dumpsites' volumes in both the 2011 and 2016 surveys was limited to visual approximations that led to indicative values rather than accurate estimations.
- Inaccessibility issues related to security and access roads.
- Data provided by the municipalities were not always reliable. Several challenges were faced throughout the survey, including lack of transparency, unwillingness to cooperate and in some cases the new municipal boards that were elected in the spring of 2016 did not have knowledge of the history of dumpsites in their area.

2016 Survey Results and Analysis

The total number of identified dumpsites in the 2016 survey was 941 versus 670 in the 2011 survey.

Municipal Solid Waste Dumpsites

In the 2011 survey, 504 MSW dumpsites were identified across Lebanon, out of which 76% (382) were operational and 24% (122) were non-operational. The volume of MSW in operational dumpsites was 2,675,548 m³ while that in non-operational dumpsites was 774,523 m³. In the 2016 survey, 617 MSW dumpsites were identified. About 55% (341) of the MSW dumpsites were identified as operational and 43% (263) as non-operational MSW dumpsites. Of the surveyed MSW dumpsites, 2% (13) were inaccessible.

Similar to the findings of the 2011 survey, the highest number of operational dumpsites in the 2016 survey is present in 'Area 3: Nabatieh and South Lebanon' which had around 37% (127) of the operational dumpsites, followed by 'Area 4: Beqaa and Baalback/Hermel' with 28% (96).

The largest MSW dumpsites in terms of volume of waste in operational dumpsites are located in areas that have witnessed a drop in the count of operational dumpsites. Open dumping activities in these areas are centralized in controlled dumpsites such as the Tripoli controlled dumpsite, Srar dumpsite in Akkar, Qabb Elias and Barr Elias dumpsites in Zahle, which explains the drop in the count of operational MSW dumpsites but significant increase in the volume in comparison to the 2011 survey in Areas 1 and 4.

'Area 2: Beirut and Mount Lebanon' which had the lowest number and volume in both operational and non-operational MSW dumpsites in the 2011 survey, witnessed a 124% increase in the count of dumpsites visited in the 2016 survey as compared to the 2011 survey with 86% of this increase being for operational dumpsites. This change is mostly attributed to the 2015 solid waste collection and disposal crisis that forced municipalities in these cazas to manage their own wastes, while they were not prepared and had no proper alternatives besides open dumping. 'Area 3: Nabatieh and South Lebanon' recorded the largest number of non-operational dumpsites in the 2016 survey with 110 non-operational dumpsites, or 42% of the national tally of non-operational MSW dumpsites.

MSW Dumpsites Status in the 2016 Survey versus 2011 Survey throughout Lebanon

MSW Dumpsites	Operational		Non-Operational		Inaccessible		Grand Total	
	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
All Lebanon								
2011	**382**	**2,675,548**	**122**	**774,523**	**-**	**-**	**504**	**3,450,073**
2016	**341**	**4,588,218**	**263**	**1,135,603**	**13**	**19,486**	**617**	**5,743,307**
Area 1: Akkar and North Lebanon								
2011	61	606,007	25	208,088	-	-	**86**	**814,095**
2016	38	2,246,797	46	182,295	3	5,280	**87**	**2,434,372**
Area 2: Beirut and Mount Lebanon								
2011	43	453,976	16	39,175	-	-	**59**	**493,151**
2016	80	767,846	46	43,885	2	2,400	**132**	**814,131**
Area 3: Nabatieh and South Lebanon								
2011	168	947,002	52	120,955	-	-	**220**	**1,067,957**
2016	127	637,590	110	480,498	1	41	**238**	**1,118,129**
Area 4: Beqaa and Baalback/Hermel								
2011	110	668,565	29	406,305	-	-	**139**	**1,074,870**
2016	96	935,985	57	428,925	7	11,765	**160**	**1,376,675**

Construction and Demolition Waste Dumpsites

In 2011, 166 CDW dumpsites were identified, out of which 80% (132) were operational and 20% (34) were non-operational. The volume of CDW in operational dumpsites was 1,468,528 m³, while that in non-operational dumpsites was 262,653 m³. The highest number of operational dumpsites was prominent in 'Area 2: Beirut and Mount Lebanon', which had around 54% (71) of the operational dumpsites, followed by 'Area 3: Nabatieh and South Lebanon' with 26 % (34).

In 2016, a total of 324 CDW dumpsites were identified. About 55% (178) of these are operational dumpsites and 45% (145) are non-operational dumpsites. Overall, there is an increase in the count and volume of CDW in dumpsites in Lebanon. The highest number of operational dumpsites was found in 'Area 3: Nabatieh and South Lebanon', which had around 39% (69) of the operational dumpsites, followed by 'Area 4: Beqaa and Baalback/Hermel' with 25% (45).

The highest CDW volumes in operational dumpsites in 2011 and 2016 were found in 'Area 2: Beirut and Mount Lebanon' followed by 'Area 4: Beqaa and Baalback/Hermel'. The highest CDW volumes in non-operational dumpsites in 2011 and 2016 was found in 'Area 2: Beirut and Mount Lebanon'.

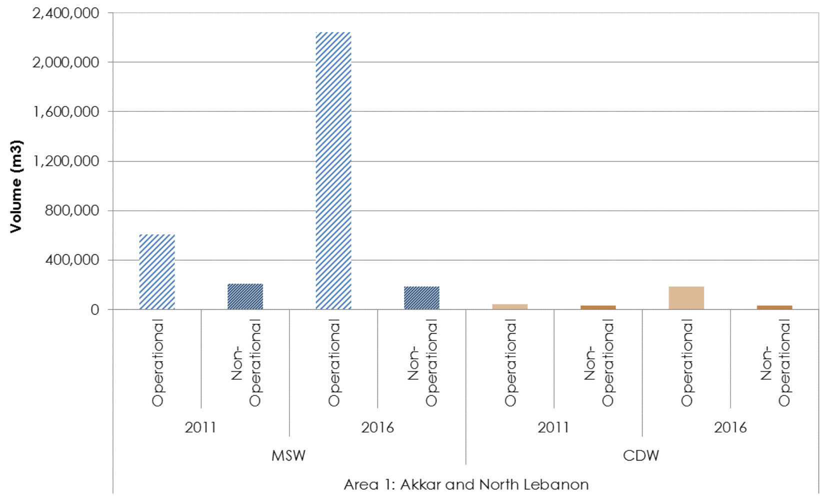
CDW Dumpsites Status in the 2016 Survey versus 2011 Survey throughout Lebanon

CDW Dumpsites	Operational		Non-Operational		Inaccessible		Grand Total	
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
All Lebanon								
2011	**132**	**1,468,528**	**34**	**262,653**	-	-	**166**	**1,731,181**
2016	**178**	**964,223**	**145**	**1,181,313**	**1**	**15,000**	**324**	**2,160,536**
Area 1: Akkar and North Lebanon								
2011	26	42,968	7	27,960	-	-	**33**	**70,928**
2016	29	183,160	18	29,006	-	-	**47**	**212,166**
Area 2: Beirut and Mount Lebanon								
2011	71	1,021,113	18	203,285	-	-	**89**	**1,224,398**
2016	35	419,880	88	1,116,910	-	-	**124**	**1,551,790**
Area 3: Nabatieh and South Lebanon								
2011	34	179,447	5	20,708	-	-	**39**	**200,155**
2016	69	159,933	35	32,897	-	-	**104**	**192,830**
Area 4: Beqaa and Baalback/Hermel								
2011	1	225,000	4	10,700	-	-	**5**	**235,700**
2016	45	201,250	4	2,500	-	-	**49**	**203,750**

Summary Findings per Area

Area 1: Akkar and North Lebanon

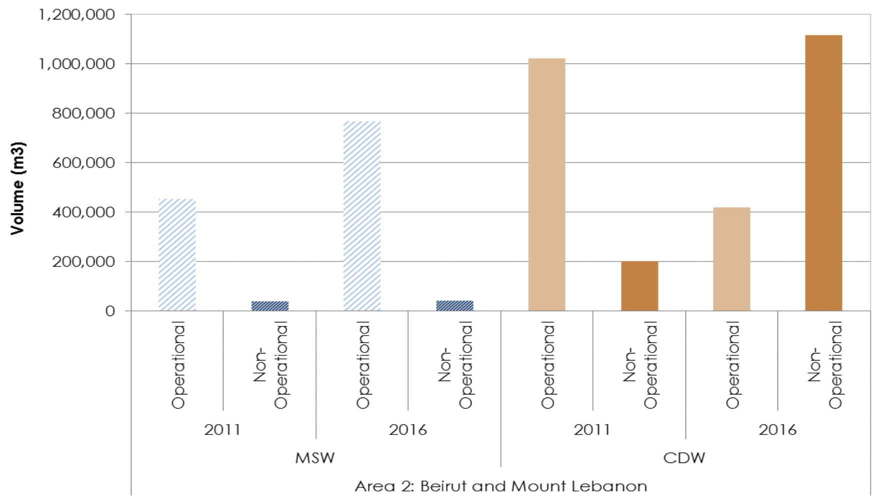
There is a general increase in the volume of both MSW and CDW operational dumpsites in 'Area 1: Akkar and North Lebanon' since the 2011 survey, as shown in the below figure. A total volume of 2,434,372 m³ of dumped MSW and 212,166 m³ of dumped CDW was estimated in the 2016 survey. Given that no major initiatives for Solid Waste Management (SWM) were implemented in the North in the past few years, along with the added pressure from the Syrian displaced people, this increase was expected.



Dumpsite Volumes in 2011 and 2016 in Area 1

Area 2: Beirut and Mount Lebanon

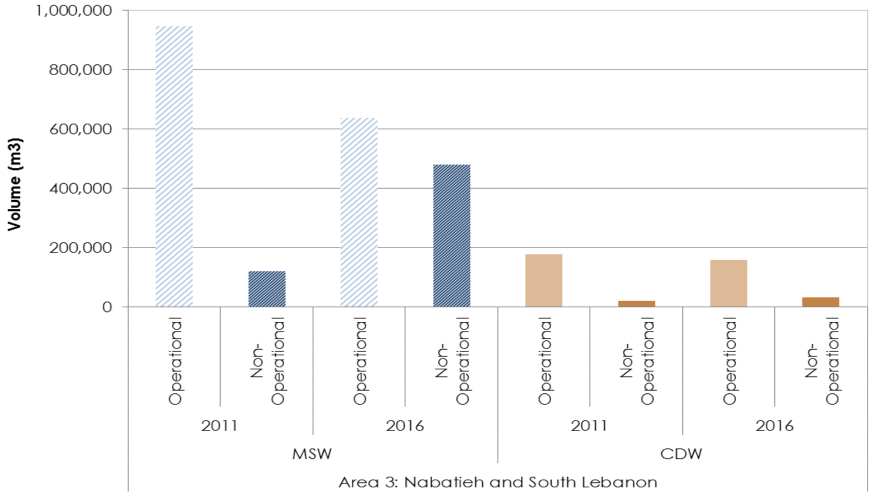
An increase in the volume of MSW in operational dumpsites in 'Area 2: Beirut and Mount Lebanon' was witnessed, as shown in the below figure. On the other hand, a significant decrease in the volume of CDW in operational dumpsites is noted, which is reflected in the increase in non-operational CDW dumpsites. A total volume of 814,131 m³ of dumped MSW and 1,551,790 m³ of dumped CDW was estimated in the 2016 survey. This increase in open dumping in 'Area 2: Beirut and Mount Lebanon' was evident mainly in Chouf and Aley cazas, which was expected given the 2015 solid waste crisis, along with the pressure from the Syrian displaced people.



Dumpsite Volumes in 2011 and 2016 in Area 2

Area 3: Nabatieh and South Lebanon

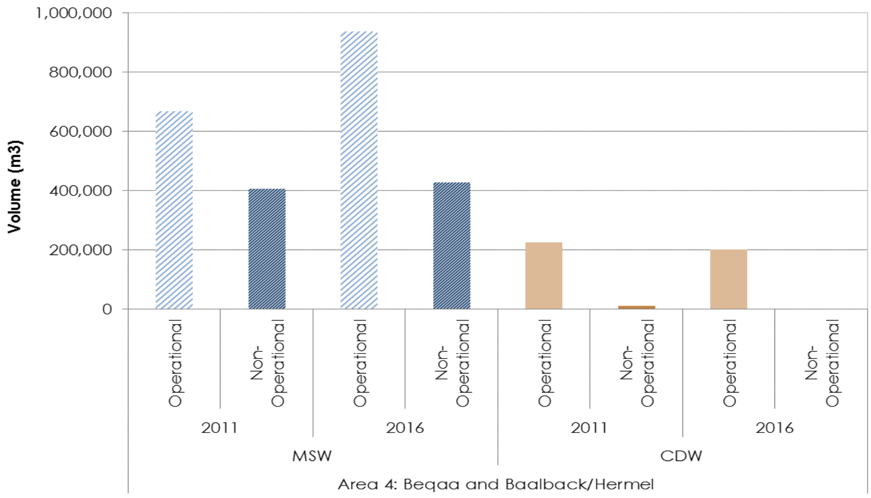
There is a significant decrease in the volume of MSW waste in operational dumpsites in 'Area 3: Nabatieh and South Lebanon' since the 2011 survey, coupled with a major increase in the volume of MSW waste in non-operational dumpsites (around 0.48 Million m³), as shown in the figure below. A total volume of 1,118,129 m³ of MSW and 192,830 m³ of CDW was estimated to be present in dumpsites in Area 3. The relatively high rate of open burning activities in the South (around 35% of dumpsites in the South undergo open burning), in addition to the significant presence of solid waste management facilities contribute to the general reduction in the volume of waste in dumpsites in 'Area 3: Nabatieh and South Lebanon'.



Dumpsite Volumes in 2011 and 2016 in Area 3

Area 4: Beqaa and Baalback/Hermel

There is a significant increase in the volume of MSW in operational dumpsites in 'Area 4: Beqaa and Baalback/Hermel' as shown in the figure below. A total volume of 1,376,675 m³ of dumped MSW was estimated in the 2016 survey. There is also a significant increase in the number of operational CDW dumpsites (45) and a net increase in their volume, taking into account Chmestar dumpsite that was partially rehabilitated since 2011. A total volume of 203,750 m³ of dumped CDW was estimated in the 2016 survey. This increase is attributed to two main reasons: the strong presence of Syrian displaced people and informal settlements, and the informal transfer of waste from other areas to Beqaa for disposal.



Dumpsite Volumes in 2011 and 2016 in Area 4

PRIORITIZATION MODEL

A Prioritization Decision Tool (PDT) was developed in order to prioritize dumpsites for rehabilitation based on a Risk Sensitivity Index (RSI). Two (2) different models were developed to separately address MSW and CDW dumpsites, which have different features.

Ten (10) attributes were selected for MSW dumpsites prioritization, and eight (8) for CDW dumpsites prioritization. These attributes were each assigned a specific "weight" reflecting the relative significance of their associated environmental impact. Weights ranged from 1 to 10 for MSW dumpsites, and from 1 to 8 for CDW dumpsites. Each attribute was then given a "sensitivity grade" varying from 0 to 1 and divided into 4 quarters or ranges as shown in the following tables.

MSW Dumpsite Attributes Table

<table>
<tr><th colspan="2">Attribute</th><th>Weighing Factor</th><th>0.0-0.25</th><th>0.25-0.5</th><th>0.5-0.75</th><th>0.75-1.0</th></tr>
<tr><td colspan="2">Volume of waste at site (m^3)</td><td>10</td><td><10,000</td><td>10,000-50,000</td><td>50,000-100,000</td><td>>100,000</td></tr>
<tr><td rowspan="2">Geology</td><td>Lithology (70%)</td><td rowspan="2">9</td><td>Considerable to high clay content</td><td>Clay contents and jointing systems</td><td>Secondary porosity, different forms of karstification and presence of some marl intercalations</td><td>Secondary porosity (cracks and joints) of carbonate rock, plus high karstification</td></tr>
<tr><td>Faults and lineaments density (segment/km^2) (30%)</td><td><10</td><td>10-15</td><td>15-20</td><td>> 20</td></tr>
<tr><td rowspan="2">Hydrology</td><td>Distance to drainage line (m) (80%)</td><td rowspan="2">8</td><td>>200</td><td>200-100</td><td>100-50</td><td><50</td></tr>
<tr><td>Distance to springs (m) (20%)</td><td>>200</td><td>200-150</td><td>150-100</td><td><100</td></tr>
<tr><td colspan="2">Distance to urban areas (m)</td><td>7</td><td>>1,000</td><td>1,000- 500</td><td>500-250</td><td><250</td></tr>
<tr><td colspan="2">Quantity of waste currently dumped at site (t/d)</td><td>6</td><td><10</td><td>10-50</td><td>50-100</td><td>>100</td></tr>
<tr><td colspan="2">Presence of alternatives</td><td>5</td><td>No alternatives</td><td>Working on alternative solution and funding</td><td>Alternative under construction</td><td>Alternative operational</td></tr>
<tr><td colspan="2">Open burning of waste</td><td>4</td><td colspan="2">Burned</td><td colspan="2">Not burned</td></tr>
<tr><td colspan="2">Visibility</td><td>3</td><td colspan="2">Not visible</td><td colspan="2">Visible</td></tr>
<tr><td colspan="2">Depth of filling of waste (m)</td><td>2</td><td><1</td><td>1-5</td><td>5-10</td><td>>10</td></tr>
<tr><td colspan="2">Duration of exposure (year)</td><td>1</td><td><10</td><td>10-20</td><td>20-30</td><td>>30</td></tr>
</table>

CDW Dumpsite Attributes Table

Attribute		Weighing Factor	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
Volume of waste at site (m^3)		8	<3,000	3,000-10,000	10,000-50,000	>50,000
Visibility		7	Not visible		Visible	
Hydro-logy	Distance to drainage line (80%)	6	>200	200-100	100-50	<50
	Distance to springs (20%)		>200	200-150	150-100	<100
Distance to urban areas		5	>1,000	1,000-500	500-250	<250
Presence of alternatives/intended use		4	No alternativ es/no plans	Working on alternative solution and funding	Alternative under construction	Alternative operational
Status (Non-operational/ Operational)		3	Remove d	Covered	Non operational	Operational
Geolog y	Lithology (70%)	2	Consider-able to high clay content	Clay contents and jointing systems	Secondary porosity, different forms of karstification and presence of some marl intercalations	Secondary porosity (cracks and joints) of carbonate rock, plus high karstification
	Faults & lineaments density (segment/ km^2) (30%)		<10	10-15	15-20	>20
Duration of exposure (yr)		1	<10	10-20	20-30	>30

The RSI was calculated for each dumpsite by adding all attributes, after multiplying each sensitivity grade (class) by its respective weight. A sensitivity analysis was tested on the PDT model to verify and confirm its validity. The model proved to be very stable.

A site with a higher RSI indicates more risk to the environment, and indicates that it requires a more urgent intervention. Conversely, when the total RSI score of a dumpsite decreases, the priority for its rehabilitation decreases. The following tables show RSI ranges and the number of dumps falling within each category.

Number of Dumpsites per RSI Range

RSI Range	Number of MSW Dumpsites
> 30	10
25 - 30	69
20 -25	245
15 - 20	248
< 15	45
Total	**617**

RSI Range	Number of CDW Dumpsites
> 20	29
18 - 20	69
14 -18	143
10 -14	75
< 10	8
Total	**324**

Although the RSI has been calculated for all surveyed dumpsites, only the 20 highest ranked are presented herein. These 20 "priority" dumpsites:

- Form an aggregate volume which represents 66% and 35% of the total volume of waste in MSW and CDW dumpsites respectively;
- Cover all surveyed dumpsites comprised in the first range of priority for MSW dumpsites and 69% for CDW dumpsites.

The top 20 priority dumpsites for MSW and CDW are presented in the following tables.

Top 20 Priority MSW Dumpsites

Rank	Dumpsite ID	Caza	Area	RSI Score
1	R6-Tripoli-0	Tripoli	Area 1: Akkar and North Lebanon	40.73
2	N5-Hbaline-0	Jbeil	Area 2: Beirut and Mount Lebanon	40.31
3	R7-Adweh-0	Minieh-Dannieh	Area 1: Akkar and North Lebanon	34.76
4	P5-Batroun-0	Batroun	Area 1: Akkar and North Lebanon	34.59
5	T9-Srar-0	Akkar	Area 1: Akkar and North Lebanon	34.27
6	J6-Qabb Elias-00	Zahle	Area 4: Beqaa and Baalback/Hermel	32.50
7	C1-Deir Qanoun El-Aain-01	Sour	Area 3: Nabatieh and South Lebanon	31.42
8	L5-Balloune-3	Kesrouane	Area 2: Beirut and Mount Lebanon	30.32
9	L5-Beit Chabab-1n	Maten	Area 2: Beirut and Mount Lebanon	30.20
10	J7-Barr Elias-00	Zahle	Area 4: Beqaa and Baalback/Hermel	30.15
11	R9-Fnaydek-0	Akkar	Area 1: Akkar and North Lebanon	29.83
12	F2-Sarafand-01	Saida	Area 3: Nabatieh and South Lebanon	29.64
13	G4-Jezzine-00	Jezzine	Area 3: Nabatieh and South Lebanon	29.03
14	D2-Abbesye-03	Sour	Area 3: Nabatieh and South Lebanon	28.96
15	M9-Baalback-02	Baalback	Area 4: Beqaa and Baalback/Hermel	28.90
16	R9-Mishmesh-0	Akkar	Area 1: Akkar and North Lebanon	28.39
17	G2-Ghaziye-00	Saida	Area 3: Nabatieh and South Lebanon	28.35
18	E3-Kfour En-Nabatieh-00	Nabatieh	Area 3: Nabatieh and South Lebanon	28.13
19	G2-Saida-1n	Saida	Area 3: Nabatieh and South Lebanon	28.08
20	R7-Kfar Chellane-0	Minieh-Dannieh	Area 1: Akkar and North Lebanon	28.05

Top 20 Priority CDW Dumpsites

Rank	Dumpsite ID	Caza	Area	RSI Score
1	Q7-Morh Kfarsghab-2	Zgharta	Area 1: Akkar and North Lebanon	23.53
2	R7-Deir Ammar-2	Minieh-Dannieh	Area 1: Akkar and North Lebanon	23.53
3	K5 - Broummana -1n	Maten	Area 2: Beirut and Mount Lebanon	23.48
4	K4-Beit Meri-00	Maten	Area 2: Beirut and Mount Lebanon	23.21
5	P6-Kosba-2	Koura	Area 1: Akkar and North Lebanon	23.19
6	L5-Balloune-2	Kesrouane	Area 2: Beirut and Mount Lebanon	23.16
7	L5-Qlaiaat-3	Kesrouane	Area 2: Beirut and Mount Lebanon	22.85
8	I5-Maaser Ech Chouf-0	Chouf	Area 2: Beirut and Mount Lebanon	22.59
9	L4-Dik Al-Mahdi-0	Maten	Area 2: Beirut and Mount Lebanon	22.51
10	K5- Ras El Maten-2n	Maten	Area 2: Beirut and Mount Lebanon	22.50
11	L8-Chmestar-01	Baalback	Area 4: Beqaa and Baalback/Hermel	22.15
12	L5-Aain Er-Rihane-3	Kesrouane	Area 2: Beirut and Mount Lebanon	22.08
13	L4-Mtayleb-1	Maten	Area 2: Beirut and Mount Lebanon	21.82
14	L4-Zouk Al Khrab-6n	Maten	Area 2: Beirut and Mount Lebanon	21.74
15	L4-Zouk Al Khrab-5	Maten	Area 2: Beirut and Mount Lebanon	21.49
16	M9-Maqne-07n	Baalback	Area 4: Beqaa and Baalback/Hermel	21.39
17	J4-Aaytat-0	Aley	Area 2: Beirut and Mount Lebanon	21.39
18	O6-Tartej-0n	Jbeil	Area 2: Beirut and Mount Lebanon	21.37
19	L5- KfarTay- 1n	Maten	Area 2: Beirut and Mount Lebanon	21.34
20	N10-Rasm Al Hadath-00n	Baalback	Area 4: Beqaa and Baalback/Hermel	21.30

REHABILITATION OPTIONS AND REHABILITATION COST ESTIMATES

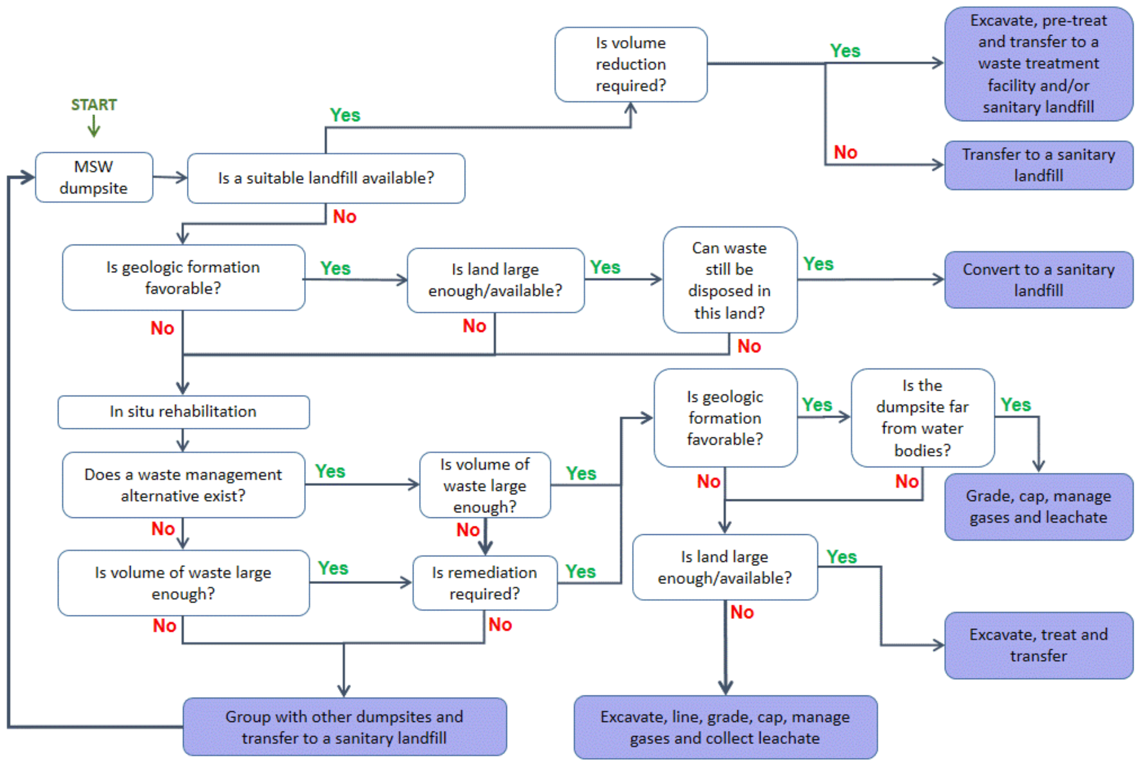
Remedial measures differ from one dumpsite to the other based on the complexity of the case and the availability of alternative waste management solutions.

Seven remedial measures were considered for MSW dumpsites. These include:

- Excavate, pre-treat and transfer to a waste treatment facility and/or sanitary landfill;
- Transfer to a sanitary landfill;
- Convert to a sanitary landfill;
- Grade, cap, manage gases and leachate;
- Excavate, treat and transfer;
- Excavate, line, grade, cap, manage gases and collect leachate; and
- Group with other dumpsites and transfer to a sanitary landfill.

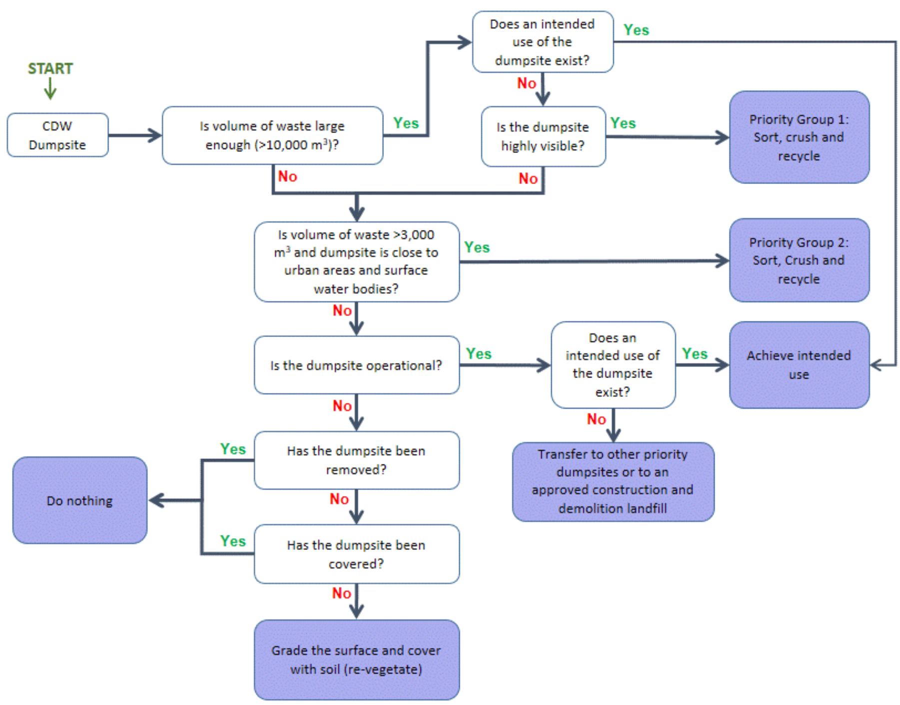
The Rehabilitation Decision Tool (RDT) provides a methodology for the description and comparison of alternative remediation scenarios relying on the RSI. The RDT is based on a decision tree module. Two decision trees were developed to identify the most suitable rehabilitation option for MSW and CDW dumpsites based on a set of Yes/No questions as per the below decision trees.

MSW Dumpsite Rehabilitation Options Decision Tree



For CDW dumpsites, four remedial measures were considered, consisting of:

- Sort, crush and recycle;
- Transfer to other priority dumpsites or to an approved construction and demolition landfill;
- Grade the surface and cover with soil (re-vegetate); and
- Achieve intended use.



CDW Dumpsite Rehabilitation Options Decision Tree

The model automatically identifies the most suitable rehabilitation option for each dumpsite. However, the top 20 dumpsites were given special consideration where a detailed assessment for their rehabilitation options and associated costs were appraised by an expert. Proposed rehabilitation plans and the rehabilitation cost for the 20 highest ranked dumpsites are below.

Proposed Rehabilitation Plans for the Top 20 Priority MSW Dumpsites

Rank	Dumpsite ID	Proposed Rehabilitation Plan	Cost (USD)
1	R6-Tripoli-0	Grade, cap, manage gases and leachate	6,557,287
2	N5-Hbaline-0	Option 1 - Grade, cap, manage gases and leachate	2,931,075
		Option 2 - Convert to a sanitary landfill	6,946,524
3	R7-Adweh-0	Grade, cap, manage gases and leachate	1,612,762
4	P5-Batroun-0	Excavate, line, grade, cap, manage gases and collect leachate	1,039,300
5	T9-Srar-0	Convert to a sanitary landfill	6,732,524
6	J6-Qabb Elias-00	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	2,163,875
		Option 2 - Transfer to a sanitary landfill	1,613,750
7	C1-Deir Qanoun El-Aain-01	Convert to a sanitary landfill	4,748,516
8	L5-Balloune-3	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	336,500
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	164,500
9	L5-Beit Chabab-1n	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	240,250
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	176,500
10	J7-Barr Elias-00	Option 1- Excavate, treat and transfer	3,758,262
		Option 2 - Grade, cap, manage gases and leachate	1,765,675
11	R9-Fnaydek-0	Excavate, line, grade, cap, manage gases and collect leachate	895,875
12	F2-Sarafand-01	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	443,625
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	375,250
13	G4-Jezzine-00	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	334,750
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	193,000
14	D2-Abbesye-03	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	435,000
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	398,750
15	M9-Baalback-02	Excavate, line, grade, cap, manage gases and collect leachate	1,147,000
16	R9-Mishmesh-0	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	150,250
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	74,500
17	G2-Ghaziye-00	Excavate, line, grade, cap, manage gases and collect leachate	457,200
18	E3-Kfour En-Nabatieh-00	Excavate, line, grade, cap, manage gases and collect leachate	678,750
19	G2-Saida-1n	Grade, cap, manage gases and leachate	359,250
20	R7-Kfar Chellane-0	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	225,310
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	133,375
Cost Range: 32,130,590 - 39,187,061			

Proposed rehabilitation plans and the rehabilitation cost for the 20 highest ranked CDW dumpsites are shown below.

Proposed Rehabilitation Plans for the Top 20 Priority CDW Dumpsites

Rank	Dumpsite ID	Proposed Rehabilitation Plan	Cost (USD)
1	Q7-Morh Kfarsghab-2	Achieve intended use (build a church)	40,267
2	R7-Deir Ammar-2	Priority Group 1: Sort, crush and recycle	422,550
3	K5 - Broummana -1n	Priority Group 1: Sort, crush and recycle	839,960
4	K4-Beit Meri-00	Priority Group 1: Sort, crush and recycle	939,750
5	P6-Kosba-2	Achieve intended use (establish a parking)	109,433
6	L5-Balloune-2	Priority Group 1: Sort, crush and recycle	362,900
7	L5-Qlaiaat-3	Priority Group 1: Sort, crush and recycle	553,850
8	I5-Maaser Ech Chouf-0	Priority Group 2: Sort, crush and recycle	102,440
9	L4-Dik Al-Mahdi-0	Priority Group 1: Sort, crush and recycle	243,600
10	K5- Ras El Maten-2n	Achieve intended use (build a new road)	147,000
11	L8-Chmestar-01	Priority Group 1: Sort, crush and recycle	127,300
12	L5-Aain Er-Rihane-3	Priority Group 1: Sort, crush and recycle	1,175,000
13	L4-Mtayleb-1	Priority Group 2: Sort, crush and recycle	57,185
14	L4-Zouk Al Khrab-6n	Priority Group 2: Sort, crush and recycle	64,650
15	L4-Zouk Al Khrab-5	Priority Group 2: Sort, crush and recycle	65,650
16	M9-Maqne-07n	Priority Group 1: Sort, crush and recycle	155,625
17	J4-Aaytat-0	Achieve intended use (expand the land)	77,600
18	O6-Tartej-0n	Achieve intended use (transform to a garden)	22,800
19	L5- KfarTay- 1n	Priority Group 1: Sort, crush and recycle	686,084
20	N10-Rasm Al Hadath-00n	Priority Group 1: Sort, crush and recycle	129,765
		Total Cost	**6,323,409**

Rehabilitation Cost Estimates

The average total cost for rehabilitating the top 20 MSW dumpsites is in the order of **35,660,000 USD**. The cost for rehabilitating the remaining MSW dumpsites beyond the top 20 is estimated to be in the order of **24,550,000 USD**.

The estimated cost for rehabilitating the top 20 CDW dumpsites is in the order of **6,324,000 USD**. The cost for rehabilitating the remaining CDW dumpsites beyond the top 20 is estimated to be in the order of **7,455,000 USD.**

ملخّص تنفيذي

المقدمة

في العام ٢٠١١، قامت وزارة البيئة وبرنامج الأمم المتحدة الإنمائي، بمساعدة تقنية من شركة الأرض للتنمية المتطورة للموارد (ELARD)، بإعداد مخطّط توجيهي لإغلاق وإعادة تأهيل المكبّات العشوائية في لبنان. ومنذ ذلك الحين، أدى حدثان رئيسيان إلى ضرورة تحديث المخطّط التوجيهي لعام ٢٠١١، وهما:

- النزاع في سوريا المستمرّ منذ العام ٢٠١١ الذي أجبر أكثر من مليون شخص على اللجوء إلى الأراضي اللبنانية؛ و
- أزمة جمع النفايات الصلبة والتخلّص منها التي بدأت في شهر تموز من العام ٢٠١٥ مع إغلاق مطمر الناعمة الذي كان يخدم المناطق الأكثر اكتظاظاً بالسكان في بيروت وجبل لبنان (باستثناء قضاء جبيل).

يهدف المخطّط التّوجيهي المحدّث عام ٢٠١٦ لإغلاق وإعادة تأهيل المكبات العشوائية في لبنان إلى:

- فهم وضع ونمط وديناميكية أنشطة المكبّات العشوائية منذ آخر مسح أجري كجزء من المخطّط التّوجيهي لعام ٢٠١١، مع مراعاة الحدثين المذكورين أعلاه؛
- تحديد المناطق المثيرة للقلق؛
- تحديد المكبّات ذات الأولويّة من حيث حاجتها إلى الإغلاق وإعادة التأهيل في ضوء آثارها المحتملة على البيئة على أساس نموذج تحديد الأولويّات المطوّر لهذا الغرض؛ و
- اقتراح خيارات إعادة التأهيل لكل مكبّ بناءً على "أداة قرار إعادة التأهيل" (Decision Tool Rehabilitation).

ويعرض هذا التقرير المنهجية المتبعة لتحديث المخطّط التّوجيهي ويلخص استنتاجاته الرّئيسية وإجراءاته في ثلاثة مجلدات، كما هو مبيّن أدناه.

عناصر المخطّط التّوجيهي المحدّث

العنوان	المجلّد
المخطّط التّوجيهي المحدّث لإغلاق وإعادة تأهيل المكبّات العشوائية في لبنان	**المجلّد أ**
التّقييم البيئي للمكبّات العشوائية	**المجلّد ب**
مذكّرة المعلومات الأساسيّة حول تقييم كلفة المكبّات العشوائية في لبنان في العام ٢٠١٦	**المجلّد ج**

يعود هذا الملخص التنفيذي للمجلد أ: المخطّط التّوجيهي المحدّث لإغلاق وإعادة تأهيل المكبّات العشوائية في لبنان.

منهجيّة المسح

تنقسم المكبّات التّي خضعت للمسح إلى نوعين: النفايات المنزلية الصلبة (MSW) و نفايات البناء والرّدميّات (CDW). وتنقسم المكبّات أيضاً إلى مجموعتين رئيستين: ناشطة وغير ناشطة. واعتمدت التعريفات التالية عموما في جميع مراحل الدراسة:

- مكب النفايات المنزلية الصلبة (MSW): مكب للنفايات يحتوي على أكثر من ٨٥٪ من النفايات المنزلية الصلبة. وقد يشمل بالإضافة إلى ذلك، نفايات المستشفيات، النفايات الصناعية و البناء والرّدميّات.
- مكب نفايات البناء والردميات (CDW): مكبّ نفايات يحتوي على أكثر من ٨٥٪ من مخلفات البناء والهدم التي تشمل الأنقاض والردميات والنفايات الخضراء وركام البناء والهدم.

تم إجراء المسح الميداني، الذي يشكل الركيزة الأساسية للمخطّط التّوجيهي، بين شهري تمّوز ٢٠١٦ وآذار ٢٠١٧. تم تقسيم الأراضي اللبنانية إلى أربع مناطق بهدف تنظيم عملية المسح:

المنطقة :1 عكّار ولبنان الشّمالي

المنطقة :2 بيروت وجبل لبنان

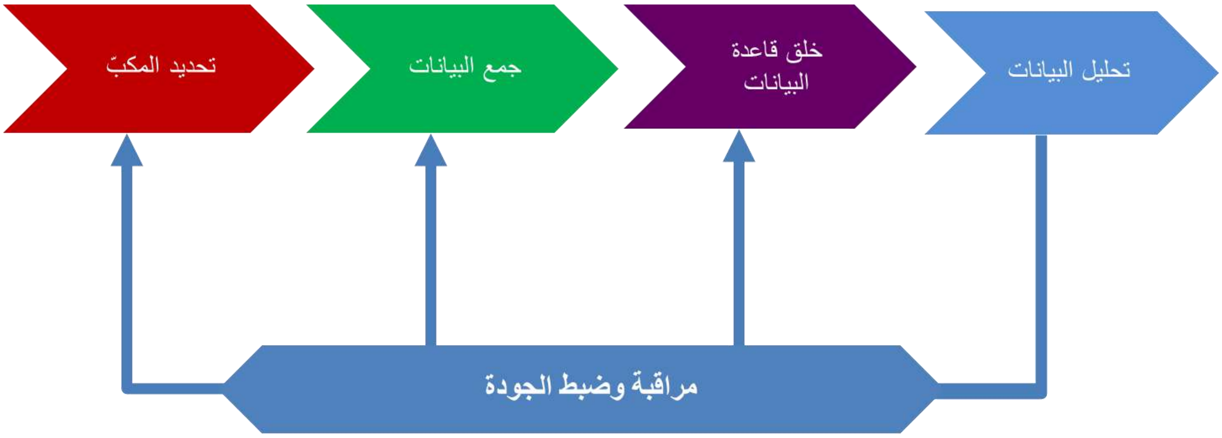
المنطقة :3 النّبطيّة ولبنان الجنوبي

المنطقة :4 البقاع وبعلبك/الهرمل

التوزيع الجغرافي لفرق المسح

بدأت عمليّة المسح من خلال تحديد المكبّات ثم جمع البيانات الميدانية من قبل المساحين. تم إعداد نموذج توصيف للموقع (Site Characterization Form) وتحويله إلى تطبيق على الهواتف الذكية لتسهيل العمل الميداني. يشمل النموذج البيانات الميدانيّة التي تسمح بجمع المعلومات عن المكب نفسه والبلدية المعنية.

تمّ إدخال البيانات الميدانيّة في تطبيق الهواتف الذكية مما سمح بتخزين البيانات ونقلها تلقائياً إلى منصة جمع البيانات الأساسية (server) في شركة ELARD. وبعد ضمان ومراقبة جودة (QA/QC) البيانات الميدانيّة والتحليل الأولي للبيانات، تم القيام بزيارات متابعة لسدّ الثغرات والتحقق من نتائج قاعدة البيانات النهائية.



عمليّة تنفيذ المسح

واجه المساحون عدة تحديات أثناء مرحلة جمع البيانات. وتشمل هذه التّحدّيات:

- طبيعة أنشطة إدارة النفايات المتمثلة بالعشوائية وعدم التنظيم. ويُعتبَر تتبّع هذه الأنشطة أمر صعب ويمكن أن يكون غير دقيق نظراً لعدم تسجيل المعلومات رسميًا.
- اقتصرت المنهجية المستخدمة لتقدير أحجام المكبّات في كل من مسحي العامين ٢٠١١ و٢٠١٦ على التقريبات البصرية الأمر الذي أدى إلى الحصول على قيم إرشادية بدلاً من تقديرات دقيقة.
- عدم الوصول الى بعض المواقع بسبب الأوضاع الأمنية وحالة الطرقات.
- البيانات التي قدمتها البلديات لم تكن موثوقة دائماً. واجهت عمليّة المسح العديد من التحديات، بما في ذلك انعدام الشفافية وعدم الرغبة في التعاون، وفي بعض الحالات لم تكن المجالس البلدية الجديدة التي انتخبت في ربيع العام ٢٠١٦ على علم بتفاصيل المكبات في منطقتها.

نتائج المسح والتحليل للعام ٢٠١٦

بلغ إجمالي عدد مكبّات النفايات المحددة في مسح عام ٢٠١٦ ٩٤١ مقابل ٦٧٠ في مسح عام ٢٠١١.

مكبات النفايات المنزلية الصلبة

في مسح العام ٢٠١١، تمّ تحديد ٥٠٤ مكبّات للنفايات المنزلية الصلبة في لبنان، منها ٧٦٪ (٣٨٢) ناشطة و٢٤٪ (١٢٢) غير ناشطة. وبلغ حجم النفايات المنزلية الصلبة في المكبّات النّاشطة ٢،٦٧٥،٥٤٨ متر مكعب، في حين بلغ حجم النفايات في المكبّات غير النّاشطة ٧٧٤،٥٢٣ متر مكعب. وفي مسح العام ٢٠١٦، تمّ تحديد ٦١٧ مكبّاً للنفايات المنزلية الصلبة: حوالي ٥٥٪ (٣٤١) منها ناشطة و٤٣٪ (٢٦٣) غير ناشطة. ومن ضمن مكبّات النفايات المنزلية الصلبة التي شملتها الدراسة، تعذر الوصول إلى ٢٪ (١٣).

على غرار نتائج مسح العام ٢٠١١، فإن أكبر عدد من المكبّات النّاشطة في مسح العام ٢٠١٦ موجود في "المنطقة ٣: النبطية وجنوب لبنان" التي كانت تحتوي على حوالي ٣٧٪ (١٢٧) من المكبات النّاشطة، تليها "المنطقة ٤: البقاع وبعلبك / الهرمل بنسبة ٢٨٪ (٩٦ مكبّاً).

تقع أكبر مكبّات النفايات المنزلية الصلبة من حيث حجم النفايات في المكبّات النّاشطة في المناطق التي شهدت انخفاضاً في عدد هذه المكبّات. تتركز أنشطة التخلص من النفايات في هذه المناطق ضمن مكبّات خاضعة للمراقبة وهي مكب طرابلس ومكب سرار في عكار ومكبّيّ قب الياس وبر الياس في زحلة. ممّا يفسر الانخفاض في عدد مكبات النفايات المنزلية الصلبة النّاشطة مقابل زيادة كبيرة في الحجم مقارنة مع مسح العام ٢٠١١ في المنطقتين ١ و ٤.

"المنطقة ٢: بيروت وجبل لبنان" التي كانت تحظى بأقلّ عدد وأصغر حجم لمكبّات النفايات المنزلية الصلبة النّاشطة وغير النّاشطة في مسح العام ٢٠١١ شهدت زيادة بنسبة ١٢٤٪ في عدد المكبات ٢٠١٦ مقارنة مع العام ٢٠١١ حيث أن ٨٦٪ من هذه الزيادة شملت المكبّات النّاشطة. ويعزى هذا التغيير في الغالب إلى أزمة جمع النفايات الصلبة والتخلص منها في العام ٢٠١٥ التي أجبرت البلديات على إدارة نفاياتها، في حين لم تكن مستعدة ولم تكن لديها بدائل مناسبة سوى المكبّات العشوائية. أما في "المنطقة ٣: النّبطيّة ولبنان الجنوبي" فقد سجلت محافظتا النبطية وجنوب لبنان وجود أكبر عدد من المكبات غير الناشطة فيها في مسح العام ٢٠١٦ مع ١١٠ مكبّات غير ناشطة، أي ٤٢٪ من إجمالي المكبّات غير النّاشطة على مستوى البلد ككلّ.

وضع مكبّات النّفايات المنزليّة الصّلبة في العام ٢٠١٦ مقارنةً مع مسح العام ٢٠١١ في كافّة أنحاء لبنان

مكبّات النّفايات المنزليّة الصّلبة	ناشطة		غير ناشطة		لا يمكن الوصول إليها		المجموع الإجمالي	
	#	الحجم (m^3)	#	الحجم (m^3)	#	الحجم (m^3)	#	الحجم (m^3)
كامل الأراضي اللبنانيّة								
2011	**382**	**2,675,548**	**122**	**774,523**	**-**	**-**	**504**	**3,450,073**
2016	**341**	**4, 588,218**	**263**	**1,135,603**	**13**	**19,486**	**617**	**5,743,307**
المنطقة :1 عكّار ولبنان الشّمالي								
2011	61	606,007	25	208,088	-	-	**86**	**814,095**
2016	38	2,246,797	46	182,295	3	5,280	**87**	**2,434,372**
المنطقة :2 يروت وجبل لبنان								
2011	43	453,976	16	39,175	-	-	**59**	**493,151**
2016	80	767,846	46	43,885	2	2,400	**132**	**814,131**
المنطقة :3 النّبطيّة ولبنان الجنوبي								
2011	168	947,002	52	120,955	-	-	**220**	**1,067,957**
2016	127	637,590	110	480,498	1	41	**238**	**1,118,129**
المنطقة :4 البقاع وبعلبك/الهرمل								
2011	110	668,565	29	406,305	-	-	**139**	**1,074,870**
2016	96	935,985	57	428,925	7	11,765	**160**	**1,376,675**

مكبات نفايات البناء والردميات

في العام ٢٠١١، تم تحديد ١٦٦ مكبّاً لمخلفات البناء والهدم (CDW)، منها ٨٠٪ (١٣٢) ناشطة و٢٠٪ (٣٤) غير ناشطة. بلغ حجم المخلفات في المكبّات النّاشطة ١،٤٦٨،٥٢٨ متر مكعب، في حين بلغ الحجم في المكبات غير النّاشطة ٢٦٢،٦٥٣ متر مكعب. واتضح أن أكبر عدد من المكبّات النّاشطة هو في "المنطقة ٢: بيروت وجبل لبنان"، إذ فيها حوالي ٥٤٪ (٧١) من المكبّات النّاشطة. وتليها "المنطقة ٣: النبطية ولبنان الجنوبي" بنسبة ٢٦٪ (٣٤).

في العام ٢٠١٦، تم تحديد ٣٢٤ مكبّاً لنفايات البناء والردميات . حوالي ٥٥٪ (١٧٨) من هذه المكبّات ناشطة و٤٥٪ (١٤٥) غير ناشطة. وبصفة عامة، هناك زيادة في عدد وحجم مكبّات مخلفات البناء والردميات في لبنان. تم العثور على أعلى عدد من المكبّات النّاشطة في "المنطقة ٣: النبطية وجنوب لبنان"، التي تضم حوالي ٣٩٪ (٦٩) من المكبات النّاشطة، تليها "المنطقة ٤: البقاع وبعلبك / الهرمل" بنسبة ٢٥٪ (٤٥).

أوضحت نتائج المسح أن أعلى حجم من مخلفات البناء والردم في المكبّات النّاشطة في عامي ٢٠١١ و ٢٠١٦ هو في "المنطقة ٢: بيروت وجبل لبنان"، تليها "المنطقة ٤: البقاع وبعلبك / الهرمل". واكتشفت أكبر أحجام مخلفات البناء والهدم في مكبّات غير ناشطة في العامين ٢٠١١ و ٢٠١٦ في "المنطقة ٢: بيروت وجبل لبنان."

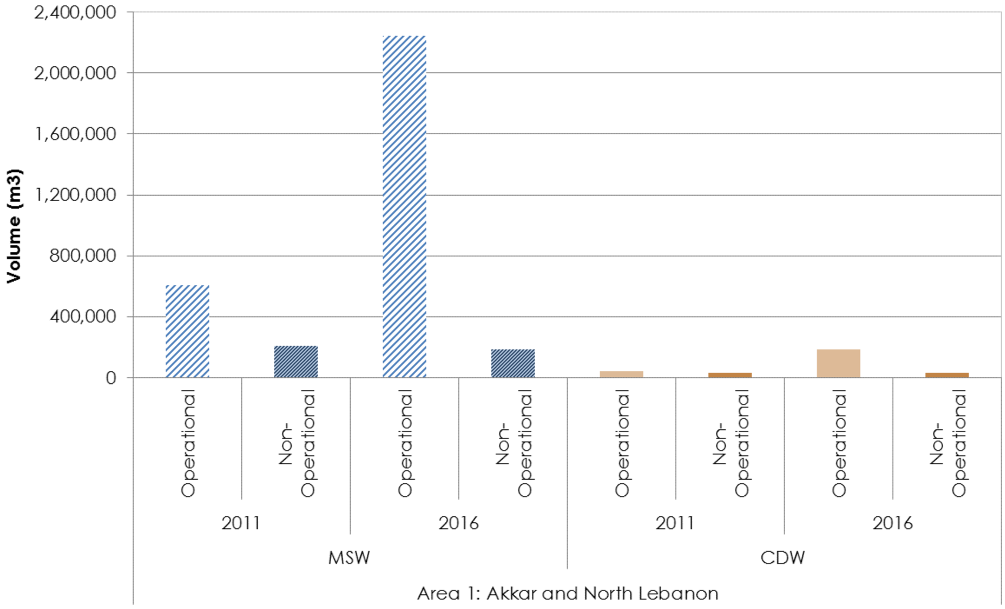
وضع مكبّات مخلفات البناء والهدم في العام ٢٠١٦ مقارنةً مع مسح العام ٢٠١١ في كافّة أنحاء لبنان

المكبّات مخلفات البناء والهدم	ناشط		غير ناشط		يمكن الوصول إليه		المجموع العامّ	
	#	الحجم (m^3)	#	الحجم (m^3)	#	الحجم (m^3)	#	الحجم (m^3)
كامل الأراضي اللّبنانيّة								
2011	**132**	**1,468,528**	**34**	**262,653**	**-**	**-**	**166**	**1,731,181**
2016	**178**	**964,223**	**145**	**1,181,313**	**1**	**15,000**	**324**	**2,160,536**
المنطقة :1 عكّار ولبنان الشّمالي								
2011	26	42,968	7	27,960	-	-	**33**	**70,928**
2016	29	183,160	18	29,006	-	-	**47**	**212,166**
المنطقة :2 يروت وجبل لبنان								
2011	71	1,021,113	18	203,285	-	-	**89**	**1,224,398**
2016	35	419,880	88	1,116,910	-	-	**124**	**1,551,790**
المنطقة :3 النّبطيّة ولبنان الجنوبي								
2011	34	179,447	5	20,708	-	-	**39**	**200,155**
2016	69	159,933	35	32,897	-	-	**104**	**192,830**
المنطقة :4 البقاع وبعلبك/الهرمل								
2011	1	225,000	4	10,700	-	-	**5**	**235,700**
2016	45	201,250	4	2,500	-	-	**49**	**203,750**

ملخّص النّتائج حسب المناطق

المنطقة 1: عكّار ولبنان الشّمالي

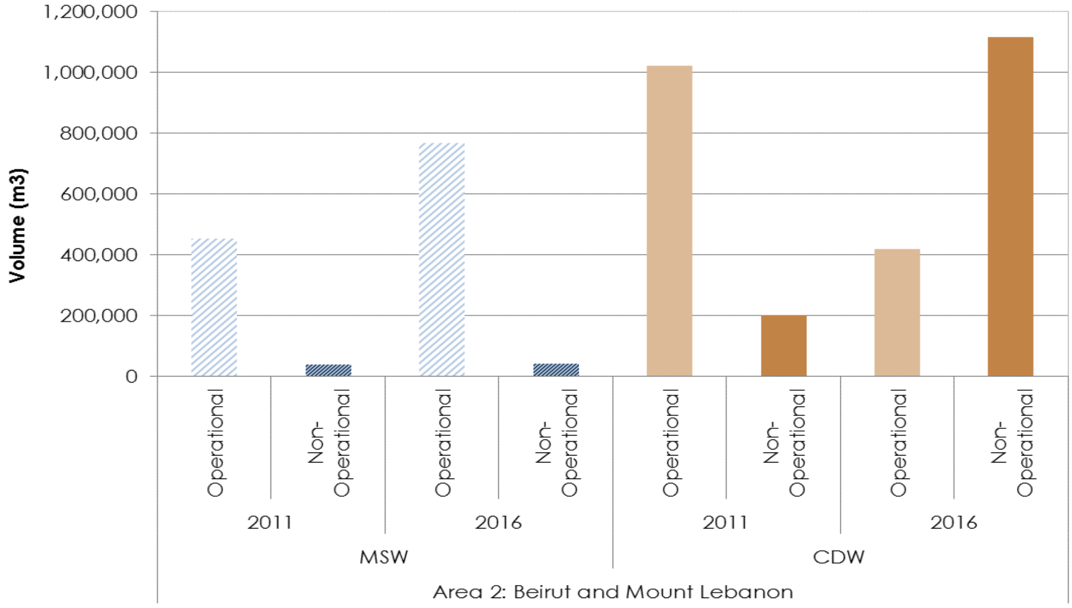
هناك زيادة عامة في حجم كل من مكبّات النفايات المنزلية الصلبة ومخلفات البناء والرّدميّات في "المنطقة ١: عكار ولبنان الشّمالي" منذ مسح العام ٢٠١١، كما هو مبين في الرّسم البياني أدناه. تم تقدير إجمالي الحجم بـ ٢،٢٤٤،٣٧٢ متر مكعب من النفايات المنزلية الصلبة التي تمّ التخلص منها في المكبات، و٢١٢،١٦٦ متر مكعب من مخلفات البناء والهدم في مسح العام ٢٠١٦. ونظراً لعدم تنفيذ أيّة مبادرات رئيسية لإدارة النفايات الصلبة في الشمال في السنوات القليلة الماضية مرافقةً مع الضغط الإضافي من النازحين السوريين، كانت هذه الزيادة المتوقعة.



حجم المكبات العشوائية في المنطقة ١ بين عامي ٢٠١١ و ٢٠١٦

المنطقة ٢:بيروت وجبل لبنان

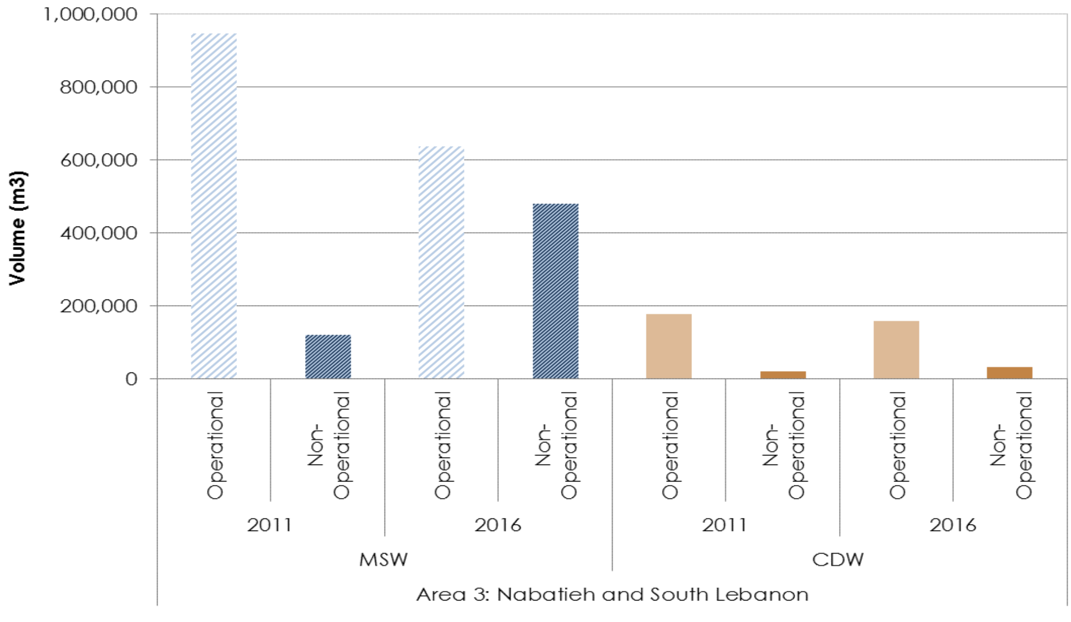
شهدت"المنطقة ٢: بيروت وجبل لبنان" زيادة في حجم النفايات المنزلية الصلبة في المكبّات النفايات المنزلية الصلبة الناشطة ، كما هو مبين في الرّسم البياني أدناه. ومن ناحية أخرى، لوحظ انخفاض كبير في حجم مكبات نفايات البناء والردميات في المكبات النّاشطة، وهو ما ينعكس زيادة في عدد مكبّات نفايات البناء والردميات غير النّاشطة. وتمّ تقدير إجمالي حجم النفايات المنزلية الصلبة التي تم إلقاؤها بـ ٨١٤،١٣١ متراً مكعباً و ١،٥٥١،٧٩٠ متر مكعب من مخلفات البناء والهدم في مسح العام ٢٠١٦. وكانت هذه الزيادة في عدد المكبّات العشوائية في "المنطقة ٢: بيروت وجبل لبنان" واضحة بشكل أساسي في قضائي الشوف وعاليه ومتوقّعة أيضاً بسبب أزمة النّفايات الصّلبة في العام ٢٠١٥ ، إلى جانب الضغوط بسبب وجود النازحين السوريين.



حجم المكبات العشوائية في المنطقة ٢ بين عامي ٢٠١١ و ٢٠١٦

المنطقة 3: النّبطيّة ولبنان الجنوبي

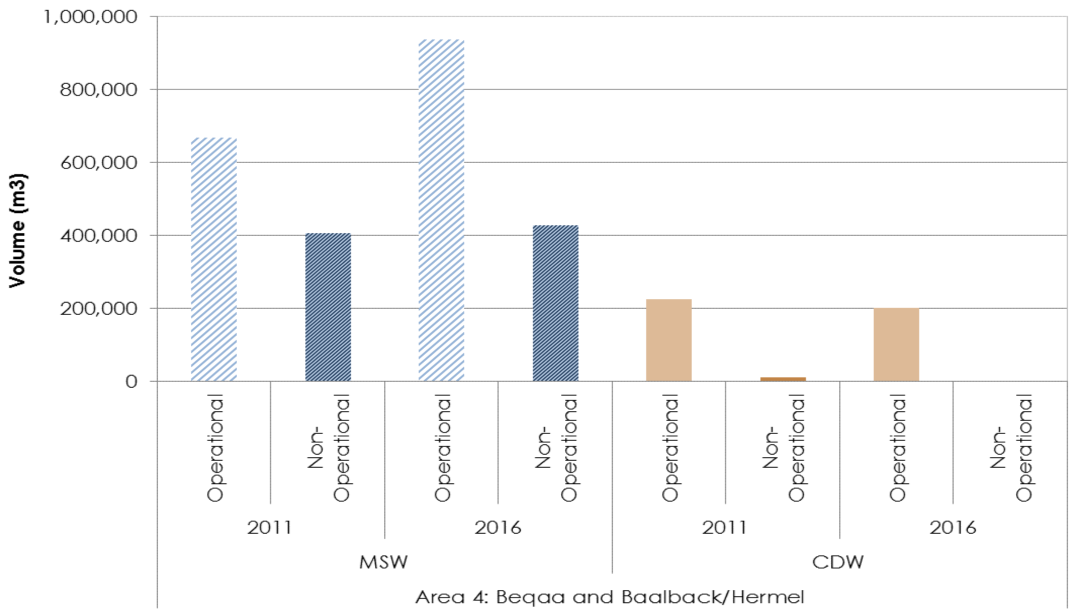
هناك انخفاض كبير في حجم النفايات المنزلية الصلبة في المكبّات النّاشطة في "المنطقة ٣: النبطية ولبنان الجنوبي" منذ مسح العام ٢٠١١، ويترافق مع زيادة كبيرة في حجم النفايات المنزلية الصلبة في المكبّات غير النّاشطة (حوالي ٠,٤٨ مليون متر مكعب)، كما هو مبين في الرّسم البياني أدناه. وقدّر حجم النّفايات في المنطقة ٣ بحوالي ١،١١٨،١٢٩ متر مكعب للنفايات المنزليّة الصّلبة و ١٩٢،٨٣٠ مترا مكعبا لمنفايات البناء والردميات. إن المعدل المرتفع نسبيا لأنشطة حرق النفايات في الجنوب (حوالي ٣٥٪ من مكبّات النفايات في الجنوب تعتمد حرق النفايات في الهواء الطّلق) إضافة إلى وجود عدد كبير من مرافق إدارة النفايات الصلبة يساهمان في تقليص حجم النفايات في المكبات العشوائية في "المنطقة ٣: النبطية ولبنان الجنوبي".



حجم المكبات العشوائية في المنطقة ٣ بين عامي ٢٠١١ و ٢٠١٦

المنطقة ٤: البقاع وبعلبك/الهرمل

شهدت "المنطقة ٤: البقاع وبعلبك / الهرمل "زيادة كبيرة في حجم النفايات المنزلية الصلبة في المكبّات النّاشطة كما هو مبين في الرسم البياني أدناه. قدّر إجمالي حجم النفايات المنزلية الصلبة في المكبات العشوائية في مسح العام ٢٠١٦ بحوالي ١،٧٦٦،٦٧٥ متر مكعب. كما أن هناك زيادة كبيرة في عدد وحجم مكبات نفايات البناء والردم (٤٥)، ، مع الأخذ بعين الاعتبار مكبّ شمسطار الذي تمّت إعادة تأهيله جزئياً منذ العام ٢٠١١. وقدّر إجمالي حجم مخلفات البناء والهدم بـ ٢٠٣،٧٥٠ متر مكعب في مسح العام ٢٠١٦. وتعزى هذه الزيادة إلى سببين رئيسين: التواجد الكثيف للنازحين السوريين والمخيّمات العشوائية، والنقل غير الرسمي للنفايات من مناطق أخرى إلى البقاع للتخلّص منها.



حجم المكبات العشوائية في المنطقة ٤ بين عامي ٢٠١١ و ٢٠١٦

نموذج تحديد الأولويات

تم تطوير نموذج تحديد الأولويّات (Prioritization Decision Tool) من أجل إعطاء الأولويّة لإعادة تأهيل المكبّات بناءً على مؤشر الحساسية على المخاطر (RSI-Risk Sensitivity Index). تم تطوير نموذجين مختلفين للتطرق الى مكبّات النفايات المنزلية الصلبة ومخلفات البناء والردميات بشكل منفصل، نظراً إلى أنّ لها ميزات مختلفة.

تمّ اختيار عشر (١٠) سمات لتحديد أولويات مكبّات النفايات المنزلية الصلبة وثماني سمات (٨) لتحديد أولويات مكبات مخلفات البناء والهدم. ووضع لكل من هذه السمات "وزنا" محدداً يعكس الأهمية النسبية للأثر البيئي المرتبط بها. وتراوحت الأوزان بين ١ و ١٠ لمكبّات النفايات المنزلية الصلبة ، وبين ١ و ٨ لمكبات مخلفات البناء والهدم. ثم أعطيت كل سمة "درجة حساسية" تتفاوت من ٠ إلى ١ مقسمة إلى أربعة أرباع أو نطاقات كما هو مبين في الجداول التالية.

جدول سمات مكبّ النّفايات المنزليّة الصّلبة

السّمة		عامل الوزن	**0.0-0.25**	**0.25-0.5**	**0.5-0.75**	**0.75-1.0**
حجم النّفايات في الموقع (متر مكعب)		10	<10,000	10,000-50,000	50,000-100,000	>100,000
جيولوجيا	الصفات الحجريّة (70%)	9	وجود مهمّ أو كبير للآجر	وجود الآجر وأنظمة الوصل	مسامية ثانويّة، اشكال مختلفة من التّرب الكارستيّة ووجود بعض التّرابطات الكلسيّة	مساميّة ثانويّة (شقوق ومفاصل) الصخر المكربن، فضلاً عن نسبة مرتفعة من التّرب الكارستيّة
	كثافة الصّدوع والفتحات (segment/km^2) (30%)		<10	10-15	15-20	>20
هيدرولوجيا	المسافة إلى مجاري التصريف (متر)(80%)	8	>200	200-100	100-50	<50
	البعد عن ينابيع المياه (متر) (20%)		>200	200-150	150-100	<100
البعد عن المناطق السّكنيّة (متر)		7	>1,000	1,000-500	500-250	<250
كميّة النّفايات الفعليّة المرميّة في المكبّ (طن/يوم)		6	<10	10-50	50-100	>100
وجود بدائل		5	لا توجد بدائل	العمل جار على إيجاد حلّ بديل وتمويل	البديل قيد الانشاء	بديل موجود وقيد التشغيل
حرق النّفايات في المكبّات العشوائيّة		4	يتمّ حرقها		لا يتمّ حرقها	
عامل رؤية المكب		3	غير ظاهر		ظاهر	
عمق طمر النّفايات (متر)		2	<1	1-5	5-10	>10
مدة تواجد المكب (عام)		1	<10	10-20	20-30	>30

جدول سمات مكبّ نفايات البناء والردم

السّمة		عامل الوزن	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
حجم النّفايات في الموقع (متر مكعب)		8	<3,000	3,000-10,000	10,000-50,000	>50,000
عامل رؤية المكب		7	غير ظاهر		ظاهر	
	المسافة إلى مجاري التصريف (متر)(80%)	6	>200	200-100	100-50	<50
	البعد عن ينابيع المياه (متر) (20%)		>200	200-150	150-100	<100
البعد عن المناطق السّكنيّة (متر)		5	>1,000	1,000-500	500-250	<250
وجود بدائل/ الوجهة المطروحة لاستعمال الموقع		4	لا توجد بدائل/ لا يوجد طرح لاستعمال الموقع	العمل جار على إيجاد حلّ بديل وتمويل	البديل قيد الانشاء	بديل موجود وقيد التشغيل
الحالة (ناشط وغير ناشط)		3	تمّت إزالته	تمّت تغطيته	غير ناشط	ناشط
الجيولوجيا	علم الصّخور (70%)	2	وجود مهمّ أو كبير للآجر	وجود الآجر وأنظمة الوصل	مسامية ثانويّة، اشكال مختلفة من التّرب الكارستيّة ووجود بعض التّرابطات الكلسيّة	مساميّة ثانويّة (شقوق ومفاصل) الصخر المكربن، فضلاً عن نسبة مرتفعة من التّرب الكارستيّة
	كثافة الصّدوع والفتحات ($segment/km^2$) (30%)		<10	10-15	15-20	>20
مدة تواجد المكب (عام)		1	<10	10-20	20-30	>30

تم احتساب مؤشر الحساسية على المخاطر لكل مكبّ عن طريق جمع العلامة المعطاة لكل سمة، والتي تم احتسابها عبر ضرب عامل الوزن بدرجة الحساسية (فئة) المؤاتية لكل سمة. تم اختبار تحليل الحساسية على نموذج أداة تحديد الأولويّات (Prioritization Decision Tool) للتحقق من صحته وفعاليّته. وقد ثبت أن هذا النموذج مستقر جداً.

وجود مؤشر حساسية على المخاطر عالي يشير إلى وجود مزيد من المخاطر على البيئة، ويشير إلى أنه يتطلب تدخلاً أكثر إلحاحاً. وفي المقابل، عندما ينخفض مؤشر الحساسية على المخاطر لمكبّ ما، فإن الأولوية لإعادة تأهيله تنخفض. وتظهر الجداول التالية نطاقات مؤشر الحساسية على المخاطر وعدد المكبّات التي تقع ضمن كل فئة.

عدد المكبّات نسبة إلى RSI

نطاق مؤشر الحساسية على المخاطر	عدد مكبّات النفايات المنزلية الصلبة
> 30	10
25 - 30	69
20 -25	245
15 - 20	248
< 15	45
المجموع	**617**

نطاق مؤشر الحساسية على المخاطر	عدد مكبّات مخلفات البناء والهدم
> 20	29
18 - 20	69
14 -18	143
10 -14	75
< 10	8
المجموع	**324**

تم احتساب مؤشر الحساسية على المخاطر لجميع المكبّات التي شملها المسح الميداني، ويعرض أدناه المكبات ال٢٠ التي حظيت على أعلى علامة مؤشر الحساسية على المخاطر. هذه المكبّات ال ٢٠ "ذات الأولويّة":

- تشكّل حجماً إجماليّاً يمثّل ٦٦٪ من إجمالي حجم النفايات في مكبّات النفايات المنزلية الصلبة و ٣٥٪ من نفايات البناء والردم.
- تشمل جميع مكبّات النفايات التي شملتها الدراسة وتدخل ضمن النطاق الأول من بالنّسبة للنّفايات المنزلية الصلبة و٪ ٦٩ لمكبات نفايات البناء والردم.

تعرض الجداول التالية المكبات ال٢٠ ذات الأولويّة لكل فئة من المكبات: النفايات المنزلية الصلبة ونفايات البناء والردم.

مكبّات النفايات المنزلية الصلبة ال٢٠ ذات الأولوية

المرتبة	تعريف المكبّ	القضاء	المنطقة	علامة مؤشر الحساسية على المخاطر
1	R6-Tripoli-0	طرابلس	المنطقة ١: عكّار ولبنان الشّمالي	40.73
2	N5-Hbaline-0	جبيل	المنطقة ٢: بيروت وجبل لبنان	40.31
3	R7-Adweh-0	المنية – الضنّيّة	المنطقة ١: عكّار ولبنان الشّمالي	34.76
4	P5-Batroun-0	البترون	المنطقة ١: عكّار ولبنان الشّمالي	34.59
5	T9-Srar-0	عكّار	المنطقة ١: عكّار ولبنان الشّمالي	34.27
6	J6-Qabb Elias-00	زحلة	المنطقة ٤: البقاع وبعلبك/الهرمل	32.50
7	C1-Deir Qanoun El-Aain-01	صور	المنطقة ٣:النّبطيّة ولبنان الجنوبي	31.42
8	L5-Balloune-3	كسروان	المنطقة ٢: بيروت وجبل لبنان	30.32
9	L5-Beit Chabab-1n	المتن	المنطقة ٢: بيروت وجبل لبنان	30.20
10	J7-Barr Elias-00	زحلة	المنطقة ٤: البقاع وبعلبك/الهرمل	30.15
11	R9-Fnaydek-0	عكّار	المنطقة ١: عكّار ولبنان الشّمالي	29.83
12	F2-Sarafand-01	صيدا	المنطقة ٣:النّبطيّة ولبنان الجنوبي	29.64
13	G4-Jezzine-00	جزّين	المنطقة ٣:النّبطيّة ولبنان الجنوبي	29.03
14	D2-Abbesye-03	صور	المنطقة ٣:النّبطيّة ولبنان الجنوبي	28.96
15	M9-Baalback-02	بعلبك	المنطقة ٤: البقاع وبعلبك/الهرمل	28.90
16	R9-Mishmesh-0	عكّار	المنطقة ١: عكّار ولبنان الشّمالي	28.39
17	G2-Ghaziye-00	صيدا	المنطقة ٣:النّبطيّة ولبنان الجنوبي	28.35
18	E3-Kfour En-Nabatieh-00	النّبطيّة	المنطقة ٣:النّبطيّة ولبنان الجنوبي	28.13
19	G2-Saida-1n	صيدا	المنطقة ٣:النّبطيّة ولبنان الجنوبي	28.08
20	R7-Kfar Chellane-0	المنية – الضنّيّة	المنطقة ١: عكّار ولبنان الشّمالي	28.05

مكبّات مخلفات البناء والهدم ال٢٠ ذات الأولوية

المرتبة	تعريف المكبّ	القضاء	المنطقة	علامة مؤشر الحساسية على المخاطر
1	Q7-Morh Kfarsghab-2	زغرتا	المنطقة ١: عكّار ولبنان الشّمالي	23.53
2	R7-Deir Ammar-2	المنية – الضنّيّة	المنطقة ١: عكّار ولبنان الشّمالي	23.53
3	K5 - Broummana -1n	المتن	المنطقة ٢: بيروت وجبل لبنان	23.48
4	K4-Beit Meri-00	المتن	المنطقة ٢: بيروت وجبل لبنان	23.21
5	P6-Kosba-2	الكورة	المنطقة ١: عكّار ولبنان الشّمالي	23.19
6	L5-Balloune-2	كسروان	المنطقة ٢: بيروت وجبل لبنان	23.16
7	L5-Qlaiaat-3	كسروان	المنطقة ٢: بيروت وجبل لبنان	22.85
8	I5-Maaser Ech Chouf-0	الشّوف	المنطقة ٢: بيروت وجبل لبنان	22.59
9	L4-Dik Al-Mahdi-0	المتن	المنطقة ٢: بيروت وجبل لبنان	22.51
10	K5- Ras El Maten-2n	المتن	المنطقة ٢: بيروت وجبل لبنان	22.50
11	L8-Chmestar-01	بعلبك	المنطقة ٤: البقاع وبعلبك/الهرمل	22.15
12	L5-Aain Er-Rihane-3	كسروان	المنطقة ٢: بيروت وجبل لبنان	22.08
13	L4-Mtayleb-1	المتن	المنطقة ٢: بيروت وجبل لبنان	21.82
14	L4-Zouk Al Khrab-6n	المتن	المنطقة ٢: بيروت وجبل لبنان	21.74
15	L4-Zouk Al Khrab-5	المتن	المنطقة ٢: بيروت وجبل لبنان	21.49
16	M9-Maqne-07n	بعلبك	المنطقة ٤: البقاع وبعلبك/الهرمل	21.39
17	J4-Aaytat-0	عاليه	المنطقة ٢: بيروت وجبل لبنان	21.39
18	O6-Tartej-0n	جبيل	المنطقة ٢: بيروت وجبل لبنان	21.37
19	L5- KfarTay- 1n	المتن	المنطقة ٢: بيروت وجبل لبنان	21.34
20	N10-Rasm Al Hadath-00n	بعلبك	المنطقة ٤: البقاع وبعلبك/الهرمل	21.30

خيارات إعادة التّأهيل وتقديرات تكاليفها

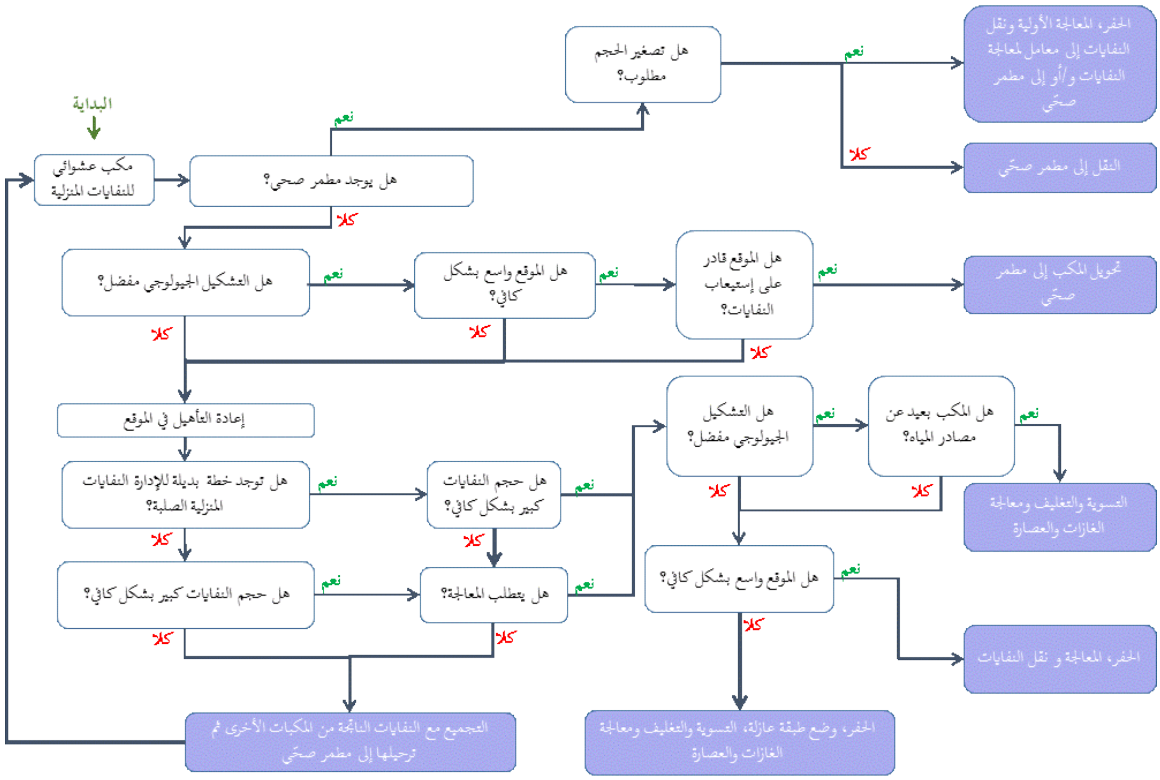
تختلف إجراءات إعادة التّأهيل من مكبّ لآخر استناداً إلى مدى صعوبة الحالة وتوافر الحلول البديلة لإدارة النّفايات.

تمّ أخذ ٧ خيارات لإعادة تأهيل مكبّات النّفايات المنزلية الصّلبة بالاعتبار، وهي :

- الحفر، المعالجة الأولية ونقل النفايات إلى معامل لمعالجة النفايات و/أو إلى مطمر صحّي؛
- النقل إلى مطمر صحّي؛
- تحويل المكب إلى مطمر صحّي؛
- التسوية والتغليف ومعالجة الغازات والعصارة؛

- الحفر، المعالجة و نقل النفايات؛
- الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة؛
- التجميع مع النفايات الناتجة من المكبات الأخرى ثم ترحيلها إلى مطمر صحّي.

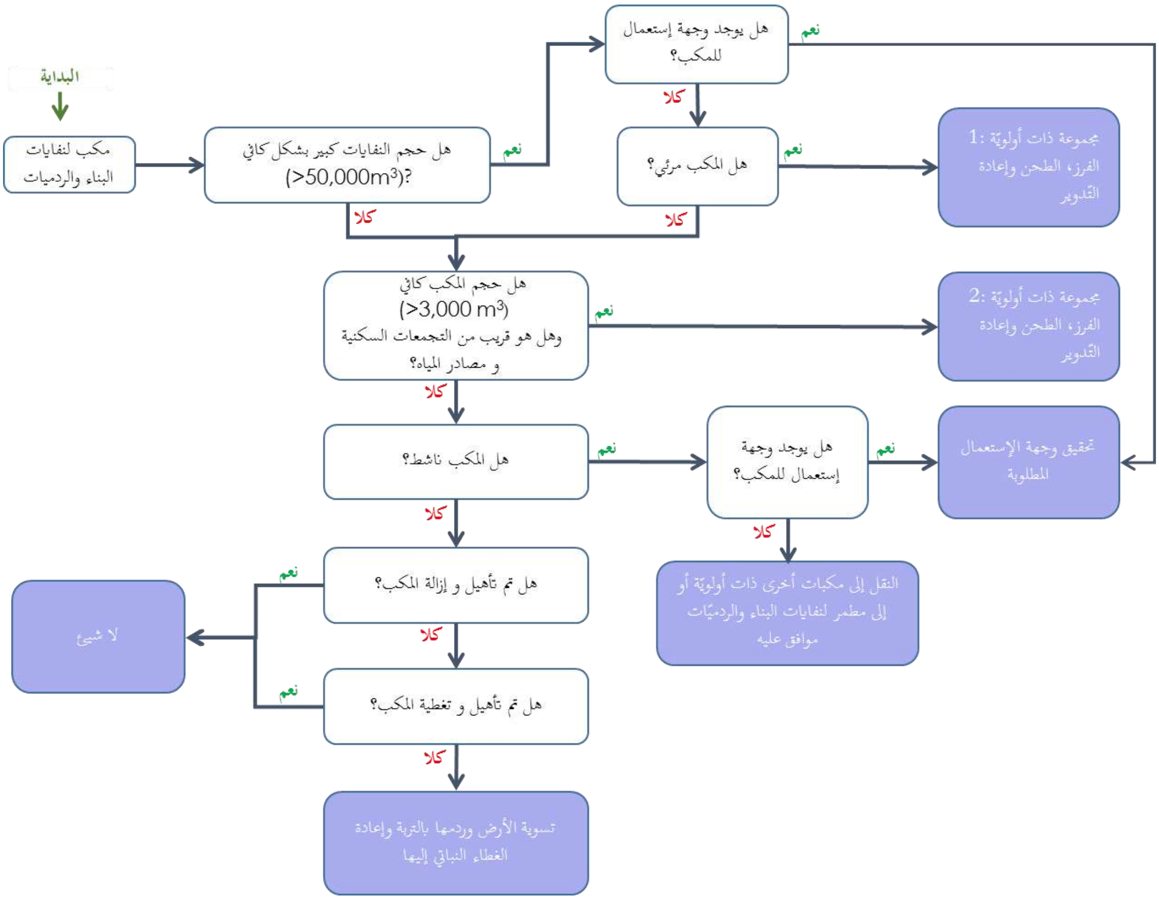
توفّر أداة قرار إعادة التّأهيل (Rehabilitation Decision Tool) منهجيّة لشرح حلول المعالجة البديلة التّي تستند إلى مؤشر الحساسية على المخاطر ومقارنتها. تستند هذه الأداة أيضاً إلى وحدة شجرة القرار. تمّ وضع شجرتي قرار لتحديد خيار إعادة التّأهيل الأكثر ملاءمة بالنّسبة لمكبّات النّفايات المنزليّة الصّلبة ومخلفات البناء والردم بناءً على أسئلة تكون أجاباتها بنعم أو لا كما في شجرتي القرار أدناه.



شجرة القرار العائدة لخيارات إعادة تأهيل مكبّات النّفايات المنزليّة الصّلبة

بالنّسبة لمكبّات نفايات البناء والردميات ، تمّ أخذ أربع إجراءات تصحيحيّة بالاعتبار:

- الفرز، الطحن وإعادة التدوير؛
- النقل إلى مكبات أخرى ذات أولويّة أو إلى مطمر لنفايات البناء والردميّات موافق عليه؛
- تسوية الأرض وردمها بالتربة وإعادة الغطاء النباتي إليها؛
- تحقيق وجهة الإستعمال المطلوبة (توسيع الطريق، إنشاء حديقة، إلخ) في حال وجودها.



شجرة القرار العائدة لخيارات إعادة تأهيل مكبّات مخلفات البناء والهدم

يحدّد النّموذج تلقائيّاً خيار إعادة التّاهيل الأكثر ملاءمةً لكلّ مكبّ. غير أنّ المكبّات الـ٢٠ ذات الأولويّة تمّ منحها اهتماماً خاصّاً إذ قام خبير بوضع تقييم مفصّل لخيارات إعادة التّأهيل والتكاليف المرتبطة بها كما هو مبين في الجدول أدناه.

خطط إعادة تأهيل مكبّات النفايات المنزليّة الصّلبة الـ٢٠ ذات الأولويّة

المرتبة	تعريف المكبّ	خطّة إعادة التّاهيل المقترحة	الكلفة (USD)
1	R6-Tripoli-0	التسوية والتغليف ومعالجة الغازات والعصارة	6,557,287
2	N5-Hbaline-0	الخيار ١ –التسوية والتغليف ومعالجة الغازات والعصارة	2,931,075
		الخيار ٢– التّحويل إلى مطمر صحّي	6,946,524
3	R7-Adweh-0	تسوية الأرض وطمرها ومعالجة الغازات والعصارة	1,612,762
4	P5-Batroun-0	الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	1,039,300
5	T9-Srar-0	التّحويل إلى مطمر صحّي	6,732,524
6	J6-Qabb Elias-00	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	2,163,875
		الخيار ٢– النّقل إلى مطمر صحّي	1,613,750
7	C1-Deir Qanoun El-Aain-01	التّحويل إلى مطمر صحّي	4,748,516
8	L5-Balloune-3	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	336,500
		الخيار ٢– الضمّ إلى مكبّ آخر النّقل إلى مطمر صحّي	164,500
9	L5-Beit Chabab-1n	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	240,250
		الخيار ٢– الضمّ إلى مكبّ آخر والنّقل إلى مطمر صحّي	176,500
10	J7-Barr Elias-00	الخيار ١– الحفر والمعالجة والنّقل	3,758,262
		الخيار ٢– التسوية والتغليف ومعالجة الغازات والعصارة	1,765,675
11	R9-Fnaydek-0	الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	895,875
12	F2-Sarafand-01	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	443,625
		الخيار ٢– التجميع مع النفايات الناتجة من المكبات الأخرى ثم ترحيلها إلى مطمر صحّي	375,250
13	G4-Jezzine-00	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	334,750
		الخيار ٢– التجميع مع النفايات الناتجة من المكبات الأخرى ثم ترحيلها إلى مطمر صحّي	193,000
14	D2-Abbesye-03	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	435,000
		الخيار ٢– التجميع مع النفايات الناتجة من المكبات الأخرى ثم ترحيلها إلى مطمر صحّي	398,750
15	M9-Baalback-02	الحفر، وضع طبقة عازلة، تسوية الأرض وطمرها ومعالجة الغازات والعصارة	1,147,000
16	R9-Mishmesh-0	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	150,250
		الخيار ٢– التجميع مع النفايات الناتجة من المكبات الأخرى ثم ترحيلها إلى مطمر صحّي	74,500
17	G2-Ghaziye-00	الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	457,200
18	E3-Kfour En-Nabatieh-00		678,750
19	G2-Saida-2n	التسوية والتغليف ومعالجة الغازات والعصارة	359,250
20	R7-Kfar Chellane-0	الخيار ١– الحفر، وضع طبقة عازلة، التسوية والتغليف ومعالجة الغازات والعصارة	225,310
		الخيار ٢– التجميع مع النفايات الناتجة من المكبات الأخرى ثم ترحيلها إلى مطمر صحّي	133,375

معدّل الكلفة: 32,130,590 - 39,187,061

يتمّ عرض خطط إعادة التّأهيل المقترحة وتكاليفها بالنّسبة لتأهيل المكبّات الـ٢٠ ذات الأولويّة في الجدول أدناه.

خطط إعادة تأهيل مطامر لمواد البناء والرّدميّات الـ٢٠ ذات الأولويّة

المرتبة	تعريف المكبّ	خطّة إعادة التّاهيل المقترحة	الكلفة (USD)
1	Q7-Morh Kfarsghab-2	تحقيق وجهة الإستعمال المطلوبة (بناء كنيسة)	40,267
2	R7-Deir Ammar-2	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	422,550
3	K5-Broumana-1	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	839,960
4	K4-Beit Meri-00	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	939,750
5	P6-Kosba-2	تحقيق وجهة الإستعمال المطلوبة (بناء موقف)	109,433
6	L5-Balloune-2	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	362,900
7	L5-Qlaiaat-3	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	553,850
8	I5-Maaser Ech Chouf-0	مجموعة ذات أولويّة ٢: الفرز، الطحن وإعادة التّدوير	102,440
9	L4-Dik Al Mahdi-0	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	243,600
10	K5-Ras El Maten-2n	تحقيق وجهة الإستعمال المطلوبة (بناء طريق جديدة)	147,000
11	L8-Chmestar-01	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	127,300
12	L5-Ain Er rihane-3	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	1,175,000
13	L4-Mtayleb-1	مجموعة ذات أولويّة ٢: الفرز، الطحن وإعادة التّدوير	57,185
14	L4-Zouk Al Khrab-6n	مجموعة ذات أولويّة ٢: الفرز، الطحن وإعادة التّدوير	64,650
15	L4-Zouk Al Khrab-5	مجموعة ذات أولويّة٢: الفرز، الطحن وإعادة التّدوير	65,650
16	M9-Maqne-07n	مجموعة ذات أولويّة١: الفرز، الطحن وإعادة التّدوير	155,625
17	J4-Aaytat-0	تحقيق وجهة الإستعمال المطلوبة (توسيع الأرض)	77,600
18	O6-Tartej-0n	تحقيق وجهة الإستعمال المطلوبة (تحويل المكان إلى حديقة)	22,800
19	L5-Kfar Tay-1n	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	686,084
20	N10-Rasm Al Hadath-00n	مجموعة ذات أولويّة ١: الفرز، الطحن وإعادة التّدوير	129,765
		الكلفة الكاملة	**6,323,409**

تقديرات كلفة إعادة التّأهيل

يبلغ معدّل الكلفة الإجماليّة لإعادة تأهيل مكبّات النّفايات المنزليّة الصّلبة الـ٢٠ ذات الأولوية **٣٥،٦٦٠،٠٠٠ مليون دولار أميركي**. فيما تقدّر كلفة إعادة تأهيل مكبّات النّفايات المنزليّة الصّلبة الأخرى بحوالي **٢٤،٥٥٠،٠٠٠ دولار أميركي**.

يبلغ معدّل الكلفة الإجماليّة لإعادة تأهيل مكبّات نفايات البناء والردميات الـ٢٠ ذات الأولوية **٦،٣٢٤،٠٠٠ مليون دولار أميركي** فيما تقدّر كلفة إعادة تأهيل المكبّات الأخرى بحوالي **٧،٤٥٥،٠٠٠ دولار أميركي**.

RESUME

INTRODUCTION

En 2011, le ministère de l'Environnement (MdE) et le Programme des Nations Unies pour le développement (PNUD), avec l'assistance technique de « Earth Link and Advanced Resources Development », s.l.l. (ELARD), ont préparé un Plan directeur pour la fermeture et la réhabilitation des décharges non-contrôlées au Liban.

Depuis, deux évènements majeurs ont déclenché la nécessité d'actualiser le Plan directeur de l'an 2011, à savoir:

- Le conflit armé en Syrie qui se poursuit depuis 2011 et qui a obligé plus d'un million de personnes à chercher refuge sur le territoire libanais; et
- La crise de collecte et d'élimination des déchets solides qui a commencé en juillet 2015 avec la fermeture du site d'enfouissement de Naameh qui servait les régions les plus densément peuplées de Beyrouth et du Mont Liban (à l'exception du Caza de Jbeil).

Le Plan directeur actualisé pour la fermeture et la réhabilitation des décharges non-contrôlées au Liban de 2016 vise à:

- Comprendre l'état, le modèle et les dynamiques de la mise en décharge non-contrôlée des déchets depuis la dernière enquête effectuée dans le cadre du Plan directeur de 2011, en tenant compte des deux événements mentionnés ci-dessus;
- Identifier les enjeux principaux;
- Identifier les décharges de haute priorité pour les plans de fermeture et de réhabilitation à la lumière des impacts potentiels sur l'environnement, selon un modèle de priorisation élaboré à cet effet; et
- Proposer des mesures de réhabilitation pour chaque décharge basées sur un outil de décision de réhabilitation (ODR).

Ce rapport-ci décrit la méthodologie suivie pour le Plan directeur actualisé et résume ses conclusions principales et procédures dans trois volumes, comme indiqué ci-dessous.

Éléments du Plan Directeur Actualisé

Volume	Titre
Volume A	**Plan directeur actualisé pour la fermeture et la réhabilitation des décharges non-contrôlées au Liban**
Volume B	**Evaluation environnementale des décharges non-contrôlées**
Volume C	**Note d'information sur l'évaluation des coûts des décharges en 2016**

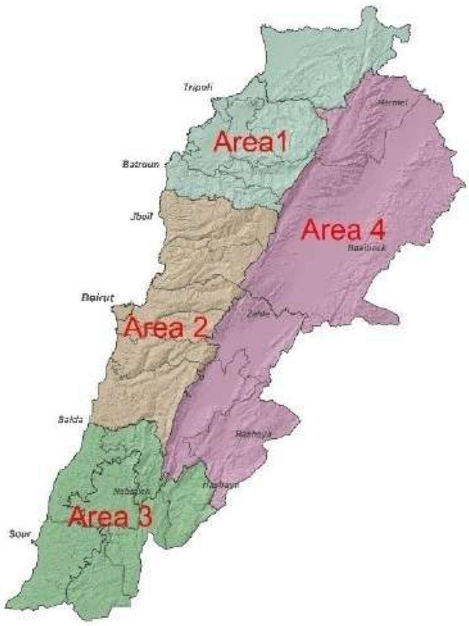
Ce résumé couvre le volume A: Plan directeur actualisé pour la fermeture et la réhabilitation des décharges non-contrôlées au Liban.

METHODOLOGIE DE L'ENQUETE

Les décharges étudiées sont divisées en deux types: celles des déchets solides municipaux (DSM) et celles des déchets de construction et de démolition (DCD). En outre, chaque type de décharge est également divisé en deux groupes principaux: décharge opérationnelle et décharge non-opérationnelle. Les définitions suivantes ont généralement été adoptées tout au long de l'enquête:

- Décharge de déchets solides municipaux (DSM): une décharge contenant plus de 85% de DSM. Cela pourrait inclure, en plus des DSM, les déchets hospitaliers, les DCD et les déchets industriels.
- Décharge de déchets de construction et de démolition (DCD): une décharge contenant plus de 85% de DCD. Il s'agit notamment des blocailles, de déchets verts, et de débris de construction et de démolition.

L'enquête sur le terrain, qui constitue le pilier du Plan directeur actualisé, a été menée entre juillet 2016 et mars 2017. Le territoire libanais a été divisé en quatre zones d'enquête:

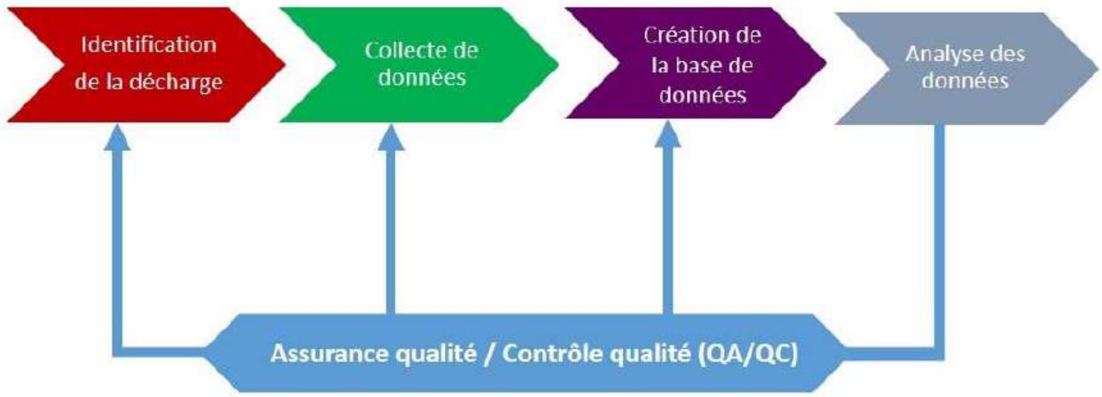


1. Zone 1: Akkar et Liban Nord
2. Zone 2: Beyrouth et Mont Liban
3. Zone 3: Nabatieh et Liban Sud
4. Zone 4: Bekaa et Baalback / Hermel

Distribution Géographique des Equipes de l'Enquête

Le processus de mise en œuvre de l'enquête a commencé avec l'identification des décharges suivie de la collecte de données sur le terrain par les enquêteurs. Un formulaire de caractérisation du site (FCS) a été préparé et converti en une application mobile pour faciliter le travail sur le terrain. Le FCS comprend les données in situ qui permettent de recueillir des informations sur la décharge même et la municipalité concernée.

Les données collectées ont ensuite été enregistrées sur l'application mobile qui stocke et transfère automatiquement les données au serveur d'ELARD. Après l'assurance de la qualité/contrôle qualité (QA / QC) des données rapportées et leur analyse préliminaire, des visites de suivi ont été effectuées pour combler les lacunes et vérifier les résultats de la base de données finale.



Processus de Mise en Œuvre de l'Enquête

Les enquêteurs ont rencontré plusieurs contraintes durant la phase de collecte de données, dont:

- La complexité des activités de gestion des déchets solides qui sont aléatoires et non organisées. Le suivi de ces activités est difficile et peut être inexact puisque les informations ne sont pas officiellement enregistrées.
- La méthodologie utilisée pour estimer les volumes des décharges dans les enquêtes des années 2011 et 2016 a été limitée aux approximations visuelles qui ont conduit à des valeurs indicatives plutôt qu'à des estimations précises.
- L'inaccessibilité à certaines décharges due à la sécurité et aux routes d'accès.
- Les données fournies par les municipalités n'étaient pas toujours fiables. Plusieurs défis ont été rencontrés tout au long de l'enquête, y compris le manque de transparence, la réticence à coopérer et, dans certains cas, les nouveaux conseils municipaux élus en printemps 2016 n'avaient pas de données sur le passé des décharges dans leur région.

RESULTATS ET ANALYSE DE L'ENQUETE 2016

Le nombre total de décharges identifiées dans l'enquête de l'an 2016 était de 941 contre 670 dans l'enquête de l'an 2011.

Décharges de déchets solides municipaux

Au cours de l'enquête de 2011, 504 décharges de DSM ont été identifiées au Liban, dont 76% (382) étaient opérationnelles et 24% (122) non- opérationnelles. Le volume de DSM dans les décharges opérationnelles était de 2.675.548 m³ alors que dans les décharges non-opérationnelles il était de 774 523 m³. Dans l'enquête de 2016, 617 décharges de DSM ont été identifiées. Environ 55% (341) des décharges DSM ont été identifiées comme opérationnelles et 43% (263) en tant que décharges DSM non-opérationnelles. Sur les décharges DSM étudiées, 2% (13) étaient inaccessibles.

À l'instar des résultats de l'enquête de l'an 2011, le plus grand nombre de décharges opérationnelles dans l'enquête de 2016 est présent dans la 'Zone 3: Nabatieh et Liban Sud' qui représentait environ 37% (127) des décharges opérationnelles, suivie de la 'Zone 4: Bekaa et Baalback / Hermel' avec 28% (96).

Les plus grandes décharges de DSM en termes de volume de déchets dans les décharges opérationnelles sont situées dans des zones qui ont connu une baisse du nombre de décharges opérationnelles. Les activités de déversement ouvert dans ces zones sont centralisées dans des décharges contrôlées telles que la décharge contrôlée de Tripoli, la décharge de Srar à Akkar, les décharges de Qabb Elias et de Barr Elias à Zahle, ce qui explique la baisse du nombre de décharges de DSM opérationnelles, mais une augmentation significative du volume comparé à l'enquête de l'an 2011 dans les zones 1 et 4.

'Zone 2: Beyrouth et Mont Liban', qui a connu les nombre et volume les plus bas de décharges de DSM opérationnelles et non-opérationnelles dans l'enquête de l'an 2011, a connu une augmentation de 124% du nombre de décharges visitées dans l'enquête de 2016 par rapport à celle de 2011 avec 86% de cette augmentation relative aux décharges opérationnelles. Ce changement est principalement attribué à la crise de collecte et d'élimination des déchets solides de l'an 2015 qui a forcé les municipalités dans ces zones à gérer leurs propres déchets, alors qu'elles n'étaient pas préparées et n'avaient pas de solutions alternatives appropriées hormis les décharges non-contrôlées. Le plus grand nombre de décharges non-opérationnelles dans l'enquête de 2016 se trouve dans la 'Zone 3: Nabatieh et Liban Sud': 110 décharges non-opérationnelles, soit 42% du total national des décharges de DSM non-opérationnelles.

Etat des Décharges de DSM en 2016 versus l'Enquête de l'An 2011 au Liban

Décharge de DSM	Opérationnelle		Non-Opérationnelle		Inaccessible		Total	
	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
Tout le Liban								
2011	**382**	**2.675.548**	**122**	**774.523**	**-**	**-**	**504**	**3.450.073**
2016	**341**	**4.588.218**	**263**	**1.135.603**	**13**	**19.486**	**617**	**5.743.307**
Zone 1: Akkar et Liban Nord								
2011	61	606.007	25	208.088	-	-	**86**	**814.095**
2016	38	2.246.797	46	182.295	3	5.280	**87**	**2.434.372**
Zone 2: Beyrouth et Mont Liban								
2011	43	453.976	16	39.175	-	-	**59**	**493.151**
2016	80	767.846	46	43.885	2	2.400	**132**	**814.131**
Zone 3: Nabatieh et Liban Sud								
2011	168	947.002	52	120.955	-	-	**220**	**1.067.957**
2016	127	637.590	110	480.498	1	41	**238**	**1.118.129**
Zone 4: Bekaa et Baalback/Hermel								
2011	110	668.565	29	406.305	-	-	**139**	**1.074.870**
2016	96	935.985	57	428.925	7	11.765	**160**	**1.376.675**

Déchets de construction et de démolition DCD

En 2011, 166 décharges de DCD ont été identifiées, dont 80% (132) étaient opérationnelles et 20% (34) non- opérationnelles. Le volume de DCD dans les décharges opérationnelles était de 1.468.528 m³, tandis que celui de décharges non-opérationnelles était de 262.653 m³. Le nombre le plus élevé de décharges opérationnelles était dans la 'Zone 2: Beyrouth et Mont Liban', qui représentait environ 54% (71) des décharges opérationnelles, suivie de la 'Zone 3: Nabatieh et Liban Sud' avec 26% (34).

En 2016, un total de 324 décharges de DCD a été identifié. Environ 55% (178) sont opérationnelles et 45% (145) sont non-opérationnelles. En tout, il y a une augmentation du nombre et du volume de DCD dans les décharges au Liban. Le plus grand nombre de décharges opérationnelles se trouve dans la 'Zone 3: Nabatieh et Liban Sud', qui compte environ 39% (69) des décharges opérationnelles, suivie de la 'Zone 4: Bekaa et Baalback/Hermel' avec 25% (45).

Les volumes de DCD les plus élevés dans les décharges opérationnelles en 2011 et 2016 ont été trouvés dans la 'Zone 2: Beyrouth et Mont Liban', suivie de la 'Zone 4: Bekaa et Baalback/Hermel'. Les volumes de DCD les plus élevés dans les décharges non-opérationnelles en 2011 et 2016 ont été trouvés dans la 'Zone 2: Beyrouth et Mont Liban'.

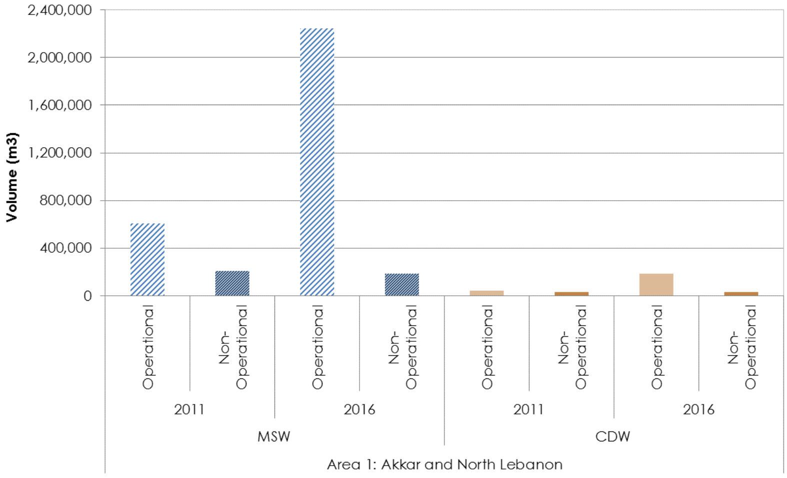
Etat des Décharges de DCD en 2016 versus l'Enquête de l'An 2011 au Liban

Décharge de DSM	Opérationnelle		Non-Opérationnelle		Inaccessible		Total	
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
Tout le Liban								
2011	**132**	**1.468.528**	**34**	**262.653**	**-**	**-**	**166**	**1.731.181**
2016	**178**	**964.223**	**145**	**1.181.313**	**1**	**15.000**	**324**	**2.160.536**
Zone 1: Akkar et Liban Nord								
2011	26	42.968	7	27.960	-	-	**33**	**70.928**
2016	29	183.160	18	29.006	-	-	**47**	**212.166**
Zone 2: Beyrouth et Mont Liban								
2011	71	1.021.113	18	203.285	-	-	**89**	**1.224.398**
2016	35	419.880	88	1.116.910	-	-	**124**	**1.551.790**
Zone 3: Nabatieh et Liban Sud								
2011	34	179.447	5	20.708	-	-	**39**	**200.155**
2016	69	159.933	35	32.897	-	-	**104**	**192.830**
Zone 4: Bekaa et Baalback/Hermel								
2011	1	225.000	4	10.700	-	-	**5**	**235.700**
2016	45	201.250	4	2.500	-	-	**49**	**203.750**

Résumé des résultats par zone

Zone 1: Akkar et Liban Nord

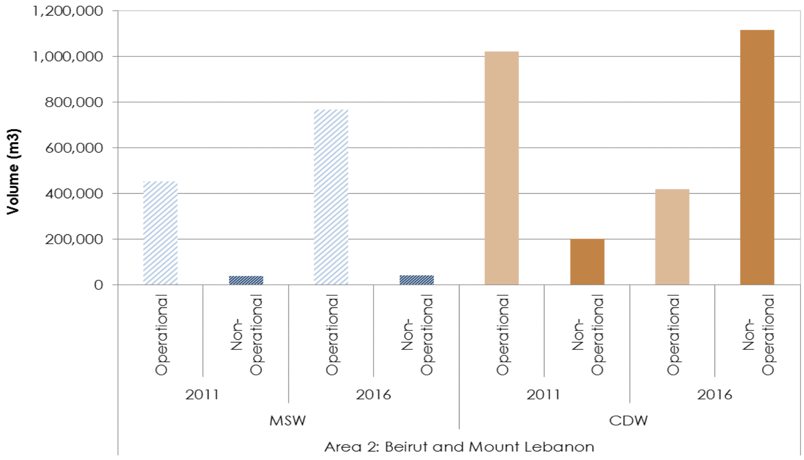
Il y a une augmentation générale du volume des décharges opérationnelles de DSM et DCD dans la 'Zone 1: Akkar et Liban Nord' depuis l'enquête de l'an 2011, comme démontré dans l'illustration ci-dessous. Un volume total de 2.434.372 m³ de DSM déversé et 212.166 m³ de DCD déversé a été estimé pendant l'enquête de 2016. Étant donné qu'aucune initiative majeure pour la gestion des DSM a été mise en œuvre au Liban Nord au cours des dernières années, ainsi que l'augmentation du nombre de déplacés syriens, cette augmentation était prévue.



Volumes des Décharges en 2011 et 2016 dans la Zone 1

Zone 2: Beyrouth et Mont Liban

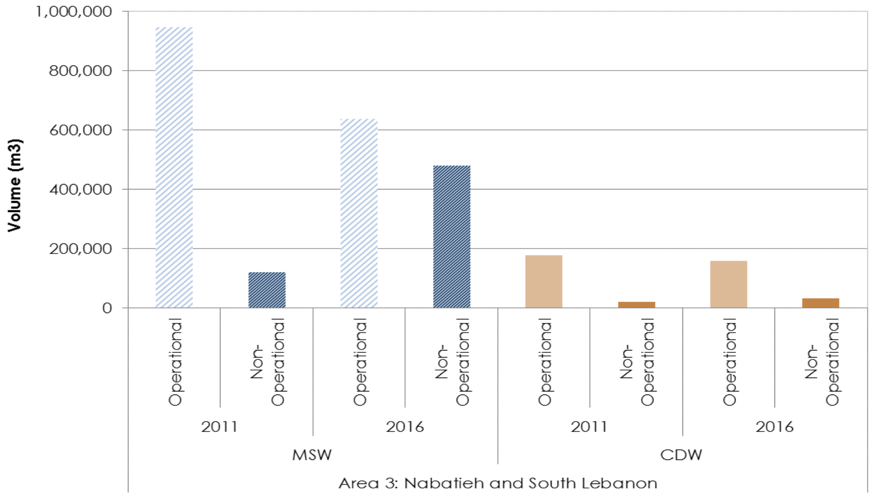
Une augmentation du volume de DSM dans les décharges opérationnelles de la 'Zone 2: Beyrouth et Mont Liban' a été observée, comme démontré dans l'illustration ci-dessous. D'autre part, on observe une diminution significative du volume de DCD dans les décharges opérationnelles, ce qui se traduit par l'augmentation du nombre de décharges de DCD non-opérationnelles. Un volume total de 814.131 m³ de DSM déversé et 1.551.790 m³ de DCD déversé a été estimé dans l'enquête de 2016. Cette augmentation des décharges non-contrôlées dans la 'Zone 2: Beyrouth et Mont Liban' était évidente principalement aux Cazas du Chouf et Aley, ce qui était prévu compte tenu de la crise des déchets solides en 2015, ainsi que de l'augmentation du nombre de déplacés syriens.



Volumes des Décharges en 2011 et 2016 dans la Zone 2

Zone 3: Nabatieh et Liban Sud

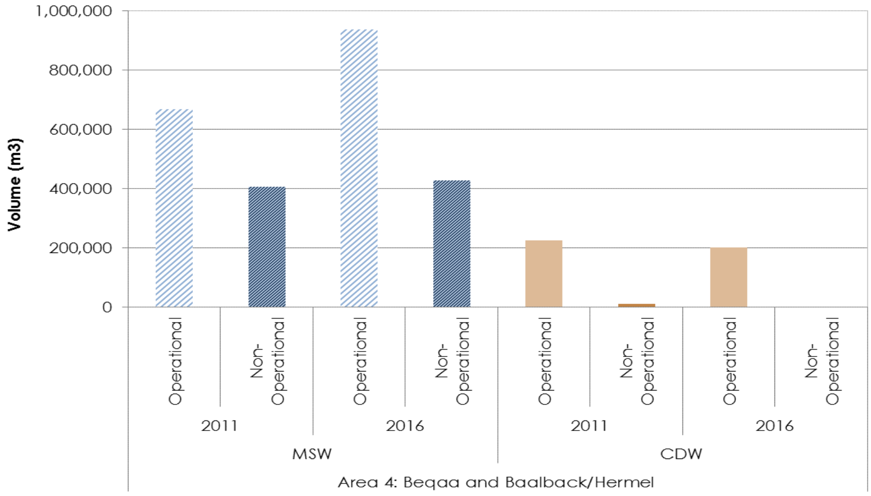
Il y a une diminution significative du volume de déchets de DSM dans les décharges opérationnelles de la 'Zone 3: Nabatieh et Liban Sud' depuis l'enquête de l'an 2011. Cette diminution est associée à une augmentation importante du volume de DSM dans les décharges non-opérationnelles (environ 0,48 million de m³), comme indiqué dans la figure ci-dessous. Un volume total de 1.118.129 m³ de DSM et 192.830 m³ de DCD a été estimé dans les décharges de la Zone 3. Le taux relativement élevé d'activités de brûlage à l'air libre au Sud (environ 35% des décharges au Sud subissent du brûlage à l'air libre), en plus de la présence significative d'installations de gestion de déchets solides contribuent à la réduction générale du volume de déchets dans les décharges de la 'Zone 3: Nabatieh et Liban Sud'.



Volumes des Décharges en 2011 et 2016 dans la Zone 3

Zone 4: Bekaa et Baalback / Hermel

Il y a une augmentation significative du volume de DSM dans les décharges opérationnelles dans la 'Zone 4: Bekaa et Baalback/Hermel', comme indiqué dans la figure ci-dessous. Un volume total de 1.376.675 m³ de DSM déversé a été estimé dans l'enquête de 2016. Il y a également une augmentation significative du nombre de décharges opérationnelles de DCD (45) et une augmentation nette de leur volume, en tenant compte de la décharge de Chmestar qui a été partiellement réhabilitée depuis 2011. Un volume total de 203.750 m³ de DCD déversé a été estimé pendant l'enquête de l'an 2016. Cette augmentation est attribuée à deux raisons principales: la forte présence de déplacés syriens ainsi que les établissements informels et le transfert informel des déchets provenant d'autres zones pour être éliminés à la Bekaa.



Volumes des Décharges en 2011 et 2016 dans la Zone 4

MODELE DE PRIORISATION

Un outil de décision de priorisation (ODP) a été développé afin de prioriser les décharges à réhabiliter en fonction d'un indice de sensibilité au risque (ISR). Deux modèles différents, ayant différentes caractéristiques, ont été développés pour traiter les décharges de DSM et de DCD séparément.

Dix (10) attributs ont été sélectionnés pour la priorisation des décharges de DSM et huit (8) pour la priorisation des décharges de DCD. Chacun de ces attributs a un « poids » spécifique qui reflète l'importance relative de leur impact environnemental associé. Les poids varient entre 1 et 10 pour les décharges de DSM, et entre 1 et 8 pour les décharges de DCD. Chaque attribut reçoit ensuite une "note de sensibilité" entre 0 et 1 qui est divisée en 4 quarts ou classes comme indiqué dans les tableaux suivants.

Tableau d'Attributs pour les Décharges de DSM

Attribut		Facteur de pondération	0,0-0,25	0,25-0,5	0,5-0,75	0,75-1,0
Volume de déchets au site (m^3)		10	<10.000	10.000-50.000	50.000-100.000	>100.000
Géologie	Lithologie (70%)	9	Teneur en Argile considérable à élevée	Contenu en Argile et système de fissures	Porosité secondaire, différentes formes de karstification, et présence de quelques intercalations de Marne	Porosité secondaire (fissures) en roche carbonatée, plus karstification élevée
	Failles et densité des linéaments (segment/km^2) (30%)		<10	10-15	15-20	> 20
Hydrologie	Distance de la ligne de drainage (m) (80%)	8	>200	200-100	100-50	<50
	Distance des sources (m) (20%)		>200	200-150	150-100	<100
Distance des zones urbaines (m)		7	>1.000	1.000- 500	500-250	<250
Quantité de déchets actuellement mis en décharge sur le site (t/jour)		6	<10	10-50	50-100	>100
Disponibilité d'alternatives		5	Pas d'alternatives	Solution alternative et financement sous considération	Alternative en cours de construction	Alternative opérationnelle
Brûlage des déchets à feu ouvert		4	Pratiqué		Non pratiqué	
Visibilité		3	Non visible		Visible	
Profondeur d'enfouissement des déchets (m)		2	<1	1-5	5-10	>10
Durée d'enfouissement (années)		1	<10	10-20	20-30	>30

Tableau d'Attributs pour les Décharges de DCD

Attribut		Facteur de pondération	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
Volume de déchets au site (m^3)		8	<3.000	3.000-10.000	10.000-50.000	>50.000
Visibilité		7	Non visible		Visible	
Hydrologie	Distance de la ligne de drainage (m) (80%)	6	>200	200-100	100-50	<50
	Distance des sources (m) (20%)		>200	200-150	150-100	<100
Distance des zones urbaines		5	>1.000	1.000-500	500-250	<250
Disponibilité d'alternatives/ Usage prévu		4	Pas d'alternatives	Solution alternative et financement sous considération	Alternative en cours de construction	Alternative opérationnelle
Statut (Non-opérationnelle/ Opérationnelle)		3	Enlevée	Couverte	Non opérationnelle	Opérationnelle
Géologie	Lithologie (70%)	2	Teneur en Argile considérable à élevée	Contenu en Argile et système de fissures	Porosité secondaire, différents formes de karstification, et présence de quelques intercalations de Marne	Porosité secondaire (fissures) en roche carbonatée, plus karstification élevée
	Failles et densité des linéaments (segment/km^2) (30%)		<10	10-15	15-20	>20
Durée d'enfouissement (années)		1	<10	10-20	20-30	>30

L'ISR a été calculé pour chaque décharge en additionnant tous les attributs, après avoir multiplié chaque note de sensibilité (classe) par son poids respectif. Une analyse de sensibilité a été testée sur l'ODP pour vérifier et confirmer sa validité. Le modèle s'est avéré très stable.

Un site avec un ISR élevé indique des risques élevés sur l'environnement, la nécessité d'une intervention urgente. À l'inverse, lorsque l'ISR total de la décharge est bas, la priorité de réhabilitation est plus basse et moins urgente. Les tableaux suivants présentent les gammes ISR et le nombre de décharges situées dans chaque catégorie.

Nombre de Décharges par Gamme RSI

Gamme ISR	Nombre de Décharges de DSM
> 30	10
25 - 30	69
20 -25	245
15 - 20	248
< 15	45
Total	**617**

Gamme ISR	Nombre de Décharges de DCD
> 20	29
18 - 20	69
14 -18	143
10 -14	75
< 10	8
Total	**324**

Bien que l'ISR ait été calculé pour toutes les décharges étudiées, seules les 20 premières sont présentées ici. Ces 20 décharges "prioritaires":

- Forment un volume agrégé qui représente respectivement 66% et 35% du volume total de déchets dans les décharges de DSM et DCD;
- Couvrent toutes les décharges recensées dans la première gamme de priorités pour les décharges de DSM et 69% pour les décharges de DCD.

Les 20 décharges prioritaires pour de DSM et DCD sont présentées dans les tableaux suivants.

Les 20 Décharges Prioritaires de DSM

Classement	Décharge	Caza	Zone	ISR
1	R6-Tripoli-0	Tripoli	Zone 1: Akkar et Liban Nord	40,73
2	N5-Hbaline-0	Jbeil	Zone 2: Beyrouth et Mont Liban	40,31
3	R7-Adweh-0	Minieh-Dannieh	Zone 1: Akkar et Liban Nord	34,76
4	P5-Batroun-0	Batroun	Zone 1: Akkar et Liban Nord	34,59
5	T9-Srar-0	Akkar	Zone 1: Akkar et Liban Nord	34,27
6	J6-Qabb Elias-00	Zahle	Zone 4: Bekaa et Baalback/Hermel	32,50
7	C1-Deir Qanoun El-Aain-01	Sour	Zone 3: Nabatieh et Liban Sud	31,42
8	L5-Balloune-3	Kesrouane	Zone 2: Beyrouth et Mont Liban	30,32
9	L5-Beit Chabab-1n	Maten	Zone 2: Beyrouth et Mont Liban	30,20
10	J7-Barr Elias-00	Zahle	Zone 4: Bekaa et Baalback/Hermel	30,15
11	R9-Fnaydek-0	Akkar	Zone 1: Akkar et Liban Nord	29,83
12	F2-Sarafand-01	Saida	Zone 3: Nabatieh et Liban Sud	29,64
13	G4-Jezzine-00	Jezzine	Zone 3: Nabatieh et Liban Sud	29,03
14	D2-Abbesye-03	Sour	Zone 3: Nabatieh et Liban Sud	28,96
15	M9-Baalback-02	Baalback	Zone 4: Bekaa et Baalback/Hermel	28,90
16	R9-Mishmesh-0	Akkar	Zone 1: Akkar et Liban Nord	28,39
17	G2-Ghaziye-00	Saida	Zone 3: Nabatieh et Liban Sud	28,35
18	E3-Kfour En-Nabatieh-00	Nabatieh	Zone 3: Nabatieh et Liban Sud	28,13
19	G2-Saida-1n	Saida	Zone 3: Nabatieh et Liban Sud	28,08
20	R7-Kfar Chellane-0	Minieh-Dannieh	Zone 1: Akkar et Liban Nord	28,05

Les 20 Décharges Prioritaires de DCD

Classement	Décharge	Caza	Zone	ISR
1	Q7-Morh Kfarsghab-2	Zgharta	Zone 1: Akkar et Liban Nord	23,53
2	R7-Deir Ammar-2	Minieh-Dannieh	Zone 1: Akkar et Liban Nord	23,53
3	K5 - Broummana -1n	Maten	Zone 2: Beyrouth et Mont Liban	23,48
4	K4-Beit Meri-00	Maten	Zone 2: Beyrouth et Mont Liban	23,21
5	P6-Kosba-2	Koura	Zone 1: Akkar et Liban Nord	23,19
6	L5-Balloune-2	Kesrouane	Zone 2: Beyrouth et Mont Liban	23,16
7	L5-Qlaiaat-3	Kesrouane	Zone 2: Beyrouth et Mont Liban	22,85
8	I5-Maaser Ech Chouf-0	Chouf	Zone 2: Beyrouth et Mont Liban	22,59
9	L4-Dik Al-Mahdi-0	Maten	Zone 2: Beyrouth et Mont Liban	22,51
10	K5- Ras El Maten-2n	Maten	Zone 2: Beyrouth et Mont Liban	22,50
11	L8-Chmestar-01	Baalback	Zone 4: Bekaa et Baalback/Hermel	22,15
12	L5-Aain Er-Rihane-3	Kesrouane	Zone 2: Beyrouth et Mont Liban	22,08
13	L4-Mtayleb-1	Maten	Zone 2: Beyrouth et Mont Liban	21,82
14	L4-Zouk Al Khrab-6n	Maten	Zone 2: Beyrouth et Mont Liban	21,74
15	L4-Zouk Al Khrab-5	Maten	Zone 2: Beyrouth et Mont Liban	21,49
16	M9-Maqne-07n	Baalback	Zone 4: Bekaa et Baalback/Hermel	21,39
17	J4-Aaytat-0	Aley	Zone 2: Beyrouth et Mont Liban	21,39
18	O6-Tartej-0n	Jbeil	Zone 2: Beyrouth et Mont Liban	21,37
19	L5- KfarTay- 1n	Maten	Zone 2: Beyrouth et Mont Liban	21,34
20	N10-Rasm Al Hadath-00n	Baalback	Zone 4: Bekaa et Baalback/Hermel	21,30

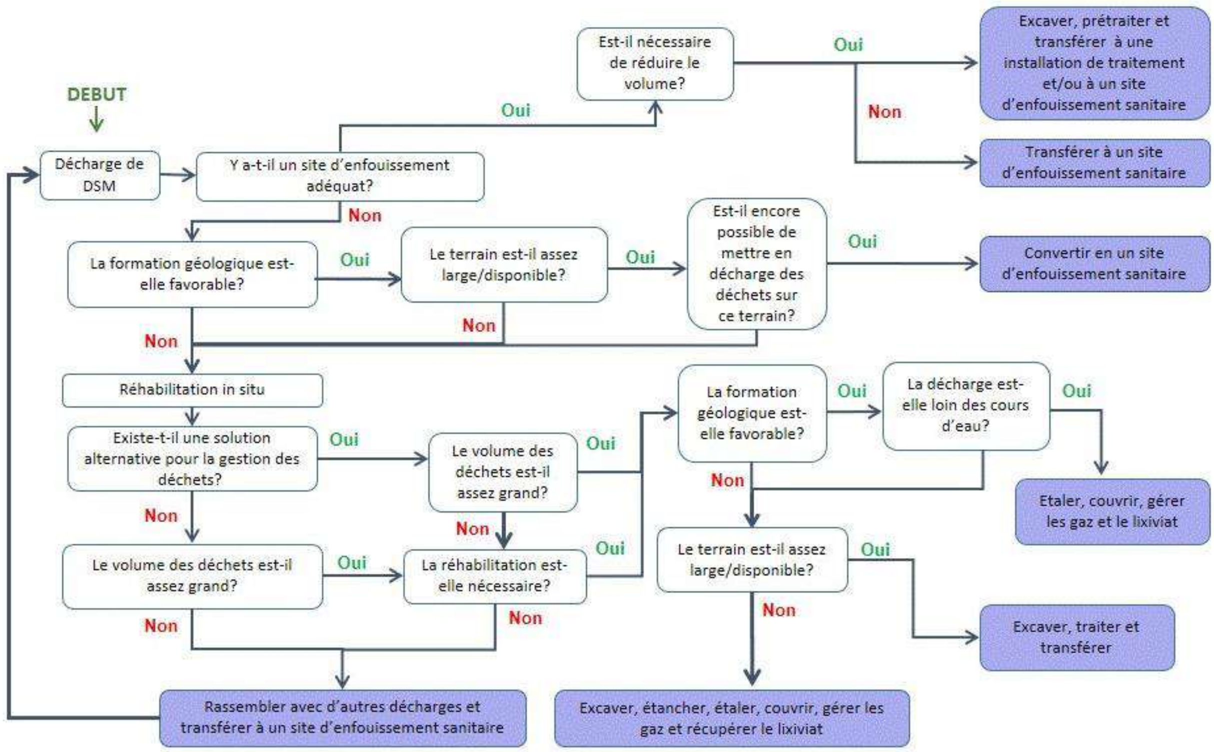
MESURES DE REHABILITATION ET ESTIMATIONS DE COUT

Les mesures de réhabilitation diffèrent d'une décharge à l'autre en fonction de la complexité du cas et de la disponibilité de solutions alternatives de gestion des déchets.

Sept mesures de réhabilitation ont été prises en compte pour les décharges de DSM. Celles-ci incluent:

- Excaver, prétraiter et transférer à une installation de traitement et/ou à un site d'enfouissement sanitaire;
- Transférer à un site d'enfouissement sanitaire;
- Convertir en un site d'enfouissement sanitaire;
- Etaler, couvrir, gérer les gaz et le lixiviat;
- Excaver, traiter et transférer;
- Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat; et
- Rassembler avec d'autres décharges et transférer à un site d'enfouissement sanitaire.

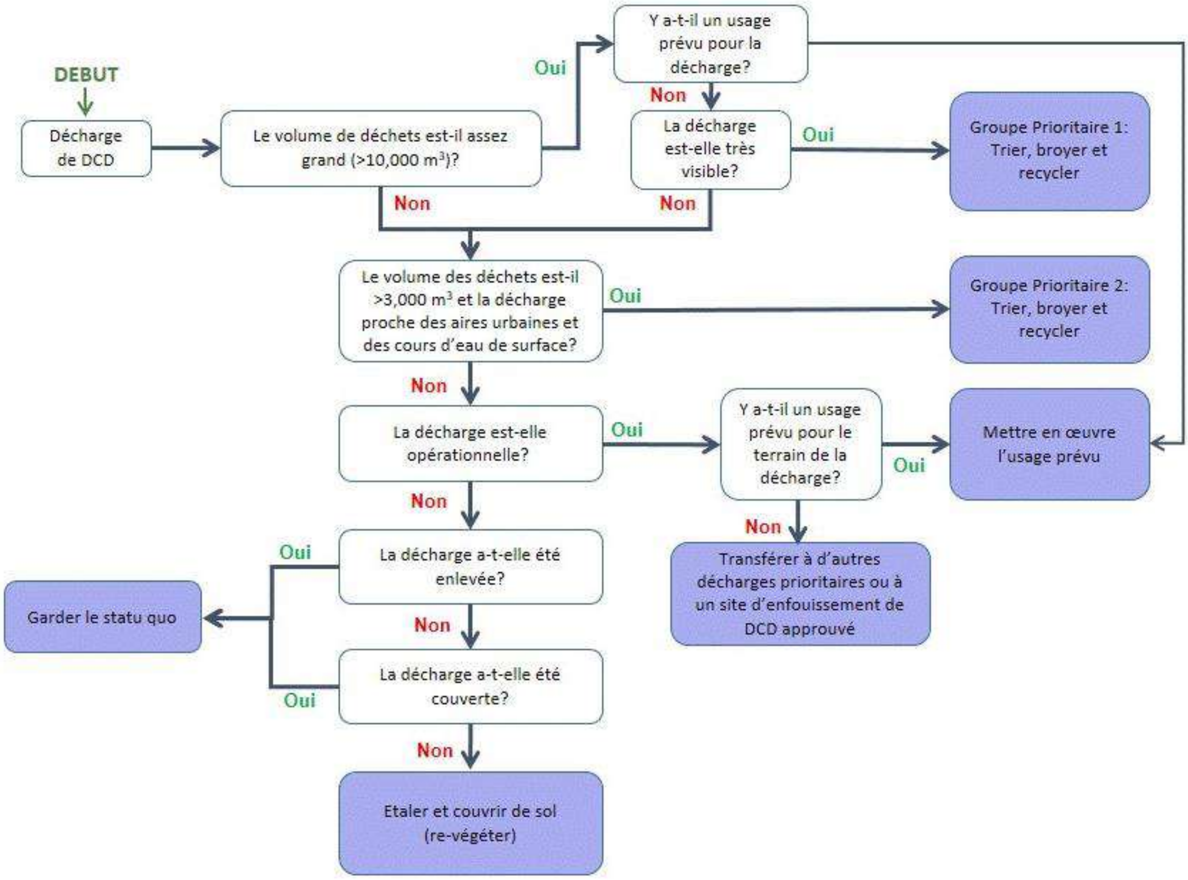
L'outil de décision de réhabilitation (ODR) fournit une méthodologie pour la description et la comparaison des scénarios de remédiation alternatifs reposant sur l'ISR. L'ODR est basé sur un module d'arbre de décision. Deux arbres de décision ont été développés pour identifier la mesure de réhabilitation la plus adaptée aux décharges de DSM et DCD en fonction d'un ensemble de questions Oui / Non selon les arbres de décision ci-dessous.



Arbre de Décision pour les Options de Réhabilitation des Décharges de DSM

Pour les décharges de DCD, quatre mesures de réhabilitation ont été prises en considération, comme suit:

- Trier, broyer et recycler;
- Transférer à d'autres décharges prioritaires ou à un site d'enfouissement de DCD approuvé;
- Etaler et couvrir de sol (re-végéter); et
- Mettre en œuvre l'usage prévu (prolongement de la route, parc, etc.), si disponible.



Arbre de décision pour les options de réhabilitation des décharges de DCD

Le modèle identifie automatiquement l'option de réhabilitation la plus appropriée pour chaque décharge. Cependant, les 20 premières décharges ont été spécialement prises en considération puisqu'une évaluation détaillée de leurs options de réhabilitation et leurs coûts associés a été effectuée par un expert. Les mesures de réhabilitation proposées et les coûts de réhabilitation pour les 20 décharges prioritaires sont ci-dessous.

Plan de Réhabilitation Proposé pour les 20 Décharges Prioritaires de DSM

Classement	Décharge	Mesure de Réhabilitation Proposée	Coût (USD)
1	R6-Tripoli-0	Etaler, couvrir, gérer les gaz et le lixiviat	6.557287
2	N5-Hbaline-0	Option 1 - Etaler, couvrir, gérer les gaz et le lixiviat	2.931.075
		Option 2 - Convertir en un site d'enfouissement sanitaire	6.946.524
3	R7-Adweh-0	Etaler, couvrir, gérer les gaz et le lixiviat	1.612.762
4	P5-Batroun-0	Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	1.039.300
5	T9-Srar-0	Convertir en un site d'enfouissement sanitaire	6.732.524
6	J6-Qabb Elias-00	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	2.163.875
		Option 2 – Transférer à un site d'enfouissement sanitaire	1.613.750
7	C1-Deir Qanoun El-Aain-01	Convertir en un site d'enfouissement sanitaire	4.748.516
8	L5-Balloune-3	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	336.500
		Option 2 - Grouper avec d'autres décharges et transférer à un site d'enfouissement sanitaire	164.500
9	L5-Beit Chabab-1n	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	240.250
		Option 2 - Rassembler avec d'autres décharges et transférer à un site d'enfouissement sanitaire	176.500
10	J7-Barr Elias-00	Option 1- Excaver, traiter et transférer	3.758.262
		Option 2 - Etaler, couvrir, gérer les gaz et le lixiviat	1.765.675
11	R9-Fnaydek-0	Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	895.875
12	F2-Sarafand-01	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	443.625
		Option 2 - Rassembler avec d'autres décharges et transférer à un site d'enfouissement sanitaire	375.250
13	G4-Jezzine-00	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	334.750
		Option 2 - Rassembler avec d'autres décharges et transférer à un site d'enfouissement sanitaire	193.000
14	D2-Abbesye-03	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	435.000
		Option 2 - Rassembler avec d'autres décharges et transférer à un site d'enfouissement sanitaire	398.750
15	M9-Baalback-02	Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	1.147.000
16	R9-Mishmesh-0	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	150.250
		Option 2 - Rassembler avec d'autres décharges et transférer à un site d'enfouissement sanitaire	74.500
17	G2-Ghaziye-00	Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	457.200
18	E3-Kfour En-Nabatieh-00	Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	678.750
19	G2-Saida-2n	Etaler, couvrir, gérer les gaz et le lixiviat	359.250
20	R7-Kfar Chellane-0	Option 1 - Excaver, étancher, étaler, couvrir, gérer les gaz et récupérer le lixiviat	225.310
		Option 2 - Rassembler avec d'autres décharges et transférer à un site d'enfouissement sanitaire	133.375
Coût: entre 32.130.590 et 39.187.061			

Les plans de réhabilitation proposés et les coûts de réhabilitation des 20 décharges DCD les meilleures classées sont présentés ci-dessous.

Plan de Réhabilitation Proposé pour les 20 Décharges Prioritaires de DCD

Classement	Décharge	Mesure de Réhabilitation Proposée	Coût (USD)
1	Q7-Morh Kfarsghab-2	Mettre en œuvre l'usage prévu (construire une église)	40.267
2	R7-Deir Ammar-2	Groupe Prioritaire 1: Trier, broyer et recycler	422.550
3	K5-Broumana-1	Groupe Prioritaire 1: Trier, broyer et recycler	839.960
4	K4-Beit Meri-00	Groupe Prioritaire 1: Trier. broyer et recycler	939.750
5	P6-Kosba-2	Mettre en œuvre l'usage prévu (Etablir un parking)	109.433
6	L5-Balloune-2	Groupe Prioritaire 1: Trier. broyer et recycler	362.900
7	L5-Qlaiaat-3	Groupe Prioritaire 1: Trier. broyer et recycler	553.850
8	I5-Maaser Ech Chouf-0	Groupe Prioritaire 2: Trier. broyer et recycler	102.440
9	L4-Dik Al Mahdi-0	Groupe Prioritaire 1: Trier. broyer et recycler	243.600
10	K5-Ras El Maten-2n	Mettre en œuvre l'usage prévu (construire une nouvelle route)	147.000
11	L8-Chmestar-01	Groupe Prioritaire 1: Trier. broyer et recycler	127.300
12	L5-Ain Er Rihane-3	Groupe Prioritaire 1: Trier. broyer et recycler	1.175.000
13	L4-Mtayleb-1	Groupe Prioritaire 2: Trier. broyer et recycler	57.185
14	L4-Zouk Al Khrab-6n	Groupe Prioritaire 2: Trier. broyer et recycler	64.650
15	L4-Zouk Al Khrab-5	Groupe Prioritaire 2: Trier. broyer et recycler	65.650
16	M9-Maqne-07n	Groupe Prioritaire 1: Trier. broyer et recycler	155.625
17	J4-Aaytat-0	Mettre en œuvre l'usage prévu (expansion du terrain)	77.600
18	O6-Tartej-0n	Mettre en œuvre l'usage prévu (transformer en un jardin)	22.800
19	L5-Kfar Tay-1n	Groupe Prioritaire 1: Trier. broyer et recycler	686.084
20	N10-Rasm Al Hadath-00n	Groupe Prioritaire 1: Trier. broyer et recycler	129.765
Coût Total			**6.323.409**

Estimations des coûts de réhabilitation

Le coût total moyen pour la réhabilitation des 20 décharges prioritaires de DSM est de l'ordre de **35.660.000 USD**. Le coût de la réhabilitation des décharges de DSM restantes au-delà des 20 prioritaires est estimé à l'ordre de **24.550.000 USD**.

Le coût estimé pour la réhabilitation des 20 décharges prioritaires de DCD est de l'ordre de **6.324.000 USD**. Le coût de la réhabilitation des décharges de DCD restantes au-delà des 20 prioritaires est estimé à l'ordre de **7.455.000 USD**.

1. INTRODUCTION

1.1 BACKGROUND

In 2011, the Ministry of Environment (MoE) and the United Nations Development Programme (UNDP), with the technical assistance of Earth Link and Advanced Resources Development s.a.l. (ELARD), prepared a Master Plan for the Closure and Rehabilitation of Uncontrolled Dumpsites in Lebanon.

Two major events triggered the need to update the 2011 Master Plan, namely:

- The armed conflict in Syria that has been on-going since 2011 and which forced reportedly more than one million persons to seek refuge in the Lebanese territory; and
- The solid waste collection and disposal crisis that started in July 2015 with the closure of the Naameh Landfill which served the most densely populated regions of Beirut and Mount Lebanon (except Jbeil).

The MoE, supported by the UNDP, launched a competitive tender process in April 2016 to select a Consultant to update the 2011 Master Plan. The contract with ELARD was signed in June 2016.

As per the agreed contractual terms, ELARD is responsible to deliver the following:

1. An Updated Master Plan for the Rehabilitation of Open and Uncontrolled Dumpsites in Lebanon, including a detailed description of the adopted survey methodology, a prioritization model and a rehabilitation decision tool.
2. A methodology for the assessment of main environmental impacts from the presence of open/uncontrolled dumpsites in Lebanon to be used by the Ministry of Environment, local authorities or other stakeholders as needed. The methodology focuses on assessing the impacts on water resources and air quality, and was tested in a pilot area in Lebanon.
3. The Cost of Environmental Degradation as a result of open dumping activities which was estimated based on internationally accepted methods.
4. A conceptual design for the closure of the Tripoli dumpsite and a preliminary study to identify alternative sites to serve as a landfill after the closure of the existing dumpsite. This report is delivered separately from the 2016 Updated Master Plan as its aim is to facilitate mobilization of resources for the rehabilitation of the Tripoli dumpsite and is not directly related to the update of the Master Plan.
5. A conceptual design for the expansion and enhancement of the existing Zahle landfill site. This report is delivered separately from the 2016 Master Plan as its aim is to facilitate mobilization of resources for the improvement of the Zahle site for the direct benefit of the Zahle Municipality.

1.2 OVERVIEW OF 2011 MASTER PLAN FINDINGS

At the time of the 2011 study, a total of 670 dumpsites were identified and surveyed, out of which 504 were Municipal Solid Waste (MSW) dumpsites and 166 were Construction and Demolition Waste (CDW) dumpsites. A total of 382 MSW dumpsites were operational with an estimated volume of 4,058,552 m^3, including Saida dumpsite. A total of 132 CDW dumpsites were operational with an estimated volume of 1,468,528 m^3.

In the 2011 study, the Saida dumpsite, which was the major dumpsite in the South area receiving around 300 tons per day from around 15 municipalities (UNDP, 2016), ranked as the top priority site for rehabilitation among the MSW dumpsites. The Chmestar dumpsite in Baalback ranked as the top priority site for rehabilitation among the CDW dumpsites.

1.3 SWM PROCEEDINGS SINCE 2011

Since 2011, a few dumpsites were rehabilitated or begun the process of being rehabilitated. The rehabilitation of Saida MSW dumpsite was completed in 2016 (UNDP, 2016). Ghazze MSW dumpsite was partly rehabilitated. Chmestar dumpsite was also partly rehabilitated by the municipality; nonetheless it remained operational but decreased in volume. Other small-scale rehabilitation plans were initiated such as the preparation of detailed rehabilitation plans for the two Kayal dumpsites in Baalback, which ranked among the top 20 MSW dumpsites in the 2011 study, however these plans were not implemented.

The armed conflict in Syria that started in the beginning of 2011 imparts a heavy pressure on Lebanon’s already fragile infrastructure and resources resulting from incoming displaced persons which reach around 1.1 Million (UNHCR, 2017). In 2014, the incremental quantity of MSW generated by displaced people was estimated to be in the order of 683 tons per day (MOE/EU/UNDP, 2014). The same study reported that around 48.4% of this incremental MSW quantity goes to Solid Waste Management Facilities (SWMF) where full or partial treatment is practiced, and the remaining 51.6% are sent to open dumpsites (MOE/EU/UNDP, 2014).

The closure of the Naameh landfill in July 2015 also had significant impacts on the solid waste management sector in Lebanon, and particularly in the areas that were served by the facility, i.e. Beirut and Mount Lebanon, with the exception of Jbeil Caza, since 1998. Since no alternative was readily available at the date of closure, and given the limited capabilities for provision of solid waste management services at the municipal level, waste accumulated in the streets and other temporary storage areas for about eight months until a four-year emergency plan was adopted by the Council of Ministers (CoM) in March 2016.

After the closure of the Naameh landfill, municipalities, that were neither experienced nor equipped to manage solid waste, were forced to find immediate, emergency solutions, which were not necessarily sustainable. Waste was collected and stored in public places or disposed of randomly, as shown in the example in Figure 1-1. The majority of these storage areas were eventually cleared of the waste which was sent to the waste management facilities of Naameh, Costa Brava and Bourj Hammoud.

Figure 1-1 Temporary Placement of Waste in Public Areas

The Council of Ministers (CoM) issued the Decision no. 1 dated 17/3/2016 stipulating the re-opening of the Naameh landfill for a period of two months to receive the waste that accumulated on the streets and public areas. In the meantime, the sites of Costa Brava and Bourj Hammoud were selected to serve as landfill sites to receive waste from Beirut and specified regions in Mount Lebanon for the next four years. The contracts for the Construction and Operation of the Costa Brava and Bourj Hammoud sites were awarded in May 2016.

The Costa Brava site is designed to receive waste from part of Beirut, Baabda caza and Municipalities from the southern suburbs of Aley caza (Bchamoun, Aramoun, Choueifat and Deir Koubel). The Costa Brava site started receiving waste on August 25, 2016, however, waste bales were being stored at a designated area within the site for few months beforehand, and this waste was then moved to Cell 1 at the landfill after its construction was completed.

The Bourj Hammoud site, designed to receive waste from the remaining areas in Beirut, Maten and Kesrouane cazas, became operational on October 8, 2016.

The same Decision (Decision no. 1 dated 17/3/2016) has called for a third site for a sanitary landfill to serve the Chouf and Aley cazas to be chosen at a later stage in coordination with the involved municipalities.

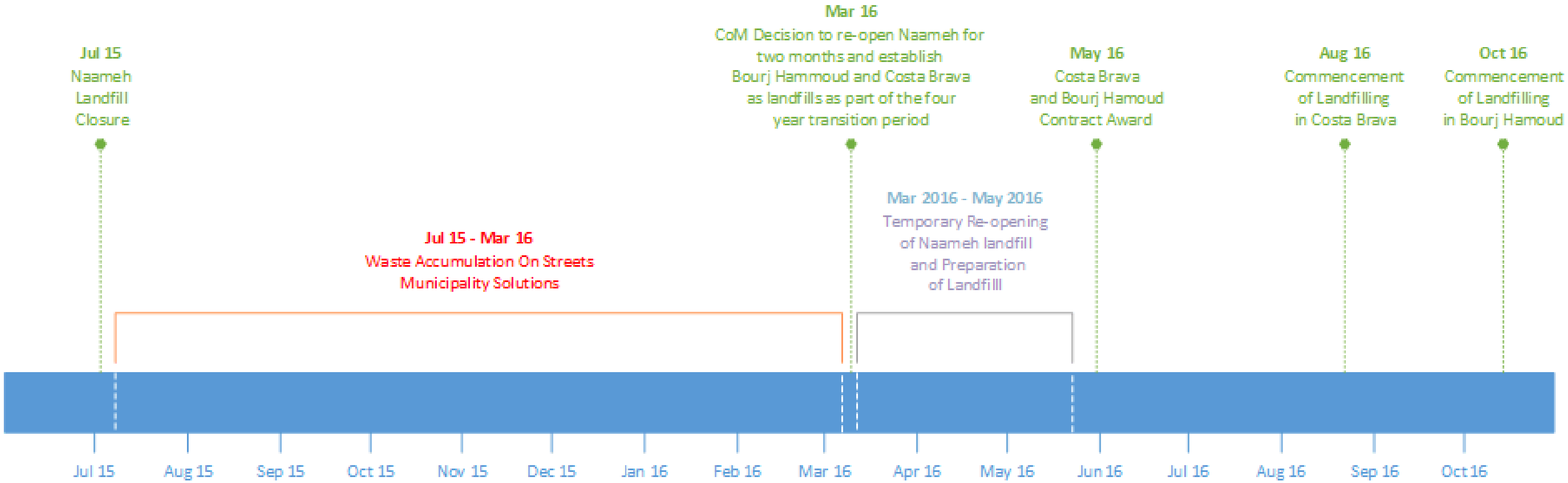


Figure 1-2 Timeline Showing Major Events since the Closure of the Naameh Landfill

1.4 OBJECTIVES OF THE 2016 UPDATE OF THE MASTER PLAN AND REPORT STRUCTURE

The 2016 Updated Master Plan for the Closure and Rehabilitation of Open and Uncontrolled Dumpsites throughout the Country Lebanon aims to:

- Provide an understanding of the status, pattern and dynamics of open dumping activities since the latest survey undertaken as part of the 2011 Master Plan;
- Pinpoint areas of concern;
- Identify the dumpsites of highest priority for closure and rehabilitation plans in light of potential impacts on the environment as per the Prioritization Model developed for this purpose; and
- Propose rehabilitation options for each dumpsite as per the Rehabilitation Decision Tool (RDT).

The present report describes the methodology followed for the Updated Master Plan and summarizes its main findings and proceedings in three volumes as follows:

Volume A: Updated Master Plan for the Closure and Rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon

Section 1: Introduction

Section 2: Survey Methodology, Implementation Process and Limitations

Section 3: Survey Results and Analysis

Section 4: Prioritization Model

Section 5: Rehabilitation Decision Tool (RDT)

Section 6: Prioritization Decision Tool (PDT) for Dumpsite Rehabilitation

Section 7: Cost Estimates Summary

Section 8: References

Section 9: Appendices

Volume B: Environmental Assessment of Uncontrolled Dumpsites

Volume C: Background Note on the Cost Assessment of Dumpsites in 2016

2. SURVEY METHODOLOGY, IMPLEMENTATION PROCESS AND LIMITATIONS

ELARD's field survey, which forms the backbone of the Updated Master Plan, was conducted between July 2016 and March 2017. The survey implementation process, as illustrated in Figure 2-1, started with dumpsite identification and was followed by field data collection by surveyors. The collected data was then logged into a mobile application that automatically stored and communicated the data to ELARD's server. Quality Assurance/Quality Control (QA/QC) was then conducted on the reported data, and upon preliminary analysis of the data, secondary visits were carried out to bridge gaps and verify the findings for the final database.

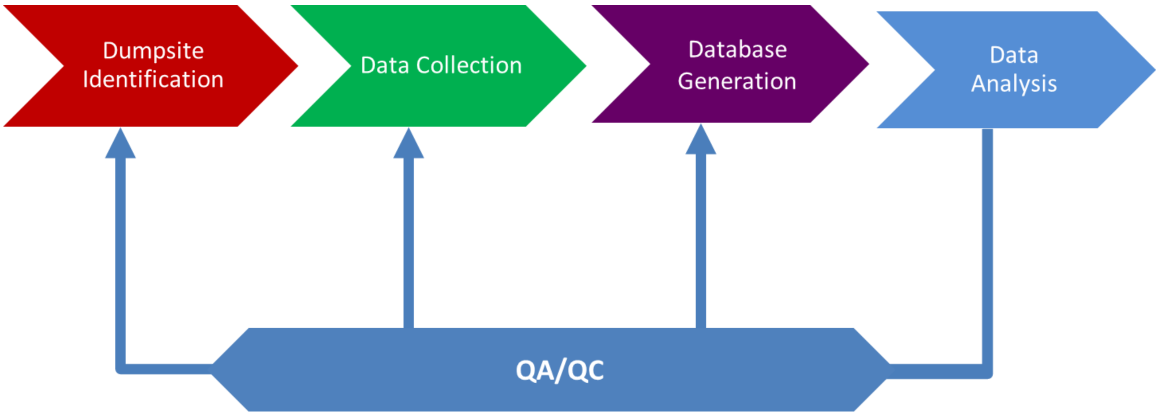


Figure 2-1 Survey Implementation Process

The activities carried out in each of the steps in the survey implementation process are further elaborated in the following sub-sections.

2.1 DEFINITIONS

The surveyed dumpsites are divided into two types: MSW and CDW dumpsites. These are also further divided into two main groups: operational and non-operational. The following definitions were generally adopted throughout the survey:

- Municipal Solid Waste (MSW) Dumpsite: a dumpsite containing over 85% of Municipal Solid Waste. This might include, in addition to MSW, hospital waste, CDW, industrial waste, etc.
- Construction and Demolition Waste (CDW) Dumpsite: a dumpsite containing over 85% of CDW. These include rubble, green waste, construction and demolition debris, etc.
- Operational Dumpsite: a waste disposal area that is being regularly used to dispose of waste (MSW or CDW) in significant amounts. Sites that were used for temporary placement/storing of waste bales or bags are not considered as dumpsites and are excluded from this survey.
- Non-operational Dumpsite: a waste disposal area that is not active anymore. Non-operational dumpsites are further sub-divided into the following subcategories:
    - Non-operational – Not rehabilitated: these are non-operational dumpsites that still contain uncovered MSW or CDW without any type of rehabilitation;

- Non-operational – Rehabilitated – Covered: non-operational dumpsites that are completely covered, where wastes cannot be visually identified but there is evidence based on gathered information that waste is still present at the site;
- Non-operational – Rehabilitated – Removed: non-operational dumpsites that are completely removed, where there is no sign of waste or cover at the site.

2.2 DUMPSITES IDENTIFICATION

Existing, or old, dumpsites were identified based on the data collected in the 2011 survey. New dumpsites were identified during the field visits and from information collected during interviews with municipal officials. Each municipality was contacted, and after introducing the project and its purpose, the municipality was asked about its solid waste management activities and the presence of dumpsites in its area. In the absence of a municipality or lack of cooperation, contact was established with the Mayor (“Mokhtar") and/or local residents.

2.3 DATA COLLECTION

2.3.1 Survey Areas and Project Team

The Lebanese territory was divided into four survey areas, as shown in Figure 2-2.

Area 1: Akkar and North Lebanon

Area 2: Beirut and Mount Lebanon

Area 3: Nabatieh and South Lebanon

Area 4: Beqaa and Baalback/Hermel

Figure 2-2 Geographical Distribution of Survey Teams

One team of two surveyors was responsible for data collection in each survey area. The survey teams operated under the supervision of the Project Coordinator who provided the office support and logistical backup, and coordinated among the survey teams, the experts and the project management team. The project organization structure is shown in Figure 2-3.

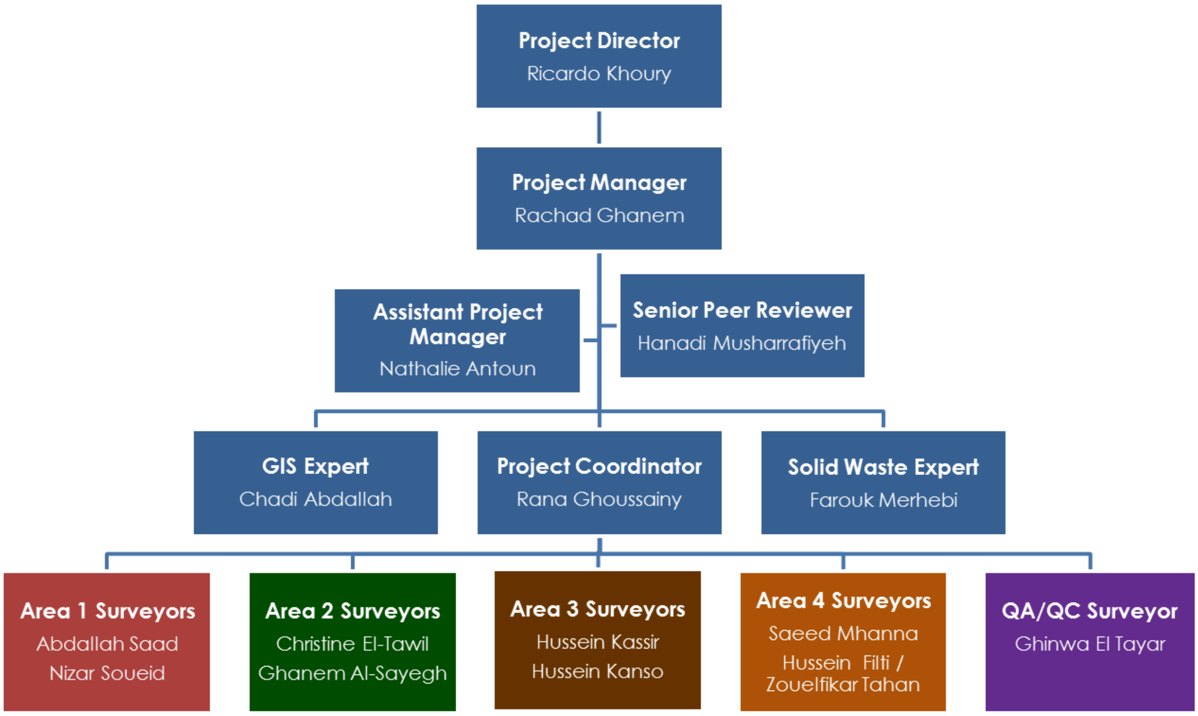


Figure 2-3 Project Organization Chart

2.3.2 Survey Tools & Field Equipment

A Site Characterization Form (SCF) was prepared to facilitate the field work. The SCF includes the data fields which allow information to be collected on the dumpsite itself and the concerned municipality. Some of the data fields of the SCF are: dumpsite location, dumpsite status, area and height, year dumpsite was opened and year it closed, municipal rehabilitation plans, etc. The SCF form is provided in Appendix A.

The SCF was converted into a mobile application that was installed on the tablets. The mobile application enabled the surveyors to:

- Collect and update information and capture photos during the field survey to allow for data collection with ensured spatial accuracy for the dumpsites and their surroundings,
- Improve gathered data quality with easy-to-use maps,
- Take all related maps and data offline and synchronize changes when connected,
- Utilize the geospatial collector features of Google Earth (or ESRI features base maps), which were displayed as background, and
- Connect and upload digital spatial maps from ELARD server, create, edit and delete spatial features in real-time.

The mobile application proved to be very useful as it saved time and simplified the process of data collection. The surveyors were able to determine their location on the map using the application and assign the dumpsites to be visited thus ensuring that all pre-identified sites are visited and new dumpsites are identified. A screenshot of a mobile application interface is shown in Figure 2-4.

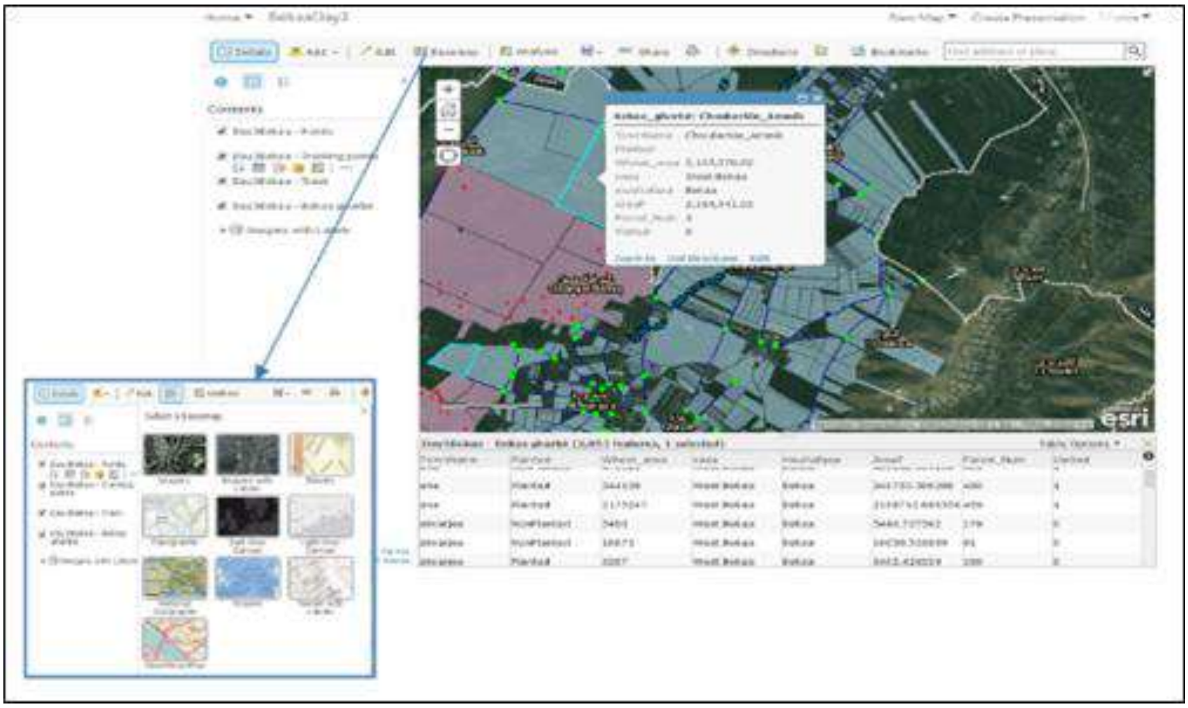


Figure 2-4 Mobile Application Connection with ESRI Maps

Each survey team was provided with a vehicle and necessary tools to enable them to conduct the survey in a practical and safe manner. The list of equipment is shown in Table 2-1.

Table 2-1 List of Field Equipment per Survey Team

Equipment	Description
Vehicles	1 x Suitable vehicle
Field Equipment	1 x Samsung Galaxy Tab S2 9.7" 32 GB (with car battery charging cables) 1 x GPS 1x Geological compass 1 x Digital camera 1 x First aid kit Dust masks
Equipment recommended to be taken to field by surveyors	Mobile phone Self-Treatment / Medicine Kit Sun cream PPE

2.3.3 *Data Assembly*

The locations of old dumpsites were pinned on the maps in the mobile application previously mentioned in section 2.3.2. After establishing contact with the local authorities which led to the identification of new dumpsites, the surveyors proceeded to visit each of the identified, old and new, dumpsites (Figure 2-5). During the field visits, the surveyors:

1. Determined the exact coordinates of the dumpsite location using a GPS and the mobile application;
2. Took photographs of the dumpsite and its surroundings;
3. Gathered the data related to the dumpsite as per the SCF;
4. Entered the collected data from the municipality and from the site onto the mobile application;
5. Reported the number and IDs of visited dumpsites, synchronized and emailed their collected data at the end of each working day to the Project Coordinator who retrieved the data on a daily basis for validation and QA/QC.

Figure 2-5 Field Surveyor Logging Data on the Mobile Application

2.4 DATABASE GENERATION

The aggregated database was downloaded, synchronized and standardized. The GIS data were subdivided as MSW and CDW then converted into separate Geodatabases. The dumpsite data was dropped on the caza distribution and a primary key map tips with HTML popup was applied in order to facilitate the spatial display along with the embedded database as illustrated in Figure 2-6.

Once the survey was completed and the data was thoroughly subjected to the QA/QC process, the final database was revised and set for the analysis and the prioritization model.

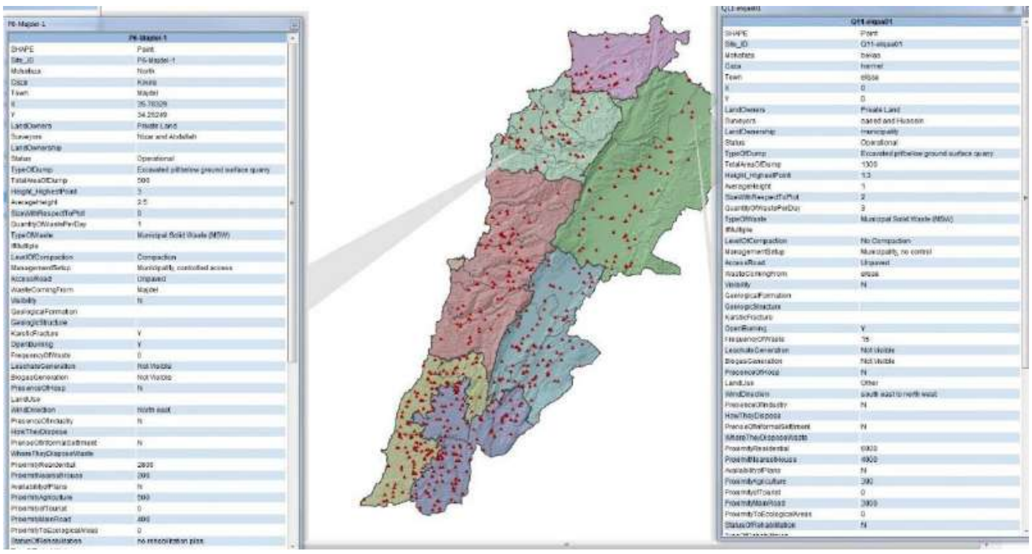


Figure 2-6 Screenshot Showing the Use of HTML Popup Option

2.5 DATA ANALYSIS

Data analysis was carried out on two levels:

- Statistical and
- Software analysis.

For statistical analysis, the data was extracted from the database, organized and prepared in Microsoft Excel. Analysis was done per area and per caza. The database from the 2016 survey was merged with the database from the 2011 survey in order to analyze and understand the changes in the status of dumpsites.

The analysis also entailed the use of more complex software to run the prioritization and rehabilitation models which are elaborated in Sections 4 and 5.

2.6 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Quality Assurance and Quality Control (QA/QC) was carried out at every step of the survey implementation process.

The surveyors were trained prior to the commencement of the field work. The training included presentations, workshops and field work to cover the use of the SCF, mobile application, data probing and verification with interviewees, technical observation of dumpsites' characteristics, etc. to ensure that the surveyors are well-informed and equipped to carry out a detailed and thorough survey.

2.6.1 Dumpsites Identification

Old dumpsites were pointed out on the maps for easy navigation. Contact information for municipalities were provided to the surveyors to ensure proper coordination. Daily planning was coordinated between the teams and the Project Coordinator. The mobile application showed the map within grids, these grids were utilized as guidelines to plan the field work. The area within each grid was completely covered before the surveyors team moved to the next grid. This optimized the survey procedure and ensured all areas are covered.

2.6.2 Data Collection and Database Generation

The collected data was checked at the office at the end of each working day. Missing information was highlighted for further cross-checking, as shown in Figure 2-7. The QA/QC on collected data was performed based on professional judgment of the recorded information, photos provided for each dumpsite, previous knowledge on some of the dumpsites, as well as random checks with informants from municipalities and residents. As part of the QA/QC procedure, the Project Coordinator visited the survey teams on-site on an occasional basis to check how the surveying procedures were being carried out, how the data is being collected and recorded/reported, and discuss any observed issues/problems.

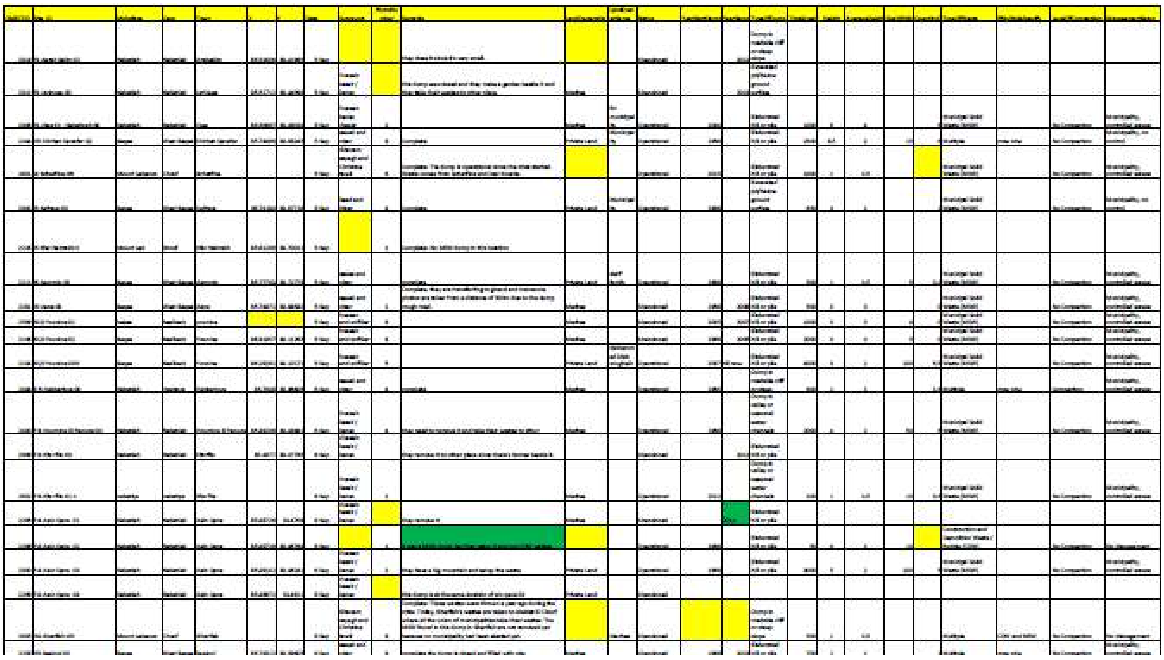


Figure 2-7 Sample Datasheet

2.6.3 Data Analysis

The analyzed data was studied, presented and discussed with the stakeholders that included representatives from the UNDP, MoE, Office of the Minister of State for Administrative Reform (OMSAR) and the Council for Development and Reconstruction (CDR). Accordingly, gaps, unrealistic findings and questionable data were identified. A QA/QC survey team was then established to investigate and/or validate the findings through additional field visits, municipal interviews and phone call interviews. Areas with gaps were revisited and at times, resurveyed. New collected data was entered into the database, while previously questionable findings were modified and/or validated.

The information on each entry in the database was comprehensively double-checked using Google Earth, field pictures and recorded data to ensure that the reported information is as accurate as possible, and to ensure that the analysis is a true reflection of the 2016 status of the dumpsites. Case-specific notes were included in the remark attribute of each dumpsite.

2.7 LIMITATIONS

Several challenges were faced during the data collection phase. These include:

2.7.1 Nature of the Solid Waste Management Activities

Open dumping activities are by nature random and unorganized. Tracking of such activities is challenging and can be grossly inaccurate as information is not formally recorded. Constant status changes, no clear trend, and variable reports from informants can result in changing information on the dumpsite from one visit to another within short periods of time. For example, during the early stages of the survey implementation (July 2016), Deir Ammar was found to be a non-operational MSW dumpsite. However, when revisiting this dumpsite in February 2017, it was found to be operational and officially used by the municipality with a significant increase in volume.

2.7.2 Dumpsites Definition

As far as CDW dumpsites are concerned, it is a noteworthy observation that many small piles of CDW exist in certain areas, mainly next to construction sites. These were not identified as dumpsites because they seemed to be used as one-time dumping sites, and therefore they do not fit the definition of a CDW dumpsite, as being an area that is or was regularly used to dispose of waste.

Moreover, it was noted that there is a general misconception about what constitutes an open dumpsite. For instance, an excavated pit where MSW is buried and regularly covered with soil was not perceived as a dumpsite in the opinion of some municipal officials and locals. CDW dumpsites, specially, can become unnoticed because they have become a fairly common practice with no direct implications on the community, such as odor or leachate generation. For this reason, CDW dumpsites in particular were a challenge to identify and obtain solid information about, especially pertaining to quantity of waste being dumped, since most municipalities disregard their existence and may not acknowledge their presence in the first place.

To overcome misconceptions about what constitutes a dumpsite, the surveyors took the time to explain the project objectives and elaborate on the definition of an open dumpsite in order to gain cooperation and transparency.

2.7.3 Volume Estimations

The methodology used to estimate dumpsites' volumes in both the 2011 and 2016 surveys was limited to visual approximations that led to indicative estimations rather than accurate values. Accurate values require more sophisticated surveying techniques such as topographic and geophysical surveys, which have time and cost implications and were not considered in the survey methodology. It is important to note that every dumpsite that is planned to be rehabilitated would need to be more accurately surveyed first especially to define the estimated volume of waste in place.

In order to ensure that volume estimations are as accurate as possible, volumes were reviewed and verified by the experts via photographic documentation and other relevant information.

2.7.4 Accessibility

A total of 14 dumpsites from the 2016 survey were inaccessible. Seven of these dumpsites were in the Beqaa area. The two major reasons for inaccessibility were due to security issues and rough unpaved roads that rendered the dumpsites unreachable by regular vehicles and required heavy vehicles such as trucks. In some cases, no clear access road was found to the dumpsite and the municipality did not provide further guidance to the surveyors.

In many cases, available data on inaccessible dumpsites were collected from the municipality and from local residents.

2.7.5 Municipality-Related Setbacks

Data provided by the municipalities were not always reliable. Several challenges were faced throughout the survey, including:

- New municipalities: municipal elections took place in the spring of 2016, and therefore many interviewed municipal officials had been recently elected and did not have knowledge of the history of the dumpsites in their area;
- Lack of transparency: many municipalities were not very clear about their activities. A main challenge was in the data related to open burning activities, quantities of waste collected versus dumped per day, number of dumpsites within their areas and the locations of these dumpsites, and ultimately most municipalities were unclear and vague about their future SWM plans;
- Unwillingness to cooperate: some municipalities refused to carry out the interview, or provide any information. Others provided the information but refused to provide the location of the dumpsite and/or point out its exact location.

In some cases, information related to some dumpsites were collected from local residents or neighboring municipalities.

3. SURVEY RESULTS AND ANALYSIS

The total number of identified dumpsites in the 2016 survey was 941 versus 670 in the 2011 survey. This section presents a comparative overview of the findings from the 2011 and the 2016 surveys to bring into focus how open dumping and solid waste management have evolved from 2011 to 2016.

3.1 MUNICIPAL SOLID WASTE DUMPSITES

This section focus on MSW dumpsites and summarizes the findings of the 2011 survey and presents the outcomes of the 2016 survey in that respect. A comparative analysis between the findings of the two surveys follows.

3.1.1 MSW Dumpsites Status in the 2011 Survey

In the 2011 survey, 504 MSW dumpsites were identified, out of which 76% (382) were operational and 24% (122) were non-operational. The volume of MSW in operational dumpsites was 2,675,548 m^3 while that in non-operational dumpsites was 774,523 m^3.

As per the figures summarized in Table 3-1, the highest number of operational dumpsites in the 2011 survey was found in 'Area 3: Nabatieh and South Lebanon' which had around 44% (168) of the operational dumpsites, followed by 'Area 4: Beqaa and Baalback/Hermel' with 29% (110). The volume of MSW in open dumpsites was also the highest in these two areas, with 1,067,956 m^3 and 1,074,869 m^3 respectively. 'Area 2: Beirut and Mount Lebanon' had the lowest number and volume in both operational and non-operational MSW dumpsites in the 2011 survey.

Table 3-1 MSW Dumpsites Status in the 2011 Survey throughout Lebanon

	Operational		Non-Operational		Grand Total	
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
All Lebanon						
	382	**2,675,548***	**122**	**774,523**	**504**	**3,450,073**
Area 1: Akkar and North Lebanon						
	61	**606,007**	**25**	**208,088**	**86**	**814,095**
Akkar	22	337,300	9	16,620	**31**	**353,920**
Minieh-Dannieh	7	171,750	5	29,060	**12**	**200,810**
Tripoli	-	-	-	-	-	-
Zgharta	5	5,767	6	31,428	**11**	**37,195**
Koura	17	69,920	2	7,680	**19**	**77,600**
Bcharre	4	3,920	1	300	**5**	**4,220**
Batroun	6	17,350	2	123,000	**8**	**140,350**
Area 2: Beirut and Mount Lebanon						
	43	**453,976**	**16**	**39,175**	**59**	**493,151**
Jbeil	3	376,100	-	-	**3**	**376,100**
Kesrouane	9	15,555	10	26,725	**19**	**42,280**
Maten	11	31,620	1	1,000	**12**	**32,620**
Baabda	7	10,026	1	5,000	**8**	**15,026**
Aley	5	6,550	1	4,000	**6**	**10,550**
Chouf	8	14,125	3	2,450	**11**	**16,575**
Area 3: Nabatieh and South Lebanon						
	168	**947,002**	**52**	**120,955**	**220**	**1,067,957**
Nabatieh	13	309,437	17	12,768	**30**	**322,205**
Hasbaya	19	48,009	3	3,455	**22**	**51,464**
Marjeyoun	22	44,980	3	8,069	**25**	**53,049**
Bent Jbeil	31	78,828	6	2,808	**37**	**81,636**
Jezzine	15	9,936	1	35	**16**	**9,971**
Saida	33	186,925*	6	73,292	**39**	**260,217**
Sour	35	268,887	16	20,528	**51**	**289,415**
Area 4: Beqaa and Baalback/Hermel						
	110	**668,565**	**29**	**406,305**	**139**	**1,074,870**
Zahle	5	283,000	13	312,480	**18**	**595,480**
West Beqaa	25	137,350	2	2,100	**27**	**139,450**
Rashaya	29	26,695	3	325	**32**	**27,020**
Hermel	4	10,600	1	600	**5**	**11,200**
Baalback	47	210,920**	10	90,800	**57**	**301,720**

*G2-Saida volume was excluded from both 2011 and 2016 survey figures for ease of comparison.

**The volumes of M9-Baalback-1 and M9-Baalback-2, otherwise known as the Kayal dumpsites, were overestimated in the 2011 survey. The volumes of these two dumpsites were modified based on the figures reported by Laceco (2012) in a study on the rehabilitation of the Kayal dumpsites. The volumes of the M9-Baalback-01 were thus set at 39,000m³, and M9-Baalback-02 at 42,000m³.

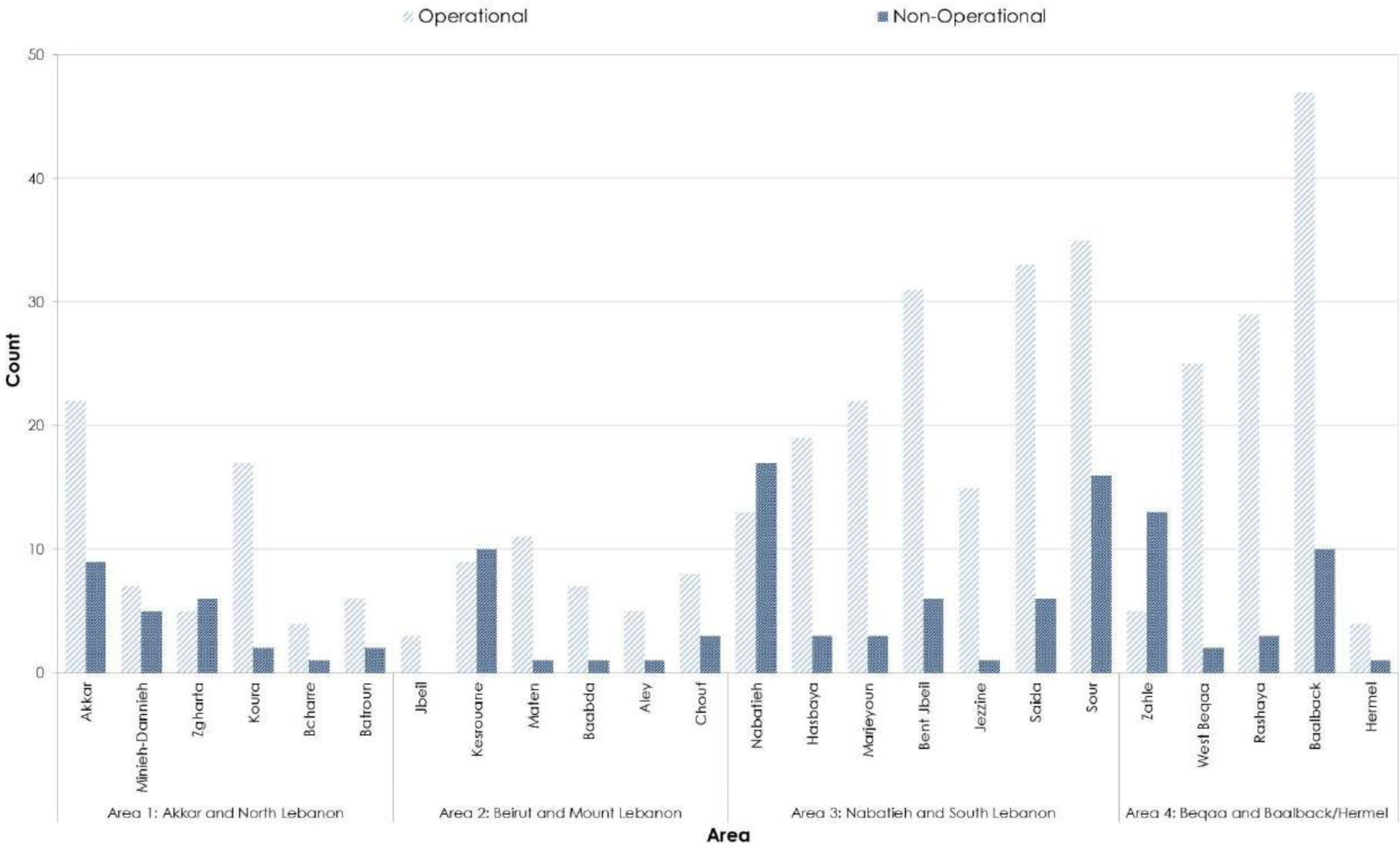


Figure 3-1 Count of MSW Dumpsites in the 2011 Survey throughout Lebanon

3.1.2 MSW Dumpsites Status in the 2016 Survey

In the 2016 survey, 617 MSW dumpsites were identified. The geographical distribution, status and volumes of these dumpsites are shown in Figure 3-2 and Figure 3-3. About 55% (341) of the MSW dumpsites were identified as operational and 43% (263) as non-operational MSW dumpsites as presented in Table 3-2. Of the surveyed MSW dumpsites, 2% (13) were inaccessible.

Similar to the findings of the 2011 survey, the highest number of operational dumpsites in the 2016 survey is still present in 'Area 3: Nabatieh and South Lebanon' which had around 37% (127) of the operational dumpsites, followed by 'Area 4: Beqaa and Baalback/Hermel' with 28% (96). Baalback and Chouf cazas each have around 11% (39 and 35 respectively) of the total number of operational dumpsites in Lebanon, followed by Sour caza with around 10% (33).

The largest MSW dumpsites in terms of volume of waste in operational dumpsites are located in cazas with a fewer number of MSW dumpsites such as in Tripoli, Akkar, Jbeil and Zahle cazas. Open dumping activities in these cazas are centralized in controlled dumpsites, namely the Tripoli dumpsite, Srar dumpsite in Akkar, Hbaline dumpsite in Jbeil, Qabb Elias and Barr Elias dumpsites in Zahle, as opposed to other cazas, such as Baalback, Chouf and Sour, which have a high number of small-scale scattered dumpsites.

'Area 2: Beirut and Mount Lebanon' which had the lowest number and volume in both operational and non-operational MSW dumpsites in the 2011 survey, witnessed a 124% increase in the count of dumpsites visited in the 2016 survey, where 86% of this increase is for operational dumpsites. The single largest increase in dumpsites is in the Chouf and Aley cazas with a total of 62 operational MSW dumpsites, which is 49 more operational dumpsites than in 2011. This change is mostly attributed to the 2015 solid waste collection and disposal crisis that had forced municipalities in these cazas to manage their own waste while they had no proper alternatives besides open dumping.

As for the non-operational MSW dumpsites, the majority of these (45%) are not rehabilitated (118), while 43 were classified as rehabilitated-covered (16%) and 102 (39%) were classified as rehabilitated-removed.

'Area 3: Nabatieh and South Lebanon' recorded the largest number of non-operational dumpsites in the 2016 survey with 110 non-operational dumpsites, or 42% of the national tally of non-operational MSW dumpsites.

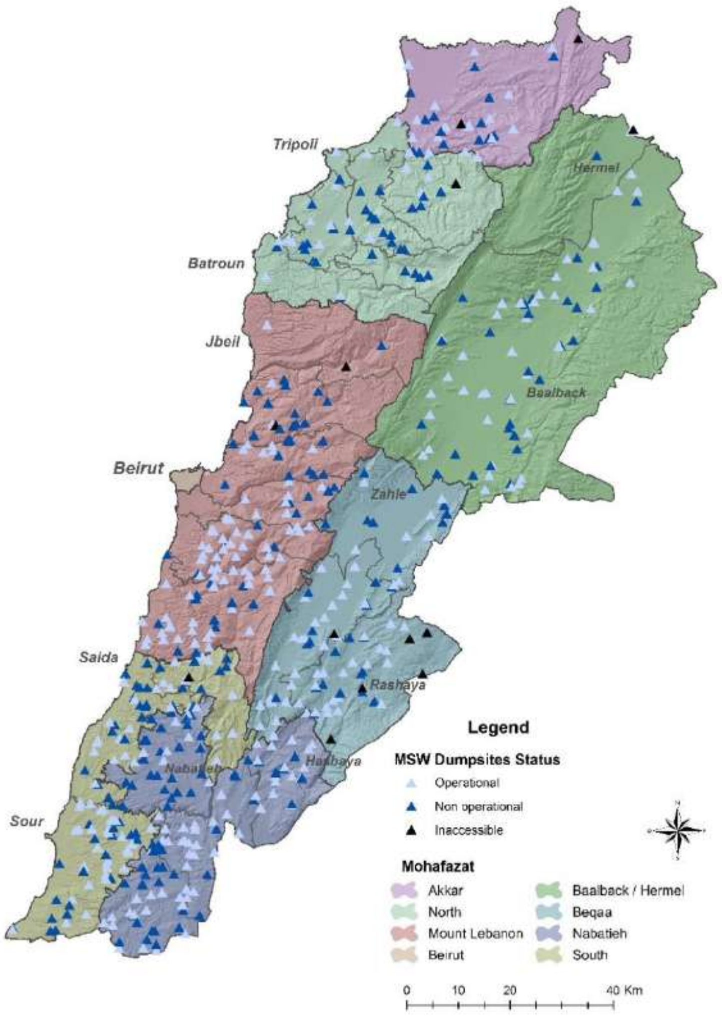


Figure 3-2 Map Showing the Geographical Locations and Status of MSW Dumpsites in 2016

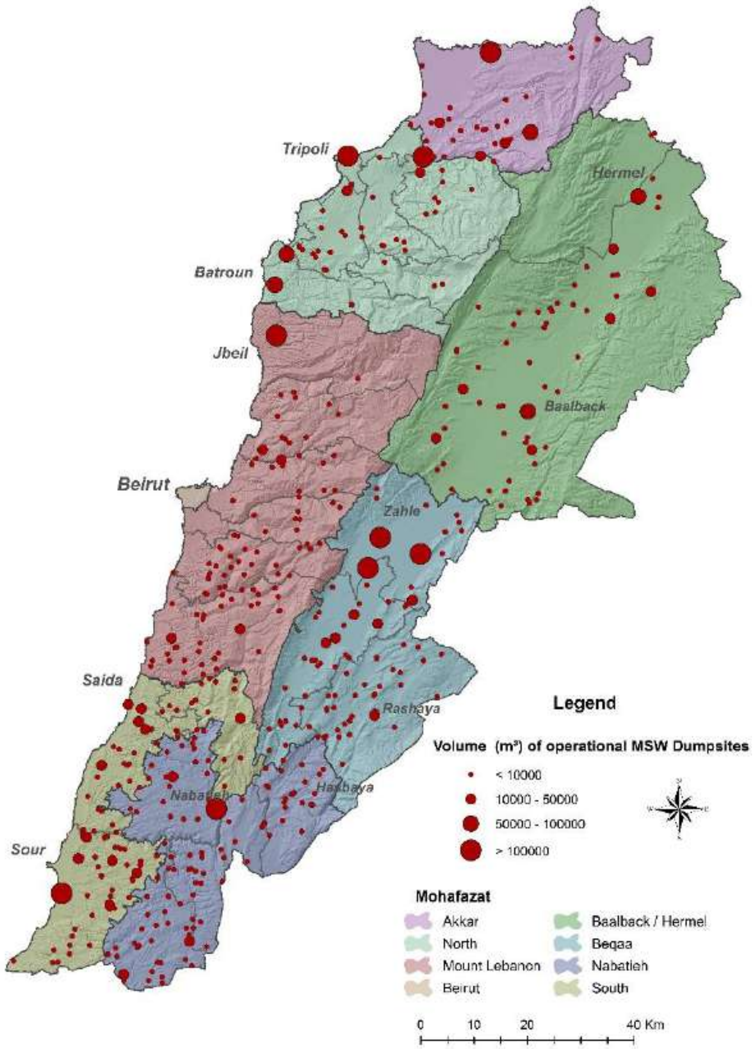


Figure 3-3 Map Showing the Geographical Locations and Volumes of MSW Dumpsites in 2016

Table 3-2 MSW Dumpsites Status in the 2016 Survey throughout Lebanon

	Operational		Non-Operational						Inaccessible		Grand Total	
			Not Rehabilitated		Rehabilitated							
					Covered		Removed					
	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
All Lebanon												
	341	**4,588,218**	**118**	**719,344**	**43**	**416,259**	**102**	**0**	**13**	**19,486**	**617**	**5,743,307**
Area 1: Akkar and North Lebanon												
	38	**2,246,797**	**28**	**175,695**	**3**	**6600**	**15**	**0**	**3**	**5,280**	**87**	**2,434,372**
Akkar	19	686,575	9	71,285	2	2,600	4	0	2	5,220	**36**	**765,680**
Minieh-Dannieh	5	273,572	4	10,800	-	-	2	0	1	60	**12**	**284,432**
Tripoli	1	1,200,000	-	-	-	-	-	-	-	-	**1**	**1,200,000**
Zgharta	2	2,450	4	5,600	-	-	5	0	-	-	**11**	**8,050**
Koura	8	25,200	7	14,750	1	4,000	1	0	-	-	**17**	**43,950**
Bcharre	-	-	3	1,260	-	-	2	0	-	-	**5**	**1,260**
Batroun	3	59,000	1	72,000	-	-	1	0	-	-	**5**	**131,000**
Area 2: Beirut and Mount Lebanon												
	80	**767,846**	**19**	**26,440**	**7**	**17,445**	**24**	**0**	**2**	**2,400**	**132**	**814,131**
Jbeil	1	600,000	-	-	-	-	1	0	1	400	**3**	**600,400**
Kesrouane	4	19,750	6	6,150	2	14,150	5	0	1	2,000	**18**	**42,050**
Maten	4	14,560	5	3,530	2	1,220	5	0	-	-	**16**	**19,310**
Baabda	9	14,470	2	1,210	1	1,000	4	0	-	-	**16**	**16,680**
Aley	27	45,691	1	5,100	-	-	2	0	-	-	**30**	**50,791**
Chouf	35	73,375	5	10,450	2	1,075	7	0	-	-	**49**	**84,900**

	Operational		Non-Operational						Inaccessible		Grand Total	
			Not Rehabilitated		Rehabilitated							
					Covered		Removed					
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
Area 3: Nabatieh and South Lebanon												
	127	**637,590**	**45**	**381,679**	**19**	**98,819**	**46**	**0**	**1**	**41**	**238**	**1,118,129**
Nabatieh	8	265,500	13	14,029	2	620	8	0	-	-	**31**	**280,149**
Hasbaya	16	29,165	5	8,900	2	7,880	1	0	-	-	**24**	**45,945**
Marjeyoun	20	28,545	1	2,000	1	3,090	5	0	-	-	**27**	**33,635**
Bent Jbeil	20	38,460	10	12,595	5	48,740	8	0	-	-	**43**	**99,795**
Jezzine	10	19,910	2	1,800	2	177	1	0	1	41	**16**	**21,928**
Saida	20	124,500	7	37,688	3	25,046	12	0	-	-	**42**	**187,234**
Sour	33	131,510	7	304,667	4	13,266	11	0	-	-	**55**	**449,443**
Area 4: Beqaa and Baalback/Hermel												
	96	**935,985**	**26**	**135,530**	**14**	**293,395**	**17**	**0**	**7**	**11,765**	**160**	**1,376,675**
Zahle	7	470,500	2	10,000	6	253,750	2	0	-	-	**17**	**734,250**
West Beqaa	24	131,990	6	15,300	1	100	1	0	1	2,625	**33**	**150,015**
Rashaya	23	27,180	3	16,560	5	1,045	3	0	5	3,140	**39**	**47,925**
Hermel	3	61,250	-	-	-	-	1	0	1	6,000	**5**	**67,250**
Baalback	39	245,065	15	93,670	2	38,500	10	0	-	-	**66**	**377,235**

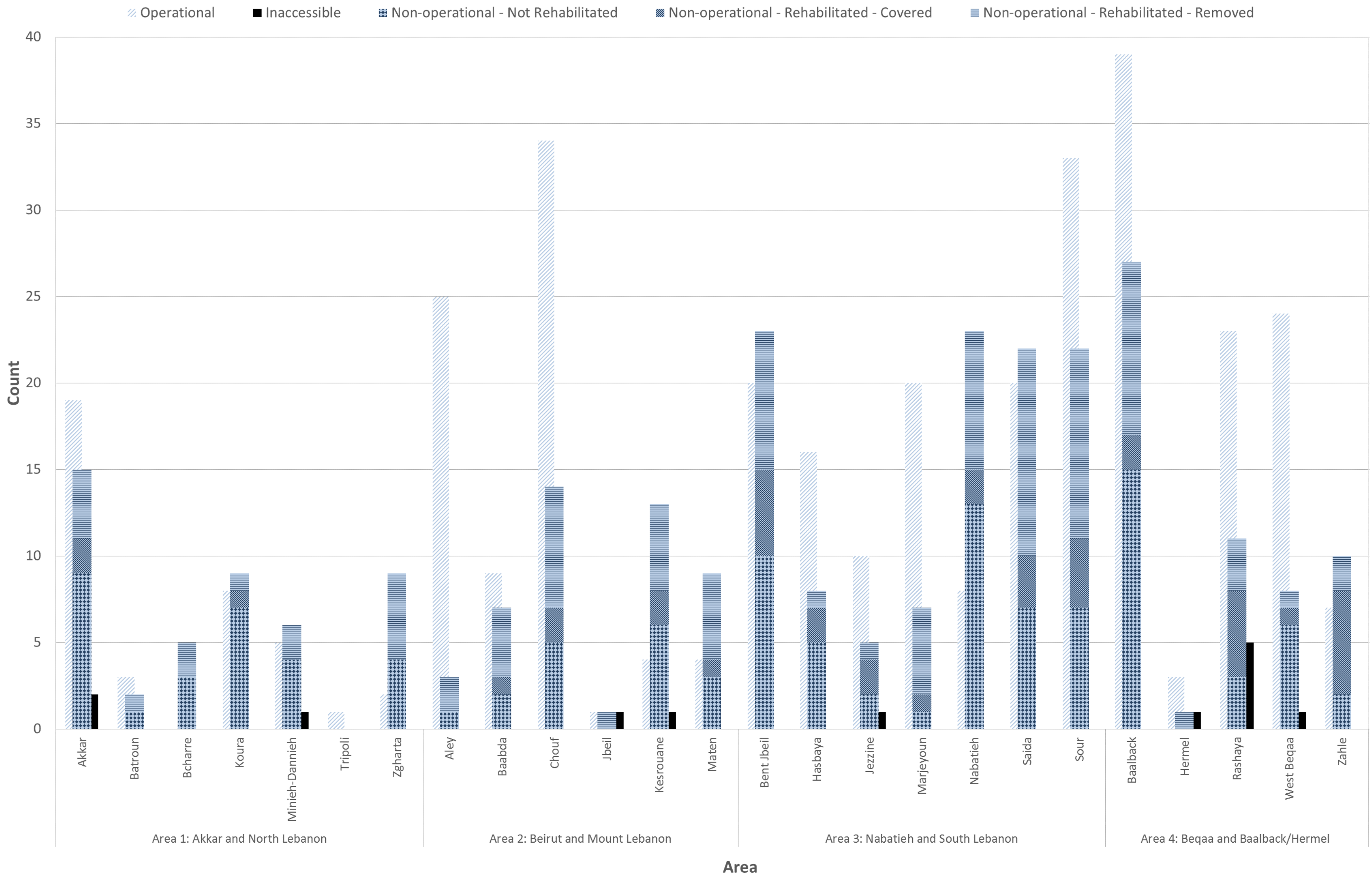


Figure 3-4 Count of MSW Dumpsites in the 2016 Survey throughout Lebanon

3.1.3 Changes between the 2011 Survey and 2016 Survey per Caza

This section presents a comparative overview of the changes in MSW dumpsites between the 2011 and the 2016 surveys according to the survey areas and cazas. It aims to clarify how open dumping activities changed since 2011, while shedding the light on the status of solid waste management in each Area and Caza.

A detailed recount on the changes between the 2011 and 2016 surveys in each Caza is illustrated in Appendix B.

3.1.3.1 <u>Area 1: Akkar and North Lebanon</u>

There is a general increase in the volume of MSW disposed of in uncontrolled dumpsites in 'Area 1: Akkar and North Lebanon'. A decrease in burning practices in Area 1 in the 2016 survey was observed overall with respect to the 2011 survey as shown in Figure 3-5.

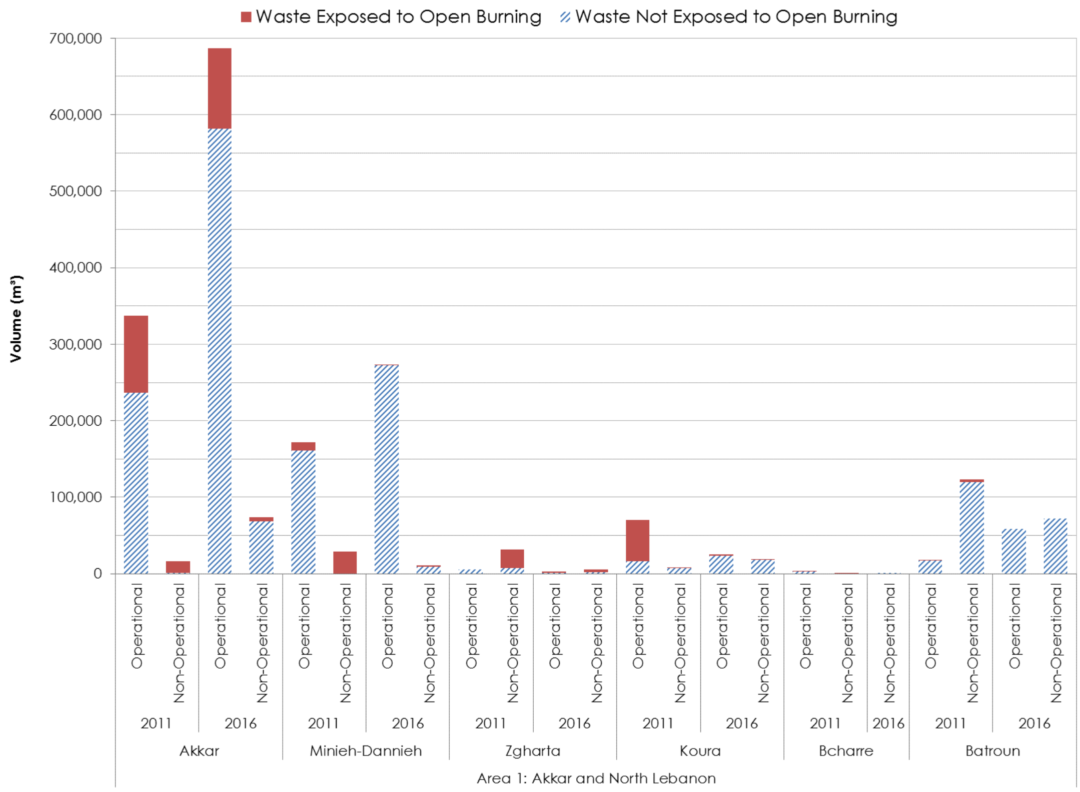


Figure 3-5 Volume of MSW in Relation to Dumpsite Status and Exposure to Open Burning in 2011 and 2016 in 'Area 1: Akkar and North Lebanon'

3.1.3.1.1 Akkar Caza

The overall count and volume of MSW in dumpsites in the Akkar caza has increased between 2011 and 2016, as shown in Table 3-3.

Table 3-3 MSW Dumpsites Status in 2011 and 2016 Surveys - Akkar Caza

MSW Akkar Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		22	337,300	19	686,575
Non-operational	**Not rehabilitated**	9	16,620	9	71,285
	Covered			2	2,600
	Removed			4	0
Inaccessible		-	-	2	5,220
TOTAL		**31**	**353,920**	**36**	**765,680**

Of the 19 operational MSW dumpsites in Akkar caza that were surveyed in 2016:

- 13 existed and were operational as per the 2011 survey;
- Four were newly identified;
- Two MSW dumpsites which were non-operational in the 2011 survey have become operational in the 2016 survey.

Although the 2016 survey recorded three fewer operational MSW dumpsites in the Akkar caza as compared to the 2011 survey, the total volume of operational MSW dumpsites in the 2016 survey was 686,575 m³ representing a 104% increase on the figure reported in the 2011 survey due to the increase of the rate of MSW generated in the North mostly as result of the increase in the number of displaced people.

The total volume of operational MSW dumpsites in Akkar is 686,575 m³, mostly attributed to Srar dumpsite which is a central dumpsite in Area 1 with an estimated volume of 570,000 m³.

A total of 15 MSW dumpsites were identified as non-operational in the 2016 survey, out of which nine were not rehabilitated, two were rehabilitated-covered and four were rehabilitated-removed. Two dumpsites were inaccessible in the 2016 survey for which the same volumes from the 2011 survey were retained.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Akkar caza, is shown in Table B - 1 in Appendix B.

3.1.3.1.2 Minieh-Dannieh Caza

The volume of MSW in dumpsites in Minieh-Dannieh caza has increased by 83,622 m³ between 2011 and 2016, as shown in Table 3-4.

Table 3-4 MSW Dumpsites Status in 2011 and 2016 Surveys - Minieh-Dannieh Caza

MSW Minieh-Dannieh Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		7	171,750	5	273,572
Non-operational	**Not rehabilitated**	5	29,060	4	10,800
	Covered			-	-
	Removed			2	0
Inaccessible		-	-	1	60
TOTAL		**12**	**200,810**	**12**	**284,432**

There are five operational MSW dumpsites in the Minieh-Dannieh caza, out of these:

- Three dumpsites existed and were operational as per the 2011 survey;
- One dumpsite was non-operational in the 2011 survey and has become operational in the 2016 survey;
- One new operational dumpsite was identified in the Minieh-Dannieh caza in the 2016 survey.

The total volume of operational MSW dumpsites in Minieh-Dannieh caza is 273,572 m³ which presents a 59% increase on the figure reported in the 2011 survey for operational dumpsites. The majority of this increase is attributed to R7-Adweh dumpsite which is a major dumpsite in Minieh-Dannieh with an estimated volume of 255,372 m³. Adweh dumpsite receives waste from many municipalities in the North, in addition to the rejects coming from the Minieh sorting plant, which also receives waste from many municipalities outside the caza.

A total of six dumpsites were identified as non-operational in the 2016 survey, four were not rehabilitated, and two were rehabilitated-removed by 2016. One dumpsite was inaccessible in the 2016 survey.

One dumpsite which was non-operational MSW in the 2011 survey has been classified as CDW in 2016.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Minieh-Dannieh caza, is shown to Table B - 2 in Appendix B.

3.1.3.1.3 Tripoli Caza

One main operational MSW dumpsite exists in Tripoli caza, namely the Tripoli dumpsite with an estimated volume of 1,200,000 m³. This dumpsite was not part of the scope of the 2011 survey.

3.1.3.1.4 Zgharta Caza

The volume of MSW in dumpsites in Zgharta caza has decreased by 29,145 m³ between 2011 and 2016, as shown in Table 3-5.

Table 3-5 MSW Dumpsites Status in 2011 and 2016 Surveys - Zgharta Caza

MSW Zgharta Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		5	5,767	2	2,450
Non-operational	**Not rehabilitated**	6	31,428	4	5,600
	Covered			-	-
	Removed			5	0
TOTAL		**11**	**37,195**	**11**	**8,050**

There are two operational dumpsites in Zgharta caza. These dumpsites are new dumpsites identified in the 2016 survey.

The total volume of operational MSW dumpsites in Zgharta caza is 2,450 m³ which presents a 64% decrease on the figure reported in the 2011 survey for operational dumpsites.

A total of nine dumpsites were identified as non-operational in the 2016 survey. Four were not rehabilitated, and five were rehabilitated-removed by 2016.

These findings are due to the fact that Zgharta is transporting the majority of its waste to dumpsites outside its territory, mainly Adweh and Srar dumpsites as confirmed by the Union of Municipalities of Zgharta. The Union claims there are no dumpsites in Zgharta caza and they intend to operate the sorting and composting facility currently under design and send the rejects to dumpsites outside their caza.

Two dumpsites which were operational in the 2011 survey have been classified as CDW in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Zgharta caza, is shown to Table B - 3 in Appendix B.

3.1.3.1.5 Koura Caza

The volume of MSW in dumpsites in the Koura caza has decreased by 33,650 m³ between 2011 and 2016, as shown in Table 3-6.

Table 3-6 MSW Dumpsites Status in 2011 and 2016 Surveys - Koura Caza

MSW Koura Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		17	69,920	8	25,200
Non-operational	**Not rehabilitated**	2	7,680	7	14,750
	Covered			1	4,000
	Removed			1	0
TOTAL		**19**	**77,600**	**17**	**43,950**

There are eight operational dumpsites in the Koura caza, out of these:

- Seven dumpsites existed and were operational in the 2011 survey;
- One dumpsite was non-operational in the 2011 survey and has become operational in the 2016 survey.

The total volume of operational MSW dumpsites in the Koura caza is 25,200 m³ which presents a 64% decrease on the figure reported in the 2011 survey for operational dumpsites.

A total of nine dumpsites were identified as non-operational in the 2016 survey, seven were not rehabilitated, one was rehabilitated-covered and one was rehabilitated-removed.

This overall decrease is because Koura is transporting the majority of its waste (around 70%) to dumpsites outside its territory as confirmed by the Union of Municipalities of Koura. The Union aims to completely eliminate dumpsites within its caza by sorting and composting its MSW and sending all rejects to other operational dumpsites outside its caza. Koura caza has two operational sorting plants and one treatment plant under construction.

Two dumpsites which were operational MSW in the 2011 survey are classified as CDW in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Koura caza, is shown to Table B - 4 in Appendix B.

3.1.3.1.6 Bcharre Caza

The volume of MSW in dumpsites in the Bcharre caza has decreased by 2,960 m³ since 2011, as shown in Table 3-7.

Table 3-7 MSW Dumpsites Status in 2011 and 2016 Surveys - Bcharre Caza

MSW Bcharre Caza		**2011 Survey**		**2016 Survey**	
		Count	**Volume (m³)**	**Count**	**Volume (m³)**
Operational		4	3,920	-	-
Non-operational	**Not rehabilitated**	1	300	3	1,260
	Covered			-	-
	Removed			2	0
TOTAL		**5**	**4,220**	**5**	**1,260**

No operational dumpsites in the Bcharre caza were recorded as per the 2016 survey. All four operational dumpsites identified in the 2011 survey have become non-operational.

Five dumpsites were identified as non-operational in the 2016 survey, three were not rehabilitated and two were rehabilitated-removed.

These findings are consistent with what was reported by the Municipalities and the Union of Municipalities of Bcharre. All MSW in Bcharre goes to Bsarma sorting facility where the waste is sorted and the remaining rejects go to dumpsites in other cazas.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Bcharre caza, is shown to Table B - 5 in Appendix B.

3.1.3.1.7 Batroun Caza

The volume of MSW in dumpsites in the Batroun caza has decreased by 9,350 m³ between 2011 and 2016, as shown in Table 3-8.

Table 3-8 MSW Dumpsites Status in 2011 and 2016 Surveys - Batroun Caza

MSW Batroun Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		6	17,350	3	59,000
Non-operational	**Not rehabilitated**	2	123,000	1	72,000
	Covered			-	-
	Removed			1	0
TOTAL		**8**	**140,350**	**5**	**131,000**

There are only three operational dumpsites in the Batroun caza as per the 2016 survey, out of these two dumpsites existed and were operational while one dumpsite existed and was non-operational as per the 2011 survey.

The total volume of operational MSW dumpsites in the Batroun caza is 59,000 m³ which presents a 240% increase on the figure reported in the 2011 survey for operational dumpsites. The majority of this increase is attributed to P5-Batroun-0 which is the main MSW for all Batroun caza with an estimated volume of 55,000 m³ in 2016 survey.

Two dumpsites were identified as non-operational in the 2016 survey, one was not rehabilitated and one was rehabilitated-removed. One dumpsite (P5-Hamat-1) which was non-operational and not rehabilitated in the 2011 survey with a total volume of 120,000 m³ is still non-operational in the 2016 survey with a decrease in volume in the order of 48,000 m³.

No new dumpsites were identified in the Batroun caza during the 2016 survey.

Two MSW dumpsites that were operational in 2011 were classified as CDW in the 2016 survey. While one MSW dumpsite (O6-Kfour Al Aarabi-2) in the 2011 survey was removed from the 2016 survey since it was considered as duplicate to O6-Kfour Al Aarabi-3 which is a CDW dumpsite.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Batroun caza, is shown to Table B - 6 in Appendix B.

3.1.3.2 Area 2: Beirut and Mount Lebanon

There is a general increase in the volume of MSW in dumpsites in 'Area 2: Beirut and Mount Lebanon', this increase is prominent at all caza levels with the exception of Maten caza, which is discussed in Section 3.1.3.2.3. Burning practices in 2016 survey in Area 2 were not very evident, it was mainly localized in some parts of Kesrouane and Chouf cazas as shown in Table 3-10.

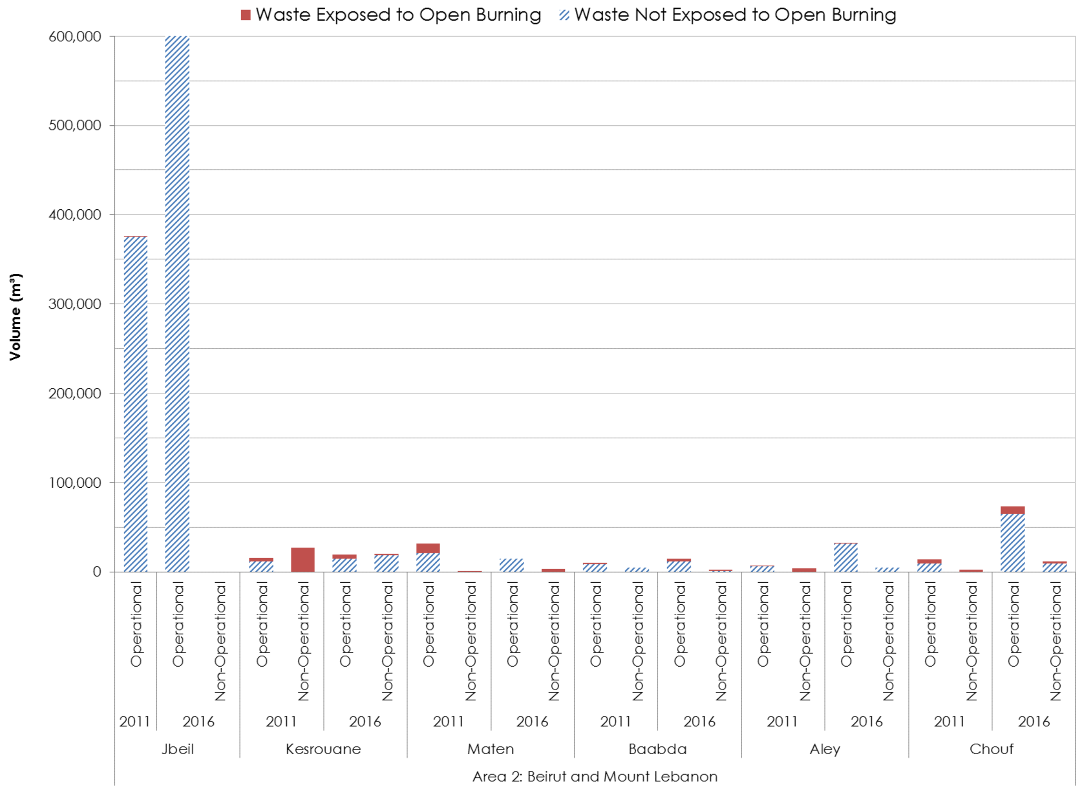


Figure 3-6 Volume of MSW in Relation to Dumpsite Status and Exposure to Open Burning in 2011 and 2016 in 'Area 2: Beirut and Mount Lebanon'

3.1.3.2.1 Jbeil Caza

The volume of MSW in dumpsites in Jbeil caza has increased by 224,300 m³ between 2011 and 2016, as shown in Table 3-9.

Table 3-9 MSW Dumpsites Status in 2011 and 2016 Surveys - Jbeil Caza

MSW Jbeil Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		3	376,100	1	600,000
Non-operational	**Not rehabilitated**	-	-	-	-
	Covered			-	-
	Removed			1	0
Inaccessible		-	-	1	400
TOTAL		**3**	**376,100**	**3**	**600,400**

One major dumpsite exists for Jbeil caza (N5-Hbaline-0), the total volume of this dumpsite is 600,000 m³ which represents a 60% increase from the figure reported in the 2011 survey.

One dumpsite was identified as non-operational in the 2016 survey; this dumpsite was rehabilitated-removed.

One dumpsite was inaccessible in the 2016 survey due to the absence of an access road.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Jbeil caza, is shown to Table B - 7 in Appendix B.

3.1.3.2.2 Kesrouane Caza

The volume of waste in MSW dumpsites in the Kesrouane caza has decreased by 230 m³ between 2011 and 2016, as shown in Table 3-10.

Table 3-10 MSW Dumpsites Status in 2011 and 2016 Surveys - Kesrouane Caza

MSW Kesrouane Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		9	15,555	4	19,750
Non-operational	Not rehabilitated	10	26,725	6	6,150
	Covered			2	14,150
	Removed			5	0
Inaccessible		-	-	1	2,000
TOTAL		**19**	**42,280**	**18**	**42,050**

Out of the four operational MSW dumpsites in the Kesrouane caza, two were non-operational in 2011 and two were new MSW dumpsites identified in the 2016 survey.

The total volume of MSW in operational dumpsites in the Kesrouane caza is 19,750 m³ which is 27% more than the figure reported in the 2011 survey.

13 dumpsites were identified as non-operational in the 2016 survey, six dumpsites were not rehabilitated, two were rehabilitated-covered and five were rehabilitated-removed. One dumpsite could not be accessed in the 2016 survey.

Three dumpsites that were MSW in 2011 were classified as CDW in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Kesrouane caza, is shown to Table B - 8 in Appendix B.

3.1.3.2.3 Maten Caza

The volume of MSW in dumpsites in the Maten caza has decreased by 13,310 m³ between 2011 and 2016, as shown in Table 3-11.

Table 3-11 MSW Dumpsites Status in 2011 and 2016 Surveys - Maten Caza

MSW Maten Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		11	31,620	4	14,560
Non-operational	Not rehabilitated	1	1,000	5	3,530
	Covered			2	1,220
	Removed			5	0
TOTAL		**12**	**32,620**	**16**	**19,310**

Of the four operational MSW dumpsites in the Maten caza that were surveyed in 2016, two existed and were operational as per the 2011 survey and two new operational dumpsites were identified.

The total volume of operational MSW dumpsites in the Maten caza is 14,560 m³ which represents a 54% decrease on the figure reported in the 2011 survey for operational dumpsites.

A total of 12 dumpsites were identified as non-operational in the 2016 survey, out of which five were not rehabilitated, two were rehabilitated-covered and five were rehabilitated-removed. Four of the non-operational not rehabilitated dumpsites were newly identified in the 2016 survey.

Two dumpsites classified as MSW dumpsites in the 2011 survey were reclassified as CDW dumpsites in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Maten caza, is shown to Table B - 9 in Appendix B.

3.1.3.2.4 Baabda Caza

The volume of MSW in dumpsites in the Baabda caza has increased by 1,654 m³ between 2011 and 2016, as shown in Table 3-12.

Table 3-12 MSW Dumpsites Status in 2011 and 2016 Surveys - Baabda Caza

MSW Baabda Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		7	10,026	9	14,470
Non-operational	**Not rehabilitated**	1	5,000	2	1,210
	Covered			1	1,000
	Removed			4	0
TOTAL		**8**	**15,026**	**16**	**16,680**

Of the nine operational MSW dumpsites in Baabda caza that were surveyed in 2016, two existed and were operational as per the 2011 survey and seven new operational dumpsites were identified.

The total volume of operational MSW dumpsites in Baabda caza is 14,470 m³ which represents a 44% increase on the figure reported in the 2011 survey for operational dumpsites.

A total of seven dumpsites were identified as non-operational in the 2016 survey, out of which two were not rehabilitated, one was rehabilitated-covered and four were rehabilitated-removed.

The non-operational dumpsite in the 2011 survey was reclassified as a CDW dumpsite in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Baabda caza, is shown to Table B - 10 in Appendix B.

3.1.3.2.5 Aley Caza

The volume of waste in MSW dumpsites in the Aley caza has increased by 40,241 m³ between 2011 and 2016, as shown in Table 3-13.

Table 3-13 MSW Dumpsites Status in 2011 and 2016 Surveys - Aley Caza

MSW Aley Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		5	6,550	27	45,691
Non-operational	**Not rehabilitated**	1	4,000	1	5,100
	Covered			-	-
	Removed			2	0
TOTAL		**6**	**10,550**	**30**	**50,791**

Out of the 27 operational MSW dumpsites in the Aley caza that were surveyed in 2016:

- Two existed and were operational during the 2011 survey;
- One was non-operational in 2011 and became operational in 2016;
- 24 new operational dumpsites were identified in the 2016 survey.

The total volume of operational MSW dumpsites in the Aley caza is 45,691 m³ which represents a 381% increase on the figure reported in the 2011 survey for operational dumpsites.

Three dumpsites that were operational in the 2011 survey were identified as non-operational in the 2016 survey, out of which one was not rehabilitated and two were rehabilitated-removed.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Aley caza, is shown to Table B - 11 in Appendix B.

3.1.3.2.6 Chouf Caza

The volume of MSW in dumpsites in the Chouf caza has increased by 68,325 m³ between 2011 and 2016, as shown in Table 3-14.

Table 3-14 MSW Dumpsites Status in 2011 and 2016 Surveys - Chouf Caza

MSW Chouf Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		8	14,125	35	73,375
Non-operational	**Not rehabilitated**	3	2,450	5	10,450
	Covered			2	1,075
	Removed			7	0
TOTAL		**11**	**16,575**	**49**	**84,900**

Of the 35 operational MSW dumpsites in Chouf caza that were surveyed in 2016, only one existed and was operational as per the 2011 survey while 34 new operational dumpsites were identified.

The total volume of operational MSW dumpsites in Chouf caza is 73,375 m³ which represents a 412% increase on the figure reported in the 2011 survey for operational dumpsites.

A total of 14 dumpsites were identified as non-operational in the 2016 survey, out of which five were not rehabilitated, two were rehabilitated-covered and seven were rehabilitated-removed. 10 of these dumpsites existed in the 2011 survey while four were newly identified in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Chouf caza, is shown to Table B - 12 in Appendix B.

3.1.3.3 *Area 3: Nabatieh and South Lebanon*

There is a general decrease in the volume of MSW in operational dumpsites in 'Area 3: Nabatieh and South Lebanon', this decrease is prominent at most caza levels with the exception of Jezzine. On the other hand, a general increase in the volume of MSW was noted in non-operational dumpsites. Burning practices were significantly present in operational dumpsites in Area 3 with the exception of Nabatieh caza as shown in Figure 3-7.

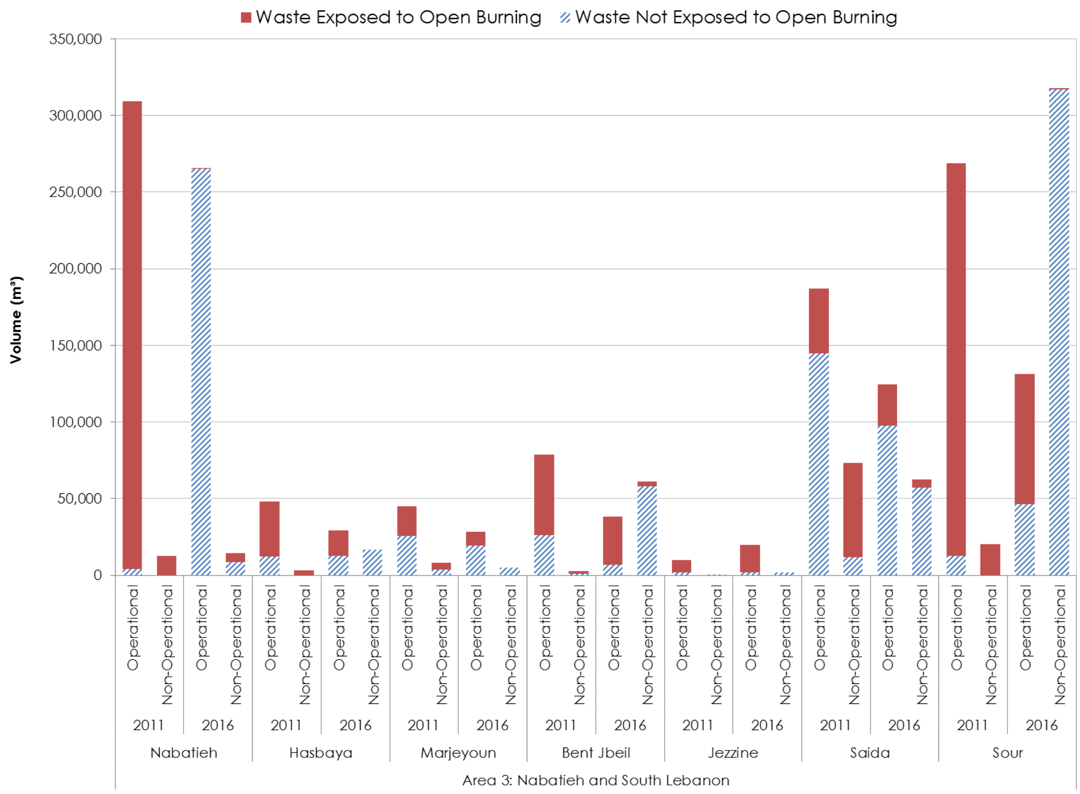


Figure 3-7 Volume of MSW in Relation to Dumpsite Status and Exposure to Open Burning in 2011 and 2016 in 'Area 3: Nabatieh and South Lebanon'

3.1.3.3.1 Nabatieh Caza

The volume of waste in MSW dumpsites in Nabatieh caza has decreased by 42,056 m³ between 2011 and 2016, as shown in Table 3-15.

Table 3-15 MSW Dumpsites Status in 2011 and 2016 Surveys - Nabatieh Caza

MSW Nabatieh Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		13	309,437	8	265,500
Non-operational	**Not rehabilitated**	17	12,768	13	14,029
	Covered			2	620
	Removed			8	0
TOTAL		**30**	**322,205**	**31**	**280,149**

Eight operational MSW dumpsites in Nabatieh caza were surveyed in 2016; six of these dumpsites also existed and were operational as per the 2011 survey. Two new operational dumpsites were identified in the 2016 survey.

The total volume of operational MSW dumpsites in Nabatieh caza is 265,500 m³ which represents around 14% decrease on the figure reported in the 2011 survey for operational dumpsites. Generally all the dumpsites had an increase in volume with the exception of one dumpsite (E4-Kfar Tibnit-00) which had an estimated volume of 295,800 m³ in 2011 survey versus 200,000 m³ in 2016 survey. A major part of this dumpsite is rehabilitated-covered and currently it is being used by Kfar Tibnit only.

A total of 23 dumpsites were identified as non-operational in the 2016 survey, out of which 13 were not rehabilitated, two were rehabilitated-covered and eight were rehabilitated-removed. 22 of these existed in the 2011 survey and one was newly identified in 2016 survey.

Two dumpsites were identified as MSW in 2011 survey and were re-classified as CDW dumpsites in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Nabatieh caza, is shown in Table B - 13 in Appendix B.

3.1.3.3.2 Hasbaya Caza

The volume of waste in MSW dumpsites in Hasbaya caza has decreased by 5,519 m³ between 2011 and 2016, as shown in Table 3-16.

Table 3-16 MSW Dumpsites Status in 2011 and 2016 Surveys - Hasbaya Caza

MSW Hasbaya Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		19	48,009	16	29,165
Non-operational	**Not rehabilitated**	3	3,455	5	8,900
	Covered			2	7,880
	Removed			1	0
TOTAL		**22**	**51,464**	**24**	**45,945**

16 operational MSW dumpsites in Hasbaya caza were surveyed in 2016; 14 of these dumpsites also existed and were operational as per the 2011 survey. Two new operational dumpsites were identified in the 2016 survey.

The total volume of operational MSW dumpsites in Hasbaya caza is 29,165 m³ which represents around 40% decrease on the figure reported in the 2011 survey for operational dumpsites.

This decrease in volume is related to activities being carried out by the municipalities such as burning and burial to manage the MSW volumes.

A total of eight dumpsites were identified as non-operational in the 2016 survey, out of which five were not rehabilitated, two were rehabilitated-covered and one was rehabilitated-removed.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Hasbaya caza, is shown in Table B - 14 in Appendix B.

3.1.3.3.3 Marjeyoun Caza

The volume of waste in MSW dumpsites in Marjeyoun caza has decreased by 19,414 m³ between 2011 and 2016, as shown in Table 3-17.

Table 3-17 MSW Dumpsites Status in 2011 and 2016 Surveys - Marjeyoun Caza

MSW Marjeyoun Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		22	44,980	20	28,545
Non-operational	**Not rehabilitated**	3	8,069	1	2,000
	Covered			1	3,090
	Removed			5	0
TOTAL		**25**	**53,049**	**27**	**33,635**

Out of the 20 operational MSW dumpsites in Marjeyoun caza were surveyed in 2016:

- 16 of these dumpsites also existed and were operational as per the 2011 survey;
- Two new operational dumpsites were identified in the 2016 survey;
- Two non-operational dumpsites recorded in the 2011 survey were operational in the 2016 survey.

The total volume of operational MSW dumpsites in Marjeyoun caza is 28,545 m³ which represents around 37% decrease on the figure reported in the 2011 survey for operational dumpsites. This overall volume decrease is attributed to four dumpsites that were operational in 2011 survey and were rehabilitated-removed by 2016. One of these dumpsites was E4-Dibbine-03 which alone had an estimated volume in the order of 23,000 m³.

A total of seven dumpsites that existed in the 2011 survey were identified as non-operational in the 2016 survey. Out of these one was not rehabilitated, one was rehabilitated-covered and five were rehabilitated-removed. A more detailed analysis on the changes between the 2011 and 2016 surveys in Marjeyoun caza, is shown in Table B – 15 in Appendix B.

3.1.3.3.4 Bent Jbeil Caza

The volume of waste in MSW dumpsites in Bent Jbeil caza has increased by 18,159 m³ between 2011 and 2016, as shown in Table 3-18.

Table 3-18 MSW Dumpsites Status in 2011 and 2016 Surveys - Bent Jbeil Caza

MSW Bent Jbeil Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		31	78,828	20	38,460
Non-operational	**Not rehabilitated**	6	2,808	10	12,595
	Covered			5	48,740
	Removed			8	0
TOTAL		**37**	**81,636**	**43**	**99,795**

Out of the 20 operational MSW dumpsites in Bent Jbeil caza that were surveyed in 2016:

- 13 of these dumpsites also existed and were operational as per the 2011 survey;
- 6 new operational dumpsites were identified in the 2016 survey.

The total volume of operational MSW dumpsites in Bent Jbeil caza is 38,460 m³ which represents around 51% decrease on the figure reported in the 2011 survey for operational dumpsites. This decrease is mainly attributed to the 18 dumpsites that were operational in 2011 and became non-operational in 2016 survey.

A total of 23 dumpsites that existed in 2011 survey were identified as non-operational in the 2016 survey. Out of these, 10 were not rehabilitated, five were rehabilitated-covered and eight were rehabilitated-removed.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Bent Jbeil caza, is shown in Table B – 16 in Appendix B.

3.1.3.3.5 Jezzine Caza

The volume of waste in MSW dumpsites in the Jezzine caza has increased by 11,957 m³ between 2011 and 2016, as shown in Table 3-19.

Table 3-19 MSW Dumpsites Status in 2011 and 2016 Surveys - Jezzine Caza

MSW Jezzine Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		15	9,936	10	19,910
Non-operational	**Not rehabilitated**	1	35	2	1,800
	Covered			2	177
	Removed			1	0
Inaccessible		-	-	1	41
TOTAL		**16**	**9,971**	**16**	**21,928**

The 10 operational MSW dumpsites in the Jezzine caza that were surveyed in 2016 also existed and were operational as per the 2011 survey.

The total volume of operational MSW dumpsites in the Jezzine caza is 19,910 m³ which represents around 100.4% increase on the figure reported in the 2011 survey for operational dumpsites.

A total of five dumpsites were identified as non-operational in the 2016 survey, out of which two were not rehabilitated, two were rehabilitated-covered and one was rehabilitated-removed. One dumpsite was inaccessible in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Jezzine caza, is shown in Table B – 17 in Appendix B.

3.1.3.3.6 Saida Caza

The volume of waste in MSW dumpsites in the Saida caza has decreased by 72,983 m³ between 2011 and 2016, as per Table 3-20.

In this section, Saida dumpsite (1,200,000 m³) that was rehabilitated since 2011 is excluded from the volume figures to give a more direct comparative assessment of the findings.

Table 3-20 MSW Dumpsites Status in 2011 and 2016 Surveys - Saida Caza

MSW Saida Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		33	186,925*	20	124,500
Non-operational	**Not rehabilitated**	6	73,292	7	37,688
	Covered			3	25,046
	Removed			12	0
TOTAL		**39**	**260,217**	**42**	**187,234**

*G2-Saida volume was excluded from both 2011 and 2016 survey figures for ease of comparison.

Out of the 20 operational MSW dumpsites in the Saida caza that were surveyed in 2016:

- 15 of these dumpsites also existed and were operational as per the 2011 survey;
- One dumpsite was non-operational in 2011 survey and has become operational in 2016;
- 4 new operational MSW dumpsites were identified in 2016 survey.

The total volume of operational MSW dumpsites in the Saida caza is 124,500 m³ which represents around 33.3% decrease on the figure reported in the 2011 survey for operational dumpsites. This decrease is mainly attributed to the 18 dumpsites that were operational in 2011 and became non-operational in 2016 survey with around 87,186 m³ decrease in volume.

A total of 22 dumpsites were identified as non-operational in the 2016 survey, out of which seven were not rehabilitated, three were rehabilitated-covered and 12 were rehabilitated-removed.

One dumpsite was reclassified as CDW in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Saida caza, is shown in Table B – 18 in Appendix B.

3.1.3.3.7 Sour Caza

The volume of waste in MSW dumpsites in Sour caza has increased by 160,028 m³ between 2011 and 2016, as shown in Table 3-21.

Table 3-21 MSW Dumpsites Status in 2011 and 2016 Surveys - Sour Caza

MSW Sour Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		35	268,887	33	131,510
Non-operational	**Not rehabilitated**	16	20,528	7	304,667
	Covered			4	13,266
	Removed			11	0
TOTAL		**51**	**289,415**	**55**	**449,443**

Of the 33 operational MSW dumpsites in Sour caza were surveyed in 2016:

- 21 of these dumpsites also existed and were operational as per the 2011 survey;
- Five dumpsites were non-operational in the 2011 survey and have become operational in 2016;
- Seven new operational dumpsites were identified in the 2016 survey.

The total volume of operational MSW dumpsites in Sour caza is 131,510 m³ which represents around 51% decrease on the figure reported in the 2011 survey for operational dumpsites. This is mainly because the C1-Deir Qanoun El-Aain-01 dumpsite which was operational in 2011 with a volume of 184,000 m³ became non-operational in 2016 with a volume of 300,000 m³.

A total of 22 dumpsites were identified as non-operational in the 2016 survey, out of which seven were not rehabilitated, four were rehabilitated-covered and eleven were rehabilitated-removed.

Three dumpsites were reclassified as CDW in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Saida caza, is shown in Table B – 19 in Appendix B.

3.1.3.4 Area 4: Beqaa and Baalback/Hermel

There is a general increase in the volume of MSW waste in 'Area 4: Beqaa and Baalback/Hermel' which is prominent at most caza levels. Burning practices were significant in operational dumpsites in Area 4 as shown in Figure 3-8.

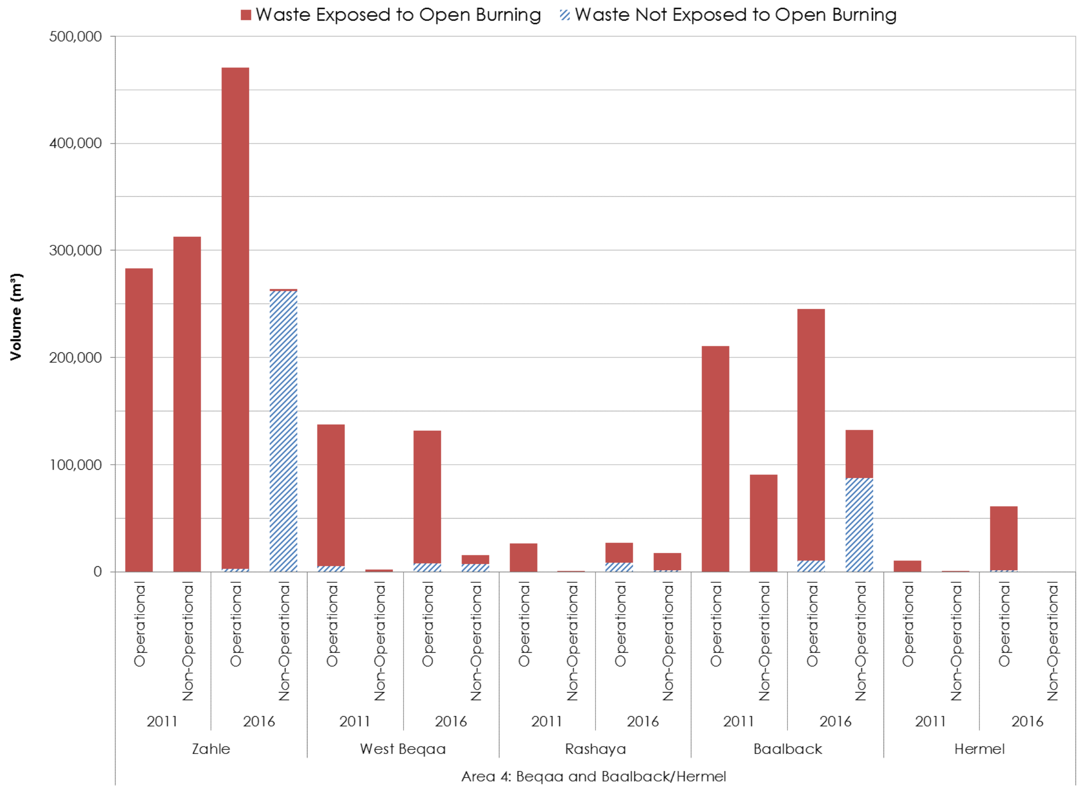


Figure 3-8 Volume of MSW in Relation to Dumpsite Status and Exposure to Open Burning in 2011 and 2016 in 'Area 4: Beqaa and Baalback/Hermel'

3.1.3.4.1 Zahle Caza

The volume of MSW in dumpsites in the Zahle caza has increased by 138,770 m³ between 2011 and 2016, as shown in Table 3-22.

Table 3-22 MSW Dumpsites Status in 2011 and 2016 Surveys - Zahle Caza

MSW Zahle Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		5	283,000	7	470,500
Non-operational	**Not rehabilitated**	13	312,480	2	10,000
	Covered			6	253,750
	Removed			2	0
TOTAL		**18**	**595,480**	**17**	**734,250**

Of the seven operational MSW dumpsites in Zahle caza that were surveyed in 2016:

- Five existed and were operational in the 2011 survey;
- One dumpsite that was not operational in the 2011 survey has become operational in the 2016 survey;
- One new operational dumpsite was identified.

The total volume of operational MSW dumpsites in Zahle caza is 470,500 m³ which represents a 66.3% increase on the figure reported in the 2011 survey for operational dumpsites.

A total of 10 dumpsites were identified as non-operational in the 2016 survey; among these, two were not rehabilitated, six rehabilitated-covered and two rehabilitated-removed. These 10 dumpsites were also non-operational in the 2011 survey.

Two dumpsites were reclassified as CDW in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Zahle caza, is shown in Table B – 20 in Appendix B.

3.1.3.4.2 West Beqaa Caza

The volume of MSW in dumpsites in West Beqaa caza has increased by 10,565 m³ between 2011 and 2016, as shown in Table 3-23.

Table 3-23 MSW Dumpsites Status in 2011 and 2016 Surveys - West Beqaa Caza

MSW West Beqaa Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		25	137,350	24	131,990
Non-operational	**Not rehabilitated**	2	2,100	6	15,300
	Covered			1	100
	Removed			1	0
Inaccessible		-	-	1	2,625
TOTAL		**27**	**139,450**	**33**	**150,015**

Of the 24 operational MSW dumpsites in West Beqaa caza that were surveyed in 2016, 18 existed and were operational as per the 2011 survey. Six new operational dumpsites were identified in West Beqaa.

The total volume of operational MSW dumpsites in West Beqaa caza is 131,990 m³ which represents a 4% decrease on the figure reported in the 2011 survey for operational dumpsites.

A total of eight dumpsites were identified as non-operational in the 2016 survey, out of which one was rehabilitated-covered and one was rehabilitated-removed.

One dumpsite which was operational in 2011 was inaccessible in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in West Beqaa caza, is shown in Table B – 21 in Appendix B.

3.1.3.4.3 Rashaya Caza

The volume of MSW in dumpsites in the Rashaya caza has increased by 20,905 m³ between 2011 and 2016, as shown in Table 3-24.

Table 3-24 MSW Dumpsites Status in 2011 and 2016 Surveys - Rashaya Caza

MSW Rashaya Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		29	26,695	23	27,180
Non-operational	**Not rehabilitated**	3	325	3	16,560
	Covered			5	1,045
	Removed			3	0
Inaccessible		-	-	5	3,140
TOTAL		**32**	**27,020**	**39**	**47,925**

Of the 23 operational MSW dumpsites in the Rashaya caza that were surveyed in 2016:

- 15 existed and were operational in the 2011 survey;
- Two existed and were non-operational in the 2011 survey;
- And six new MSW dumpsites were identified in the 2016 survey.

The total volume of operational MSW dumpsites in the Rashaya caza is 27,180 m³ which represents a 1.8% increase on the figure reported in the 2011 survey for operational dumpsites.

A total of eleven dumpsites were identified as non-operational in the 2016 survey, out of which three are not rehabilitated, five were covered and three were removed.

A total of five dumpsites were inaccessible due to security reasons and rough road conditions.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Rashaya caza, is shown in Table B – 22 in Appendix B.

3.1.3.4.4 Hermel Caza

The volume of MSW in dumpsites in the Hermel caza has increased by 57,350 m³ between 2011 and 2016, as shown in Table 3-25.

Table 3-25 MSW Dumpsites Status in 2011 and 2016 Surveys - Hermel Caza

MSW Hermel Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		4	10,600	3	61,250
Non-operational	**Not rehabilitated**	1	600	-	-
	Covered			-	-
	Removed			1	0
Inaccessible		-	-	1	6,000
TOTAL		**5**	**11,200**	**5**	**67,250**

The three operational dumpsites in the Hermel caza existed and were operational in the 2011 survey.

One dumpsite (R11-Hermel-01) was identified as non-operational in the 2011 survey and has since been rehabilitated-removed.

One dumpsite was inaccessible.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Hermel caza, is shown in Table B – 23 in Appendix B.

3.1.3.4.5 Baalback Caza

The volume of MSW in dumpsites in the Baalback caza has increased by 75,515 m³ between 2011 and 2016, as shown in Table 3-26.

Table 3-26 MSW Dumpsites Status in 2011 and 2016 Surveys - Baalback Caza

MSW Baalback Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		47	210,920*	39	245,065
Non-operational	**Not rehabilitated**	10	90,800*	15	93,670
	Covered			2	38,500
	Removed			10	0
TOTAL		**57**	**301,720**	**66**	**377,235**

*The volumes of M9-Baalback-1 and M9-Baalback-2, otherwise known as the Kayal dumpsites, were overestimated in the 2011 survey. The volumes of these two dumpsites were modified based on the figures reported by Laceco (2012) in a study on the rehabilitation of the Kayal dumpsites. The volumes of the M9-Baalback-01 were thus put at 39,000m³, and M9-Baalback-02 at 42,000m³.

Out of the 39 operational MSW dumpsites in Baalback caza that were surveyed in 2016:

- 28 existed and were operational as per the 2011 survey;
- Three MSW dumpsites that were non-operational in 2011 have become operational in 2016;
- Eight new operational MSW dumpsites were identified in the 2016 survey.

The total volume of operational MSW dumpsites in Baalback caza of 245,065 m³ thus represents a 16% increase on the figure reported in the 2011 survey for operational dumpsites.

A total of 27 dumpsites were identified as non-operational in the 2016 survey, out of which 15 are not rehabilitated, two are rehabilitated-covered and 10 are rehabilitated-removed. Among these, 26 dumpsites existed in the 2011 survey and one was newly identified in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Baalback caza, is shown in Table B – 24 in Appendix B.

3.2 CONSTRUCTION AND DEMOLITION WASTE DUMPSITES

3.2.1 CDW Dumpsites Status in the 2011 Survey

Back in the 2011 survey, 166 CDW dumpsites were identified, out of which 80% (132) were operational and 20% (34) were non-operational (Table 3-27). The volume of CDW in operational dumpsites was 1,468,528 m³ while that in non-operational dumpsites was 262,653 m³.

As can be seen in Table 3-27, the highest number of operational dumpsites was prominent in 'Area 2: Beirut and Mount Lebanon', which had around 54% (71) of the operational dumpsites, followed by 'Area 3: Nabatieh and South Lebanon' with 26 % (34).

Kesrouane caza alone had around 19% (25) of the total number of operational dumpsites in Lebanon, while Chouf caza held the highest volume of CDW in operational dumpsites at 608,758 m³.

'Area 2: Beirut and Mount Lebanon' also hosted the largest number of non-operational dumpsites and the largest volume of CDW in non-operational dumpsites, at 53% (18) and 77% respectively (203,285 m³).

'Area 4: Beqaa and Baalback/Hermel' had the lowest number in both operational and non-operational CDW dumpsites. It also had the lowest volume of non-operational CDW dumpsites, while 'Area 1: Akkar and North Lebanon' had the lowest volume in operational CDW dumpsites.

Table 3-27 CDW Dumpsites Status in 2011 Survey throughout Lebanon

	Operational		Non-Operational		Grand Total	
	#	**Volume (m^3)**	**#**	**Volume (m^3)**	**#**	**Volume (m^3)**
All Lebanon						
	132	**1,468,528**	**34**	**262,653**	**166**	**1,731,181**
Area 1: Akkar and North Lebanon						
	26	**42,968**	**7**	**27,960**	**33**	**70,928**
Akkar	8	15,600	1	270	**9**	**15,870**
Minieh-Dannieh	1	200	-	-	**1**	**200**
Tripoli	-	-	-	-	-	-
Zgharta	4	3,525	3	16,640	**7**	**20,165**
Koura	8	14,763	-	-	**8**	**14,763**
Bcharre	1	400	1	2,250	**2**	**2,650**
Batroun	4	8,480	2	8,800	**6**	**17,280**
Area 2: Beirut and Mount Lebanon						
	71	**1,021,113**	**18**	**203,285**	**89**	**1,224,398**
Jbeil	1	3,000	-	-	**1**	**3,000**
Kesrouane	25	151,190	5	118,900	**30**	**270,090**
Maten	22	181,460	8	45,735	**30**	**227,195**
Baabda	4	21,300	1	14,000	**5**	**35,300**
Aley	7	55,405	2	21,200	**9**	**76,605**
Chouf	12	608,758	2	3,450	**14**	**612,208**
Area 3: Nabatieh and South Lebanon						
	34	**179,447**	**5**	**20,708**	**39**	**200,155**
Nabatieh	5	14,552	-	-	**5**	**14,552**
Hasbaya	3	114,082	-	-	**3**	**114,082**
Marjeyoun	6	18,855	-	-	**6**	**18,855**
Bent Jbeil	6	11,810	3	9,038	**9**	**20,848**
Jezzine	3	6,897	-	-	**3**	**6,897**
Saida	3	7,374	-	-	**3**	**7,374**
Sour	8	5,877	2	11,670	**10**	**17,547**
Area 4: Beqaa and Baalback/Hermel						
	1	**225,000**	**4**	**10,700**	**5**	**235,700**
Zahle	-	-	3	3,700	**3**	**3,700**
West Beqaa	-	-	1	7,000	**1**	**7,000**
Rashaya	-	-	-	-	**-**	**-**
Hermel	-	-	-	-	**-**	**-**
Baalback	1	225,000	-	-	**1**	**225,000**

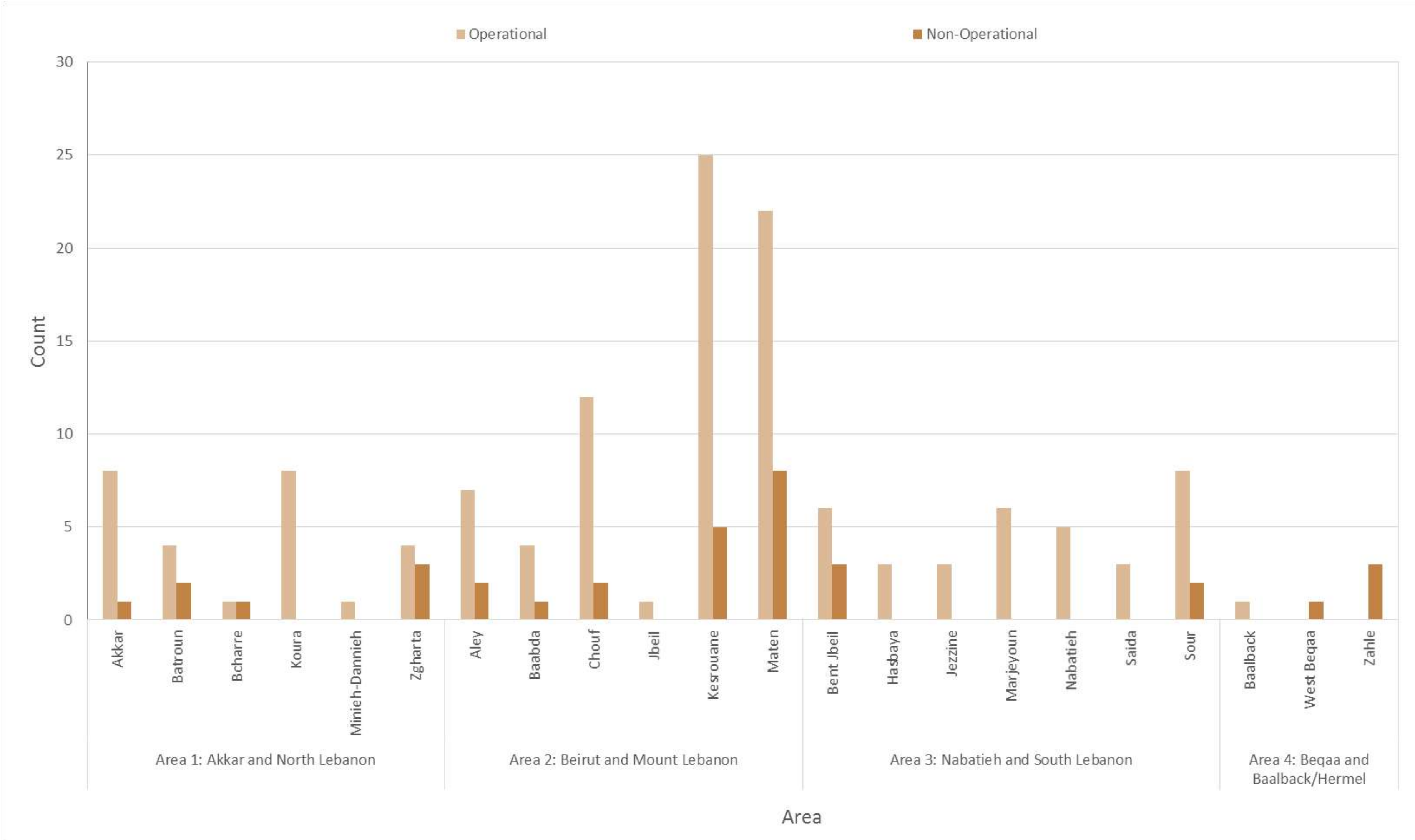


Figure 3-9 **Count of CDW Dumpsites in the 2011 Survey throughout Lebanon**

3.2.2 CDW Dumpsites Status in the 2016 Survey

In the 2016 survey, 324 CDW dumpsites were identified. The geographical distribution, status and volume of these dumpsites can be seen in Figure 3-10 and Figure 3-11. About 55% (178) of these were operational dumpsites whereas, 45% (145) were identified as non-operational dumpsites, as shown in Table 3-28.

The highest number of operational dumpsites was found in ‘Area 3: Nabatieh and South Lebanon’ which had around 39% (69) of the operational dumpsites, followed by ‘Area 4: Beqaa and Baalback/Hermel’ with 25% (45), as shown in Table 3-28 and Figure 3-12.

Baalback caza alone had around 15% (27) of the total number of operational dumpsites in Lebanon, followed by Bent Jbeil and Nabatieh cazas with around 10% (19) and 8% (15).

The highest CDW volumes in operational dumpsites in 2011 and 2016 were found in ‘Area 2: Beirut and Mount Lebanon’ followed by ‘Area 4: Beqaa and Baalback/Hermel’, as illustrated in Figure 3-12. The highest CDW volumes was prominent in Maten caza, with 28% (265,650 m^3).

The highest CDW volumes in non-operational dumpsites in 2011 and 2016 was found in ‘Area 2: Beirut and Mount Lebanon’, followed by ‘Area 4: Beqaa and Baalback/Hermel’ in 2016 and ‘Area 1: Akkar and North Lebanon’ in 2011. ‘Area 2: Beirut and Mount Lebanon’ also had the highest number and volume of not rehabilitated, covered and removed CDW dumpsites in 2016.

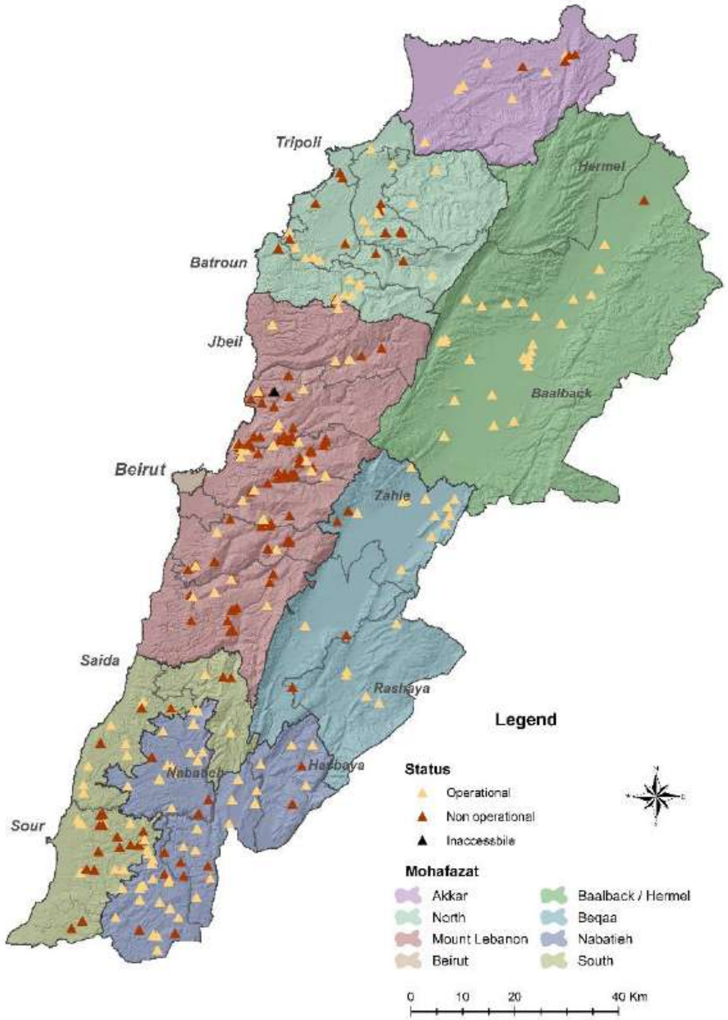


Figure 3-10 Map Showing the Geographical Locations and Status of CDW Dumpsites in 2016

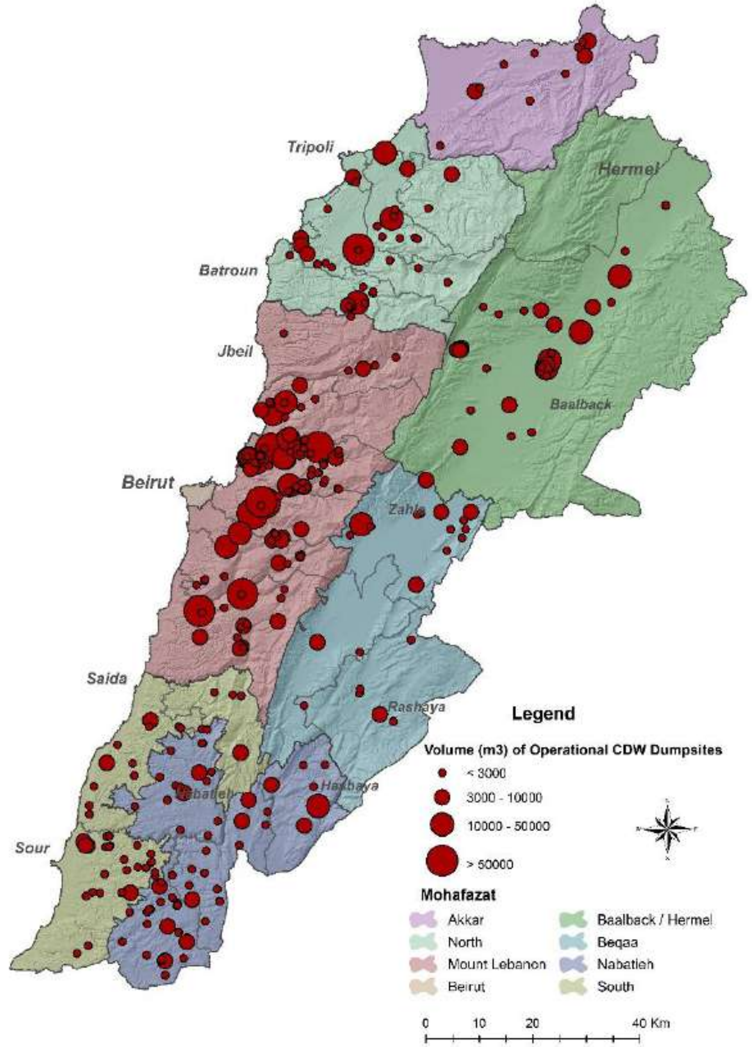


Figure 3-11 Map Showing the Geographical Locations and Volumes of Operational CDW Dumpsites in 2016

Table 3-28 CDW Dumpsites Status in 2016 Survey throughout Lebanon

	Operational		Non-Operational						Inaccessible		Grand Total	
			Not Rehabilitated		Rehabilitated							
					Covered		Removed					
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
All Lebanon												
	178	**964,223**	**92**	**463,316**	**21**	**717,997**	**32**	**0**	**1**	**15,000**	**324**	**2,160,536**
Area 1: Akkar and North Lebanon												
	29	**183,160**	**13**	**27,506**	**1**	**1,500**	**4**	**0**	**-**	**-**	**47**	**212,166**
Akkar	8	20,420	2	6,150	-	-	2	0	-	-	**12**	**26,570**
Minieh-Dannieh	3	41,100	-	-	-	-	-	-	-	-	**3**	**41,100**
Tripoli	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zgharta	4	24,900	4	6,950	-	-	1	0	-	-	**9**	**31,850**
Koura	6	73,300	5	12,006	-	-	-	-	-	-	**11**	**85,306**
Bcharre	1	1,200	1	1,800	-	-	1	0	-	-	**3**	**3,000**
Batroun	7	22,240	1	600	1	1,500	-	-	-	-	**9**	**24,340**
Area 2: Beirut and Mount Lebanon												
	35	**419,880**	**53**	**401,540**	**18**	**715,370**	**17**	**0**	**1**	**15,000**	**124**	**1,551,790**
Jbeil	4	9,000	1	1,000	-	-	1	0	-	-	**6**	**10,000**
Kesrouane	8	87,930	15	192,475	4	11,720	8	0	1	15,000	**36**	**307,125**
Maten	13	265,650	20	161,015	4	80,000	6	0	-	-	**43**	**506,665**
Baabda	3	2,450	3	15,900	3	19,400		-	-	-	**9**	**37,750**
Aley	3	42,650	7	15,200	2	26,250	2	0	-	-	**14**	**84,100**
Chouf	4	12,200	7	15,950	5	578,000	-	-	-	-	**16**	**606,150**
Area 3: Nabatieh and South Lebanon												
	69	**159,933**	**22**	**31,770**	**2**	**1,127**	**11**	**0**	**-**	**-**	**104**	**192,830**
Nabatieh	15	24,313	2	4,700	-	-	2	0	-	-	**19**	**29,013**
Hasbaya	4	42,500	2	6,750	-	-	-	-	-	-	**6**	**49,250**

	Operational		Non-Operational						Inaccessible		Grand Total	
			Not Rehabilitated		Rehabilitated							
					Covered		Removed					
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
Marjeyoun	10	16,925	5	8,200	-	-	-	-	-	-	**15**	**25,125**
Bent Jbeil	19	38,475	-	-	-	-	4	0	-	-	**23**	**38,475**
Jezzine	1	2,400	2	1,000	-	-	-	-	-	-	**3**	**3,400**
Saida	10	13,400	2	5,800	-	-	1	0	-	-	**13**	**19,200**
Sour	10	21,920	9	5,320	2	1,127	4	0	-	-	**25**	**28,367**
Area 4: Beqaa and Baalback/Hermel												
	45	**201,250**	**4**	**2,500**	**-**	**-**	**-**	**-**	**-**	**-**	**49**	**203,750**
Zahle	12	43,750	1	100	-	-	-	-	-	-	**13**	**43,850**
West Beqaa	1	7,500	2	900	-	-	-	-	-	-	**3**	**8,400**
Rashaya	5	9,700	-	-	-	-	-	-	-	-	**5**	**9,700**
Hermel	-	-	1	1,500	-	-	-	-	-	-	**1**	**1,500**
Baalback	27	140,300	-	-	-	-	-	-	-	-	**27**	**140,300**

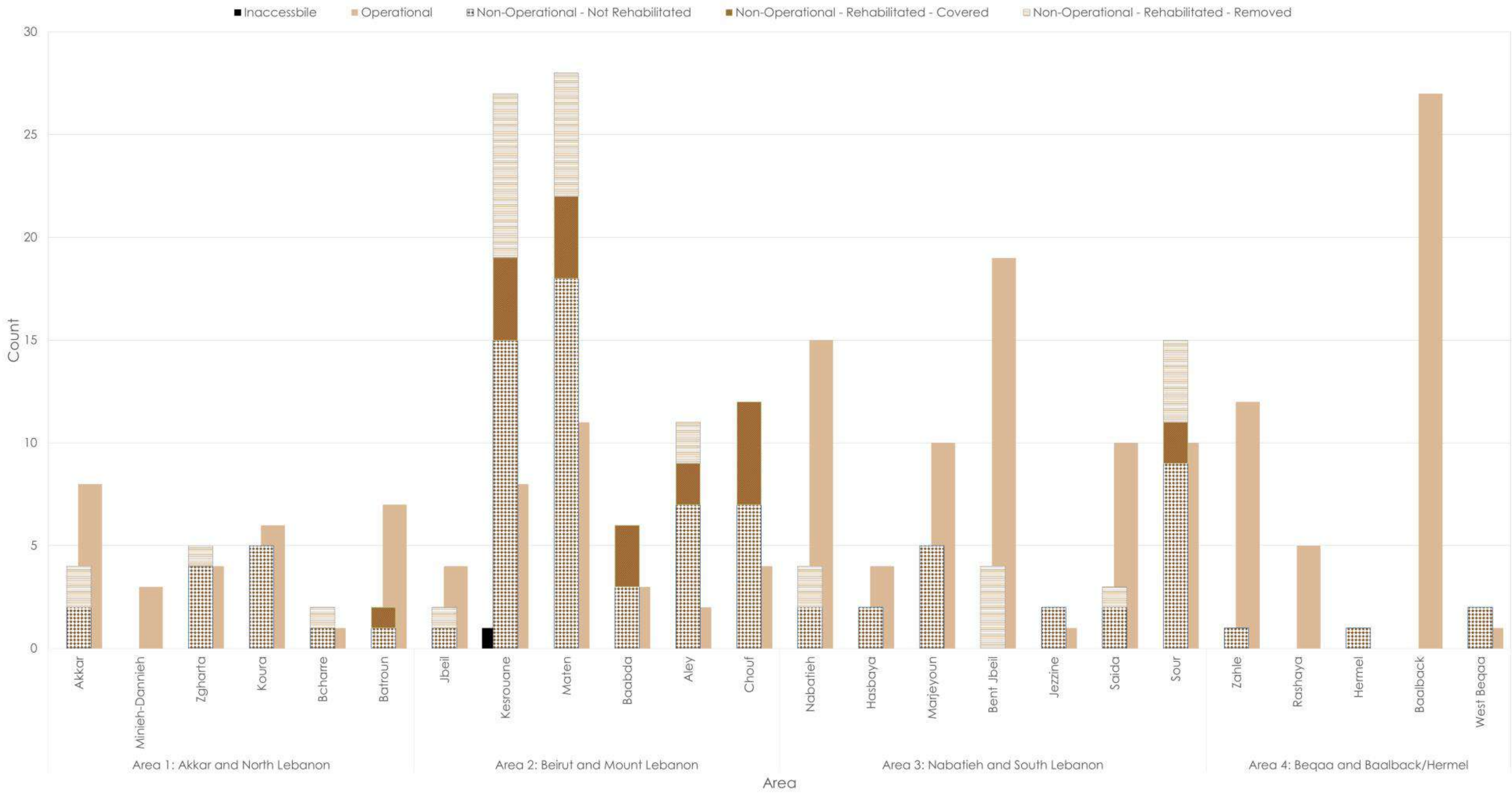


Figure 3-12 Count of CDW Dumpsites in the 2016 Survey throughout Lebanon

3.2.3 *Changes between the 2011 Survey and 2016 Survey per Caza*

This section presents a comparative overview of the changes in CDW dumpsites between the 2011 and the 2016 surveys according to the survey areas and cazas.

A detailed recount on the changes between the 2011 and 2016 surveys is illustrated in Appendix B.

3.2.3.1 *Area 1: Akkar and North Lebanon*

There is a general increase in the count and volume of CDW dumpsites in 'Area 1: Akkar and North Lebanon'. A detailed presentation on each caza will be presented in the following sections.

3.2.3.1.1 Akkar Caza

The volume of waste in CDW dumpsites in the Akkar caza has increased by 10,700 m³ between 2011 and 2016, as shown in Table 3-29.

Table 3-29 CDW Dumpsites Status in 2011 and 2016 Surveys - Akkar Caza

CDW Akkar Caza		**2011 Survey**		**2016 Survey**	
		Count	**Volume (m³)**	**Count**	**Volume (m³)**
Operational		8	15,600	8	20,420
Non-operational	**Not rehabilitated**	1	270	2	6,150
	Covered			-	-
	Removed			2	0
TOTAL		**9**	**15,870**	**12**	**26,570**

Eight operational CDW dumpsites were identified in the Akkar caza in the 2016 survey. Five of these dumpsites existed and were operational in the 2011 survey and three were new dumpsites identified in the 2016 survey.

The total volume of these dumpsites is 20,420 m³ which represents a 31% increase on the figure reported in the 2011 survey.

Four dumpsites were identified as non-operational in the 2016 survey; two of them were not rehabilitated and two were rehabilitated-removed.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Akkar caza, is shown in Table B – 25 in Appendix B.

3.2.3.1.2 Minieh-Dannieh Caza

The volume of waste in CDW dumpsites in the Minieh-Dannieh caza has increased by 40,900 m³ between 2011 and 2016, as shown in Table 3-30.

Table 3-30 CDW Dumpsites Status in 2011 and 2016 Surveys - Minieh-Dannieh Caza

CDW Minieh-Dannieh Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		1	200	3	41,100
Non-operational	Not rehabilitated	-	-	-	-
	Covered			-	-
	Removed			-	-
TOTAL		**1**	**200**	**3**	**41,100**

Three operational CDW dumpsites were identified in the Minnieh-Dannieh caza in the 2016 survey. One dumpsite already existed in the 2011 survey, one was newly identified in the 2016 survey and one dumpsite that was classified as a non-operational MSW dumpsite in the 2011 survey became an operational CDW dumpsite by 2016.

The total volume of these dumpsites is 41,100 m³ which represents around a 20,450% increase from the figure reported in the 2011 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Minieh-Dannieh caza, is shown in Table B – 26 in Appendix B.

3.2.3.1.3 Tripoli Caza

No CDW dumpsites were recorded in Tripoli.

3.2.3.1.4 Zgharta Caza

The volume of waste in CDW dumpsites in the Zgharta caza has increased by 11,685 m³ between 2011 and 2016, as shown in Table 3-31.

Table 3-31 CDW Dumpsites Status in 2011 and 2016 Surveys - Zgharta Caza

CDW Zgharta Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		4	3,525	4	24,900
Non-operational	Not rehabilitated	3	16,640	4	6,950
	Covered			-	-
	Removed			1	0
TOTAL		**7**	**20,165**	**9**	**31,850**

Four operational CDW dumpsites were identified in the Zgharta caza in 2016. Two of these dumpsites had already been identified as operational in the 2011 survey; one was non-operational and became operational by 2016 and one was classified as an operational MSW dumpsite in 2011 and became an operational CDW dumpsite by 2016.

The total volume of these dumpsites is 24,900 m³ which represents a 606% increase from the figure reported in the 2011 survey.

Five dumpsites were identified as non-operational in the 2016 survey. Four were not rehabilitated and one was rehabilitated-removed. Among these, two were operational in 2011 survey and became non-operational, two were non-operational and remained non-operational in 2016 survey and one dumpsite was operational MSW in 2011 survey and became non-operational CDW in 2016.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Zgharta caza, is shown in Table B – 27 in Appendix B.

3.2.3.1.5 Koura Caza

The volume of waste in CDW dumpsites in the Koura caza has increased by 70,543 m³ between 2011 and 2016, as shown in Table 3-32.

Table 3-32 CDW Dumpsites Status in 2011 and 2016 Surveys - Koura Caza

CDW Koura Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		8	14,763	6	73,300
Non-operational	**Not rehabilitated**	-	-	5	12,006
	Covered			-	-
	Removed			-	-
TOTAL		**8**	**14,763**	**11**	**85,306**

Six operational CDW dumpsites were identified in the Koura caza in the 2016 survey. Four of these dumpsites already existed since 2011 and two dumpsites that were classified as MSW dumpsites in 2011 were classified as operational CDW dumpsites in 2016.

The total volume of these dumpsites is 73,300 m³ which represents approximately a 400% increase from the figure reported in the 2011 survey.

Five dumpsites were identified as non-operational and not rehabilitated in the 2016 survey. Among these, four were operational CDW dumpsites in the 2011 survey and were non-operational in 2016 and one dumpsite was newly identified in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Koura caza, is shown in Table B – 28 in Appendix B.

3.2.3.1.6 Bcharre Caza

The volume of waste in CDW dumpsites in the Bcharre caza has increased by 350 m³ between 2011 and 2016, as shown in Table 3-33.

Table 3-33 CDW Dumpsites Status in 2011 and 2016 Surveys - Bcharre Caza

CDW Bcharre Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		1	400	1	1,200
Non-operational	**Not rehabilitated**	1	2,250	1	1,800
	Covered			-	-
	Removed			1	0
TOTAL		**2**	**2,650**	**3**	**3,000**

One new dumpsite was operational in the 2016 survey with a total volume of 1,200 m³.

Two dumpsites were identified as non-operational in the 2016 survey. One was not rehabilitated and one was rehabilitated-removed. Both of these dumpsites existed in the 2011 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Bcharre caza, is shown in Table B – 29 in Appendix B.

3.2.3.1.7 Batroun Caza

The volume of waste in CDW dumpsites in the Batroun caza has increased by 7,060 m³ between 2011 and 2016, as shown in Table 3-34.

Table 3-34 CDW Dumpsites Status in 2011 and 2016 Surveys - Batroun Caza

CDW Batroun Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		4	8,480	7	22,240
Non-operational	**Not rehabilitated**	2	8,800	1	600
	Covered			1	1,500
	Removed			-	-
TOTAL		**6**	**17,280**	**9**	**24,340**

Seven operational CDW dumpsites were identified in the Batroun caza during the 2016 survey. Four of these dumpsites existed and were operational in the 2011 survey. One dumpsite was non-operational in 2011 and has become operational in 2016. One dumpsite was newly identified in the 2016 survey and one dumpsite was an operational MSW dumpsite in the 2011 survey and was classified as an operational CDW dumpsite in 2016.

The total volume of waste in these dumpsites is 22,240 m³.

Two dumpsites were identified as non-operational in the 2016 survey. One was not rehabilitated and one was rehabilitated-covered. One was non-operational CDW in 2011 survey and one was operational MSW in 2011 and was reclassified as CDW in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Batroun caza, is shown in Table B – 30 in Appendix B.

3.2.3.2 *Area 2: Beirut and Mount Lebanon*

An increase in the count and volume of CDW dumpsites has been witnessed in 'Area 2: Beirut and Mount Lebanon'. The following sections show the changes in each caza.

3.2.3.2.1 Jbeil Caza

The volume of CDW in dumpsites in the Jbeil caza has increased by 7,000 m³ between 2011 and 2016, as shown in Table 3-35.

Table 3-35 CDW Dumpsites Status in 2011 and 2016 Surveys - Jbeil Caza

CDW Jbeil Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		1	3,000	4	9,000
Non-operational	**Not rehabilitated**	-	-	1	1,000
	Covered			-	-
	Removed			1	0
TOTAL		**1**	**3,000**	**6**	**10,000**

Four new operational CDW dumpsites were identified in the Jbeil caza in 2016.

The total volume of these dumpsites is 9,000 m³ which represents a 200% increase from the figure reported in the 2011 survey.

Two dumpsites were identified as non-operational in the 2016 survey, one not rehabilitated and one rehabilitated-removed. One existed in the 2011 survey and one was newly identified in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Jbeil caza, is shown in Table B – 31 in Appendix B.

3.2.3.2.2 Kesrouane Caza

The volume of CDW in dumpsites in the Kesrouane caza has increased by 37,035 m³ between 2011 and 2016, as shown in Table 3-36.

Table 3-36 CDW Dumpsites Status in 2011 and 2016 Surveys - Kesrouane Caza

CDW Kesrouane Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		25	151,190	8	87,930
Non-operational	**Not rehabilitated**	5	118,900	15	192,475
	Covered			4	11,720
	Removed			8	0
Inaccessible		-	-	1	15,000
TOTAL		**30**	**270,090**	**36**	**307,125**

Eight operational CDW dumpsites were identified in the Kesrouane caza in 2016. Two of these dumpsites already existed and were operational since the 2011 survey, two dumpsites were non-operational in 2011 and became operational in the 2016 survey, one dumpsite was identified in the 2016 survey, and three dumpsites were classified as MSW in 2011 and became CDW in 2016.

The total volume of these dumpsites is 87,930 m³ which represents a 41.8% decrease from the figure reported in the 2011 survey.

27 dumpsites were identified as non-operational in the 2016 survey. 15 were not rehabilitated, four were rehabilitated-covered and eight were rehabilitated-removed. Among these, 25 dumpsites already existed in 2011 survey and two were newly identified in 2016 survey.

One dumpsite was non-operational in the 2011 survey while it became inaccessible in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Kesrouane caza, is shown in Table B – 32 in Appendix B.

3.2.3.2.3 Maten Caza

The volume of CDW in dumpsites in the Maten caza has increased by 279,470 m³ between 2011 and 2016, as shown in Table 3-37.

Table 3-37 CDW Dumpsites Status in 2011 and 2016 Surveys - Maten Caza

<table>
<tr><th colspan="2" rowspan="2">CDW
Maten Caza</th><th colspan="2">2011 Survey</th><th colspan="2">2016 Survey</th></tr>
<tr><th>Count</th><th>Volume (m³)</th><th>Count</th><th>Volume (m³)</th></tr>
<tr><td colspan="2">Operational</td><td>22</td><td>181,460</td><td>13</td><td>265,650</td></tr>
<tr><td rowspan="3">Non-operational</td><td>Not rehabilitated</td><td rowspan="3">8</td><td rowspan="3">45,735</td><td>20</td><td>161,015</td></tr>
<tr><td>Covered</td><td>4</td><td>80,000</td></tr>
<tr><td>Removed</td><td>6</td><td>0</td></tr>
<tr><td colspan="2">TOTAL</td><td>30</td><td>227,195</td><td>43</td><td>506,665</td></tr>
</table>

Out of the 13 operational CDW dumpsites were identified in the Maten caza in 2016, five of these already existed and were operational in the 2011 survey; two dumpsites were non-operational in 2011 and became operational by 2016; and six dumpsites were newly identified in the 2016 survey.

The total volume of these dumpsites is 265,650 m³ which presents a 46% increase from the figure reported in the 2011 survey.

30 dumpsites were identified as non-operational in the 2016 survey. 20 were not rehabilitated, four were rehabilitated-covered and six were rehabilitated-removed. Among these 23 already existed in the 2011 survey and five CDW dumpsites were newly identified in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Maten caza, is shown in Table B – 33 in Appendix B.

3.2.3.2.4 Baabda Caza

The volume of CDW in dumpsites in the Baabda caza has increased by 2,450 m³ between 2011 and 2016, as shown in Table 3-38.

Table 3-38 CDW Dumpsites Status in 2011 and 2016 Surveys - Baabda Caza

CDW Baabda Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		4	21,300	3	2,450
Non-operational	Not rehabilitated	1	14,000	3	15,900
	Covered			3	19,400
	Removed			-	-
TOTAL		5	35,300	9	37,750

Three operational CDW dumpsites were identified in the Baabda caza in 2016. Two of these dumpsites was identified in the 2016 survey and one dumpsite was MSW in the 2011 survey and became operational CDW in 2016.

The total volume of these dumpsites is 2,450 m³ which represents an 88% decrease from the figure reported in the 2011 survey.

Six dumpsites were identified as non-operational in the 2016 survey, with three being not rehabilitated and three rehabilitated-covered. Five of these existed in 2011 survey and one was newly identified in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Maten caza, is shown in Table B – 34 in Appendix B.

3.2.3.2.5 Aley Caza

The volume of CDW in dumpsites in the Aley caza has increased by 4,995 m³ between 2011 and 2016, as shown in Table 3-39.

Table 3-39 CDW Dumpsites Status in 2011 and 2016 Surveys - Aley Caza

CDW Aley Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		7	55,405	3	42,650
Non-operational	Not rehabilitated	2	21,200	7	15,200
	Covered			2	26,250
	Removed			2	0
TOTAL		9	76,605	14	84,100

Out of the three operational CDW dumpsites identified in the Aley caza in 2016, one already existed and was operational in 2011 survey and two were newly identified in 2016 survey.

The total volume of these dumpsites is 42,650 m³ which represents a 23% decrease from the figure reported in the 2011 survey due to the increase in the number and volume of non-operational dumpsites.

11 dumpsites were identified as non-operational in the 2016 survey, of which seven were not rehabilitated, two rehabilitated-covered and two rehabilitated-removed. Eight of these dumpsites existed since the 2011 survey and 3 were newly identified in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Aley caza is shown in Table B – 35 in Appendix B.

3.2.3.2.6 Chouf Caza

The volume of CDW in dumpsites in the Chouf caza has decreased by 6,057 m³ between 2011 and 2016, as shown in Table 3-40.

Table 3-40 CDW Dumpsites Status in 2011 and 2016 Surveys - Chouf Caza

CDW Chouf Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		12	608,757	4	12,200
Non-operational	**Not rehabilitated**	2	3,450	7	15,950
	Covered			5	578,000
	Removed			-	-
TOTAL		**14**	**612,207**	**16**	**606,150**

Out of the four operational CDW dumpsites identified in the Chouf caza in 2016, two already existed and were operational in the 2011 survey and two were newly identified in the 2016 survey.

The total volume of these dumpsites is 12,200 m³ which represents a 98% decrease from the figure reported in the 2011 survey. This is coupled with an increase in the volume of CDW in non-operational dumpsites.

12 dumpsites, which existed in the 2011 survey, were identified as non-operational in the 2016 survey, of which seven were not rehabilitated and five were rehabilitated-covered.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Chouf caza is shown in Table B – 36 in Appendix B.

3.2.3.3 *Area 3: Nabatieh and South Lebanon*

An increase in the count of CDW dumpsites has been witnessed in 'Area 3: Nabatieh and South Lebanon'. The following sections go through the changes in the dumpsites status in each caza.

3.2.3.3.1 Nabatieh Caza

The volume of waste in CDW dumpsites in the Nabatieh caza has increased by 14,461 m³ between 2011 and 2016, as shown in Table 3-41.

Table 3-41 CDW Dumpsites Status in 2011 and 2016 Surveys - Nabatieh Caza

CDW Nabatieh Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		5	14,552	15	24,313
Non-operational	**Not rehabilitated**	-	-	2	4,700
	Covered			-	-
	Removed			2	0
TOTAL		**5**	**14,552**	**19**	**29,013**

Out of the 15 operational CDW dumpsites identified in the Nabatieh caza in 2016:

- One existed and was operational in 2011 survey;
- 12 were newly identified in 2016 survey;
- Two operational dumpsites were MSW in 2011 survey and were classified as CDW in 2016 survey.

The total volume of waste in these dumpsites is 24,313 m³ which represents a 67% increase from the figure reported in the 2011 survey.

Four dumpsites which were operational in 2011 survey were identified as non-operational in the 2016 survey. Two were not rehabilitated and two were rehabilitated-removed.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Nabatieh caza is shown in Table B – 37 in Appendix B.

3.2.3.3.2 Hasbaya Caza

The volume of waste in the CDW dumpsites in the Hasbaya caza has decreased by 64,832 m³ between 2011 and 2016, as shown in Table 3-42.

Table 3-42 CDW Dumpsites Status in 2011 and 2016 Surveys - Hasbaya Caza

CDW Hasbaya Caza		2011 Survey		2016 Survey	
		Count	Volume (m^3)	Count	Volume (m^3)
Operational		3	114,082	4	42,500
Non-operational	**Not rehabilitated**	-	-	2	6,750
	Covered			-	-
	Removed			-	-
TOTAL		**3**	**114,082**	**6**	**49,250**

Four operational CDW dumpsites were identified in the Hasbaya caza in the 2016 survey. One of these dumpsites existed and was operational in the 2011 survey and three were new dumpsites identified in the 2016 survey. The total volume of these dumpsites is 42,500 m³ which represents a 63% decrease from the figure reported in the 2011 survey.

Two dumpsites that were operational in the 2011 survey were identified as non-operational and not rehabilitated in the 2016 survey. A more detailed analysis on the changes between the 2011 and 2016 surveys in Hasbaya caza is shown in Table B – 38 in Appendix B.

3.2.3.3.3 Marjeyoun Caza

The volume of waste in CDW dumpsites in the Marjeyoun caza has increased by 6,270 m³ between 2011 and 2016, as shown in Table 3-43.

Table 3-43 CDW Dumpsites Status in 2011 and 2016 Surveys - Marjeyoun Caza

CDW Marjeyoun Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		6	18,855	10	16,925
Non-operational	**Not rehabilitated**	-	-	5	8,200
	Covered			-	-
	Removed			-	-
TOTAL		**6**	**18,855**	**15**	**25,125**

Of the 10 operational CDW dumpsites identified in the Marjeyoun caza in the 2016 survey, one of these dumpsites existed and was operational in 2011 and nine are new dumpsites identified in the 2016 survey.

The total volume of these dumpsites is 16,925 m³ which represents a 10% decrease from the figure reported in the 2011 survey. This is coupled with an increase in volume in non-operational CDW dumpsites.

Five dumpsites which were operational in 2011 survey were identified as non-operational in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Marjeyoun caza is shown in Table B – 39 in Appendix B.

3.2.3.3.4 Bent Jbeil Caza

The volume of waste in CDW dumpsites in the Bent Jbeil caza has increased by 17,627 m³ between 2011 and 2016, as shown in Table 3-44.

Table 3-44 CDW Dumpsites Status in 2011 and 2016 Surveys - Bent Jbeil Caza

CDW Bent Jbeil Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		6	11,810	19	38,475
Non-operational	**Not rehabilitated**	3	9,038	-	-
	Covered			-	-
	Removed			4	0
TOTAL		**9**	**20,848**	**23**	**38,475**

Out of the 19 operational CDW dumpsites identified in the Bent Jbeil caza in the 2016 survey, three existed and were operational since the 2011 survey; two were non-operational in 2011 and have become operational in 2016; and 14 are new dumpsites identified in the 2016 survey.

The total volume of waste in these dumpsites is 38,475 m³ which represents a 226% increase from the figure reported in the 2011 survey

Four dumpsites were identified as non-operational and removed in the 2016 survey. Three of these were operational in the 2011 survey while one was non-operational. A more detailed analysis on the changes between the 2011 and 2016 surveys in Bent Jbeil caza is shown in Table B – 40 in Appendix B.

3.2.3.3.5 Jezzine Caza

The volume of waste in CDW dumpsites in the Jezzine caza has decreased by 3,497 m³ between 2011 and 2016, as shown in Table 3-45.

Table 3-45 CDW Dumpsites Status in 2011 and 2016 Surveys - Jezzine Caza

CDW Jezzine Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		3	6,897	1	2,400
Non-operational	**Not rehabilitated**	-	-	2	1,000
	Covered			-	-
	Removed			-	-
TOTAL		**3**	**6,897**	**3**	**3,400**

The operational CDW dumpsite identified in the Jezzine caza in the 2016 survey was also operational in 2011. Its volume of 2,400 m³ represents a 65% decrease from the figure reported in the 2011 survey for the three operational CDW dumpsites. The remaining two dumpsites which were operational in 2011 were identified as non-operational in the 2016 survey. A more detailed analysis on the changes between the 2011 and 2016 surveys in Bent Jbeil caza is presented in Table B – 41 in Appendix B.

3.2.3.3.6 Saida Caza

The volume of waste in CDW dumpsites in the Saida caza has increased by 11,826 m³ between 2011 and 2016, as shown in Table 3-46.

Table 3-46 CDW Dumpsites Status in 2011 and 2016 Surveys - Saida Caza

CDW Saida Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		3	7,374	10	13,400
Non-operational	**Not rehabilitated**	-	-	2	5,800
	Covered			-	-
	Removed			1	0
TOTAL		**3**	**7,374**	**13**	**19,200**

Ten operational CDW dumpsites were identified in the Saida caza in the 2016 survey. One of these dumpsites existed and has been operational since it was identified in the 2011 survey and nine are new dumpsites identified in the 2016 survey.

The total volume of waste in these dumpsites is 13,400 m³ which represents around 82% increase from the figure reported in the 2011 survey.

Three dumpsites were identified as non-operational in the 2016 survey. Two were not rehabilitated and one was rehabilitated-removed. Two were operational in the 2011 survey and one was classified as an MSW in 2011 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Saida caza is presented in Table B – 42 in Appendix B.

3.2.3.3.7 Sour Caza

The volume of waste in the CDW dumpsites in the Sour caza has increased by 10,820 m³ between 2011 and 2016, as shown in Table 3-47.

Table 3-47 Dumpsites Status in 2011 and 2016 Surveys - Sour Caza

CDW Sour Caza		**2011 Survey**		**2016 Survey**	
		Count	**Volume (m³)**	**Count**	**Volume (m³)**
Operational		8	5,877	10	21,920
Non-operational	**Not rehabilitated**	2	11,670	9	5,320
	Covered			2	1,127
	Removed			4	0
TOTAL		**10**	**17,547**	**25**	**28,367**

Ten operational CDW dumpsites were identified in the Sour caza in the 2016 survey. Two of these dumpsites existed and have been operational since the 2011 survey, seven are new dumpsites identified in the 2016 survey, and one was classified as an operational MSW dumpsite in 2011 and has become a CDW dumpsite in 2016.

The total volume of waste in these dumpsites is 21,920 m³ which represents a 273% increase from the figure reported in the 2011 survey.

15 dumpsites were identified as non-operational in the 2016 survey. Nine were not rehabilitated, two were rehabilitated-covered and four were rehabilitated-removed. 10 of these already existed in the 2011 survey while 5 are new dumpsites identified in 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Sour caza is shown in Table B – 43 in Appendix B.

3.2.3.4 <u>Area 4: Beqaa and Baalback/Hermel</u>

An increase in the count of CDW dumpsites has been witnessed in 'Area 4: Beqaa and Baalback/Hermel'. The following sections show the changes in the dumpsites status in each caza.

3.2.3.4.1 Zahle Caza

The volume of waste in CDW dumpsites in the Zahle caza has increased by 40,150 m³ between 2011 and 2016, as shown in Table 3-48.

Table 3-48 CDW Dumpsites Status in 2011 and 2016 Surveys - Zahle Caza

CDW Zahle Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		-	-	12	43,750
Non-operational	Not rehabilitated	3	3,700	1	100
	Covered			-	-
	Removed			-	-
TOTAL		**3**	**3,700**	**13**	**43,850**

12 operational CDW dumpsites were identified in the Zahle caza in the 2016 survey. Eight new CDW dumpsites were identified, three were non-operational in 2011 survey and became operational in 2016 and one dumpsite was classified as MSW in the 2011 survey and has become CDW in 2016. The total volume of waste in these dumpsites is 40,050 m³.

One dumpsite was identified as non-operational in the 2016 survey. It was classified as MSW in the 2011 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Zahle caza is presented in Table B – 44 in Appendix B.

3.2.3.4.2 West Beqaa Caza

The volume of waste in CDW dumpsites in the West Beqaa caza has increased by 1,400 m³ between 2011 and 2016, as shown in Table 3-49.

Table 3-49 CDW Dumpsites Status in 2011 and 2016 Surveys - West Beqaa Caza

CDW West Beqaa Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		-	-	1	7,500
Non-operational	Not rehabilitated	1	7,000	2	900
	Covered			-	-
	Removed			-	-
TOTAL		**1**	**7,000**	**3**	**8,400**

One operational CDW dumpsite was identified in the West Beqaa caza during the 2016 survey. This dumpsite was non-operational in 2011 survey. Two new CDW dumpsites were identified as non-operational and not rehabilitated in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in West Beqaa caza is presented in Table B – 45 in Appendix B.

3.2.3.4.3 Rashaya Caza

The volume of waste in CDW in dumpsites in the Rashaya caza has increased by 9,700 m³ between 2011 and 2016, as shown in Table 3-50.

Table 3-50 CDW Dumpsites Status in 2011 and 2016 Surveys - Rashaya Caza

CDW Rashaya Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		-	-	5	9,700
Non-operational	Not rehabilitated	-	-	-	-
	Covered			-	-
	Removed			-	-
TOTAL		-	-	5	9,700

Five new operational CDW dumpsites were identified in the 2016 survey. The total volume of waste in these dumpsites is 9,700 m³. CDW dumpsites were not identified in 2011 survey in Rashaya Caza.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Rashaya caza is presented in Table B – 46 in Appendix B.

3.2.3.4.4 Hermel Caza

The volume of waste in CDW dumpsites in the Hermel caza is 1,500 m³ in 2016, as shown in Table 3-51.

Table 3-51 CDW Dumpsites Status in 2011 and 2016 Surveys - Hermel Caza

CDW Hermel Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		-	-	-	-
Non-operational	Not rehabilitated	-	-	1	1,500
	Covered			-	-
	Removed			-	-
TOTAL		-	-	1	1,500

No operational CDW dumpsites were identified in the Hermel caza in the 2011 survey, or in the 2016 survey. Only one new CDW dumpsite was identified as non-operational in the 2016 survey.

A more detailed analysis on the changes between the 2011 and 2016 surveys in Hermel caza is presented in Table B – 47 in Appendix B.

3.2.3.4.5 Baalback Caza

The volume of waste in CDW dumpsites in the Baalback caza has decreased by 84,700 m³ between 2011 and 2016, as shown in Table 3-52.

Table 3-52 CDW Dumpsites Status in 2011 and 2016 Surveys - Baalback Caza

CDW Baalback Caza		2011 Survey		2016 Survey	
		Count	Volume (m³)	Count	Volume (m³)
Operational		1	225,000	27	140,300
Non-operational	**Not rehabilitated**	-	-	-	-
	Covered			-	-
	Removed			-	-
TOTAL		**1**	**225,000**	**27**	**140,300**

Of the 27 operational CDW dumpsites identified in the Baalback caza in the 2016 survey, only one existed in the 2011 survey while 26 are new dumpsites identified in the 2016 survey.

The total volume of these dumpsites is 140,300 m³ which represents a 37.6% decrease from the figure reported in the 2011 survey. This is because of one dumpsite (L8-Chmestar-01) which was partially rehabilitated with a significant decrease in volume.

Detailed analysis on the changes between the 2011 and 2016 surveys are presented in Table B – 48 in Appendix B.

3.3 MIXED WASTE DUMPSITES

As stated in Section 2.1, a dumpsite is classified as MSW or CDW in accordance to the majority (more than 85%) of its waste type.

Alternatively, mixed CDW dumpsites containing MSW could be classified as MSW since MSW has direct short-term impacts on the environment. If this approach was followed in the 2016 survey and mixed dumpsites were considered as MSW, then a total of 41 mixed dumpsites categorized as CDW with a volume of 497,570 m³ would be added to MSW figures as shown in Table 3-53.

As a result, the total count of MSW dumpsites would become 658 with a total volume of 6,240,877 m³ while the total count of CDW dumpsites would become 283 with 1,622,966 m³ as shown in the below table.

Table 3-53 Total Count of Dumpsites surveyed in the 2016 survey if Mixed Waste Dumps were Considered as MSW

Dumpsite Type	Count	Volume (m³)
MSW	617	5,743,307
Mixed	41	497,570
MSW total with mixed dumpsites	**658**	**6,240,877**
CDW total without mixed dumpsites	**283**	**1,662,966**
Total	**941**	**7,903,843**

Out of the 41 mixed dumpsites, 27 are operational and have a volume of 394,720 m³ and 14 are non-operational and not rehabilitated and have a volume of 102,850 m³ as shown in Table 3-54.

Table 3-54 Distribution of Mixed Dumpsites Status in the 2016 Survey throughout Lebanon

	Operational		Non-Operational						Inaccessible		Grand Total	
			Not Rehabilitated		Rehabilitated							
					Covered		Removed					
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
All Lebanon												
	27	**394,720**	**14**	**102,850**	**-**	**-**	**-**	**-**	**-**	**-**	**41**	**497,570**
Area 1: Akkar and North Lebanon												
	3	**42,500**	**2**	**3,150**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**45,650**
Akkar	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Minieh-Dannieh	2	41,000	-	-	-	-	-	-	-	-	**2**	**41,000**
Tripoli	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zgharta	-	-	2	3,150	-	-	-	-	-	-	**2**	**3,150**
Koura	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Bcharre	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Batroun	1	1,500	-	-	-	-	-	-	-	-	**1**	**1,500**
Area 2: Beirut and Mount Lebanon												
	13	**322,700**	**12**	**99,700**	**-**	**-**	**-**	**-**	**-**	**-**	**25**	**422,400**
Jbeil	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Kesrouane	5	82,300	1	5,000	-	-	-	-	-	-	**6**	**87,300**
Maten	4	230,250	7	81,400	-	-	-	-	-	-	**11**	**311,650**
Baabda	2	1,950	1	10,000	-	-	-	-	-	-	**3**	**11,950**
Aley	-	-	3	3,300	-	-	-	-	-	-	**3**	**3,300**
Chouf	2	8,200	-	-	-	-	-	-	-	-	**2**	**82,000**
Area 3: Nabatieh and South Lebanon												
	5	**5,820**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**5,820**
Nabatieh	1	200	-	-	-	-	-	-	-	-	**1**	**200**
Hasbaya	-	-	-	-	-	-	-	-	-	-	**-**	**-**

	Operational		Non-Operational						Inaccessible		Grand Total	
			Not Rehabilitated		Rehabilitated							
					Covered		Removed					
	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
Marjeyoun	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Bent Jbeil	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Jezzine	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Saida	1	1,000	-	-	-	-	-	-	-	-	**1**	**1,000**
Sour	3	4,620	-	-	-	-	-	-	-	-	**3**	**4,620**
Area 4: Beqaa and Baalback/Hermel												
	6	**23,700**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**6**	**23,700**
Zahle	1	5,000	-	-	-	-	-	-	-	-	**1**	**5,000**
West Beqaa	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Rashaya	1	200	-	-	-	-	-	-	-	-	**1**	**200**
Hermel	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Baalback	4	18,500	-	-	-	-	-	-	-	-	**4**	**18,500**

3.4 SUMMARY FINDINGS PER AREA

General findings per geographical area are summarized in the below sections.

3.4.1 Area 1: Akkar and North Lebanon

There is a general increase in the volume of both MSW and CDW operational dumpsites in 'Area 1: Akkar and North Lebanon' since the 2011 survey as shown in Figure 3-13. A total volume of 2,434,372 m³ of dumped MSW and 212,166 m³ of dumped CDW was estimated in the 2016 survey.

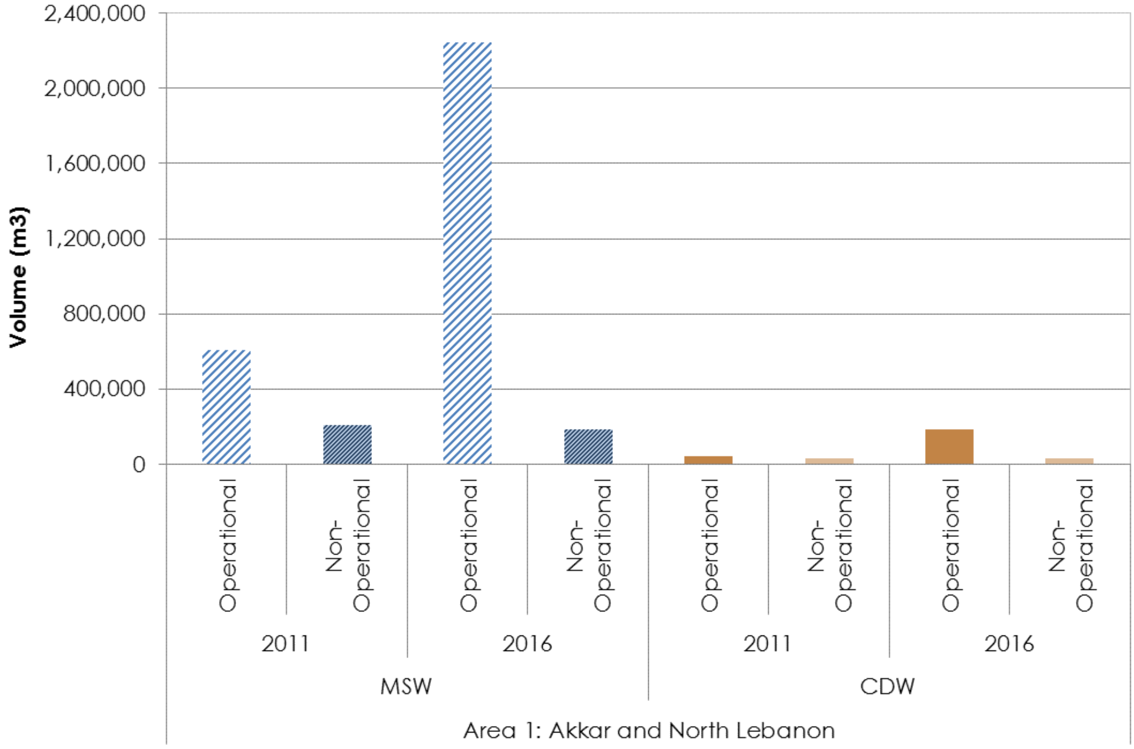


Figure 3-13 Dumpsite Volumes in 2011 and 2016 in Area 1

Around 26.3% of Syrian displaced people are located in the North, estimated to produce around 198 tons/day (MOE/EU/UNDP, 2014). In Tripoli dumpsite alone, a total increase in the order of 150-200 tons/day coming from displaced camps has been reported by the Union of Al Fayhaa.

Given that no major initiatives for SWM were implemented in the North in the past few years, along with the added pressure from the Syrian displaced people, this increase was expected.

It is estimated that around 1,000 tons per day of waste is generated in the North (GIZ /SWEEP-Net/ D-Waste, 2014). Around 500 tons per day go to Tripoli dumpsite, the rest is distributed between Srar dumpsite, which is a major dumpsite in Akkar, and other open dumpsites.

Currently, only five solid waste management facilities (SWMF) are operational in 'Area 1: Akkar and North Lebanon'. A SWMF in Tripoli is in the pilot phase, and several future SWMFs are being planned as shown in Figure 3-14 . Detailed information about the SWMFs is presented in Appendix C.

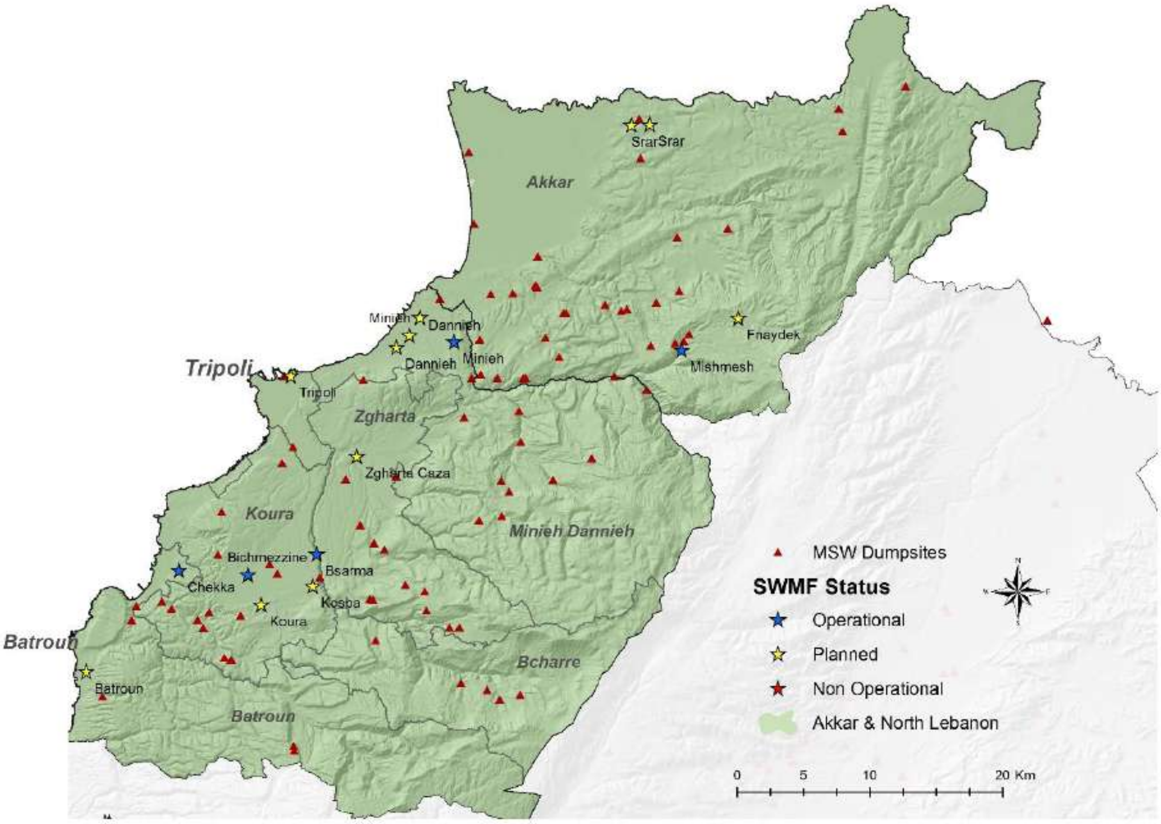


Figure 3-14 Map Showing the Geographical Locations of the SWMFs in Area 1

3.4.2 Area 2: Beirut and Mount Lebanon

An increase in the volume of MSW in operational dumpsites in 'Area 2: Beirut and Mount Lebanon' was witnessed, as shown in Figure 3-15. On the other hand, a significant decrease in the volume of CDW in operational dumpsites is noted, which is reflected in the increase in non-operational CDW dumpsites. A total volume of 814,131 m³ of dumped MSW and 1,551,790 m³ of dumped CDW was estimated in the 2016 survey.

Around 26.7% of Syrian displaced people are located in Beirut and Mount Lebanon, and are estimated to produce around 321 tons/day (MOE/EU/UNDP, 2014) which is about 11% of the total amount of generated waste in Beirut and Mount Lebanon.

A significant increase in open dumping in 'Area 2: Beirut and Mount Lebanon' was evident mainly in Chouf and Aley cazas, which was expected given the 2015 solid waste crisis, along with the pressure from the Syrian displaced people. This increase was stunted for the following main reasons:

- Between July 2015 and March 2016, about 200,000 tons of wastes generated from Beirut suburbs area (mainly Dahyeh) were buried in a specific site in the airport area instead of being disposed of in various dumpsites;
- The majority of the accumulated waste on the streets was collected and disposed in the Naameh Landfill during the two month temporary re-opening of the landfill (refer to section 1.4);
- Costa Brava started operating late August 2016 however waste bales were being stored in the parking area for months before that; Bourj Hamoud started operating in early October 2016;

- Several municipalities reported sending their waste to Beqaa area and other anonymous areas with private collectors (Bhamdoum, Arsoun, Sawfar, Chhim, Chemlin, Baskinta, Hemleya, Qmatiyeh to name a few);
- Open burning of waste was widely practiced in many areas in Mount Lebanon area with the start of the July 2015 waste crisis to reduce the volume of accumulated MSW, this practice diminished with time.

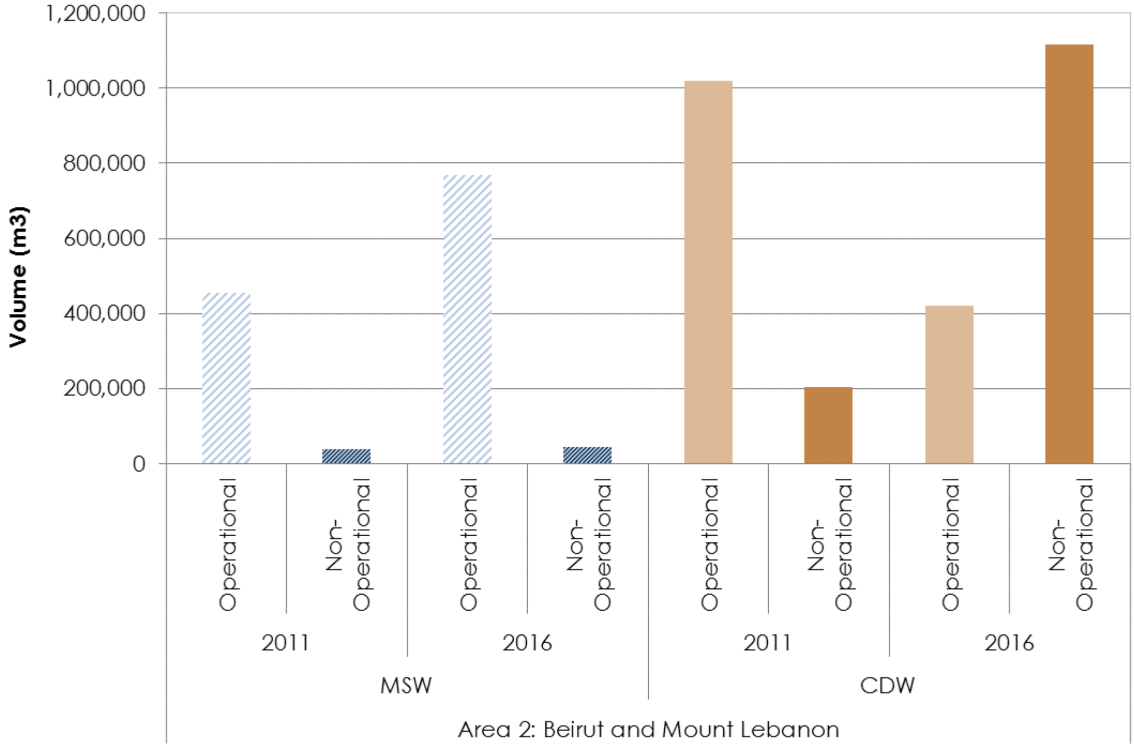


Figure 3-15 Dumpsite Volumes in 2011 and 2016 in Area 2

It is estimated that around 2,850 tons per day of waste is generated in Beirut and Mount Lebanon (GIZ /SWEEP-Net/ D-Waste, 2014). Costa Brava receives around 1,000 tons per day and Bourj Hamoud around 1,200 ton per day which covers 77% of the waste generated in Mount Lebanon and Beirut. Around 192 tons per day are sent from Beirut to IBC treatment plant in Saida as reported by the plant Operator. The remaining waste goes to open dumpsites in Mount Lebanon. Hbaline dumpsite alone, which is the main dumpsite in Jbeil caza, receives around 120 tons per day.

There are 21 operational SWMFs in 'Area 2: Beirut and Mount Lebanon' as shown in Figure 3-16. Detailed information about the SWMFs is presented in Appendix C.

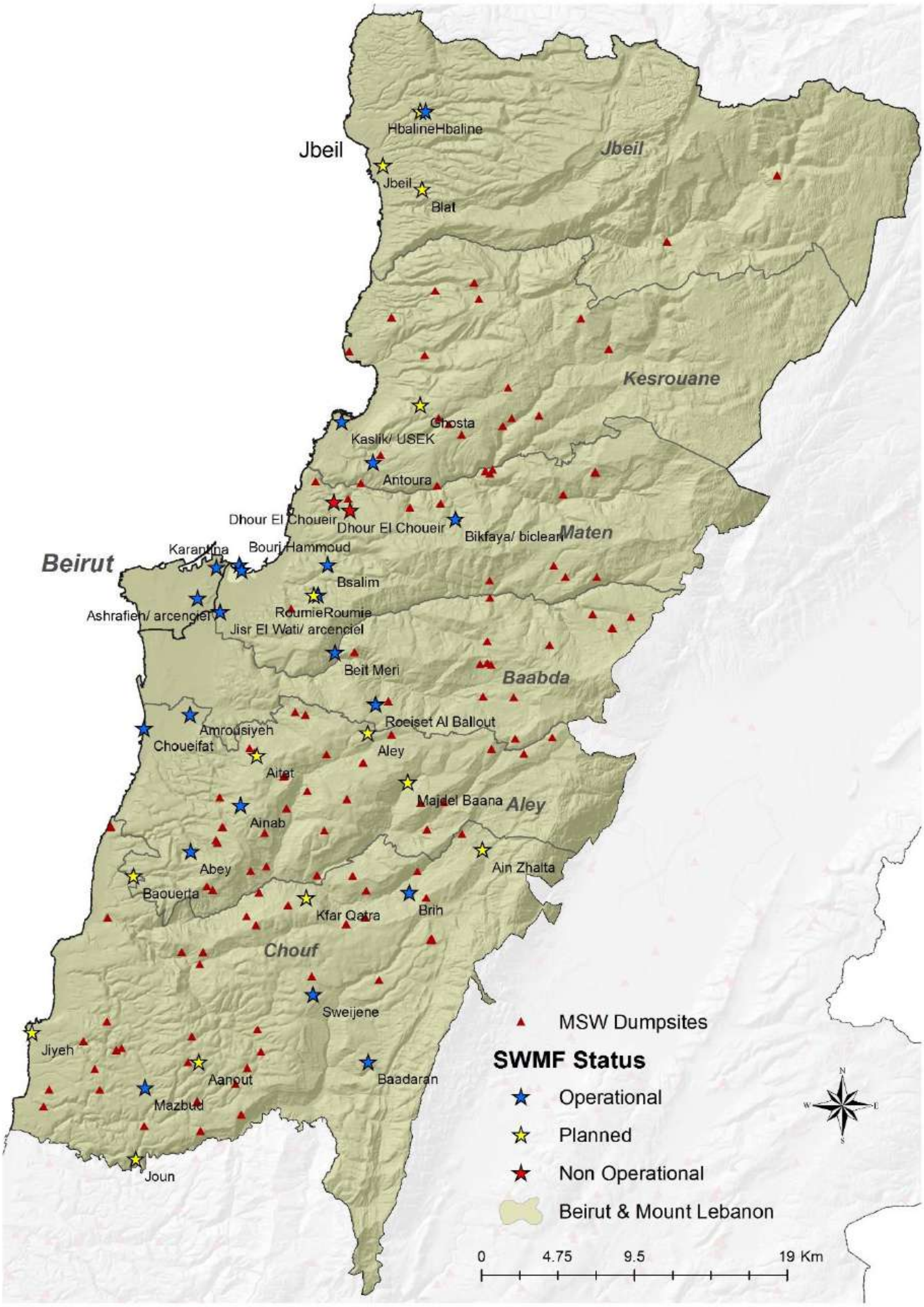


Figure 3-16 Map Showing the Geographical Locations of the SWMFs in Area 2

3.4.3 Area 3: Nabatieh and South Lebanon

There is a significant decrease in the volume of MSW waste in operational dumpsites in 'Area 3: Nabatieh and South Lebanon' since the 2011 survey, this is coupled with a major increase in the volume of MSW waste in non-operational dumpsites (around 0.48 Million m³), as shown in Figure 3-17. A total volume of 1,118,129 m³ of MSW and 192,830 m³ of CDW was estimated to be present in dumpsites in Area 3.

Around 12.38% of Syrian displaced people are located in the South and Nabatieh and are estimated to produce around 117 tons/day (MOE/EU/UNDP, 2014).

The relatively high rate of open burning activities in the South (around 35% of dumpsites in the South undergo open burning), in addition to the strong presence of solid waste management facilities contribute to the general reduction of the volume of waste in dumpsites in 'Area 3: Nabatieh and South Lebanon'.

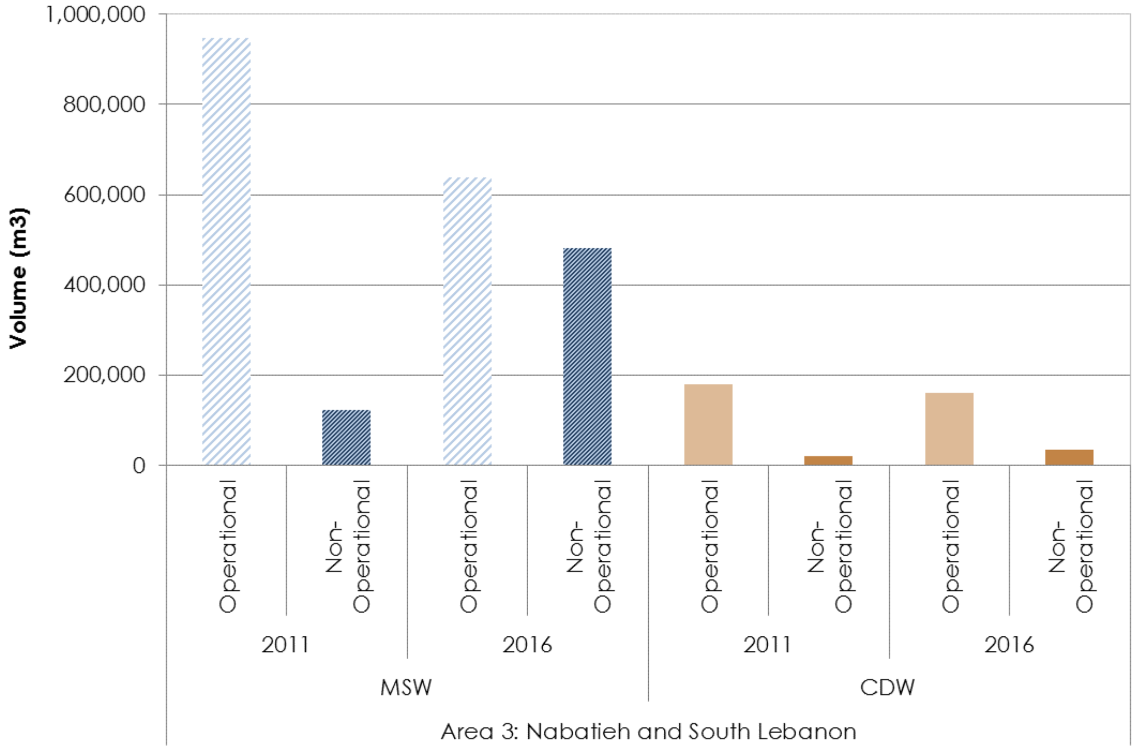


Figure 3-17 Dumpsite Volumes in 2011 and 2016 in Area 3

It is estimated that around 1,000 tons per day of waste is generated in the South and Nabatieh (GIZ /SWEEP-Net/ D-Waste, 2014). With the exception of the IBC treatment plant in Saida, which receives around 450 tons per day (245 tons per day from 16 municipalities in Saida/Zahrani, in addition to around 13 tons per day incoming from Jezzine and 192 tons per day from Beirut), all remaining waste in 'Area 3: Nabatieh and South Lebanon' goes to SWMFs and eventually open dumpsites.

There are 13 operational solid waste management facilities (SWMF) in 'Area 3: Nabatieh and South Lebanon' as shown in Figure 3-18 below. Detailed information about the SWMFs is presented in Appendix C.

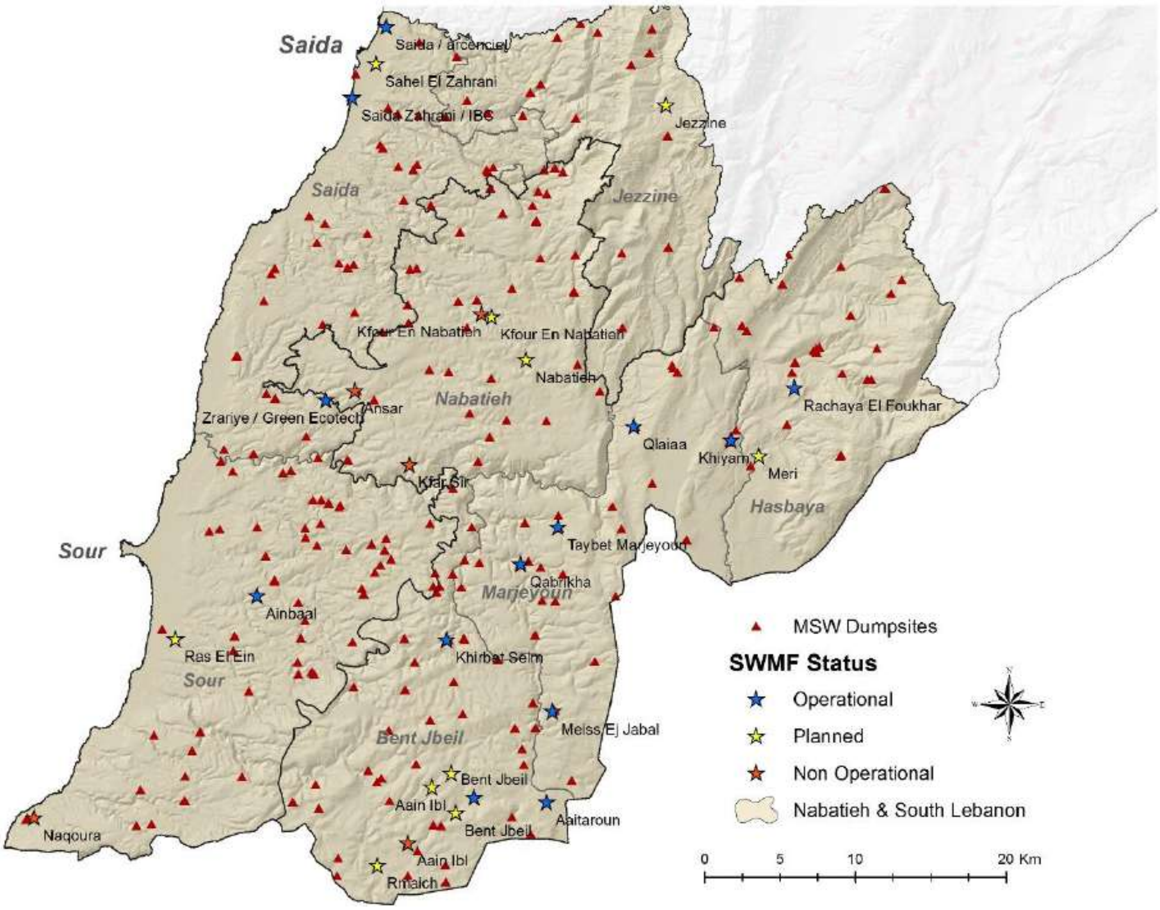


Figure 3-18 Map Showing the Geographical Locations of the SWMFs in Area 3

3.4.4 Area 4: Beqaa and Baalback/Hermel

There is a significant increase in the volume of MSW in operational dumpsites in 'Area 4: Beqaa and Baalback/Hermel' as shown in Figure 3-19. A total volume of 1,376,675 m³ of dumped MSW was estimated in the 2016 survey. There is also a significant increase in the number of operational CDW dumpsites (45) and a net increase in their volume, excluding L8-Chmestar-01 (refer to section 3.2.3.4.5). A total volume of 203,750 m³ of dumped CDW was estimated in the 2016 survey.

Around 34.6% of Syrian displaced people are located in the Beqaa and are estimated to produce around 253 tons/day (MOE/EU/UNDP, 2014).

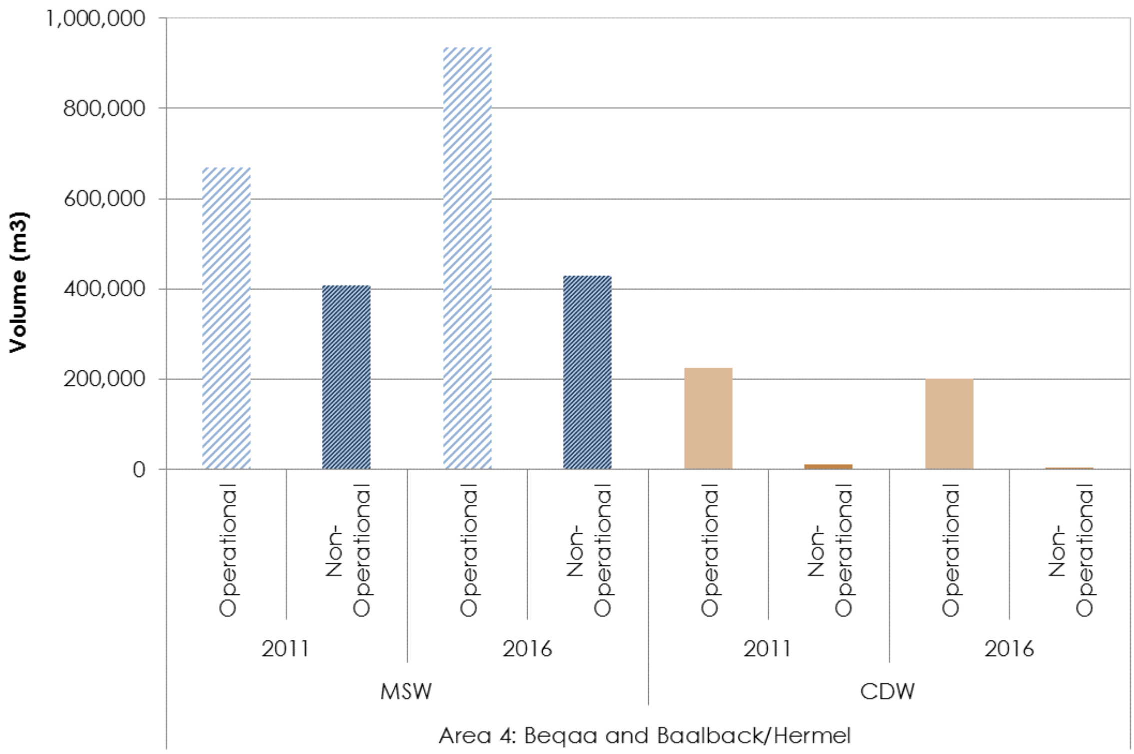


Figure 3-19 Dumpsite Volumes in 2011 and 2016 in Area 4

A major increase in MSW volumes was noted in Beqaa, this is attributed to two main reasons:

- Strong presence of Syrian displaced people and informal settlements;
- Several municipalities in Mount Lebanon reported sending their waste to the Beqaa for disposal.

It is estimated that around 750 tons per day of waste is generated in the Beqaa region (GIZ /SWEEP-Net/ D-Waste, 2014). Zahle Landfill receives a total of 280 tons per day, an increase in the order of 160 tons per day from MSW incoming from the displaced camps have been reported in the Zahle landfill. The remaining waste in Beqaa region goes to SWMFs and open dumpsites.

There are seven operational solid waste management facilities (SWMF) in 'Area 4: Beqaa and Baalback/Hermel' and several planned as shown in Figure 3-20 below. Detailed information about the SWMFs is presented in Appendix C.

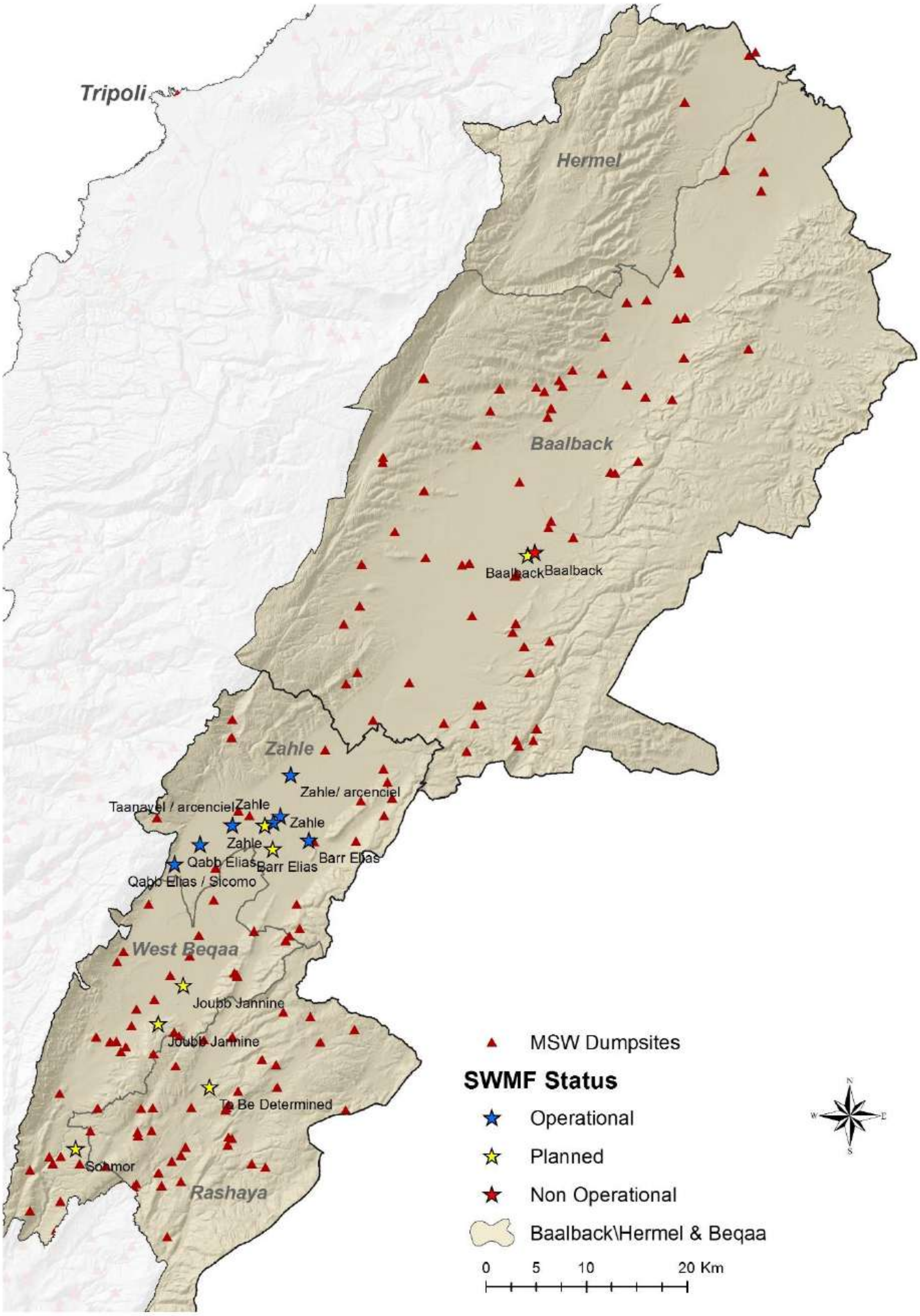


Figure 3-20 Map Showing the Geographical Locations of the SWMFs in Area 4

4. PRIORITIZATION MODEL

4.1 METHODOLOGY

Identifying priority dumpsites for rehabilitation is a complex procedure which requires the processing of a large amount of spatial data, while taking into account several social, environmental, and technical parameters. The initial model used in the 2011 Master Plan was derived from various methods (Yoon *et al.*, 1995; Leao *et al.*, 2004; Pellow, 2004; Calvo *et al.*, 2007; Rahman *et al.*, 2008; Ekmekçioğlu *et al.*, 2010; Junggoth *et al.*, 2010; Şener *et al.*, 2010) in order to present an integrated risk-based approach for developing a decision-making tool for dumpsite prioritization and rehabilitation. The same model is adopted for the Updated Master Plan with some revision and slight modification in light of the new findings. The adopted approach reframes and relates important parameters for dumpsite prioritization under the GIS umbrella.

The adopted approach involves the development of a Prioritization Decision Tool (PDT) for dumpsite rehabilitation which consists of the following:

1. Selecting a number of risk-indicating attributes for the evaluation of dumpsites;
2. Assigning a weight to each selected attribute based on its significance and overall impact;
3. Assigning a sensitivity grade for each attribute based on collected data;
4. Calculating a Risk Sensitivity Index (RSI) for each dumpsite based on assigned attributes, weights, and sensitivity grade.

Two different models were developed to separately address MSW and CDW dumpsites, as these are characterized by very different features.

The following sub-sections explain each of the steps followed in the model development and application process.

4.1.1 *Selection of Attributes*

A large set of characteristic data was collected for each dumpsite as part of the survey phase. These were congregated to a smaller number of features reflecting "priority" attributes which would guide the prioritization process. Ten attributes were selected for MSW dumpsites as follows:

- Volume of waste at site (m^3);
- Geology;
- Hydrology;
- Distance to urban areas (m);
- Quantity of waste currently dumped at site (t/d);
- Presence of alternatives;
- Open burning of waste;
- Visibility;
- Depth of filling of waste (m); and
- Duration of exposure (years).

As for CDW dumpsites, the following eight (8) attributes were considered:

- Volume of waste at site (m^3);
- Visibility;
- Hydrology;
- Distance to urban areas (m);
- Presence of alternatives/intended use;
- Status;
- Geology; and
- Duration of exposure (years).

Scores for some of these attributes (model parameters) were obtained based on field survey results, such as volume of waste, quantity of waste, and age of filling. However, attributes such as geology and hydrology required modeling under GIS environment so as to confirm and complete observations collected during field visits.

Each of the attributes listed above, as well as the method used to assign their respective sensitivity grades, is further described below:

- **Volume of waste at site (m^3):** The volume of wastes for each dumpsite was measured directly at the site. This was done using a GPS for the area of dumpsite measurements. The height was deduced through bearing using a geological compass. Volumes of dumpsites ranged between 1 and 1,200,000 m^3 and were divided into 4 classes: less than 10,000 m^3; between 10,000 and 50,000 m^3; between 50,000 and 100,000 m^3; and more than 100,000 m^3. This classification was based mainly on the field data gathered and comparison and classification of the data.
- **Geology** (Figure 4-1)**:** This attribute was used to reflect the potential environmental impact on groundwater represented by the **lithology** (70% of the overall weighing factor) and **faults and lineaments density** (30% of the overall weighing factor of the geology attribute).

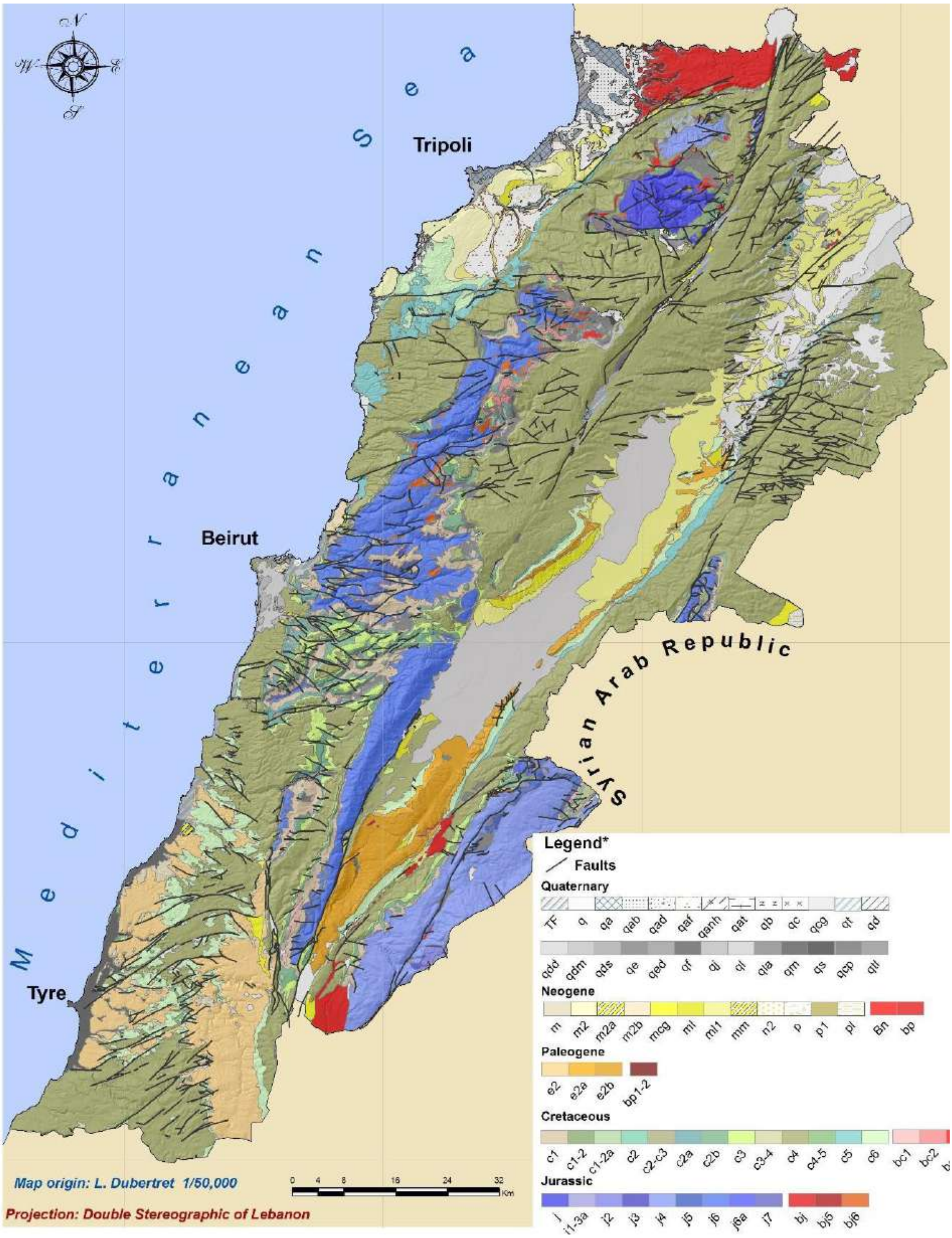


Figure 4-1 Appended Geological Sheet Maps of 1:50,000

a) Lithology: Lithological formations or rock facies have an important influence on infiltration rates and govern several effects on drainage networks and fracturing systems (Seelman, 1983; El-Baz and Himida, 1995; Ibrahim and Ammar, 2000). They were extracted through appending 27 sheets of 1: 50,000 geological map of Lebanon (Dubertret, 1955) (Figure 4-1). Lithological formations were classified in function of their infiltration capacity (Table 4-1) and intersected with the dumpsites layer. The results were verified and compared with the data gathered in the field.

Table 4-1 Distribution of Lithological Formation According to Infiltration

Infiltration Capacity	Geological Formation (Age)	Effective Infiltration Elements
Very high (I)	Upper Aptian (C2b), Cambrian (J4), Callovian (J6)	Secondary porosity (cracks and joints) of carbonate rock, plus high karstification
High (II)	Mio-Pliocene (Mp), Luticien (e1), Perician (e2), Cenomanian (C4), Portoladian (J7)	Secondary porosity, different forms of karstification and presence of some marl intercalations
Moderate (III)	Turonian (C5), Lower Aptian (C2a), Neocomian (C1), Oxfordian (J5)	Clay contents and jointing systems
Slightly moderate to low (IV)	Quaternary (Q), Pliocene (P), Vendobian (m2), Pordogalian (m1), and Basalts (B), Senonian (C6), Albian (C3)	Considerable clayey content

b) Faults and lineaments density: Faults and lineaments, representing the tectonic factor, play an important role in defining fractured zones revealing different infiltration rates. They were extracted through visual and automated interpretations of Landsat 7 ETM satellite imagery (30 m) acquired in March 2005. To achieve this, various steps of image enhancement were undertaken on both single and multi-bands consisting of sharpness, contrast and directional filtering. The thermal band (120 m) was also considered, providing optimum information in detecting wet horizons that trace fractured zones carrying water. It is important to mention that the extraction process has considered only lineaments representing existing fractures in rock formations, without taking into account those related to linear artificial (man-made) and counterfeit features. This was done through overlapping the produced lineaments map with the relevant topographic maps, with special reference to linear objects such as roads, pipelines and terraces.

The "faults and lineaments" frequency density L_f, representing the visible number of faults and lineaments per unit area, was calculated by applying **Equation 1** (Greenbaum, 1985):

Equation 1

$$L_f = \frac{\sum L_{ns}}{A}$$

Where Σ Lns is the total number of lineaments, and A is the area in km².

Figure 4-2 Lineament Map Extracted from Satellite Images

To calculate Equation 1, a sliding window method was applied on the produced faults and lineaments map. This is done by dividing the study area into a grid mesh of equidistant cells. Taking into account that the size of the cells is depending on diverse factors (e.g. distribution appearance of linear features), a cell of 1 km x 1 km was considered. The number of linear segments was counted for each cell. Each number obtained was plotted in the mid of the cell. Therefore, the average value of each four neighboring cells was calculated and the result was plotted on the intersection point of the four cells (Figure 4-3).

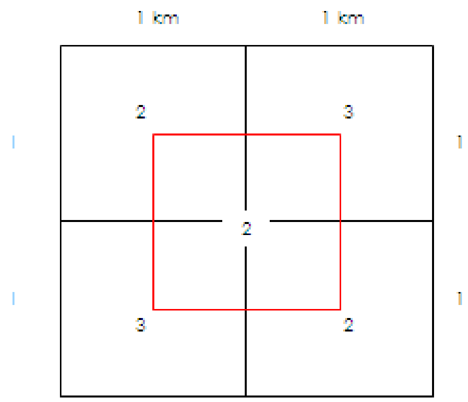


Figure 4-3 Sliding Window Method for Frequency Densities of Faults and Lineaments Calculation

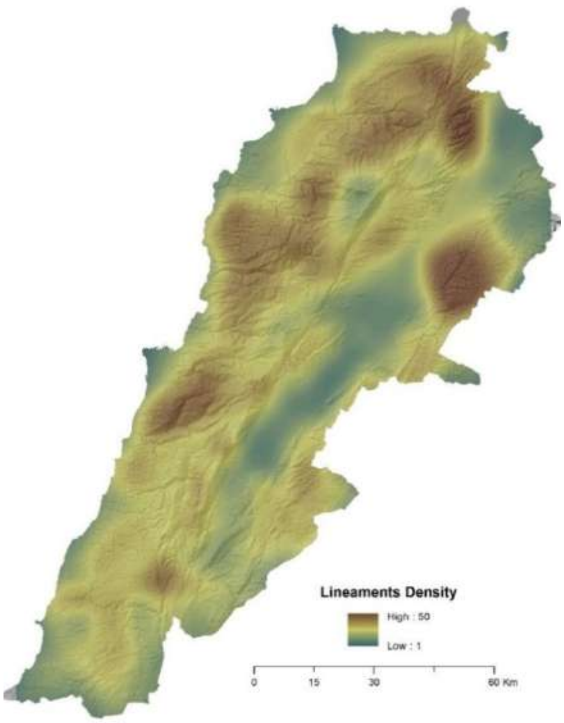


Figure 4-4 Fault - Lineament Density Map

From the plotted values, a point theme layer was created using a kriging interpolation method. Each point holds the mean sum number of lineament segments in the four neighboring cells, thus resulting in a "floating" surface grid representing the lineament frequencies (Figure 4-4). The resultant map was intersected with the point dumpsite maps to allocate for each dumpsite its corresponding fault-lineament density category that it falls in.

- **Hydrology:** According to the literature review (Dorhofer and Siebert, 1998; Kontos et al., 2005; Nas el at., 2008), dumpsites should not be placed near any water surfaces (rivers, streams, and springs). To reflect this attribute (hydrology), two themes were considered: distance to drainage (rivers and streams), and distance to springs, having an 80% and 20% of influence respectively on the hydrology attribute.
  - Distance to drainage: The rivers and streams were extracted from the topographic maps of Lebanon 1: 50,000 scale using heads-up digitizing. After appending all digital blue line maps, a distance to line approach was conducted giving a continuous raster data file. The resultant was then intersected with the spatial distribution of the dumpsite sites and collected in the dumpsites database. In the dumpsites database, the distance to drainage was categorized in 4 classes: more than 200m; between 200 and 100m; between 100 and 50m; and less than 50m respectively.
  - Distance to springs: All existing spring on the topographic sheets of 1: 50,000 for Lebanon were plotted and the distance to springs procedure was calculated (Figure 4-5).

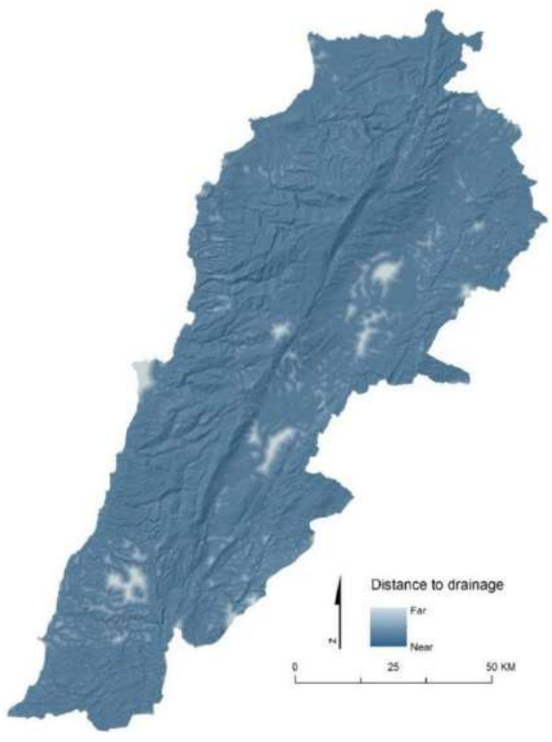


Figure 4-5 Distance to Drainage Line Raster Data

Following the same procedure of distance to drainage line, the distance to springs from the dumpsites was grouped in four classes (Figure 4-6).

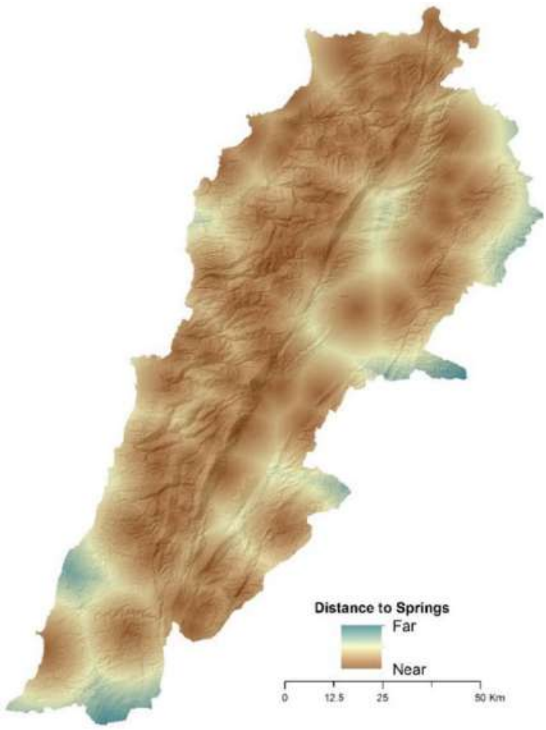


Figure 4-6 Distance to Spring Raster Data

- **Distance to urban areas:** The map of urban agglomeration was plotted in GIS and the distance to urban areas was established. This in turn was overlapped with the dumpsites point location layer to include the distance of each dumpsite to urban areas. The distance of dumpsites to urban agglomeration was then classified into four classes: more than 1,000m; between 1,000 and 500 m; between 500 and 250 m; and less than 250m.
- **Quantity of waste currently dumped at site (t/d)** was collected during the field surveys, introduced in the database and distributed among four classes: less than 10 t/d; between 10 and 50 t/d; between 50 and 100 t/d; and more than 100 t/d respectively. This factor is very important to categorize the size of an active dumpsite and to differentiate it from an abandoned dumpsite.
- **Presence of alternatives:** After consultation with the municipalities, each site was assigned one of four categories for this attribute: No alternatives, working on alternative solution and funding, alternative under construction, and alternative operational. The presence of an alternative solution is a very critical factor for the decision-making process to close or rehabilitate a dumpsite. Absence of an alternative solution will get a low value for the score of this attribute (0-0.25), while the presence of an operational alternative would receive a high score (0.75 to 1). The rationale is that based on previous experience, initiating the rehabilitation of a site without an alternative solution in place can actually lead to more negative impacts. This is because generated waste would most probably be disposed of randomly in the absence of alternative sites for disposal.
- **Open burning of waste:** The score of this attribute for each site was defined based on observations during site visits and discussions with residents and municipal members. A value of 0.25 was assigned to dumpsites where waste is being burned, while a value of 0.75 was assigned to dumpsites where waste is piled up and not burned. When waste

is burned, the volume of waste in the dumpsite and its biodegradability are reduced, consequently lowering the impact of the dumpsite (from a biogas generation and leachate pollution perspective).

- **Visibility:** The score of this attribute for each site was defined based on the field visits. A value of 0.25 was assigned for the sensitivity value when a dumpsite is not visible from the main road and from the urban areas, compared to a sensitivity value of 0.75 for a dumpsite that is clearly visible from the main road and urban areas.
- **Depth of filling of waste (m):** The depth of filling waste was measured through bearing, using a geological compass, and reclassified in the dumpsite database into four classes: less than 1 m; between 1 and 5 m; between 5 and 10 m; and more than 10 m.
- **Duration of dumpsite exposure (in years):** This information was collected during the field survey. It represents the overall duration that the dumpsite has been in existence, hence exposing potential receptors to its impacts. Sites were classified in 4 classes for this attribute: less than 10 years; between 10 and 20 years; between 20 and 30 years; and more than 30 years.

4.1.2 Attribute Tables

As explained above, ten (10) attributes were selected for MSW dumpsite prioritization, and eight (8) were considered for CDW dumpsites prioritization. These attributes were each assigned a specific "weight" reflecting the relative significance of their associated environmental impact. Weights ranged from 1 to 10 for MSW dumpsites, and from 1 to 8 for CDW dumpsites. Each attribute was then given a "sensitivity grade" varying from 0 to 1 and divided into 4 quarters or ranges.

Table 4-2 displays all ten (10) attributes selected for MSW dumpsites, while

Table 4-3 displays CDW dumpsites attributes; along with their associated weights and sensitivity grades.

Table 4-2 MSW Dumpsites Attribute Table

Attribute		Weighing Factor	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
Volume of waste at site (m^3)		10	<10,000	10,000-50,000	50,000-100,000	>100,000
Geology	Lithology (70%)	9	Considerable to high clay content	Clay contents and jointing systems	Secondary porosity, different forms of karstification and presence of some marl intercalations	Secondary porosity (cracks and joints) of carbonate rock, plus high karstification
	Faults and lineaments density (segment/km^2) (30%)		<10	10-15	15-20	> 20
Hydrology	Distance to drainage line (m) (80%)	8	>200	200-100	100-50	<50
	Distance to springs (m) (20%)		>200	200-150	150-100	<100
Distance to urban areas (m)		7	>1,000	1,000- 500	500-250	<250
Quantity of waste currently dumped at site (t/d)		6	<10	10-50	50-100	>100
Presence of alternatives		5	No alternatives	Working on alternative solution and funding	Alternative under construction	Alternative operational
Open burning of waste		4	Burned		Not burned	
Visibility		3	Not visible		Visible	
Depth of filling of waste (m)		2	<1	1-5	5-10	>10
Duration of exposure (year)		1	<10	10-20	20-30	>30

Table 4-3 CDW Dumpsites Attribute Table

Attribute		Weighing Factor	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
Volume of waste at site (m^3)		8	<3,000	3,000-10,000	10,000-50,000	>50,000
Visibility		7	Not visible		Visible	
Hydrology	Distance to drainage line (80%)	6	>200	200-100	100-50	<50
	Distance to springs (20%)		>200	200-150	150-100	<100
Distance to urban areas		5	>1,000	1000-500	500-250	<250
Presence of alternatives/intended use		4	No alternatives/no plans	Working on alternative solution and funding	Alternative under construction	Alternative operational
Status (Non Operational/Operational)		3	Removed	Covered	Non operational	Operational
Geology	Lithology (70%)	2	Considerable to high clay content	Clay contents and jointing systems	Secondary porosity, different forms of karstification and presence of some marl intercalations	Secondary porosity (cracks and joints) of carbonate rock, plus high karstification
	Faults & lineaments density (segment/km^2) (30%)		<10	10-15	15-20	>20
Duration of exposure (year)		1	<10	10-20	20-30	>30

4.1.3 RSI Calculation

The RSI was calculated for each dumpsite by adding all attributes, after multiplying each sensitivity grade (class) by its respective weight (Equation 2).

Equation 2

$$\boldsymbol{RSI = W_i S_i}$$

Where:

RSI: Risk Sensitivity Index variable ranging from Minimum 0 to Maximum 55

W_i: is the weightage of the i[th] variable ranging from 1-10

S_i: Sensitive index of the i[th] variable ranging from 0-1

Nevertheless, data could not be combined unless they measured the same values. For instance, it is not possible to combine data corresponding to measured values in years (age of filling) and values related to quantities of waste dumped at sited holding units in tons per day. Moreover, data values gathered in the dumpsites database are of two types, being either categorical (such as lithology, visibility, and age of filling) or numerical (such as lineaments, distance to roads, and depth of filling). Categorical data were thus reclassified, while numerical floating values were either plotted linearly or exponentially to unify the rating categories and assigned utilities for each class in its corresponding attribute.

Reclassification of the geology attribute normalized the categorical values of the predefined four classes. Accordingly "considerable to high clay content" scored "0.15" , clay contents and jointing systems scored "0.35"; "secondary porosity, different forms of karstification and presence of some marl intercalations" scored "0.65", and "secondary porosity (cracks and joints) of carbonate rock, plus high karstification" obtained the highest score "0.85". The same procedure for assigning utility numbers in categorical classes was used, with exception of visibility and open burning attributes, where the only two classes (visible, not visible), (burned, not burned) were assigned 0.25 and 0.75 respectively.

On the other hand, a linear equation, Equation 3, was applied to normalize the numerical values of each class in the corresponding attribute (Figure 4-7).

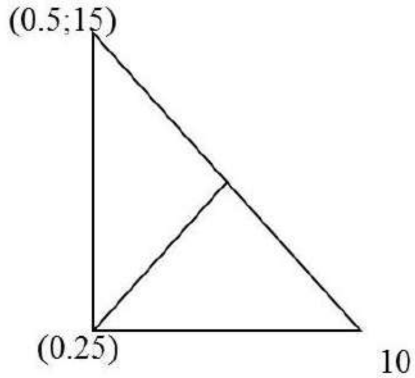


Figure 4-7 Example of Normalizing Values for Lineaments Ranging from 10 to 15

Equation 3

$$\mathrm{Y} = a_i\, x_i + b$$

Moreover, to stretch values that inversely increase by rate of each class interval, like distance to drainage or distance to urban areas (see Table 4-2 and

Table 4-3), the following equation (**Equation 4**) was used.

Equation 4

$$Y = \left(\frac{100 - \left(\frac{((x-b) \times 100)}{(a-b)} \right) \times (d-c)}{100} \right) + c$$

Where:

a_i: is the upper maximum value of the class rate (for the rate class between 0 and 0.25 of distance to spring, will be 200 m)

x_i: is the value of the parameter before stretching (example; the dumpsite is at a distance of 300 m from a spring)

b: is the minimal value of the class rate (for the class rate between 0.0 to 0.25 of distance to spring; will be 22,595 m)

c: is the minimal class rate value (for interval 0.25-0.5; c= 0.25)

d: is the maximal class rater value (for interval 0.5-0.75; c= 0.5 and d= 0.75)

For distance to spring and when distributing the values on the four rate interval slots, Equation 4 will be written simultaneously for each rate interval (i.e., 0-0.25; 0.25-0.5; 0.5-0.75; and 0.75-1) as follows:

(((100 - ((([M_Dist_Spr] - 200) * 100) / (22595- 200))) *0.25) / 100) + 0

(((100 - ((([M_Dist_Spr] - 150) * 100) / (200- 150))) *0.25) / 100) + 0.25

(((100 - ((([M_Dist_Spr] - 100) * 100) / (150- 100))) *0.25) / 100) + 0.5

(((100 - ((([M_Dist_Spr] - 0) * 100) / (100- 0))) *0.25) / 100) + 0.75

A Prefix of "M" was given for the new established fields (with new columns being added to the databases). RSIs were then calculated accordingly, based on Equation 4 above.

A dumpsite with a higher score indicates more risk to human health and the environment, and suggests that it requires a more urgent intervention. Conversely, when the total RSI score of a dumpsite decreases, the priority for its rehabilitation decreases.

4.2 RESULTS

Once the prioritization model was run, dumpsites were classified and represented on digital maps as per their RSI. Table 4-4 and Table 4-5 provide the number of dumpsites per RSI range for MSW and for CDW dumpsites.

Table 4-4 Number of MSW Dumpsites per RSI Range

RSI Range	Number of Dumpsites
> 30	10
25 - 30	69
20 -25	245
15 - 20	248
< 15	45
Total	**617**

Table 4-5 Number of CDW Dumpsites per RSI Range

RSI Range	Number of Dumpsites
> 20	29
18 - 20	69
14 -18	143
10 -14	75
< 10	8
Total	**324**

Figure 4-8 and Figure 4-9 show the resulting RSI of dumpsites over Lebanon. While the surveyed dumpsites and their RSI score can be viewed in the Geotabase and Application (Appendix D), the 20 top ranking dumpsites are shown in Table 4-6 and Table 4-7.

Although the RSI has been calculated for all dumpsites, only the twenty (20) highest ranked are shown here. These twenty "priority" dumpsites:

- Form an aggregate volume which represents respectively 66% and 35% of the total volume of MSW and CDW dumpsites;
- Cover all dumpsites comprised in the first range of priority for MSW dumpsites and 69% for CDW dumpsites.

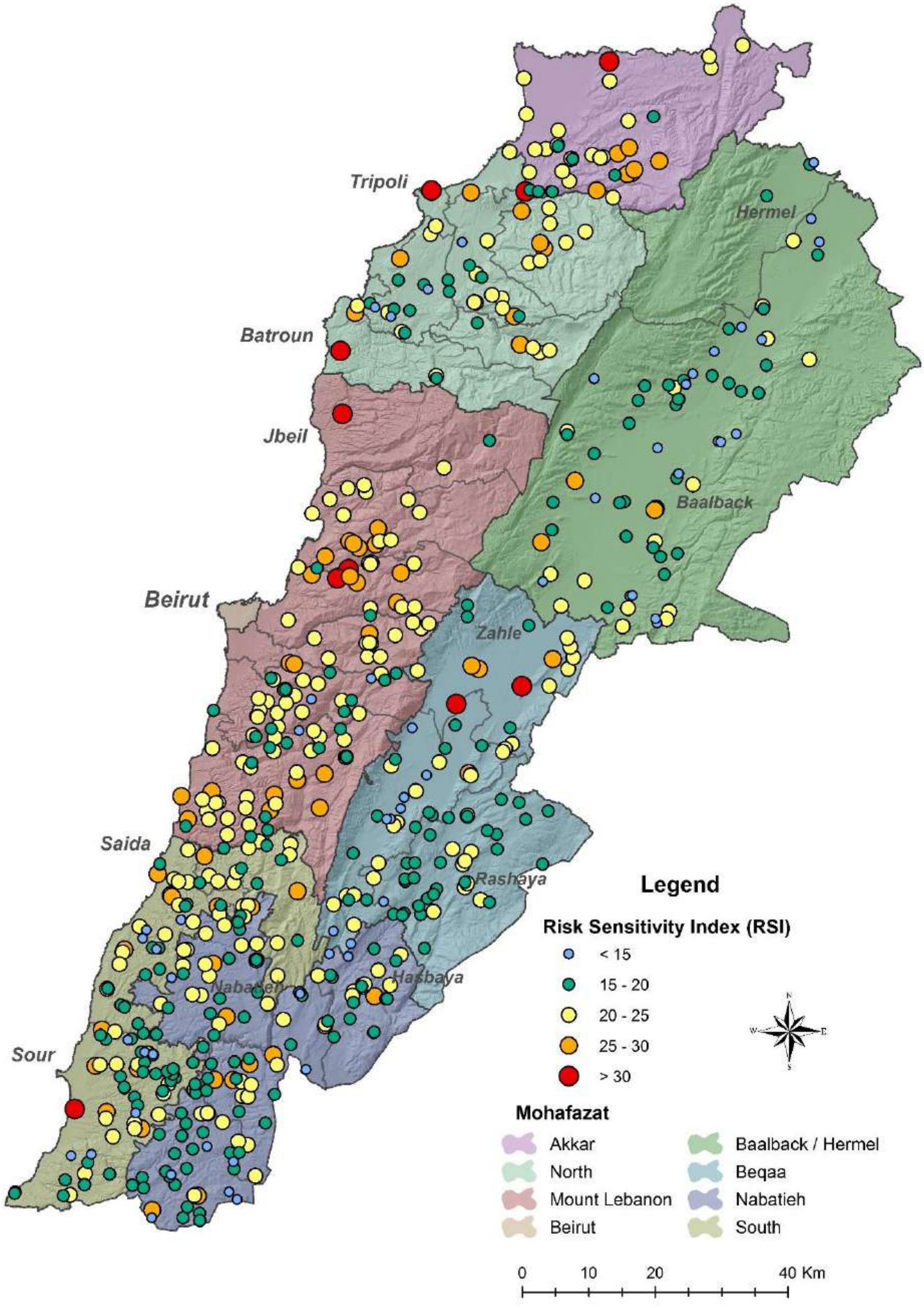


Figure 4-8 RSI Map of MSW Dumpsites

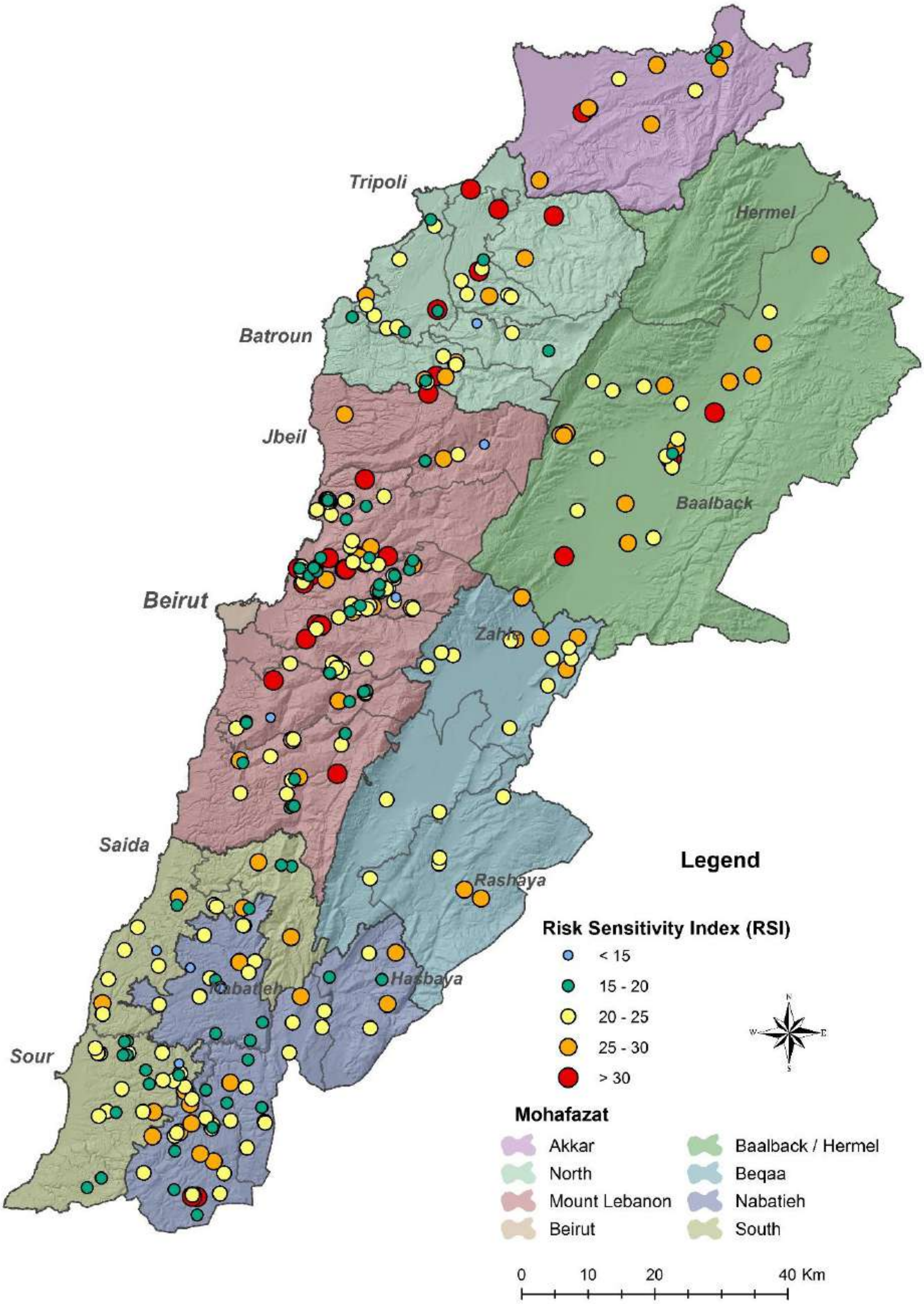


Figure 4-9 RSI Map of CDW Dumpsites

Table 4-6 Top 20 Priority MSW Dumpsites

Rank	Dumpsite ID	Caza	Area	RSI Score
1	R6-Tripoli-0	Tripoli	Area 1: Akkar and North Lebanon	40.73
2	N5-Hbaline-0	Jbeil	Area 2: Beirut and Mount Lebanon	40.31
3	R7-Adweh-0	Minieh-Dannieh	Area 1: Akkar and North Lebanon	34.76
4	P5-Batroun-0	Batroun	Area 1: Akkar and North Lebanon	34.59
5	T9-Srar-0	Akkar	Area 1: Akkar and North Lebanon	34.27
6	J6-Qabb Elias-00	Zahle	Area 4: Beqaa and Baalback/Hermel	32.50
7	C1-Deir Qanoun El-Aain-01	Sour	Area 3: Nabatieh and South Lebanon	31.42
8	L5-Balloune-3	Kesrouane	Area 2: Beirut and Mount Lebanon	30.32
9	L5-Beit Chabab-1n	Maten	Area 2: Beirut and Mount Lebanon	30.20
10	J7-Barr Elias-00	Zahle	Area 4: Beqaa and Baalback/Hermel	30.15
11	R9-Fnaydek-0	Akkar	Area 1: Akkar and North Lebanon	29.83
12	F2-Sarafand-01	Saida	Area 3: Nabatieh and South Lebanon	29.64
13	G4-Jezzine-00	Jezzine	Area 3: Nabatieh and South Lebanon	29.03
14	D2-Abbesye-03	Sour	Area 3: Nabatieh and South Lebanon	28.96
15	M9-Baalback-02	Baalback	Area 4: Beqaa and Baalback/Hermel	28.90
16	R9-Mishmesh-0	Akkar	Area 1: Akkar and North Lebanon	28.39
17	G2-Ghaziye-00	Saida	Area 3: Nabatieh and South Lebanon	28.35
18	E3-Kfour En-Nabatieh-00	Nabatieh	Area 3: Nabatieh and South Lebanon	28.13
19	G2-Saida-1n	Saida	Area 3: Nabatieh and South Lebanon	28.08
20	R7-Kfar Chellane-0	Minieh-Dannieh	Area 1: Akkar and North Lebanon	28.05

The total volume of these 20 priority MSW dumpsites is around 3,795,872 m³ which is around 66.0% of the total volume of MSW dumpsites.

Table 4-7 Top 20 Priority CDW Dumpsites

Rank	Dumpsite ID	Caza	Area	RSI Score
1	Q7-Morh Kfarsghab-2	Zgharta	Area 1: Akkar and North Lebanon	23.53
2	R7-Deir Ammar-2	Minieh-Dannieh	Area 1: Akkar and North Lebanon	23.53
3	K5 - Broummana -1n	Maten	Area 2: Beirut and Mount Lebanon	23.48
4	K4-Beit Meri-00	Maten	Area 2: Beirut and Mount Lebanon	23.21
5	P6-Kosba-2	Koura	Area 1: Akkar and North Lebanon	23.19
6	L5-Balloune-2	Kesrouane	Area 2: Beirut and Mount Lebanon	23.16
7	L5-Qlaiaat-3	Kesrouane	Area 2: Beirut and Mount Lebanon	22.85
8	I5-Maaser Ech Chouf-0	Chouf	Area 2: Beirut and Mount Lebanon	22.59
9	L4-Dik Al-Mahdi-0	Maten	Area 2: Beirut and Mount Lebanon	22.51
10	K5- Ras El Maten-2n	Maten	Area 2: Beirut and Mount Lebanon	22.50
11	L8-Chmestar-01	Baalback	Area 4: Beqaa and Baalback/Hermel	22.15
12	L5-Aain Er-Rihane-3	Kesrouane	Area 2: Beirut and Mount Lebanon	22.08
13	L4-Mtayleb-1	Maten	Area 2: Beirut and Mount Lebanon	21.82
14	L4-Zouk Al Khrab-6n	Maten	Area 2: Beirut and Mount Lebanon	21.74
15	L4-Zouk Al Khrab-5	Maten	Area 2: Beirut and Mount Lebanon	21.49
16	M9-Maqne-07n	Baalback	Area 4: Beqaa and Baalback/Hermel	21.39
17	J4-Aaytat-0	Aley	Area 2: Beirut and Mount Lebanon	21.39
18	O6-Tartej-0n	Jbeil	Area 2: Beirut and Mount Lebanon	21.37
19	L5- KfarTay- 1n	Maten	Area 2: Beirut and Mount Lebanon	21.34
20	N10-Rasm Al Hadath-00n	Baalback	Area 4: Beqaa and Baalback/Hermel	21.30

The total volume of these 20 priority CDW dumpsites is around 755,800 m³ which is around 35% of total volume of CDW dumpsites.

4.3 SENSITIVITY ANALYSIS

A sensitivity analysis exercise was conducted over the PDT model results so as to verify, fine-tune and confirm the model's validity. Weighing factors were interchanged among attributes and several tests were run accordingly. Outcomes were then compared with the original model results. A series of fine-tuning measures were then implemented based on drawn conclusions.

The results of one of the sensitivity analysis rounds, with weights set as shown in Table 4-8 below, are shown in Table 4-9.

Table 4-8 Original and Test Weights Used in Sample Sensitivity Analysis

Original Version			Test Version	
Attribute	**Weight Factor**		**Attribute**	**Weight Factor**
Total Quantity	**10**		**Total Quantity**	**10**
Geology	9		Geology	8
Hydrology	8		Hydrology	9
Distance to urban areas	7		Distance to urban areas	5
Quantity dumped (t/d)	6		Quantity dumped (t/d)	4
Alternatives	5		Alternatives	2
Open burning	4		Open burning	7
Visibility	3		Visibility	3
Filling depth	2		Filling depth	6
Exposure time	1		Exposure time	1

Only the three highlighted dumpsites out of the 20 do not figure in the Original Priority Dumpsites table. All 17 remaining dumpsites figure in both the Original and the Test versions.

Table 4-9 Results from Sample Sensitivity Analysis

Original Version			Test Version			
Rank	**Dumpsite ID**	**RSI Score**	**Rank**	**Dumpsite ID**	**RSI Score**	**Original Version Rank**
1	R6-Tripoli-0	40.73	1	N5-Hbaline-0	42.10	2
2	N5-Hbaline-0	40.31	2	R6-Tripoli-0	40.98	1
3	R7-Adweh-0	34.76	3	T9-Srar-0	35.77	5
4	P5-Batroun-0	34.59	4	R7-Adweh-0	34.57	3
5	T9-Srar-0	34.27	5	P5-Batroun-0	34.18	4
6	J6-Qabb Elias-00	32.50	6	C1-Deir Qanoun El-Aain-01	34.17	7
7	C1-Deir Qanoun El-Aain-01	31.42	7	J6-Qabb Elias-00	31.73	6
8	L5-Balloune-3	30.32	8	L5-Beit Chabab-1n	30.54	9
9	L5-Beit Chabab-1n	30.20	9	G2-Ghaziye-00	30.31	17
10	J7-Barr Elias-00	30.15	10	L5-Balloune-3	30.23	8
11	R9-Fnaydek-0	29.83	11	R9-Fnaydek-0	30.07	11
12	F2-Sarafand-01	29.64	12	R9-Beit Ayyoub- 1	29.90	21
13	G4-Jezzine-00	29.03	13	P5-Hamat-1	29.73	25
14	D2-Abbesye-03	28.96	14	F2-Sarafand-01	29.33	12
15	M9-Baalback-02	28.90	15	J7-Barr Elias-00	29.32	10
16	R9-Mishmesh-0	28.39	16	G4-Jezzine-00	28.77	13
17	G2-Ghaziye-00	28.35	17	G2-Saida-1n	28.49	19
18	E3-Kfour En-Nabatieh-00	28.13	18	Q8-Bqaa Sifreen-0	28.26	26
19	G2-Saida-1n	28.08	19	R7-Kfar Chellane-0	28.33	20
20	R7-Kfar Chellane-0	28.05	20	R9-Mishmesh-0	28.00	16

5. REHABILITATION DECISION TOOL (RDT)

Remedial measures differ from one dumpsite to the other based on the complexity of the case and the availability of alternative waste management solutions.

Seven remedial measures were considered for MSW dumpsites. These include:

- Excavate, pre-treat and transfer to a waste treatment facility and/or sanitary landfill;
- Transfer to a sanitary landfill;
- Convert to a sanitary landfill;
- Grade, cap, manage gases and leachate;
- Excavate, treat and transfer;
- Excavate, line, grade, cap, manage gases and collect leachate; and
- Group with other dumpsites and transfer to a sanitary landfill.

Whereas, four remedial measures were considered for CDW dumpsites, consisting of:

- Sort, crush and recycle;
- Transfer to other priority dumpsites or to an approved construction and demolition landfill;
- Grade the surface and cover with soil (re-vegetate); and
- Achieve intended use.

5.1 METHODOLOGY

The Rehabilitation Decision Tool (RDT) provides a methodology for the description and comparison of alternative remediation scenarios relying on the RSI. The RDT module procedure allows the user to describe and compare the following aspects:

- The post remediation site use and related socio-economic benefits;
- The remediation plan and related costs, time of interventions, performance reliabilities and environmental impacts (RSI);
- The reduction of the risk posed by contaminants in soil and groundwater (RSI), resulting from the simulated application of the remediation plan.

A set of indices identifies advantages and drawbacks of each scenario, such as the socio-economic benefits for the selected post-remediation land use, technological and logistical quality of the technological set, residual risk (spatial extension, average magnitude and magnitude reduction), total cost and duration of interventions, and environmental impacts.

Lower costs may be combined with longer intervention periods for the rehabilitation of the site; high treatment performances may lead, especially in case of large contaminated volumes, to relevant positive environmental impacts. The most suitable site end-use may require very strict risk minimization targets and high remediation costs.

The RDT is based on a decision tree module that is used to determine the remedial measure needed for each site. The decision tree helps to identify the most suitable rehabilitation option for each dumpsite based on its characteristics.

Two decision trees are used to properly address both types of dumpsites, MSW and CDW. These were built based on a set of Yes/No questions, the answers to which would lead to one result or another, ultimately revealing the most suitable rehabilitation option.

Table 5-1 below lists the set of questions raised within the decision tree for the MSW dumpsites, along with the main attribute each question refers to, and the criteria based on which one path would be taken over the other (the Yes or the No paths). A walkthrough the decision tree shown in Figure 5-1 would lead to the preferred remedial measure needed for each MSW dumpsite.

Similarly, Table 5-2 below lists the set of questions raised within the decision tree for the CDW dumpsites, and Figure 5-2 presents a walkthrough the decision tree that would lead to the preferred remedial measure needed for each CDW dumpsite.

Table 5-1 MSW Dumpsites Decision Tree Explanation

Question	Reference Attribute*	Criteria** for Yes	Criteria** for No
Is a suitable landfill available?	-	Suitable landfill available nearby	Suitable landfill not available nearby
Is volume reduction required?	-	M_T_Qty > 0.85: Size with respect to allocated plot >50%	M_T_Qty < 0.85: Size with respect to allocated plot < 50%
Is land large enough?	-	Size with respect to allocated plot >50%	Size with respect to allocated plot <50%
Can waste still be disposed in this land?	Distance to Urban Areas; Visibility	M_Dist_Urb <0.35; and M_visibility <0.25	M_Dist_Urb >0.35; and M_visibility >0.25
Does a WM alternative exist?	Presence of Alternatives	M_pres alt > 0.5	M_pres alt < 0.5
Is volume of waste large enough?	Volume; Quantity	M_Volume > 0.5 or M_quantity >0.5	M_Volume <0.5 or M_quantity<0.5
Is geologic formation favorable?	Geology	M_geology < 0.25	M_geology > 0.25
Is dumpsite far from water bodies?	Hydrology	M_hydrology < 0.5	M_hydrology > 0.5
Is remediation required?	Volume; Quantity	M_Volume >0.2 M_quantity >0.2	M_Volume <0.2 and M_quantity <0.2

**refer to Attribute Table*

***refer to Sensitivity Grade results*

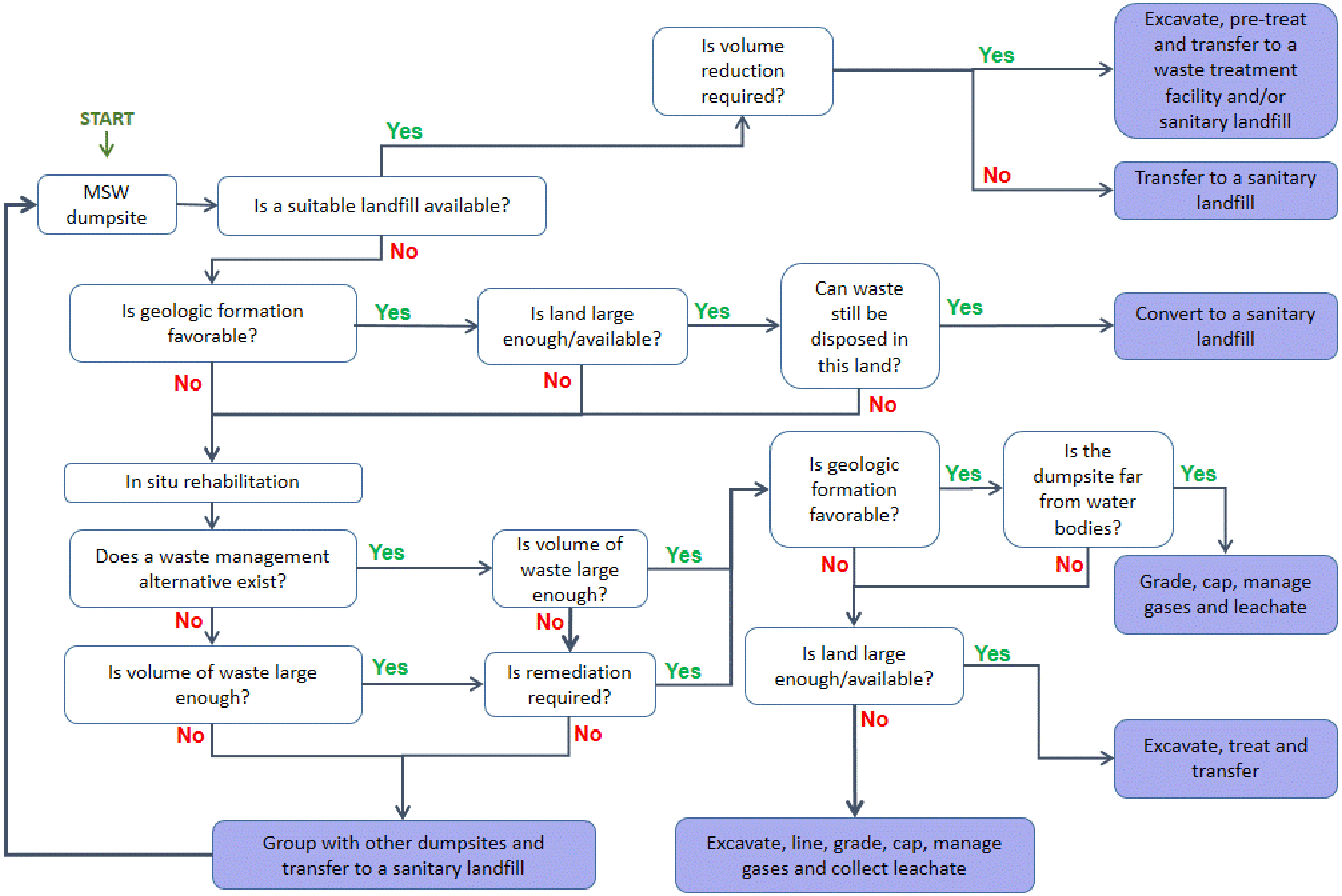


Figure 5-1 MSW Dumpsites Rehabilitation Options Decision Tree

Table 5-2 CDW Dumpsites Decision Tree Explanation

Question	Reference Attribute*	Criteria** for Yes	Criteria** for No
Does an intended use of the dumpsite exist?	Presence of Alternatives	M_pres_alt >=0.5	M_pres_alt <=0.5
Is volume of waste large enough?	Volume	V>=10,000 m^3	V<=10,000 m^3
Is the dumpsite highly visible?	Visibility	M_Value for visibility >=0.5	M_Value for visibility <=0.5
Is volume of waste >3,000 m^3 and dumpsite is close to urban areas and surface water bodies?	Volume	3,000m^3 <= V <=10,000 m^3	V<3,000 m^3
	Distance to Urban Areas	M_dist _urban >=0.5	M_dist _urban <= 0.5
	Distance to Water Bodies	M_Hydrology>=0.5	M_Hydrology<=0.5
Is the dumpsite operational?	Status	Operational	Non operational
Has the dumpsite been removed?	Status Subcategory	Non operational Removed	Non operational Not removed
Has the dumpsite been covered?	Status Subcategory	Non operational Covered	Non operational Not Covered

**refer to Attribute Table*
*** refer to Sensitivity Grade results*

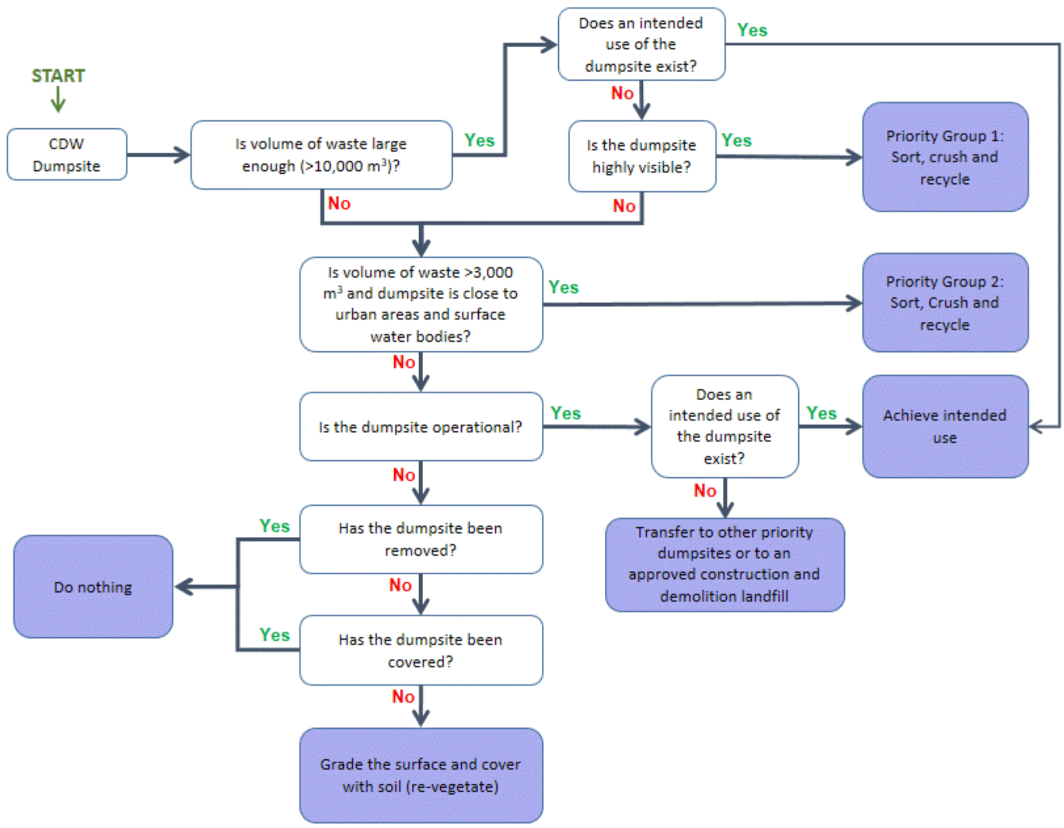


Figure 5-2 CDW Dumpsites Rehabilitation Options Decision Tree

5.2 RESULTS

The model automatically identifies the most suitable rehabilitation option for each dumpsite. However, the top 20 dumpsites were given special consideration where a detailed assessment for their rehabilitation options and associated costs (section 7.1) were appraised by an expert. Table 5-3 and Table 5-4 summarize the proposed rehabilitation plan for the 20 highest ranked MSW and CDW dumpsites, respectively.

Table 5-3 Proposed Rehabilitation Plan for the Top 20 Priority MSW Dumpsites

Rank	Dumpsite ID	Caza	Proposed Rehabilitation Plan
1	R6-Tripoli-0	Tripoli	Grade, cap, manage gases and leachate
2	N5-Hbaline-0	Jbeil	Option 1 - Grade, cap, manage gases and leachate
			Option 2 - Convert to a sanitary landfill
3	R7-Adweh-0	Minieh-Dannieh	Grade, cap, manage gases and leachate
4	P5-Batroun-0	Batroun	Excavate, line, grade, cap, manage gases and collect leachate
5	T9-Srar-0	Akkar	Convert to a sanitary landfill
6	J6-Qabb Elias-00	Zahle	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Transfer to a sanitary landfill
7	C1-Deir Qanoun El-Aain-01	Sour	Convert to a sanitary landfill
8	L5-Balloune-3	Kesrouane	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
9	L5-Beit Chabab-1n	Maten	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
10	J7-Barr Elias-00	Zahle	Option 1: Excavate, treat and transfer
			Option 2: Grade, cap, manage gases and leachate
11	R9-Fnaydek-0	Akkar	Excavate, line, grade, cap, manage gases and collect leachate
12	F2-Sarafand-01	Saida	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
13	G4-Jezzine-00	Jezzine	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
14	D2-Abbesye-03	Sour	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
15	M9-Baalback-02	Baalback	Excavate, line, grade, cap, manage gases and collect leachate
16	R9-Mishmesh-0	Akkar	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
17	G2-Ghaziye-00	Saida	Excavate, line, grade, cap, manage gases and collect leachate
18	E3-Kfour En-Nabatieh-00	Nabatieh	Excavate, line, grade, cap, manage gases and collect leachate
19	G2-Saida-1n	Saida	Grade, cap, manage gases and leachate
20	R7-Kfar Chellane-0	Minieh-Dannieh	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Table 5-4 Proposed Rehabilitation Plan for the Top 20 Priority CDW Dumpsites

Rank	Dumpsite ID	Caza	Proposed Rehabilitation Plan
1	Q7-Morh Kfarsghab-2	Zgharta	Achieve intended use (building a church)
2	R7-Deir Ammar-2	Minieh-Dannieh	Priority Group 1: Sort, crush and recycle
3	K5 - Broummana -1n	Maten	Priority Group 1: Sort, crush and recycle
4	K4-Beit Meri-00	Maten	Priority Group 1: Sort, crush and recycle
5	P6-Kosba-2	Koura	Achieve intended use (establish a parking)
6	L5-Balloune-2	Kesrouane	Priority Group 1: Sort, crush and recycle
7	L5-Qlaiaat-3	Kesrouane	Priority Group 1: Sort, crush and recycle
8	I5-Maaser Ech Chouf-0	Chouf	Priority Group 2: Sort, crush and recycle
9	L4-Dik Al-Mahdi-0	Maten	Priority Group 1: Sort, crush and recycle
10	K5- Ras El Maten-2n	Maten	Achieve intended use (build a new road)
11	L8-Chmestar-01	Baalback	Priority Group 1: Sort, crush and recycle
12	L5-Aain Er-Rihane-3	Kesrouane	Priority Group 1: Sort, crush and recycle
13	L4-Mtayleb-1	Maten	Priority Group 2: Sort, crush and recycle
14	L4-Zouk Al Khrab-6n	Maten	Priority Group 2: Sort, crush and recycle
15	L4-Zouk Al Khrab-5	Maten	Priority Group 2: Sort, crush and recycle
16	M9-Maqne-07n	Baalback	Priority Group 1: Sort, crush and recycle
17	J4-Aaytat-0	Aley	Achieve intended use (expand the land)
18	O6-Tartej-0n	Jbeil	Achieve intended use (transform to a garden)
19	L5- KfarTay- 1n	Maten	Priority Group 1: Sort, crush and recycle
20	N10-Rasm Al Hadath-00n	Baalback	Priority Group 1: Sort, crush and recycle

As for dumpsites beyond the top 20, the proposed rehabilitation options and costs are automatically set by the RDT model and are presented in Appendix D. In the event that rehabilitation initiatives are being considered, it is recommended that detailed studies and assessments be carried out by experts.

6. PRIORITIZATION DECISION TOOL (PDT) FOR DUMPSITE REHABILITATION

After having integrated the whole database in a digital GIS form, an easy access interface was created for both MSW and CDW dumpsites using a freeware application. The PDT is developed in python language and implemented as a plugin in an open source geographic information system (QGIS) (Figure 6-1).

Figure 6-1 Python Scripting for the MSW Risk Index

This application supports various GIS formats (ESRI .shp, Personal Geodatabase, etc.) and was specifically designed for both MSW and CDW dumpsites. Its user-friendly GUI (graphical user interface) (Figure 6-2) guides the user throughout the process of the prioritization operation and allows the user to complete the following tasks in the press of a button:

1. Loading the mandatory data
2. Locating the data (in case the data is not found by the application, a browsing window automatically opens, asking the user to manually locate the data)
3. Adjusting the weighing parametersk, if the default weights are required differently
4. Running the RSI model according to the given weighing parameters for both MSW and CDW dumpsites
5. Classifying the dumpsites according to the RSI score (very low, low, medium, high, very high)
6. Running the rehabilitation model
7. Navigating through the map using the map toolbar
8. Visualizing the results in excel format
9. Exporting datasheets, where information about a certain dumpsite can be acquired by a simple click on the map.

Further explanation along with screenshots can be found below.

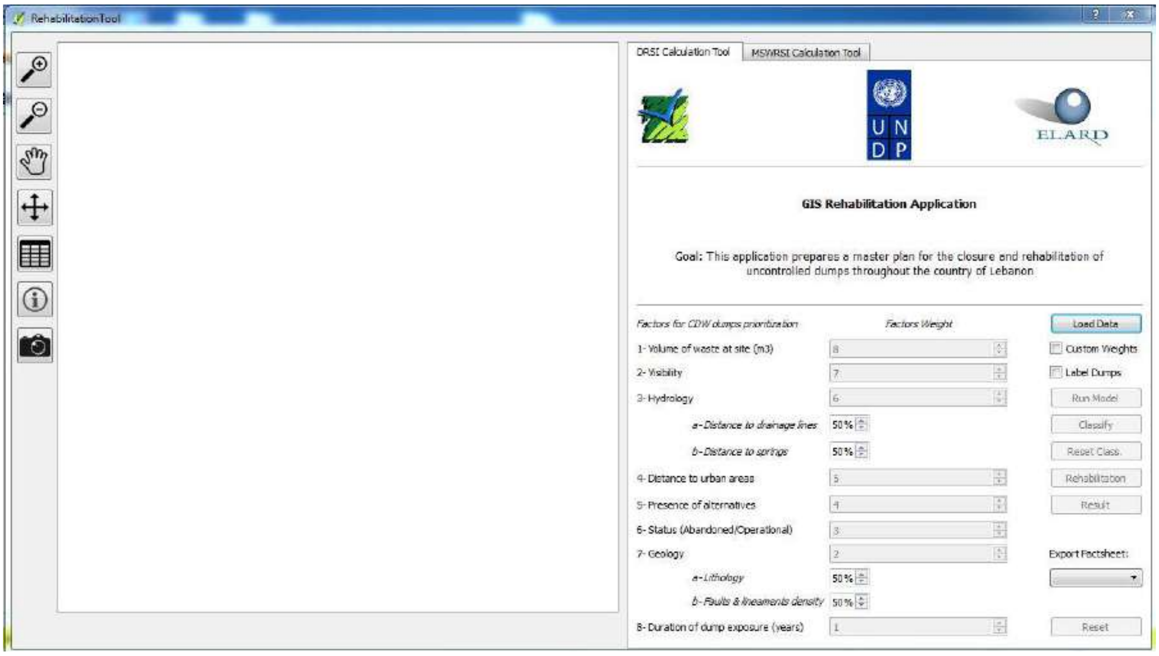


Figure 6-2 PDT Application General Interface

1. Loading the mandatory data

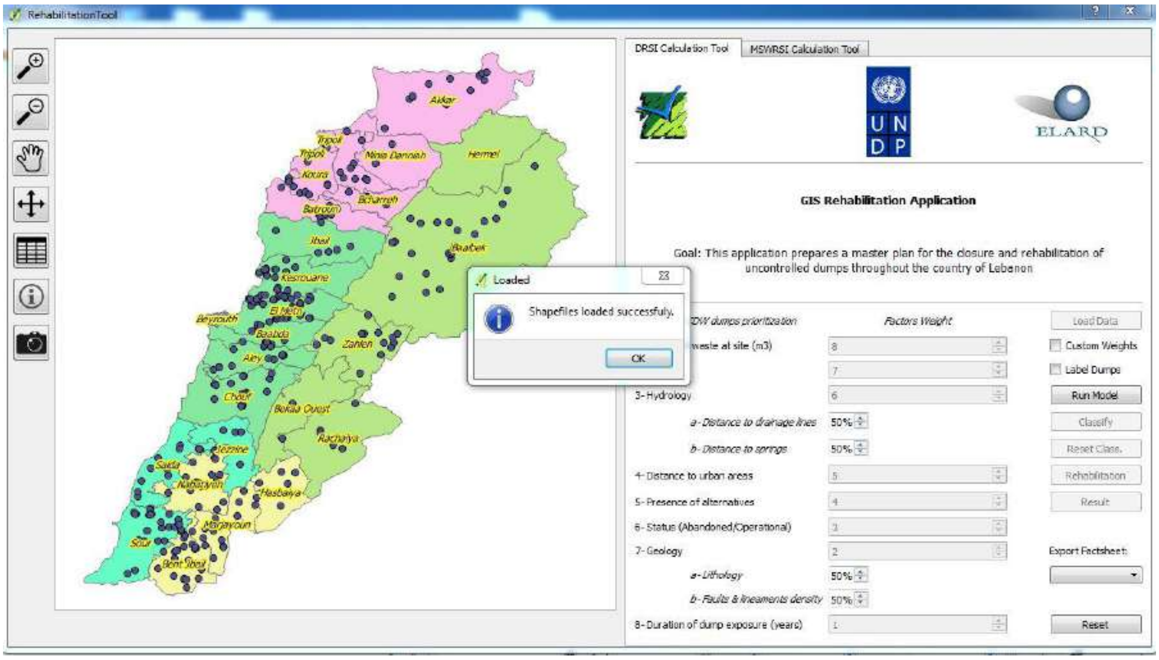


Figure 6-3 Data Loading and Model Parameter Activation

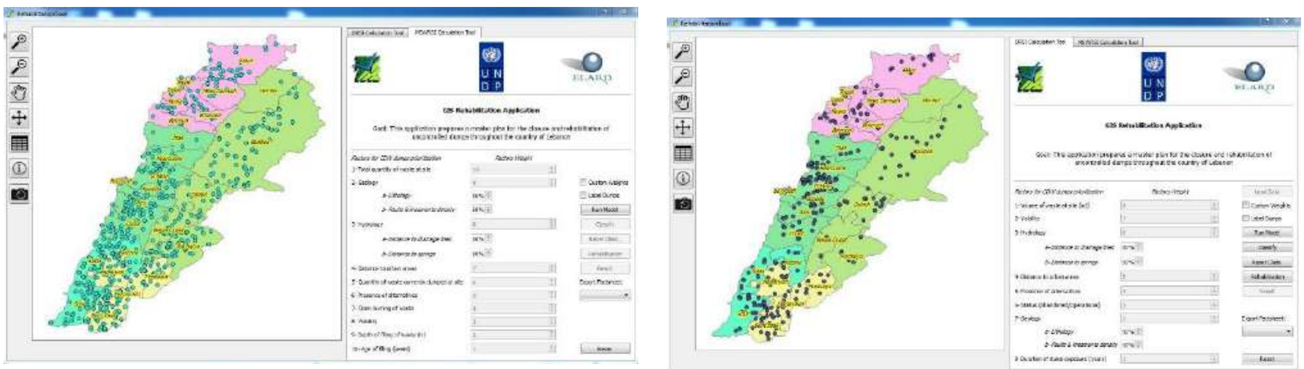
Once the user clicks on the "load data" button, the mandatory GIS layers are automatically imported into the map canvas, the "run model" button is enabled and a message is displayed indicating the success of this operation.

It should be noted that the user can easily switch between the two sections of this application:

1- MSWRSI: RSI for MSW dumpsites

2- DRSI: RSI for CDW dumpsites

PDT



MSWSRI DWRSI

Figure 6-4 PDT Application Interface

2. Locating the data

In case the data is not found by the application, the tool is able to display a useful message box (Figure 6-5) including the name of the missing parameters, and asks the user to manually locate them.

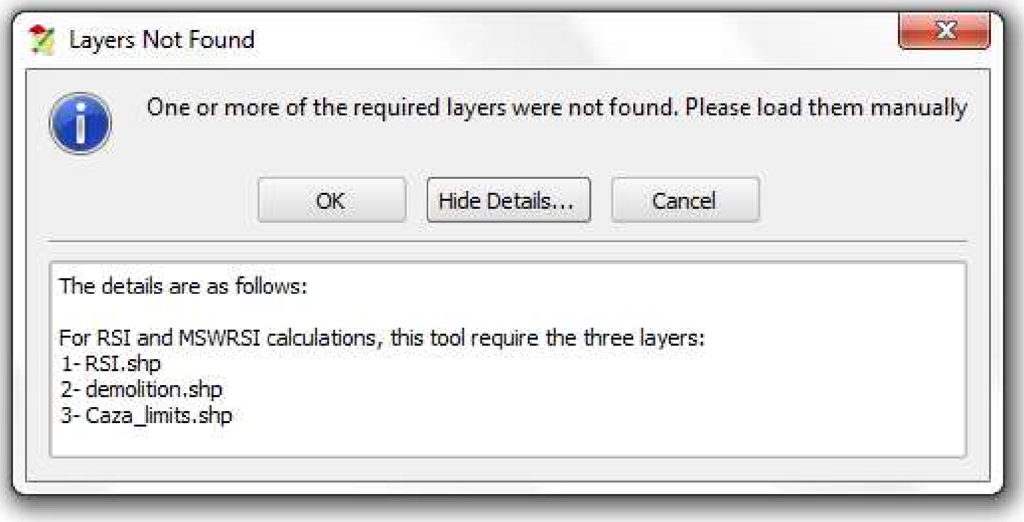


Figure 6-5 Adjust the Weighing Parameters

3. Adjusting the weighing parameters

Users are given the option to change the weighing factor of each parameter and see how this will affect the total RSI scoring.

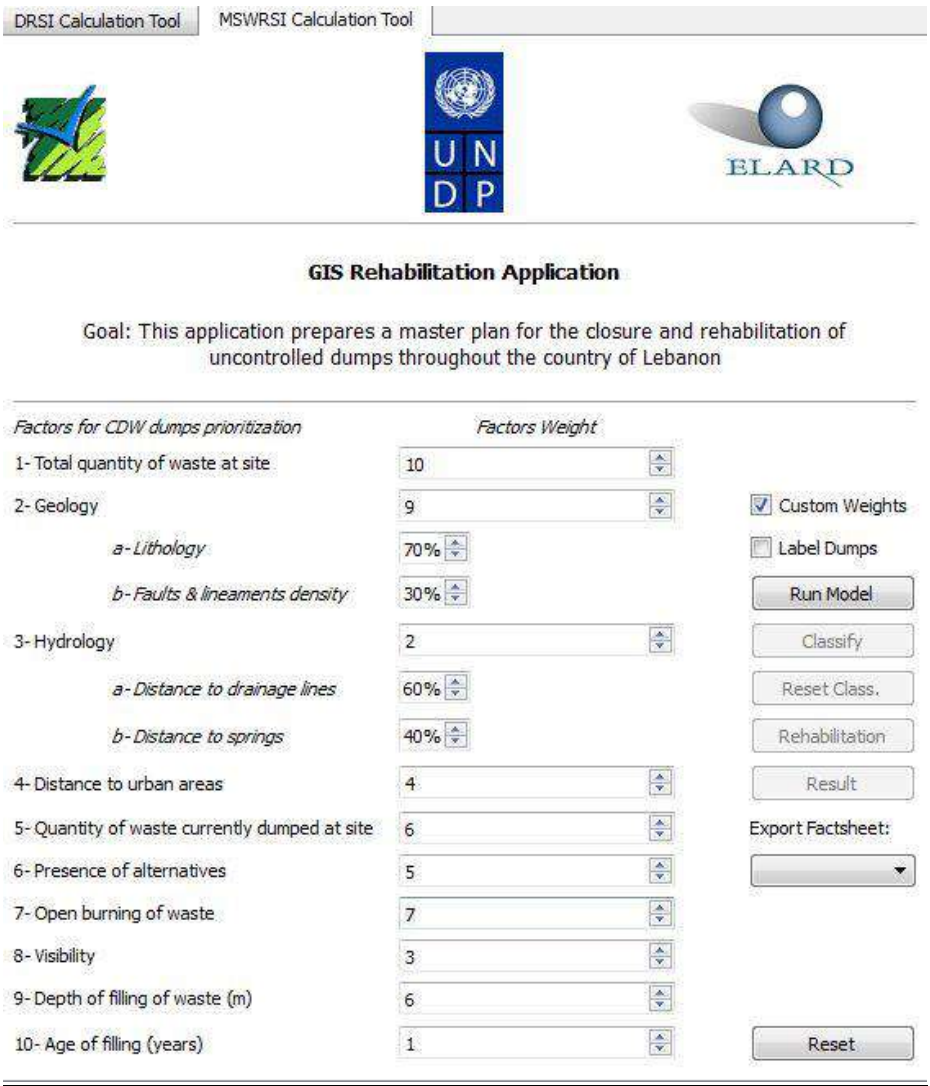


Figure 6-6 Manual Weight Adjustment

4. Running the RSI model

Calculating the RSI is a must to activate the rehabilitation process button and to display the results. It can be done by clicking on the "Run Model" button (Figure 6-7). The fact that all buttons are active is an indicator that the RSI has been calculated and that the model is ready to run the rehabilitation process and display the results. A message is displayed indicating the success of this operation.

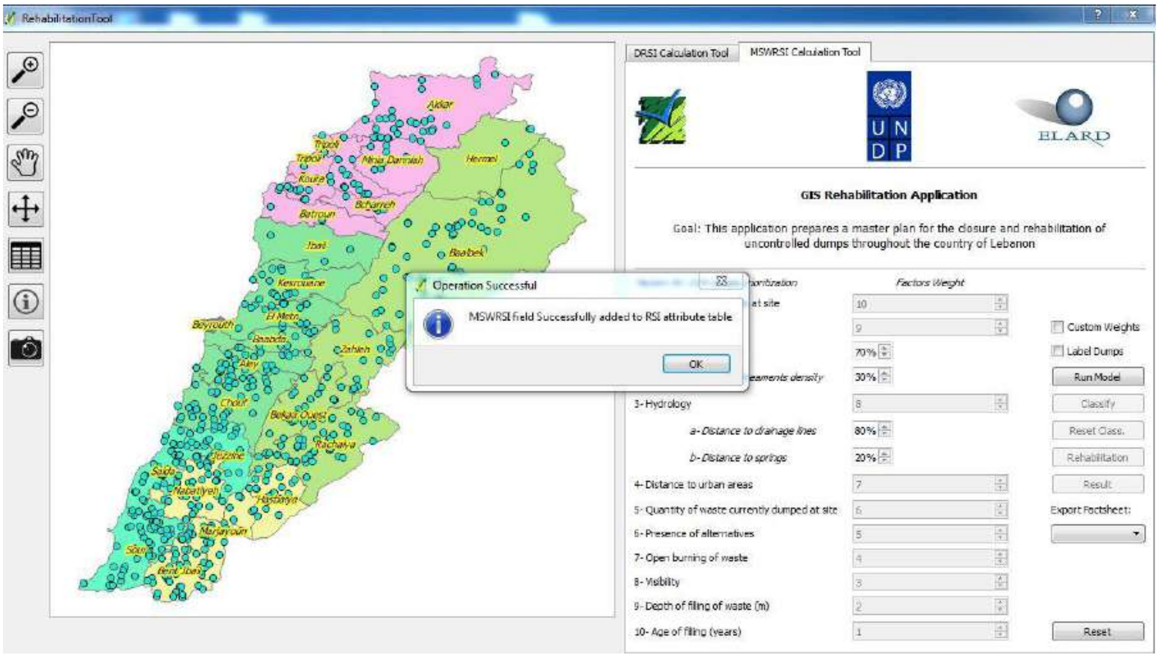


Figure 6-7 **The RSI Has Been Successfully Calculated**

5. Classifying the dumpsites according to the RSI score

For better visual interpretation, the user can classify the dumpsites according to the RSI scores (Figure 6-8).

Figure 6-8 **Ranking Classification "Order\Color" of the RSI**

6. Running the rehabilitation model

The rehabilitation button applies the decision tree model consisting of alternative executions, chained conditionals, conditional execution, boolean expressions and logical operators. When all statements are justified in the decision tree, the designed model automatically calculates the average cost ($/m^3) and the total cost (US $) per dumpsite depending on the rehabilitation type and the volume. A message is displayed indicating the success of this operation (Figure 6-9).

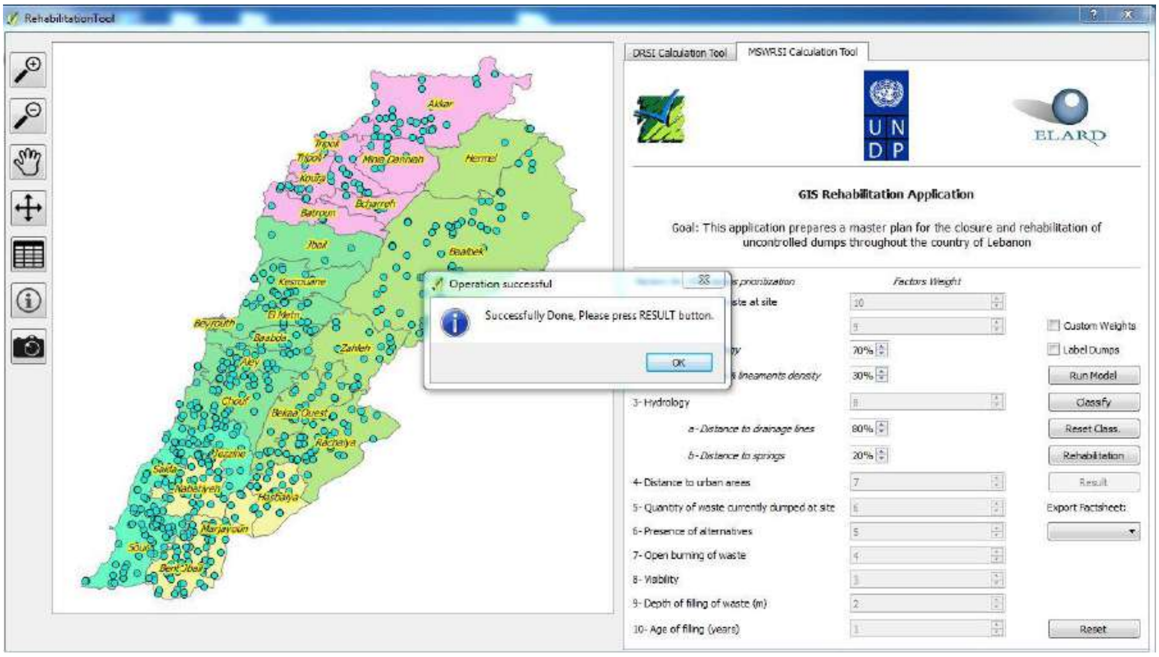


Figure 6-9 Pop Up Window Indication that the Rehabilitation Type and Cost Has Been Successfully Calculated

7. Navigating through the map using the map toolbar

→ Zoom in
→ Zoom out
→ Pan
→ Zoom to extent
→ Open attribute table

8. Visualizing the results in excel format

The results are displayed in a standalone table; Excel Sheet and independent of the model, where the dumpsite ID, its coordinates, the Caza and Mohafazat, the RSI score, rehabilitation type, average cost and total cost are displayed.

9. Exporting datasheets

A useful option is also included in the interface allowing the user to export printable datasheets for each dumpsite. Once saved, a previously designed layout containing important information about the dumpsites and a map showing the designated dumpsite will be automatically displayed (Figure 6-10).

The 40 Datasheets for the top 20 MSW dumpsites and CDW dumpsites figure under Appendix E of this report. They detail the following:

- Site name and location
- Type of dumpsite
- Estimated volume of wastes (m^3)
- Priority ranking for rehabilitation
- Preferred rehabilitation option
- Technical requirements (to be used as part of ToRs for contractor)
- Responsibility

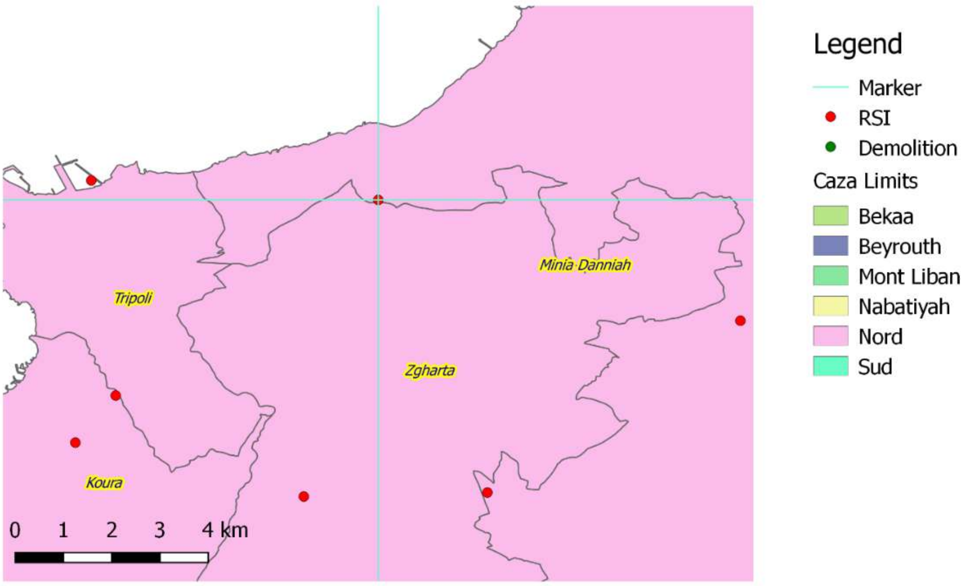
- Legal requirements, if any
- Monitoring requirements
- Operation and maintenance requirements
- Estimated cost
- Possible sources of financing.

ELARD

UNDP

Rehabilitation Report

Preparation of a master plan for the closure & rehabilitation closure & rehabilitation of uncontrolled dumps throughout the country of Lebanon



Template Form for Municipal Solid Waste

Name of dump: R7-Deir Ammar-1	Distance to urban areas: 1500
Location of dump (WGS-1984):	Dump status: Operational
X: 35.89819516 m	Estimated volume: 1200.0 m3
Y: 34.44960322 m	Area: 150 m2
Z: 198.9052582 m	Visibility: N
Mohafaza: North	Priority Ranking for Rehabilitation: 61
Caza: Minieh-Dannieh	Risk Sensitivity Index Score: 25.47
Town: Deir Ammar	Estimated rehabilitation cost: 18000.0 $

Recommended Rehabilitation Option: Group with other dumps and transfer to sanitary landfill

Figure 6-10 Fact Sheet Example for a MSW Dumpsite

7. COST ESTIMATES SUMMARY

In the following sections unit and total cost estimates per dumpsite for the priority MSW and CDW dumpsites are presented.

7.1 MSW DUMPSITES REHABILITATION COST ESTIMATES

Cost estimates for the proposed rehabilitation plans for the top 20 priority MSW dumpsites are provided in Table 7-1.

Table 7-1 Summary of Cost Estimates for the Top 20 Priority MSW Dumpsites

Rank	Dumpsite ID	Proposed Rehabilitation Plan	Cost (USD)
1	R6-Tripoli-0	Grade, cap, manage gases and leachate	6,557,287
2	N5-Hbaline-0	Option 1 - Grade, cap, manage gases and leachate	2,931,075
		Option 2 - Convert to a sanitary landfill	6,946,524
3	R7-Adweh-0	Grade, cap, manage gases and leachate	1,612,762
4	P5-Batroun-0	Excavate, line, grade, cap, manage gases and collect leachate	1,039,300
5	T9-Srar-0	Convert to a sanitary landfill	6,732,524
6	J6-Qabb Elias-00	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	2,163,875
		Option 2 - Transfer to a sanitary landfill	1,613,750
7	C1-Deir Qanoun El-Aain-01	Convert to a sanitary landfill	4,748,516
8	L5-Balloune-3	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	336,500
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	164,500
9	L5-Beit Chabab-1n	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	240,250
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	176,500
10	J7-Barr Elias-00	Option 1: Excavate, treat and transfer	3,758,262
		Option 2: Grade, cap, manage gases and leachate	1,765,675
11	R9-Fnaydek-0	Excavate, line, grade, cap, manage gases and collect leachate	895,875
12	F2-Sarafand-01	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	443,625
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	375,250
13	G4-Jezzine-00	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	334,750
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	193,000
14	D2-Abbesye-03	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	435,000
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	398,750
15	M9-Baalback-02	Excavate, line, grade, cap, manage gases and collect leachate	1,147,000
16	R9-Mishmesh-0	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	150,250
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	74,500
17	G2-Ghaziye-00	Excavate, line, grade, cap, manage gases and collect leachate	457,200
18	E3-Kfour En-Nabatieh-00	Excavate, line, grade, cap, manage gases and collect leachate	678,750
19	G2-Saida-1n	Grade, cap, manage gases and leachate	359,250
20	R7-Kfar Chellane-0	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	225,310
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	133,375
Cost Range: 32,130,590 – 39,187,061			

Cost estimates for each type of proposed rehabilitation plan for the top 20 MSW dumpsites are presented in Table 7-2, Table 7-3, Table 7-4 and Table 7-5.

Table 7-2 Summary of Cost Estimates for Excavate, Line, Grade, Cap, Manage Gases and Collect Leachate Rehabilitation Plan

Excavate, Line, Grade, Cap, Manage Gases and Collect Leachate		
Site Name	**Volume (m^3)**	**Average Cost (USD/m^3)**
P5-Batroun-0	55,000	18.90
J6-Qabb Elias-00	219,000	9.88
L5-Balloune-3	14,000	24.04
L5-Beit Chabab-1n	10,000	24.03
R9-Fnaydek-0	72,000	12.44
F2-Sarafand-01	33,000	13.44
G4-Jezzine-00	16,000	20.92
D2-Abbesye-03	35,000	12.43
M9-Baalbeck-02	75,000	15.29
R7-Kfar Chellane-0	11,500	19.59
G2-Ghaziye-00	32,000	14.29
E3-Kfour En-Nabatieh-00	42,000	16.16
R9-Mishmesh-0	6,000	25.04

Excavate, Line, Grade, Cap, Manage Gases and Collect Leachate	
Volume (m^3)	**Average Cost (USD /m^3)**
>100,000	10.5
Between 10,000 and 100,000	17.0
<10,000	26.0

Table 7-3 Summary of Cost Estimates for Grade, Cap, Manage Gases and Leachate Rehabilitation Plan

Grade, Cap, Manage Gases and Leachate		
Site Name	**Volume (m^3)**	**Average Cost (USD /m^3)**
N5-Hbaline-0	600,000	4.89
R7-Adweh-0	255,372	6.32
R6-Tripoli-0	1,206,000	5.44
G2-Saida-1n	50,000	7.19
J7-Barr Elias-00	200,000	8.83

Grade, Cap, Manage Gases and Leachate	
Volume (m^3)	**Average Cost (USD /m^3)**
>100,000	5.5
Between 10,000 and 100,000	7.0
<10,000	9.5

Table 7-4 Summary of Cost Estimates for Group with Other Dumpsites and Transfer to a Sanitary Landfill Rehabilitation Plan

Group with Other Dumpsites and Transfer to a Sanitary Landfill		
Site Name	**Volume (m^3)**	**Average Cost (USD/m^3)**
L5-Balloune-3	14,000	11.75
L5-Beit Chabab-1n	10,000	17.65
F2-Sarafand-01	33,000	11.37
G4-Jezzine-00	16,000	12.06
D2-Abbesye-03	35,000	11.39
R7-Kfar Chellane-0	11,500	11.60
J6-Qabb Elias-00	219,000	7.37
R9-Mishmesh-0	6,000	12.42

Group with Other Dumpsites and Transfer to a Sanitary Landfill	
Volume (m^3)	**Average Cost (USD/m^3)**
>100,000	8.0
Between 10,000 and 100,000	13.0
<10,000	15.0

Table 7-5 Summary of Cost Estimates for Covert to a Sanitary Landfill Rehabilitation Plan

Convert to a Sanitary Landfill		
Site Name	**Volume (m^3)**	**Average Cost (USD/m^3)**
T9-Srar-0	570,000	11.81
C1-Deir Qanoun El Ain-01	300,000	15.83
N5-Hbaline-0	600,000	11.58
J7-Barr Elias-00	200,000	18.79

Convert to a Sanitary Landfill	
Volume (m^3)	**Average Cost (USD/m^3)**
>500,000	11.8
between 100,000 and 500,000	16.5
<100,000	22.0

The average total cost for rehabilitating the top 20 MSW dumpsites is in the order of **35,660,000 USD**. The cost for rehabilitating the remaining MSW dumpsites beyond the top 20 is estimated to be in the order of **24,550,000 USD**.

Details on the proposed rehabilitation plan for each dumpsite and associated cost are presented in Appendix D.

7.2 CDW DUMPSITES REHABILITATION COST ESTIMATES

Unit and total cost estimates per dumpsite for the 20 priority CDW dumpsites are provided in Table 7-6.

Table 7-6 Summary of Cost Estimates for the Top 20 Priority CDW Dumpsites

Rank	Dumpsite ID	Proposed Rehabilitation Plan	Cost (USD)
1	Q7-Morh Kfarsghab-2	Achieve intended use (building a church)	40,267
2	R7-Deir Ammar-2	Priority Group 1: Sort, crush and recycle	422,550
3	K5 - Broummana -1n	Priority Group 1: Sort, crush and recycle	839,960
4	K4-Beit Meri-00	Priority Group 1: Sort, crush and recycle	939,750
5	P6-Kosba-2	Achieve intended use (establish a parking)	109,433
6	L5-Balloune-2	Priority Group 1: Sort, crush and recycle	362,900
7	L5-Qlaiaat-3	Priority Group 1: Sort, crush and recycle	553,850
8	I5-Maaser Ech Chouf-0	Priority Group 2: Sort, crush and recycle	102,440
9	L4-Dik Al-Mahdi-0	Priority Group 1: Sort, crush and recycle	243,600
10	K5- Ras El Maten-2n	Achieve intended use (build a new road)	147,000
11	L8-Chmestar-01	Priority Group 1: Sort, crush and recycle	127,300
12	L5-Aain Er-Rihane-3	Priority Group 1: Sort, crush and recycle	1,175,000
13	L4-Mtayleb-1	Priority Group 2: Sort, crush and recycle	57,185
14	L4-Zouk Al Khrab-6n	Priority Group 2: Sort, crush and recycle	64,650
15	L4-Zouk Al Khrab-5	Priority Group 2: Sort, crush and recycle	65,650
16	M9-Maqne-07n	Priority Group 1: Sort, crush and recycle	155,625
17	J4-Aaytat-0	Achieve intended use (expand the land)	77,600
18	O6-Tartej-0n	Achieve intended use (transform to a garden)	22,800
19	L5- KfarTay- 1n	Priority Group 1: Sort, crush and recycle	686,084
20	N10-Rasm Al Hadath-00n	Priority Group 1: Sort, crush and recycle	129,765
Total Cost			**6,323,409**

Cost estimates for each type of proposed rehabilitation plan for CDW dumpsites are presented in Table 7-7, Table 7-8, Table 7-9 and Table 7-10.

Table 7-7 Summary of Cost Estimates for Achieve Intended Use Rehabilitation Plan

Achieve Intended Use	
Volume (m^3)	**Unit Rate (USD/m^3)**
>50,000	1.7
Between 10,000 and 50,000	2.5
<10000	10

Table 7-8 Summary of Cost Estimates for Sort, Crush and Recycle Rehabilitation Plan

Sort, Crush and Recycle	
Volume (m^3)	**Unit Rate (USD /m^3)**
>50,000	11.5
Between 10,000 and 50,000	12.5
<10000	14

Table 7-9 Summary of Cost Estimates for Transfer to Other Priority Dumpsites Rehabilitation Plan

Transfer to Other Priority Dumpsites	
Volume (m^3)	**Unit Rate (USD /m^3)**
<3,000	6

Table 7-10 Summary of Cost Estimates for Grade the Surface and Cover with Soil Rehabilitation Plan

Grade the Surface and Cover with Soil	
Volume (m^3)	**Unit Rate (USD /m^3)**
<3000	5

The estimated cost for rehabilitating the top 20 CDW dumpsites is in the order of **6,324,000 USD**. The cost for rehabilitating the remaining CDW dumpsites beyond the top 20 is estimated to be in the order of **7,455,000 USD.**

Details on the proposed rehabilitation plan for each dumpsite and associated cost are presented in the Geodatabase in Appendix D.

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9. APPENDICES

APPENDIX A – SITE CHARACTERIZATION FORM (SCF)

Site Characterization Form

Column	Column Title	Associated Drop-Down List
A	Site ID	
B	Photographs Number	
C	Date of Visit	
D	Surveyors	
E	Mohafaza	
F	Caza	
G	Town	
H	X	
I	Y	
J	Z	
K	Land Ownership	Private Land Machaa Wakef Other
L	Land Owner Name	
M	Status	Operational Non-operational
N	Type of Dump	Excavated pit/below ground surface quarry Elaborated hill or pile Dump in valley or seasonal water channels Sea-dump Dump bordering major river channel Dump in roadside cliff or steep slope Dumps in used-up surface quarry
O	Total Area of dump	
P	Height (highest point)	
Q	Average Height	
R	Size with respect to allocated plot	
S	Year waste started being dumped	
T	Year waste stopped being dumped	
U	Quantity of waste dumped per day	
V	Types of waste being dumped	Municipal Solid Waste (MSW)

Column	Column Title	Associated Drop-Down List
		Hazardous Waste (HW) Industrial Waste (IW) Medical Waste (MW) Slaughterhouse Waste (SW) Construction and Demolition Waste / Rubble (CDW) Multiple
W	if multiple waste type, specify here	
X	Level of Compaction	Compaction No Compaction
Y	Management Set-up	Central Government **Federation of Municipalities, Controlled Access** **Federation of Municipalities, No Control** Municipality, Controlled Access Municipality, No Control Contracted by Municipality, Managed by Private Sector **Private Sector with No Supervision** No Management
Z	Access Road	NA Paved Unpaved
AA	Waste coming from	
AB	Visibility	Y N
AC	Geological Formation	
AD	Geological Structure	Y N
AE	Karstic Fractures	Y N
AF	Open Burning	Y N
AG	Frequency of Open Burning	
AH	Leachate Generation	Visible Not Visible
AI	Biogas Generation	Visible Not Visible
AJ	Presence of Scavengers	Y N
AK	Land Use of Area	Residential

Column	Column Title	Associated Drop-Down List
		Agricultural Industrial Touristic Religious River Property Other
AL	Predominant Wind Direction	
AM	Presence of Hospitals in the Area	Y (if yes, ask how they dispose their medical waste) N
AN	Presence of Industrial Facilities in the Area	Y (if yes, ask how they dispose their industrial waste) N
AO	Proximity to Residential Areas	
AP	Proximity to Nearest House/Building	
AQ	**Presence of Informal Settlement**	**Y (if yes, ask when they settled here)** **N**
AR	Availability of down-gradient Springs and Wells	Y N
AS	Proximity to Agricultural Areas	
AT	Proximity to Tourist and Cultural Facilities	
AU	Proximity to Main Road	
AV	Proximity to Areas of Ecological Importance	
AW	Status of Rehabilitation	
AX	Type of Rehabilitation	Any plans to close the dump? (Y/N) If yes, What is the plan? Availability of Funds? Sources of Fund
AY	Intended Future-use	
AZ	Public Complaints	Y N
BA	**Availability of an existing or planned nearby waste treatment facility**	**Y (if yes, ask about facility components and distance from dump site)** **N**
BB	Remarks	

APPENDIX B – DETAILED CAZA TABLES

Table B - 1 MSW Comparative Analysis between 2011 and 2016 Survey - Akkar Caza

MSW Akkar Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**13**	**242,600**	**678,735**	**436,135**	**179.8**	13 dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**2**	**1,300**	**1,100**	**-200**	**-15.4**	Two dumpsites were non-operational in the 2011 survey and have become operational in the 2016 survey with a decrease in volume. In addition to the normal decomposition/settlement of MSW waste in non-operational dumpsites that reduces volume, burning activities were reported for both dumpsites in 2011 survey and for one of the dumpsites in 2016 which further decreases the volume.
Operational in 2011 and Non-operational in 2016		**9**	**94,700**	**69,900**	**-24,800**	**-26.2**	Nine dumpsites were operational in the 2011 survey with a total volume of 94,700 m³ and have become non-operational in the 2016 survey with a decrease in volume. This volume decrease is attributed to the following: - One dumpsite (R8-Birkayel-0) which alone had an estimated volume of 70,200 m³ in 2011 had an estimated volume of 25,000 m³ in 2016 survey since it was mostly rehabilitated-covered. The remaining five dumpsites were operational in the 2011 survey and have become non-operational with an increase in volume (if the big decrease in Birkayel-0 figures is excluded). - Two dumpsites were rehabilitated-removed by 2016. One dumpsite was covered.
	Not rehabilitated	*6*	*91,700*	*67,900*	*-23,800*		
	Covered	*1*	*2,000*	*2,000*	*0*		
	Removed	*2*	*1,000*	*0*	*-1,000*		
Non-Operational in 2011 and Non-Operational in 2016		**5**	**10,100**	**3,985**	**-6,115**	**-60.5**	Five dumpsites which were non-operational in the 2011 survey with a total volume of 10,100 m³ were still non-operational in the 2016 survey with a decrease in volume of 6,115 m³. This volume decrease is attributed to the following: - Three of these dumpsites were not rehabilitated by 2016 yet their volume decreased by 4,615 m³ due to natural degradation/etc. - One of these dumpsites which had a total volume of 1,500 m³ in 2011 was rehabilitated-removed by 2016. One dumpsite was covered.
	Not rehabilitated	*3*	*8,000*	*3,385*	*-4,615*		
	Covered	*1*	*600*	*600*	*0*		
	Removed	*1*	*1,500*	*0*	*-1,500*		

MSW Akkar Caza		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
New dumpsites identified in 2016		**5**		**-**	**6,740**	**6,740**	**100.0**	Four new operational dumpsites were identified with an estimated volume of 6,740 m³. One new non-operational dumpsite was also identified; however it appeared to have been removed.
	Operational	*4*		-	*6,740*	*6,740*		
	Non-operational	*1*		-	*0*	*0*		
Non-operational in 2011 and Inaccessible in 2016		**2**		**5,220**	**5,220**	**0**	**0.0**	Two dumpsites which were non-operational in 2011 were unreachable in 2016 due to security reasons and inaccessible roads.
TOTAL		**2011**	**31**	**353,920**	**765,680**	**411,760**	**116.3**	
		2016	**36**					

Table B - 2 MSW Comparative Analysis between 2011 and 2016 Survey - Minieh-Dannieh Caza

MSW Minieh-Dannieh Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**3**	**160,000**	**261,972**	**101,972**	**63.7**	Three dumpsites which were operational in the 2011 survey remained operational in 2016 with an increase in volume. One of these dumpsites is R7-Adweh dumpsite which is a major dumpsite in Minieh-Dannieh with an estimated volume of 255,372 m³.
Non-operational in 2011 and Operational in 2016		**1**	**10,000**	**11,500**	**1,500**	**15.0**	One dumpsite was non-operational in the 2011 survey and was found to be operational in 2016.
Operational in 2011 and Non-operational in 2016		**4**	**11,750**	**2,800**	**-8,950**	**-76.1**	Four dumpsites were operational in the 2011 survey with a total volume in the order of 11,750 m³. These dumpsites were recorded as non-operational in the 2016 survey with a decrease in volume. This decrease is attributed to the following: - Two of these dumpsites are not rehabilitated with a decrease in volume as a result of burning activities and natural degradation/decomposition/etc. - Two dumpsites with a volume of 8,000 m³ were rehabilitated-removed by 2016.
	Not rehabilitated	*2*	*3,750*	*2,800*	*-950*		
	Covered	-	-	-	-		
	Removed	*2*	*8,000*	*0*	*-8,000*		
Non-Operational in 2011 and Non-Operational in 2016		**2**	**14,000**	**8,000**	**-6,000**	**-42.9**	Two dumpsites which were non-operational in the 2011 survey remain not rehabilitated with a decrease in volume due to reported burning activities since the 2011 survey in addition to natural degradation/decomposition as both dumpsites were reportedly closed since 2005/2006.
	Not rehabilitated	*2*	*14,000*	*8,000*	*-6,000*		
	Covered	-	-	-	-		
	Removed	-	-	-	-		
New dumpsites identified in 2016		**1**	**-**	**100**	**100**	**100.0**	One new dumpsite with a 100 m³ volume was identified.
	Operational	*1*	-	*100*	*100*		
	Non-operational	-	-	-	-		

MSW Minieh-Dannieh Caza	Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m^3)	% Change	
Non-operational MSW in 2011 and Operational CDW in 2016	1		5,000	Comment	-5,000	100.0	One dumpsite (Q8-Taran-0) which was non-operational MSW in the 2011 survey has been reclassified as CDW in 2016. This volume of this dumpsite (6,000 m³) is added to the CDW figures in Minieh-Dannieh caza.
Non-operational in 2011 and Inaccessible in 2016	1		60	60	0	0.0	One dumpsite was non-operational in the 2011 survey and inaccessible in the 2016 survey due to the absence of a clear access road and municipality support.
TOTAL	2011	12	200,810	284,432	83,622	41.6	
	2016	12					

Table B - 3 MSW Comparative Analysis between 2011 and 2016 Survey - Zgharta Caza

MSW Zgharta Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**-**	**-**	**-**	**-**	**-**	
Non-operational in 2011 and Operational in 2016		**-**	**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**3**	**1,867**	**400**	**-1,467**	**-78.6**	Three dumpsites were operational in the 2011 survey with a total volume in the order of 1,867 m³. These dumpsites have become non-operational in the 2016 survey with a 1,467 m³ decrease in volume. This decrease in volume is attributed to the following: - One dumpsite remained operational until 2012 after the 2011 survey before it became non-operational with no burning activities, which explains the increase in volume. - Two dumpsites were rehabilitated-removed by 2016.
	Not rehabilitated	*1*	*60*	*400*	*340*		
	Covered	-	-	-	-		
	Removed	*2*	*1,807*	*0*	*-1,807*		
Non-Operational in 2011 and Non-Operational in 2016		**6**	**31,428**	**5,200**	**-26,228**	**-83.5**	Six dumpsites were non-operational in the 2011 survey with a total volume in the order of 31,428 m³. These dumpsites have become non-operational in the 2016 survey with a large decrease in volume. This decrease in volume is attributed to the following: - One dumpsite (Q7-Kfarzaina-0), which was reported non-operational in 2011 survey with a total volume of 24,000 m³, was in fact operational until 2015 after which it became non-operational with an estimated volume of 4,000 m³. This means that either the figure reported in 2011 is overestimated or the dumpsite was partly rehabilitated/covered. The other two dumpsites remained not rehabilitated by 2016 with a normal decrease in volume as a result of natural degradation/etc. - Three dumpsites were rehabilitated-removed by 2016.
	Not rehabilitated	*3*	*25,425*	*5,200*	*-20,225*		
	Covered	-	-	-	-		
	Removed	*3*	*6,003*	*0*	*-6,003*		
New dumpsites identified in 2016		**2**	**-**	**2,450**	**2,450**	**100.0**	Two new operational MSW dumpsites were identified in Zgharta caza with an estimated volume of 2,450 m³.
	Operational	*2*	-	*2,450*	*2,450*		
	Non-operational	-	-	-	-		

MSW Zgharta Caza	Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational MSW dumpsites in 2011 and Operational CDW in 2016	1		900	-	-900	-100.0	One dumpsite was operational MSW dumpsite in the 2011 survey and was classified as CDW dumpsite in the 2016 survey. Its estimated volume (2,000 m³) is added to the CDW volume in Zgharta caza.
Operational MSW dumpsites in 2011 and Non-operational CDW in 2016	1		3,000	-	-3,000	-100.0	One dumpsite was operational MSW dumpsites in the 2011 survey and was classified as non-operational CDW dumpsite in the 2016 survey. Its estimated volume (150 m³) is added to the CDW volume in Zgharta caza.
TOTAL	2011	11	37,195	8,050	-29,145	-78.3	
	2016	11					

Table B - 4 MSW Comparative Analysis between 2011 and 2016 Survey - Koura Caza

MSW Koura Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance: Volume (m³)	Balance: % Change	Comments
Operational in 2011 and 2016		**7**	**25,770**	**23,400**	**-2,370**	**-9.2**	Seven dumpsites which were operational in the 2011 survey remained operational in 2016 with a slight decrease in volume.
Non-operational in 2011 and Operational in 2016		**1**	**7,500**	**1,800**	**-5,700**	**-76.0**	One dumpsite was non-operational in the 2011 survey and was found to be operational in 2016.
Operational in 2011 and Non-operational in 2016		**8**	**40,750**	**18,750**	**-22,000**	**-54.0**	Eight dumpsites were operational in the 2011 survey with a total volume in the order of 40,750 m³. These dumpsites have become non-operational in 2016 survey with a 22,000 m³ decrease in volume.
	Not rehabilitated	*7*	*36,750*	*14,750*	*-22,000*		This decrease in volume is attributed to the following: - Seven dumpsites which were not rehabilitated by the year 2016 have had a decrease in volume. One dumpsite (P6-Kfar Aaqqa-0) had a volume of 25,000 m³ in the 2011 survey and was found to be much smaller in the 2016 survey with a volume estimated to be around 7,350 m³. Possible reasons could be that the old waste was covered with soil or the 2011 figure was overestimated. One dumpsite is rehabilitated-covered.
	Covered	*1*	*4,000*	*4,000*	*0*		
	Removed	-	-	-	-		
Non-Operational in 2011 and Non-Operational in 2016		**1**	**180**	**0**	**-180**	**-100.0**	One dumpsite which was identified as non-operational in the 2011 survey was removed by 2016.
	Not rehabilitated	-	-	-	-		
	Covered	-	-	-	-		
	Removed	*1*	*180*	*0*	*-180*		
New dumpsites identified in 2016		**-**	**-**	**-**	**-**	**-**	
Operational MSW dumpsites in 2011 and Operational CDW in 2016		**2**	**3,400**	**-**	**-3,400**	**-100.0**	Two dumpsites which were operational MSW dumpsites in the 2011 survey were classified as operational CDW dumpsites in the 2016 survey. Their estimated volume (3,400 m³) is added to the CDW figures.
TOTAL		**2011: 19** **2016: 17**	**77,600**	**43,950**	**-33,650**	**-43.4**	

Table B - 5 MSW Comparative Analysis between 2011 and 2016 Survey - Bcharre Caza

MSW Bcharre Caza		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
Operational in 2011 and 2016		**-**		**-**	**-**	**-**	**-**	
Non-operational in 2011 and Operational in 2016		**-**		**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**4**		**3,920**	**1,100**	**-2,820**	**-71.9**	Four dumpsites were operational in 2011 survey and have become non-operational by 2016 with a general decrease in volume. This decrease is attributed to the two dumpsites that were completely rehabilitated-removed by 2016.
	Not rehabilitated	*2*		*720*	*1,100*	*380*		
	Covered	-		-	-	-		
	Removed	*2*		*3,200*	*0*	*-3,200*		
Non-Operational in 2011 and Non-Operational in 2016		**1**		**300**	**160**	**-140**	**-46.7**	One dumpsite remained not rehabilitated in the 2016 survey with a decrease in volume due to natural decomposition/scattering/ etc.
	Not rehabilitated	*1*		*300*	*160*	*-140*		
	Covered	-		-	-	-		
	Removed	-		-	-	-		
TOTAL		**2011**	**5**	**4,220**	**1,260**	**-2,960**	**-70.1**	
		2016	**5**					

Table B - 6 MSW Comparative Analysis between 2011 and 2016 Survey - Batroun Caza

MSW Batroun Caza		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**2**		**15,300**	**58,000**	**42,700**	**279.1**	Two dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with a big increase in volume. One of these dumpsites is P5-Batroun-0 which is the main MSW for all Batroun caza with an estimated volume of 55,000 m³ in 2016 survey.
Non-operational in 2011 and Operational in 2016		**1**		**3,000**	**1,000**	**-2,000**	**-66.7**	One dumpsite was non-operational in 2011 and became operational in 2016 with a decrease in volume. This dumpsite had been non-operational since 2010 and became operational again in 2015. Natural degradation and decomposition in addition to reported burning activities in 2011 survey justify the decrease in volume.
Operational in 2011 and Non-operational in 2016		**1**		**150**	**0**	**-150**	**-100.0**	One dumpsite was operational in the 2011 survey and was non-operational and removed by 2016.
	Not rehabilitated	-		-	-	-		
	Covered	-		-	-	-		
	Removed	*1*		*150*	*0*	*-150*		
Non-Operational in 2011 and Non-Operational in 2016		**1**		**120,000**	**72,000**	**-48,000**	**-40.0**	One dumpsite (P5-Hamat-1) which was non-operational and not rehabilitated in the 2011 survey with a total volume of 120,000 m³ is still non-operational in the 2016 survey with a decrease in volume in the order of 48,000 m³.
	Not rehabilitated	*1*		*120,000*	*72,000*	*-48,000*		
	Covered	-		-	-	-		
	Removed	-		-	-	-		
New dumpsites identified in 2016		**-**		**-**	**-**	**-**	**-**	
Operational MSW dumpsites in 2011 and Operational CDW in 2016		**1**		**300**	**Comment**	**-300**	**-100.0**	One dumpsite was operational MSW in 2011 survey was reclassified as operational CDW in 2016 survey. Its estimated volume of 10,800 m³ is added to the CDW figures.
Operational MSW dumpsites in 2011 and Non-operational CDW in 2016		**1**		**1,500**		**-1,500**	**-100.0**	One dumpsite was operational MSW in 2011 survey was reclassified as CDW non-operational in 2016 survey. Its estimated volume of 1,005 m³ is added to the CDW figures.
TOTAL		**2011**	**8**	**140,350**	**131,000**	**-9,350**	**-6.7**	
		2016	**5**					

Table B - 7 MSW Comparative Analysis between 2011 and 2016 Survey - Jbeil Caza

MSW Jbeil Caza		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**1**		**375,000**	**600,000**	**225,000**	**60.0**	Jbeil caza sends its MSW to Hbaline dumpsite which has witnessed a 60% increase in volume since the 2011 survey.
Non-operational in 2011 and Operational in 2016		**-**		**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**1**		**700**	**0**	**-700**	**100**	One dumpsite which was operational in the 2011 survey was non-operational and rehabilitated-removed in the 2016 survey.
	Not rehabilitated	-		-	-	-		
	Covered	-		-	-	-		
	Removed	*1*		*700*	*0*	*-700*		
Non-Operational in 2011 and Non-Operational in 2016		**-**		**-**	**-**	**-**	**-**	
	Not rehabilitated	-		-	-	-		
	Covered	-		-	-	-		
	Removed	-		-	-	-		
New dumpsites identified in 2016		**-**		**-**	**-**	**-**	**-**	
	Operational	-		-	-	-		
	Non-operational	-		-	-	-		
Operational in 2011 and Inaccessible in 2016		**1**		**400**	**400**	**0**	**0.0**	One dumpsite was not reachable and the municipality did not provide any information about the location.
TOTAL		**2011**	**3**	**376,100**	**600,400**	**224,300**	**59.6**	
		2016	**3**					

Table B - 8 MSW Comparative Analysis between 2011 and 2016 Survey - Kesrouane Caza

<table>
<tr><th colspan="2" rowspan="2">MSW
Kesrouane Caza</th><th rowspan="2">Count</th><th rowspan="2">Volume (m³) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m³) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m³)</th><th>% Change</th></tr>
<tr><td colspan="2">Operational in 2011 and 2016</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Non-operational in 2011 and Operational in 2016</td><td>2</td><td>3,000</td><td>19,000</td><td>16,000</td><td>533.3</td><td>Two dumpsites that were not operational in the 2011 survey became operational in the 2016 survey with a volume increase of 16,000 m³.</td></tr>
<tr><td colspan="2">Operational in 2011 and Non-operational in 2016</td><td>7</td><td>13,455</td><td>5,150</td><td>-8,305</td><td>-61.7</td><td rowspan="4">Seven dumpsites which were operational in the 2011 survey became non-operational in the 2016 survey with a 61.7% decrease in volume.

This decrease is attributed to the following:
- Four dumpsites which were non-operational in the 2016 survey were not rehabilitated however showed a decrease in volume of 6,805 m³. This is mostly attributed to M6-Hrajel-0 which has decreased by 8,700 m³ since it is located next to the river so part of the waste is washed away and the old waste was covered.
- Two dumpsites which were found to be non-operational in the 2016 survey were rehabilitated-removed resulting in a decrease of 1,500 m³.

One dumpsite was rehabilitated-covered.</td></tr>
<tr><td rowspan="3"></td><td>Not rehabilitated</td><td>4</td><td>9,955</td><td>3,150</td><td>-6,805</td><td rowspan="3"></td></tr>
<tr><td>Covered</td><td>1</td><td>2,000</td><td>2,000</td><td>0</td></tr>
<tr><td>Removed</td><td>2</td><td>1,500</td><td>0</td><td>-1,500</td></tr>
</table>

MSW Kesrouane Caza		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Non-Operational in 2011 and Non-Operational in 2016		**6**		**18,425**	**15,150**	**-3,275**	**-17.8**	Six dumpsites which were non-operational in the 2011 survey were found to be still non-operational in the 2016 survey with a decrease in their total volume.
	Not rehabilitated	*2*		*5,500*	*3,000*	*-2,500*		This decrease is attributed to the following: - Two dumpsites which were not rehabilitated had a decrease in volume. - Three dumpsites were rehabilitated-removed. One dumpsite was rehabilitated-covered.
	Covered	*1*		*12,150*	*12,150*	*0*		
	Removed	*3*		*775*	*0*	*-775*		
New dumpsites identified in 2016		**2**		**-**	**750**	**750**	**100.0**	Two new operational MSW dumpsites were identified in Kesrouane with a volume estimated to be around 750 m³.
	Operational	*2*		*-*	*750*	*750*		
	Non-operational	-		-	-	-		
Non-operational in 2011 and Inaccessible in 2016		**1**		**2,000**	**2,000**	**0**	**0.0**	One dumpsite could not be reached in the 2016 survey due to the lack of a clear access road. The Municipality ignored its presence.
Operational MSW in 2011 and Operational CDW in 2016		**2**		**2,100**	**-**	**-2,100**	**-100.0**	Two dumpsites that were classified as operational MSW dumpsites in the 2011 survey were changed to CDW dumpsites in the 2016 survey. The total volume of these in the 2016 survey is 2,030 m³ and is reflected in CDW figures.
Non-operational MSW in 2011 and Operational CDW in 2016		**1**		**3,300**	**-**	**-3,300**	**-100.0**	One dumpsite was non-operational MSW in 2011 survey and was changed to operational CDW in 2016 survey. The total volume of this dumpsite in the 2016 survey is 5,500 m³.
TOTAL		**2011**	**19**	**42,280**	**42,050**	**-230**	**-0.5**	
		2016	**18**					

Table B - 9 MSW Comparative Analysis between 2011 and 2016 Survey - Maten Caza

MSW Maten Caza	Count	Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
				Volume (m^3)	% Change	
Operational in 2011 and 2016	**2**	**13,000**	**4,360**	**-8,640**	**-66.5**	Two dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with a decrease in volume. These two dumpsites are: - L5-Mazraat Yeshouaa-0 which was estimated to have a volume of 10,000 m³ in 2011 and was estimated at 4,000 m³ at 2016. This dumpsite is being used to store MSW temporarily before it is collected, but unfortunately considerable amounts of MSW are left there every time. - L6-Aain El Qabou-0 which was estimated to have a volume of 3,000 m³ in 2011 while in 2016 survey, a volume of 360 m³ was estimated. It seems that its volume was overestimated in the 2011 survey since no other direct reasons for the decrease in volume exist.
Non-operational in 2011 and Operational in 2016	-	-	-	-	-	
Operational in 2011 and Non-operational in 2016	**8**	**12,620**	**3,220**	**-9,400**	**-74.5**	Eight dumpsites were operational in the 2011 survey with a total volume of 12,620 m³ and have become non-operational in the 2016 survey with almost a 75% decrease in volume. This volume decrease is attributed to the following: - Five dumpsites which had a total volume of 11,900 m³ in 2011 were completely rehabilitated-removed by 2016. One dumpsite (K5-Kaakour-1) was non-operational and not rehabilitated in 2016 volume with a significant increase in volume in the order of 2,800 m³ because it was extensively used during the waste crisis in 2015 and 2016.
Not rehabilitated	*2*	*700*	*3,200*	*2,500*		
Covered	*1*	*20*	*20*	*0*		
Removed	*5*	*11,900*	*0*	*-11,900*		
Non-Operational in 2011 and Non-Operational in 2016	-	-	-	-	-	One dumpsite is not rehabilitated and one dumpsite is rehabilitated-covered.

<table>
<tr><th rowspan="2" colspan="2">MSW
Maten Caza</th><th rowspan="2" colspan="2">Count</th><th rowspan="2">Volume (m³) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m³) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m³)</th><th>% Change</th></tr>
<tr><td colspan="2">New dumpsites identified in 2016</td><td colspan="2">6</td><td>-</td><td>11,730</td><td>11,730</td><td>100.0</td><td rowspan="3">Two new operational dumpsites were identified in the 2016 survey with an estimated volume of 10,200 m³.
Four new non-operational dumpsite were also identified in the 2016 survey.</td></tr>
<tr><td rowspan="2"></td><td>Operational</td><td colspan="2">2</td><td>-</td><td>10,200</td><td>10,200</td><td rowspan="2"></td></tr>
<tr><td>Non-operational</td><td colspan="2">4</td><td>-</td><td>1,530</td><td>1,530</td></tr>
<tr><td colspan="2">Non-operational MSW dumpsite in 2011 and Operational CDW dumpsite in 2016</td><td colspan="2">1</td><td>1,000</td><td>-</td><td>-1,000</td><td>-100.0</td><td>One dumpsite (K6-Aaintoura-1) which was identified as a non-operational MSW dumpsite in 2011 was classified as an operational CDW dumpsite in the 2016 survey with an estimated volume of 300 m³. It seems that its volume was overestimated in the 2011 survey since no other direct reasons for the decrease in volume exist.</td></tr>
<tr><td colspan="2">Operational MSW dumpsite in 2011 and Operational CDW dumpsite in 2016</td><td colspan="2">1</td><td>6,000</td><td>-</td><td>-6,000</td><td>-100.0</td><td>One dumpsite (L5-Khinchara-1) which was an operational MSW dumpsite in 2011 was classified as an operational CDW dumpsite in the 2016 survey with an estimated volume of 250 m³. It seems that its volume was overestimated in the 2011 survey since no other direct reasons for the decrease in volume exist.</td></tr>
<tr><td colspan="2" rowspan="2">TOTAL</td><td>2011</td><td>12</td><td rowspan="2">32,620</td><td rowspan="2">19,310</td><td rowspan="2">-13,310</td><td rowspan="2">-40.8</td><td rowspan="2"></td></tr>
<tr><td>2016</td><td>16</td></tr>
</table>

Table B - 10 MSW Comparative Analysis between 2011 and 2016 Survey - Baabda Caza

MSW Baabda Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**2**	**5,325**	**4,000**	**-1,325**	**-24.8**	Two dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with a decrease in volume mostly attributed to one dumpsite (K5-Ras El Maten-0) which had a smaller area than that reported in 2011. The waste in this dumpsite was more widely spread and unorganized in 2011 and with ongoing burning activities.
Non-operational in 2011 and Operational in 2016		**-**	**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**5**	**4,701**	**10**	**-4,691**	**-99.8**	Five dumpsites were operational in the 2011 survey with a total volume of 4,701 m³ and have become non-operational in the 2016 survey with almost a 100% decrease in volume. This volume decrease is attributed to the following: - One dumpsite (K5-Btikhnay-1) was removed with some randomly dumped waste remaining in place. - Four dumpsites which had a total volume of 4,301 m³ in 2011 were completely removed by 2016.
	Not rehabilitated	*1*	*400*	*10*	*-390*		
	Covered	-	-	-	-		
	Removed	*4*	*4,301*	*0*	*-4,301*		
Non-Operational in 2011 and Non-Operational in 2016		**-**	**-**	**-**	**-**	**-**	
New dumpsites in 2016		**9**	**-**	**12,670**	**12,670**	**100.0**	Seven new operational dumpsites were identified with an estimated volume of 10,470 m³. Two new non-operational dumpsites were also identified with a volume estimated to be in the order of 2,200 m³.
	Operational	*7*	-	*10,470*	*10,470*		
	Non-operational	*2*	-	*2,200*	*2,200*		
Non-operational MSW dumpsite in 2011 and Operational CDW dumpsite in 2016		**1**	**5,000**	**-**	**-5,000**	**-100.0**	One dumpsite (J5-Rouayset El Ballout-0) which was an MSW dumpsite in the 2011 survey is classified as a CDW dumpsite in the 2016 survey. This CDW dumpsite is now operational with an estimated volume of 1,500 m³.
TOTAL		**2011: 8** **2016: 16**	**15,026**	**16,680**	**1,654**	**11**	

Table B - 11 MSW Comparative Analysis between 2011 and 2016 Survey - Aley Caza

MSW Aley Caza		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**2**		**450**	**3,200**	**2,750**	**611.1**	Two dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**1**		**4,000**	**250**	**-3,750**	**-93.8**	One dumpsite (I4-Richmaiya-0) was non-operational in the 2011 survey and became operational in the 2016 survey with a large decrease in volume. This dumpsite was previously rehabilitated before it was opened again for waste disposal after the crisis.
Operational in 2011 and Non-operational in 2016		**3**		**6,100**	**5,100**	**-1,000**	**-16.4**	Three dumpsites were operational in the 2011 survey with a total volume of 6,100 m³ and have become non-operational in the 2016 survey with a decrease in volume because two dumpsites were completely removed by 2016.
	Not rehabilitated	*1*		*5,000*	*5,100*	*100*		
	Covered	-		-	-	-		
	Removed	*2*		*1,100*	*0*	*-1,100*		
Non-Operational in 2011 and Non-Operational in 2016		**-**		**-**	**-**	**-**	**-**	
New dumpsites identified in 2016		**24**		**-**	**42,241**	**42,241**	**100.0**	24 new operational dumpsites were identified with an estimated volume of 42,241 m³.
	Operational	*24*		-	*42,241*	*29,241*		
	Non-operational	-		-	-	-		
TOTAL		**2011**	**6**	**10,550**	**50,791**	**40,241**	**381**	
		2016	**30**					

Table B - 12 MSW Comparative Analysis between 2011 and 2016 Survey - Chouf Caza

MSW Mount Lebanon - Chouf		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**1**	**3,750**	**9,000**	**5,250**	**140.0**	One dumpsite was operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.
Operational in 2011 and Non-operational in 2016		**7**	**10,375**	**7,825**	**-2,550**	**24.6**	Seven dumpsites were operational in the 2011 survey with a total volume of 10,375 m³ and have become non-operational in the 2016 survey with a 25% decrease in volume. This volume decrease is attributed to the following: - One dumpsite was non-operational and not rehabilitated in 2016 with an increase in volume. This dumpsite remained operational for two years after 2011. - Four dumpsites which had a total volume of 4,800 m³ in the 2011 survey were completely rehabilitated-removed by 2016. Two dumpsites were rehabilitated-covered.
	Not rehabilitated	*1*	*4,500*	*6,750*	*2,250*		
	Covered	*2*	*1,075*	*1,075*	*0*		
	Removed	*4*	*4,800*	*0*	*-4,800*		
Non-Operational in 2011 and Non-Operational in 2016		**3**	**2,450**	**0**	**-2,450**	**-100.0**	Three dumpsites were non-operational in the 2011 survey with a total volume of 2,450 m³ and remained non-operational but rehabilitated-removed in the 2016 survey.
	Not rehabilitated	-	-	-	-		
	Covered	-	-	-	-		
	Removed	*3*	*2,450*	*0*	*-2,450*		
New dumpsites identified in 2016		**40**	**-**	***68,075***	***68,075***	***100***	34 new operational dumpsites were identified with an estimated volume of 64,375 m³. Four new non-operational dumpsites were also identified with a volume estimated to be in the order of 3,700 m³.
	Operational	*34*	-	*64,375*	*64,375*		
	Non-operational	*4*	-	*3,700*	*3,700*		
TOTAL		**2011 11** **2016 49**	**16,575**	**84,900**	**68,325**	**412**	

Table B - 13 MSW Comparative Analysis between 2011 and 2016 Survey - Nabatieh Caza

MSW Nabatieh Caza	Count	Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
				Volume (m^3)	% Change	
Operational in 2011 and 2016	**6**	**303,478**	**265,000**	**-38,478**	**-12.7**	Six dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with a decrease in volume. Generally all the dumpsites had an increase in volume with the exception of one dumpsite (E4-Kfar Tibnit-00) which had an estimated volume of 295,800 m³ in 2011 survey versus 200,000 m³ in 2016 survey. A major part of this dumpsite is rehabilitated-covered and currently it is being used by Kfar Tibnit only.
Non-operational in 2011 and Operational in 2016	**-**	**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016	**7**	**5,959**	**5,180**	**-779**	**-13.1**	Seven dumpsites were operational in the 2011 survey with a total volume of 5,959 m³ and have become non-operational in the 2016 survey with a 13.1% decrease in volume. This volume change is attributed to the following: - Five dumpsites were not rehabilitated with a small increase in volume; - One volume was rehabilitated-covered; - One dumpsite was completely rehabilitated-removed by 2016.
Not rehabilitated	*5*	*4,519*	*4,730*	*211*		
Covered	*1*	*450*	*450*	*0*		
Removed	*1*	*990*	*0*	*-990*		
Non-Operational in 2011 and Non-Operational in 2016	**15**	**9,888**	**7,719**	**-2,169**	**-21.9**	15 dumpsites were non-operational in the 2011 survey and remained non-operational in 2016 with a decrease in volume. This decrease in volume is attributed to: - Seven dumpsites were non-operational and not rehabilitated with a small decrease in volume due to natural degradation and burning activities that were taking place as per the 2011 survey. - Seven dumpsites with an estimated volume of 1,985 m³ were completed rehabilitated-removed by 2016. One dumpsite was rehabilitated-covered.
Not rehabilitated	*7*	*7,733*	*7,549*	*-184*		
Covered	*1*	*170*	*170*	*0*		
Removed	*7*	*1,985*	*0*	*-1,985*		
New dumpsites identified in 2016	**3**	**-**	**2,250**	**2,250**	**100.0**	Three new dumpsites were identified in Nabatieh caza in the 2016 survey. Two were operational and one was non-operational.
Operational	*2*	*-*	*500*	*500*		

MSW Nabatieh Caza		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
	Non-operational	*1*		-	*1,750*	*1,750*		
Non-operational MSW dumpsite in 2011 and Non-operational CDW in 2016		**2**		**2,880**	**-**	**-2,880**	**-100.0**	Two dumpsites were non-operational MSW dumpsites in the 2011 survey and were classified as operational CDW dumpsites in the 2016 survey. Their volume (300 m^3) will be added to CDW figures for Nabatieh caza.
TOTAL		**2011**	**30**	**322,205**	**280,149**	**-42,056**	**-13.1**	
		2016	**31**					

Table B - 14 MSW Comparative Analysis between 2011 and 2016 Survey - Hasbaya Caza

MSW Hasbaya Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**14**	**37,185**	**24,365**	**-12,820**	**-34.5**	14 dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with a decrease in volume. - One of these dumpsites (E5-Rachaya El Foukhar-00) has been partly rehabilitated and a sorting plant established. Its volume decreased by 3,000 m³. - Two dumpsites (F5-Kfayr Ez-Zait-00 and F5-Meimes-00) witnessed a 8,000 m³ decrease in volume since the 2011 survey. F5-Kfayr Ez-Zait-00 is being burned regularly to reduce its volume while F5-Meimes-00 constantly covers the old waste and excavates new pits for new waste.
Non-operational in 2011 and Operational in 2016		**-**	**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**5**	**10,824**	**11,630**	**806**	**7.4**	Five dumpsites were operational in the 2011 survey with a total volume of 10,824 m³ and have become non-operational in the 2016 survey with almost a 7.4% increase in volume. This volume change is attributed to the following: - Two dumpsites were non-operational and not rehabilitated in 2016 with an increase in volume. These dumpsites remained operational until 2011 and 2013 which explains the small volume increase; - Two dumpsites were rehabilitated-covered; - One dumpsite was rehabilitated-removed.
	Not rehabilitated	*2*	*2,800*	*3,750*	*950*		
	Covered	*2*	*7,880*	*7,880*	*0*		
	Removed	*1*	*144*	*0*	*-144*		
Non-Operational in 2011 and Non-Operational in 2016		**3**	**3,455**	**5,150**	**1,695**	**49.0**	Three dumpsites were non-operational in the 2011 survey and remained non-operational in 2016 with an increase in volume. This increase in volume is attributed to: - Two dumpsites were reported as non-operational in the 2011 survey but remained operational until earlier years as per the 2016 survey with an increase in volume.
	Not rehabilitated	*3*	*3,455*	*5,150*	*1,695*		
	Covered	-	-	-	-		
	Removed	-	-	-	-		
New dumpsites identified in 2016		**2**	**-**	**4,800**	**4,800**	**100.0**	Two new operational dumpsites were identified in Hasbaya caza in the 2016 survey.

MSW Hasbaya Caza		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
	Operational	*2*		-	*4,800*	*4,800*		
	Non-operational	-		-	-	-		
TOTAL		**2011**	**22**	**51,464**	**45,945**	**-5,519**	**-10.7**	
		2016	**24**					

Table B - 15 MSW Comparative Analysis between 2011 and 2016 Survey - Marjeyoun Caza

MSW Marjeyoun Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**16**	**14,606**	**23,770**	**9,164**	**62.7**	16 dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**2**	**3,869**	**2,050**	**-1,819**	**-47.0**	Two dumpsites were non-operational in the 2011 survey and became operational in the 2016 survey with a decrease in volume. This decrease is attributed to: - One of these dumpsites (C3-Bany Haiyane-00) was reportedly being burned in 2011 survey. - The other dumpsite (E4-Qlaiaa-00) is close to the sorting facility and its waste was sorted out and part of it was rehabilitated.
Operational in 2011 and Non-operational in 2016		**6**	**30,374**	**5,090**	**-25,284**	**-83.2**	Six dumpsites were operational in the 2011 survey with a total volume of 30,374 m³ and have become non-operational in the 2016 survey with an 83% decrease in volume. One dumpsite (D4-Khiyam Marjeyoun-00) was non-operational and not rehabilitated in 2016 with an increase in volume. It was recently closed in 2016 which explains the increase in volume between 2011 and 2016 of the non-operational and not rehabilitated dumpsites. One dumpsite was covered. The overall volume decrease is attributed to the four dumpsites that were rehabilitated- removed by 2016. One of these dumpsites was E4-Dibbine-03 which alone had an estimated volume in the order of 23,000 m³.
	Not rehabilitated	*1*	*500*	*2,000*	*1,500*		
	Covered	*1*	*3,090*	*3,090*	*0*		
	Removed	*4*	*26,784*	*0*	*-26,784*		
Non-Operational in 2011 and Non-Operational in 2016		**1**	**4,200**	**0**	**-4,200**	**-100.0**	One dumpsite was non-operational in 2011 and remained non-operational and was removed by 2016.
	Not rehabilitated	-	-	-	*0*		

MSW Marjeyoun Caza		**Count**		**Volume (m³) of Dumpsites in 2011 Survey**	**Volume (m³) of Dumpsites in 2016 Survey**	**Balance**		**Comments**
						Volume (m³)	**% Change**	
	Covered	-		-	-	*0*		
	Removed	*1*		*4,200*	*0*	*-4,200*		
New dumpsites identified in 2016		**2**		**-**	**2,725**	**2,725**	**100.0**	Two new operational dumpsites were identified in Marjeyoun caza in the 2016 survey.
	Operational	*2*		-	*2,725*	*2,725*		
	Non-operational	-		-	-	-		
TOTAL		**2011**	**25**	**53,049**	**33,635**	**-19,414**	**-36.6**	
		2016	**27**					

Table B - 16 MSW Comparative Analysis between 2011 and 2016 Survey - Bent Jbeil Caza

MSW Bent Jbeil Caza	Count	Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
				Volume (m^3)	% Change	
Operational in 2011 and 2016	**13**	**8,814**	**27,400**	**18,586**	**210.9**	13 dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016	**1**	**288**	**900**	**612**	**212.5**	One dumpsite was non-operational in 2011 and was operational by 2016 with an increase in volume.
Operational in 2011 and Non-operational in 2016	**18**	**70,014**	**60,675**	**-9,339**	**-13.3**	18 dumpsites were operational in the 2011 survey with a total volume of 70,014 m³ and have become non-operational in the 2016 survey with a 13% decrease in volume. Four dumpsites were rehabilitated-covered. One of these dumpsites (B2-Aayta Ech-Chaab-01), which had a total volume of 24,500 m³ in 2011 survey was closed in 2013, and is mostly covered but has some remaining waste. This overall volume decrease is attributed to the following: - Eight dumpsites were non-operational and not rehabilitated in 2016 with a decrease in volume. One of these dumpsites (B2-Debl-00) decreased by around 5,000 m³. This decrease is attributed to burning activities in addition to potential area overestimation in 2011. The remaining dumpsites remained active for a few years after 2011. However, open burning among these dumpsites is present and reported in both surveys which is why the increase in volume is not significant. - Six dumpsites were completely rehabilitated-removed by 2016. Four dumpsites were rehabilitated-covered.
Not rehabilitated	*8*	*16,440*	*12,205*	*-4,235*		
Covered	*4*	*47,420*	*48,470*	*1,050*		
Removed	*6*	*6,154*	*0*	*-6,154*		
Non-Operational in 2011 and Non-Operational in 2016	**5**	**2,520**	**660**	**-1,860**	**-73.8**	Five dumpsites were non-operational in the 2011 survey and remained non-operational in 2016 with a decrease in volume. This volume decrease is attributed to:
Not rehabilitated	*2*	*1,935*	*390*	*-1,545*		
Covered	*1*	*270*	*270*	*0*		

MSW Bent Jbeil Caza		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
	Removed	2		*315*	*0*	*-315*		- Two dumpsites were non-operational and not rehabilitated in 2016 with a decrease in volume due to burning activities as reported in the 2011 survey and natural degradation. - Two dumpsites were completely rehabilitated-removed by 2016. One dumpsite was rehabilitated-covered.
New dumpsites identified in 2016		**6**		**-**	**10,160**	**10,160**	**100.0**	Six new operational dumpsites were identified in Bent Jbeil caza in the 2016 survey.
	Operational	6		-	*10,160*	*10,160*		
	Non-operational	-		-	-	**-**		
TOTAL		**2011**	**37**	**81,636**	**99,795**	**18,159**	**22.2**	
		2016	**43**					

Table B - 17 MSW Comparative Analysis between 2011 and 2016 Survey - Jezzine Caza

<table>
<tr><th rowspan="2" colspan="2">MSW
Jezzine Caza</th><th rowspan="2" colspan="2">Count</th><th rowspan="2">Volume (m³) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m³) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m³)</th><th>% Change</th></tr>
<tr><td colspan="2">Operational in 2011 and 2016</td><td colspan="2">10</td><td>7,049</td><td>19,910</td><td>12,861</td><td>182.5</td><td>10 dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.</td></tr>
<tr><td colspan="2">Non-operational in 2011 and Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Operational in 2011 and Non-operational in 2016</td><td colspan="2">4</td><td>2,846</td><td>1,942</td><td>-904</td><td>-31.8</td><td rowspan="4">Four dumpsites were operational in the 2011 survey with a total volume of 2,846 m³ and have become non-operational in the 2016 survey with almost a 32% decrease in volume.
This volume decrease is attributed to the following:
- Two dumpsites were non-operational and not rehabilitated in 2016 with a decrease in volume. One dumpsite (G4-Qtale Jezzine-00) witnessed a 1,800 m³ decrease since it was partially rehabilitated-removed.
- One dumpsite was completely rehabilitated-removed by 2016.</td></tr>
<tr><td rowspan="3"></td><td>Not rehabilitated</td><td colspan="2">2</td><td>2,640</td><td>1,800</td><td>-840</td><td rowspan="3"></td></tr>
<tr><td>Covered</td><td colspan="2">1</td><td>142</td><td>142</td><td>0</td></tr>
<tr><td>Removed</td><td colspan="2">1</td><td>64</td><td>0</td><td>-64</td></tr>
<tr><td colspan="2">Non-Operational in 2011 and Non-Operational in 2016</td><td colspan="2">1</td><td>35</td><td>35</td><td>0</td><td>0.0</td><td rowspan="4">One dumpsite was non-operational in the 2011 survey with a total volume of 35 m³ and was covered by 2016.</td></tr>
<tr><td rowspan="3"></td><td>Not rehabilitated</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td rowspan="3"></td></tr>
<tr><td>Covered</td><td colspan="2">1</td><td>35</td><td>35</td><td>0</td></tr>
<tr><td>Removed</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">New dumpsites in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Operational in 2011 and Inaccessible in 2016</td><td colspan="2">1</td><td>41</td><td>41</td><td>0</td><td>0</td><td>One dumpsite was operational in the 2011 survey but inaccessible in the 2016 survey for security reasons.</td></tr>
<tr><td colspan="2" rowspan="2">TOTAL</td><td>2011</td><td>16</td><td rowspan="2">9,971</td><td rowspan="2">21,928</td><td rowspan="2">11,957</td><td rowspan="2">119.9</td><td rowspan="2"></td></tr>
<tr><td>2016</td><td>16</td></tr>
</table>

Table B - 18 MSW Comparative Analysis between 2011 and 2016 Survey - Saida Caza

MSW Saida Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**15**	**48,904**	**69,250**	**20,346**	**41.6**	15 dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**1**	**957**	**2,000**	**1,043**	**109.0**	One dumpsite was non-operational in the 2011 survey and became operational in the 2016 survey with an increase in volume.
Operational in 2011 and Non-operational in 2016		**18**	**138,021***	**50,834**	**-87,186**	**-63.2**	18 dumpsites were operational in the 2011 survey with a total volume of 138,020 m³ and have become non-operational in the 2016 survey with almost a 63% decrease in volume. This volume decrease is attributed to the following: - Seven dumpsites were non-operational and not rehabilitated in 2016 with a decrease in volume. One of these dumpsites is G2-Ghazieh-00 which had witnessed a decrease from 102,300 m³ to 32,000 m³ because it was partially rehabilitated. - Nine dumpsites were completely rehabilitated-removed by 2016. These had a total volume of 21,947 m³ in the 2011 survey. Two dumpsites were rehabilitated-covered.
	Not rehabilitated	*7*	*102,928*	*37,688*	*-65,239*		
	Covered	*2*	*13,146*	*13,146*	*0*		
	Removed	*9*	*21,947**	*0*	*-21,947*		
Non-Operational in 2011 and Non-Operational in 2016		**4**	**72,005**	**11,900**	**-60,105**	**-83.5**	Four dumpsites were non-operational in the 2011 survey with a total volume of 72,005 m³, out of which one was rehabilitated-covered and three were rehabilitated - removed by 2016.
	Not rehabilitated	-	-	-	-		
	Covered	*1*	*11,900*	*11,900*	*0*		
	Removed	*3*	*60,105*	*0*	*-60,105*		
New dumpsites identified in 2016		**4**	**-**	**53,250**	**53,250**	**100.0**	Four new operational MSW dumpsites were identified in Saida caza.
	Operational	*4*	-	*53,250*	*53,250*		
	Non-operational	-	-	-	-		

MSW Saida Caza	Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m^3)	% Change	
Non-operational MSW dumpsite in 2011 and Non-operational CDW in 2016	**1**		**330**	**-**	**-330**	**-100.0**	One dumpsite was non-operational MSW in 2011 survey and was classified as CDW in 2016. Its estimated volume (2,200 m^3) is added to the CDW figure.
TOTAL	**2011**	**39**	**260,217**	**187,234**	**-72,983**	**-28.0**	
	2016	**42**					

*G2-Saida volume was excluded from both 2011 and 2016 survey figures for ease of comparison.

Table B - 19 MSW Comparative Analysis between 2011 and 2016 Survey - Sour Caza

MSW Sour Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**21**	**62,607**	**70,650**	**8,043**	**12.8**	21 dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**5**	**3,010**	**20,230**	**17,220**	**572.1**	Five dumpsites were non-operational in the 2011 survey and have become operational in 2016 with an increase in volume. One of these dumpsites (D2-Maarake-00) has become a major dumpsite in 2016 survey with an estimated volume of 16,000 m³ versus 1,250 m³ in 2011 survey.
Operational in 2011 and Non-operational in 2016		**13**	**205,511**	**304,697**	**99,186**	**48.3**	13 dumpsites were operational in the 2011 survey with a total volume of 205,511 m³ and have become non-operational in the 2016 survey with a 48% increase in volume. This volume increase is attributed to the following: - Six dumpsites were non-operational and not rehabilitated in 2016 with a large increase in volume. One of these dumpsites is C1-Deir Qanoun El-Aain-01 which had remained operational until 2014 before being closed. This dumpsite was estimated to have a volume of around 300,000 m³ in the 2016 survey. - Six dumpsites were completely rehabilitated-removed by 2016; these had a total volume of 16,063 m³ in the 2011 survey. One dumpsite was rehabilitated-covered.
	Not rehabilitated	*6*	*189,358*	*304,607*	*115,249*		
	Covered	*1*	*90*	*90*	*0*		
	Removed	*6*	*16,063*	*0*	*-16,063*		
Non-Operational in 2011 and Non-Operational in 2016		**9**	**15,393**	**13,236**	**-2,157**	**-14.0**	Nine dumpsites were non-operational in the 2011 survey with a total volume of 15,393 m³, out of which one was not rehabilitated, yet its volume decreased and five were rehabilitated-removed by 2016.
	Not rehabilitated	*1*	*245*	*60*	*-185*		
	Covered	*3*	*13,176*	*13,176*	*0*		
	Removed	*5*	*1,972*	*0*	*-1,972*		
New dumpsites identified in 2016		**7**	**-**	**40,630**	**40,630**	**100.0**	Seven new operational MSW dumpsites were identified in Sour.
	Operational	*7*	*-*	*40,630*	*40,630*		

MSW Sour Caza		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
	Non-operational	-		-	-	-		
Operational MSW dumpsites in 2011 and Operational CDW in 2016		**1**		**768**	**-**	**-768**	**-100.0**	One dumpsite was operational MSW in the 2011 survey and was classified as CDW in the 2016 survey. Its estimated 2016 volume of 600 m³ is added in the CDW figures.
Non-operational MSW dumpsites in 2011 and Non-operational CDW in 2016		**2**		**2,125**	**-**	**-2,125**	**-100.0**	Two dumpsites were MSW dumpsites in the 2011 survey and were classified as CDW in the 2016 survey. Their estimated volume of 550 m³ in 2016 survey is added in the CDW figures for Sour Caza.
TOTAL		**2011**	**51**	**289,415**	**449,443**	**160,028**	**55.2**	
		2016	**55**					

Table B - 20 MSW Comparative Analysis between 2011 and 2016 Survey - Zahle Caza

MSW Zahle Caza		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**5**	**283,000**	**460,000**	**177,000**	**62.5**	Five dumpsites were operational in the 2011 survey and remained as such in the 2016 survey with a volume increase.
Non-operational in 2011 and Operational in 2016		**1**	**10,000**	**7,500**	**-2,500**	**-25.0**	One dumpsite (J7-Terbol-00) was reported non-operational in the 2011 survey and had been closed since 2008. This dumpsite was operational by the 2016 survey with a decrease in volume which is a result of the open burning activities reported in both 2011 and 2016 surveys.
Non-Operational in 2011 and Non-Operational in 2016		**10**	**302,180**	**263,750**	**-38,430**	**-12.7**	10 dumpsites were non-operational in the 2011 survey with a total volume of 302,180 m³ are still non-operational in the 2016 survey with a decrease in volume. This volume decrease is attributed to the following: - Two of these dumpsites were not rehabilitated by 2016 however their volume decreased by 38,000 m³, where J6-Saadnayel-00 dumpsite was sorted out/cleaned up with some remaining waste. - Two of these dumpsites which had a total volume of 430 m³ in 2011 were completely rehabilitated-removed by 2016. Six dumpsites were rehabilitated-covered.
	Not rehabilitated	*2*	*48,000*	*10,000*	*-38,000*		
	Covered	*6*	*253,750*	*253,750*	*0*		
	Removed	*2*	*430*	*0*	*-430*		
New dumpsites identified in 2016		**1**	**-**	**3,000**	**3,000**	**100.0**	One new operational dumpsite was identified in Zahle with an estimated volume of 3,000 m³.
	Operational	1	-	3,000	3,000		
	Non-operational	-	-	-	**-**		
Non-operational MSW in 2011 and Operational CDW in 2016		**1**	**200**	**-**	**-200**	**-100.0**	One dumpsite (K8-Rayak-00) which was a MSW non-operational dumpsite in 2011 was classified as an operational CDW dumpsite in 2016 survey. Its estimated volume of 5,000 m³ is added to the CDW figure.
Non-operational MSW in 2011 and Non-operational CDW in 2016		**1**	**100**	**-**	**-100**	**-100.0**	One dumpsite (J6-Bouarej-00) which was a MSW non-operational dumpsite in 2011 was classified as a non-operational CDW dumpsite in 2016 survey. Its estimated volume of 100 m³ is added to the CDW figure.
TOTAL		**2011: 18** **2016: 17**	**595,480**	**734,250**	**138,770**	**23.3**	

Table B - 21 MSW Comparative Analysis between 2011 and 2016 Survey - West Beqaa Caza

MSW Beqaa - West Beqaa		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**18**		**123,475**	**100,940**	**-22,535**	**-18.3**	18 dumpsites were operational in the 2011 survey and remained as such in the 2016 survey with a decrease in volume. This decrease can be attributed to several reasons one of which is that 13 of these dumpsites are being burned on a regular basis and that causes a substantial decrease in their volume.
Operational in 2011 and Non-operational in 2016		**6**		**11,250**	**14,300**	**3,050**	**27.1**	Six dumpsites which were operational in the 2011 survey with a total volume of 11,250 m³ have become non-operational in the 2016 survey with an increase in volume of 3,050 m³. This volume increase is attributed to the following: - The five dumpsites that were identified as non-operational and not rehabilitated in the 2016 survey remained operational and were receiving waste after the 2011 survey for few years before they became non-operational. Three of these dumpsites were closed in 2013, one in 2014 and one remained operational until 2015. - One dumpsite with a total volume of 1,250 m³ was completely rehabilitated-removed by 2016.
	Not rehabilitated	*5*		*10,000*	*14,300*	*4,300*		
	Covered	-		-	-	-		
	Removed	*1*		*1,250*	*0*	*-1,250*		
Non-Operational in 2011 and Non-Operational in 2016		**2**		**2,100**	**1,100**	**-1,000**	**-47.6**	Two dumpsites were non-operational in the 2011 survey with a total volume of 2,100 m³ and are still non-operational in the 2016 survey with almost 50% decrease in volume. One of these dumpsites is not rehabilitated and one is rehabilitated-covered.
	Not rehabilitated	*1*		*2,000*	*1,000*	*-1000*		
	Covered	*1*		*100*	*100*	*0*		
	Removed	-		-	-	-		
New dumpsites identified in 2016		**6**		**-**	**31,050**	**31,050**	**100.0**	Six new operational dumpsites were identified in West Beqaa in the 2016 survey with an estimated volume of 31,050 m³.
	Operational	*6*		-	*31,050*	*31,050*		
	Non-operational	-		-	-	-		
Operational in 2011 and Inaccessible in 2016		**1**		**2,625**	**2,625**	**0**	**0.0**	One dumpsite, which was operational in the 2011 survey, was inaccessible in the 2016 survey for security reasons.
TOTAL		**2011**	**27**	**139,450**	**150,015**	**10,565**	**7.6**	
		2016	**33**					

Table B - 22 MSW Comparative Analysis between 2011 and 2016 Survey - Rashaya Caza

MSW Rashaya Caza		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**15**		**15,802**	**17,780**	**1,978**	**12.5**	15 dumpsites were operational in the 2011 survey and remained as such in the 2016 survey with a small increase in volume.
Non-operational in 2011 and Operational in 2016		**2**		**200**	**2,250**	**2,050**	**1,025**	Two dumpsites were non-operational in 2011 and became operational in the 2016 survey with an increase in volume.
Operational in 2011 and Non-operational in 2016		**9**		**7,753**	**1,480**	**-6,273**	**-80.9**	Nine dumpsites which were operational in the 2011 survey with a total volume of 7,753 m³ have become non-operational in the 2016 survey with a decrease in volume of 6,273 m³. This volume decrease is attributed to the following: - Two of these dumpsites were not rehabilitated by 2016 however their volume decreased by 380 m³. - Four of these dumpsites were rehabilitated-covered between 2011 and 2016, and their volumes decreased by 243 m³. - Three of these dumpsites which had a total volume of 5,650 m³ in 2011 were completely rehabilitated-removed by 2016.
	Not rehabilitated	*2*		*940*	*560*	*-380*		
	Covered	*4*		*1,163*	*920*	*-243*		
	Removed	*3*		*5,650*	*0*	*-5,650*		
Non-Operational in 2011 and Non-Operational in 2016		**1**		**125**	**125**	**0**	**0.0**	One dumpsite which was non-operational in the 2011 survey with a total volume of 125 m³ was non-operational in the 2016 survey and rehabilitated-covered.
	Not rehabilitated	-		-	-	-		
	Covered	*1*		*125*	*125*	*0*		
	Removed	-		-	-	-		
New dumpsites identified in 2016		**7**		**-**	**23,150**	**23,150**	**100.0**	Seven new dumpsites have been identified in Rashaya, six of them are operational while one is non-operational and not rehabilitated.
	Operational	6		-	*7,150*	-		
	Non-operational	1		-	*16,000*	-		
Operational in 2011 survey and Inaccessible in 2016		**5**		**3,140**	**3,140**	**0**	**0.0**	Five dumpsites were inaccessible for security reasons or due to rough roads.
TOTAL		**2011**	**32**	**27,020**	**47,925**	**20,905**	**77.3**	
		2016	**39**					

Table B - 23 MSW Comparative Analysis between 2011 and 2016 Survey - Hermel Caza

MSW Beqaa - Hermel		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**3**		**4,600**	**61,250**	**56,650**	**1,231.5**	Three dumpsites were operational in the 2011 survey and remained operational in the 2016 survey with a large increase in volume.
Non-operational in 2011 and Operational in 2016		**-**		**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**-**		**-**	**-**	**-**	**-**	
	Not rehabilitated	-		-	-	**-**		
	Covered	-		-	-	**-**		
	Removed	-		-	-	**-**		
Non-Operational in 2011 and Non-Operational in 2016		**1**		**600**	**0**	**-600**	**-100.0**	One dumpsite which was non-operational in the 2011 survey with a total volume of 600 m³ was non-operational in the 2016 survey and rehabilitated-removed
	Not rehabilitated	-		-	**-**	**-**		
	Covered	-		-	-	**-**		
	Removed	*1*		*600*	*0*	***-600***		
New dumpsites identified in 2016		**-**		-	**-**	**-**	**-**	
	Operational	-		-	-	**-**		
	Non-operational	-		-	-	**-**		
Operational in 2011 and Inaccessible in 2016		**1**		**6,000**	**6,000**	**0**	**0.0**	One dumpsite (R11-El Qasr-02) is located next to the Syrian borders and was unreachable for security reasons.
TOTAL		**2011**	**5**	**11,200**	**67,250**	**56,050**	**500.4**	
		2016	**5**					

Table B - 24 MSW Comparative Analysis between 2011 and 2016 Survey - Baalback Caza

MSW Beqaa - Baalback		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
Operational in 2011 and 2016		**28**		**114,575***	**210,840**	**96,265**	**84.0**	28 dumpsites were operational in the 2011 survey and remained as such in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**3**		**8,900**	**9,500**	**600**	**6.7**	Three dumpsites were non-operational in the 2011 survey and became operational in the 2016 survey with volume increase.
Operational in 2011 and Non-operational in 2016		**19**		**96,345**	**55,550**	**-40,795**	**-42.3**	19 dumpsites which were operational in the 2011 survey with a total volume of 96,345 m^3 have become non-operational in the 2016 survey with a decrease in volume of around 40,795 m^3. This volume decrease is attributed to the following: - 10 of these dumpsites were not rehabilitated by 2016 however their volume decreased by 24,350 m^3. - Eight of these dumpsites which had a total volume of 16,445 m^3 in 2011 were rehabilitated-removed by 2016. One dumpsite was rehabilitated-covered.
	Not rehabilitated	*10*		*78,900*	*54,550*	*-24,350*		
	Covered	*1*		*1,000*	*1,000*	*0*		
	Removed	*8*		*16,445*	*0*	*-16,445*		
Non-Operational in 2011 and Non-Operational in 2016		**7**		**81,900**	**76,020**	**-5,880**	**-7.2**	Seven dumpsites which were non-operational in the 2011 survey with a total volume of 81,900 m^3 are still non-operational in the 2016 survey with a decrease in volume of around 5,880 m^3. This volume decrease is attributed to the following: - Four of these dumpsites were not rehabilitated by 2016 yet their volume decreased by 5,080 m^3. - Two of these dumpsites which had a total volume of 800 m^3 in 2011 were rehabilitated- removed by 2016. One dumpsite was rehabilitated-covered.
	Not rehabilitated	*4*		*43,600**	*38,520*	*-5,080*		
	Covered	*1*		*37,500*	*37,500*	*0*		
	Removed	*2*		*800*	*0*	*-800*		
New dumpsites identified in 2016		**9**		**-**	**25,825**	**25,825**	**100.0**	Nine new dumpsites have been identified in Baalback caza, eight of them are operational while one is non-operational.
	Operational	8		-	25,225	25,225		
	Non-operational	1		-	600	600		
TOTAL		**2011**	**57**	**301,720**	**377,235**	**75,515**	**25**	
		2016	**66**					

*The volumes of M9-Baalback-1 and M9-Baalback-2, otherwise known as the Kayal dumpsites, were overestimated in the 2011 survey. The volumes of these two dumpsites were modified based on the figures reported by Laceco (2012) in a study on the rehabilitation of the Kayal dumpsites. The volumes of the M9-Baalback-01 were thus put at 39,000m^3, and M9-Baalback-02 at 42,000m^3.

Table B - 25 CDW Comparative Analysis between 2011 and 2016 Survey - Akkar Caza

CDW Akkar		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
Operational in 2011 and 2016		**5**		**13,130**	**16,275**	**3,145**	**24.0**	Five dumpsites have existed since 2011 and were still operational in 2016 with an increase in volume.
Non-operational in 2011 and Operational in 2016		**-**		**-**	**-**	**-**	**-**	
Operational in 2011 and Non-Operational in 2016		**3**		**2,470**	**6,150**	**3,680**	**149.0**	Three dumpsites were operational in the 2011 survey and have become non-operational in the 2016 survey with an increase in volume. This volume increase can be attributed to two non-operational but not rehabilitated dumpsites which were closed in 2014 and 2016. One dumpsite was rehabilitated-removed.
	Not rehabilitated	*2*		*2,350*	*6,150*	*3,800*		
	Covered	-		-	-	-		
	Removed	*1*		*120*	*0*	*-120*		
Non-Operational in 2011 and Non-Operational in 2016		**1**		**270**	**0**	**-270**	**-100.0**	One dumpsite which was non-operational in the 2011 survey was removed by 2016.
	Not rehabilitated	-		-	-	-		
	Covered	-		-	-	-		
	Removed	*1*		*270*	*0*	*-270*		
New dumpsites identified in 2016		**3**		**-**	**4,145**	**4,145**	**100.0**	Three new operational CDW dumpsites were identified in the Akkar caza in the 2016 survey.
	Operational	*3*		-	*4,145*	*4,145*		
	Non-operational	-		-	-	-		
TOTAL		**2011**	**9**	**15,870**	**26,570**	**10,700**	**67.4**	
		2016	**12**					

Table B - 26 CDW Comparative Analysis between 2011 and 2016 Survey - Minieh-Dannieh Caza

CDW Minieh Dannieh		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
Operational in 2011 and 2016		1		200	35,000	34,800	17,400.0	One dumpsite (R7-Deir Ammar-2) was operational in the 2011 survey and remains as such in the 2016 survey with a large increase in volume.
Non-operational in 2011 and Operational in 2016		-		-	-	-	-	
Operational in 2011 and Non-operational in 2016		-		-	-	-	-	
Non-Operational in 2011 and Non-Operational in 2016		-		-	-	-	-	
New dumpsites identified in 2016		1		-	100	100	100.0	One new operational CDW dumpsite was identified in the Minieh-Dannieh caza in the 2016 survey.
	Operational	*1*		-	*100*	*100*		
	Non-operational	-		-	-	-		
Non-Operational MSW in 2011 and Operational CDW in 2016		1		-	6,000	6,000	100.0	One dumpsite was classified as non-operational MSW in the 2011 survey and has become an operational CDW in the 2016 survey. Its estimated volume in 2011 is added to the MSW figures.
TOTAL		2011	1	200	41,100	40,900	20,450.0	
		2016	3					

Table B - 27 CDW Comparative Analysis between 2011 and 2016 Survey - Zgharta Caza

CDW Zgharta	Count	Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
				Volume (m^3)	% Change	
Operational in 2011 and 2016	**2**	**525**	**21,500**	**20,975**	**3,995.2**	Two dumpsites already existed and were operational in the 2011 survey with a large increase in volume.
Non-operational in 2011 and Operational in 2016	**1**	**640**	**1,400**	**760**	**118.8**	One dumpsite that non-operational in 2011 has become operational in 2016 with an increase in volume.
Operational in 2011 and Non-operational in 2016	**2**	**3,000**	**4,600**	**1,600**	**53.3**	Two dumpsites were operational in the 2011 survey and have become non-operational and not rehabilitated in 2016 with an increase in volume. The estimated closure date for these dumpsites was in 2012 which explains the increase in volume.
Not rehabilitated	*2*	*3,000*	*4,600*	*1,600*		
Covered	-	-	-	-		
Removed	-	-	-	-		
Non-Operational in 2011 and Non-Operational in 2016	**2**	**16,000**	**2,200**	**-13,800**	**-86.3**	Two dumpsites were non-operational in 2011 with an overall decrease in volume. One dumpsite was non-operational and not rehabilitated in 2016, however this dumpsite has witnessed an increase in volume since 2011 which means that it was still being used between 2011 and 2016. The second dumpsite was rehabilitated-removed.
Not rehabilitated	*1*	*1,000*	*2,200*	*1,200*		
Covered	-	-	-	-		
Removed	*1*	*15,000*	*0*	*-15,000*		
Operational MSW in 2011 and Operational CDW in 2016	**1**	**-**	**2,000**	**2,000**	**100.0**	One dumpsite was classified as an operational MSW dumpsite in the 2011 survey and has become an operational CDW dumpsite in the 2016 survey. Its estimated volume in 2011 is added to the MSW figures.
Operational MSW in 2011 and Non-Operational CDW in 2016	**1**	**-**	**150**	**150**	**100.0**	One dumpsite was classified as an operational MSW dumpsite in the 2011 survey and has become a non-operational CDW dumpsite in the 2016 survey. Its estimated volume in 2011 is added to the MSW figures.
TOTAL	**2011 7** **2016 9**	**20,165**	**31,850**	**11,685**	**58.0**	

Table B - 28 CDW Comparative Analysis between 2011 and 2016 Survey - Koura Caza

<table>
<tr><th rowspan="2" colspan="2">CDW
Koura</th><th rowspan="2" colspan="2">Count</th><th rowspan="2">Volume (m³) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m³) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m³)</th><th>% Change</th></tr>
<tr><td colspan="2">Operational in 2011 and 2016</td><td colspan="2">4</td><td>10,200</td><td>69,900</td><td>59,700</td><td>585.3</td><td>Four dumpsites existed and were operational in the 2011 survey and remained operational in the 2016 survey with a large increase in volume.</td></tr>
<tr><td colspan="2">Non-operational in 2011 and Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Operational in 2011 and Non-operational in 2016</td><td colspan="2">4</td><td>4,563</td><td>11,556</td><td>6,993</td><td>153.3</td><td rowspan="4">Four dumpsites were operational in the 2011 survey and became non-operational in 2016 with an increase in volume. These dumpsites remained operational for a few years before being closed by 2016, which explains this increase in volume.</td></tr>
<tr><td rowspan="3"></td><td>Not rehabilitated</td><td colspan="2">4</td><td>4,563</td><td>11,556</td><td>6,993</td><td rowspan="3"></td></tr>
<tr><td>Covered</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Removed</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Non-Operational in 2011 and Non-Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">New dumpsites identified in 2016</td><td colspan="2">1</td><td>-</td><td>450</td><td>450</td><td>100.0</td><td rowspan="3">One new CDW dumpsite was identified in the 2016 survey. This dumpsite was non-operational and not rehabilitated.</td></tr>
<tr><td rowspan="2"></td><td>Operational</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td rowspan="2"></td></tr>
<tr><td>Non-operational</td><td colspan="2">1</td><td>-</td><td>450</td><td>450</td></tr>
<tr><td colspan="2">Operational MSW in 2011 and Operational CDW in 2016</td><td colspan="2">2</td><td>-</td><td>3,400</td><td>3,400</td><td>100.0</td><td>Two dumpsites were classified as operational MSW dumpsites in the 2011 survey and have become operational CDW dumpsites in 2016. Their volume in 2011 was 3,400 m³. The P5-Btaaboura-2 dumpsite has increased in volume, while the P6-Kaftoun-2 dumpsite has decreased in volume because part of the old MSW waste was removed. Their estimated volume in 2011 is added to the MSW figures.</td></tr>
<tr><td colspan="2" rowspan="2">TOTAL</td><td>2011</td><td>8</td><td rowspan="2">14,763</td><td rowspan="2">85,306</td><td rowspan="2">70,543</td><td rowspan="2">477.8</td><td rowspan="2"></td></tr>
<tr><td>2016</td><td>11</td></tr>
</table>

Table B - 29 CDW Comparative Analysis between 2011 and 2016 Survey - Bcharre Caza

CDW Bcharre		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
Operational in 2011 and 2016		-		-	-	-	-	
Non-operational in 2011 and Operational in 2016		-		-	-	-	-	
Operational in 2011 and Non-operational in 2016		1		400	1,800	1,400	350.0	One dumpsite was operational in the 2011 survey and has become non-operational in 2016 with an increase in volume. This increase is attributed to the fact that the dumpsite remained operational until 2012.
	Not rehabilitated	*1*		*400*	*1,800*	*1,400*		
	Covered	-		-	-	-		
	Removed	-		-	-	-		
Non-Operational in 2011 and Non-Operational in 2016		1		2,250	0	-2,250	-100.0	One dumpsite was non-operational in the 2011 survey and was rehabilitated-removed by 2016.
	Not rehabilitated	-		-	-	-		
	Covered	-		-	-	-		
	Removed	*1*		*2,250*	*0*	*-2,250*		
New dumpsites identified in 2016		1		-	1,200	1,200	100.0	One new operational CDW dumpsite was identified in the 2016 survey.
	Operational	*1*		-	*1,200*	*1,200*		
	Non-operational	-		-	-	-		
TOTAL		2011	2	2,650	3,000	350	13.2	
		2016	3					

Table B - 30 CDW Comparative Analysis between 2011 and 2016 Survey - Batroun Caza

CDW Batroun		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
Operational in 2011 and 2016		**4**		**8,480**	**8,800**	**320**	**3.8**	Four dumpsites existed and were operational in the 2011 survey and remained operational in the 2016 survey with a slight increase in volume.
Non-operational in 2011 and Operational in 2016		**1**		**8,000**	**2,100**	**-5,900**	**-73.8**	One dumpsite was non-operational in the 2011 survey and became operational in 2016 with a large decrease in volume.
Operational in 2011 and Non-operational in 2016		**-**		**-**	**-**	**-**	**-**	
Non-Operational in 2011 and Non-Operational in 2016		**1**		**800**	**600**	**-200**	**-62.5**	One dumpsite was non-operational in the 2011 survey and witnessed a decrease in volume by 2016.
	Not rehabilitated	*1*		*800*	*600*	*-500*		
	Covered	-		-	-	-		
	Removed	-		-	-	-		
New dumpsites identified in 2016		**1**		**-**	**540**	**240**	**100.0**	One new operational CDW dumpsite was identified in the Batroun caza in the 2016 survey.
	Operational	*1*		-	*540*	*540*		
	Non-operational	-		-	-	-		
Operational MSW in 2011 and Operational CDW in 2016		***1***		**-**	***10,800***	***10,800***	**100.0**	One dumpsite was classified as operational MSW in the 2011 survey and has been reclassified as operational CDW in the 2016 survey. Its estimated volume in 2011 is added to the MSW figures.
Operational MSW in 2011 and Non-Operational CDW in 2016		***1***		**-**	***1,500***	***1,500***	**100.0**	One dumpsite was classified as operational MSW in the 2011 survey and has been reclassified as non-operational rehabilitated-covered CDW in the 2016 survey. Its estimated volume in 2011 is added to the MSW figures.
TOTAL		**2011**	**6**	**17,280**	**24,340**	**7,060**	**40.9**	
		2016	**9**					

Table B - 31 CDW Comparative Analysis between 2011 and 2016 Survey - Jbeil Caza

CDW Jbeil		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		-		-	-	-	-	
Non-operational in 2011 and Operational in 2016		-		-	-	-	-	
Operational in 2011 and Non-operational in 2016		1		3,000	0	-3,000	-100.0	One dumpsite was operational in the 2011 survey; this dumpsite was rehabilitated-removed by 2016.
	Not rehabilitated	-		-	-	-		
	Covered	-		-	-	-		
	Removed	*1*		*3,000*	*0*	*-3,000*		
Non-Operational in 2011 and Non-Operational in 2016		-		-	-	-	-	
New dumpsites identified in 2016		5		-	10,000	10,000	100.0	Five new CDW dumpsites were identified in the Jbeil caza in the 2016 survey. Four were operational with 9,000 m³ volume and one was non-operational.
	Operational	*4*		-	*9,000*	*9,000*		
	Non-operational	*1*		-	*1,000*	*1,000*		
TOTAL		2011	1	3,000	10,000	7,000	233	
		2016	6					

Table B - 32 CDW Comparative Analysis between 2011 and 2016 Survey - Kesrouane Caza

CDW Kesrouane		Count	Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m^3)	% Change	
Operational in 2011 and 2016		**2**	**600**	**2,100**	**1,500**	**250.0**	Two dumpsites existed and were operational in the 2011 survey and remained as such in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**2**	**3,500**	**60,000**	**56,500**	**1,614.3**	Two dumpsites were non-operational in the 2011 survey and became operational in the 2016 survey with a huge increase in volume. These are the L5-Balloune-1 and L5-Balloune-2 dumpsites.
Operational in 2011 and Non-operational in 2016		**23**	**150,590**	**103,520**	**-47,070**	**-31.3**	23 dumpsites were operational in the 2011 survey and became non-operational in the 2016 survey with a big decrease in volume. This decrease is attributed to: - 12 dumpsites were not rehabilitated with a decrease in volume. One of these dumpsites is L5-Qlaiaat-3 which decreased by 30,000 m³. Part of the material in this dumpsite was removed/used, part is covered and part is not rehabilitated; - Seven dumpsites were completely removed by 2016. Four dumpsites were rehabilitated-covered.
	Not rehabilitated	*12*	*126,870*	*91,800*	*-35,070*		
	Covered	*4*	*11,720*	*11,720*	*0*		
	Removed	*7*	*12,000*	*0*	*-12,000*		
Non-Operational in 2011 and Non-Operational in 2016		**2**	**100,400**	**100,000**	**-400**	**-0.4**	Two dumpsites were non-operational in the 2011 survey, and remained as such in the 2016 survey. One of these dumpsites is not rehabilitated and one is rehabilitated-removed.
	Not rehabilitated	*1*	*100,000*	*100,000*	*0*		
	Covered	-	-	-			
	Removed	*1*	*400*	*0*	*-400*		
New dumpsites identified in 2016		**3**	**-**	**975**	**975**	**100.0**	Three new CDW dumpsites were identified in the 2016 survey. One is operational and two are non-operational.
	Operational	*1*	-	*300*	*300*		
	Non-operational	*2*	-	*675*	*675*		
Operational MSW in 2011 and Operational CDW in 2016		**2**	**-**	**20,030**	**25,030**	**100.0**	Two dumpsites were classified as operational MSW in the 2011 survey and have become operational CDW

CDW Kesrouane	Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m^3)	% Change	
							dumpsites in the 2016 survey. Their estimated volume in 2011 is added to the MSW figures.
Non-Operational MSW in 2011 and Operational CDW in 2016	**1**		**-**	**5,500**	**5,500**	**100.0**	One dumpsite was classified as non-operational MSW in the 2011 survey and has become an operational CDW dumpsite in the 2016 survey. Its estimated volume in 2011 is added to the MSW figures.
Non-operational in 2011 and Inaccessible in 2016	**1**		**15,000**	**15,000**	**15,000**	**100.0**	One dumpsite was abandoned in the 2011 survey and was inaccessible in the 2016 survey because its road was blocked.
TOTAL	**2011**	**30**	**270,090**	**307,125**	**37,035**	**13.7**	
	2016	**36**					

Table B - 33 CDW Comparative Analysis between 2011 and 2016 Survey - Maten Caza

CDW Maten		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**5**		**44,900**	**30,900**	**-14,000**	**-31.1**	Five dumpsites were operational in the 2011 survey and remained as such in the 2016 survey with a decrease in volume. This decrease is attributed to partial rehabilitation.
Non-operational in 2011 and Operational in 2016		**2**		**35,500**	**78,000**	**42,500**	**119.7**	Two dumpsites were non-operational in the 2011 survey and have become operational in the 2016 survey with an increase in volume.
Operational in 2011 and Non-operational in 2016		**17**		**136,560**	**98,515**	**-38,045**	**-27.9**	17 dumpsites were operational in the 2011 survey and became non-operational in the 2016 survey with a decrease in volume. This decrease is attributed to: - 12 dumpsites were not rehabilitated with a slight decrease in volume - Three dumpsites were rehabilitated-removed by 2016.
	Not rehabilitated	*12*		*27,060*	*26,515*	*-545*		
	Covered	*2*		*72,000*	*72,000*	*0*		
	Removed	*3*		*37,500*	*0*	*-37,500*		
Non-Operational in 2011 and Non-Operational in 2016		**6**		**10,235**	**4,350**	**-5,885**	**-57.5**	Six dumpsites were non-operational in the 2011 survey and remained as such in the 2016 survey with a decrease in volume. This decrease is because - Two dumpsites were not rehabilitated with a decrease in volume - Three dumpsites were rehabilitated-removed by 2016.
	Not rehabilitated	*2*		*1,425*	*350*	*-1,075*		
	Covered	*1*		*4,000*	*4,000*	*0*		
	Removed	*3*		*4,810*	*0*	*-4,810*		
New dumpsites identified in 2016		**11**		**-**	**294,350**	**294,350**	**100.0**	11 new CDW dumpsites were identified in the 2016 survey. Four are operational with 5,400 m³ volume and five were non-operational.
	Operational	*4*		-	*156,200*	*156,200*		
	Non-operational	*7*		-	*138,150*	*138,150*		
Operational MSW in 2011 survey and Operational CDW in 2016 survey		**1**		**-**	**250**	**250**	**100.0**	One dumpsite was classified as an operational MSW dumpsite in the 2011 survey and has been reclassified as an operational CDW dumpsite in 2016 with a 250 m³ estimated volume. Its estimated volume in 2011 is added to the MSW figures.
Non-Operational MSW in 2011 survey and Operational CDW in 2016 survey		**1**		**-**	**300**	**300**	**100.0**	One dumpsite was classified as a non-operational MSW dumpsite in the 2011 survey and has been reclassified as an operational CDW dumpsite in 2016 with a 300 m³ estimated volume. Its estimated volume in 2011 is added to the MSW figures.
TOTAL		**2011**	**30**	**227,195**	**506,665**	**279,470**	**123.0**	
		2016	**43**					

Table B - 34 CDW Comparative Analysis between 2011 and 2016 Survey - Baabda Caza

CDW Baabda		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**-**		**-**	**-**	**-**	**-**	
Non-operational in 2011 and Operational in 2016		**-**		**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**4**		**21,300**	**20,800**	**-500**	**-2.3**	Four dumpsites were operational in the 2011 survey and have become non-operational in 2016, with a slight decrease in volume of 500 m³.
	Not rehabilitated	*2*		*15,900*	*15,400*	*-500*		
	Covered	*2*		*5,400*	*5,400*	*0*		
	Removed	-		-	-	-		
Non-Operational in 2011 and Non-Operational in 2016		**1**		**14,000**	**14,000**	**0**	**0**	One dumpsite was non-operational in the 2011 survey and was rehabilitated-covered by 2016.
	Not rehabilitated	-		-	-	-		
	Covered	*1*		*14,000*	*14,000*	*0*		
	Removed	-		-	-	-		
New dumpsites identified in 2016		**3**		**-**	**1,450**	**1,450**	**100.0**	Three new CDW dumpsites were identified in the Baabda caza in the 2016 survey. Two were operational with 950 m³ volume and one was non-operational with 500 m³ volume.
	Operational	*2*		-	*950*	*950*		
	Non-operational	*1*		-	*500*	*500*		
Non-Operational MSW in 2011 and Operational CDW in 2016		**1**		**-**	**1,500**	**1,500**	**100.0**	One dumpsite that was a non-operational MSW dumpsite in 2011 has become an operational CDW dumpsite in 2016. Its estimated volume in 2011 is added to the MSW figures.
TOTAL		**2011**	**5**	**35,300**	**37,750**	**2,450**	**6.9**	
		2016	**9**					

Table B - 35 CDW Comparative Analysis between 2011 and 2016 Survey - Aley Caza

CDW Aley		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance Volume (m³)	Balance % Change	Comments
Operational in 2011 and 2016		**1**	**35,000**	**40,000**	**5,000**	**14.3**	One dumpsite already existed and was operational in the 2011 survey, with a 14.36% increase in volume.
Non-operational in 2011 and Operational in 2016		**-**	**-**	**-**	**-**		
Operational in 2011 and Non-operational in 2016		**6**	**20,405**	**20,250**	**-155**	**-0.76**	Six dumpsites were operational in the 2011 survey and have become non-operational in 2016, with a slight decrease in volume of 155 m³, mainly due to the rehabilitation-removal of two dumpsites.
	Not rehabilitated	*3*	*11,000*	*14,000*	*3,000*		
	Covered	*1*	*6,250*	*6,250*	*0*		
	Removed	*2*	*3,155*	*0*	*-3,155*		
Non-Operational in 2011 and Non-Operational in 2016		**2**	**21,200**	**20,400**	**-800**	**-3.8**	Two dumpsites were non-operational in the 2011 survey and remained non-operational in 2016. One dumpsite was not rehabilitated and one was rehabilitated-covered. The decrease in volume in the non-rehabilitated dumpsite (J5-Charoun-1) is because the dumpsite is located on the side of a cliff. Its estimated volume in 2016 is based on what was visible; waste that has fallen off the cliff could not be estimated.
	Not rehabilitated	*1*	*1,200*	*400*	*-800*		
	Covered	*1*	*20,000*	*20,000*	*0*		
	Removed	-	-	-	-		
New dumpsites identified in 2016		**5**	**-**	**3,450**	**3,450**	**100.0**	Five new CDW dumpsites were identified in the Aley caza in the 2016 survey. Two were operational with 2,650 m³ volume and three were non-operational.
	Operational	*2*	-	*2,650*	*2,650*		
	Non-operational	*3*	-	*800*	*800*		
TOTAL		**2011: 9** **2016: 14**	**76,605**	**84,100**	**7,495**	**9.8**	

Table B - 36 CDW Comparative Analysis between 2011 and 2016 Survey - Chouf Caza

CDW Chouf		Count	Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m^3)	% Change	
Operational in 2011 and 2016		**2**	**18,600**	**9,000**	**-9,600**	**-51.6**	Two dumpsites already existed and were operational in the 2011 survey, with a 51.6 % decrease in volume. This decrease is mainly due to the overestimation of the area of the I5-Maaser Ech Chouf-0 dumpsite in the 2011 survey.
Non-operational in 2011 and Operational in 2016		**-**	**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**10**	**590,158**	**590,500**	**342**	**0.06**	10 dumpsites were operational in the 2011 survey and have become non-operational in 2016, with a slight increase in volume of 343 m^3. This increase is attributed to the fact that two dumpsites remained operational until 2012, while two others remained operational until 2016.
	Not rehabilitated	*6*	*15,158*	*15,500*	*342*		
	Covered	*4*	*575,000*	*575,000*	*0*		
	Removed	-	-	-	-		
Non-Operational in 2011 and Non-Operational in 2016		**2**	**3,450**	**3,450**	**0**	**0**	Two dumpsites were non-operational in the 2011 survey and remained non-operational in 2016. One dumpsite was not rehabilitated, while the second was rehabilitated-covered.
	Not rehabilitated	*1*	*450*	*450*	*0*		
	Covered	*1*	*3,000*	*3,000*	*0*		
	Removed	-	-	-	-		
New dumpsites identified in 2016		**2**	**-**	**3,200**	**3,200**	**100.0**	Two new operational dumpsites were identified in the Chouf caza in the 2016 survey, with 3,200 m^3 volume.
	Operational	2	-	*3,200*	*3,200*		
	Non-operational	-	-	-	-		
TOTAL		**2011: 14** **2016: 16**	**612,208**	**606,150**	**-6,058**	**-1.0**	

Table B - 37 CDW Comparative Analysis between 2011 and 2016 Survey - Nabatieh Caza

CDW Nabatieh		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**1**		**4,180**	**10,000**	**5,820**	**139.2**	One dumpsite existed and has been operational since 2011. It remained operational in the 2016 survey with an increase in volume.
Non-operational in 2011 and Operational in 2016		**-**		**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**4**		**10,372**	**4,700**	**-5,672**	**-54.7**	Four dumpsites were operational in the 2011 survey and have become non-operational in the 2016 survey with a decrease in volume. This decrease in volume is attributed to the following: - Two dumpsites that have become non-operational and not rehabilitated as per the 2016 survey were closed in 2015, which explains the increase in their volume; - Two dumpsites were operational in 2011 and completely rehabilitated-removed by 2016.
	Not rehabilitated	*2*		*4,560*	*4,700*	*140*		
	Covered	-		-	-	-		
	Removed	*2*		*5,812*	*0*	*-5,812*		
Non-Operational in 2011 and Non-Operational in 2016		**-**		**-**	**-**	**-**	**-**	
New dumpsites identified in 2016		**12**		**-**	**14,013**	**14,013**	**100.0**	12 new operational CDW dumpsites were identified in the Nabatieh caza in the 2016 survey.
	Operational	*12*		-	*14,013*	*14,013*		
	Non-operational	-		-	-	-		
Operational MSW in 2011 and Operational CDW in 2016		**2**		**-**	**300**	**300**	**100.0**	Two dumpsites were classified as operational MSW dumpsites in the 2011 survey and reclassified as operational CDW dumpsites in 2016. Their estimated volume in 2011 is added to the MSW figures.
TOTAL		**2011**	**5**	**14,552**	**29,013**	**12,261**	**84.3**	
		2016	**19**					

Table B - 38 CDW Comparative Analysis between 2011 and 2016 Survey - Hasbaya Caza

CDW Hasbaya		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance: Volume (m³)	Balance: % Change	Comments
Operational in 2011 and 2016		**1**	**108,000**	**36,000**	**-72,000**	**-66.7**	One dumpsite (E5-Chebaa-01) existed and was operational since 2011. It remained operational in the 2016 survey with a decrease in volume. The volume of this dumpsite was overestimated in the 2011 survey.
Non-operational in 2011 and Operational in 2016		**-**	**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**2**	**6,082**	**6,750**	**668**	**11.0**	Two dumpsites were operational in the 2011 survey and have become non-operational in the 2016 survey with an increase in volume. One dumpsite remained operational until 2014, while the other remained operational until 2016, which explains the increase in volume.
	Not rehabilitated	*2*	*6,082*	*6,750*	*668*		
	Covered	-	-	-	-		
	Removed	-	-	-	-		
Non-Operational in 2011 and Non-Operational in 2016		**-**	**-**	**-**	**-**	**-**	
New dumpsites identified in 2016		**3**	**-**	**6,500**	**6,500**	**100.0**	Three new operational CDW dumpsites were identified in the Hasbaya caza in the 2016 survey.
	Operational	*3*	-	*6,500*	*6,500*		
	Non-operational	-	-	-	-		
TOTAL		**2011: 3** **2016: 6**	**114,082**	**49,250**	**-64,832**	**-56.8**	

Table B - 39 CDW Comparative Analysis between 2011 and 2016 Survey - Marjeyoun Caza

<table>
<tr><th rowspan="2" colspan="2">CDW
Marjeyoun</th><th rowspan="2" colspan="2">Count</th><th rowspan="2">Volume (m^3) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m^3) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m^3)</th><th>% Change</th></tr>
<tr><td colspan="2">Operational in 2011 and 2016</td><td colspan="2">1</td><td>11,275</td><td>900</td><td>-10,375</td><td>-92.0</td><td>One dumpsite (C3-Qabrikha-02) existed, was operational in 2011 and remained operational in the 2016 survey with a decrease in volume. A large part of this dumpsite was rehabilitated and covered.</td></tr>
<tr><td colspan="2">Non-operational in 2011 and Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Operational in 2011 and Non-operational in 2016</td><td colspan="2">5</td><td>7,580</td><td>8,200</td><td>620</td><td>8.2</td><td rowspan="4">Five dumpsites were operational in the 2011 survey and have become non-operational in the 2016 survey with a slight increase in volume.
The average closure date for these dumpsites was around 2013 which explains the slight increase in their volume.</td></tr>
<tr><td></td><td>Not rehabilitated</td><td colspan="2">5</td><td>7,580</td><td>8,200</td><td>620</td><td rowspan="3"></td></tr>
<tr><td></td><td>Covered</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td></td><td>Removed</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Non-Operational in 2011 and Non-Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">New dumpsites identified in 2016</td><td colspan="2">9</td><td>-</td><td>16,025</td><td>16,025</td><td>100.0</td><td rowspan="3">Nine new operational CDW dumpsites were identified in the Marjeyoun caza in the 2016 survey.</td></tr>
<tr><td></td><td>Operational</td><td colspan="2">9</td><td>-</td><td>16,025</td><td>16,025</td><td rowspan="2"></td></tr>
<tr><td></td><td>Non-operational</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2" rowspan="2">TOTAL</td><td>2011</td><td>6</td><td rowspan="2">18,855</td><td rowspan="2">25,125</td><td rowspan="2">6,270</td><td rowspan="2">33.2</td><td rowspan="2"></td></tr>
<tr><td>2016</td><td>15</td></tr>
</table>

Table B - 40 CDW Comparative Analysis between 2011 and 2016 Survey - Bent Jbeil Caza

CDW Bent Jbeil		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance Volume (m³)	Balance % Change	Comments
Operational in 2011 and 2016		**3**	**9,571**	**8,300**	**-1,271**	**-13.3**	Three dumpsites were operational in 2011 and remained operational in 2016 with a slight decrease in volume. One of these dumpsites (C3-Soultaniyet Bent Jbayl-02) had decreased from 6,950 m³ in 2011 to 2,000 m³ in 2016.
Non-operational in 2011 and Operational in 2016		**2**	**8,851**	**2,200**	**-6,651**	**-75.1**	Two dumpsites were non-operational in the 2011 survey and have become operational in 2016 with a decrease in volume. Of these dumpsites, (B3-Kounine-02) decreased by 6,580 m³ which seems to have been used as fill for the nearby establishment and road.
Operational in 2011 and Non-operational in 2016		**3**	**2,239**	**0**	**-2,239**	**-100.0**	Three dumpsites were operational in the 2011 survey and have become non-operational and rehabilitated-removed by 2016.
	Not rehabilitated	-	-	-	-		
	Covered	-	-	-	-		
	Removed	*3*	*2,239*	*0*	*-2,239*		
Non-Operational in 2011 and Non-Operational in 2016		**1**	**187**	**0**	**-187**	**-100.0**	One dumpsite was non-operational in the 2011 survey and was rehabilitated-removed by 2016.
	Not rehabilitated	-	-	-	-		
	Covered	-	-	-	-		
	Removed	*1*	*187*	*0*	*-187*		
New dumpsites identified in 2016		**14**	**-**	**27,975**	**27,975**	**100.0**	14 new operational CDW dumpsites were identified in the Bent Jbeil caza during the 2016 survey.
	Operational	*14*	-	*27,975*	*27,975*		
	Non-operational	-	-	-	-		
TOTAL		**2011: 9** **2016: 23**	**20,848**	**38,475**	**17,627**	**84.5**	

Table B - 41 CDW Comparative Analysis between 2011 and 2016 Survey - Jezzine Caza

<table>
<tr><th colspan="2" rowspan="2">CDW
Jezzine</th><th colspan="2" rowspan="2">Count</th><th rowspan="2">Volume (m³) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m³) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m³)</th><th>% Change</th></tr>
<tr><td colspan="2">Operational in 2011 and 2016</td><td colspan="2">1</td><td>2,080</td><td>2,400</td><td>321</td><td>15.4</td><td>One dumpsite existed and was operational in the 2011 survey. In 2016, it remained operational and showed a slight increase in volume.</td></tr>
<tr><td colspan="2">Non-operational in 2011 and Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Operational in 2011 and Non-operational in 2016</td><td colspan="2">2</td><td>4,817</td><td>1,000</td><td>-3,817</td><td>-79.2</td><td rowspan="4">Two dumpsites that were operational in the 2011 survey have become non-operational in the 2016 survey with a decrease in volume.

This decrease in volume can attributed to the following:
- Possible reuse of the CDW
- Rehabilitation of parts of the dumpsites.</td></tr>
<tr><td rowspan="3"></td><td>Not rehabilitated</td><td colspan="2">2</td><td>4,817</td><td>1,000</td><td>-3,817</td><td rowspan="3"></td></tr>
<tr><td>Covered</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Removed</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Non-Operational in 2011 and Non-Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2" rowspan="2">TOTAL</td><td>2011</td><td>3</td><td rowspan="2">6,897</td><td rowspan="2">3,400</td><td rowspan="2">-3,497</td><td rowspan="2">-50.7</td><td rowspan="2"></td></tr>
<tr><td>2016</td><td>3</td></tr>
</table>

Table B - 42 CDW Comparative Analysis between 2011 and 2016 Survey - Saida Caza

CDW Saida		Count	Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
					Volume (m³)	% Change	
Operational in 2011 and 2016		**1**	**4,245**	**5,000**	**755**	**17.8**	One dumpsite existed and was operational since 2011 and remained operational in 2016 with an increase in volume.
Non-Operational in 2011 and Operational in 2016		**-**	**-**	**-**	**-**	**-**	
Operational in 2011 and Non-operational in 2016		**2**	**3,129**	**3,600**	**471**	**15.1**	Two dumpsites were operational in 2011 and became non-operational in 2016 with a small increase in volume. This increase is attributed to one dumpsite which remained operational until 2014 and was not rehabilitated.
	Not rehabilitated	*1*	*2,400*	*3,600*	*1,200*		
	Covered	-	-	-	-		
	Removed	*1*	*729*	*0*	*-729*		
Non-Operational in 2011 and Non-Operational in 2016		**-**	**-**	**-**	**-**	**-**	
New dumpsites identified in 2016		**9**	**-**	**8,400**	**8,400**	**100.0**	Nine new operational CDW dumpsites were identified in the Saida caza in the 2016 survey with a volume of 8,400 m³.
	Operational	*9*	-	*8,400*	*8,400*		
	Non-operational	-	-	-	-		
Non-Operational MSW in 2011 and Non-Operational CDW in 2016		**1**	**-**	**2,200**	**2,200**	**100.0**	One dumpsite was classified as a non-operational MSW dumpsite in the 2011 survey and became a non-operational CDW dumpsite in 2016. Its estimated volume in 2011 is added to the MSW figures.
TOTAL		**2011: 3** **2016: 13**	**7,374**	**19,200**	**11,826**	**160.4**	

Table B - 43 Comparative Analysis between 2011 and 2016 Survey - Sour Caza

CDW Sour		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		**2**		**4,180**	**4,900**	**720**	**17.2**	Two dumpsites have been operational since 2011 and remained operational in the 2016 survey with an increase in volume.
Operational in 2011 and Non-operational in 2016		**6**		**1,697**	**1,327**	**-519**	**-30.6**	Six dumpsites were operational in the 2011 survey and were found to be non-operational in 2016 with a decrease in volume. This decrease is attributed to the following: - Two dumpsites were non-operational and not rehabilitated with a decrease in volume; - Two dumpsites were found to have been completely rehabilitated-removed by 2016. Two dumpsites were rehabilitated-covered.
	Not rehabilitated	*2*		*427*	*200*	*-376*		
	Covered	*2*		*556*	*1,127*	*571*		
	Removed	*2*		*714*	*0*	*-714*		
Non-Operational in 2011 and Non-Operational in 2016		**2**		**11,670**	**0**	**-11,670**	**-100.0**	Two dumpsites were non-operational in the 2011 survey and were rehabilitated-removed by 2016.
	Not rehabilitated	-		-	-	-		
	Covered	-		-	-	-		
	Removed	*2*		*11,670*	*0*	*-11,670*		
New dumpsites identified in 2016		**12**		**-**	**20,990**	**20,990**	**100.0**	12 new CDW dumpsites were identified in the Sour caza in the 2016 survey. Seven were operational and five were non-operational.
	Operational	*7*		-	*16,420*	*16,420*		
	Non-operational	*5*		-	*4,570*	*4,570*		
Operational MSW in 2011 and Operational CDW in 2016		**1**		**-**	**600**	**600**	**100.0**	One dumpsite was classified as an operational MSW dumpsite in the 2011 survey and has become an operational CDW dumpsite in the 2016 survey. Its estimated volume in 2011 is added to the MSW figures.
Non-Operational MSW in 2011 and Non-Operational CDW in 2016		**2**		**-**	**550**	**550**	**100.0**	Two dumpsites were classified as non-operational MSW dumpsites in the 2011 survey and have become non-operational CDW dumpsites in the 2016 survey. Their estimated volume in 2011 is added to the MSW figures.
TOTAL		**2011**	**10**	**17,547**	**28,367**	**10,820**	**60.8**	
		2016	**25**					

Table B - 44 CDW Comparative Analysis between 2011 and 2016 Survey - Zahle Caza

CDW Zahle		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		-		-	-	-	-	
Non-operational in 2011 and Operational in 2016		3		3,700	15,500	11,800	318.9	Three dumpsites were non-operational in the 2011 survey and have become operational in the 2016 survey with a large increase in volume.
Operational in 2011 and Non-operational in 2016		-		-	-	-	-	
Non-Operational in 2011 and Non-Operational in 2016		-		-	-	-	-	
New dumpsites identified in 2016		8		-	23,250	23,250	100.0	Eight new operational CDW dumpsites were identified in the Zahle caza in the 2016 survey with a total volume of 23,250 m³.
	Operational	*8*		*-*	*23,250*	*23,250*		
	Non-operational	*-*		*-*	*-*	*-*		
Non-operational MSW in 2011 and Operational CDW in 2016		*1*		-	*5,000*	*5,000*	100.0	One dumpsite that was classified as non-operational MSW in the 2011 survey has become an operational CDW dumpsite by 2016. Its estimated volume in 2011 is added to the MSW figures.
Non-operational MSW in 2011 and Non-operational CDW in 2016		*1*		-	*100*	*100*	100.0	One dumpsite that was classified as non-operational MSW in the 2011 survey has become a non-operational CDW dumpsite by 2016. Its estimated volume in 2011 is added to the MSW figures.
TOTAL		2011	3	3,700	43,850	40,150	1,085.1	
		2016	13					

Table B - 45 CDW Comparative Analysis between 2011 and 2016 Survey - West Beqaa Caza

<table>
<tr><th colspan="2" rowspan="2">CDW
West Beqaa</th><th colspan="2" rowspan="2">Count</th><th rowspan="2">Volume (m³) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m³) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m³)</th><th>% Change</th></tr>
<tr><td colspan="2">Operational in 2011 and 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Non-operational in 2011 and Operational in 2016</td><td colspan="2">1</td><td>7,000</td><td>7,500</td><td>500</td><td>7.1</td><td>One dumpsite was non-operational in the 2011 survey and has become operational in the 2016 survey with a volume increase.</td></tr>
<tr><td colspan="2">Operational in 2011 and Non-operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Non-Operational in 2011 and Non-Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">New dumpsites identified in 2016</td><td colspan="2">2</td><td>-</td><td>900</td><td>900</td><td>100.0</td><td rowspan="3">Two new non-operational CDW dumpsites were identified in the West Beqaa caza in the 2016 survey with a total volume of 900 m³.</td></tr>
<tr><td rowspan="2"></td><td>Operational</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td rowspan="2"></td></tr>
<tr><td>Non-operational</td><td colspan="2">2</td><td>-</td><td>900</td><td>900</td></tr>
<tr><td colspan="2" rowspan="2">TOTAL</td><td>2011</td><td>1</td><td rowspan="2">7,000</td><td rowspan="2">8,400</td><td rowspan="2">1,400</td><td rowspan="2">20.0</td><td rowspan="2"></td></tr>
<tr><td>2016</td><td>3</td></tr>
</table>

Table B - 46 CDW Comparative Analysis between 2011 and 2016 Survey - Rashaya Caza

CDW Rashaya		Count		Volume (m^3) of Dumpsites in 2011 Survey	Volume (m^3) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m^3)	% Change	
Operational in 2011 and 2016		-		-	-	-	-	
Non-operational in 2011 and Operational in 2016		-		-	-	-	-	
Operational in 2011 and Non-operational in 2016		-		-	-	-	-	
Non-Operational in 2011 and Non-Operational in 2016		-		-	-	-	-	
New dumpsites identified in 2016		5		-	9,700	9,700	100.0	Five new CDW dumpsites were identified in the Rashaya caza in the 2016 survey with a total volume of 9,700 m^3.
	Operational	*5*		-	*9,700*	*9,700*		
	Non-operational	-		-	-	-		
TOTAL		2011	-	-	9,700	9,700	100.0	
		2016	5					

Table B - 47 CDW Comparative Analysis between 2011 and 2016 Survey - Hermel Caza

CDW Hermel		Count		Volume (m³) of Dumpsites in 2011 Survey	Volume (m³) of Dumpsites in 2016 Survey	Balance		Comments
						Volume (m³)	% Change	
Operational in 2011 and 2016		-		-	-	-	-	
Non-operational in 2011 and Operational in 2016		-		-	-	-	-	
Operational in 2011 and Non-operational in 2016		-		-	-	-	-	
Non-Operational in 2011 and Non-Operational in 2016		-		-	-	-	-	
New dumpsites identified in 2016		1		-	1,500	1,500	100.0	One new non-operational dumpsite with a volume of 1,500 m³ was identified in the Hermel caza in the 2016 survey.
	Operational	-		-	-	-		
	Non-operational	*1*		-	*1,500*	*1,500*		
TOTAL		2011	-	-	1,500	1,500	100.0	
		2016	1					

Table B - 48 CDW Comparative Analysis between 2011 and 2016 Survey - Baalback Caza

<table>
<tr><th colspan="2" rowspan="2">CDW
Baalback</th><th colspan="2" rowspan="2">Count</th><th rowspan="2">Volume (m³) of Dumpsites in 2011 Survey</th><th rowspan="2">Volume (m³) of Dumpsites in 2016 Survey</th><th colspan="2">Balance</th><th rowspan="2">Comments</th></tr>
<tr><th>Volume (m³)</th><th>% Change</th></tr>
<tr><td colspan="2">Operational in 2011 and 2016</td><td colspan="2">1</td><td>225,000</td><td>10,000</td><td>-215,000</td><td>-95.6</td><td>One dumpsite (L8-Chmestar-01) was operational in the 2011 survey with a total volume of 225,000 m³, this dumpsite is still operational with a 95% decrease in volume. This dumpsite was partially rehabilitated, thus the volume of accumulated CDW has significantly decreased.</td></tr>
<tr><td colspan="2">Non-operational in 2011 and Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Operational in 2011 and Non-operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">Non-Operational in 2011 and Non-Operational in 2016</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="2">New dumpsites identified in 2016</td><td colspan="2">26</td><td>-</td><td>130,300</td><td>130,300</td><td>100.0</td><td rowspan="3">26 new operational CDW dumpsites were identified in the Baalback caza in the 2016 survey.</td></tr>
<tr><td rowspan="2"></td><td>Operational</td><td colspan="2">26</td><td>-</td><td>130,300</td><td>130,300</td><td rowspan="2"></td></tr>
<tr><td>Non-operational</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2" rowspan="2">TOTAL</td><td>2011</td><td>1</td><td rowspan="2">225,000</td><td rowspan="2">140,300</td><td rowspan="2">-84,700</td><td rowspan="2">-37.6</td><td rowspan="2"></td></tr>
<tr><td>2016</td><td>27</td></tr>
</table>

APPENDIX C – LIST OF SWM FACILITIES IDENTIFIED IN THE 2016 SURVEY

Number	Caza	Location	Source of Waste	Type of Treatment	Status *	X	Y	Landuse	Start Date	End Date	Number of Employees	Quantity of Waste Received (t/day)	Capacity (t/day)	Type of Waste Received	Sorting at Source	Technology	Manual Sorting	Fate of Waste	Funding	Current Administration	Operator	Notes	Number of Photos	Source of Information
Area 1: Akkar and North Lebanon																								
1	Akkar	Fnaydek	Fnaydek	Sorting and composting	Planned S3	36.20681	34.483889	Forest	May-17	NA	6	33	50	MSW	Y	Conveyor belts	Y	Recyclables sold, compost to Fnaydek agricultural lands, rejects sent to Srar dumpsite	EU / OMSAR / Municipality	Municipality	Nasimco	If capacity is not reached, will take MSW from other municipalities	8	Mohammad Ali Ismail, Municipality
2	Akkar	Mishmesh	Mishmesh and Korne	Sorting and composting	Operational	36.15942	34.463356	Other	Jul-14	NA	7	11	11	MSW	N	Weigh bridge, conveyor belt, press for cardboard-plastic-metal, shredder for plastic, 8 in-vessel composters, shredder for organics	Y	Recyclables sold, compost freely distributed to farmers, rejects sent to Mishmesh dumpsite	EU	Municipality	Municipality		17	Mohammad Ali, Head of Municipality
3	Akkar	Srar	Akkar Mohafaza	Sanitary landfill	Planned S1	-	-	-	-	NA	-	-	-	MSW rejects	-	-	NA	NA	EU	-	-		0	Khaled El Yassin
4	Akkar	Srar	Akkar Mohafaza	Sorting and composting	Planned S1	-	-	-	End of 2018	NA	-	325	500	MSW	N	-	-	Recyclables sold, compost distributed or sold, rejects landfilled	EU	-	-		0	Khaled El Yassin
5	Batroun	Batroun	27 municipalities of Batroun caza	Thermal treatment	Planned S1	-	-	-	-	NA	-	120	150	MSW	-	-	-	-	Union of municipalities of Batroun	NA	NA	Type of treatment not final yet	0	Mario Tabchi, Municipality member
6	Batroun	Chekka	Chekka	Sorting	Operational	-	-	-	-	NA	-	-	-	MSW	N	-	Y	Recyclables to contractor, organics and rejects to dumpsite not in Chekka	Municipality	Municipality	Municipality		0	Municipality
7	Koura	Bsarma	Bsarma and Union of municipalities of Bcharreh: Bazaaoun, Bcharreh, Bqaa Kafra, Bqerqacha, Hadath El Joubbeh, Qnat, Tourza	Sorting	Operational	35.85595	34.33246	Other	2011	NA	6	35	40	MSW	N	Sorting on the ground	Y	Recyclables sold, organics and rejects sent to Adweh dumpsite	William Manassa	William Manassa	William Manassa		4	Toni Dannaoui, Municipality
8	Koura	Bichmezzine	Bichmezzine, Kfar Hazir, Dar Chmezzine, Btorran, Bdobba, Beit Roumin	Sorting	Operational	34.31984	35.78534	Other	2015	NA	10	3	10	MWS recyclables	Y	Conveyor belt, press, manual lifter	Y	Recyclables sold, rejects dumped in Bichmezzine	Center for Development, Democracy and Governance	Municipality	-	The SWMF has been operational since 2015 and has only been treating the waste produced by Bichmezzine. At the end of April 2017, it started receiving waste from 5 other municipalities. Therefore, the quantity of waste received is not accurate yet. Future plan: composting.	10	Elias Khoury, Project Coordinator
9	Koura	Kosba	All over Lebanon	Thermal treatment	Planned S2	-	-	Industrial	Aug-17	NA	-	125	450	Rubber, tires and oils	NA	Therolas (between pyrolysis and gasification)	-	Zero waste	Ouvrage	Ouvrage	Ouvrage		0	Eng. Raymond Mitri, Ouvrage
10	Koura	Koura	Koura	Sorting and composting	Planned S1	-	-	-	-	NA	-	-	150	-	-	-	-	-	EU / OMSAR	NA	NA		0	-
11	Minieh-Dannieh	Dannieh	-	Sanitary landfill	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	NA	NA	EU / OMSAR	-	-		0	-
12	Minieh-Dannieh	Dannieh	-	Sorting and composting	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	-	-	EU / OMSAR	NA	NA		0	-
13	Minieh-Dannieh	Minieh	-	Sorting and composting	Planned S1	-	-	-	-	NA	-	-	150	-	-	-	-	-	EU / OMSAR	NA	NA		0	-
14	Minieh-Dannieh	Minieh	Union of municipalities of Minieh: Minieh, Bhanine, Deri Amar, Markabta and Borj el Yahoudiyyeh	Sorting and composting	Operational	35.97349	34.473576	Other	2016	NA	35	90	100	MSW	N	Weigh bridge, trommel screen with large aperture, conveyor belt, press for cardboard and plastic, 2 shredders for plastic, 8 non-operational in-vessel composters, trommel screen with 1 cm aperture, windrow composting	Y	Recyclables sold, compost freely distributed to farmers in Union of Municipalities of Minieh, rejects sent to Adweh dumpsite	EU / OMSAR	AlJihad Group for Commerce and Contracting	AlJihad Group for Commerce and Contracting	The SWMF was non-operational for about a year (2015-2016) when the operator changed	24	Ahmad Eid, Manager of SWMF; Bilal Alm Eddine, Minieh municipality and Union of municipalities of Minieh
15	Tripoli	Tripoli	Union of municipalities of Al-Fayhaa: Tripoli, Baddaoui, Kalamoun and Mina	Sorting and composting	Pilot Phase	35.83876	34.453824	Other	May-17	NA	45	450	500	MSW	N	Weigh bridge, bag opener, conveyor belts, trommel screen, ballistic separator, magnetic separator, shredder for nylon, windrow composting, biofilter for odor control	N	Recyclables sold, compost freely distributed, rejects to Tripoli dumpsite, RDF waste to Tripoli dumpsite but looking for a market abroad	EU / OMSAR	-	AMB		14	Eng. Nader Salam, Project Manager, AMB
16	Zgharta	Zgharta Caza	31 municipalities in Zgharta Caza	Sorting and composting	Planned S1	-	-	-	-	NA	-	-	250	MSW	Y	-	-	-	EU / OMSAR	EU and Union of municipalities of Zgharta caza	-		0	Zaaini Kheir, Head of Union of municipalities of Zgharta Caza

Number	Caza	Location	Source of Waste	Type of Treatment	Status *	X	Y	Landuse	Start Date	End Date	Number of Employees	Quantity of Waste Received (t/day)	Capacity (t/day)	Type of Waste Received	Sorting at Source	Technology	Manual Sorting	Fate of Waste	Funding	Current Administration	Operator	Notes	Number of Photos	Source of Information
Area 2: Beirut and Mount Lebanon																								
17	Aley	Abey	Abey and Ain Drafil	Sorting and composting	Operational	35.51010	33.74307	Other	2015	NA	20	1	2	MSW	Y	Table for sorting organics, shredder for organics, in-vessel composter, press, incinerator for rejects that has never been operational. Recyclables sorted on the ground.	Y	Recyclables sold or freely distributed, compost freely distributed, rejects to private collector	Municipality	Municipality	Municipality	The incinerator has never been operational because the quantity of rejects generated is minimal	7	Tamara Hamzeh, Municipality
18	Aley	Ainab	Ainab, Remhala, Bsatine, Mejdlayya, Bmekkine and Kfarmatta	Sorting	Operational	35.54427	33.76826	Other	Feb-17	NA	4	15	5	MSW recyclables	Y	Press	Y	Plastic and cardboard sold, glass and metals stored	Terre des Hommes Italia and Union of municipalities of Al Gharb Al Aala and Al Shahhar	Union of municipalities of Al Gharb Al Aala and Al Shahhar	Union of municipalities of Al Gharb Al Aala and Al Shahhar		4	Alaa Al Shaar, Ainab Municipality and Abir Malaeb, Union of municipalities of Al Gharb Al Aala and Al Shahhar
19	Aley	Aitat	Aitat	Sorting	Planned S1	-	-	-	-	NA	-	2	2	MSW	-	-	Y	Recyclables sold	Private	Municipality	Municipality		0	Salah Timani, Head of Municipality
20	Aley	Aley	Aley	Thermal treatment	Planned S1	-	-	NA	-	NA	-	37	-	MSW	-	Pyrolysis	-	NA	Ouvrage	NA	NA	Need to find a suitable land. Funding available.	0	Fady Shehayeb, Municipality
21	Aley	Amrousiyeh	-	Sorting	Operational				-	-	-	-	750	-	-	-	-	-	CDR	CDR	AlJihad Group for Commerce and Contracting		0	-
22	Aley	Choueifat	Beirut, 4 municipalities from Southern suburbs of Beirut and 4 municipalities in Beirut caza	Sanitary landfill	Operational	35.48071	33.812679	Mix	2015	NA	-	1,250	3 years, 1,000 m^3	MSW, MSW rejects	N	-	NA	NA	GoL / CDR	CDR	AlJihad Group for Commerce and Contracting	Design study for landfill: Rafik El-Khoury & Partners Consulting - Engineers. Currently building the leachate treatment facility. At the moment, the leachate is taken to WWTP in Ghadir.	0	Rabih Osseiran, Dar El Handasah
23	Aley	Majdel Baana	Majdel Baana	Sorting and composting	Planned S1	35.65694	33.778685	Other	-	NA	-	-	-	-	-	-	-	-	Not available yet	NA	NA	Land available, road and preliminary infrastructure constructed	0	Rawzaba Abdel Khalek, Head of Municipality
24	Baabda	Roeiset Al Ballout	Roeiset Al Ballout and Hlaliyeh	Sorting and composting	Operational	35.63675	33.823003	Other	Mar-17	NA	5	0.85	7	MSW	Y	Conveyor belt, windrow composting	Y	Recyclables sold, compost freely distributed and rejects to Sibline for incineration	UNHCR	Municipality	Municipality		0	Hikmat Bou Zeineddine, Municipality of Hlaliyeh and Dr. Rabih Zeidan, Municipality of Roeiset El Ballout
25	Beirut	Ashrafieh/ arcenciel	-	Autoclaving	Operational	-	-	-	-	NA	-	-	-	Medical Waste	NA	-	NA	-	arcenciel	arcenciel	arcenciel		0	Mario Ghorayeb, Environmental Director arcenciel
26	Beirut	Karantina	-	Sorting and composting	Operational				-	-	-	-	1500	-	-	-	-	-	CDR	CDR	AlJihad Group for Commerce and Contracting	Composting plant under expansion	0	-
27	Chouf	Aanout	Union of municipalities of Iqlim Al Kharroub North	Thermal treatment	Planned S1	-	-	-	-	NA	-	-	-	MSW	N	-	-	-	-	-	-		0	Ziad Hajjar, Head of Union of municipalities of Iqlim El Kharroub North
28	Chouf	Ain Zhalta	Ain Zhalta	Sorting and composting	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	-	-	NA	NA	NA		0	Issam Slim, Municipality
29	Chouf	Baadaran	Ammatour, Ain Qani, Baadaran, Bater, Botme, Haret Jandal, Jbaa, Khreibeh, Maaser El Chouf, Moukhtara, Mristi, Niha	Sorting and composting	Operational	35.62559	33.622668	Other	2016	NA	16	9	25	MSW	N	Conveyor belts, press, trommel screen, windrow composting	Y	Recyclables sold, compost freely distributed, rejects to Sicomo	Mercy Corps and others	Union of municipalities of Chouf Al Aala	Union of municipalities of Chouf Al Aala		12	Nader Rasbay, Moukhtara Policeman
30	Chouf	Baouerta	Baouerta	Sorting and composting	Planned S1	35.471330	33.730243	Other	-	NA	-	-	5	-	-	-	-	-	Not available yet	NA	NA	Land available, started with road construction	0	Adnan Ayyash, Head of Municipality
31	Chouf	Brih	Brih	Sorting and composting	Operational	-	-	-	Sep-16	NA	2	0.5	1	MSW	Y	-	-	Recyclables sold, compost sold and freely distributed, rejects to Sicomo, hazardous waste to treatment facilities	Municipality	Municipality	Municipality		0	Ihab Abou Fakher, activist in Brih
32	Chouf	Jiyeh	Jiyeh	Sorting	Planned S2	35.40077	33.643712	Road	-	NA	-	14	10	MSW	Y	-	-	Recyclables sold	Municipality	Municipality	Municipality		1	Dr. Gerges Kazzi, Head of Municipality
33	Chouf	Joun	Joun	Sorting	Planned S2	35.46825	33.571453	Other	-	NA	-	2.5	12	MSW	N	-	-	-	Municipality	Municipality	Municipality	Type of treatment for organics is still to be determined	1	Ahmad, Municipality
34	Chouf	Kfar Qatra	Kfar Qatra	Sorting and composting	Planned S2	35.58686	33.715463	Other	-	NA	-	0.3	1	MSW	Y	-	-	Recyclables sold, compost distributed, no plan for rejects yet	Anonymous Donor	Municipality	Municipality		4	Samah Nasreddine, Municipality
35	Chouf	Mazbud	Mazbud	Sorting	Operational	35.47572	33.611248	Agricultural	2016	NA	-	4	4	MSW	N	Conveyor belt, press	Y	Recyclables sold, organics sent to IBC Saida	Municipality	Municipality	-		1	Dr. Walid Jamaleddine, Municipality

Number	Caza	Location	Source of Waste	Type of Treatment	Status *	X	Y	Landuse	Start Date	End Date	Number of Employees	Quantity of Waste Received (t/day)	Capacity (t/day)	Type of Waste Received	Sorting at Source	Technology	Manual Sorting	Fate of Waste	Funding	Current Administration	Operator	Notes	Number of Photos	Source of Information
36	Chouf	Sweijene	Union of municipalities of Sweijene: Aathrine, Ain Ou Zain, Ainbal, Baakline, Gharifeh, Jdeidet Ech Chouf, Kahlouniyeh, Mazraat Ech Chouf, Semqanieh, Deir El Qamar, Beit Eddine	Sorting and composting	Operational	35.589856	33.661171	Other	2015	NA	30	45	60	MSW	N	Conveyor belt, press, trommel screen, windrow composting	Y	Recyclables sold, compost freely distributed, rejects to Jdeidet Ech Chouf dumpsite	Union of municipalities of Sweijene / OMSAR	Union of municipalities of Sweijene	Union of municipalities of Sweijene		0	Khaled Abou Karroum, Manager
37	Jbeil	Blat	Blat and surrounding towns	Sorting and thermal treatment	Planned S1	-	-	Industrial	Sep-17	NA	-	-	200	All types of waste except for nuclear	N	Sorting, sterilization, electricity/fuel-generation	-	Zero waste	Ouvrage	Ouvrage	Ouvrage	Can enlarge to reach a 500 t/day capacity. Future plan: medical waste.	0	Raymond Mitri, Eng., Ouvrage
38	Jbeil	Hbaline	Union of municipalities of Jbeil and other municipalities; 30 in total	Sanitary landfill	Planned S2	35.67724	34.154861	Other	Nov-17	NA	-	-	10 years	MSW organics and rejects	N	Box culverts	NA	NA	EU / OMSAR / USAID	Union of municipalities of Jbeil	BATCO	Currently, two temporary cells are operational. Future plan: leachate treatment.	7	Joseph Germanos, Project Manager
39	Jbeil	Hbaline	Union of municipalities of Jbeil and other municipalities; 30 in total	Sorting	Operational	35.68067	34.154621	Other	2004	NA	30	70	80	MSW	N	Weigh bridge, trommel screen, conveyor belts, magnetic separator, press, 8 non-operational in-vessel composters	Y	Recyclables sold, organics and rejects to Hbaline dumpsite	EU / OMSAR / USAID	Union of municipalities of Jbeil	BATCO	Future plan: composting	4	Joseph Germanos, Project Manager
40	Jbeil	Jbeil	Jbeil	Sorting and composting	Planned S1	-	-	-	-	NA	-	26	33	MSW	Y	-	-	Recyclables sold, organics and rejects to Hbaline until composting is operational	Municipality / EU	Municipality	Municipality	Stage 1: sorting; Stage 2: composting; Stage 3: reject treatment - to be determined	0	Ramy Hosri, Municipality
41	Kesrouane	Antoura	Antoura	Sorting and composting	Operational	35.63929	33.95855	Sorting: Residential, Composting: Agricultural	2016	NA	2	3	4	MSW	Y	1 press, passively aerated static pile composting	Y	Recyclables sold, compost freely distributed, rejects stocked on site until a solution is found	Rotary and Rotaract	Municipality	Compost Baladi	Rejects stocked on site - looking into sending them to Bourj Hammoud sanitary landfill	3	Georges Abi Nakhle, Municipality and Marc Aoun, Operator
42	Kesrouane	Ghosta	Ghosta, Ghazir, Zouk Mikael, Jeita, Batha, Daroun, Dlebta, Achqout, Bzemmar, Ain El Rihane, Maarab	Sorting, composting and RDF or landfill	Planned S1	-	-	-	Jul-17	NA	-	106	106	MSW	-	-	-	Recyclables and compost to contractor	EuropeAid or Private Funding	Solutions Inc	Phoenix Energy		0	Ziad Chalfoun, Head of Municipality
43	Kesrouane	Kaslik/ USEK	USEK	Sorting and composting	Operational	35.6187	33.981896	Parking lot	Jul-05	NA	4	2	4	MSW	Y	Conveyor belt, press, actively aerated static piles	Y	Recyclables sold and compost used internally at USEK	USEK	Green Committee USEK	Compost Baladi		0	Marc Aoun, Operator
44	Maten	Beit Meri	Beit Meri	Sorting, composting and ecoboards	Operational	35.61037	33.85264	Other	Sep-16	NA	12	15.5	16	MSW	Y	Weigh bridge, conveyor belt, 2 presses, in-vessel composting	Y	Recyclables sold, compost sold and freely distributed, rejects made into ecoboards	Municipality / Cedar Environmental	Cedar Environmental	Cedar Environmental		5	Roy Abou Chedid, Head of Municipality and Ziad Abi Chaker, Contractor
45	Maten	Bikfaya/ biclean	Bikfaya, Mhayde, Bhorsaf, Sakyat El Mesk, Wadi Chahine, Ain El Kharroube (200 houses), Dahr El Sowan (30 houses, recyclables only)	Sorting and composting	Operational	35.69362	33.92562	Mix	Mar-16	NA	18	13	20	MSW	Y	Conveyor belts, 3 presses, passively aerated static pile composting	Y	Sorted material sold, organics to farms and composting, compost used on site and for municipal use, green glass used for pavements, tires to Joun, rejects to Sicomo	Municipalities of Bikfaya, Mhayde, Bhorsaf, Sakyat El Mesk	Nicole Gemayel and volunteers	Municipality	arcenciel offered technical support	7	Lina Gemayel, Volunteer Project Manager
46	Maten	Bourj Hammoud	-	Composting	Operational	-	-	-	Jul-17	NA	-	-	700	-	-	-	-	-	CDR	CDR	AlJihad Group for Commerce and Contracting		0	-
47	Maten	Bourj Hammoud	Maten and Kesrouane	Sanitary landfill	Operational	35.54751	33.903106	Industrial	Aug-16	NA	-	1,000	4 years	MSW rejects, compost, MSW	N	Cell lining system with GCL, geomembranes and a drainage system	NA	NA	GoL / CDR	CDR	Dani Khoury Contracting	Study for landfill: Libanconsult; Capacity: 1,250,000 m^3	0	Pierre Alam, Rafik El-Khoury & Partners Consulting - Engineers
48	Maten	Bsalim	-	Large waste	Operational				-	-	-	-	-	-	-	-	-	-	GoL / CDR	-	-			-
49	Maten	Dhour El Choueir	Dhour El Choueir	Incineration	Non-operational, awaiting permit	-	-	-	-	NA	NA	NA	5.5	MSW rejects	NA	-	NA	-	Previous ministers Fady Abboud and Elias Bou Saab	Municipality	Municipality		0	Habib Mjaes, VP of Municipality
50	Maten	Dhour El Choueir	Dhour El Choueir	Sorting	Non-operational, awaiting permit	-	-	-	-	NA	NA	NA	10	MSW	N	Conveyor belt, hydraulic press	Y	Recyclables sold or distributed, organics and rejects incinerated	Previous ministers Fady Abboud and Elias Bou Saab	Municipality	Municipality	Expected to receive 4.5 t/day	0	Habib Mjaes, VP of Municipality
51	Maten	Jisr El Wati/ arcenciel	-	Autoclaving	Operational	-	-	-	-	NA	-	-	-	Medical waste	NA	-	NA	-	arcenciel	arcenciel	arcenciel		0	Mario Ghorayeb, Environmental Director arcenciel
52	Maten	Roumie	Municipalities in the Maten	Sorting	Operational	33.89283	35.604715	Other	-	-	-	45	45	MSW	N	Press	Y	Recyclables sold, organics and rejects to Bourj Hammoud	Fady Riachi	Fady Riachi	Fady Riachi		0	Fady Riachi, Owner
53	Maten	Roumie	-	Sorting	Planned S1	33.89283	35.604715	Other	-	NA	-	-	200	MSW	N	-	-	Recyclables sold, organics and rejects to Bourj Hammoud	Fady Riachi	Fady Riachi	Fady Riachi		0	Fady Riachi, Owner

Number	Caza	Location	Source of Waste	Type of Treatment	Status *	X	Y	Landuse	Start Date	End Date	Number of Employees	Quantity of Waste Received (t/day)	Capacity (t/day)	Type of Waste Received	Sorting at Source	Technology	Manual Sorting	Fate of Waste	Funding	Current Administration	Operator	Notes	Number of Photos	Source of Information
Area 3: Nabatieh and South Lebanon																								
54	Bent Jbeil	Aain Ibl	Aain Ibl	Sorting	Non-operational	-	-	-	-	-	NA	NA	-	-	-	-	-	NA	Private	NA	NA		0	Imad Lallous, Head of Municipality
55	Bent Jbeil	Aain Ibl	Aain Ibl	Sorting and composting	Planned S1	-	-	Other	-	NA	5	0.8	1	MSW	Y	Sorting, press, windrow composting	Y	Excavated pit near the SWMF	Mercy Corps / UNIFIL Italian and Irish-Finnish Battalions / Municipality	NA	NA	Construction should start in Sep 2017	0	Imad Lallous, Head of Municipality
56	Bent Jbeil	Aaitaroun	Aaitaroun, Blida, Hanine	Sorting and composting	Operational	35.48804	33.11453	Agricultural	2006	NA	7	7.5	12	MSW	N	Weigh bridge, conveyor belt, press for cardboard and plastic, 2 in-vessel composters, trommel screen, shredder for organics	Y	Recyclables sold, compost freely distributed and rejects to Aaitaroun dumpsite	EU	Ahmad Srour	Ziad Abi Chaker/Abi Chalhoub	The operation was stopped for a few months in 2016 for maintenance	12	Nabil Mansouri, Municipality
57	Bent Jbeil	Bent Jbeil	Bent Jbeil	Sanitary landfill	Planned S1	-	-	-	-	NA	-	-	150	-	-	-	NA	NA	EU / OMSAR	-	-		0	-
58	Bent Jbeil	Bent Jbeil	Bent Jbeil	Sorting and composting	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	-	-	EU / OMSAR	NA	NA		0	-
59	Bent Jbeil	Bent Jbeil	Bent Jbeil	Sorting and composting	Operational	35.41277	33.10181	Other	2001	NA	10	13	15	MSW	N	Conveyor belt, press for cardboard and PET, shredder for compost, in-vessel composter with conveyor belt, trommel screen with large aperture, trommel screen with small aperture	Y	Recyclables sold, compost freely distributed and rejects to Bent Jbeil	Cooperazione Italiana ROSS Emergency Program	Municipality / Recycle	Recycle		31	Sleiman Assi, Contractor; Abd El Rahman Bazzi, Municipality Engineer
60	Bent Jbeil	Khirbet Selm	Khirbet Selm	Sorting and composting	Operational	35.4199	33.21291	Other	2002	NA	5	10	10	MSW	N	Weigh bridge, shredder for plastic, wood crusher, in-vessel composter, trommel screen, conveyor belt for compost	Y	Recyclables sold, compost sold, rejects dumped in Khirbet Selm dumpsite	YMCA	Municipality	Ziad Abi Chaker / Municipality		11	Kassem Hammoud and Ali Saad, Municipality
61	Bent Jbeil	Rmaich	Rmaich	Sorting and composting	Planned S1	-	-	Other	-	NA	-	5	7	MSW	N	-	-	Rejects landfilled	UNDP	Municipality	-		0	Maroun Chebli, Head of Municipality
62	Hasbaya	Meri	Union of municipalities of Al Aarkoub: Chebaa, Kfar Chouba, Rachaya El Foukhar,Habbariyeh, Meri, Fraydis	Sorting	Planned S1	NA	NA	NA	-	NA	-	-	-	-	-	-	-	-	NA	NA	NA		0	Municipality
63	Hasbaya	Rachaya El Foukhar	Rachaya El Foukhar	Sorting	Operational	35.67147	33.35831	Other	2016	NA	2	0.7	1	MSW	Y	Sorting on the ground	Y	Recyclables stored because no press yet, organics and rejects dumped and covered next to SWMF	Municipality / UNDP	Municipality	Municipality		7	Salim Youssef, Head of Municipality
64	Marjeyoun	Khiyam	Khiyam, Marjeyoun	Sorting and composting	Operational	35.62537	33.327964	Other	2009	NA	22	22	25	MSW	N	Weigh bridge, conveyor belt, shredder for organics, trommel screen, press, 4 non-operational in-vessel composters, windrow composting	Y	Recyclables sold or freely distributed, compost freely distributed, rejects to Khiyam dumpsite	EU / OMSAR	Municipality	Recycle		12	Mohammad Freij, Municipality
65	Marjeyoun	Meiss Ej Jabal	Meis Ej Jabal	Sorting and composting	Operational	35.4937	33.1686	Other	2002	NA	4	7.5	10	MSW	N	1 operational in-vessel composter, 1 non-operational in-vessel composter, trommel screen, converyor belt for compost, press for plastic, shredder for organics	Y	Recyclables sold, compost sold, rejects dumped right next to the SWMF	YMCA / Municipality / Council for South	Municipality / Recycle	Recycle		10	Sleiman Assi, Contractor
66	Marjeyoun	Qabrikha	Qabrikha, Touline, Sawwane, Houla, Markaba, Bani Hayyan, Tallousa and the valleys of Union of municipalities of Jabal Amel: Aadchit, Houla, Markaba, Qabrikha, Qantara, Rabb Et Talatine, Taybeh Marjeyoun	Sorting and composting	Operational	35.47361	33.25720	Other	2006	NA	9	20	20	MSW	N	Weigh bridge, conveyor belt, trommel screen, press for plastic and cardboard, windrow composting	Y	Recyclables sold, compost freely distributed, rejects proportionaly sent to different dumpsites in the villages where waste comes from	EU / OMSAR	Municipality	Al Bonyan Company for Engineering and Contracting		16	Eng. Najib Qosan, Municipality and Administration
67	Marjeyoun	Qlaiaa	Qlaiaa	Sorting and composting	Operational	35.55652	33.33781	Other	2002	NA	4	4	6	MSW	N	Conveyor belts for compost, trommel screen, 1 operational in-vessel composter, 1 non-operational in-vessel composter, press	Y	Recyclables sold, compost stored, rejects dumped in valley	Mar Mansour NGO	Municipality	Hanna Khoury		6	Maroun Karam, Municipality
68	Marjeyoun	Taybet Marjeyoun	Taybet Marjeyoun	Sorting and composting	Operational	35.50092	33.27870	Other	2002	NA	5	11	15	MSW	N	2 non-operational shredders for organics, 1 operational shredder for organics, press for cardboard and plastic, trommel screen, 1 non-operational conveyor belt, windrow composting, 20 non-operational in-vessel composters	Y	Recyclables sold, compost freely distributed, rejects dumped near the SWMF	YMCA	Municipality	Municipality		14	Hussein Haidar, Municipality, previous operational manager of the SWMF

Number	Caza	Location	Source of Waste	Type of Treatment	Status *	X	Y	Landuse	Start Date	End Date	Number of Employees	Quantity of Waste Received (t/day)	Capacity (t/day)	Type of Waste Received	Sorting at Source	Technology	Manual Sorting	Fate of Waste	Funding	Current Administration	Operator	Notes	Number of Photos	Source of Information
69	Nabatieh	Ansar	Ansar	Sorting and composting	Under rehabilitation	35.35851	33.36287	Other	Jun-17	2012	-	10	10	MSW	N	Manual sorting, in-vessel composting	Y	Recyclables sold, compost freely distributed or sold, rejects dumped next to SWMF	EU / OMSAR / UNDP	Municipality	Municipality	Expected to become operational in June 2017	11	Eng. Ali Fayad, Head of Municipality
70	Nabatieh	Kfar Sir	NA	Sorting and composting	Non-operational	-	-	-	-	-	NA	NA	15	NA	-	-	-	NA	EU / OMSAR	USAID/YMCA	NA		0	Kamal
71	Nabatieh	Kfour En Nabatieh	-	Sanitary landfill	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	NA	NA	EU / OMSAR	-	-		0	-
72	Nabatieh	Kfour En Nabatieh	NA	Sorting and composting	Non-operational	-	-	-	-	-	-	NA	100	MSW	-	-	-	NA	EU / OMSAR	NA	NA		0	Hajj Khodr Saad, Head of Municipality
73	Nabatieh	Nabatieh	Nabatieh	Sanitary landfill	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	NA	NA	EU / OMSAR	-	-		0	-
74	Jezzine	Jezzine	-	Undecided	Planned S1	NA	NA	NA	-	NA	-	-	-	-	-	-	-	-	Private	-	-		0	Rita Bou Nader, Municipality
75	Saida	Sahel El Zahrani	-	Mechanical biological treatment	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	-	-	EU / OMSAR	NA	NA		0	-
76	Saida	Saida / arcenciel	-	Autoclaving	Operational	-	-	-	-	NA	-	-	-	Medical waste	NA	-	NA	-	arcenciel	arcenciel	arcenciel		0	Mario Ghorayeb, Environmental Director arcenciel
77	Saida	Saida Zahrani / IBC	Municipalities from Saida/Zahrani, Jezzine and Beirut cazas	Sorting, composting and RDF	Operational	35.36137	33.538038	Next to the sea	2012	NA	-	450	550	MSW	N	Weigh bridge, mechanical separation, anaerobic digestion of organics, windrow composting, pellet production	N	Recyclables sold, plastics and PET used to produce pellets which are exported, silica compounds used for construction, rejects recycled into RDF for road blocks, biogas used as a fuel	IBC	Saida Municipality	IBC		2	Nabil Zantout, GM of IBC and Sami Bidawi, Managing Director of IBC
78	Saida	Zrariye / Green Ecotech	Zrariye, Kfar Roumman, Kousaibe, Adchit	Sorting and thermal treatment	Operational	35.33766	33.35777	Other	2014	NA	10	10	10	MSW	N	Weigh bridge, shredder for organics, pyrolysis reactor	Y	Coal collected and stored, syn gas used as fuel for the pyrolysis process	Green Ecotech	Green Ecotech	Green Ecotech		10	General Manager of Green Ecotech
79	Sour	Ainbaal	27 municipalities of Sour caza	Sorting and composting	Operational	35.28574	33.24165	Other	2011	NA	55	135	100	MSW	N	Weigh bridge, bag opener, 3 lines of conveyor belts, trommel screens, 4 presses, 30 blowers for compost, 10 lines for windrow composting, 12 biofilters	Y	Recyclables sold, compost distributed to farmers, rejects dumped in a dumpsite of undisclosed location	USAID / EU / OMSAR / World Bank	Al Bonyan Company for Engineering and Contracting	Al Bonyan Company for Engineering and Contracting	Planned S1: enlarging the facility to a capacity of 150 t/day	15	Anwar Wadfa, Municipality and technical supervisor; Abbas Skaiki, VP Municipality; Ali Ahmaz, SWMF Manager
80	Sour	Ras El Ein	-	Sanitary landfill	Planned S1	-	-	-	-	NA	-	-	-	-	-	-	NA	NA	EU / OMSAR	-	-		0	-
81	Sour	Naqoura	-	Sorting	Non-operational	-	-	-	NA	-	NA	NA	-	-	-	-	-	NA	Private	NA	NA		0	Municipality

Number	Caza	Location	Source of Waste	Type of Treatment	Status *	X	Y	Landuse	Start Date	End Date	Number of Employees	Quantity of Waste Received (t/day)	Capacity (t/day)	Type of Waste Received	Sorting at Source	Technology	Manual Sorting	Fate of Waste	Funding	Current Administration	Operator	Notes	Number of Photos	Source of Information
Area 4: Bekaa and Baalback/Hermel																								
82	Baalback	Baalback	15 villages around Baalback, including villages in Hermel	Sanitary landfill	Planned S1	36.20333	34.033369	Other	-	NA	-	-	20 years	MSW rejects	-	-	NA	NA	EU / OMSAR	-	-		0	Saadeddine Arafat, Municipality Engineer
83	Baalback	Baalback	15 villages around Baalback, including villages in Hermel	Sorting and composting	Under rehabilitation	36.2039	34.033162	Other	Jul-17	NA	35	250	250	MSW	N	Conveyor belt	-	Recyclables sold, rejects to landfill	EU / OMSAR / Higher Relief Commission / Some municipalities	-	-	Currently enlarging and rehabilitating the old SWMF that had a capacity of 150 t/day	0	Saadeddine Arafat, Municipality Engineer
84	Rashaya	To Be Determined	Unions of municipalities of Qalaat El-Istiklal, Al-Sahel and Jabal El-Cheikh	Sorting and composting	Planned S1	35.83803	33.562123	Dumpsite	-	NA	50	104	150	MSW	-	Conveyor belts, windrow composting	Y	Recyclables and compost sold, no plan for rejects yet	World Bank / CDR	-	-	Replacing the facility that was planned in El Bire/Rashaya	9	Fawzi Salem, Head of Union of municipalities of Qalaat Al Istiklal
85	West Bekaa	Joubb Jannine	Union of Municipalities of Al Bouhayra: Aaytanit, Ain Et Tineh, Zin Zebdeh, Baaloul, BabMareaa, Joubb Jannine, Kefraya, Khirbet Qanafar, Lala, Libbaya, Machghara, Maydoun-Loussia, Qaraaoun, Qelaya, Saghbine, Sohmor, Yohmor, Zilaya	Sanitary landfill	Planned S1	-	-	Agricultural	-	NA	-	-	6 years	MSW rejects	-	-	NA	NA	EU / OMSAR	-	Hammoud Contracting	Landfill will reach full capacity in 5-6 years. Then, a new landfill will be created in another municipality of the Union. Plot number 2225.	0	Georges Abdallah, Municipality
86	West Bekaa	Joubb Jannine	Union of Municipalities of Al Bouhayra: Aaytanit, Ain Et Tineh, Zin Zebdeh, Baaloul, BabMareaa, Joubb Jannine, Kefraya, Khirbet Qanafar, Lala, Libbaya, Machghara, Maydoun-Loussia, Qaraaoun, Qelaya, Saghbine, Sohmor, Yohmor, Zilaya	Sorting and composting	Planned S2	-	-	Agricultural	-	NA	-	55	100	MSW	N	Conveyor belts, windrow composting	Y	Probably sell recyclables, rejects to landfill	EU / OMSAR	-	Hammoud Contracting	Can be enlarged to receive 300 t/day. Plot number 2225.	0	Georges Abdallah, Municipality
87	West Bekaa	Sohmor	Sohmor,Yehmor, Ain Et Tine, Maydoun-Loussia, Zilaya, Qellaya, Libbaya, Machghara, Majdal Balhis, Haouch El Qenaabeht Qonnaabe, Kfar Mechki	Sorting	Planned S1	-	-	-	-	NA	-	-	-	MSW	N	-	-	Maybe incineration	No funding	-	-	Plot number 2264	0	Mohammad Al Khochen, Municipality
88	Zahle	Barr Elias	Barr Elias, Qabb Elias - Ouadi El Deloum and Marj	Sorting and composting	Planned S3	-	-	Vegetable market	Jun-17	NA	-	133	150	MSW	N	Manual sorting, biofilters, windrow composting	Y	Recyclables sold, compost distributed and rejects to Barr Elias sanitary landfill	UNHCR / Municipality	-	Sima for Construction sarl	Plot number 1899	0	Mawas El Araji, Head of Municipality
89	Zahle	Barr Elias	Barr Elias, Qabb Elias - Ouadi El Deloum and Marj	Sanitary landfill	Operational	-	-	Vegetable market	2017	NA	-	-	150,000 t	MSW	N	-	NA	NA	UNHCR / Municipality	-	Sima for Construction sarl	Plot number 1899. Future plan: leachate treatment, add a 2nd cell of 150,000 t capacity	0	Mawas El Araji, Head of Municipality
90	Zahle	Qabb Elias	Qabb Elias farmers' market	Composting	Operational	-	-	Agricultural	2017	NA	2	1.25	5	MSW organics	NA	Windrow composting	NA	Compost sold	Hussein Kazaoun	Hussein Kazaoun	Compost Baladi		0	Marc Aoun, Operator
91	Zahle	Qabb Elias / Sicomo	Sicomo, municipalities from Mount Lebanon and Saida Zahrani / IBC SWMF	Thermal treatment	Operational	35.80721	33.763124	Mix	2011	NA	18	200	200	MSW	N	Gasification	N	Flue gas recombusted, ash trested with solidification by mixing with cement	Sicomo	Sicomo	Sicomo		0	Karim Haddad, General Manager
92	Zahle	Taanayel / arcenciel	Domaine de Taanayel, Domaine visitors, Qabb Elias, Taanayel, Jdita	Sorting	Operational	35.87034	33.796744	Agricultural	2013	NA	15	1	6	MSW	Y	Conveyor belt, press	Y	Sold	arcenciel	arcenciel	arcenciel	Plot number 1	3	Mario Goraieb, Director of Environment arcenciel
93	Zahle	Zahle/ arcenciel	-	Autoclaving	Operational	-	-	-	-	NA	-	-	-	Medical waste	NA	-	NA	-	arcenciel	arcenciel	arcenciel		0	Mario Goraieb, Director of Environment arcenciel
94	Zahle	Zahle	25 municipalities from Central Bekaa	Sanitary landfill	Operational	35.91441	33.797889	Agricultural	1990s	NA	-	-	25 years	MSW organics and rejects	NA	-	NA	NA	World Bank	Mores	EES	Currently, 6 cells. Can go up to 10 cells	1	Ibrahim Achi, Fayez Hanna, Himmy El Tinn, Operator
95	Zahle	Zahle	25 municipalities from Central Bekaa	Sorting	Operational - under expansion	35.91441	33.797889	Agricultural	2002	NA	45	325	325	MSW	N	Weigh bridge, conveyor belt, 4 presses	Y	Recyclables sold, organics and rejects landfilled in Zahle landfill	USAID / CHF International / MercyCorps / Italian Protocol year 1997	Mores	EES	Currently enlarging facility to improve the sorting process	3	Ibrahim Achi, Fayez Hanna, Himmy El Tinn, Operator
96	Zahle	Zahle	25 municipalities from Central Bekaa	Composting	Planned S1	35.91441	33.797889	Agricultural	-	NA	-	-	200	MSW organics	N	-	NA	-	-	Mores	EES		0	Ibrahim Achi, Fayez Hanna, Himmy El Tinn, Operator

*** Status**
Planned S1: Planned Stage 1: Design phase
Planned S2: Planned Stage 2: Construction phase
Planned S3: Planned Stage 3: Mechanical installation phase

APPENDIX D – GEODATABASE AND APPLICATION (SOFTWARE)

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
R6-Tripoli-0	North	Tripoli	Operational			1,200,000	40.734	1
N5-Hbaline-0	Mount Lebanon	Jbeil	Operational			600,000	40.317	2
R7-Adweh-0	North	Minieh-Dannieh	Operational			255,372	34.763	3
P5-Batroun-0	North	Batroun	Operational			55,000	34.600	4
T9-Srar-0	North	Akkar	Operational			570,000	34.279	5
J6-Qabb Elias-00	Beqaa	Zahle	Operational			219,000	32.503	6
C1-Deir Qanoun El-Aain-01	South	Sour	Non-operational	Not Rehabilitated		300,000	31.429	7
L5-Balloune-3	Mount Lebanon	Kesrouane	Operational			14,000	30.323	8
L5- Beit Chabab- 1n	Mount Lebanon	Maten	Operational			10,000	30.205	9
J7-Barr Elias-00	Beqaa	Zahle	Operational			200,000	30.158	10
R9-Fnaydek-0	North	Akkar	Operational			72,000	29.839	11
F2-Sarafand-01	South	Saida	Operational			33,000	29.647	12
G4-Jezzine-00	South	Jezzine	Operational			16,000	29.032	13
D2-Abbesye-03	South	Sour	Operational			35,000	28.961	14
M9-Baalback-02	Beqaa	Baalback	Operational			75,000	28.905	15
R9-Mishmesh-0	North	Akkar	Operational			6,000	28.392	16
G2-Ghaziye-00	South	Saida	Non-operational	Not Rehabilitated		32,000	28.356	17
E3-Kfour En-Nabatieh-00	Nabatieh	Nabatieh	Operational			42,000	28.130	18
G2- Saida -1n	South	Saida	Operational			50,000	28.088	19
R7-Kfar Chellane-0	North	Minieh-Dannieh	Operational			11,500	28.052	20
R9-Beit Ayyoub-1	North	Akkar	Non-operational	Not Rehabilitated		32,000	28.038	21
B3-Bent Jbayl-00	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		4,000	27.906	22
J7-Terbol-00	Beqaa	Zahle	Operational			7,500	27.891	23
L6-Aain El Qabou-0	Mount Lebanon	Maten	Operational			360	27.695	24
P5-Hamat-1	North	Batroun	Non-operational	Not Rehabilitated		72,000	27.675	25
Q8-Bqaa Sifreen-0	North	Minieh-Dannieh	Non-operational	Not Rehabilitated		2,000	27.476	26
L8-Chmestar-02	Beqaa	Baalback	Non-operational	Not Rehabilitated		25,000	27.199	27
Q8-Assoun-0	North	Minieh-Dannieh	Operational			5,400	26.894	28
C4-Touline-00	Nabatieh	Marjeyoun	Operational			1,200	26.821	29
L5-Baqaata Aashquot-0	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	26.733	30
L5-Bikfaya-0	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	26.709	31
D4-Deir Mimas-00	Nabatieh	Marjeyoun	Operational			2,500	26.606	32

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
D3-Taybet Marjeyoun-00	Nabatieh	Marjeyoun	Operational			800	26.562	33
L5-Rayfoon-2	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Covered	2,000	26.545	34
S9-Rahbe-0	North	Akkar	Non-operational	Not Rehabilitated		1,500	26.452	35
D2-Maarake-00	South	Sour	Operational			16,000	26.291	36
D2-Quasmiye-02n	South	Saida	Operational			1,200	26.270	37
F4-Jbaa En-Nabatiyeh-00	Nabatieh	Nabatieh	Operational			4,000	26.226	38
P6-Bichmezzine-0	North	Koura	Non-operational	Rehabilitated	Covered	4,000	26.225	39
C2-Recheknanay-01	South	Sour	Non-operational	Not Rehabilitated		44	26.211	40
J4-Bsous-0	Mount Lebanon	Aley	Operational			1,200	26.185	41
L4-Deir Tamich-3n	Mount Lebanon	Maten	Operational			200	26.179	42
L5-Qlaiaat-1	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	26.095	43
L5-Aain Er-Rihane-1	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Covered	12,150	26.065	44
O7-Hasroun-0	North	Bcharre	Non-operational	Rehabilitated	Removed	0	25.899	45
J6-Saadnayel-00	Beqaa	Zahle	Non-operational	Not Rehabilitated		6,000	25.885	46
I5-Butme-0	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Removed	0	25.817	47
R9-Beit Ayyoub-2	North	Akkar	Non-operational	Not Rehabilitated		1,500	25.816	48
E5-Hebbariyye-00	Nabatieh	Hasbaya	Operational			600	25.804	49
C2-Hanaouay-00	South	Sour	Operational			3,000	25.749	50
E3-Mayfadoun-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		1,980	25.704	51
H4- Baadaran- 01n	Mount Lebanon	Chouf	Operational			300	25.666	52
P7-Kfarsghab-0	North	Zgharta	Non-operational	Rehabilitated	Removed	0	25.661	53
H3-Barja-1n	Mount Lebanon	Chouf	Operational			17,500	25.648	54
L5-Mazraat Yeshouaa-0	Mount Lebanon	Maten	Operational			4,000	25.614	55
C2-Recheknanay-02	South	Sour	Non-operational	Rehabilitated	Removed	0	25.603	56
G3-Qennarit-01	South	Saida	Operational			6,000	25.558	57
K5-Qornayel-0n	Mount Lebanon	Baabda	Operational			8,000	25.522	58
H4-Gharife-1	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Removed	0	25.505	59
R7-Deir Ammar-1	North	Minieh-Dannieh	Operational			1,200	25.471	60
M8-Bouday-00	Beqaa	Baalback	Operational			15,000	25.427	61
R8-Qabeeit-1	North	Akkar	Operational			15,000	25.390	62
M9-Baalback-01	Beqaa	Baalback	Non-operational	Not Rehabilitated		36,000	25.319	63
H3- Jiyeh -1n	Mount Lebanon	Chouf	Operational			5,000	25.300	64

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
H3- Wardaniye -1n	Mount Lebanon	Chouf	Operational			4,000	25.277	65
H4-Jdeidet Ech-Chouf-1n	Mount Lebanon	Chouf	Operational			20,000	25.276	66
J4-Kahhale-1n	Mount Lebanon	Aley	Operational			200	25.249	67
H6-Manara and Soltan Yaakoub Al Fawqa-01n	Beqaa	West Beqaa	Operational			16,000	25.230	68
H4-Gharifeh-3n	Mount Lebanon	Chouf	Operational			250	25.230	69
C3-Qabrikha-01	Nabatieh	Marjeyoun	Operational			3,000	25.194	70
K6-Mtain-2	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	25.185	71
L5-Ghosta-0	Mount Lebanon	Kesrouane	Operational			5,000	25.181	72
G3-Kfar Hatta-01	South	Saida	Operational			2,100	25.156	73
L5-Rayfoon-1	Mount Lebanon	Kesrouane	Inaccessible			2,000	25.142	74
S9-Tekreet-0	North	Akkar	Operational			3,000	25.128	75
G3-Aanqoun-00	South	Saida	Operational			1,200	25.107	76
G3-Saida Kefraya-00	South	Saida	Non-operational	Rehabilitated	Removed	0	25.041	77
H3- Chhim - 1n	Mount Lebanon	Chouf	Operational			560	24.891	78
G3-Kfar Melki Saida-01	South	Saida	Operational			2,000	24.860	79
J4- Rwaysset El Naaman- 1n	Mount Lebanon	Baabda	Operational			100	24.760	80
G3-Qennarit-02	South	Saida	Non-operational	Rehabilitated	Covered	11,900	24.750	81
H4-Gharife-2	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Removed	0	24.699	82
R8-Bzal-2	North	Akkar	Non-operational	Rehabilitated	Removed	0	24.667	83
L5-Faytroun-0	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		1,500	24.650	84
J5-Khraibeh-0n	Mount Lebanon	Baabda	Operational			100	24.650	85
Taran-2n	North	Minieh-Dannieh	Operational			100	24.578	86
G5-Machghara-00	Beqaa	West Beqaa	Operational			4,500	24.567	87
M5-Hsayn-0	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		500	24.554	88
Q8-Nimreen-0	North	Minieh-Dannieh	Non-operational	Rehabilitated	Removed	0	24.428	89
C2-Qana-01	South	Sour	Operational			16,000	24.412	90
F2-Merouaniye-00	South	Saida	Operational			500	24.384	91
I4- Remhala -1n	Mount Lebanon	Aley	Operational			4,125	24.335	92
G3-Berti-00	South	Saida	Non-operational	Rehabilitated	Removed	0	24.312	93
R8-Qabeeit-2	North	Akkar	Operational			500	24.279	94
R8-Bzal-1	North	Akkar	Operational			1,950	24.265	95

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
I5- Ouadi Es Set -1n	Mount Lebanon	Chouf	Operational			15	24.207	96
R8-Saysouk-0	North	Akkar	Operational			1,840	24.197	97
C3-Khirbet Selm-00	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	24.186	98
H6-Manara-00	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		2,000	24.173	99
I5-Kefraya-00	Beqaa	West Beqaa	Operational			1,300	24.168	100
J8-Qoussaya-00	Beqaa	Zahle	Non-operational	Rehabilitated	Removed	0	24.155	101
C3-Talloussa-00	Nabatieh	Marjeyoun	Operational			150	24.135	102
G5-Sohmor-00	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		3,600	24.121	103
E3-Kfour En-Nabatieh-03n	Nabatieh	Nabatieh	Operational			400	24.088	104
E4-Blat Marjeyoun-00	Nabatieh	Marjeyoun	Non-operational	Rehabilitated	Removed	0	24.084	105
K4- Fanar- 1n	Mount Lebanon	Maten	Non-operational	Not rehabilitated		135	24.051	106
F2-Seksakiye-00	South	Saida	Operational			7,000	23.991	107
J5-Hamana-1n	Mount Lebanon	Baabda	Operational			1,500	23.976	108
H4- Darayya -- 1n	Mount Lebanon	Chouf	Operational			100	23.926	109
L5-Deir Chamra-3	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	23.918	110
J5- Btalloun-1n	Mount Lebanon	Aley	Operational			15	23.869	111
C2-Chehabiye-00	South	Sour	Operational			15,000	23.864	112
L5-Deir Chamra-1	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	23.863	113
J6-Taalbaya-00	Beqaa	Zahle	Non-operational	Rehabilitated	Covered	250,000	23.862	114
G6-Dahr el Ahmar-01	Beqaa	Rashaya	Operational			4,000	23.842	115
H3- Mazbud -1n	Mount Lebanon	Chouf	Operational			300	23.813	116
O11-Aarsal-00	Beqaa	Baalback	Operational			24,000	23.808	117
O6-Douma-1	North	Batroun	Operational			3,000	23.807	118
Q8-Bakhoun-0	North	Minieh-Dannieh	Non-operational	Not Rehabilitated		6,000	23.797	119
L6- Baskinta- 1n	Mount Lebanon	Maten	Non-operational	Rehabilitated	Covered	1,200	23.742	120
R8-Dinbo-2	North	Akkar	Inaccessible			4,800	23.713	121
P7-Ijbaa-0	North	Zgharta	Non-operational	Not Rehabilitated		400	23.705	122
J7-Deir el Ghazel-00	Beqaa	Zahle	Non-operational	Not Rehabilitated		4,000	23.680	123
B3-Aintaroun-00	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		30	23.662	124
B1-Tayr Harfa-02	South	Sour	Non-operational	Not Rehabilitated		15	23.648	125
G2-Darb Es-Sim-02	South	Saida	Non-operational	Rehabilitated	Covered	12,000	23.641	126
G3-Ouade Baanqoudaine-00	South	Jezzine	Operational			60	23.591	127

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
D4-Khiyam Marjeyoun-00	Nabatieh	Marjeyoun	Non-operational	Not Rehabilitated		2,000	23.557	128
K5-Ras El Maten-0	Mount Lebanon	Baabda	Operational			3,000	23.555	129
J4- Bayssour- 1n	Mount Lebanon	Aley	Operational			10,000	23.549	130
K6-Kfarselwan-0n	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Covered	1,000	23.540	131
F6-Rashaya-01n	Beqaa	Rashaya	Non-operational	Not Rehabilitated		16,000	23.523	132
C2-Mahrouneh-00	South	Sour	Operational			1,250	23.507	133
C4-Meiss Ej-Jabal-00	Nabatieh	Marjeyoun	Operational			2,000	23.455	134
J5-Roeiset Al Ballout-1n	Mount Lebanon	Baabda	Operational			200	23.451	135
M5-Nammoura-1n	Mount Lebanon	Kesrouane	Operational			500	23.424	136
I4-Sirjbeil-5n	Mount Lebanon	Chouf	Operational			50	23.328	137
F4-Aarab Salim-01	Nabatieh	Nabatieh	Operational			9,000	23.286	138
K9-Ham-00n	Beqaa	Baalback	Operational			125	23.255	139
S9-Beet Mallat-0	North	Akkar	Non-operational	Not Rehabilitated		525	23.248	140
E5-Fardis-00	Nabatieh	Hasbaya	Non-operational	Not Rehabilitated		750	23.227	141
P7-Karm Sadde-2n	North	Zgharta	Operational			800	23.224	142
P7-Karm Sadde-1n	North	Zgharta	Operational			1,650	23.211	143
M6-Hrajel-0	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		150	23.162	144
C3-Jmaijme-02	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		360	23.110	145
G5-Sohmor-01n	Beqaa	West Beqaa	Operational			250	23.077	146
M5-Dlebta-1	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		500	23.019	147
L4-Zouk Al Khrab-1	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	23.018	148
N8-Yammoune-00	Beqaa	Baalback	Operational			6,000	23.003	149
L6- Baskinta- 2n	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		45	22.976	150
C2-Sadiqine-00	South	Sour	Operational			6,600	22.972	151
E2-Insariye-00	South	Saida	Operational			3,000	22.947	152
L5-Deir Chamra-4n	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		150	22.930	153
H3- Ketermaya -1n	Mount Lebanon	Chouf	Operational			3,375	22.923	154
K5-Btikhnay-1	Mount Lebanon	Baabda	Non-operational	Not Rehabilitated		10	22.878	155
K9-Nabi Chit-00	Beqaa	Baalback	Operational			7,500	22.878	156
F6-Tannoura-00	Beqaa	Rashaya	Operational			300	22.832	157
S8- Arqa-1n	North	Akkar	Operational			100	22.813	158
H6-Joubb Jannine-00	Beqaa	West Beqaa	Operational			18,000	22.810	159

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
F5-Kfayr Ez-Zait-00	Nabatieh	Hasbaya	Operational			6,000	22.798	160
E4-Kfar Tibnit-00	Nabatieh	Nabatieh	Operational			200,000	22.794	161
L9-Douris-00	Beqaa	Baalback	Non-operational	Rehabilitated	Covered	1,000	22.770	162
Q6-Ras Maska-1	North	Koura	Operational			13,500	22.763	163
C2-Chaaitiye-00	South	Sour	Operational			230	22.659	164
H4- Zaarouriye -2n	Mount Lebanon	Chouf	Operational			1,200	22.638	165
M5-Jouret Bedrane-1	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		2,000	22.634	166
J6-Mrayjet-00	Beqaa	Zahle	Non-operational	Rehabilitated	Removed	0	22.623	167
D4-Khiyam Marjeyoun -02n	Nabatieh	Marjeyoun	Operational			225	22.589	168
F3-Houmine El-Faouqa-00	Nabatieh	Nabatieh	Operational			4,000	22.537	169
T9-Tleel-0	North	Akkar	Non-operational	Rehabilitated	Removed	0	22.527	170
C3-Jmaijme-01	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		75	22.491	171
F5-Ain el Tine-00	Beqaa	West Beqaa	Operational			1,500	22.401	172
J5- Majdel Baana- 1n	Mount Lebanon	Aley	Operational			8,000	22.379	173
O7-Bqarqasha-0	North	Bcharre	Non-operational	Not Rehabilitated		500	22.372	174
I7-Majdal Aanjar-02	Beqaa	Zahle	Operational			30,000	22.364	175
D3-Deir Kifa-00	South	Sour	Operational			2,200	22.353	176
E2-Aadloun-01	South	Saida	Operational			5,000	22.346	177
H4-Aanout-01n	Mount Lebanon	Chouf	Operational			50	22.322	178
S7- Mhamra-1n	North	Akkar	Operational			100	22.313	179
B1-Dhayra-00	South	Sour	Non-operational	Not Rehabilitated		10	22.306	180
H3- Dalhoun - 1n	Mount Lebanon	Chouf	Operational			90	22.277	181
J4- Aitat-2n	Mount Lebanon	Aley	Operational			100	22.276	182
C2-Rmadiye-00	South	Sour	Non-operational	Rehabilitated	Removed	0	22.272	183
D2-Arzai-00	South	Saida	Operational			3,200	22.260	184
I4-Deir El Qamar-0	Mount Lebanon	Chouf	Operational			9,000	22.259	185
H4- Zaarouriye -1n	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		450	22.256	186
K5-Btikhnay-3	Mount Lebanon	Baabda	Operational			1,000	22.249	187
P6-Kaftoun-1	North	Koura	Non-operational	Not Rehabilitated		450	22.249	188
P7-Aintourine-0	North	Zgharta	Non-operational	Not Rehabilitated		400	22.245	189
R7-Jdeidet El Aite-1n	North	Akkar	Operational			6,440	22.245	190
C3-Bany Haiyane-00	Nabatieh	Marjeyoun	Operational			50	22.188	191

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
G3-Kfar Melki Saida-02	South	Saida	Non-operational	Rehabilitated	Removed	0	22.147	192
K6-Mtain-3	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		200	22.124	193
C4-Markaba-00	Nabatieh	Marjeyoun	Operational			3,200	22.076	194
H3-Barja-0	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Removed	0	22.034	195
R8-Birkayel-0	North	Akkar	Non-operational	Not Rehabilitated		25,000	22.002	196
D2-Tayr Dibba-00	South	Sour	Operational			2,700	21.994	197
E5-Aain Jarfa-02	Nabatieh	Hasbaya	Non-operational	Rehabilitated	Removed	0	21.990	198
I6-Ghazze-00	Beqaa	West Beqaa	Operational			30,000	21.984	199
J4- Ainab 01n	Mount Lebanon	Aley	Operational			5	21.981	200
H3 -Mghairiye -2n	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		800	21.980	201
K6-Jouar El Haouz-0	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Removed	0	21.954	202
O7-Bazoun-0	North	Bcharre	Non-operational	Rehabilitated	Removed	0	21.933	203
T10-Mqaible-0	North	Akkar	Inaccessible			420	21.928	204
G6-Dahr el Ahmar-02	Beqaa	Rashaya	Non-operational	Rehabilitated	Removed	0	21.913	205
H6-Mdoukha-01n	Beqaa	Rashaya	Operational			150	21.906	206
G6-Khirbet Rouha-00	Beqaa	Rashaya	Operational			3,500	21.903	207
E3-Harouf En Nabatiyeh-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		200	21.857	208
K5-Btikhnay-2	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Removed	0	21.821	209
K6-Kfarselwan-2n	Mount Lebanon	Baabda	Non-operational	Not Rehabilitated		1,200	21.817	210
K7-Timnine-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		6,000	21.791	211
G5-Qaraoun-00	Beqaa	West Beqaa	Operational			3,750	21.780	212
Q7-Aaymar-0	North	Minieh-Dannieh	Non-operational	Not Rehabilitated		1,800	21.774	213
C3-Chaqra-00	Nabatieh	Bent Jbeil	Operational			1,500	21.762	214
I4-Bchetfine-0n	Mount Lebanon	Chouf	Operational			500	21.749	215
O10-El Ain-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		2,000	21.727	216
S7-Bebnine-0	North	Akkar	Operational			1,250	21.710	217
B2-Aayta Ech-Chaab-01	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Covered	25,550	21.708	218
E4-Qlaiaa-00	Nabatieh	Marjeyoun	Operational			2,000	21.690	219
K6-Aaintoura-2	Mount Lebanon	Maten	Non-operational	Rehabilitated	Covered	20	21.686	220
I5-Kfar Nabrakh-0	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		6,750	21.685	221
J4- Ghaboun- 1n	Mount Lebanon	Aley	Operational			625	21.683	222
G4-Benouati Jezzine-00	South	Jezzine	Non-operational	Not Rehabilitated		1,500	21.602	223

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
M6-Lassa-0	Mount Lebanon	Jbeil	Inaccessible			400	21.598	224
H3- Mghairiye -1n	Mount Lebanon	Chouf	Operational			900	21.523	225
F3-Zefta-00n	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		1,750	21.521	226
I4- Majdel El Meouch-1n	Mount Lebanon	Chouf	Operational			450	21.506	227
I4-Semqaniye-0	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Removed	0	21.479	228
H6-Lala-02	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		1,000	21.477	229
Q8-Beit El Faqs-0	North	Minieh-Dannieh	Inaccessible			60	21.467	230
G3-Kfar Falous-00	South	Jezzine	Operational			700	21.422	231
F3-Aarab Ej-Jall-00	South	Saida	Non-operational	Not Rehabilitated		7	21.418	232
F3-Aazzi-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		110	21.404	233
P10-Ras Baalback-00	Beqaa	Baalback	Operational			11,000	21.402	234
E5-Aain Jarfa-03	Nabatieh	Hasbaya	Non-operational	Not Rehabilitated		2,000	21.389	235
E5-Ain Jarfa-04n	Nabatieh	Hasbaya	Operational			2,400	21.353	236
I7-Sawire-01n	Beqaa	West Beqaa	Operational			6,000	21.343	237
J5-Hamana-0	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Removed	0	21.337	238
H5-Baaloul-00	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		700	21.331	239
K6-Tarchich-0	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Removed	0	21.325	240
T10-Aydamoun-0	North	Akkar	Non-operational	Not Rehabilitated		1,360	21.313	241
G6-Kfar Denis-01n	Beqaa	Rashaya	Operational			1,250	21.311	242
I5- Ain Zhalta-1n	Mount Lebanon	Chouf	Operational			83	21.258	243
E5-Chouaya Hasbaiya-01	Nabatieh	Hasbaya	Operational			500	21.199	244
F4-Aaychiye-00	South	Jezzine	Operational			400	21.197	245
K8-Raite-00	Beqaa	Zahle	Non-operational	Rehabilitated	Covered	1,100	21.187	246
Q7-Morh Kfarsghab-1	North	Zgharta	Non-operational	Rehabilitated	Removed	0	21.177	247
D4-Kfar Kila-00	Nabatieh	Marjeyoun	Non-operational	Rehabilitated	Covered	3,090	21.155	248
K8-Yahfoufa-00n	Beqaa	Baalback	Operational			50	21.128	249
F2-Bissariye-00	South	Saida	Operational			1,400	21.118	250
G3-Aabra Saida-00	South	Saida	Non-operational	Rehabilitated	Removed	0	21.108	251
M6-Qahmez-0	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		1,500	21.094	252
G4-Mazraat El-Mathane-00	South	Jezzine	Operational			90	21.087	253
S8-Hweesh-0	North	Akkar	Operational			1,200	21.087	254
S7-Mqaiteaa-0	North	Akkar	Non-operational	Not Rehabilitated		4,000	21.063	255

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
I4-Aain Ksour-0	Mount Lebanon	Aley	Operational			2,000	21.023	256
E5-Aain Qinia-00	Nabatieh	Hasbaya	Non-operational	Rehabilitated	Covered	6,000	21.016	257
K6-Kfarselwan-1n	Mount Lebanon	Baabda	Operational			500	21.013	258
J7-Kfarzabad-00	Beqaa	Zahle	Operational			10,000	21.009	259
F7-Aayha-01	Beqaa	Rashaya	Non-operational	Rehabilitated	Removed	0	21.005	260
K9-Ham-01n	Beqaa	Baalback	Operational			750	20.995	261
G2-Qraiyet Saida-00	South	Saida	Non-operational	Rehabilitated	Removed	0	20.964	262
L6-Kfar Dibiane-0	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	20.960	263
G6-Kfar Denis-00	Beqaa	Rashaya	Non-operational	Rehabilitated	Covered	100	20.942	264
F5-Zellaya-00	Beqaa	West Beqaa	Operational			500	20.936	265
D3-Qalaouiye-03	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	20.880	266
M9-Nahle-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		4,000	20.870	267
G4-Bkassine-00	South	Jezzine	Non-operational	Rehabilitated	Covered	142	20.862	268
D2-Jannata-00	South	Sour	Operational			100	20.860	269
T7- Cheikh Zened-1n	North	Akkar	Operational			100	20.845	270
J4- Bsatine- 1n	Mount Lebanon	Aley	Operational			750	20.798	271
F3-Houmine El-Tahta-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		2,000	20.792	272
I5-Batloun- 1n	Mount Lebanon	Chouf	Operational			150	20.789	273
D3-Rabb Et-Tlatine-00	Nabatieh	Marjeyoun	Operational			1,500	20.787	274
P5-Heri-1	North	Batroun	Operational			1,000	20.731	275
J4- Mejdlayya -1n	Mount Lebanon	Aley	Operational			560	20.715	276
O8-Bqaa Kafra-0	North	Bcharre	Non-operational	Not Rehabilitated		600	20.714	277
M5-Tabarja-0	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	20.700	278
C2-Majdel-00	South	Sour	Operational			2,000	20.687	279
D2-Tayr Dibba-01	South	Sour	Operational			30	20.684	280
G4-Qtale Jezzine-00	South	Jezzine	Non-operational	Not Rehabilitated		300	20.650	281
S8-Hosniye-0	North	Akkar	Non-operational	Rehabilitated	Covered	2,000	20.649	282
F3-Nmairiye-01	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	20.632	283
E2-Ansar-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		2,000	20.613	284
I5-Ouarhaniye-3n	Mount Lebanon	Chouf	Operational			300	20.609	285
Q11-Hermel-02	Beqaa	Hermel	Operational			58,000	20.573	286
K8-Hay Al Fikani-00n	Beqaa	Zahle	Operational			3,000	20.557	287

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
L8-Haouch El-Refqa-00	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	20.550	288
G3-Ouade El-Laymoun-00	South	Jezzine	Operational			200	20.517	289
F6-Rashaya-02n	Beqaa	Rashaya	Operational			2,500	20.515	290
I7-Sawire-00	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		4,000	20.489	291
I4- Ain Ksour-1n	Mount Lebanon	Aley	Operational			120	20.461	292
R8-Chane-0	North	Akkar	Operational			600	20.433	293
C3-Safad LBattikh-01	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Covered	380	20.432	294
B3-Aain Ibl-00	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		2,400	20.423	295
P7-Ayto-2	North	Zgharta	Non-operational	Not Rehabilitated		800	20.393	296
G2-Darb Es-Sim-01	South	Saida	Non-operational	Rehabilitated	Removed	0	20.342	297
Q7-Deir Nbouh-0	North	Minieh-Dannieh	Non-operational	Rehabilitated	Removed	0	20.313	298
E3-Charqiye-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		3,560	20.298	299
F3- Baouerta- 01n	Mount Lebanon	Chouf	Operational			300	20.288	300
I3- Damour- 1n	Mount Lebanon	Chouf	Operational			1,800	20.281	301
H6-Sultan Yaacoub El Fawqa-00	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		4,000	20.272	302
E3-Douair En-Nabatiyeh-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	20.259	303
F4-Jarjouaa-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Covered	450	20.250	304
J5-Bedghan-0n	Mount Lebanon	Aley	Operational			1,000	20.235	305
M5-Safra-3	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	20.221	306
E3-Kaoutariyet Es-Siyad-01	South	Saida	Operational			4,000	20.199	307
J4- Aley-01n	Mount Lebanon	Aley	Operational			1,000	20.196	308
O9-Ram-01	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	20.162	309
Q7-Karm El-Mohr-0	North	Minieh-Dannieh	Non-operational	Not Rehabilitated		1,000	20.150	310
Q6-Ras Maska-3	North	Koura	Non-operational	Not Rehabilitated		400	20.149	311
L8-Bednayel-00	Beqaa	Baalback	Operational			4,500	20.147	312
J4- Sarhmoul - 1n	Mount Lebanon	Aley	Operational			2	20.110	313
J4-Kayfoun -1n	Mount Lebanon	Aley	Operational			3,000	20.107	314
P5-Kfarhata-1	North	Koura	Non-operational	Not Rehabilitated		1,000	20.069	315
I4-Sirjbal-2	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Covered	25	20.063	316
D3-Qaaqaaiyet Ej-Jisr-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	20.062	317
I4-Kfar Matta-0	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		5,100	20.051	318
E5-Fardis-01n	Nabatieh	Hasbaya	Operational			2,400	20.048	319

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
K5-Kaakour-1	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		3,000	20.044	320
D2-Maaroub-05n	South	Sour	Operational			600	20.028	321
T10-Aaouaainat-1	North	Akkar	Operational			1,220	20.024	322
F4-Rihane Jezzine-00	South	Jezzine	Operational			560	20.017	323
F3-Kfar Fila-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	20.014	324
Q7-Kfaryachit-0	North	Zgharta	Non-operational	Rehabilitated	Removed	0	19.968	325
C3-Aaita Ej-Jabal-00	Nabatieh	Bent Jbeil	Operational			700	19.964	326
E4-Kfar Roummane-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		60	19.945	327
J6-Aana-00	Beqaa	West Beqaa	Non-operational	Rehabilitated	Covered	100	19.936	328
D3-Froun-00	Nabatieh	Bent Jbeil	Operational			1,400	19.894	329
N6-Aaqoura-1	Mount Lebanon	Jbeil	Non-operational	Rehabilitated	Removed	0	19.861	330
C3-Kfar Dounine-00	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	19.848	331
O6-Bcheaali-0	North	Batroun	Non-operational	Rehabilitated	Removed	0	19.810	332
H6-El Bire-01n	Beqaa	Rashaya	Operational			1,050	19.794	333
R8-Dinbo-1	North	Akkar	Operational			4,000	19.743	334
E4-Dibbine-03	Nabatieh	Marjeyoun	Non-operational	Rehabilitated	Removed	0	19.702	335
L8-Taraya-00	Beqaa	Baalback	Operational			8,000	19.679	336
E2-Kharayeb Saida-01n	South	Saida	Operational			1,800	19.659	337
F4-Aarab Salim-02	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		10	19.599	338
D3-Selaa Sour-00	South	Sour	Non-operational	Rehabilitated	Removed	0	19.594	339
D2-Barich-00	South	Sour	Operational			2,000	19.593	340
M9-Haouch Tall Safia-00	Beqaa	Baalback	Operational			4,000	19.592	341
P6-Bsarma-0	North	Koura	Operational			4,350	19.583	342
E3-Jibchit-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		1,130	19.569	343
D2-Sir El Gharbiye-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	19.563	344
P7-Ehden-0	North	Zgharta	Non-operational	Rehabilitated	Removed	0	19.514	345
F3-Kfar Fila-01n	Nabatieh	Nabatieh	Operational			100	19.498	346
B2-Hanine-01	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	19.495	347
C2-Jouaiya-00	South	Sour	Non-operational	Rehabilitated	Removed	0	19.482	348
F4-Aain Qana-03	Nabatieh	Nabatieh	Operational			6,000	19.473	349
G3-Joun-1n	Mount Lebanon	Chouf	Operational			1,200	19.453	350
I4-Sirjbal-3	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Covered	1,050	19.432	351

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
G6-Aaqabe-00	Beqaa	Rashaya	Non-operational	Rehabilitated	Covered	550	19.398	352
I6-Haouch El Harime-00	Beqaa	West Beqaa	Operational			4,000	19.387	353
D2-Maaroub-01	South	Sour	Non-operational	Rehabilitated	Removed	0	19.348	354
I4-Bennaye- 1n	Mount Lebanon	Aley	Operational			960	19.344	355
L9-Taibe-01	Beqaa	Baalback	Non-operational	Rehabilitated	Covered	37,500	19.334	356
F6-Bakkifa-02	Beqaa	Rashaya	Operational			300	19.311	357
G7-Kfarqouq-00	Beqaa	Rashaya	Operational			3,000	19.302	358
O9-Ram-03	Beqaa	Baalback	Operational			15	19.300	359
D3-Srifa-03	South	Sour	Operational			6,000	19.260	360
G3-Zeita-00	South	Saida	Non-operational	Not Rehabilitated		160	19.249	361
I5- Batloun - 2n	Mount Lebanon	Chouf	Operational			140	19.246	362
F6-Ain Aata-00	Beqaa	Rashaya	Inaccessible			1,000	19.236	363
I7-Majdal Aanjar-01	Beqaa	Zahle	Non-operational	Rehabilitated	Covered	2,000	19.225	364
J4- Souk El Gharb -1n	Mount Lebanon	Aley	Operational			1,200	19.215	365
Q6-Btirram-0	North	Koura	Operational			1,400	19.208	366
C3-Deir Ntar-00	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		200	19.191	367
H4- Hasrout -1n	Mount Lebanon	Chouf	Operational			15	19.162	368
R9-Hrar-0	North	Akkar	Non-operational	Not Rehabilitated		2,400	19.148	369
K5- Hasbaya El Maten - 1n	Mount Lebanon	Baabda	Operational			70	19.147	370
I4- Kfarmatta -1n	Mount Lebanon	Aley	Operational			2,500	19.130	371
D5-Kfar Chouba-01	Nabatieh	Hasbaya	Operational			400	19.115	372
S9- Aaiyat-0	North	Akkar	Operational			675	19.105	373
H7-Aita El Foukhar-00	Beqaa	Rashaya	Operational			700	19.060	374
S8-Hosniye-1n	North	Akkar	Non-operational	Rehabilitated	Removed	0	19.044	375
P6-Majdel-1	North	Koura	Operational			1,250	19.021	376
D5-Kfar Chouba-02	Nabatieh	Hasbaya	Non-operational	Not Rehabilitated		150	19.011	377
B1-Aalm Ech-Chaab-00	South	Sour	Non-operational	Not Rehabilitated		1,250	18.997	378
C3-Haris-01	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		500	18.970	379
J4-Aaytat-1n	Mount Lebanon	Aley	Operational			500	18.966	380
R7-Jdeide-0	North	Akkar	Non-operational	Not Rehabilitated		3,000	18.925	381
P7-Torza-2	North	Bcharre	Non-operational	Not Rehabilitated		160	18.906	382
H7-Bakka-00	Beqaa	Rashaya	Operational			300	18.860	383

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
E2-Aadloun-02	South	Saida	Non-operational	Rehabilitated	Removed	0	18.844	384
E2-Kharayeb Saida-00	South	Saida	Non-operational	Not Rehabilitated		3,600	18.842	385
B2-Beit Lif-00	Nabatieh	Bent Jbeil	Operational			2,000	18.833	386
H3- Rmayleh -1n	Mount Lebanon	Chouf	Operational			500	18.816	387
E2-Babliye-00	South	Saida	Operational			1,400	18.707	388
J5- Ain Dara-01n	Mount Lebanon	Aley	Operational			5,000	18.693	389
F6-Bakkifa-01	Beqaa	Rashaya	Operational			250	18.654	390
G6-El Rafid-00	Beqaa	Rashaya	Non-operational	Not Rehabilitated		500	18.621	391
L5-Jeita-1n	Mount Lebanon	Kesrouane	Operational			250	18.605	392
G6-Kfarmechki-00	Beqaa	Rashaya	Non-operational	Rehabilitated	Covered	250	18.592	393
E3-Nabatiyeh El-Faouka-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Covered	170	18.568	394
O10-Laboue-00	Beqaa	Baalback	Operational			12,000	18.564	395
H4- Bsaba- 1n	Mount Lebanon	Chouf	Operational			1,000	18.534	396
H5-Saghbine-00	Beqaa	West Beqaa	Operational			9,000	18.529	397
I5- Barouk- 4n	Mount Lebanon	Chouf	Operational			13	18.515	398
G8-Deir El Achayer-00	Beqaa	Rashaya	Inaccessible			150	18.506	399
J5-Charoun-2	Mount Lebanon	Aley	Non-operational	Rehabilitated	Removed	0	18.500	400
B3-Aaynata Bent Jbayl-00	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Covered	21,100	18.496	401
G6-Majdel Balhis-00	Beqaa	Rashaya	Operational			350	18.484	402
D2-Maaroub-03	South	Sour	Non-operational	Rehabilitated	Removed	0	18.427	403
R8-Sfaynet Al-Qaitaa-2	North	Akkar	Non-operational	Rehabilitated	Covered	600	18.415	404
I4-Bchtfine-0	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Removed	0	18.410	405
B1-Majdelzoun-02	South	Sour	Non-operational	Not Rehabilitated		60	18.398	406
D3-Deir Siriane-00	Nabatieh	Marjeyoun	Operational			1,100	18.396	407
C4-Houla-01	Nabatieh	Marjeyoun	Non-operational	Rehabilitated	Removed	0	18.392	408
B2-Qawzah-00n	Nabatieh	Bent Jbeil	Operational			360	18.382	409
D3-Qalaouiye-01	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	18.380	410
C4-Aadaysse Marjeyoun-00	Nabatieh	Marjeyoun	Operational			500	18.371	411
H6-El Rafid-01n	Beqaa	Rashaya	Operational			1,200	18.362	412
D4-Borj El-Moulouk-00	Nabatieh	Marjeyoun	Operational			1,400	18.343	413
F5-Sohmor-03n	Beqaa	West Beqaa	Operational			4,000	18.329	414
K7-Qaa Er-Rim-00	Beqaa	Zahle	Non-operational	Rehabilitated	Covered	300	18.315	415

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
M8-Jabaa-00	Beqaa	Baalback	Operational			3,000	18.299	416
H7-Yanta-01	Beqaa	Rashaya	Operational			400	18.267	417
L9-Majdaloun-00	Beqaa	Baalback	Operational			6,000	18.266	418
C3-Tibnine-00	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Covered	270	18.244	419
I4-Sirjbal-1	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Removed	0	18.231	420
F4-Aain Qana-04	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		309	18.220	421
B2-Ramyet Bent Jbayl-00	Nabatieh	Bent Jbeil	Operational			4,000	18.197	422
I7-Aanjar-00	Beqaa	Zahle	Non-operational	Rehabilitated	Covered	300	18.168	423
G3-Mjaydel Jezzine-00	South	Jezzine	Operational			600	18.167	424
D3-Befliye-00	South	Sour	Operational			350	18.158	425
I5- Kfarnabrakh -1n	Mount Lebanon	Chouf	Operational			200	18.136	426
D3-Aadchit El-Qouassair-01	Nabatieh	Marjeyoun	Operational			1,500	18.107	427
O10-Harbta-00	Beqaa	Baalback	Operational			3,000	18.102	428
J4- Naameh - 2n	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		2,310	18.094	429
N8-YammoUne-03n	Beqaa	Baalback	Non-operational	Not Rehabilitated		600	18.062	430
P6-Aafsiddek-0	North	Koura	Operational			850	18.033	431
G5-Aitanit-00	Beqaa	West Beqaa	Operational			900	18.029	432
E5-Rachaya El Foukhar-00	Nabatieh	Hasbaya	Operational			100	18.025	433
F3-Deir Ez Zahrani-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	17.996	434
O10-Moqraq-00	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	17.991	435
D3-Qalaouiye-02	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	17.979	436
D2-Yanouh-02	South	Sour	Non-operational	Rehabilitated	Covered	96	17.912	437
D3-Zaoutar El-Gharbiye-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	17.907	438
I5- Barouk - 3n	Mount Lebanon	Chouf	Operational			140	17.852	439
E5-Chebaa-02	Nabatieh	Hasbaya	Operational			400	17.844	440
B3-Kounine-01	Nabatieh	Bent Jbeil	Operational			1,000	17.794	441
H6-Mdoukha-00	Beqaa	Rashaya	Non-operational	Not Rehabilitated		60	17.754	442
F6-Rashaya-00	Beqaa	Rashaya	Inaccessible			1,800	17.739	443
D2-Deir Qanoun En Nahr-00	South	Sour	Operational			4,500	17.718	444
F4-Aaramta-00	South	Jezzine	Operational			1,200	17.708	445
L9-Taibe-02	Beqaa	Baalback	Non-operational	Not Rehabilitated		2,000	17.683	446
D2-Derdaghaiya-03n	South	Sour	Operational			600	17.646	447

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
B3-Yaroun-02	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		150	17.629	448
P6-Amioun-0	North	Koura	Operational			1,800	17.624	449
I4- Kfar Qatra -1n	Mount Lebanon	Chouf	Operational			70	17.621	450
F5-Meimes-00	Nabatieh	Hasbaya	Operational			4,375	17.584	451
Q7-Miziara-0	North	Zgharta	Non-operational	Rehabilitated	Removed	0	17.542	452
D3-Qantara-00	Nabatieh	Marjeyoun	Operational			420	17.535	453
P10-Fekehe and Jdaide-00	Beqaa	Baalback	Operational			6,000	17.533	454
E5-Aain Jarfa-01	Nabatieh	Hasbaya	Non-operational	Not Rehabilitated		3,000	17.498	455
L9-Britel-01n	Beqaa	Baalback	Operational			9,000	17.495	456
I5- Bire- 1n	Mount Lebanon	Chouf	Operational			75	17.494	457
G6-Mhaidse-00	Beqaa	Rashaya	Operational			1,000	17.457	458
B1-Jibbayn-01	South	Sour	Non-operational	Rehabilitated	Removed	0	17.424	459
N9-Qarha-02	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	17.424	460
D2-Borj Rahhal-01	South	Sour	Non-operational	Rehabilitated	Covered	11,960	17.385	461
G3-Sfaray-00	South	Jezzine	Inaccessible			41	17.382	462
F5-Marj Ez-Zouhour-00	Nabatieh	Hasbaya	Operational			800	17.357	463
B1-Tayr Harfa-01	South	Sour	Non-operational	Rehabilitated	Covered	1,120	17.332	464
F6-Ain Harcha-00	Beqaa	Rashaya	Operational			500	17.326	465
H7-Ain Aarab-00	Beqaa	Rashaya	Operational			300	17.293	466
O9-Ram-02	Beqaa	Baalback	Operational			70	17.255	467
O10-Nabi Osman-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		4,500	17.227	468
J4- Naameh - 1n	Mount Lebanon	Chouf	Operational			3,750	17.200	469
D2-Borj Rahhal-02	South	Sour	Operational			1,800	17.192	470
C2-Debaal-02	South	Sour	Operational			4,000	17.191	471
A2-Rmaich-00	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		80	17.167	472
B1-Borj En-Naqoura-00	South	Sour	Non-operational	Rehabilitated	Removed	0	17.164	473
L9-Britel-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		2,500	17.123	474
H6-Kamed El Laouz-00	Beqaa	West Beqaa	Inaccessible			2,625	17.112	475
K7-Ablah-00	Beqaa	Zahle	Non-operational	Rehabilitated	Covered	50	17.111	476
B2-Debl-00	Nabatieh	Bent Jbeil	Non-operational	Not Rehabilitated		4,800	17.110	477
B3-Yaroun-01	Nabatieh	Bent Jbeil	Operational			900	17.082	478
R11-Hermel-01	Beqaa	Hermel	Non-operational	Rehabilitated	Removed	0	17.050	479

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
G2-Saida	South	Saida	Non-operational	Rehabilitated	Removed	0	17.043	480
J5-Bhamdoun Ed-Dayaa-3	Mount Lebanon	Aley	Non-operational	Rehabilitated	Removed	0	17.040	481
F3-Kfar Beit-00	South	Saida	Non-operational	Rehabilitated	Removed	0	17.004	482
R8-Sfaynet Al-Qaitaa-3	North	Akkar	Operational			600	16.999	483
F3-Bnaafoul-00	South	Saida	Non-operational	Not Rehabilitated		1,200	16.986	484
D5-Meri-00	Nabatieh	Hasbaya	Operational			250	16.952	485
O9-Harfoush-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		250	16.948	486
E5-Chebaa-03	Nabatieh	Hasbaya	Non-operational	Not Rehabilitated		3,000	16.939	487
E3-Kaoutariyet Es-Siyad-02	South	Saida	Non-operational	Rehabilitated	Removed	0	16.911	488
B1-Borj En-Naqoura-01n	South	Sour	Operational			3,200	16.900	489
H4- Mazraat Al Daher -1n	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		140	16.890	490
I6-Khiara-00	Beqaa	West Beqaa	Operational			3,240	16.878	491
F5-Yohmor-00	Beqaa	West Beqaa	Operational			1,250	16.866	492
F2-Teffahta-02	South	Saida	Non-operational	Not Rehabilitated		620	16.864	493
C2-Ouadi Jilo-00	South	Sour	Operational			100	16.848	494
E5-Khalouat-00	Nabatieh	Hasbaya	Operational			800	16.842	495
O9-Barqa-00	Beqaa	Baalback	Operational			4,000	16.841	496
H8-Halwa-00	Beqaa	Rashaya	Inaccessible			100	16.827	497
C3-Soultaniyet Bent Jbayl-01	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	16.777	498
R8-Sfaynet Al-Qaitaa-1	North	Akkar	Non-operational	Rehabilitated	Removed	0	16.758	499
P10-Halbata-00	Beqaa	Baalback	Operational			2,000	16.755	500
C2-Aaytit-00	South	Sour	Operational			400	16.726	501
F6-Haouch El Qinaabe-02	Beqaa	Rashaya	Operational			5	16.699	502
D2-Derdaghaiya-01	South	Sour	Non-operational	Rehabilitated	Removed	0	16.690	503
K6-Hazzerta-00	Beqaa	Zahle	Operational			1,000	16.667	504
D2-Derdaghaiya-02	South	Sour	Non-operational	Rehabilitated	Covered	90	16.662	505
G4-Saydoun-00	South	Jezzine	Non-operational	Rehabilitated	Covered	35	16.619	506
R11-El Qasr-01	Beqaa	Hermel	Operational			1,500	16.614	507
B3-Tiri-00	Nabatieh	Bent Jbeil	Operational			1,400	16.580	508
J6-Ain Dara-1n	Mount Lebanon	Aley	Operational			1,000	16.574	509
D3-Borj Qalaouiye-00	Nabatieh	Bent Jbeil	Operational			50	16.572	510
E5-Kaoukaba Hasbaiya-02	Nabatieh	Hasbaya	Non-operational	Rehabilitated	Covered	1,880	16.570	511

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
D2-Maaroub-02	South	Sour	Non-operational	Rehabilitated	Removed	0	16.537	512
B2-Chihine-01	South	Sour	Operational			1,500	16.532	513
G4-Bisri-00	South	Jezzine	Operational			100	16.469	514
N8-Chlifa-00	Beqaa	Baalback	Operational			4,500	16.468	515
D2-Bedias-01	South	Sour	Operational			50	16.464	516
B1-Jibbayn-03n	South	Sour	Operational			1,100	16.460	517
N9-Chaat-00	Beqaa	Baalback	Operational			4,000	16.446	518
G6-kfarmeshki-01n	Beqaa	Rashaya	Operational			1,000	16.438	519
J5- Ramlieh- 1n	Mount Lebanon	Aley	Operational			500	16.407	520
B3-Haddatha-00	Nabatieh	Bent Jbeil	Operational			6,000	16.369	521
D3-Ghandouriyet Bent Jbayl-00	Nabatieh	Bent Jbeil	Operational			300	16.347	522
M8-Haouch el Dahab-00	Beqaa	Baalback	Operational			1,000	16.266	523
G4-Qaytoule-00	South	Jezzine	Non-operational	Rehabilitated	Removed	0	16.239	524
Q11-El Qaa-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		5,500	16.239	525
B3-Rmaich-01n	Nabatieh	Bent Jbeil	Operational			4,000	16.223	526
P6-Kosba-1	North	Koura	Non-operational	Not Rehabilitated		3,700	16.194	527
K8-Seriine El Fawqa-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		3,000	16.174	528
P6-Majdel-2	North	Koura	Non-operational	Rehabilitated	Removed	0	16.128	529
C2-Kafra Bent Jbayl-00	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	16.124	530
N9-Deir El Ahmar-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		500	16.121	531
D2-Yanouh-01	South	Sour	Operational			1,200	16.112	532
B2-Rachaf-00	Nabatieh	Bent Jbeil	Operational			750	16.090	533
D2-Tayr Falsay-00	South	Sour	Non-operational	Not Rehabilitated		3,288	16.012	534
N10-Tawfiqiye-01	Beqaa	Baalback	Non-operational	Not Rehabilitated		1,800	15.992	535
E3-Aaba-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		500	15.983	536
F6-Haouch el Qinaabe-01	Beqaa	Rashaya	Non-operational	Rehabilitated	Covered	20	15.959	537
E3-Zibdine En-Nabatiyeh-02	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	15.951	538
F7-Aayha-02	Beqaa	Rashaya	Operational			2,000	15.897	539
E5-Kaoukaba Hasbaya-01	Nabatieh	Hasbaya	Operational			600	15.801	540
F6-Beit Lahia-00	Beqaa	Rashaya	Operational			3,000	15.719	541
G6-Kaoukaba-01	Beqaa	Rashaya	Non-operational	Rehabilitated	Covered	125	15.715	542
E4-Dibbine-01	Nabatieh	Marjeyoun	Operational			500	15.704	543

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G6-Kaoukaba-02	Beqaa	Rashaya	Operational			125	15.686	544
P6-Kfarhazir-0	North	Koura	Non-operational	Not Rehabilitated		1,100	15.673	545
H7-Yanta-02	Beqaa	Rashaya	Inaccessible			90	15.666	546
M9-Maqne-01	Beqaa	Baalback	Operational			2,500	15.661	547
E5-Kfar Hamam-00	Nabatieh	Hasbaya	Operational			240	15.652	548
F4-Aain Qana-01	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		420	15.649	549
C3-Saouanet Marjeyoun-01	Nabatieh	Marjeyoun	Non-operational	Rehabilitated	Removed	0	15.615	550
E4-Ibl Es-Saqi-00	Nabatieh	Marjeyoun	Operational			1,000	15.611	551
P5-Kifraya-1	North	Koura	Operational			1,500	15.599	552
F2-Qaaqaiyet Es-Snoaubar-01n	South	Saida	Operational			250	15.583	553
C3-Baraachit-00	Nabatieh	Bent Jbeil	Operational			8,000	15.581	554
C3-Majdel Selm-03	Nabatieh	Marjeyoun	Operational			3,000	15.579	555
E2-Zrariye-00	South	Saida	Non-operational	Rehabilitated	Covered	1,146	15.535	556
N9-Qarha-01	Beqaa	Baalback	Operational			105	15.449	557
H6-El Bire-00	Beqaa	Rashaya	Non-operational	Rehabilitated	Removed	0	15.445	558
E2-Ghassaniye-00	South	Saida	Operational			700	15.441	559
F2-Teffahta-01	South	Saida	Operational			250	15.403	560
F5-Maidoun-00	Beqaa	West Beqaa	Operational			1,500	15.365	561
J5-Charoun-3n	Mount Lebanon	Aley	Operational			1,000	15.310	562
B3-Maroun Er-Ras-01	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Covered	1,440	15.287	563
E5-Hasbaya-00	Nabatieh	Hasbaya	Operational			9,000	15.280	564
J4- Btater- 1n	Mount Lebanon	Aley	Operational			80	15.271	565
K7-Qsarnaba-00	Beqaa	Baalback	Operational			6,000	15.226	566
H6-Mansoura-00	Beqaa	West Beqaa	Operational			3,750	15.143	567
M9-Maqne-02	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	15.084	568
H5-Lala-03n	Beqaa	West Beqaa	Operational			2,400	15.081	569
B1-Majdelzoun-03	South	Sour	Non-operational	Rehabilitated	Removed	0	15.047	570
O8-Ainata-02	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	15.039	571
B3-Beit Yahoun-01	Nabatieh	Bent Jbeil	Operational			300	15.000	572
H5-Khirbet Qanafar-02	Beqaa	West Beqaa	Operational			15,000	14.976	573
A2-Aayta Ech-Chaab-02n	Nabatieh	Bent Jbeil	Operational			1,500	14.972	574
F5-Libbaya-00	Beqaa	West Beqaa	Operational			2,000	14.951	575

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
H6-Lala-01	Beqaa	West Beqaa	Non-operational	Rehabilitated	Removed	0	14.950	576
P5-Btaaboura-1	North	Koura	Non-operational	Not Rehabilitated		750	14.931	577
D2-Hallousiyeh-00	South	Sour	Operational			1,200	14.891	578
O9-Harfoush-01n	Beqaa	Baalback	Operational			500	14.883	579
H5-Baaloul-01n	Beqaa	West Beqaa	Operational			2,400	14.823	580
F2-Aadousiye-00	South	Saida	Non-operational	Not Rehabilitated		101	14.805	581
N10-Younine-02	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	14.803	582
F5-Dellafe-00	Nabatieh	Hasbaya	Operational			300	14.802	583
P6-Kfar Aaqqa-0	North	Koura	Non-operational	Not Rehabilitated		7,350	14.759	584
K9-Maaraboun-00	Beqaa	Baalback	Operational			100	14.747	585
C2-Deir Aames-00	South	Sour	Operational			500	14.733	586
Q11-Chawaghir-00	Beqaa	Hermel	Operational			1,750	14.663	587
P5-Bidneyel-0	North	Koura	Operational			550	14.620	588
O10-Nabi Osman-01n	Beqaa	Baalback	Operational			5,000	14.559	589
F3-Khzaiz-00	South	Saida	Non-operational	Rehabilitated	Removed	0	14.509	590
K9-Khraibe-00	Beqaa	Baalback	Non-operational	Not Rehabilitated		20	14.504	591
O8-Ainata-01	Beqaa	Baalback	Operational			500	14.434	592
K9-El Khoder-02	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	14.286	593
K9-El Khoder-01	Beqaa	Baalback	Operational			3,000	14.247	594
D2-Hmairi Sour-00	South	Sour	Operational			600	14.218	595
F2-Qaaqaiyet Es-Snoaubar-00	South	Saida	Non-operational	Rehabilitated	Removed	0	14.115	596
M8-Saaide-00	Beqaa	Baalback	Operational			4,500	13.805	597
F5-Qelia-00	Beqaa	West Beqaa	Operational			500	13.699	598
I4-Richmaiya-0	Mount Lebanon	Aley	Operational			250	13.638	599
D4-Kfar Kila-01n	Nabatieh	Marjeyoun	Operational			2,500	13.597	600
E4-Dibbine-02	Nabatieh	Marjeyoun	Non-operational	Rehabilitated	Removed	0	13.463	601
Q11-El Qaa-02n	Beqaa	Baalback	Operational			1,300	13.356	602
B2-Debl-01n	Nabatieh	Bent Jbeil	Operational			700	13.305	603
N10-Younine-03n	Beqaa	Baalback	Operational			8,000	13.256	604
O10-Zabboud-00	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	13.209	605
Q7-Kfarzaina-0	North	Zgharta	Non-operational	Not Rehabilitated		4,000	13.146	606
B3-Aaynata Bent Jbayl-02n	Nabatieh	Bent Jbeil	Operational			800	13.048	607

Site ID	Mohafaza	Caza	Status	Category	Subcategory	Volume (m^3)	MSWRSI	Priority Rank
O10-Sbouba-00	Beqaa	Baalback	Operational			750	12.972	608
R11-El Qasr-02	Beqaa	Hermel	Inaccessible			6,000	12.921	609
I6-Aammiq-00	Beqaa	West Beqaa	Operational			250	12.895	610
E2-Khartoum-00	South	Saida	Operational			500	12.826	611
B1-Majdelzoun-01	South	Sour	Operational			1,500	12.734	612
N9-Knaisse-00	Beqaa	Baalback	Operational			300	12.491	613
B3-Maroun Er Ras-03n	Nabatieh	Bent Jbeil	Operational			2,800	12.324	614
D2-Bedias-02	South	Sour	Operational			200	12.156	615
N10-Younine-01	Beqaa	Baalback	Non-operational	Rehabilitated	Removed	0	11.406	616
O9-Nabha-00	Beqaa	Baalback	Operational			2,000	11.277	617

Site ID	Mohafaza	Caza	Status	Category	Subcategoy	Volume (m^3)	DRSI	Priority Rank
Q7-Morh Kfarsghab-2	North	Zgharta	Operational			15,200	23.533	1
R7-Deir Ammar-2	North	Minieh-Dannieh	Operational			35,000	23.530	2
K5 - Broummana -1n	Mount Lebanon	Maten	Non-Operational	Not Rehabilitated		72,000	23.478	3
K4-Beit Meri-00	Mount Lebanon	Maten	Operational			75,000	23.210	4
P6-Kosba-2	North	Koura	Operational			57,500	23.187	5
L5-Balloune-2	Mount Lebanon	Kesrouane	Operational			30,000	23.164	6
L5-Qlaiaat-3	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		45,000	22.850	7
I5-Maaser Ech Chouf-0	Mount Lebanon	Chouf	Operational			8,000	22.594	8
L4-Dik Al-Mahdi-0	Mount Lebanon	Maten	Operational			20,000	22.509	9
K5- Ras El Maten-2n	Mount Lebanon	Maten	Operational			150,000	22.500	10
L8-Chmestar-01	Beqaa	Baalback	Operational			10,000	22.150	11
L5-Aain Er-Rihane-3	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		100,000	22.075	12
L4-Mtayleb-1	Mount Lebanon	Maten	Operational			4,500	21.821	13
L4-Zouk Al Khrab-6n	Mount Lebanon	Maten	Operational			5,000	21.737	14
L4-Zouk Al Khrab-5	Mount Lebanon	Maten	Operational			5,000	21.486	15
M9-Maqne-07n	Beqaa	Baalback	Operational			12,500	21.393	16
J4-Aaytat-0	Mount Lebanon	Aley	Operational			40,000	21.387	17
O6-Tartej-0n	Mount Lebanon	Jbeil	Operational			1,800	21.367	18
L5- KfarTay- 1n	Mount Lebanon	Maten	Non-Operational	Not Rehabilitated		58,800	21.340	19
N10-Rasm Al Hadath-00n	Beqaa	Baalback	Operational			10,500	21.303	20
O6-Douma-2	North	Batroun	Operational			10,800	21.247	21
Q8-Taran-0	North	Minieh-Dannieh	Operational			6,000	21.223	22
R7-Aachach-0	North	Zgharta	Operational			6,300	20.997	23
B3-Bent Jbayl-01n	Nabatieh	Bent Jbeil	Operational			6,000	20.947	24
L5-Qlaiaat-4	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		8,000	20.704	25
M5-Jouret Bedrane-2	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		5,000	20.681	26
S8-Cheikh Mohammad-0	North	Akkar	Operational			8,000	20.548	27
L5-Balloune-1	Mount Lebanon	Kesrouane	Operational			30,000	20.454	28
B3-Aain Ibl-01n	Nabatieh	Bent Jbeil	Operational			3,000	20.315	29
N5-Hbaline-1n	Mount Lebanon	Jbeil	Operational			1,200	19.958	30
B3-Kounine-02	Nabatieh	Bent Jbeil	Operational			2,000	19.925	31
F7-Aayha-03n	Beqaa	Rashaya	Operational			2,500	19.922	32

Site ID	Mohafaza	Caza	Status	Category	Subcategoy	Volume (m^3)	DRSI	Priority Rank
K8-Rayak-00	Beqaa	Zahle	Operational			5,000	19.914	33
G3-Maghdouche-00	South	Saida	Operational			5,000	19.910	34
T10-Jabal Al Mansoura-0	North	Akkar	Non-operational	Not Rehabilitated		3,750	19.848	35
N9-Maqne-05n	Beqaa	Baalback	Operational			12,000	19.817	36
M9-Haouch Tall Safia-01n	Beqaa	Baalback	Operational			4,500	19.791	37
L9-Taibe-03n	Beqaa	Baalback	Operational			2,500	19.789	38
J5-Rouayset El Ballout-0	Mount Lebanon	Baabda	Operational			1,500	19.721	39
E5-Chebaa-01	Nabatieh	Hasbaya	Operational			36,000	19.717	40
S8-Khreibet El-Jindi-0	North	Akkar	Operational			275	19.688	41
N6-Qartaba-1n	Mount Lebanon	Jbeil	Operational			4,000	19.670	42
N8-Yammone-05n	Beqaa	Baalback	Operational			7,000	19.630	43
E4-Dibbine-04n	Nabatieh	Marjeyoun	Operational			6,000	19.580	44
O6-Douma-3n	North	Batroun	Operational			540	19.504	45
C3-Kfar Dounine-01n	Nabatieh	Bent Jbeil	Operational			6,000	19.498	46
F4-Aaramte-01n	Nabatieh	Nabatieh	Operational			7,500	19.489	47
J8-Qussayya-01n	Beqaa	Zahle	Operational			2,500	19.452	48
N8-Yammone-01n	Beqaa	Baalback	Operational			6,000	19.421	49
C2-Mahrouneh-01n	South	Sour	Operational			4,000	19.378	50
E3-Habbouch-02	Nabatieh	Nabatieh	Operational			10,000	19.303	51
O10-Labwe-01n	Beqaa	Baalback	Operational			2,000	19.271	52
L5-Qornet Al Hamra-1n	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		1,000	19.245	53
I4-Ammiq Ech-Chouf-1n	Mount Lebanon	Chouf	Operational			3,000	19.127	54
B3-Beit Yahoun-02	Nabatieh	Bent Jbeil	Operational			6,000	19.056	55
P5-Heri-2	North	Koura	Operational			8,000	19.041	56
O6-Kfour El Aarbi-1	North	Batroun	Operational			1,000	19.006	57
L5-Khinchara-2	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		2,000	19.001	58
F5-Kfayr-01n	Nabatieh	Hasbaya	Operational			1,000	19.000	59
L6-Baskinta-1	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		2,000	18.950	60
R8-Jdeidet El Qaitaa-2	North	Akkar	Operational			500	18.906	61
I4-Dmit-0	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Covered	360,000	18.838	62
C3-Qabrikha-02	Nabatieh	Marjeyoun	Operational			900	18.835	63
K7-Niha-00	Beqaa	Zahle	Operational			8,000	18.821	64

Site ID	Mohafaza	Caza	Status	Category	Subcategoy	Volume (m^3)	DRSI	Priority Rank
O10-Nabi Osman-02n	Beqaa	Baalback	Operational			12,000	18.819	65
J5-Majdel Baana-1	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		9,000	18.812	66
K5-Baabdat-2	Mount Lebanon	Maten	Operational			3,000	18.805	67
C3-Kfar Dounine-03n	Nabatieh	Bent Jbeil	Operational			800	18.792	68
O9-Ram-04n	Beqaa	Baalback	Operational			4,000	18.770	69
H4-Jdeidet Ech Chouf-0	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		100	18.763	70
C3-Haris-02	Nabatieh	Bent Jbeil	Operational			200	18.716	71
N8-Yammone-04n	Beqaa	Baalback	Operational			9,000	18.642	72
M5-Safra-4	Mount Lebanon	Kesrouane	Operational			100	18.612	73
C2-Kafra Bent Jbayl-01n	Nabatieh	Bent Jbeil	Operational			1,000	18.612	74
N8-Yammone-02n	Beqaa	Baalback	Operational			4,000	18.550	75
G4-Roum-00	South	Jezzine	Operational			2,400	18.532	76
K5-Kaakour-2	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		500	18.492	77
L5-Qlaiaat-5n	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		175	18.484	78
O6-Bchaele-1	North	Batroun	Operational			5,500	18.433	79
G3-Kfar Melki Saida-03n	South	Saida	Operational			400	18.401	80
T10-Aandqat-0	North	Akkar	Operational			4,500	18.386	81
Q7-Karm El Mahr-1	North	Minieh-Dannieh	Operational			100	18.314	82
T9-Kouachra-0	North	Akkar	Non-operational	Not Rehabilitated		2,400	18.278	83
N10-Al-Tawfiqiyi-02n	Beqaa	Baalback	Operational			10,000	18.267	84
K5-Baabdat-3n	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		200	18.241	85
S8-Khreibet El-Jindi-1n	North	Akkar	Operational			750	18.228	86
K8-Ali Al Nahre-00	Beqaa	Zahle	Operational			4,500	18.227	87
M9-Maqne-03n	Beqaa	Baalback	Operational			4,000	18.223	88
M5-Safra-1	Mount Lebanon	Kesrouane	Operational			30	18.164	89
S9-Aaiyat-1n	North	Akkar	Operational			795	18.144	90
P7-Ayto-1	North	Zgharta	Non-operational	Not Rehabilitated		2,200	18.143	91
K7-El Forzol-00	Beqaa	Zahle	Operational			2,500	18.088	92
E2-Quasmiye-03n	South	Saida	Operational			2,000	18.050	93
F6-Rashaya-03n	Beqaa	Rashaya	Operational			4,000	18.049	94
C3-Soultaniyet Bent Jbayl-02	Nabatieh	Bent Jbeil	Operational			2,000	18.041	95
L5-Qlaiaat-2	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		10,000	18.039	96

Site ID	Mohafaza	Caza	Status	Category	Subcategoy	Volume (m^3)	DRSI	Priority Rank
Q11-Elqaa-01	Beqaa	Hermel	Non-operational	Not Rehabilitated		1,500	18.001	97
K6-Aaintoura-3n	Mount Lebanon	Maten	Operational			400	18.001	98
J8-Deir Al-Ghazal-01n	Beqaa	Zahle	Operational			2,500	17.990	99
I4-Baaouarta-0	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		3,000	17.982	100
C4-Houla-02	Nabatieh	Marjeyoun	Non-operational	Not Rehabilitated		1,000	17.979	101
M5-Ghazir-0	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		15,000	17.923	102
M5-Safra-8n	Mount Lebanon	Kesrouane	Operational			300	17.909	103
T9-Tleel-1n	North	Akkar	Operational			2,600	17.879	104
S10-Qbaiyat-0	North	Akkar	Operational			3,000	17.817	105
M8-Kfarden-01n	Beqaa	Baalback	Operational			300	17.794	106
C3-Haris-03	Nabatieh	Bent Jbeil	Operational			300	17.743	107
P7-Beslouqit-1	North	Zgharta	Non-operational	Not Rehabilitated		3,000	17.700	108
M5-Safra-5	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		50	17.644	109
P5-Bidneyel-1	North	Koura	Operational			3,700	17.610	110
M5-Kfour-0	Mount Lebanon	Kesrouane	Inaccessbile			15,000	17.564	111
O6-Kfour El-Aarbi-4	North	Batroun	Operational			2,100	17.555	112
L4-Beit Al Chaar-0	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		5,000	17.533	113
P10-Ras Baalback-01n	Beqaa	Baalback	Operational			2,000	17.524	114
M5-Ghidras-0	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		750	17.471	115
D2-Aabassiyeh Sour-00	South	Sour	Operational			4,800	17.437	116
L6-Marjaba-0	Mount Lebanon	Maten	Operational			500	17.422	117
E4-Qlaiaa-01n	Nabatieh	Marjeyoun	Operational			4,500	17.420	118
D4-Khiyam Marjeyoun-01n	Nabatieh	Marjeyoun	Operational			300	17.417	119
I7-Aanjar-01n	Beqaa	Zahle	Operational			8,000	17.404	120
L4-Zouk Al Khrab-4	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		14,000	17.327	121
C2-Hannaouy-01N	South	Sour	Non-operational	Not Rehabilitated		3,000	17.317	122
P7-Hadchit-0	North	Bcharre	Non-operational	Not Rehabilitated		1,800	17.316	123
Q6-Ras Maska-4	North	Koura	Non-operational	Not Rehabilitated		2,000	17.314	124
J6-Jdita-00	Beqaa	Zahle	Operational			3,000	17.297	125
I4-Deir El-Qamar-1n	Mount Lebanon	Chouf	Operational			200	17.290	126
C3-Kfar Dounine-02n	Nabatieh	Bent Jbeil	Operational			400	17.138	127
C2-Mazraat Mechref-00n	South	Sour	Operational			600	17.112	128

Site ID	Mohafaza	Caza	Status	Category	Subcategoy	Volume (m^3)	DRSI	Priority Rank
L5-Aajaltoun-1	Mount Lebanon	Kesrouane	Operational			20,000	17.090	129
P6-Qalhaat-0n	North	Koura	Non-operational	Not Rehabilitated		450	17.054	130
L5-Deir Chamra-2	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		300	17.021	131
I4-Ammiq Ech Chouf-0	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Covered	200,000	16.943	132
D5-Kfar Chouba-03	Nabatieh	Hasbaya	Non-operational	Not Rehabilitated		5,200	16.867	133
D2-Aabassiyeh-02	South	Sour	Operational			4,000	16.860	134
M5-Nahr El-Dahab-0	Mount Lebanon	Kesrouane	Operational			2,000	16.858	135
L4-Zouk Mousbeh-7	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Covered	2,000	16.790	136
K5-Kaakour-3n	Mount Lebanon	Maten	Non-operational	Rehabilitated	Covered	4,000	16.788	137
P7-Beslouqit-2	North	Zgharta	Non-operational	Not Rehabilitated		150	16.738	138
C3-Majdel Selm-02	Nabatieh	Marjeyoun	Non-operational	Not Rehabilitated		5,000	16.697	139
K5-Mar Moussa Ed-Douar-0	Mount Lebanon	Maten	Non-operational	Rehabilitated	Covered	30,000	16.680	140
C4-Meiss Ej Jabal-01n	Nabatieh	Marjeyoun	Operational			1,600	16.672	141
C4-Bani Hayan-01n	Nabatieh	Marjeyoun	Operational			200	16.631	142
E4-Ibl Es-Saqi-01n	Nabatieh	Marjeyoun	Operational			300	16.597	143
C3-Harris-04n	Nabatieh	Bent Jbeil	Operational			150	16.573	144
B3-Maroun Er Ras-02	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	16.496	145
N8-Chlifa-01n	Beqaa	Baalback	Operational			1,500	16.494	146
C3-Safad El-Battikh-03n	Nabatieh	Bent Jbeil	Operational			2,500	16.494	147
H7-Aytta Al-Fokhar-01n	Beqaa	Rashaya	Operational			200	16.486	148
O6-Bchaele-3	North	Batroun	Operational			800	16.478	149
P5-Kifraya-2	North	Koura	Non-operational	Not Rehabilitated		5,700	16.437	150
J8-Terbol-01n	Beqaa	Zahle	Operational			2,250	16.434	151
F4-Aain Qana-05n	Nabatieh	Nabatieh	Operational			600	16.400	152
P7-Karm Sadde-0	North	Zgharta	Operational			1,400	16.343	153
J5-Baalechmey-1n	Mount Lebanon	Baabda	Operational			450	16.339	154
C3-Safad El-Battikh-04n	Nabatieh	Bent Jbeil	Operational			100	16.315	155
H5-Khirbet Qanafar-01	Beqaa	West Beqaa	Operational			7,500	16.276	156
J5-Ras El Harf-1	Mount Lebanon	Baabda	Non-operational	Not Rehabilitated		5,400	16.269	157
J5-Chbaniye-0	Mount Lebanon	Baabda	Non-operational	Not Rehabilitated		10,000	16.242	158
L5-Aachqout-0	Mount Lebanon	Kesrouane	Operational			5,500	16.239	159
M5-Safra-6	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		700	16.238	160

Site ID	Mohafaza	Caza	Status	Category	Subcategoy	Volume (m^3)	DRSI	Priority Rank
N9-Younine-04n	Beqaa	Baalback	Operational			2,500	16.233	161
D2-Ouidi Jilo-01n	South	Sour	Non-operational	Not Rehabilitated		400	16.232	162
D3-Chehour-00	South	Sour	Operational			600	16.106	163
F2-Sarafand-02	South	Saida	Non-operational	Not Rehabilitated		3,600	16.090	164
Q7-Aarjis-0	North	Zgharta	Operational			2,000	16.086	165
E2-Ghassaniye-01n	South	Saida	Operational			2,000	16.076	166
K6-Mtain-1	Mount Lebanon	Maten	Operational			900	16.048	167
O8-Barqa-01n	Beqaa	Baalback	Operational			3,000	16.041	168
M9-Maqne-06n	Beqaa	Baalback	Operational			3,000	16.038	169
F4-Aain Qana-02	Nabatieh	Nabatieh	Operational			100	16.033	170
K7-El Forzol-01	Beqaa	Zahle	Operational			1,500	15.956	171
P5-Btaaboura-2	North	Koura	Operational			2,400	15.937	172
F4-Aarab Salim-03n	Nabatieh	Nabatieh	Operational			600	15.900	173
K8-Raite-01n	Beqaa	Zahle	Operational			2,000	15.870	174
J4-Kahhale-0	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Covered	14,000	15.869	175
H4-Daraiya Ech Chouf-0	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Covered	9,000	15.833	176
L4-Zouk Mousbeh-1	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		4,000	15.784	177
B3-Aain Ibl-02n	Nabatieh	Bent Jbeil	Operational			300	15.781	178
Q7-Iaal-1	North	Zgharta	Non-operational	Not Rehabilitated		1,600	15.779	179
G3-Kfar Hatta-02	South	Saida	Non-operational	Not Rehabilitated		2,200	15.764	180
O9-Ram-05n	Beqaa	Baalback	Operational			2,000	15.748	181
G5-Sohmor-02n	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		500	15.721	182
E2-Aadloun-03n	South	Saida	Operational			1,000	15.717	183
K6-Aaintoura-1	Mount Lebanon	Maten	Operational			300	15.632	184
B2-Beit Lif-01n	Nabatieh	Bent Jbeil	Operational			300	15.630	185
E3-Habbouch-01	Nabatieh	Nabatieh	Operational			200	15.609	186
E3-Kfour En-Nabatiyeh-02n	Nabatieh	Nabatieh	Operational			900	15.583	187
G3-Kfar Hatta Saida-03n	South	Saida	Operational			1,000	15.565	188
G6-Mhadyse-03	Beqaa	Rashaya	Operational			1,800	15.561	189
C1-Deir Qanoun El-Aain-02	South	Sour	Operational			100	15.539	190
F2-Bissariye-01n	South	Saida	Operational			1,000	15.536	191
D3-Deir Kifa-01n	South	Sour	Operational			300	15.530	192

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C4-Houla-04n	Nabatieh	Marjeyoun	Operational			800	15.510	193
E3-Harouf En-Nabatiyeh-01n	Nabatieh	Nabatieh	Operational			1,500	15.496	194
L4-Zouk Al Khrab-3	Mount Lebanon	Maten	Non-operational	Rehabilitated	Covered	42,000	15.424	195
D4-Kfar Kila-02n	Nabatieh	Marjeyoun	Operational			2,250	15.407	196
L5- Zabbougha -1n	Mount Lebanon	Maten	Operational			800	15.406	197
F5-Meimes-01n	Nabatieh	Hasbaya	Operational			1,000	15.338	198
N9-Chaat-01n	Beqaa	Baalback	Operational			6,000	15.325	199
J5-Aazounieh-3n	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		250	15.323	200
F3-Aazzi-01n	Nabatieh	Nabatieh	Operational			13	15.319	201
D2-Deir Qanoun El-Naher-01	South	Sour	Operational			1,000	15.229	202
O8-Ainata-03n	Beqaa	Baalback	Operational			2,500	15.180	203
G3-Kfar Hatta Saida-04n	South	Saida	Operational			200	15.172	204
E3-Harouf En-Nabatiyeh-02n	Nabatieh	Nabatieh	Operational			800	15.166	205
L5-Btighreen-0	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		125	15.142	206
H6-Kamed El-Lawz-01n	Beqaa	West Beqaa	Non-operational	Not Rehabilitated		400	15.138	207
L5-Khinchara-1	Mount Lebanon	Maten	Operational			250	15.113	208
I5-Ouarhaniye-02	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		1,200	15.063	209
L9-Douris-01n	Beqaa	Baalback	Operational			1,500	15.021	210
D3-Selaa Sour-01n	South	Sour	Non-operational	Not Rehabilitated		30	15.017	211
K5-Ras El Maten-1n	Mount Lebanon	Baabda	Non-operational	Not Rehabilitated		500	15.002	212
D3-Srifa-04	South	Sour	Operational			20	14.934	213
J5-Aazounieh-2n	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		50	14.886	214
M5-Kfar Yasine-0	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Covered	4,500	14.884	215
G6-Mhadyse-02	Beqaa	Rashaya	Operational			1,200	14.850	216
E2-Quasmiye-01n	South	Saida	Operational			750	14.780	217
J8-Kfarzabad-01n	Beqaa	Zahle	Operational			2,000	14.777	218
J5-Ras El Harf-3	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Covered	3,600	14.695	219
J5-Bhamdoun Ed Dayaa-2	Mount Lebanon	Aley	Non-operational	Rehabilitated	Covered	6,250	14.672	220
H4-Mazraat Ech Chouf-1	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		500	14.667	221
K5-Kaakour-5n	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		2,000	14.591	222
N9-Maqne-04n	Beqaa	Baalback	Operational			1,000	14.573	223
P6-Kaftoun-2	North	Koura	Operational			1,000	14.547	224

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E2-Ansar-01n	Nabatieh	Nabatieh	Operational			800	14.538	225
B3-Aaynata Bent Jbayl-01n	Nabatieh	Bent Jbeil	Operational			6,000	14.465	226
J5-Baalechmey-0n	Mount Lebanon	Baabda	Operational			500	14.420	227
O6-Kfour El Aarbi-3	North	Batroun	Operational			1,500	14.322	228
M5-Safra-7n	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		500	14.254	229
J6-Bouarej-00	Beqaa	Zahle	Non-operational	Not Rehabilitated		100	14.243	230
C3-Jmaijme-03	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	14.165	231
J5-Ras El Harf-2	Mount Lebanon	Baabda	Non-operational	Rehabilitated	Covered	1,800	14.156	232
K5-Aayoun-0	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	14.124	233
L5-Kfar Aaqab-2	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		300	14.121	234
L5-Aajaltoun-2	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		1,200	14.104	235
N6-Yanouh-1n	Mount Lebanon	Jbeil	Non-operational	Not Rehabilitated		1,000	14.102	236
J4-Aaraya-0	Mount Lebanon	Aley	Non-operational	Rehabilitated	Covered	20,000	14.097	237
I4-Aatrine-2	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		200	14.088	238
D3-Befliye-01N	South	Sour	Non-operational	Not Rehabilitated		240	14.071	239
D2-Abbasiyat-01	South	Sour	Operational			6,500	14.059	240
K5-Kaakour-4n	mount lebanon	Maten	Non-operational	Not Rehabilitated		150	14.058	241
D4-Arnoun-00	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		400	13.964	242
P6-Kosba-3	North	Koura	Non-operational	Not Rehabilitated		456	13.926	243
G4-Wadi Jezzine-00	South	Jezzine	Non-operational	Not Rehabilitated		400	13.925	244
L5-Kfar Aaqab-1	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		2,000	13.901	245
D2-Toura-02	South	Sour	Non-operational	Not Rehabilitated		150	13.840	246
I4-Sirjbal-4	Mount Lebanon	Chouf	Operational			1,000	13.822	247
J5-Aazounieh-0	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		2,000	13.804	248
L4-Deir Tamich-1	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Covered	4,500	13.754	249
K4-Roumie-0	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	13.751	250
N9-Maqne-08n	Beqaa	Baalback	Operational			5,000	13.709	251
L5-Khinchara-4	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		200	13.645	252
B2-Hanine-02	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	13.603	253
P6-Kaftoun-3	North	Koura	Operational			700	13.566	254
N6-Qartaba-2n	Mount Lebanon	Jbeil	Operational			2,000	13.539	255
E3-Kfour Nabatiyeh-01n	Nabatieh	Nabatieh	Operational			300	13.480	256

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D2-Maaroub-04n	South	Sour	Non-operational	Not Rehabilitated		900	13.477	257
C3-Saouanet Marjeyoun-02	Nabatieh	Marjeyoun	Non-operational	Not Rehabilitated		1,500	13.468	258
I4-Aabey-1N	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		500	13.434	259
L5-Khinchara-5	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		15	13.407	260
J5-Charoun-1	Mount Lebanon	Aley	Non-operational	Not Rehabilitated		400	13.380	261
D3-Srifa-01	South	Sour	Non-operational	Not Rehabilitated		400	13.226	262
C3-Safad El-Battikh-02	Nabatieh	Bent Jbeil	Non-operational	Rehabilitated	Removed	0	13.179	263
Q6-Ras Maska-2	North	Koura	Non-operational	Not Rehabilitated		3,400	13.131	264
J5-Charoun-4n	Mount Lebanon	Aley	Operational			150	13.102	265
L5-Khinchara-3	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		50	13.070	266
M5-Safra-2	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		2,000	13.000	267
L4-Zouk Mousbeh-5	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	12.990	268
G4-Homsiye-00	South	Jezzine	Non-operational	Not Rehabilitated		600	12.959	269
L6-Baskinta-3	Mount Lebanon	Maten	Non-operational	Rehabilitated	Covered	4,000	12.888	270
O8-Bqaa Kafra-1n	North	Bcharre	Operational			1,200	12.877	271
I4- Abey - 2n	Mount Lebanon	Aley	Operational			2,500	12.821	272
P5-Hamat-2	North	Batroun	Non-operational	Rehabilitated	Covered	1,500	12.800	273
C3-Majdel Selm-01	Nabatieh	Marjeyoun	Non-operational	Not Rehabilitated		300	12.789	274
H4-Mazraat Ech Chouf-4	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		3,500	12.780	275
C4-Houla-03	Nabatieh	Marjeyoun	Non-operational	Not Rehabilitated		400	12.715	276
B2-Chihine-02	South	Sour	Non-operational	Not Rehabilitated		50	12.693	277
H4-Mazraat Ech Chouf-3	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Covered	6,000	12.458	278
L4-Zouk Mousbeh-6	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	12.417	279
B3-Haddatha-01n	Nabatieh	Bent Jbeil	Operational			25	12.415	280
I5-Ouarhaniye-1	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		450	12.353	281
T10-Aaouaainat-2	North	Akkar	Non-operational	Rehabilitated	Removed	0	12.327	282
L5-Aain Er-Rihane-2	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	12.310	283
E5-Chouaya Hasbaiya-02	Nabatieh	Hasbaya	Non-operational	Not Rehabilitated		1,550	12.154	284
J5-Bhamdoun Ed Dayaa-1	Mount Lebanon	Aley	Non-operational	Rehabilitated	Removed	0	12.154	285
E3-Zibdine En Nabatiyeh-01	Nabatieh	Nabatieh	Non-operational	Not Rehabilitated		4,300	12.098	286
I4-Aatrine-1	Mount Lebanon	Chouf	Non-operational	Not Rehabilitated		10,000	11.974	287
L4-Zouk Al Khrab-2	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	11.948	288

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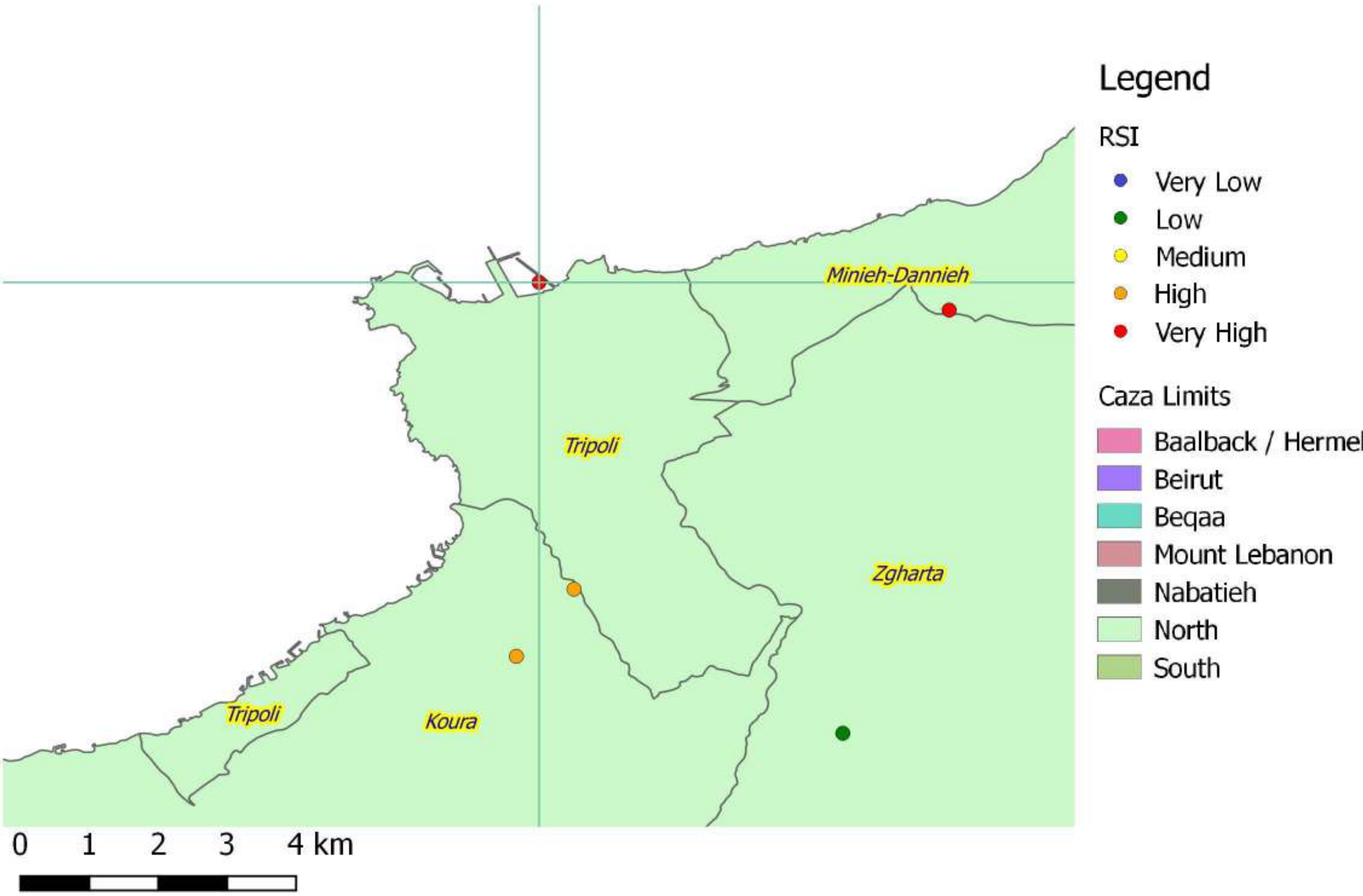
L4-Deir Tamich-2	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	11.828	289
E5-Koukaba Hasbaya-03n	Nabatieh	Hasbaya	Operational			4,500	11.748	290
D2-Toura-01	South	Sour	Non-operational	Rehabilitated	Covered	500	11.623	291
L4-Zouk Mousbeh-8	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Covered	720	11.532	292
B3-Yaroun-03n	Nabatieh	Bent Jbeil	Operational			1,400	11.482	293
D2-Bedias-03	South	Sour	Non-operational	Not Rehabilitated		150	11.415	294
K5-Ed Douar-0	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		75	11.411	295
L4-Zouk Mousbeh-4	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	11.389	296
D3-Zaoutar El-Gharbiye-01n	Nabatieh	Nabatieh	Operational			400	11.212	297
F4-Jbaa En-Nabatiyeh-01n	Nabatieh	Nabatieh	Operational			200	11.056	298
B1-Jibbayn-02	South	Sour	Non-operational	Rehabilitated	Removed	0	10.907	299
D2-Bedias-04	South	Sour	Non-operational	Rehabilitated	Covered	627	10.896	300
G3-Qennarit-03	South	Saida	Non-operational	Rehabilitated	Removed	0	10.890	301
D3-Deir Serian-01n	Nabatieh	Marjeyoun	Operational			75	10.742	302
M5-Dlebta-2	Mount Lebanon	Kesrouane	Non-operational	Not Rehabilitated		100	10.718	303
D4-Yohmor En-Nabatiyeh-00	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	10.718	304
K5-Baabdat-1	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	10.681	305
L6-Baskinta-2	Mount Lebanon	Maten	Non-operational	Not Rehabilitated		300	10.651	306
L4-Zouk Mousbeh-3	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	10.598	307
C2-Qana-02	South	Sour	Non-operational	Rehabilitated	Removed	0	10.544	308
T10-Aaouaainat-3	North	Akkar	Non-operational	Rehabilitated	Removed	0	10.497	309
C2-Debaal-01	South	Sour	Non-operational	Rehabilitated	Removed	0	10.470	310
Q7-Iaal-2	North	Zgharta	Non-operational	Rehabilitated	Removed	0	10.455	311
O6-Bchaele-2	North	Batroun	Non-operational	Not Rehabilitated		600	10.444	312
H4-Mazraat Ech Chouf-2	Mount Lebanon	Chouf	Non-operational	Rehabilitated	Covered	3,000	10.302	313
L4-Deir Mar Aabda el Mshammar-0	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	10.101	314
L4-Zouk Mousbeh-2	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	10.089	315
M5-Shahtoul-0	Mount Lebanon	Kesrouane	Non-operational	Rehabilitated	Removed	0	10.009	316
E3-Zibdine En-Nabatiyeh-03n	Nabatieh	Nabatieh	Operational			400	9.856	317
F2-Teffahta-03n	South	Saida	Operational			50	9.819	318
K6-Mrooj-0	Mount Lebanon	Maten	Non-operational	Rehabilitated	Removed	0	9.693	319

Site ID	Mohafaza	Caza	Status	Category	Subcategoy	Volume (m^3)	DRSI	Priority Rank
J4-Dfoun-0	Mount Lebanon	Aley	Non-operational	Rehabilitated	Removed	0	9.436	320
P7-Torza-1	North	Bcharre	Non-operational	Rehabilitated	Removed	0	9.062	321
F3-Nmairiye-02	Nabatieh	Nabatieh	Non-operational	Rehabilitated	Removed	0	8.674	322
D3-Srifa-02	South	Sour	Non-operational	Rehabilitated	Removed	0	8.590	323
N6-Aapoura-2	Mount Lebanon	Jbeil	Non-operational	Rehabilitated	Removed	0	8.016	324

APPENDIX E – DATASHEETS FOR PRIORITY DUMPSITES

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: R6-Tripoli-0

Location of dumpsite (WGS-1984):

X: 35.83 m

Y: 34.45 m

Z: 0.0 m

Mohafaza: North

Caza: Tripoli

Town: Tripoli

Distance to urban areas: 2100 m

Dump status: Operational

Estimated volume: 1200000.0 m3

Area: 67000 m2

Visibility: Y

Priority Ranking for Rehabilitation: 1

Risk Sensitivity Index Score: 40.73

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**R6-Tripoli-0**
X	35.839
Y	34.372
Z	0 m
Mohafaza	North Lebanon
Caza	Tripoli
Town	Tripoli
2- Type of Dump	Elaborated hill
Distance to Urban areas	140 m
Open Burning	No
3- Estimated Volume	1,206,000 m^3
Area	67,000 m^2
Height	18 m
Quantity of waste currently dumped	450 t/d
Waste coming from	Union of Municipalities of Fayhaa
4- Priority Ranking for Rehabilitation	**1**
Risk Sensitivity Index Score	40.733 out of 55
5- Preferred Rehabilitation Option	Grade, cap, manage gases and leachate
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of extending the life expectancy of the dump and raising the plateau to 19 m, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm compacted soil layer, 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. d-Active harnessing of gases from the dumpsite by drilling the necessary number of gas wells 21 gas wells) and installing silica-based gravel inside gas wells, gas collection pipes (perforated and non perforated HDPE pipes), headers and subheaders (HDPE pipes), grouts and plugs, and the appropriate blower and connect them to the gas flaring unit. e- Leachate collection and recirculation including construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Drilling of leachate recirculation wells with all accessories. Leachate and diverted rain water should be collected in the existing leachate collection tank supplied with the necessary pumping system and returned back to site through the recirculation wells.
7- Responsibility	Union of Municipalities of Fayhaa
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management.
11 - Estimated cost (USD)	6,557,287 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	5.437 USD/m^3
12- Possible sources of financing	Donor agencies

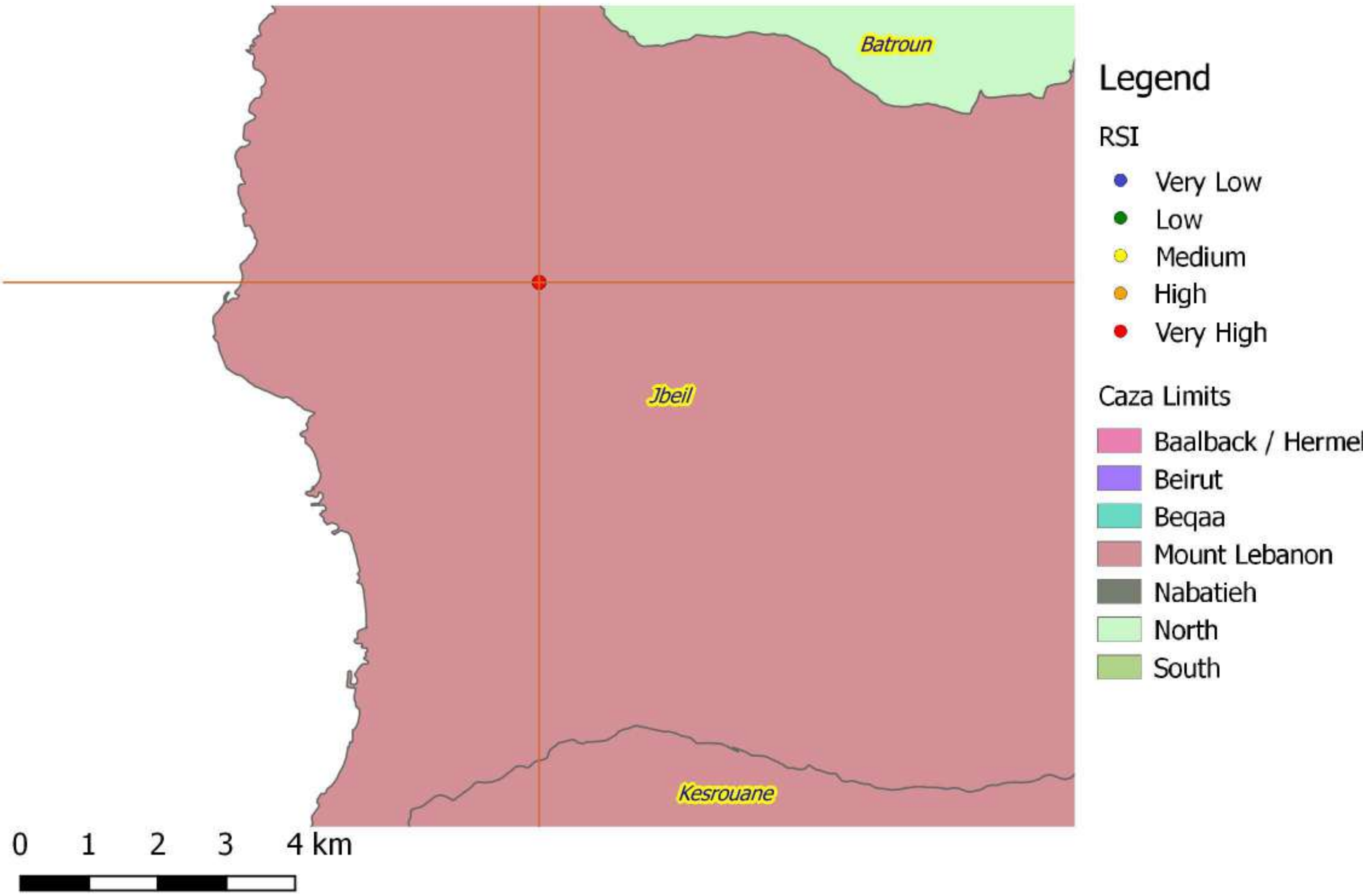
COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	50,000.0	50,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	50,000.0	50,000
2. Waste reshaping (cut & fill) - Earthworks				
2.1 - Waste reshaping - Cut	m^3	1,317.42	4.00	5,269.68
2.2- Soil for the formation of plateu, smoothing layer and roads	m^3	101,904.50	2.00	203,809.00
3. Sealing Works				
3.1- Construction of the sealing surface of the existing landfill, which includes a leveling layer, gas drainage layer, a separation geotextile, a sealing layer, a drainage layer, a separation geotextile, soil and a cultivation layer (Cells 0-5)				
3.2-Leveling layer 0,30 m	m^3	22,516.04	12.00	270,192.42
3.3-Gas drainage layer 0,30 m (gravel)	m^3	22,516.04	40.00	900,641.40
3.4-Separation geotextile (500g/m^2)	m^2	75,053.45	3.00	225,160.35
3.5-Sealing layer 0,50 m (clay)	m^3	37,526.73	12.00	450,320.70
3.6-Drainage layer 0,50 m (gravel)	m^3	37,526.73	40.00	1,501,069.00
3.7-Separation geotextile (500g/m^2)	m^2	75,053.45	3.00	225,160.35
3.8-Soil/ Cultivation layer 0,5 m	m^3	37,526.73	20.00	750,534.50
3. Leachate Management Works				
4.1- Vertical leachate recirculation wells				
4.1.1- Drilling (11 items)	m	110.00	120.00	13,200.00
4.1.2- Non perforated Pipe HDPE PN10	m	25.00	110.00	2,750.00
4.1.3- Perforated Pipe HDPE PN10	m	85.00	150.00	12,750.00
4.1.4- Bentonite seal	m^3	56.20	10.00	562.00
4.1.5- Gravel backfill 25/50	m^3	380.75	40.00	15,230.00
4.1.6- Other items (valves, flanges, etc.)	item	1.00	15,000.00	15,000.00
4.2- Leachate recirculation network, recirculation pump station				
4.2.1- Recirculation pump station	item	1.00	40,000.00	40,000.00
4.2.2- Leachate recirculation pipe from leachate treatment facility to leachate pumpstation	m	10.00	75.00	750.00
4.2.3- Main leachate recirculation pipe network	m	492.00	75.00	36,900.00
4.2.4- Secondary leachate recirculation pipe network	m	910.00	25.00	22,750.00
4.2.5-Excavation of trench for the installation of the main leachate recirculation network (0,50 x 0,50)	m^3	123.00	6.00	738.00
4.2.6- Sand layer 0,20 m	m^3	49.20	20.00	984.00
4.2.7- Backfill material 0,30 m	m3	73.80	9.00	664.20
4.2.8- Excavation of trench for the installation of the secondary leachate recirculation network (0,30 x 0,30)	m^3	81.90	81.90	6,707.61
4.2.9- Sand layer 0,12 m	m^3	32.76	20.00	655.20
4.2.10- Backfill material 0,18 m	m^3	49.14	9.00	442.26
4.2.11-Leachate treatment (treatment plant, pipe work, etc)	item	1.00	1,000,000.00	1,000,000.00
5. Biogas Management Works				
5.1- Construction of LFG vertical wells and conveyance network for the existing and the proposed landfill				
5.1.1-Drilling of LFG wells (21 items)	m	546.00	120.00	65,520.00
5.1.2-Non perforated Pipe HDPE PN10	m	84.00	110.00	9,240.00
5.1.3- Perforated Pipe HDPE PN10	m	462.00	150.00	69,300.00
5.1.4- Non perforated Concrete Protection Pipe	m	10.50	140.00	1,470.00
5.1.5- Bentonite seal	m^3	88.12	10.00	881.17
5.1.6- Gravel backfill 25/50	m^3	484.64	40.00	19,385.60
5.1.7- -Galvanized biogas well heads	item	21.00	700.00	14,700.00
5.1.8- Manifolds	item	3.00	5,000.00	15,000.00
5.1.9- Condensate traps	item	3.00	600.00	1,800.00
5.1.10- HDPE pipe from manifolds to flare	m	488.26	100.00	48,826.00

5.1.11- HDPE pipe from wells to manifolds	m	1,232.24	80.00	98,579.20
5.1.12- Excavation of trench for the installation of the conveyance network (0,50 x 0,50)	m^3	430.14	6.00	2,580.84
5.1.13- Sand layer 0,20 m	m^3	172.05	20.00	3,441.00
5.1.14 -Backfill material 0,30 m	m^3	258.08	9.00	2,322.68
5.1.15 -Miscellaneous biogas management works (Flaring unit)	item	1.00	150,000.00	150,000.00
6. Monitoring				
6.1- Groundwater monitoring wells	item	3	20,000.00	60,000.00
6.2- Biogas monitoring well	item	12.00	1,000.00	12,000.00
6.3- Environmental monitoring equipment	item	1.00	30,000.00	30,000.00
6.4- Control and Supervision	item	1.00	250,000.00	250,000.00
TOTAL COST (USD)				**6,557,287**
AVERAGE COST (USD/m^3)				**5.437**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: N5-Hbaline-0

Location of dumpsite (WGS-1984):

X: 35.68 m

Y: 34.15 m

Z: 232.0 m

Mohafaza: Mount Lebanon

Caza: Jbeil

Town: Hbaline

Distance to urban areas: 500 m

Dump status: Operational

Estimated volume: 600000.0 m3

Area: 40000 m2

Visibility: Y

Priority Ranking for Rehabilitation: 2

Risk Sensitivity Index Score: 40.32

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**N5-Hbaline-0**	
X	35.679	
Y	34.155	
Z	232 m	
Mohafaza	Mount Lebanon	
Caza	Jbeil	
Town	Hbaline	
2- Type of Dump	Dump in Valley or seasonal water channel	
Distance to Urban areas	177 m	
Open Burning	No	
3- Estimated Volume	600,000 m^3	
Area	40,000 m^2	
Height	15 m	
Quantity of waste currently dumped	120 t/d	
Waste coming from	All villages of the caza of Jbeil	
4- Priority Ranking for Rehabilitation	**2**	
Risk Sensitivity Index Score	40.316 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Grade, cap, manage gases and leachate Option 2 - Convert to a sanitary landfill	
6- Technical Requirements	Option 1 - a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. d-Active harnessing of gases from the dumpsite by drilling the necessary number of gas wells (minimum 1 gas well for each 10,000 m^3 of waste) and installing silica-based gravel inside gas wells, gas collection pipes (perforated and non perforated HDPE pipes), headers and subheaders (HDPE pipes), grouts and plugs, and the appropriate blower and gas flaring unit. e- Leachate collection and recirculation including construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessary pumping system and returned back to site through the recirculation wells.	
	Option 2 - Convert to sanitary landfill after expropriating additional lands from the other side of the valley and constructing the water culvert. This includes the Installation of the necessary composite liner system and soil protection measures for preparing the bottom of the sanitary landfill and all active gas wells harnessing system.	
7- Responsibility	Union of Municipalities of Jbeil & Municipality of Hbaline	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management.	
11 - Estimated cost (USD)	2,931,075 USD for Option 1	6,946,524 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	4.885 USD/m^3 for Option 1	11.578 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Option 1 - Grade, cap, manage gases and leachate

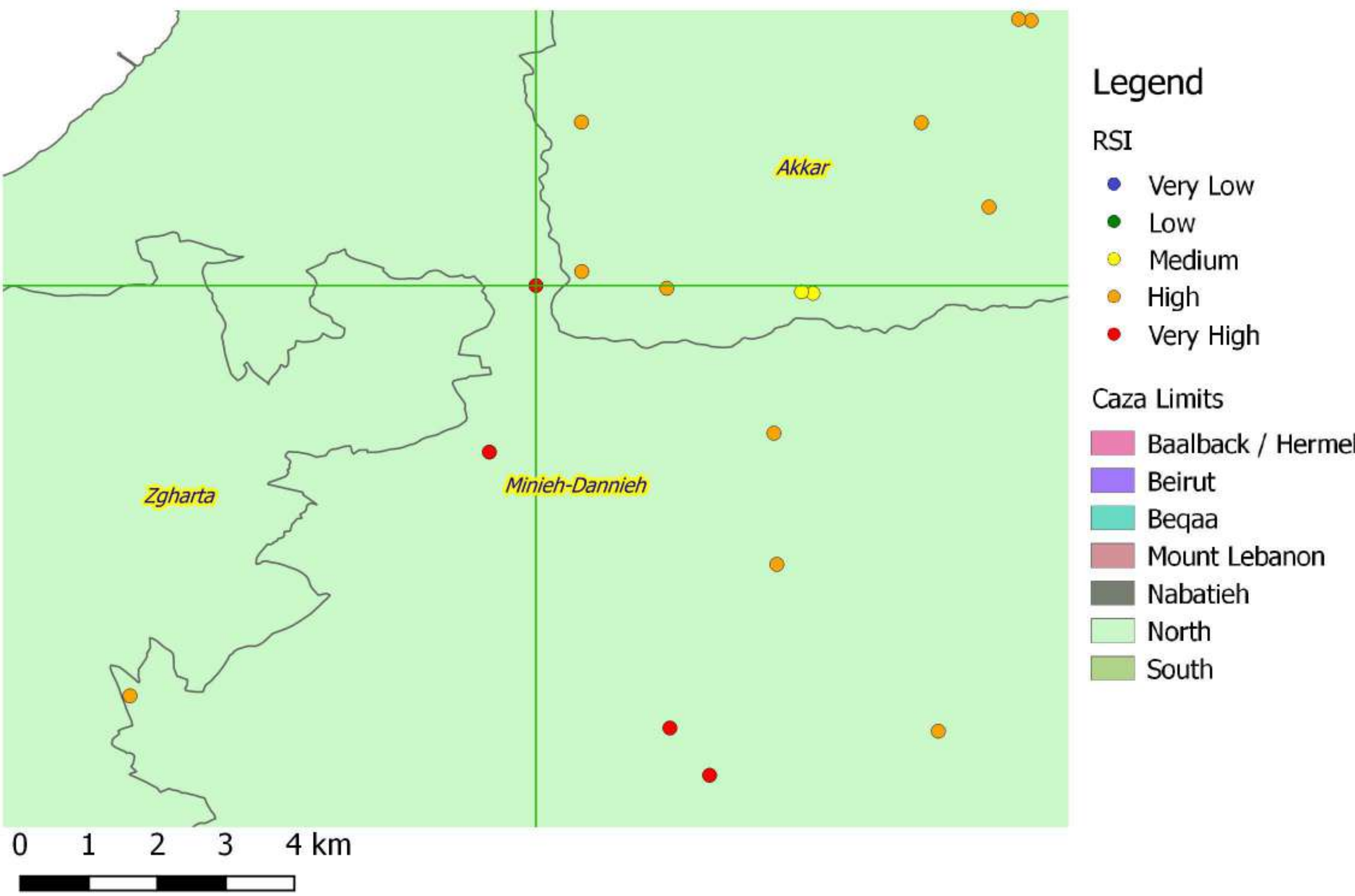
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	15,000.0	15,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	40,000.0	40,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	120,000	4.0	480,000
2.2 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	40,000	2.0	80,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	24,000	14.0	336,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	14,400	40.0	576,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	14,400	15.0	216,000
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	48,000	4.0	192,000
4. Gas Management Works				
4.1 -Drilling of gas wells: The drilling should be done using an auger (preferably a hollow stem Auger type). The diameter of all boreholes is fixed to 90 cm while the depth vary according to depth of waste. The Radius of influence of gas wells to vary between 15 and 20 m.	lm	900	125.0	112,500
4.2 - Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage.	m^3	572	50.0	28,575
4.3 - Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	900	130.0	117,000
4.4 -Supply and install connection headers including main venting header and sub venting header, complete including all accessries. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves,m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc.	Lm	2,100	140.0	294,000
4.5 - Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 50 m3/hr	unit	1	90,000.0	90,000
4.6- Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	50	50.0	2,500
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 50 m3 complete including pumping system and recirculation system	unit	1	50,000.0	50,000
5.2 - Leachate recirculation network: Include pipe networks, recirculation wells, excavation and backfilling	unit	1	80,000.0	80,000
5.3 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	700	45.0	31,500
5.4 - Cut off walls	lm	400	100.0	40,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	150,000.0	150,000
TOTAL COST (USD)				**2,931,075**
AVERAGE COST (USD/m^3)				**4.885**

Option 2 - Convert to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	15,000.0	15,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, design of the new landfill, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	40,000.0	40,000
2. Earth Movement Works				
2.1 - Excavate the waste in the dump and transfer to the newly formed sanitary landfill	m^3	600,000	3.0	1,800,000
3. Construction of three cells of the sanitary landfill				
3.1 -Bottom sealing works. Including soil shaping, subbase, sealing layer, geomembrane, geotextile, drainage and sand layer (Area 30,000 m2)	30,000			
Excavation and surface preparation	m^3	30,000	6.0	180,000
Subbase	m^3	7,500	10.00	75,000
Sealing layer 0,50 m (clay)	m^3	15,000	12.00	180,000
Geomembrane HDPE 2mm	m^2	36,000	10.00	360,000
Separation geotextile (500g/m^2)	m^2	36,000	3.00	108,000
Drainage layer 0,50 m (gravel)	m^3	15,000	40.00	600,000
Sand layer	m^3	3,750	20.00	75,000
3.2 - **Construction of the sealing surface** of the three cells including a leveling layer, gas drainage layer, a separation geotextile, a sealing layer, a drainage layer, a separation geotextile, soil and a cultivation layer (Cells 1-2)				
Leveling layer 0,30 m	m^3	9,000	12.00	108,000
Gas drainage layer 0,30 m (gravel)	m^3	9,000	40.00	360,000
Separation geotextile (500g/m^2)	m^2	30,000	3.00	90,000
Sealing layer 0,50 m (clay)	m^3	15,000	12.00	180,000
Drainage layer 0,50 m (gravel)	m^3	15,000	40.00	600,000
Separation geotextile (500g/m^2)	m^2	30,000	3.00	90,000
Soil 0,70 m	m^3	21,000	20.00	420,000
Cultivation layer 0,30 m	m^3	9,000	15.00	135,000
3.3 - Leachate collection network for the proposed two cells				0
Leachate collection network	m	2,000	110.00	220,000
Leachate collection - transfer pipe	m	250	150.00	37,500
Leachate collection shaft	item	3	5,000.00	15,000
Excavation of trench for the installation of the main leachate collection network, sand and backfilling	m^3	300	15.00	4,500
Leachate pumping station	unit	1	40,000.00	40,000
Leachate treatment plant (RO system)	unit	1	500,000.00	500,000
6.4 - Biogas management including construction of LFG vertical wells and conveyance network and biogas flaring unit				0
Construction of gas wells within a Radius of influence of 15 and 20 m.	lm	48	125.0	6,000
Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage	m^3	30	50.0	1,524
Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	720	130.0	93,600
Supply and install connection headers including main venting header and sub venting header, complete including all accessries. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves,m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc	Lm	800	150.0	120,000
Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 50 m^3/hr	unit	1	90,000.0	90,000
Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	48	50.0	2,400
4. Culvert Diversion work				
4.1- Construct a culvert along the length of the site to divert the river	Lm	300	500.0	150,000
4. Control and Monitoring				
4.1 - Control and Monitoring of works	LS	1	250,000.0	250,000
TOTAL COST (USD)				**6,946,524**
AVERAGE COST (USD/m^3)				**11.578**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: R7-Adweh-0

Distance to urban areas: 1600 m

Location of dumpsite (WGS-1984):

Dump status: Operational

X: 35.99 m

Estimated volume: 255372.0 m3

Y: 34.45 m

Area: 21281 m2

Z: 215.03 m

Visibility: Y

Mohafaza: North

Priority Ranking for Rehabilitation: 3

Caza: Minieh-Dannieh

Risk Sensitivity Index Score: 34.76

Town: Adweh

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

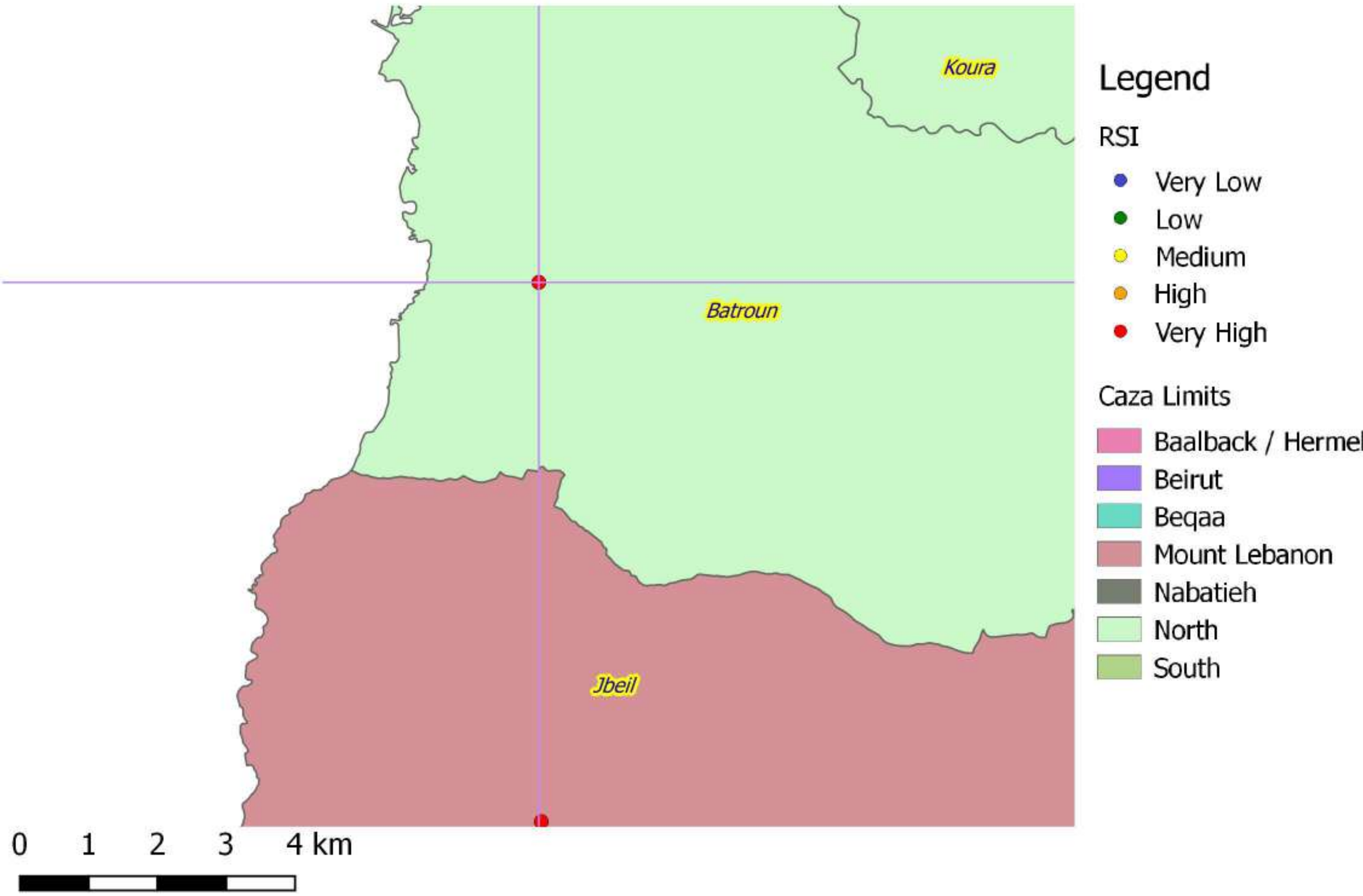
1- Site Name and Location	**R7-Adweh-0**
X	35.988
Y	34.451
Z	215 m
Mohafaza	North
Caza	El Minieh
Town	Adweh
2- Type of Dump	Dump in Valley or seasonal water channel
Distance to Urban areas	131 m
Open Burning	No
3- Estimated Volume	255,372 m^3
Area	21,281 m^2
Height	12 m
Quantity of waste currently dumped	150 t/d
Waste coming from	Most of the villages of Minieh, Koura and Diniyeh
4- Priority Ranking for Rehabilitation	**3**
Risk Sensitivity Index Score	34.762 out of 55
5- Preferred Rehabilitation Option	Grade, cap, manage gases and leachate
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. d-Active harnessing of gases from the dumpsite by drilling the necessary number of gas wells (minimum 1 gas well for each 10000 m^3 of waste) and installing silica-based gravel inside gas wells, gas collection pipes (perforated and non perforated HDPE pipes), headers and subheaders (HDPE pipes), grouts and plugs, and the appropriate blower and gas flaring unit. e- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.
7- Responsibility	Union of Municipalities of El Minieh / Municipality of Adweh
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management
11 - Estimated cost (USD)	1,612,762 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	6.315 USD/m^3
12- Possible sources of financing	National Budget or donor agencies

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	15,000.0	15,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	30,000.0	30,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	89,380	4.0	357,521
2.2- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	21,281	2.0	42,562
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	12,769	14.0	178,760
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	7,661	40.0	306,446
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	7,661	15.0	114,917
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	25,537	4.0	102,149
4. Gas Management Works				
4.1 -Drilling of gas wells: The drilling should be done using an auger (preferably a hollow stem Auger type). The diameter of all boreholes is fixed to 90 cm while the depth vary according to depth of waste. The Radius of influence of gas wells to vary between 15 and 20 m.	lm	306	125.0	38,306
4.2 - Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage.	m^3	195	50.0	9,730
4.3 - Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	306	130.0	39,838
4.4 -Supply and install connection headers including main venting header and sub venting header, complete including all accessries. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves,m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc.	Lm	966	140.0	135,256
4.5 - Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 40 m^3/hr	unit	1	75,000.0	75,000
4.6- Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	26	50.0	1,277
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 40 m3 complete including pumping system	unit	1	30,000.0	30,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	800	45.0	36,000
5.3 - Cut off walls	lm	500	100.0	50,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	50,000.0	50,000
TOTAL COST (USD)				**1,612,762**
AVERAGE COST (USD/m^3)				**6.315**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: P5-Batroun-0

Location of dumpsite (WGS-1984):

X: 35.68 m

Y: 34.24 m

Z: 94.27 m

Mohafaza: North

Caza: Batroun

Town: Batroun

Distance to urban areas: 7000 m

Dump status: Operational

Estimated volume: 55000.0 m3

Area: 22000 m2

Visibility: N

Priority Ranking for Rehabilitation: 4

Risk Sensitivity Index Score: 34.6

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

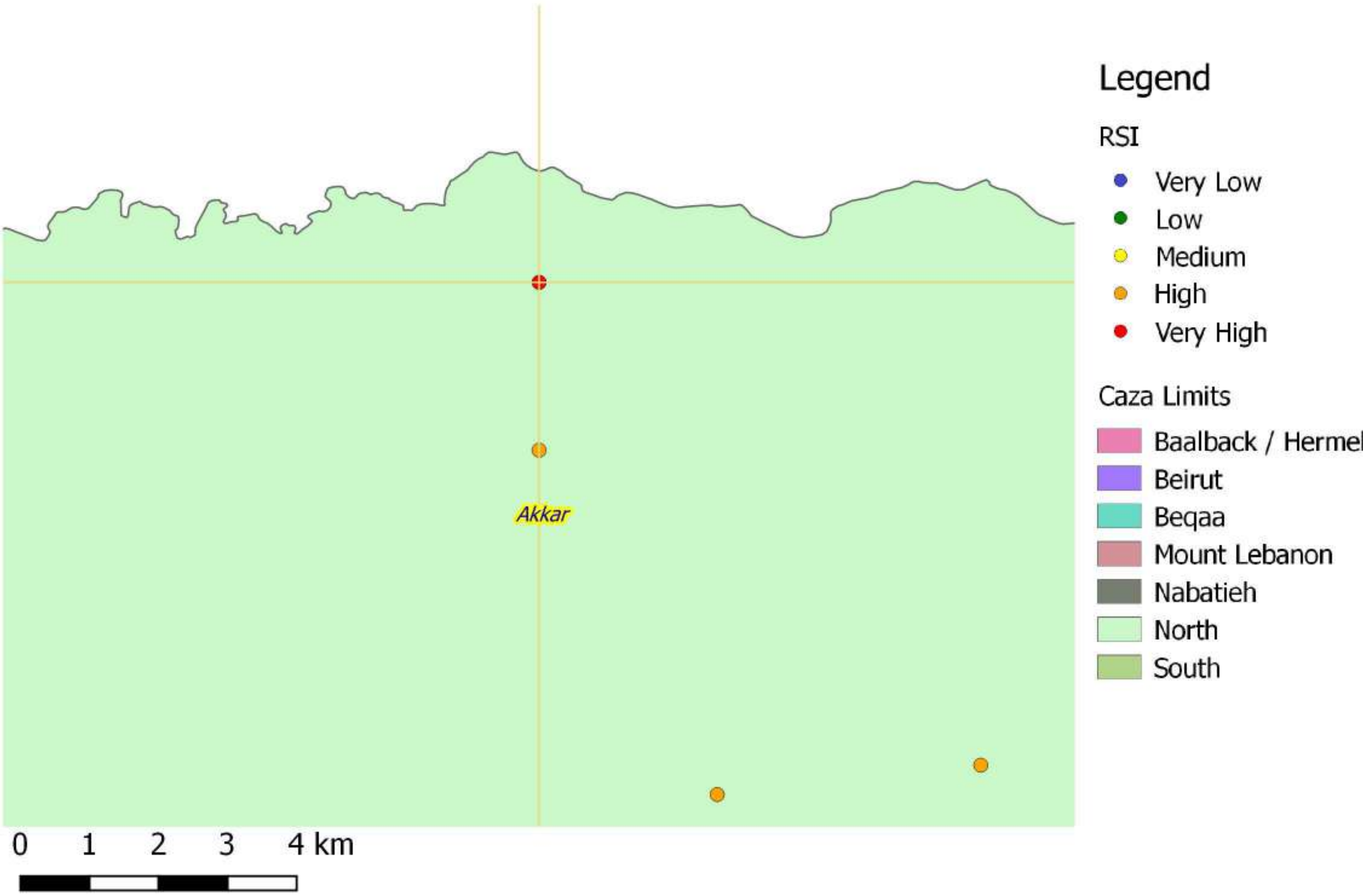
1- Site Name and Location	**P5-Batroun-0**
X	35.667
Y	34.240
Z	94 m
Mohafaza	North Lebanon
Caza	Batroun
Town	Batroun
2- Type of Dump	Dumps in used-up surface quarry
Distance to Urban areas	100 m
Open Burning	No
3- Estimated Volume	55,000 m^3
Area	22,000 m^2
Height	2.5 m
Quantity of waste currently dumped	80 t/d
Waste coming from	All Batroun Villages
4- Priority Ranking for Rehabilitation	**4**
Risk Sensitivity Index Score	34.599 out of 55
5- Preferred Rehabilitation Option	Excavate, line, grade, cap, manage gases and collect leachate
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location (one third the area) within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.
7- Responsibility	Union of Municipality of Batroun
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.
11 - Estimated cost (USD)	1,039,300 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	18.896 USD/m^3
12- Possible sources of financing	National Budget or donor agencies

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	20,000.0	20,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	55,000	4.0	220,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	6,600	14.0	92,400
2.2.1-Install a geomembrane liner and geotextile	m^2	11,000	13.0	143,000
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby	m^3	27,500	4.0	110,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	11,000	2.0	22,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	6,600	14.0	92,400
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	3,300	40.0	132,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	3,300	15.0	49,500
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	11,000	4.0	44,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	20,000.0	20,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	10,000.0	10,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	200	45.0	9,000
5.3 - Cut off walls	lm	150	100.0	15,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	50,000.0	50,000
TOTAL COST (USD)				**1,039,300**
AVERAGE COST (USD/m^3)				**18.896**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: T9-Srar-0

Location of dumpsite (WGS-1984):

X: 36.13 m

Y: 34.62 m

Z: 140.54 m

Mohafaza: North

Caza: Akkar

Town: Srar

Distance to urban areas: 1300 m

Dump status: Operational

Estimated volume: 570000.0 m3

Area: 38000 m2

Visibility: N

Priority Ranking for Rehabilitation: 5

Risk Sensitivity Index Score: 34.28

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

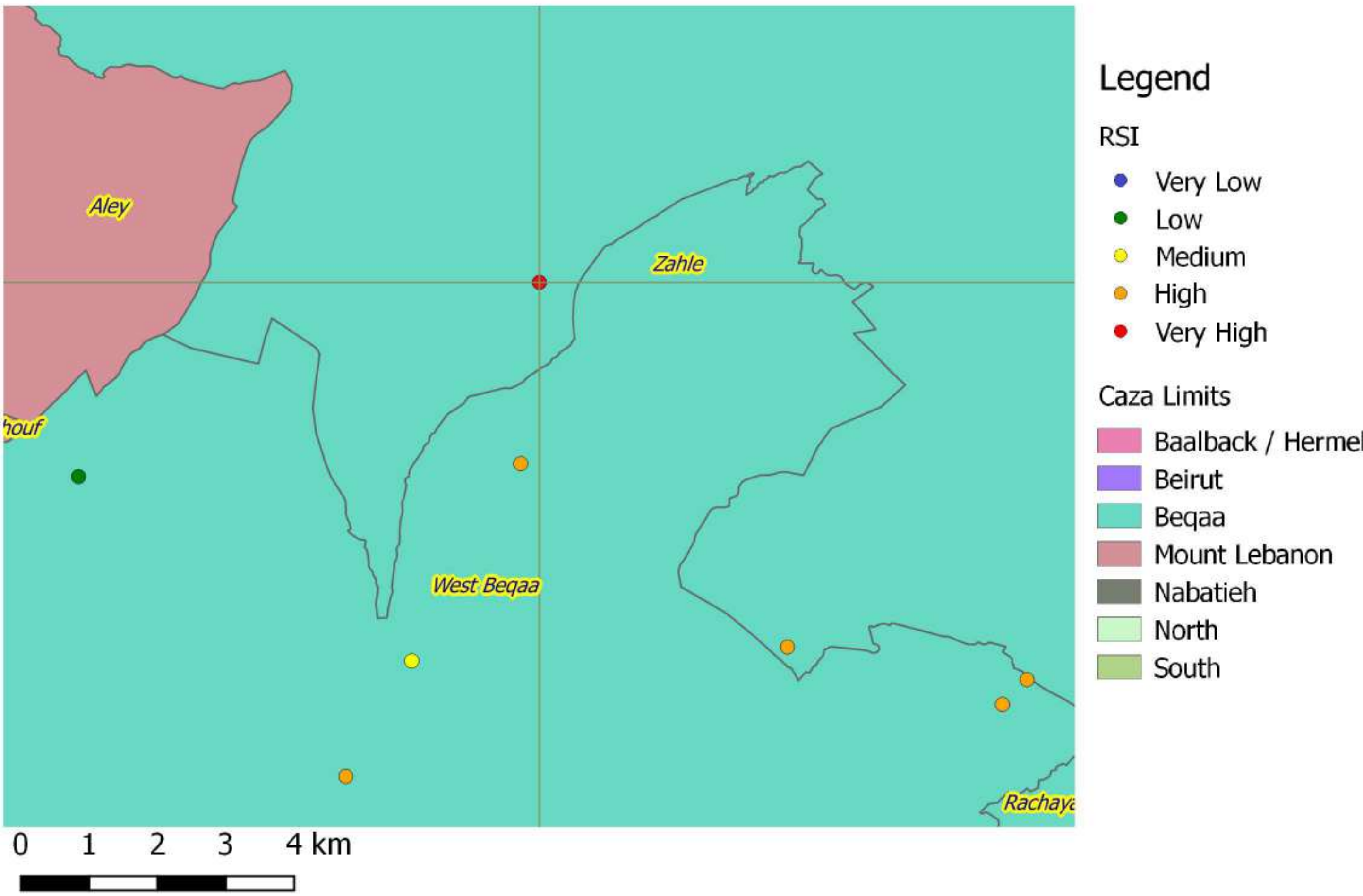
1- Site Name and Location	**T9-Srar-0**
X	36.130
Y	34.621
Z	141 m
Mohafaza	North
Caza	Akkar
Town	Srar
2- Type of Dump	Elaborated Hill
Distance to Urban areas	437 m
Open Burning	No
3- Estimated Volume	570,000 m^3
Area	38,000 m^2
Height	15 m
Quantity of waste currently dumped	300 t/d
Waste coming from	Most villages in the caza of Akkar
4- Priority Ranking for Rehabilitation	**5**
Risk Sensitivity Index Score	34.279 out of 55
5- Preferred Rehabilitation Option	Convert to a sanitary landfill
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Construct 3 cells of the sanitary landfill having a surface area of 30,000 m^2 with all needed protection c-Installation of the necessary composite liner system and soil protection measures for preparing the bottom of the sanitary landfill. This should include all drainage layers, perforated pipes and sump pits for leachate collection within the landfill. d-Active harnessing of gases from the landfill by building the necessary number of gas wells (minimum 1 gas well for each 7500 m3 of waste) and installing silica-based gravel inside gas wells, gas collection pipes (perforated and non perforated PVC pipes), headers and subheaders (HDPE pipes), grouts and plugs, and the appropriate blower and gas flaring unit. e-Transfer the waste to the newly formed cells of the landfill
7- Responsibility	Municipality of Srar / Private Operator
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management
11 - Estimated cost (USD)	6,732,524 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	11.811 USD/m^3
12- Possible sources of financing	European Union through OMSAR

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	25,000.0	25,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, design of the new landfill, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump	LS	1	50,000.0	50,000
2. Earth Movement Works				
2.1 - Excavate the waste in the dump and transfer to the newly formed sanitary landfill	m^3	570,000	3.0	1,710,000
3. Construction of three cells of the sanitary landfill				
3.1 -Bottom sealing works. Including soil shaping, subbase, sealing layer, geomembrane, geotextile, drainage and sand layer (Area 30,000 m2)	30,000			
Subbase	m^3	9,000	10.00	90,000
Sealing layer 0,50 m (clay)	m^3	18,000	12.00	216,000
Geomembrane HDPE 2mm	m^2	36,000	10.00	360,000
Separation geotextile (500g/m^2)	m^2	36,000	3.00	108,000
Drainage layer 0,50 m (gravel)	m^3	18,000	40.00	720,000
Sand layer	m^3	4,500	20.00	90,000
3.2 - **Construction of the sealing surface** of the three cells including a leveling layer, gas drainage layer, a separation geotextile, a sealing layer, a drainage layer, a separation geotextile, soil and a cultivation layer (Cells 1-2)				
Leveling layer 0,30 m	m^3	9,000	12.00	108,000
Gas drainage layer 0,30 m (gravel)	m^3	9,000	40.00	360,000
Separation geotextile (500g/m^2)	m^2	30,000	3.00	90,000
Sealing layer 0,50 m (clay)	m^3	15,000	12.00	180,000
Drainage layer 0,50 m (gravel)	m^3	15,000	40.00	600,000
Separation geotextile (500g/m^2)	m^2	30,000	3.00	90,000
Soil 0,70 m	m^3	21,000	20.00	420,000
Cultivation layer 0,30 m	m^3	9,000	15.00	135,000
3.3 - Leachate collection network for the proposed two cells				0
Leachate collection network	m	2,000	110.00	220,000
Leachate collection - transfer pipe	m	250	150.00	37,500
Leachate collection shaft	item	3	5,000.00	15,000
Excavation of trench for the installation of the main leachate collection network, sand and backfilling	m^3	300	15.00	4,500
Leachate pumping station	unit	1	40,000.00	40,000
Leachate treatment plant (RO system)	unit	1	500,000.00	500,000
6.4 - Biogas management including construction of LFG vertical wells and conveyance network and biogas flaring unit				0
Construction of gas wells within a Radius of influence of 15 and 20 m.	lm	48	125.0	6,000
Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage.	m^3	30	50.0	1,524
Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	720	130.0	93,600
Supply and install connection headers including main venting header and sub venting header, complete including all accessries. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves,m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc.	Lm	800	150.0	120,000
Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 50 m3/hr	unit	1	90,000.0	90,000
Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	48	50.0	2,400
4. Control and Monitoring				
4.1 - Control and Monitoring of works	LS	1	250,000.0	250,000
TOTAL COST (USD)				**6,732,524**
AVERAGE COST (USD/m^3)				**11.811**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: J6-Qabb Elias-00

Distance to urban areas: 500 m

Location of dumpsite (WGS-1984):

Dump status: Operational

X: 35.85 m

Estimated volume: 219000.0 m3

Y: 33.76 m

Area: 36500 m2

Z: 871.97 m

Visibility: Y

Mohafaza: Beqaa

Priority Ranking for Rehabilitation: 6

Caza: Zahle

Risk Sensitivity Index Score: 32.5

Town: Qabb Elias -Ouadi el Deloum

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**J6-Qabb Elias-00**	
X	35.851	
Y	33.758	
Z	872 m	
Mohafaza	Bekaa	
Caza	Zahle	
Town	Qabb Elias	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	434 m	
Open Burning	Yes	
3- Estimated Volume	219,000 m^3	
Area	36,500 m^2	
Height	6 m	
Quantity of waste currently dumped	60 t/d	
Waste coming from	Qabb Elias and nearby settlements	
4- Priority Ranking for Rehabilitation	**6**	
Risk Sensitivity Index Score	32.503 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Transfer to a sanitary landfill	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location (one third the area) within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.	
	Option 2: Conduct earth movement and transfer waste to the Barr Elias new sanitary landfill	
7- Responsibility	Municipality of Qabb Elias	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management	
11 - Estimated cost (USD)	2,163,875 USD for Option 1	1,613,750 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	9.881 USD/m^3 for Option 1	7.369 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

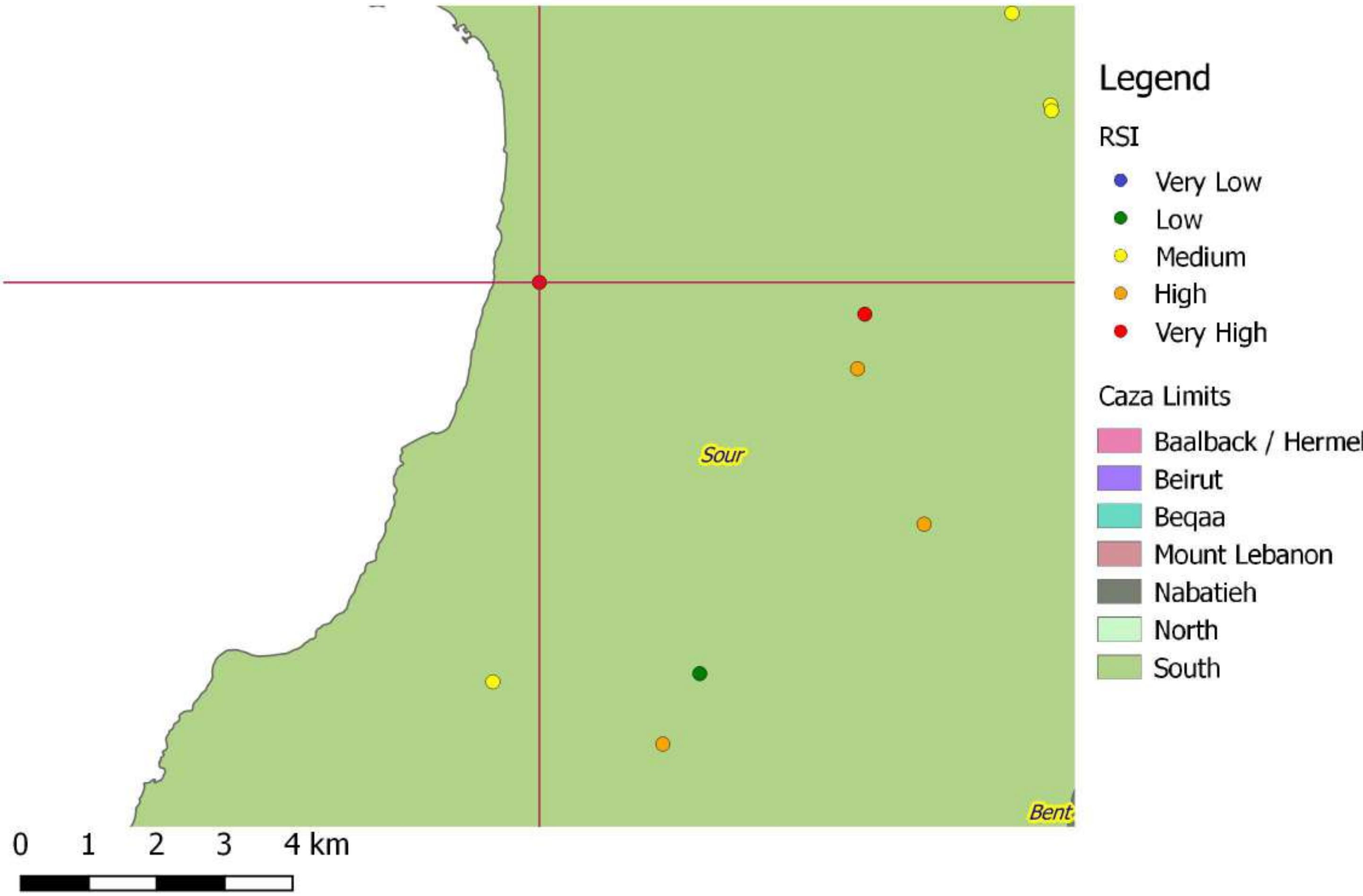
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	20,000.0	20,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	30,000.0	30,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	219,000	4.0	876,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	9,125	14.0	127,750
2.2.1-Install a geomembrane liner and geotextile	m^2	18,250	13.0	237,250
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	18,250	4.0	73,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	18,250	2.0	36,500
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	9,125	14.0	127,750
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	5,475	40.0	219,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	5,475	15.0	82,125
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	18,250	4.0	73,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	50,000.0	50,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	30,000.0	30,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	300	45.0	13,500
5.3 - Cut off walls	lm	180	100.0	18,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	150,000.0	150,000
TOTAL COST (USD)				**2,163,875**
AVERAGE COST (USD/m^3)				**9.881**

Option 2 - Transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	10,000.0	10,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to Barr Elias sanitary landfill	m^3	219,000	2.0	438,000
2.2 - Transfer waste to Barr Elias sanitary landfill	trucks	10,950	65.0	711,750
2.3 - Gate fee at Barr Elias landfill	m^3	37,000	12.0	444,000
TOTAL COST (USD)				**1,613,750**
AVERAGE COST (USD/m^3)				**7.369**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: C1-Deir Qanoun El-Aain-01

Distance to urban areas: 400 m

Location of dumpsite (WGS-1984):

Dump status: Non-operational

X: 35.22 m

Estimated volume: 300000.0 m3

Y: 33.22 m

Area: 13000 m2

Z: 21.33 m

Visibility: Y

Mohafaza: South

Priority Ranking for Rehabilitation: 7

Caza: Sour

Risk Sensitivity Index Score: 31.43

Town: Deir Qanoun Ras el Ein

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

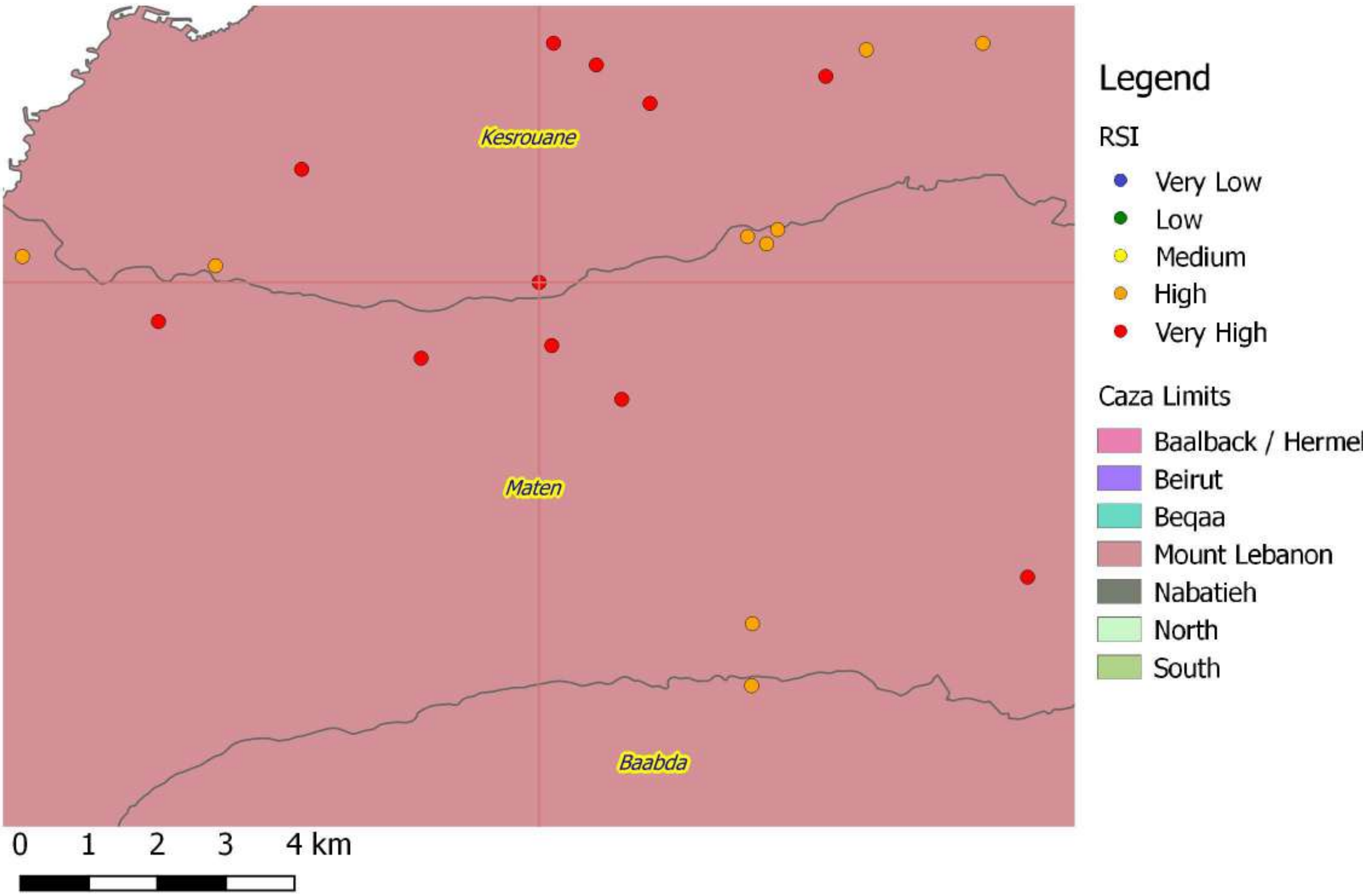
1- Site Name and Location	**C1-Deir Qanoun El-Aain-01**	
X	35.217	
Y	33.223	
Z	21.3346138	m
Mohafaza	South	
Caza	Sour	
Town	Deir Qanoun El Ain	
2- Type of Dump	Elaborated Hill or pile	
Distance to Urban areas	25	m
Open Burning	No	
3- Estimated Volume	300,000	m^3
Area	15,000	m^2
Height	20	m
Quantity of waste currently dumped	0	t/d
Waste coming from	Non - Operational	
4- Priority Ranking for Rehabilitation	**7**	
Risk Sensitivity Index Score	31.428	out of 55
5- Preferred Rehabilitation Option	Convert to a sanitary landfill	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Construct 2 cells of the sanitary landfill having a surface area of 20,000 m2 with all needed protection c-Installation of the necessary composite liner system and soil protection measures for preparing the bottom of the sanitary landfill. This should include all drainage layers, perforated pipes and sump pits for leachate collection within the landfill. d-Active harnessing of gases from the landfill by building the necessary number of gas wells (minimum 1 gas well for each 7500 m3 of waste) and installing silica-based gravel inside gas wells, gas collection pipes (perforated and non perforated PVC pipes), headers and subheaders (HDPE pipes), grouts and plugs, and the appropriate blower and gas flaring unit. e-Transfer the waste to the newly formed cells of the landfill	
7- Responsibility	Union of Municipalities of Tyre	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management	
11 - Estimated cost (USD)	4,748,516	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	15.828	USD/m^3
12- Possible sources of financing	European Union through OMSAR	

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	25,000.0	25,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, design of the new landfill, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	50,000.0	50,000
2. Earth Movement Works				
2.1 - Excavate the waste in the dump and transfer to the newly formed sanitary landfill	m^3	300,000	4.0	1,200,000
3 Construction of the first two cells of the sanitary landfill				
3.1 -Bottom sealing works. Including soil shaping, subbase, sealing layer, geomembrane, geotextile, drainage and sand layer (Area 20,000 m2)	20,000			
Subbase	m^3	5,000	10.00	50,000
Sealing layer 0,50 m (clay)	m^3	10,000	12.00	120,000
Geomembrane HDPE 2mm	m^2	24,000	10.00	240,000
Separation geotextile (500g/m^2)	m^2	24,000	3.00	72,000
Drainage layer 0,50 m (gravel)	m^3	10,000	40.00	400,000
Sand layer	m^3	2,500	20.00	50,000
3.2 - Construction of the sealing surface of the two cells including a leveling layer, gas drainage layer, a separation geotextile, a sealing layer, a drainage layer, a separation geotextile, soil and a cultivation layer (Cells 1-2)				
Leveling layer 0,30 m	m^3	6,000	12.00	72,000
Gas drainage layer 0,30 m (gravel)	m^3	6,000	40.00	240,000
Separation geotextile (500g/m^2)	m^2	20,000	3.00	60,000
Sealing layer 0,50 m (clay)	m^3	10,000	12.00	120,000
Drainage layer 0,50 m (gravel)	m^3	10,000	40.00	400,000
Separation geotextile (500g/m^2)	m^2	20,000	3.00	60,000
Soil 0,70 m	m^3	14,000	20.00	280,000
Cultivation layer 0,30 m	m^3	6,000	15.00	90,000
3.3 - Leachate collection network for the proposed two cells				0
Leachate collection network	m	1,250	110.00	137,500
Leachate collection - transfer pipe	m	200	150.00	30,000
Leachate collection shaft	item	2	5,000.00	10,000
Excavation of trench for the installation of the main leachate collection network, sand and backfilling	m^3	200	15.00	3,000
Leachate pumping station	unit	1	40,000.00	40,000
Leachate treatment plant (RO system)	unit	1	500,000.00	500,000
3.4 - Biogas management including construction of LFG vertical wells and conveyance network and biogas flaring unit				0
Construction of gas wells within a Radius of influence of 15 and 20 m.	lm	32	125.0	4,000
Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage.	m^3	20	50.0	1,016
Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	480	130.0	62,400
Supply and install connection headers including main venting header and sub venting header, complete including all accessries. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves,m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc	Lm	600	150.0	90,000
Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 50 m3/hr	unit	1	90,000.0	90,000
Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	32	50.0	1,600
4. Control and Monitoring				
4.1 - Control and Monitoring of works	LS	1	250,000.0	250,000
TOTAL COST (USD)				**4,748,516**
AVERAGE COST (USD/m^3)				**15.828**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: L5-Balloune-3

Location of dumpsite (WGS-1984):

X: 35.68 m

Y: 33.94 m

Z: 461.17 m

Mohafaza: Mount Lebanon

Caza: Kesrouane

Town: Balloune

Distance to urban areas: 500 m

Dump status: Operational

Estimated volume: 14000.0 m3

Area: 7000 m2

Visibility: N

Priority Ranking for Rehabilitation: 8

Risk Sensitivity Index Score: 30.32

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L5-Balloune-3**	
X	35.681	
Y	33.945	
Z	461 m	
Mohafaza	nt Lebanon Lebanon	
Caza	Keserwan	
Town	Balloune	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	175 m	
Open Burning	No	
3- Estimated Volume	14,000 m^3	
Area	7,000 m^2	
Height	2 m	
Quantity of waste currently dumped	3 t/d	
Waste coming from	Balloune village	
4- Priority Ranking for Rehabilitation	**8**	
Risk Sensitivity Index Score	30.323 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Group with other dumpsites and transfer to a sanitary landfill	
6- Technical Requirements	For Option 1 - a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer. d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.	
	For Option 2: Transfer all the original volume of waste to the Karantina Sanitary landfill in 20 m3 transfer trucks.	
7- Responsibility	Municipality of Ballouneh	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.	
11 - Estimated cost (USD)	336,500 USD for Option 1	164,500 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	24.036 USD/m^3 for Option 1	11.750 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

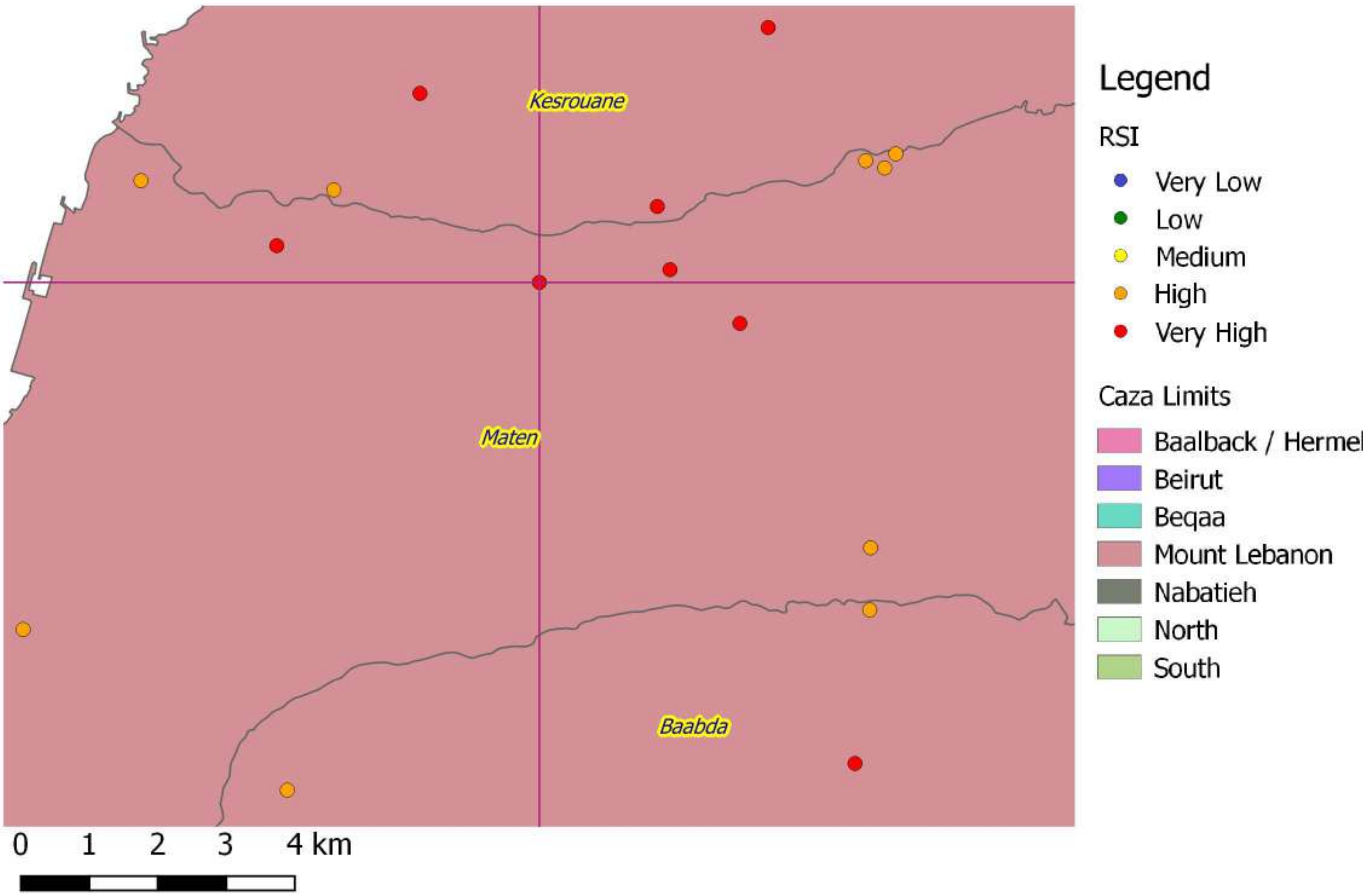
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	7,500.0	7,500
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	14,000	4.0	56,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	1,750	14.0	24,500
2.2.1-Install a geomembrane liner and geotextile	m^2	3,500	13.0	45,500
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	7,000	4.0	28,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	3,500	2.0	7,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	1,750	14.0	24,500
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	1,050	40.0	42,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	1,050	15.0	15,750
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	3,500	4.0	14,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost	LS	1	20,000.0	20,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	10,000.0	10,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	150	45.0	6,750
5.3 - Cut off walls	lm	100	100.0	10,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	20,000.0	20,000
TOTAL COST (USD)				**336,500**
AVERAGE COST (USD/m^3)				**24.036**

Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to Karantina sanitary landfill	m^3	14,000	2.0	28,000
2.2 - Transfer waste to sanitary landfill	trucks	700	65.0	45,500
2.3 - Gate fee at sanitary landfill	t	7,000	12.0	84,000
TOTAL COST (USD)				**164,500**
AVERAGE COST (USD/m^3)				**11.750**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: L5- Beit Chabab- 1n

Location of dumpsite (WGS-1984):

X: 35.66 m

Y: 33.93 m

Z: 0.0 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Beit Chabab

Distance to urban areas: No information m

Dump status: Operational

Estimated volume: 10000.0 m3

Area: 2500 m2

Visibility: No information

Priority Ranking for Rehabilitation: 9

Risk Sensitivity Index Score: 30.21

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L5-Beit Chabab-1n**	
X	35.663	
Y	33.932	
Z	250 m	
Mohafaza	Mount Lebanon	
Caza	Maten	
Town	Beit Chabab	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	212 m	
Open Burning	N	
3- Estimated Volume	10,000 m^3	
Area	2,500 m^2	
Height	4 m	
Quantity of waste currently dumped	6 t/d	
Waste coming from	Beit Chabab	
4- Priority Ranking for Rehabilitation	**9**	
Risk Sensitivity Index Score	30.205 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Group with other dumpsites and transfer to sanitary landfill	
6- Technical Requirements	For Option 1: a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump to half, grading, compaction and sabilization of waste within the dump (slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by naturally pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.	
	For Option 2: Transfer all the original volume of waste to a nearby sanitary landfill in 20 m3 transfer trucks.	
7- Responsibility	Municipality of Beit Chabab	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.	
11 - Estimated cost (USD)	240,250 USD for Option 1	176,500 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	24.025 USD/m^3 for Option 1	17.650 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

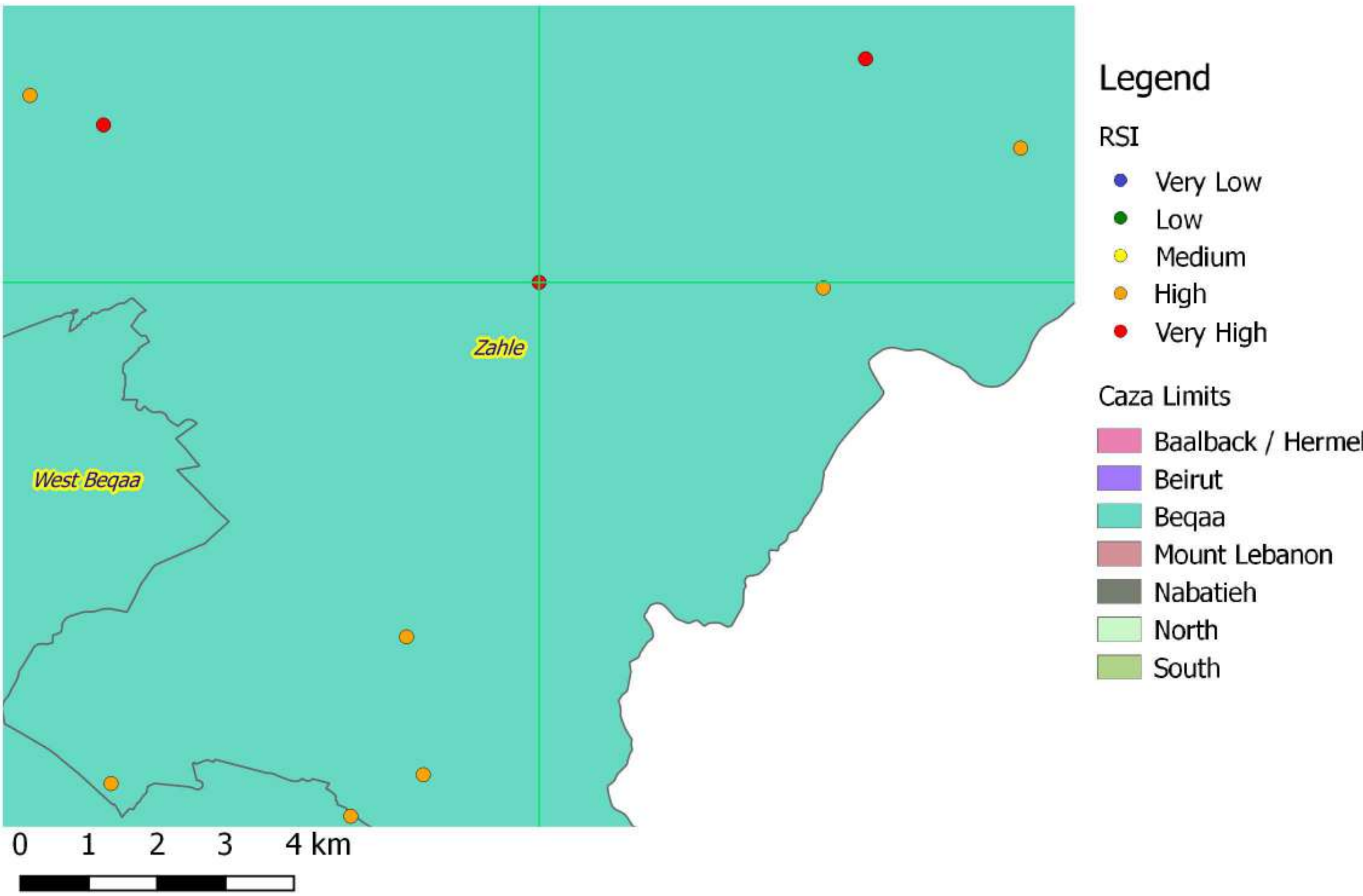
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	10,000	4.0	40,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	3,000	14.0	42,000
2.2.1-Install a geomembrane liner and geotextile	m^2	2,500	13.0	32,500
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps,	m^3	5,000	4.0	20,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	1,250	2.0	2,500
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	1,250	14.0	17,500
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	750	40.0	30,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	750	15.0	11,250
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m2	2,500	4.0	10,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	5,000.0	5,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 5 m3 complete including pumping system	unit	1	3,000.0	3,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump.	lm	100	45.0	4,500
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	15,000.0	15,000
TOTAL COST (USD)				**240,250**
AVERAGE COST (USD/m^3)				**24.025**

Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to a sanitary landfill	m^3	10,000	2.0	20,000
2.2 - Transfer waste to nearby sanitary landfill	trucks	500	65.0	32,500
2.3 - Gate fee at landfill	t	10,000	12.0	120,000
TOTAL COST (USD)				**176,500**
AVERAGE COST (USD/m^3)				**17.650**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: J7-Barr Elias-00

Location of dumpsite (WGS-1984):

X: 35.96 m

Y: 33.78 m

Z: 871.22 m

Mohafaza: Beqaa

Caza: Zahle

Town: Barr Elias

Distance to urban areas: 1500 m

Dump status: Operational

Estimated volume: 200000.0 m3

Area: 40000 m2

Visibility: Y

Priority Ranking for Rehabilitation: 10

Risk Sensitivity Index Score: 30.16

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**J7-Barr Elias-00**	
X	35.957	
Y	33.780	
Z	872 m	
Mohafaza	**Beqaa**	
Caza	**Zahle**	
Town	**Barr Elias**	
2- Type of Dump	Elaborated Hill	
Distance to Urban areas	543 m	
Open Burning	yes	
3- Estimated Volume	200,000 m^3	
Area	40,000 m^2	
Height	5 m	
Quantity of waste currently dumped	50 t/d	
Waste coming from	Barr Elias and El Marj	
4- Priority Ranking for Rehabilitation	**10**	
Risk Sensitivity Index Score	30.157 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Excavate, treat and transfer Option 2 - Grade, cap, manage gases and leachate	
6- Technical Requirements	**OPTION 1**- a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Construct 2 cells of the sanitary landfill having a surface area of 15,000 m^2 with all needed protection c-Installation of the necessary composite liner system and soil protection measures for preparing the bottom of the sanitary landfill. This should include all drainage layers, perforated pipes and sump pits for leachate collection within the landfill. d-Active harnessing of gases from the landfill by building the necessary number of gas wells (minimum 1 gas well for each 7500 m3 of waste) and installing silica-based gravel inside gas wells, gas collection pipes (perforated and non perforated PVC pipes), headers and subheaders (HDPE pipes), grouts and plugs, and the appropriate blower and gas flaring unit. e-Transfer the waste to the newly formed cells of the landfill	
	OPTION 2 - Grade, cap, manage gases and leachate	
7- Responsibility	Union of Municipalities of West Bekaa / Municipality of Barr Elias	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap, biofilter, leachate generation and management	
11 - Estimated cost (USD)	3,758,262 USD for Option 1	1,765,675 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	18.791 USD/m^3 for Option 1	8.828 USD/m^3 for Option 2
12- Possible sources of financing	Economic and Social Fund for development and Municipality	

COST ESTIMATE

Option 1 - Excavate, treat and transfer

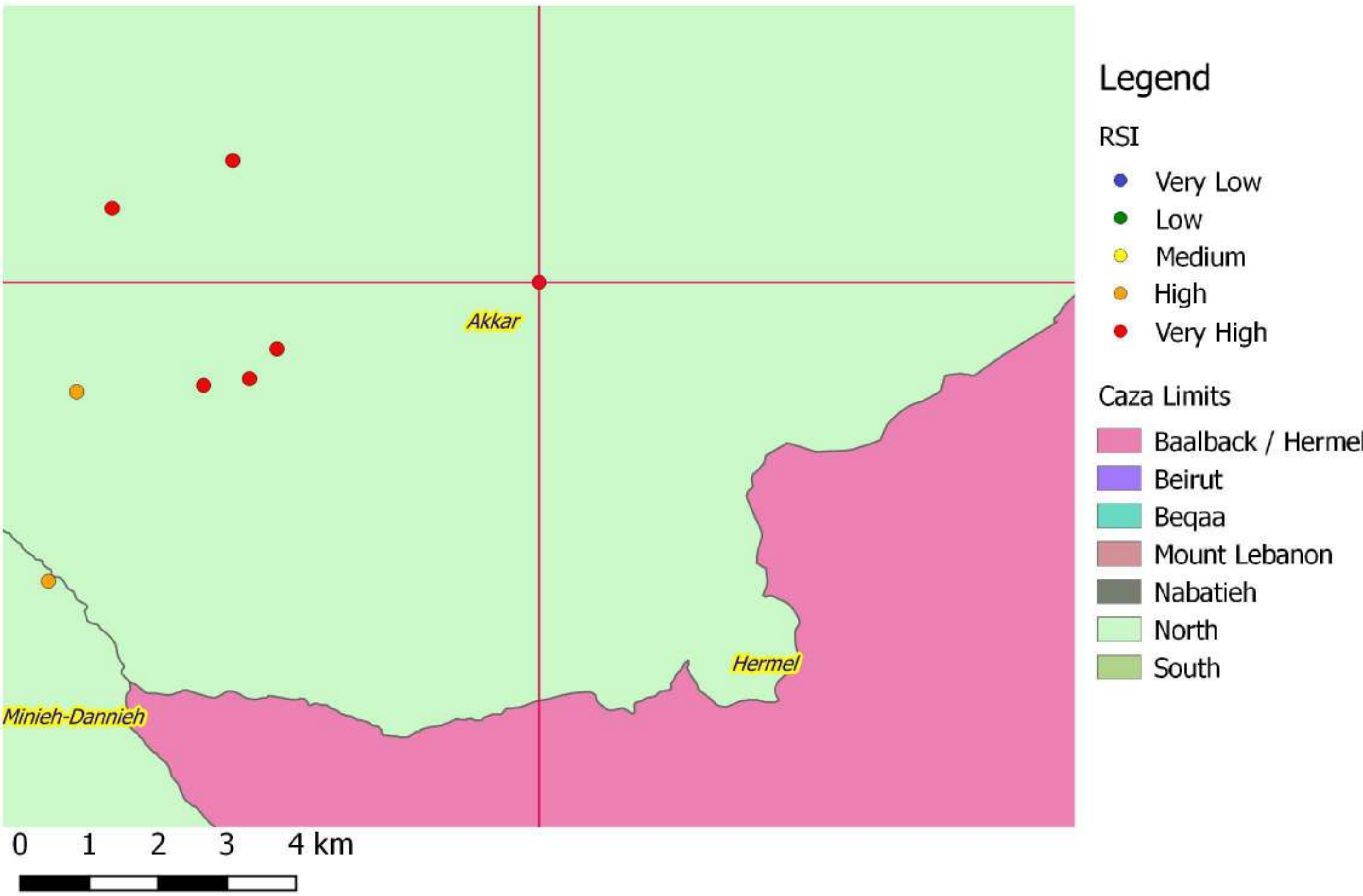
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	20,000.0	20,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, design of the new landfill, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	30,000.0	30,000
2. Earth Movement Works				
2.1 - Excavate the waste in the dump and transfer to the newly formed sanitary landfill	m^3	200,000	4.0	800,000
3. Construction of the first two cells of the sanitary landfill				
3.1 -Bottom sealing works. Including soil shaping, subbase, sealing layer, geomembrane, geotextile, drainage and sand layer (Area 15,000 m^2)	15,000			
Subbase	m^3	3,750	10.00	37,500
Sealing layer 0,50 m (clay)	m^3	9,000	12.00	108,000
Geomembrane HDPE 2mm	m^2	18,000	10.00	180,000
Separation geotextile (500g/m^2)	m^2	18,000	3.00	54,000
Drainage layer 0,50 m (gravel)	m^3	9,000	40.00	360,000
Sand layer	m^3	1,875	20.00	37,500
3.2 - Construction of the sealing surface of the two cells including a leveling layer, gas drainage layer, a separation geotextile, a sealing layer, a drainage layer, a separation geotextile, soil and a cultivation layer (Cells 1-2)				
Leveling layer 0,30 m	m^3	4,500	12.00	54,000
Gas drainage layer 0,30 m (gravel)	m^3	4,500	40.00	180,000
Separation geotextile (500g/m^2)	m^2	15,000	3.00	45,000
Sealing layer 0,50 m (clay)	m^3	7,500	12.00	90,000
Drainage layer 0,50 m (gravel)	m^3	7,500	40.00	300,000
Separation geotextile (500g/m^2)	m^2	15,000	3.00	45,000
Soil 0,70 m	m^3	10,500	20.00	210,000
Cultivation layer 0,30 m	m^3	4,500	15.00	67,500
3.3 - Leachate collection network for the proposed two cells				0
Leachate collection network	m	1,000	110.00	110,000
Leachate collection - transfer pipe	m	200	150.00	30,000
Leachate collection shaft	item	2	5,000.00	10,000
Excavation of trench for the installation of the main leachate collection network, sand and backfilling	m^3	200	15.00	3,000
Leachate pumping station	unit	1	40,000.00	40,000
Leachate treatment plant (RO system)	unit	1	500,000.00	500,000
3.4 - Biogas management including construction of LFG vertical wells and conveyance network and biogas flaring unit				0
Construction of gas wells within a Radius of influence of 15 and 20 m.	lm	24	125.0	3,000
Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage.	m^3	15	50.0	762
Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	360	130.0	46,800
Supply and install connection headers including main venting header and sub venting header, complete including all accessries. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves, m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc.	Lm	700	150.0	105,000
Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 50 m^3/hr	unit	1	90,000.0	90,000
Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	24	50.0	1,200
4. Control and Monitoring				
4.1 - Control and Monitoring of works	LS	1	200,000.0	200,000
TOTAL COST (USD)				**3,758,262**
AVERAGE COST (USD/m^3)				**18.791**

Option 2 - Grade, cap, manage gases and leachate

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	15,000.0	15,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	30,000.0	30,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	60,000	4.0	240,000
2.2- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	20,000	2.0	40,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	20,000	14.0	280,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	12,000	40.0	480,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	12,000	15.0	180,000
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	40,000	4.0	160,000
4. Gas Management Works				
4.1 -Drilling of gas wells: The drilling should be done using an auger (preferably a hollow stem Auger type). The diameter of all boreholes is fixed to 90 cm while the depth vary according to depth of waste. The Radius of influence of gas wells to vary between 15 and 20 m.	lm	100	125.0	12,500
4.2 - Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage.	m^3	64	50.0	3,175
4.3 - Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	100	130.0	13,000
4.4 -Supply and install connection headers including main venting header and sub venting header, complete including all accessries. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves,m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc.	Lm	500	140.0	70,000
4.5 - Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 40 m^3/hr	unit	1	75,000.0	75,000
4.6- Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	20	50.0	1,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 40 m3 complete including pumping system	unit	1	30,000.0	30,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	800	45.0	36,000
5.3 - Cut off walls	lm	500	100.0	50,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	50,000.0	50,000
TOTAL COST (USD)				**1,765,675**
AVERAGE COST (USD/m^3)				**8.828**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: R9-Fnaydek-0

Location of dumpsite (WGS-1984):

X: 36.21 m

Y: 34.48 m

Z: 1449.09 m

Mohafaza: North

Caza: Akkar

Town: Fnaydek

Distance to urban areas: 2000 m

Dump status: Operational

Estimated volume: 72000.0 m3

Area: 6000 m2

Visibility: N

Priority Ranking for Rehabilitation: 11

Risk Sensitivity Index Score: 29.84

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

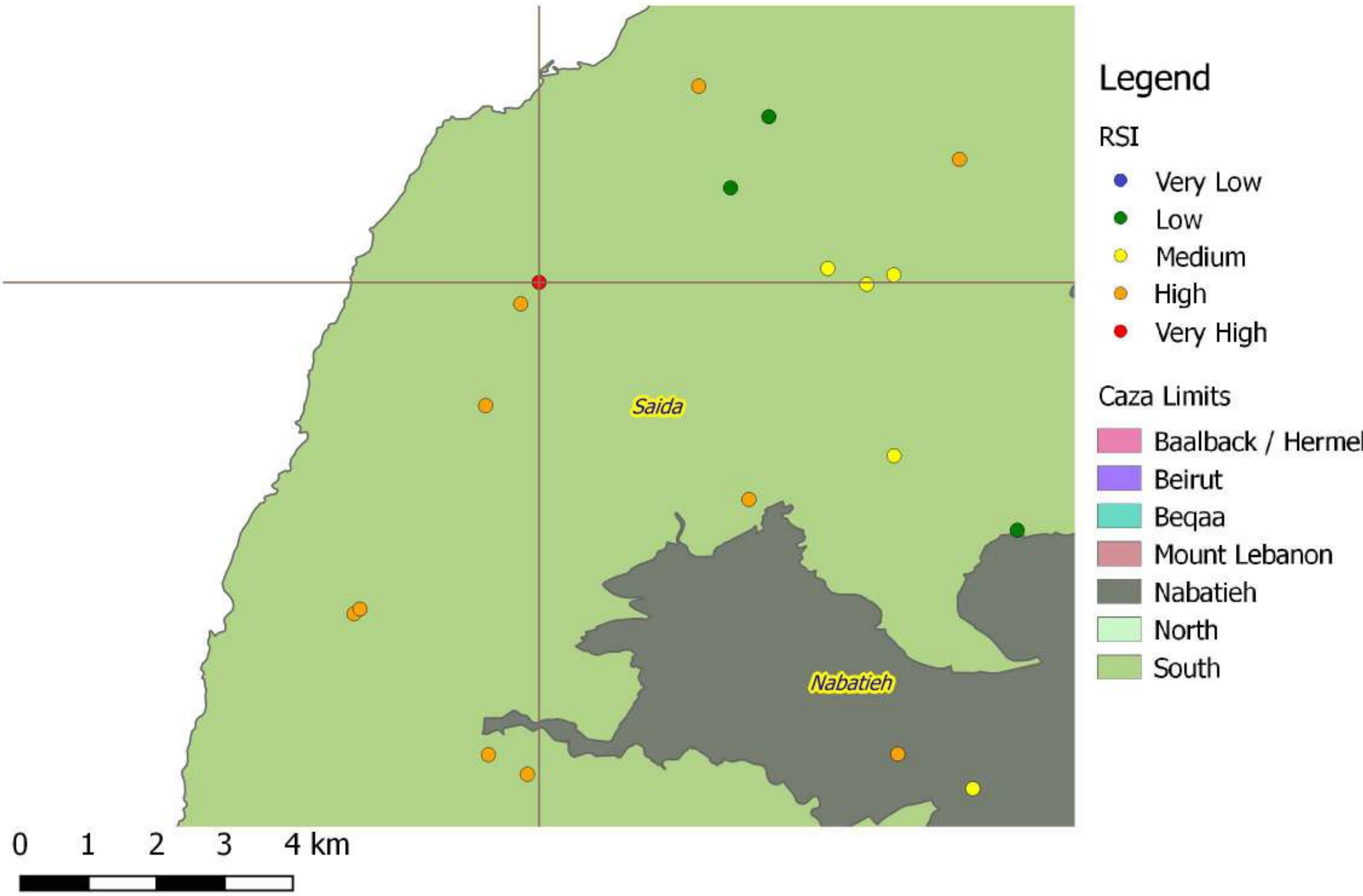
1- Site Name and Location	**R9-Fnaydek-0**
X	36.207
Y	34.484
Z	1449 m
Mohafaza	North
Caza	Akkar
Town	Fnaydek
2- Type of Dump	Excavated pit/below ground surface quarry
Distance to Urban areas	115 m
Open Burning	yes
3- Estimated Volume	72,000 m^3
Area	6,000 m^2
Height	12 m
Quantity of waste currently dumped	5 t/d
Waste coming from	Fnaydek
4- Priority Ranking for Rehabilitation	**11**
Risk Sensitivity Index Score	29.839 out of 55
5- Preferred Rehabilitation Option	Excavate, line, grade, cap, manage gases and collect leachate
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.
7- Responsibility	Municipality of Fnaydek
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap, biofilter system, leachate generation and management.
11 - Estimated cost (USD)	895,875 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.443 USD/m^3
12- Possible sources of financing	National Budget or donor agencies

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	20,000.0	20,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	72,000	4.0	288,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer, installing a geomembrane and geotextile	m^3	6,000	14.0	84,000
2.2.1-Install a geomembrane liner and geotextile	m^2	6,000	13.0	78,000
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	36,000	4.0	144,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	4,500	2.0	9,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	3,000	14.0	42,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	1,800	40.0	72,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	1,800	15.0	27,000
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	6,000	4.0	24,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	20,000.0	20,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	10,000.0	10,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	175	45.0	7,875
5.3 - Cut off walls	lm	100	100.0	10,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	50,000.0	50,000
TOTAL COST (USD)				**895,875**
AVERAGE COST (USD/m^3)				**12.443**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: F2-Sarafand-01

Location of dumpsite (WGS-1984):

X: 35.3 m

Y: 33.44 m

Z: 132.7 m

Mohafaza: South

Caza: Saida

Town: Sarafand

Distance to urban areas: 150 m

Dump status: Operational

Estimated volume: 33000.0 m3

Area: 6000 m2

Visibility: N

Priority Ranking for Rehabilitation: 12

Risk Sensitivity Index Score: 29.65

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**F2-Sarafand-01**	
X	35.305	
Y	33.438	
Z	133 m	
Mohafaza	South Lebanon	
Caza	Saida	
Town	Sarafand	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	60 m	
Open Burning	No	
3- Estimated Volume	33,000 m^3	
Area	6,000 m^2	
Height	5.5 m	
Quantity of waste currently dumped	37 t/d	
Waste coming from	Sarafand and surrounding villages	
4- Priority Ranking for Rehabilitation	**12**	
Risk Sensitivity Index Score	29.646 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Group with other dumpsites and transfer to a sanitary landfill	
6- Technical Requirements	For Option 1: a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump to half, grading, compaction and sabilization of waste within the dump (slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by naturally pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessary pumping system.	
	For Option 2: Transfer all the original volume of waste to a nearby sanitary landfill in 20 m3 transfer trucks.	
7- Responsibility	Municipality of Sarafand	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.	
11 - Estimated cost (USD)	443,625 USD for Option 1	375,250 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	13.443 USD/m^3 for Option 1	11.371 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

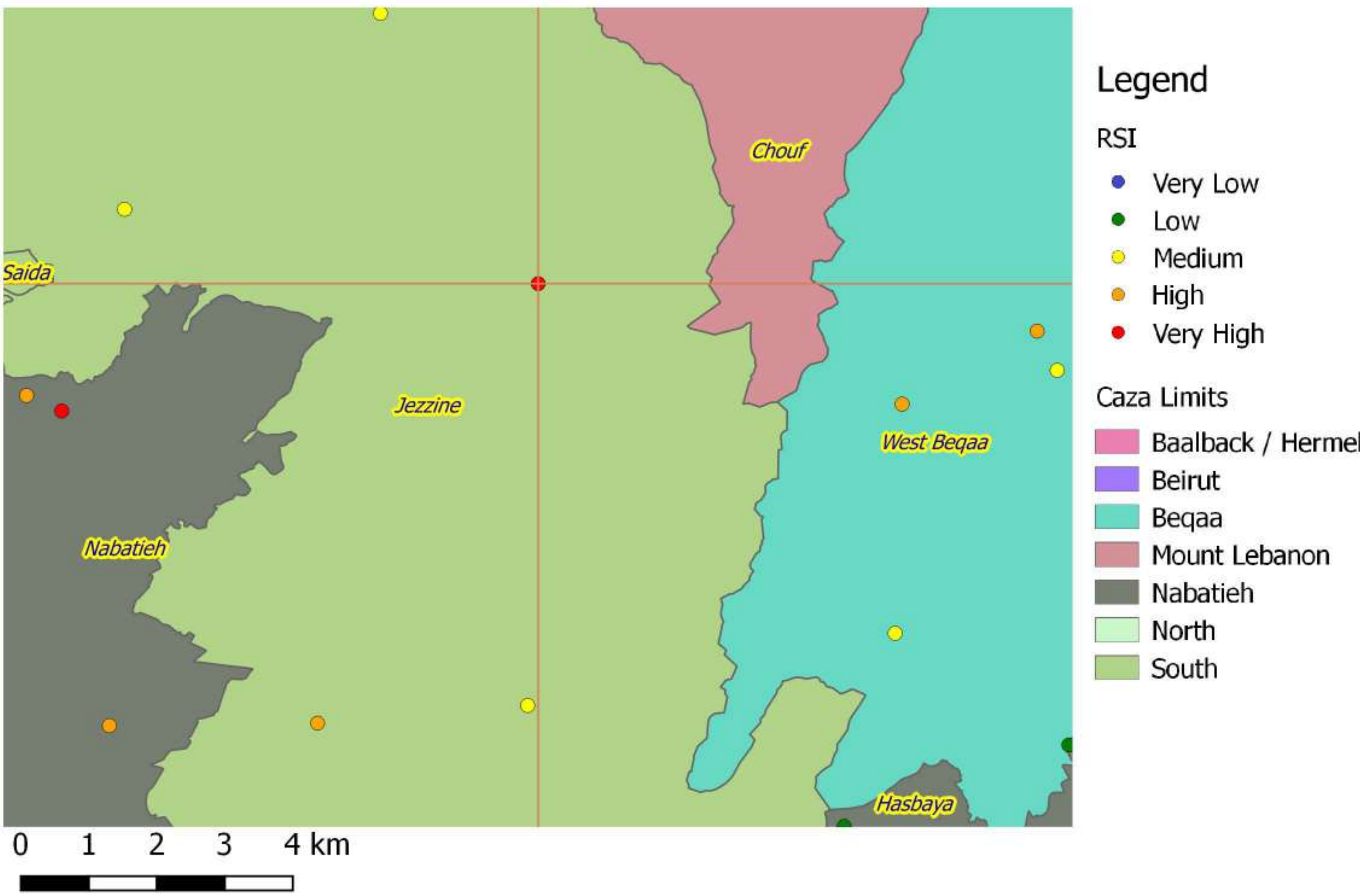
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	33,000	4.0	132,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	2,250	30.0	67,500
2.2.1-Install a geomembrane liner and geotextile	m^2	3,000	13.0	39,000
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps,	m^3	16,500	4.0	66,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	3,000	2.0	6,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	1,500	14.0	21,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	900	40.0	36,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	900	15.0	13,500
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	3,000	4.0	12,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	5,000.0	5,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 5 m3 complete including pumping system	unit	1	5,000.0	5,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump.	lm	125	45.0	5,625
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	30,000.0	30,000
TOTAL COST (USD)				**443,625**
AVERAGE COST (USD/m^3)				**13.443**

Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to a sanitary landfill	m^3	33,000	2.0	66,000
2.2 - Transfer waste to nearby sanitary landfill	trucks	1,650	65.0	107,250
2.3 - Gate fee at landfill	t	16,500	12.0	198,000
TOTAL COST (USD)				**375,250**
AVERAGE COST (USD/m^3)				**11.371**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: G4-Jezzine-00

Location of dumpsite (WGS-1984):

X: 35.59 m

Y: 33.51 m

Z: 1130.57 m

Mohafaza: South

Caza: Jezzine

Town: Jezzine

Distance to urban areas: 850 m

Dump status: Operational

Estimated volume: 16000.0 m3

Area: 4000 m2

Visibility: Y

Priority Ranking for Rehabilitation: 13

Risk Sensitivity Index Score: 29.03

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**G4-Jezzine-00**		
X	35.586		
Y	33.511		
Z	1130.574341 m		
Mohafaza	South Lebanon		
Caza	Jezzine		
Town	Jezzine		
2- Type of Dump	Elaborated hill or pile		
Distance to Urban areas	87 m		
Open Burning	Yes		
3- Estimated Volume	16,000 m^3		
Area	4,000 m^2		
Height	4 m		
Quantity of waste currently dumped	12 t/d		
Waste coming from	Jezzine		
4- Priority Ranking for Rehabilitation	**13**		
Risk Sensitivity Index Score	29.031 out of 55		
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Group with other dumpsites and transfer to a sanitary landfill		
6- Technical Requirements	For Option 1 - a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.		
	For Option 2: Transfer all the original volume of waste to a nearby sanitary landfill in 20 m3 transfer trucks.		
7- Responsibility	Union of Municipalities of Jezzine		
8- Legal requirements	Enforce legislation and ban open dumping.		
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators		
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.		
11 - Estimated cost (USD)	334,750	USD for Option 1	193,000 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	20.922	USD/m^3 for Option 1	12.063 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies		

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	7,500.0	7,500
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	16,000	4.0	64,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	3,000	14.0	42,000
2.2.1-Install a geomembrane liner and geotextile	m^2	3,000	13.0	39,000
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	8,000	4.0	32,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	3,000	2.0	6,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	1,500	14.0	21,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	900	40.0	36,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	900	15.0	13,500
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	3,000	4.0	12,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	10,000.0	10,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	5,000.0	5,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	150	45.0	6,750
5.3 - Cut off walls	lm	100	100.0	10,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	25,000.0	25,000
TOTAL COST (USD)				**334,750**
AVERAGE COST (USD/m^3)				**20.922**

Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to a sanitary landfill	m^3	16,000	2.0	32,000
2.2 - Transfer waste to nearby sanitary landfill	trucks	800	75.0	60,000
2.3 - Gate fee at landfill	t	8,000	12.0	96,000
TOTAL COST (USD)				**193,000**
AVERAGE COST (USD/m^3)				**12.063**

Rehabilitation Report

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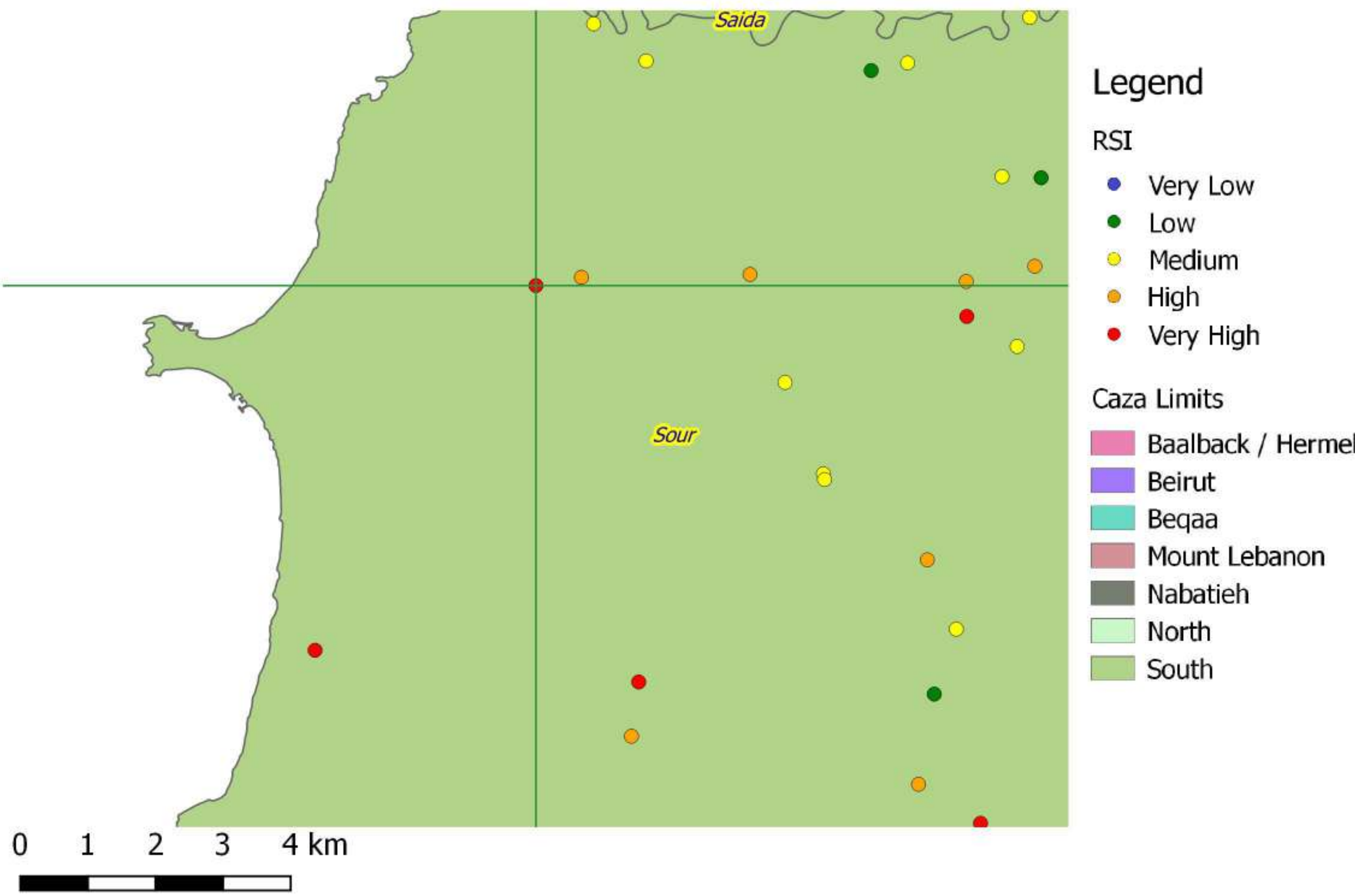


Template Form for Municipal Solid Waste

Name of dumpsite: D2-Abbesye-03

Distance to urban areas: 700 m

Location of dumpsite (WGS-1984):

Dump status: Operational

X: 35.25 m

Estimated volume: 35000.0 m3

Y: 33.28 m

Area: 7000 m2

Z: 59.81 m

Visibility: Y

Mohafaza: South

Priority Ranking for Rehabilitation: 14

Caza: Sour

Risk Sensitivity Index Score: 28.96

Town: Abbesye

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**D2-Abbeseye-03**	
X	35.252	
Y	33.280	
Z	60 m	
Mohafaza	South Lebanon	
Caza	Sour	
Town	Abbasiyeh	
2- Type of Dump	Dump in valley or seasonal water channels	
Distance to Urban areas	125 m	
Open Burning	No	
3- Estimated Volume	35,000 m^3	
Area	7,000 m^2	
Height	5 m	
Quantity of waste currently dumped	34 t/d	
Waste coming from	Abbeseye village and from UNIFIL	
4- Priority Ranking for Rehabilitation	**15**	
Risk Sensitivity Index Score	28.961 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Group with other dumpsites and transfer to a sanitary landfill	
6- Technical Requirements	For Option 1: a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump to half, grading, compaction and sabilization of waste within the dump (slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d- Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by naturally pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.	
	For Option 2: Transfer all the original volume of waste to a nearby sanitary landfill in 20 m3 transfer trucks.	
7- Responsibility	Municipality of Abbeseye	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.	
11 - Estimated cost (USD)	435,000 USD for Option 1	398,750 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	12.429 USD/m^3 for Option 1	11.393 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

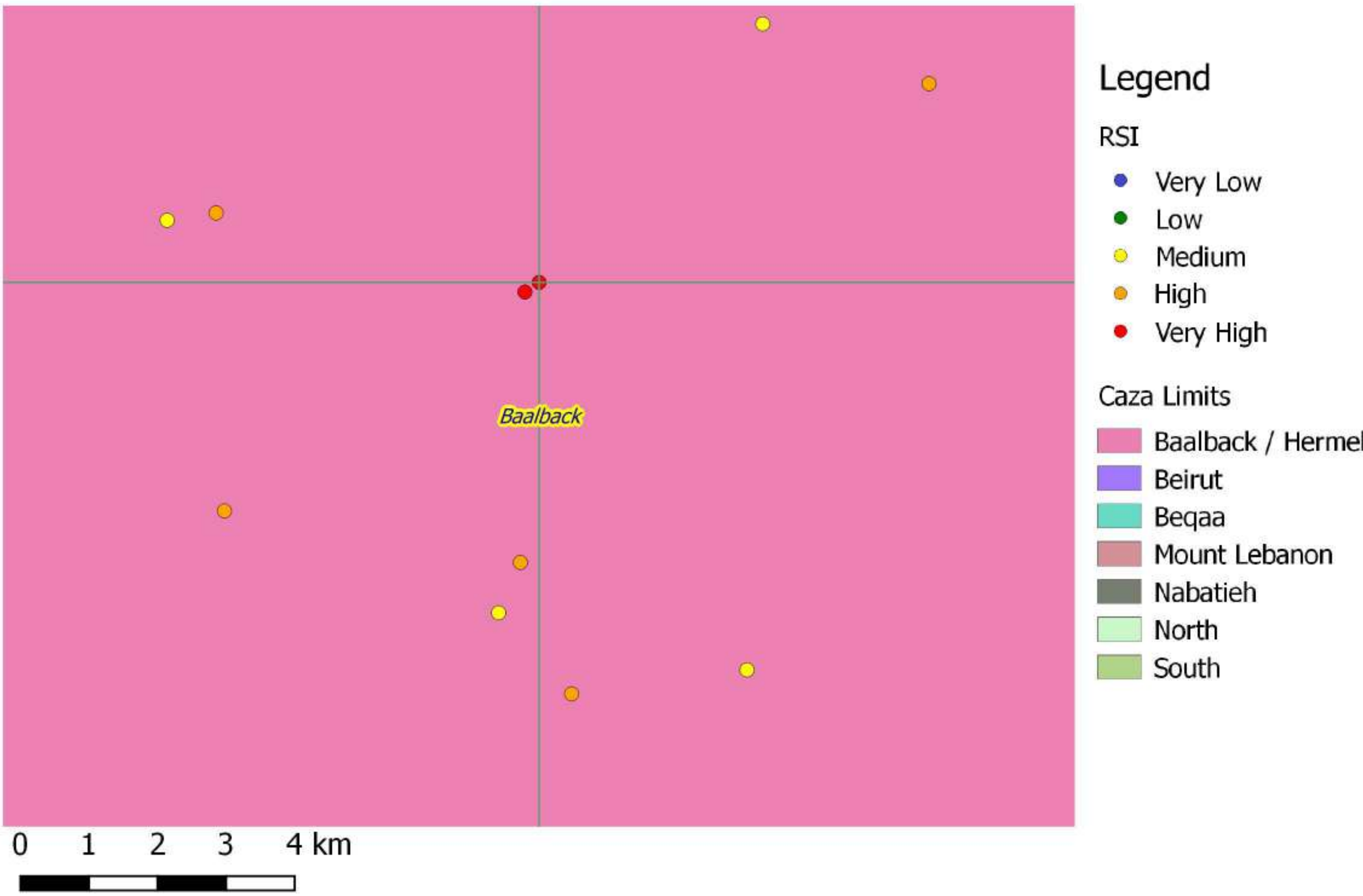
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	35,000	4.0	140,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer.	m^3	1,750	14.0	24,500
2.2.1-Install a geomembrane liner and geotextile	m^2	3,500	13.0	45,500
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any).	m^3	17,500	4.0	70,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less	m^2	3,500	2.0	7,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	1,750	14.0	24,500
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	1,050	40.0	42,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	1,050	15.0	15,750
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	3,500	4.0	14,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	5,000.0	5,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 5 m^3 complete including pumping system	unit	1	5,000.0	5,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump.	lm	150	45.0	6,750
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	30,000.0	30,000
TOTAL COST (USD)				**435,000**
AVERAGE COST (USD/m^3)				**12.429**

Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to a sanitary landfill	m^3	35,000	2.0	70,000
2.2 - Transfer waste to nearby sanitary landfill	trucks	1,750	65.0	113,750
2.3 - Gate fee at landfill	tonne	17,500	12.0	210,000
TOTAL COST (USD)				**398,750**
AVERAGE COST (USD/m^3)				**11.393**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: M9-Baalback-02	Distance to urban areas: 300 m
Location of dumpsite (WGS-1984):	Dump status: Operational
X: 36.18 m	Estimated volume: 75000.0 m3
Y: 34.01 m	Area: 15000 m2
Z: 1110.16 m	Visibility: N
Mohafaza: Beqaa	Priority Ranking for Rehabilitation: 15
Caza: Baalback	Risk Sensitivity Index Score: 28.9
Town: Baalback	Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

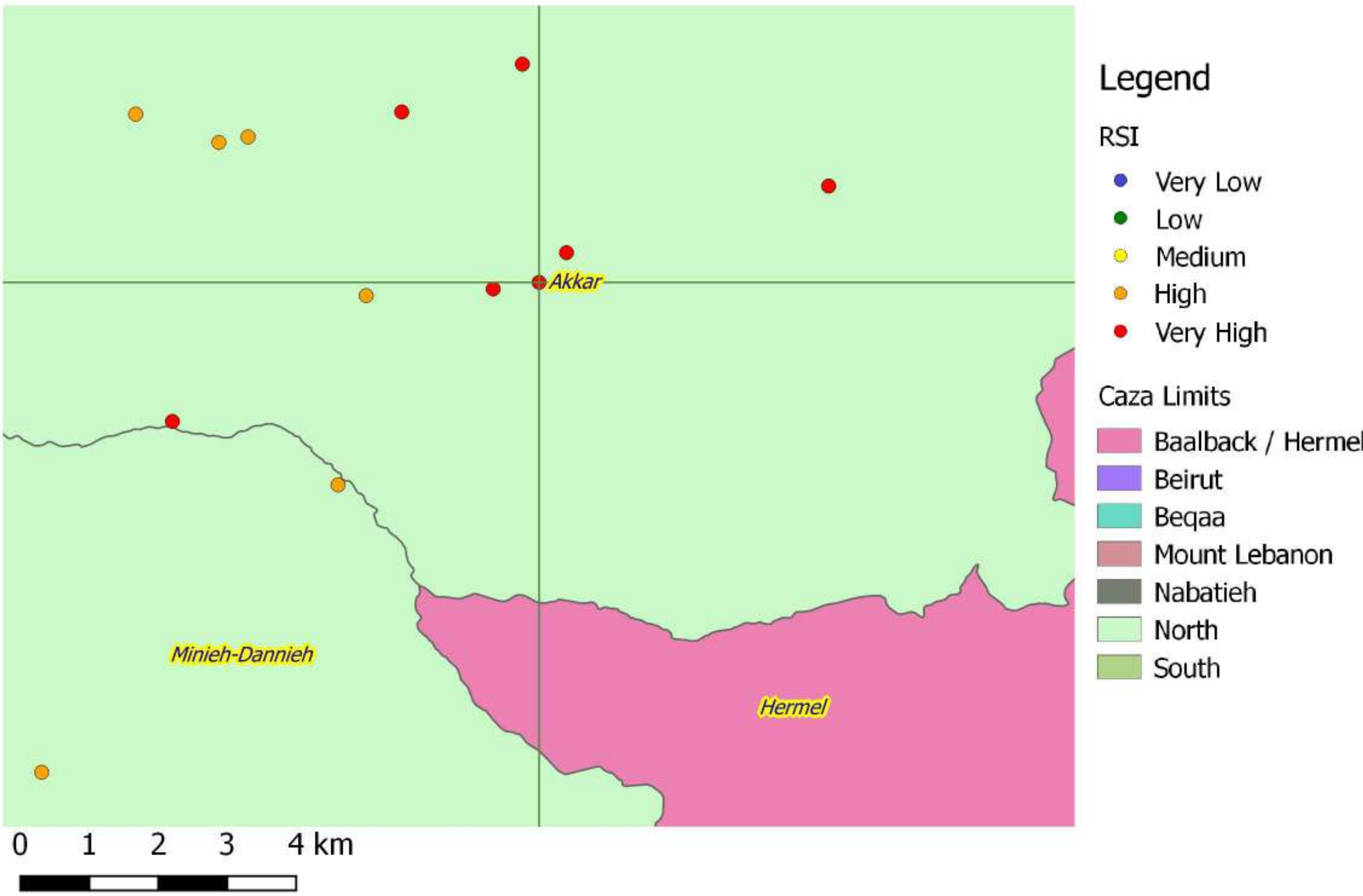
1- Site Name and Location	**M9-Baalback-02**
X	36.185
Y	34.014
Z	1099.966309 m
Mohafaza	Beqaa
Caza	Baalbeck
Town	Baalbeck
2- Type of Dump	Dumps in used-up surface quarry
Distance to Urban areas	254 m
Open Burning	No
3- Estimated Volume	75,000 m^3
Area	15,000 m^2
Height	5 m
Quantity of waste currently dumped	50 t/d
Waste coming from	Villages in Baalbeck caza
4- Priority Ranking for Rehabilitation	**16**
Risk Sensitivity Index Score	28.905 out of 55
5- Preferred Rehabilitation Option	Excavate, line, grade, cap, manage gases and collect leachate
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.
7- Responsibility	Municipality of Baalback
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap, biofilter system, leachate generation and management.
11 - Estimated cost (USD)	1,147,000 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	15.293 USD/m^3
12- Possible sources of financing	National Budget or donor agencies

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	10,000.0	10,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	75,000	4.0	300,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	5,625	14.0	78,750
2.2.1-Install a geomembrane liner and geotextile	m^2	11,250	13.0	146,250
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	37,500	4.0	150,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	11,250	2.0	22,500
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	5,625	14.0	78,750
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	3,375	40.0	135,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	3,375	15.0	50,625
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	11,250	4.0	45,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	15,000.0	15,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	10,000.0	10,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	225	45.0	10,125
5.3 - Cut off walls	lm	100	100.0	10,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	75,000.0	75,000
TOTAL COST (USD)				**1,147,000**
AVERAGE COST (USD/m^3)				**15.293**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: R9-Mishmesh-0

Location of dumpsite (WGS-1984):

X: 36.16 m

Y: 34.47 m

Z: 913.74 m

Mohafaza: North

Caza: Akkar

Town: Mishmesh

Distance to urban areas: 1600 m

Dump status: Operational

Estimated volume: 6000.0 m3

Area: 1500 m2

Visibility: Y

Priority Ranking for Rehabilitation: 16

Risk Sensitivity Index Score: 28.39

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**R9-Mishmesh-0**
X	36.162
Y	34.469
Z	914 m
Mohafaza	North
Caza	Akkar
Town	Mishmesh
2- Type of Dump	Dump bordering major river channel
Distance to Urban areas	94 m
Open Burning	N
3- Estimated Volume	6,000 m^3
Area	1,500 m^2
Height	4 m
Quantity of waste currently dumped	13 t/d
Waste coming from	Operational
4- Priority Ranking for Rehabilitation	**16**
Risk Sensitivity Index Score	28.390 out of 55
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Group with other dumpsites and transfer to a sanitary landfill
6- Technical Requirements	For Option 1: a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump to half, grading, compaction and sabilization of waste within the dump (slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by naturally pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system. For Option 2: Transfer all the original volume of waste to a nearby sanitary landfill in 20 m3 transfer trucks.
7- Responsibility	Municipality of Mishmesh
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and
11 - Estimated cost (USD)	150,250 USD for Option 1 | 74,500 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	25.042 USD/m^3 for Option 1 | 12.417 USD/m^3 for Option 2
12- Possible sources of financing	National Budget

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

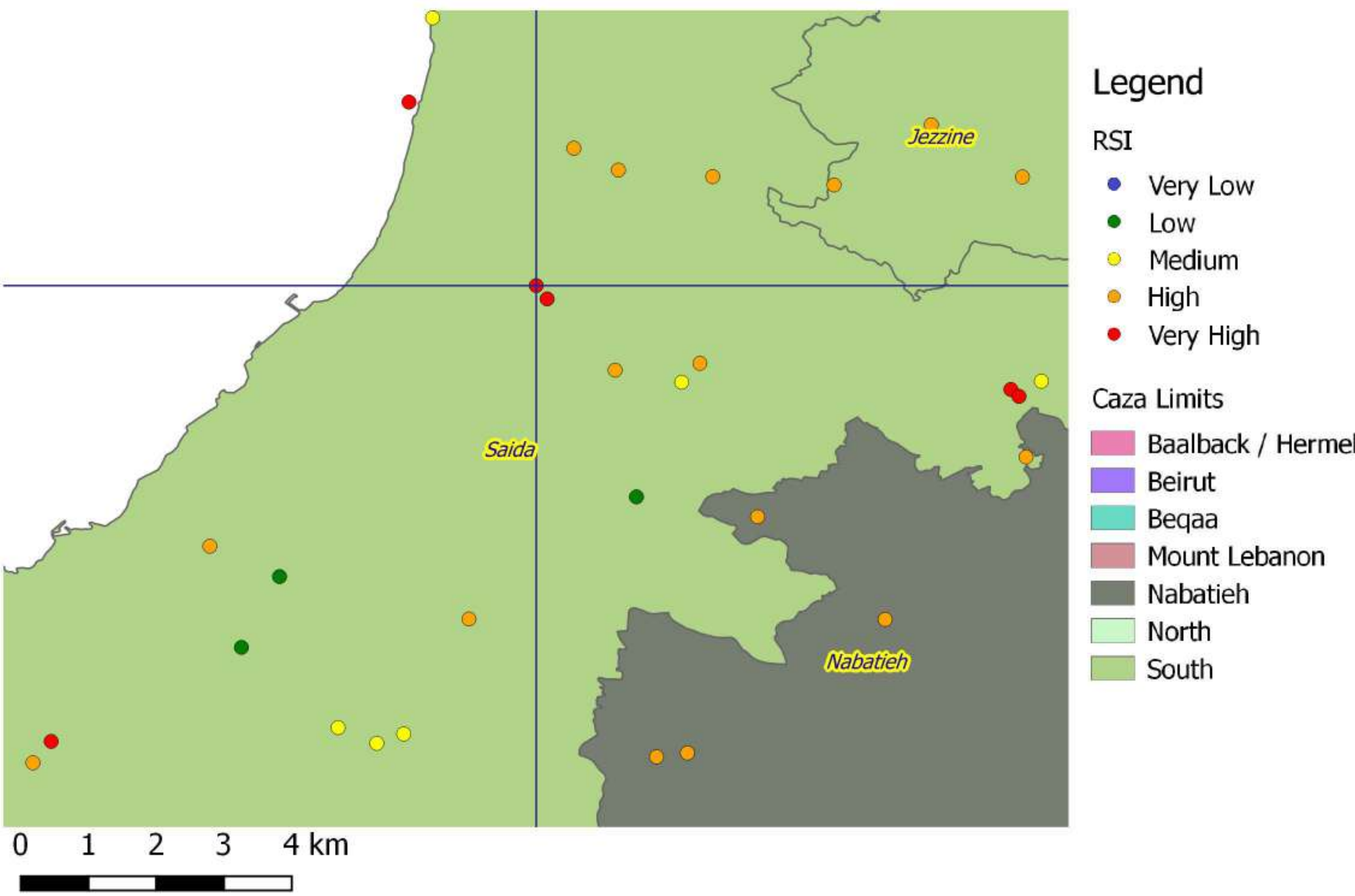
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	6,000	4.0	24,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer, installing a geomembrane and geotextile	m^3	1,500	14.0	21,000
2.2.1-Install a geomembrane liner and geotextile	m^2	1,500	13.0	19,500
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	3,000	4.0	12,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	1,500	2.0	3,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	750	14.0	10,500
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	450	40.0	18,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	450	15.0	6,750
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	1,500	4.0	6,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	5,000.0	5,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 5 m3 complete including pumping system	unit	1	3,000.0	3,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump.	lm	100	45.0	4,500
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	10,000.0	10,000
TOTAL COST (USD)				**150,250**
AVERAGE COST (USD/m^3)				**25.042**

Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to a sanitary landfill	m^3	6,000	2.0	12,000
2.2 - Transfer waste to nearby sanitary landfill	trucks	300	75.0	22,500
2.3 - Gate fee at landfill	t	3,000	12.0	36,000
TOTAL COST (USD)				**74,500**
AVERAGE COST (USD/m^3)				**12.417**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: G2-Ghaziye-00	Distance to urban areas: 600 m
Location of dumpsite (WGS-1984):	Dump status: Non-operational
X: 35.38 m	Estimated volume: 32000.0 m3
Y: 33.51 m	Area: 4000 m2
Z: 102.29 m	Visibility: N
Mohafaza: South	Priority Ranking for Rehabilitation: 17
Caza: Saida	Risk Sensitivity Index Score: 28.36
Town: Ghazieh	Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

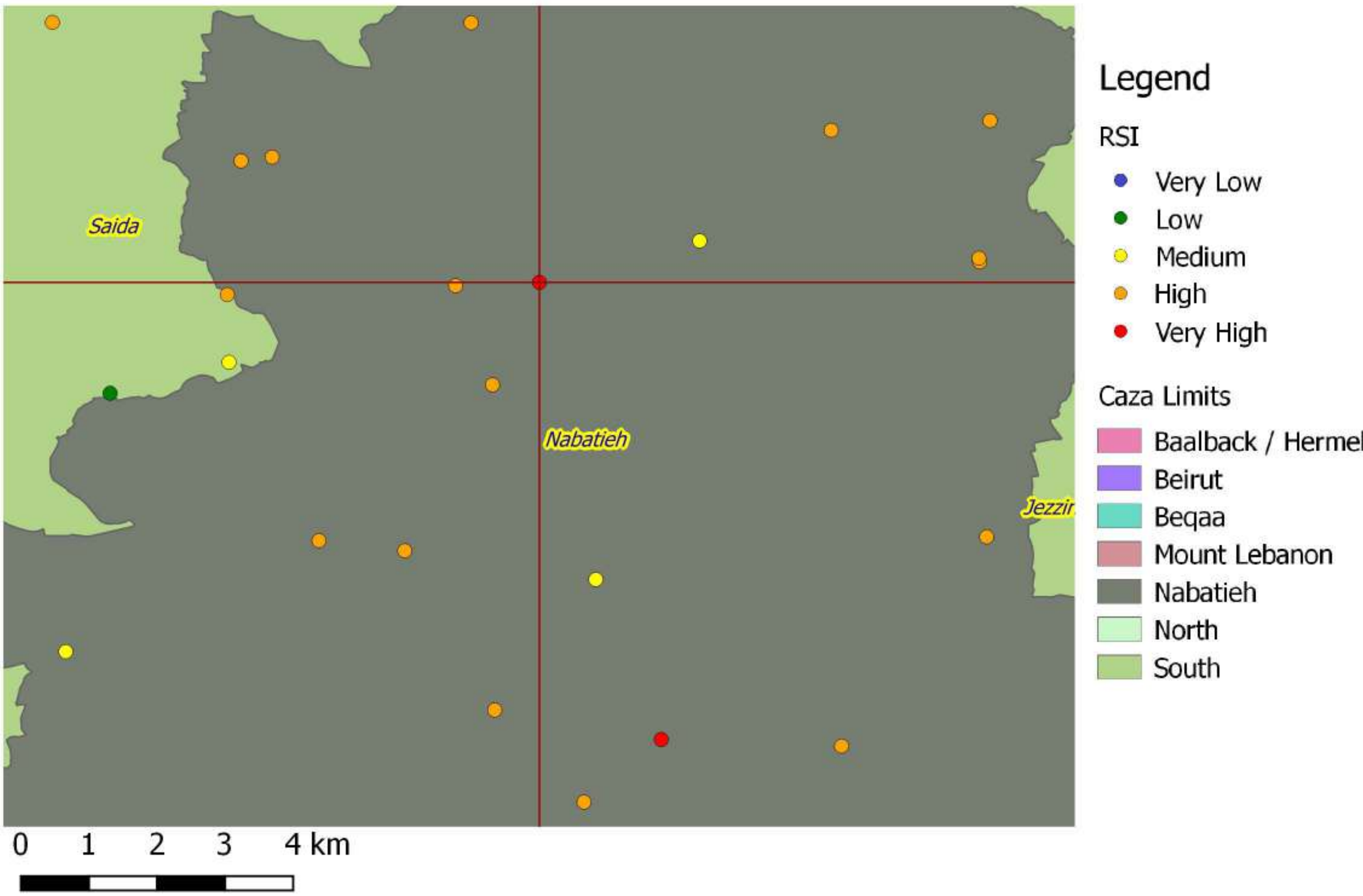
1- Site Name and Location	**G2-Ghaziye-00**	
X	35.381	
Y	33.509	
Z	102.3	m
Mohafaza	South	
Caza	Saida	
Town	Ghaziye	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	368	m
Open Burning	N	
3- Estimated Volume	32,000	m^3
Area	4,000	m^2
Height	8	m
Quantity of waste currently dumped	0	t/d
Waste coming from	Ghaziye	
4- Priority Ranking for Rehabilitation	**17**	
Risk Sensitivity Index Score	28.356	out of 55
5- Preferred Rehabilitation Option	Excavate, line, grade, cap, manage gases and collect leachate	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.	
7- Responsibility	Municipality of Ghaziye	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap, biofilter system, leachate generation	
11 - Estimated cost (USD)	457,200	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	14.288	USD/m^3
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	10,000.0	10,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	32,000	4.0	128,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	3,600	14.0	50,400
2.2.1-Install a geomembrane liner and geotextile	m^2	3,600	13.0	46,800
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	16,000	4.0	64,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	3,000	2.0	6,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	1,500	14.0	21,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	900	40.0	36,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	900	15.0	13,500
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	3,000	4.0	12,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost	LS	1	10,000.0	10,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	10,000.0	10,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	100	45.0	4,500
5.3 - Cut off walls	lm	50	100.0	5,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	30,000.0	30,000
TOTAL COST (USD)				**457,200**
AVERAGE COST (USD/m^3)				**14.288**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: E3-Kfour En-Nabatieh-00	Distance to urban areas: 3000 m
Location of dumpsite (WGS-1984):	Dump status: Operational
X: 35.45 m	Estimated volume: 42000.0 m3
Y: 33.42 m	Area: 6000 m2
Z: 369.68 m	Visibility: N
Mohafaza: Nabatieh	Priority Ranking for Rehabilitation: 18
Caza: Nabatieh	Risk Sensitivity Index Score: 28.13
Town: Kfour	Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

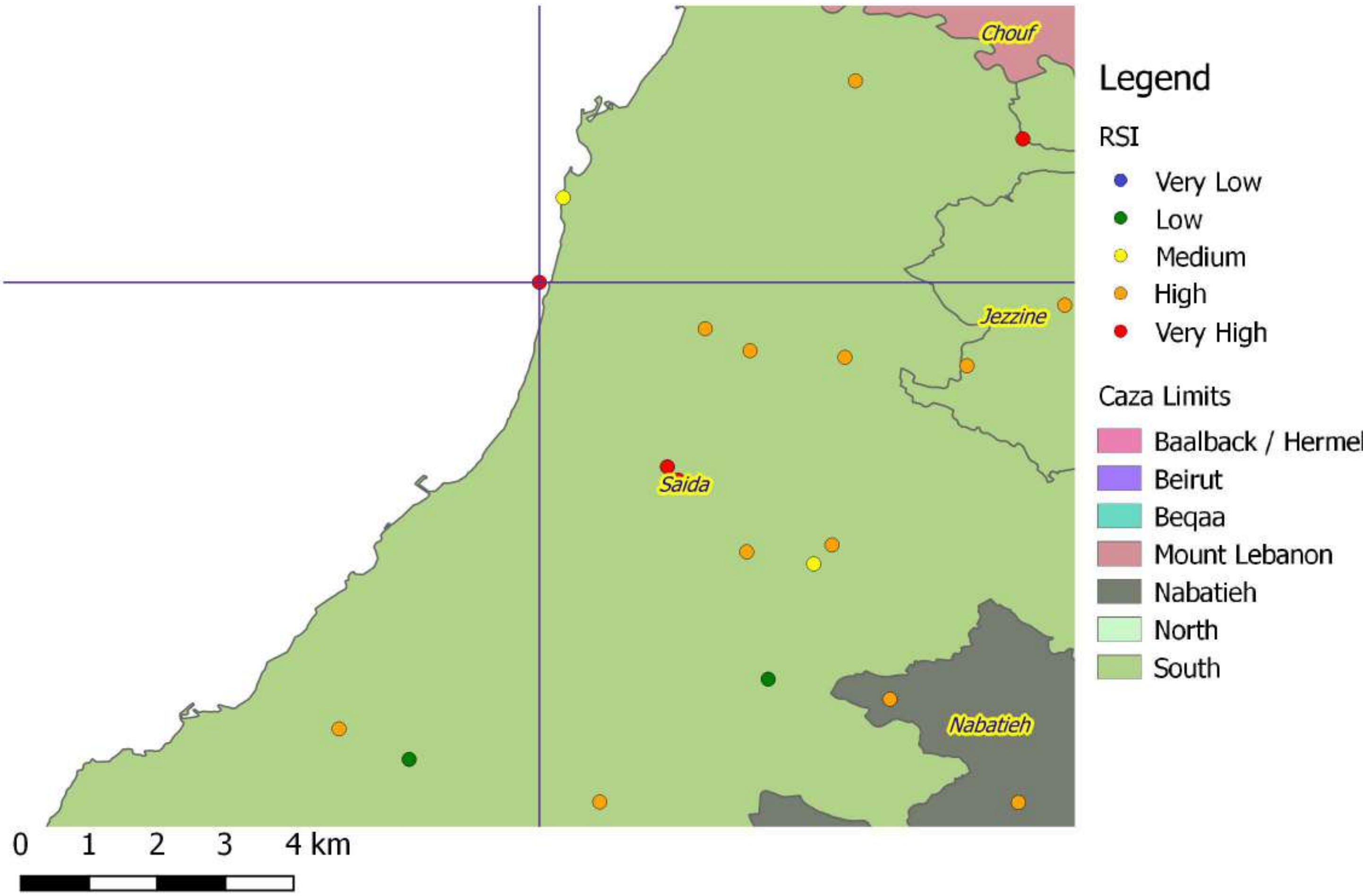
1- Site Name and Location	**E3-Kfour En-Nabatieh-00**	
X	35.360	
Y	33.415	
Z	370	m
Mohafaza	Nabatieh	
Caza	Nabatieh	
Town	Kfour	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	262	m
Open Burning	N	
3- Estimated Volume	42,000	m^3
Area	6,000	m^2
Height	7	m
Quantity of waste currently dumped	40	t/d
Waste coming from	Union of Chqif	
4- Priority Ranking for Rehabilitation	**18**	
Risk Sensitivity Index Score	28.131	out of 55
5- Preferred Rehabilitation Option	Excavate, line, grade, cap, manage gases and collect leachate	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of transfering the waste to a more appropriate location within the site, minimizing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location (one third the area) within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer . d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the e-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.	
7- Responsibility	Union of Municipalities of Chqif	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.	
11 - Estimated cost (USD)	678,750	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	16.161	USD/m^3
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	15,000.0	15,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	42,000	4.0	168,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	3,600	14.0	50,400
2.2.1-Install a geomembrane liner and geotextile	m^2	7,200	13.0	93,600
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps,	m^3	21,000	4.0	84,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	3,000	2.0	6,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	3,000	14.0	42,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	1,800	40.0	72,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	1,800	15.0	27,000
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	6,000	4.0	24,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	10,000.0	10,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	10,000.0	10,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	150	45.0	6,750
5.3 - Cut off walls	lm	100	100.0	10,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	50,000.0	50,000
TOTAL COST (USD)				**678,750**
AVERAGE COST (USD/m^3)				**16.161**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: G2- Saida -1n

Location of dumpsite (WGS-1984):

X: 35.36 m

Y: 33.54 m

Z: 0.0 m

Mohafaza: South

Caza: Saida

Town: Saida

Distance to urban areas: 1140 m

Dump status: Operational

Estimated volume: 50000.0 m3

Area: 5000 m2

Visibility: Y

Priority Ranking for Rehabilitation: 19

Risk Sensitivity Index Score: 28.09

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

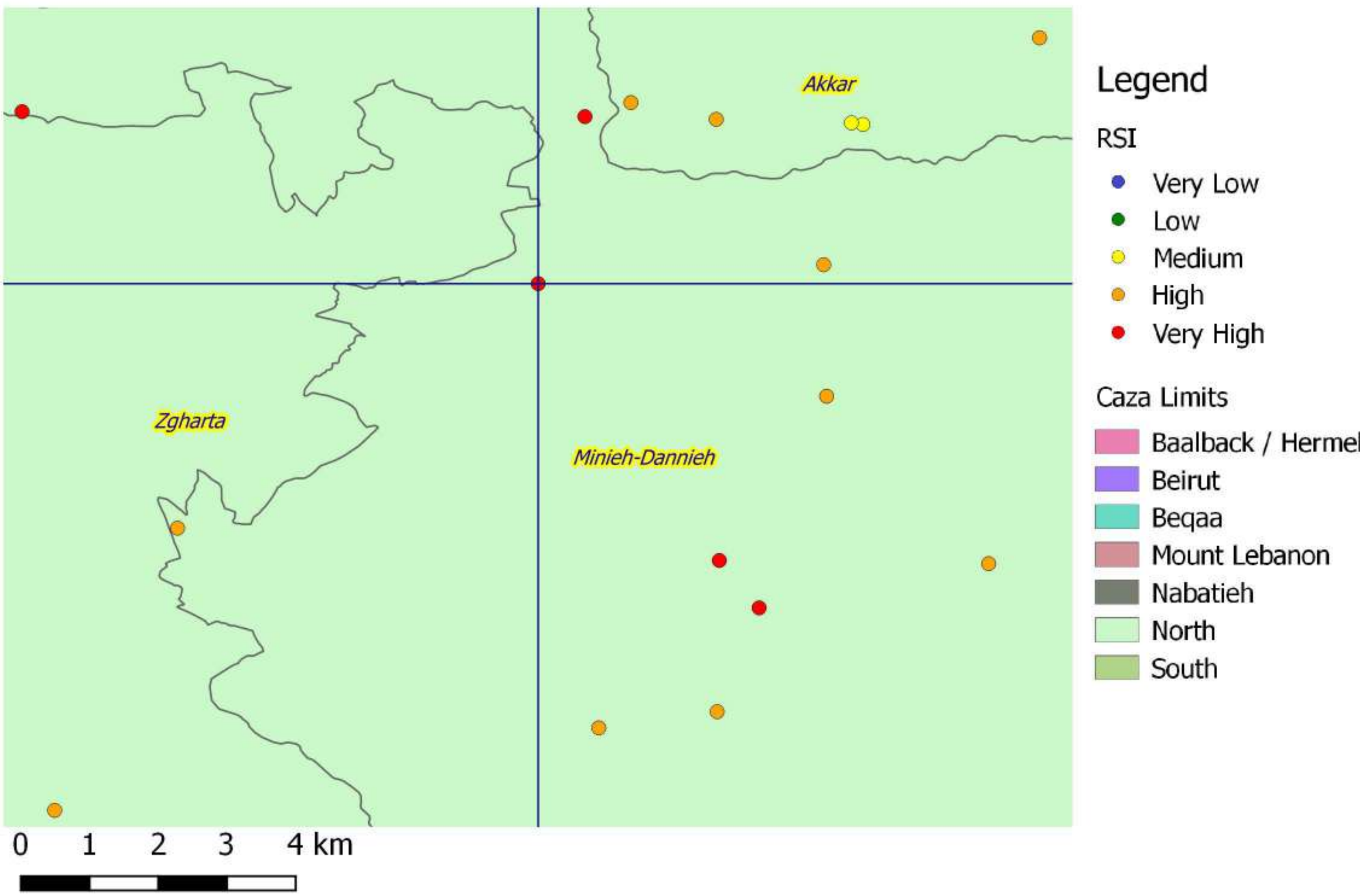
1- Site Name and Location	**G2-Saida-1n**
X	35.360
Y	33.539
Z	5 m
Mohafaza	South
Caza	Saida
Town	Saida
2- Type of Dump	Elaborated hill or pile
Distance to Urban areas	111 m
Open Burning	No
3- Estimated Volume	50,000 m^3
Area	5,000 m^2
Height	10 m
Quantity of waste currently dumped	50 t/d
Waste coming from	Union of Saida Municipalities
4- Priority Ranking for Rehabilitation	**19**
Risk Sensitivity Index Score	28.087 out of 55
5- Preferred Rehabilitation Option	Grade, cap, manage gases and leachate
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. d-Passive harnessing of gases from the dumpsite by natural pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. e- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.
7- Responsibility	Municipality of Saida
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management
11 - Estimated cost (USD)	359,250 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	7.185 USD/m^3
12- Possible sources of financing	National Budget or donor agencies

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	20,000.0	20,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	25,000	4.0	100,000
2.2 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	2,500	2.0	5,000
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	2,500	14.0	35,000
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	1,500	40.0	60,000
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	1,500	15.0	22,500
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	5,000	4.0	20,000
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	30,000.0	30,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 20 m^3 complete including pumping system	unit	1	20,000.0	20,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	150	45.0	6,750
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	30,000.0	30,000
TOTAL COST (USD)				**359,250**
AVERAGE COST (USD/m^3)				**7.185**

Rehabilitation Report

Updated Master Plan for the closure & rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Municipal Solid Waste

Name of dumpsite: R7-Kfar Chellane-0

Location of dumpsite (WGS-1984):

X: 35.98 m

Y: 34.42 m

Z: 360.26 m

Mohafaza: North

Caza: Minieh-Dannieh

Town: Kfar Chellane

Distance to urban areas: 1000 m

Dump status: Operational

Estimated volume: 11500.0 m3

Area: 2300 m2

Visibility: N

Priority Ranking for Rehabilitation: 20

Risk Sensitivity Index Score: 28.05

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**R7-Kfar Chellane-0**	
X	35.980	
Y	34.422	
Z	360 m	
Mohafaza	North	
Caza	Minieh-Dannieh	
Town	Kfar Chellane	
2- Type of Dump	Dump in valley or seasonal water channel	
Distance to Urban areas	113 m	
Open Burning	N	
3- Estimated Volume	11,500 m^3	
Area	2,300 m^2	
Height	5 m	
Quantity of waste currently dumped	3 t/d	
Waste coming from	Operational	
4- Priority Ranking for Rehabilitation	**20**	
Risk Sensitivity Index Score	28.052 out of 55	
5- Preferred Rehabilitation Option	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate Option 2 - Group with other dumpsites and transfer to a sanitary landfill	
6- Technical Requirements	For Option 1: a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump to half, grading, compaction and sabilization of waste within the dump (slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer including drainage, intallation of a geomembrane and a a geotextile layer. d-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. e-Passive harnessing of gases from the dumpsite by naturally pathways and drainage layers within the dumpsite. The passive venting system should include the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost. f- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.	
	For Option 2: Transfer all the original volume of waste to a nearby sanitary landfill in 20 m^3 transfer trucks.	
7- Responsibility	Municipality of Kfar Chellane	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise transfer and treatment activities. b- Monitor and extinguish fires/gases c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of cap,biofilter, leachate generation and management / Continuous control and inspection of moving trucks.	
11 - Estimated cost (USD)	225,310 USD for Option 1	133,375 USD for Option 2
Average rehabilitation/closure cost (USD per m^3 of waste)	19.592 USD/m^3 for Option 1	11.598 USD/m^3 for Option 2
12- Possible sources of financing	National Budget or donor agencies	

COST ESTIMATE

Option 1 - Excavate, line, grade, cap, manage gases and collect leachate

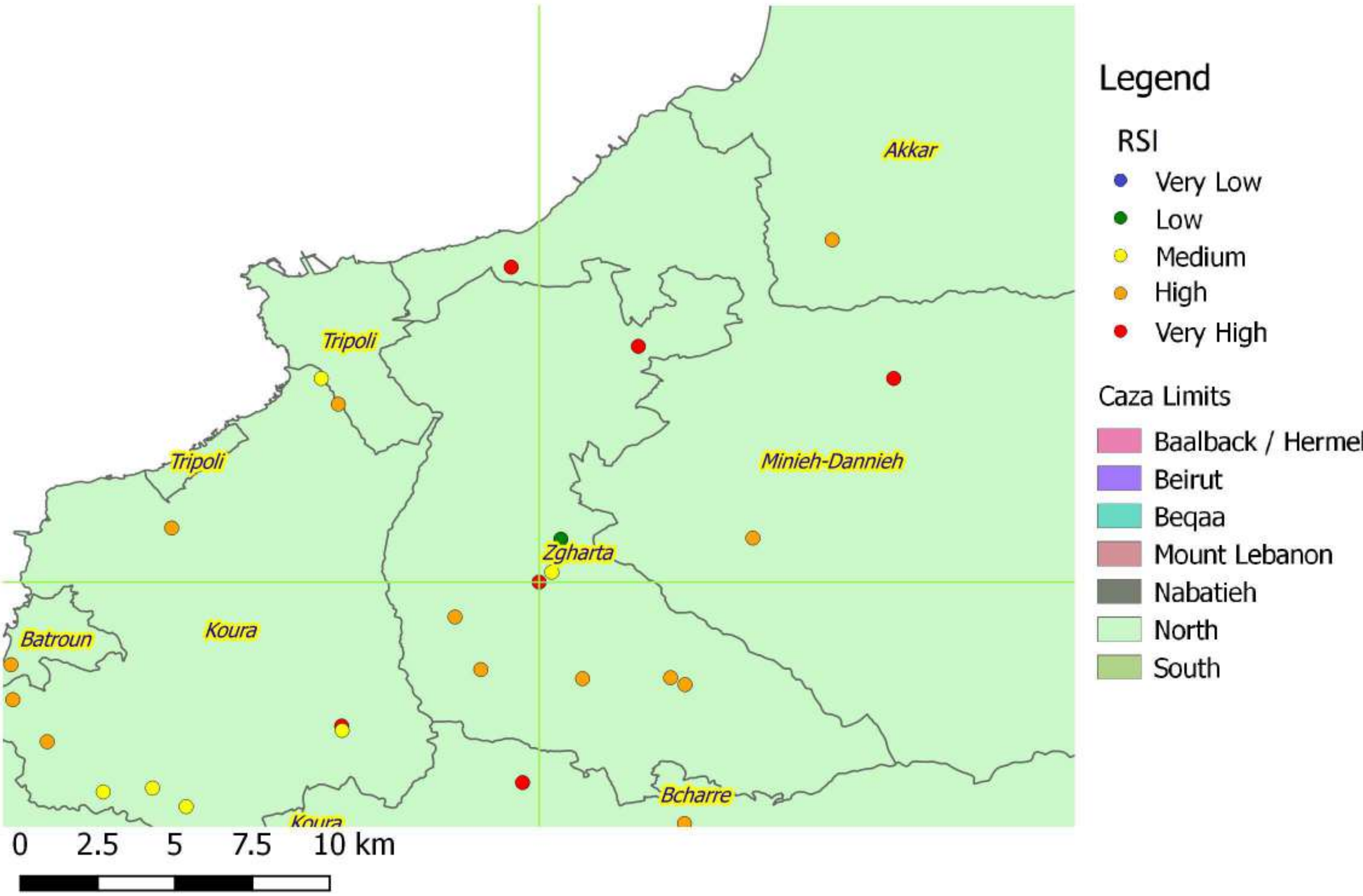
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	3,000.0	3,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	4,000.0	4,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to another location in the same plot.	m^3	11,500	4.0	46,000
2.2-Prepare bottom layer surface in new location within the site by placement and compaction of a 50 cm clay layer	m^3	1,380	14.0	19,320
2.2.1-Install a geomembrane liner and geotextile	m^2	1,380	13.0	17,940
2.3 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m^3	5,750	4.0	23,000
2.4 - Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	1,150	2.0	2,300
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m^3	1,150	14.0	16,100
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m^3	690	40.0	27,600
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m^3	690	15.0	10,350
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m^2	2,300	4.0	9,200
4. Gas Management Works				
4.1 - Supply and install a passive venting system complete inluding all accessories. The venting system includes the necessary gravel, piping, metallic funnel shaped structure, activated carbon, geotextile, and wood ships or compost.	LS	1	5,000.0	5,000
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 10 m3 complete including pumping system	unit	1	5,000.0	5,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	200	45.0	9,000
5.3 - Cut off walls	lm	75	100.0	7,500
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	20,000.0	20,000
TOTAL COST (USD)				**225,310**
AVERAGE COST (USD/m^3)				**19.592**

Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of transfer its components to Karantina sanitary landfill	m^3	11,500	2.0	23,000
2.2 - Transfer waste to sanitary landfill	trucks	575	65.0	37,375
2.3 - Gate fee at sanitary landfill	t	5,750	12.0	69,000
TOTAL COST (USD)				**133,375**
AVERAGE COST (USD/m^3)				**11.598**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: Q7-Morh Kfarsghab-2	Distance to urban areas: 500.0 m
Location of dumpsite (WGS-1984):	Dump status: Operational
X: 35.91 m	Estimated volume: 15200.0 m3
Y: 34.34 m	Area: 3800.0 m2
Z: 308.35 m	Visibility: Y
Mohafaza: North	Priority Ranking for Rehabilitation: 1
Caza: Zgharta	Risk Sensitivity Index Score: 23.53
Town: Morh Kfarsghab	Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

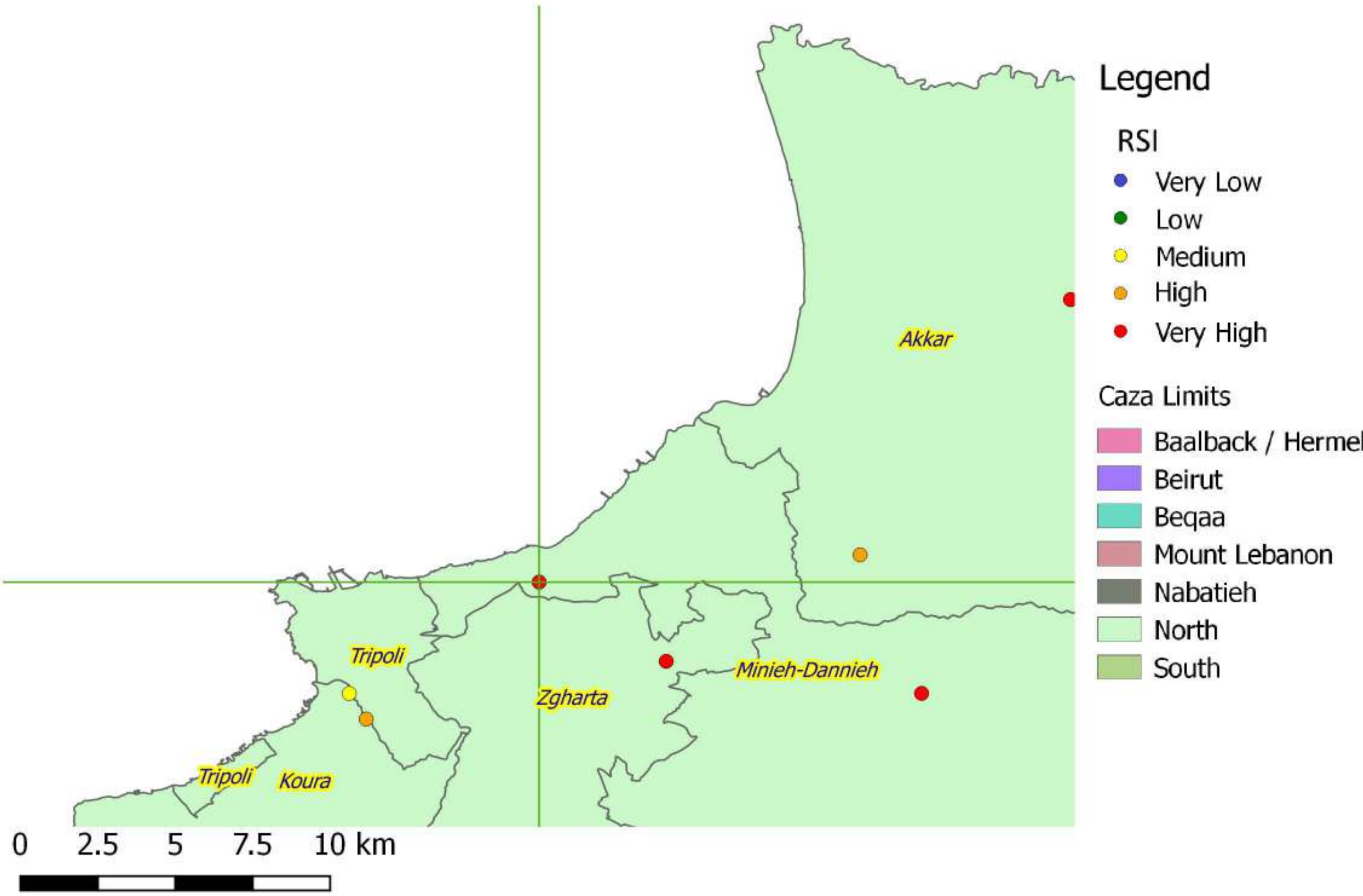
1- Site Name and Location	**Q7-Morh Kfarsghab-2**	
X	35.909	
Y	34.343	
Z	308.35	m
Mohafaza	North	
Caza	Zgharta	
Town	Kfarsghab	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	12.4	m
Status	Operational	
3- Estimated Volume	15,200	m^3
Area	3,800	m^2
Height	4.0	m
Visibility	Y	
4- Priority Ranking for Rehabilitation	**1**	
Risk Sensitivity Index Score	23.53	out of 36.000
5- Preferred Rehabilitation Option	Achieve intended use (build a church)	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of rubble using the necessary machinery for the purpose of grading and compacting the waste in the dump. c- Stabilize slopes and cover dump and side slope with sand and plant with trees	
7- Responsibility	Municipality of Kfarsghab	
8- Legal requirements	Enforce legislation and ban open dumping of rubble.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works c-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of treatment and sorting activities.	
11 - Estimated cost (USD)	40,267	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	2.649	USD/m^3
12- Possible sources of financing	Municipality Budget	

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and all necessary work needed to assess conditions of the dump.	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of rubble within the dump for the purpose of grading and compaction	m^3	3,800	2.0	7,600
2.2-Manual segregation of waste and removal of any recyclable or bulky materials	unit	1	600.0	600
2.3- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	1,900	2.0	3,800
2.4-Adding a layer of agricultural top soil on side slopes (50 cm thickness)	m^3	1,900	10.0	19,000
2.5- Planting trees	unit	63	20.0	1,267
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	4,000.0	4,000
TOTAL COST (USD)				**40,267**
AVERAGE COST per unit Volume (USD/m^3)				**2.649**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: R7-Deir Ammar-2	Distance to urban areas: 600.0 m
Location of dumpsite (WGS-1984):	Dump status: Operational
X: 35.9 m	Estimated volume: 35000.0 m3
Y: 34.45 m	Area: 5000.0 m2
Z: 117.64 m	Visibility: Y
Mohafaza: North	Priority Ranking for Rehabilitation: 2
Caza: Minieh-Dannieh	Risk Sensitivity Index Score: 23.53
Town: Deir Ammar	Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**R7-Deir Ammar-2**
X	35.899
Y	34.454
Z	117.64 m
Mohafaza	North
Caza	Minieh-Dannieh
Town	Deir Ammar
2- Type of Dump	Dump in roadside cliff or steep slope
Distance to Urban areas	72.3 m
Status	Operational
3- Estimated Volume	35,000 m^3
Area	5,000 m^2
Height	7.0 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**2**
Risk Sensitivity Index Score	23.53 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Deir Ammar
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	422,550 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.073 USD/m^3
Potential revenues	90,081 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

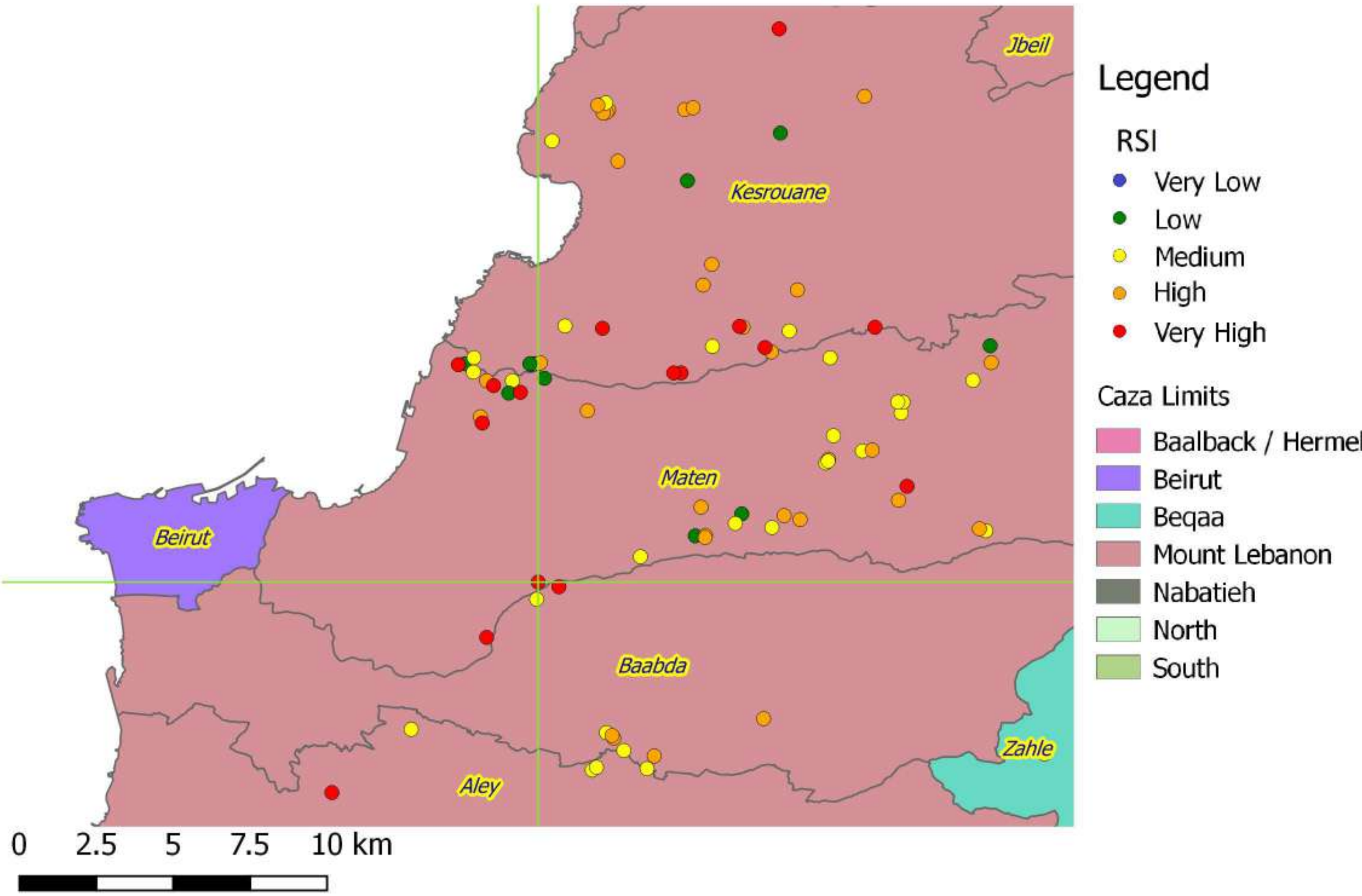
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate part of the waste dump for the purpose of treatment/sorting and earth movement	m^3	35,000	4.0	140,000
2.2-Manual segregation of waste into different recyclable materials	m^3	1,050	3.0	3,150
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	33,250	4.0	133,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	13,300	8.0	106,400
2.5- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	2,500	2.0	5,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	25,000.0	25,000
TOTAL COST (USD)				**422,550**
AVERAGE COST per unit Volume (USD/m^3)				**12.073**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	140	20.0	2,800
Fine sand	m^3	8,313	2.5	20,781
Coarse sand	m^3	13,300	1.5	19,950
Aggregates	m^3	6,650	6.0	39,900
Steel	t	67	100.0	6,650
TOTAL Revenues (USD)				**90,081**
AVERAGE Revenues per unit volume (USD/m^3)				**2.574**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: K5 - Broummana -1n

Location of dumpsite (WGS-1984):

X: 35.63 m

Y: 33.87 m

Z: 430.0 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Broummana

Distance to urban areas: 220.0 m

Dump status: Non-Operational

Estimated volume: 72000.0 m3

Area: 18000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 3

Risk Sensitivity Index Score: 23.48

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**K5-Broummana-1n**	
X	35.629	
Y	33.872	
Z	430.00	m
Mohafaza	Mount Lebanon	
Caza	Maten	
Town	Broummana	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	270.0	m
Status	Non-operational	
3- Estimated Volume	72,000	m^3
Area	18,000	m^2
Height	4.0	m
Visibility	Y	
4- Priority Ranking for Rehabilitation	**3**	
Risk Sensitivity Index Score	23.53	out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher	
7- Responsibility	Municipality of Broummana	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.	
11 - Estimated cost (USD)	839,960	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	11.666	USD/m^3
Potential revenues	185,310	USD
12- Possible sources of financing	Municipality budget/National Budget	

COST ESTIMATE

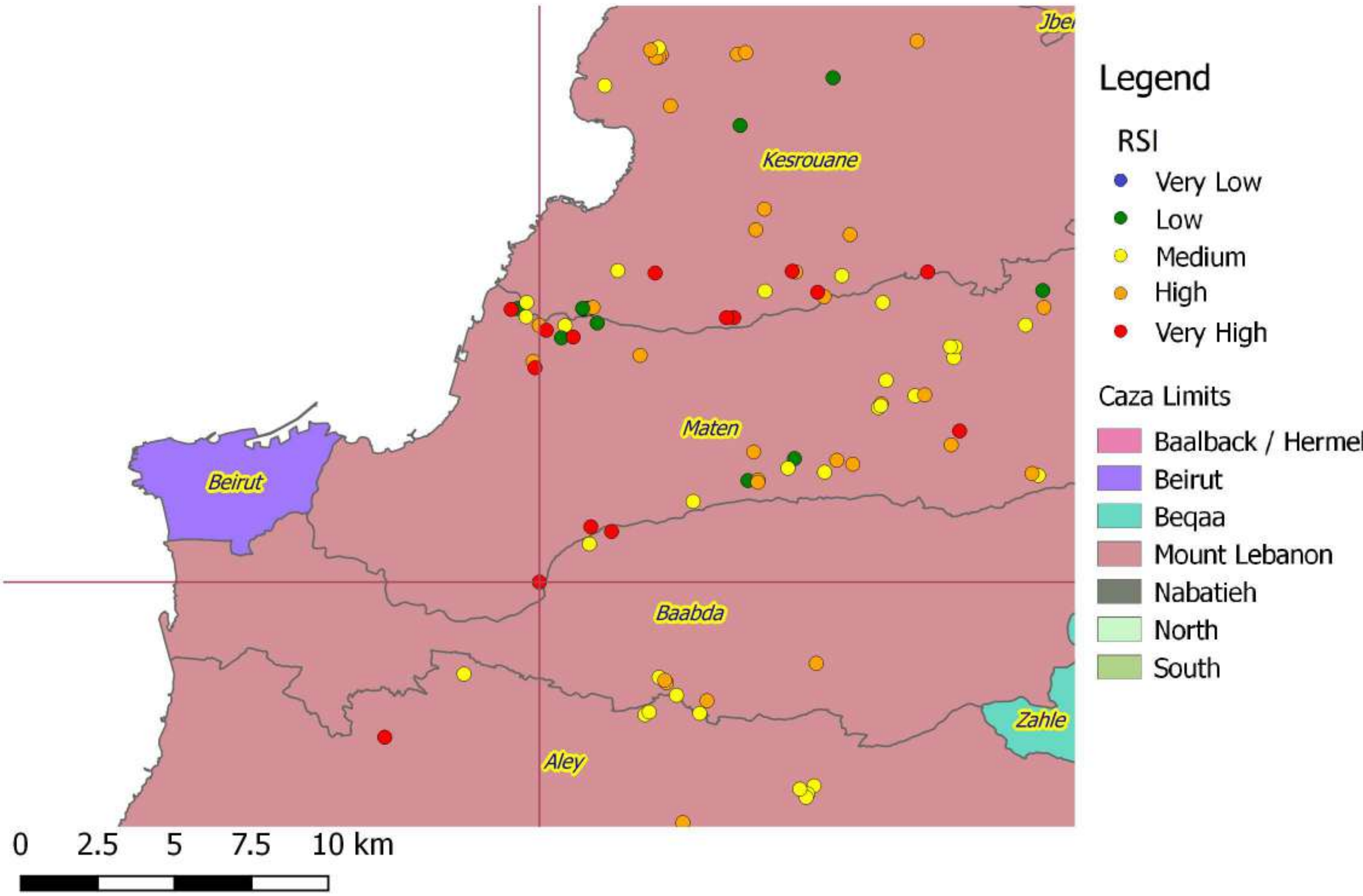
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate part of the waste dump for the purpose of treatment/sorting and earth movement	m^3	72,000	4.0	288,000
2.2-Manual segregation of waste into different recyclable materials	m^3	2,160	3.0	6,480
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	68,400	4.0	273,600
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	27,360	8.0	218,880
2.5- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	9,000	2.0	18,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	25,000.0	25,000
TOTAL COST (USD)				**839,960**
AVERAGE COST per unit Volume (USD/m^3)				**11.666**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	288	20.0	5,760
Fine sand	m^3	17,100	2.5	42,750
Coarse sand	m^3	27,360	1.5	41,040
Aggregates	m^3	13,680	6.0	82,080
Steel	t	137	100.0	13,680
TOTAL Revenues (USD)				**185,310**
AVERAGE Revenues per unit volume (USD/m^3)				**2.574**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: K4-Beit Meri-00

Location of dumpsite (WGS-1984):

X: 35.61 m

Y: 33.85 m

Z: 258.34 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Beit Meri

Distance to urban areas: 1000.0 m

Dump status: Operational

Estimated volume: 75000.0 m3

Area: 30000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 4

Risk Sensitivity Index Score: 23.21

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**K4-Beit Meri-00**
X	35.611
Y	33.853
Z	258.34 m
Mohafaza	Mount Lebanon
Caza	Maten
Town	Beit Meri
2- Type of Dump	Dump in valley or seasonal water channels
Distance to Urban areas	346.3 m
Status	Operational
3- Estimated Volume	75,000 m^3
Area	30,000 m^2
Height	2.5 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**4**
Risk Sensitivity Index Score	23.21 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Beit Meri
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	939,750 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.530 USD/m^3
Potential revenues	193,031 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

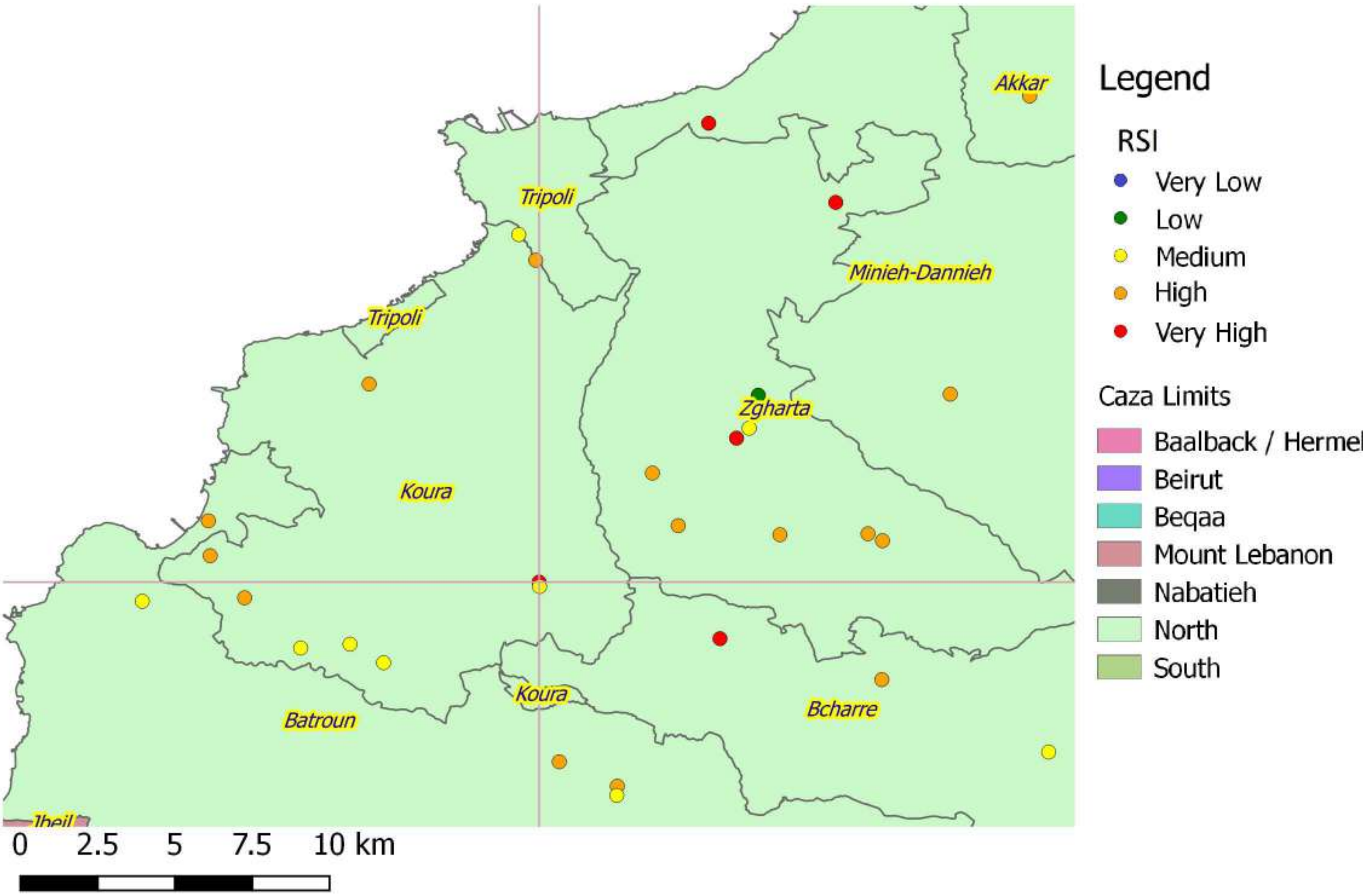
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	10,000.0	10,000
2. Earth Movement Works				
2.1 - Excavate part of the waste dump for the purpose of treatment/sorting and earth movement	m^3	75,000	4.0	300,000
2.2-Manual segregation of waste into different recyclable materials	m^3	2,250	3.0	6,750
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	71,250	4.0	285,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	28,500	8.0	228,000
2.5- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	15,000	2.0	30,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	70,000.0	70,000
TOTAL COST (USD)				**939,750**
AVERAGE COST per unit Volume (USD/m^3)				**12.530**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	300	20.0	6,000
Fine sand	m^3	17,813	2.5	44,531
Coarse sand	m^3	28,500	1.5	42,750
Aggregates	m^3	14,250	6.0	85,500
Steel	t	143	100.0	14,250
TOTAL Revenues (USD)				**193,031**
AVERAGE Revenues per unit volume (USD/m^3)				**2.574**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: P6-Kosba-2

Location of dumpsite (WGS-1984):

X: 35.84 m

Y: 34.29 m

Z: 400.28 m

Mohafaza: North

Caza: Koura

Town: Kosba

Distance to urban areas: 500.0 m

Dump status: Operational

Estimated volume: 57500.0 m3

Area: 11500.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 5

Risk Sensitivity Index Score: 23.19

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

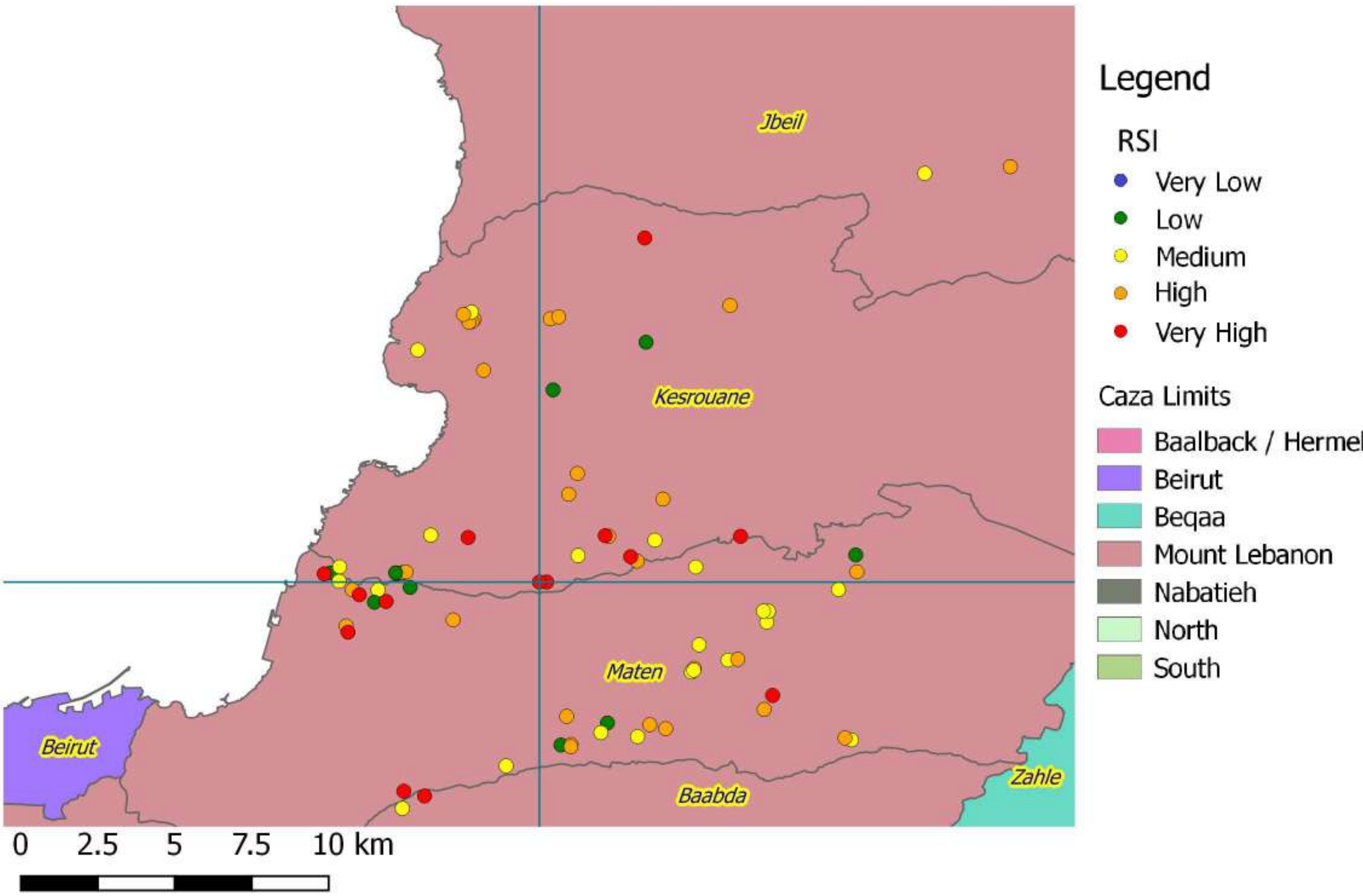
1- Site Name and Location	**P6-Kosba-2**	
X	35.840	
Y	34.293	
Z	400.3	m
Mohafaza	North	
Caza	Koura	
Town	Kosba	
2- Type of Dump	Dump in roadside cliff or steep slope	
Distance to Urban areas	146.0	m
Status	Operational	
3- Estimated Volume	57,500	m^3
Area	11,500	m^2
Height	5	m
Visibility	Y	
4- Priority Ranking for Rehabilitation	**5**	
Risk Sensitivity Index Score	23.19	out of 36.000
5- Preferred Rehabilitation Option	Achieve intended use (establish a parking)	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of rubble using the necessary machinery for the purpose of grading and compacting the waste in the dump. c- Stabilize slopes and cover dump and side slope with sand and plant with trees	
7- Responsibility	Municipality of Kosba	
8- Legal requirements	Enforce legislation and ban open dumping of rubble.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works c-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of treatment and sorting activities.	
11 - Estimated cost (USD)	109,433	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	1.903	USD/m^3
12- Possible sources of financing	Municipality Budget	

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of rubble within the dump for the purpose of grading and compaction	m^3	11,500	2.0	23,000
2.2-Manual segregation of waste and removal of any recyclable or bulky materials	unit	1	600.0	600
2.3- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	5,750	2.0	11,500
2.4-Adding a layer of agricultural top soil on side slopes (50 cm thickness)	m^3	5,750	10.0	57,500
2.5- Planting trees	unit	192	20.0	3,833
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	8,000.0	8,000
TOTAL COST (USD)				**109,433**
AVERAGE COST per unit Volume (USD/m^3)				**1.903**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L5-Balloune-2	Distance to urban areas: 400.0 m
Location of dumpsite (WGS-1984):	Dump status: Operational
X: 35.68 m	Estimated volume: 30000.0 m3
Y: 33.95 m	Area: 15000.0 m2
Z: 573.1 m	Visibility: Y
Mohafaza: Mount Lebanon	Priority Ranking for Rehabilitation: 6
Caza: Kesrouane	Risk Sensitivity Index Score: 23.16
Town: Balloune	Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L5-Balloune-2**	
X	35.677	
Y	33.946	
Z	573.10	m
Mohafaza	Mount Lebanon	
Caza	Kesrouane	
Town	Balloune	
2- Type of Dump	Elaborated hill or pile, Dump in valley or seasonal water channels	
Distance to Urban areas	175.25	m
Status	Operational	
3- Estimated Volume	30,000	m^3
Area	15,000	m^2
Height	2	m
Visibility	N	
4- Priority Ranking for Rehabilitation	**6**	
Risk Sensitivity Index Score	23.16	out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher	
7- Responsibility	Municipality of Balloune	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.	
11 - Estimated cost (USD)	362,900	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.097	USD/m^3
Potential revenues	82,913	USD
12- Possible sources of financing	Municipality budget/National Budget	

COST ESTIMATE

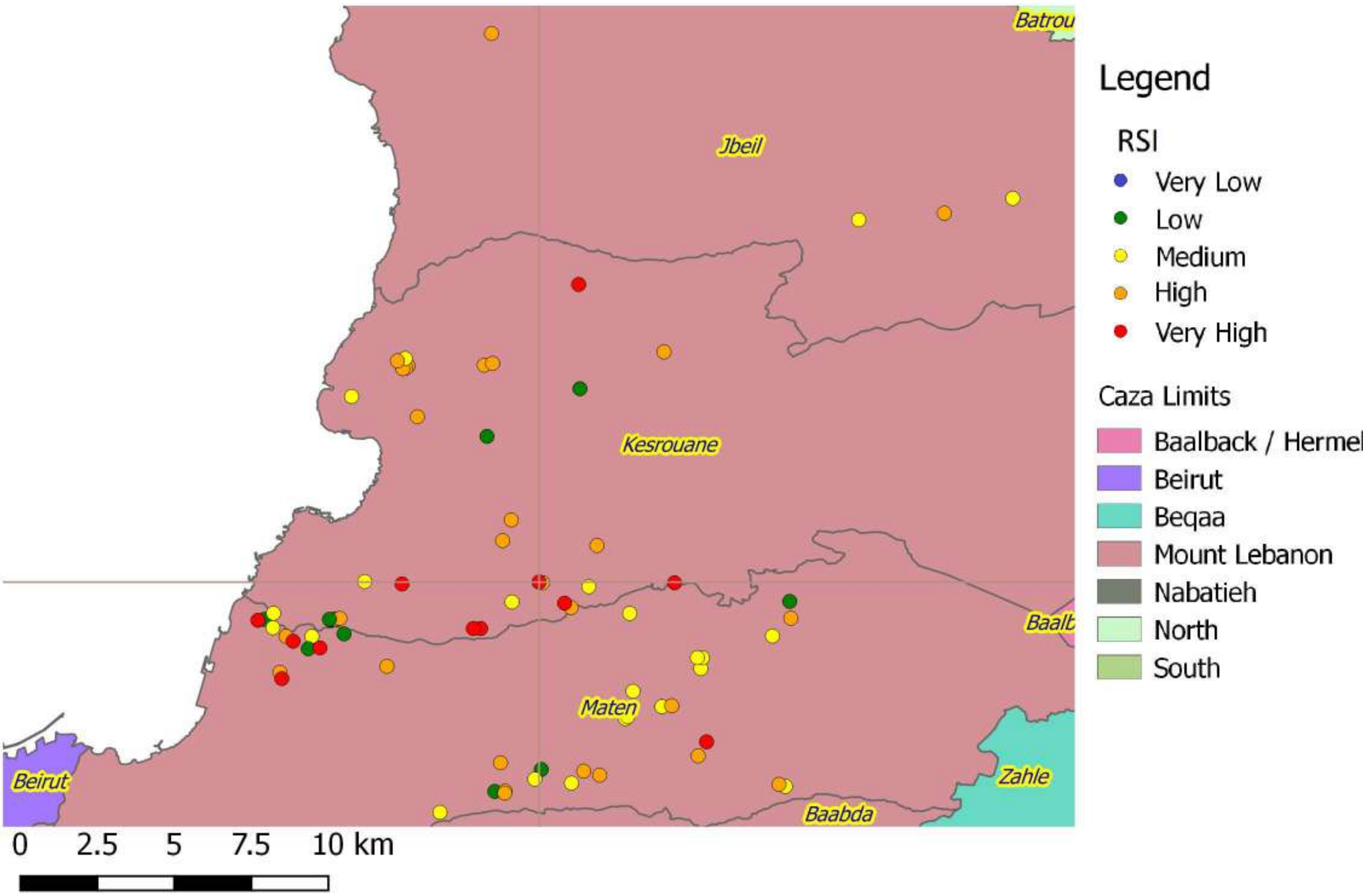
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	30,000	4.0	120,000
2.2-Manual segregation of waste into different recyclable materials	m^3	900	3.0	2,700
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	28,500	4.0	114,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	11,400	8.0	91,200
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	25,000.0	25,000
TOTAL COST (USD)				**362,900**
AVERAGE COST per unit Volume (USD/m^3)				**12.097**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	120	20.0	2,400
Fine sand	m^3	7,125	2.5	17,813
Coarse sand	m^3	11,400	1.5	17,100
Aggregates	m^3	5,700	6.0	34,200
Steel	t	114	100.0	11,400
TOTAL Revenues (USD)				**82,913**
AVERAGE Revenues per unit volume (USD/m^3)				**2.764**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L5-Qlaiaat-3

Location of dumpsite (WGS-1984):

X: 35.7 m

Y: 33.96 m

Z: 827.68 m

Mohafaza: Mount Lebanon

Caza: Kesrouane

Town: Qlaiaat

Distance to urban areas: 500.0 m

Dump status: Non-operational

Estimated volume: 45000.0 m3

Area: 15000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 7

Risk Sensitivity Index Score: 22.85

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L5-Qlaiaat-3**	
X	35.700	
Y	33.962	
Z	827.68	m
Mohafaza	Mount Lebanon	
Caza	Kesrouane	
Town	Qlaiaat	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	12.77	m
Status	Non-operational	
3- Estimated Volume	45,000	m^3
Area	15,000	m^2
Height	3	m
Visibility	N	
4- Priority Ranking for Rehabilitation	**7**	
Risk Sensitivity Index Score	22.85	out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher	
7- Responsibility	Municipality of Qleiaat	
8- Legal requirements	Enforce legislation and ban open dumping of rubble.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works c-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of treatment and sorting activities.	
11 - Estimated cost (USD)	553,850	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.308	USD/m^3
Potential revenues	105,469	USD
12- Possible sources of financing	Municipality Budget	

COST ESTIMATE

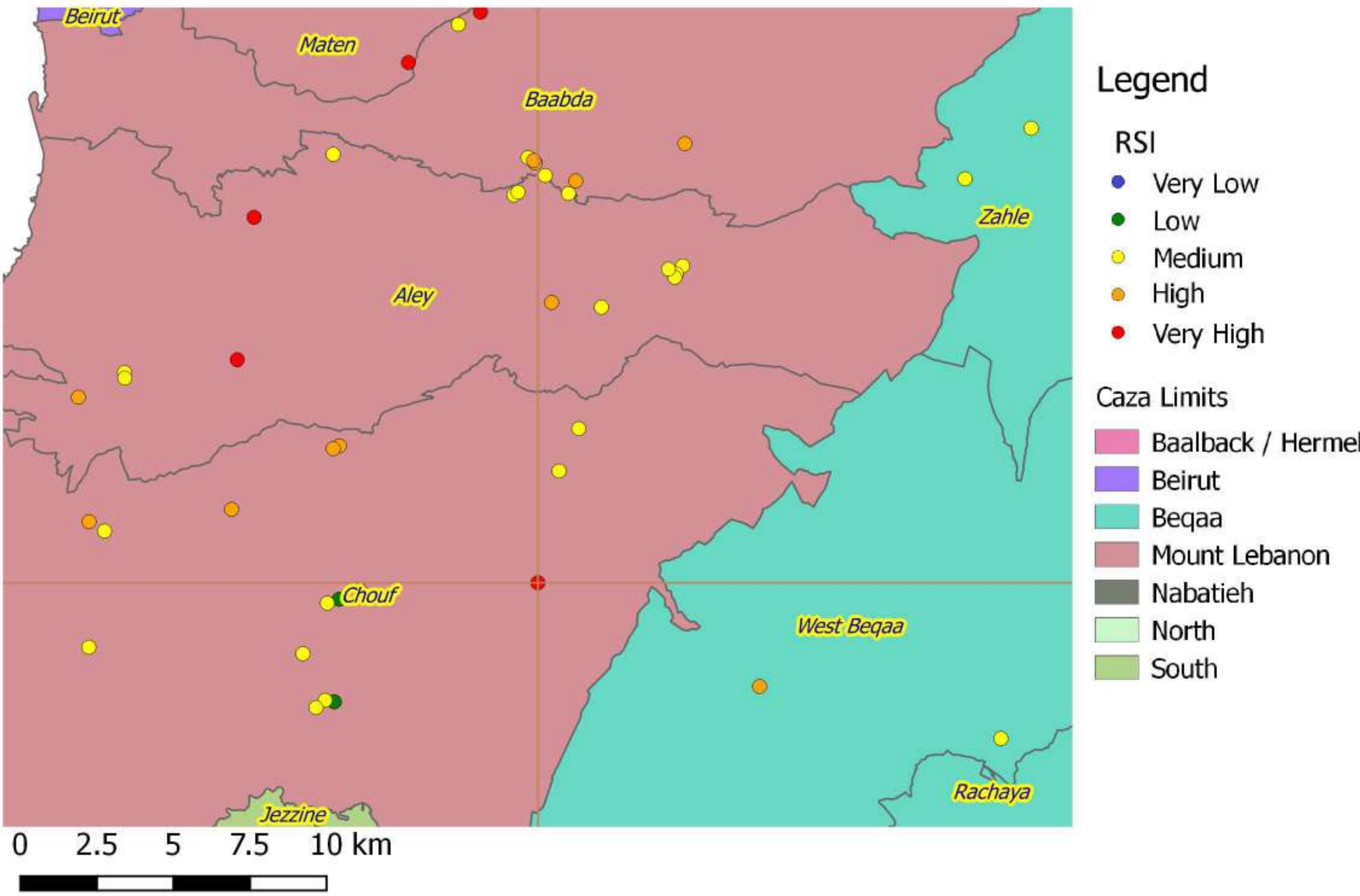
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	6,000.0	6,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	6,000.0	6,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	45,000	4.0	180,000
2.2-Manual segregation of waste into different recyclable materials	m^3	1,350	3.0	4,050
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	42,750	4.0	171,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	17,100	8.0	136,800
2.5- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	7,500	2.0	15,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	35,000.0	35,000
TOTAL COST (USD)				**553,850**
AVERAGE COST per unit Volume (USD/m^3)				**12.308**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	90	20.0	1,800
Fine sand	m^3	10,688	2.5	26,719
Coarse sand	m^3	17,100	1.5	25,650
Aggregates	m^3	8,550	6.0	51,300
Steel	t	0	100.0	0
TOTAL Revenues (USD)				**105,469**
AVERAGE Revenues per unit volume (USD/m^3)				**2.344**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: I5-Maaser Ech Chouf-0

Location of dumpsite (WGS-1984):

X: 35.66 m

Y: 33.67 m

Z: 1081.56 m

Mohafaza: Mount Lebanon

Caza: Chouf

Town: Maaser Ech Chouf

Distance to urban areas: 1100.0 m

Dump status: Operational

Estimated volume: 8000.0 m3

Area: 2000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 8

Risk Sensitivity Index Score: 22.59

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**I5-Maaser Ech Chouf-0**
X	35.657
Y	33.669
Z	1082 m
Mohafaza	Mount Lebanon
Caza	Chouf
Town	Maaser Ech Chouf
2- Type of Dump	Dump in roadside cliff or steep slope
Distance to Urban areas	68.57 m
Status	Operational
3- Estimated Volume	8,000 m^3
Area	2,000 m^2
Height	4 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**8**
Risk Sensitivity Index Score	22.59 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 2: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Maasser Ech Chouf
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a- Control dust during earth moving and sorting works b-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection
11 - Estimated cost (USD)	102,440 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.805 USD/m^3
13- Possible sources of financing	Municipality Budget

COST ESTIMATE

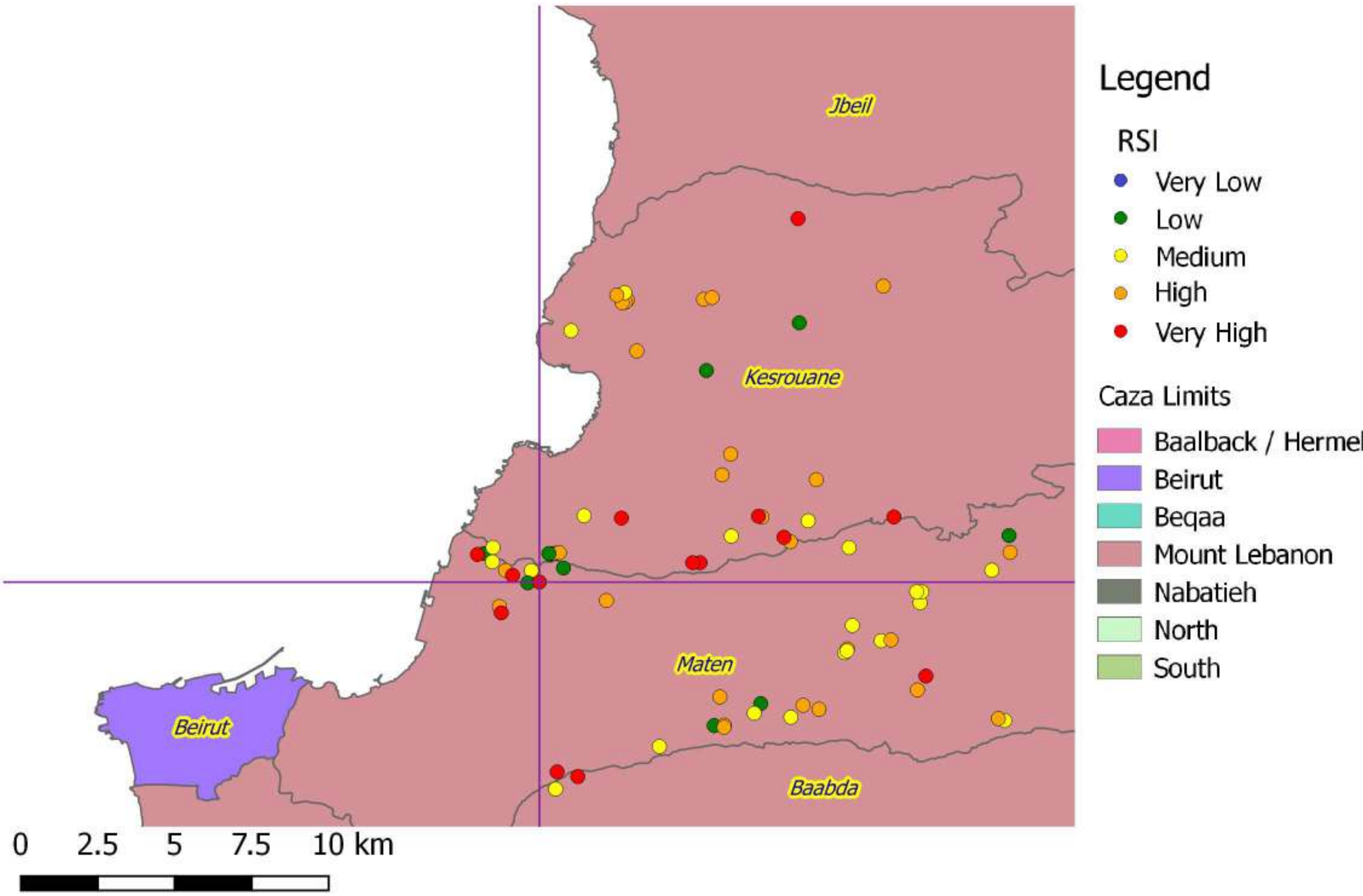
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	3,000.0	3,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	8,000	4.0	32,000
2.2-Manual segregation of waste into different recyclable materials	m^3	240	3.0	720
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	7,600	4.0	30,400
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	3,040	8.0	24,320
2.5- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	1,000	2.0	2,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	7,000.0	7,000
TOTAL COST (USD)				**102,440**
AVERAGE COST per unit Volume (USD/m^3)				**12.805**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	0	20.0	0
Fine sand	m^3	1,900	2.5	4,750
Coarse sand	m^3	3,040	1.5	4,560
Aggregates	m^3	1,520	6.0	9,120
Steel	t	30	100.0	3,040
TOTAL Revenues (USD)				**21,470**
AVERAGE Revenues per unit volume (USD/m^3)				**2.684**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L4-Dik Al-Mahdi-0

Location of dumpsite (WGS-1984):

X: 35.62 m

Y: 33.94 m

Z: 168.33 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Dik Al-Mahdi

Distance to urban areas: 400.0 m

Dump status: Operational

Estimated volume: 20000.0 m3

Area: 5000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 9

Risk Sensitivity Index Score: 22.51

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L4-Dik Al-Mahdi-0**
X	35.623
Y	33.939
Z	168.33 m
Mohafaza	Mount Lebanon
Caza	Maten
Town	Dik Al Mahdi
2- Type of Dump	Elaborated hill or pile
Distance to Urban areas	81.31 m
Status	Operational
3- Estimated Volume	20,000 m^3
Area	5,000 m^2
Height	4 m
Visibility	N
4- Priority Ranking for Rehabilitation	**9**
Risk Sensitivity Index Score	22.51 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Dik Al Mahdi
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	243,600 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.180 USD/m^3
Potential revenues	55,275 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

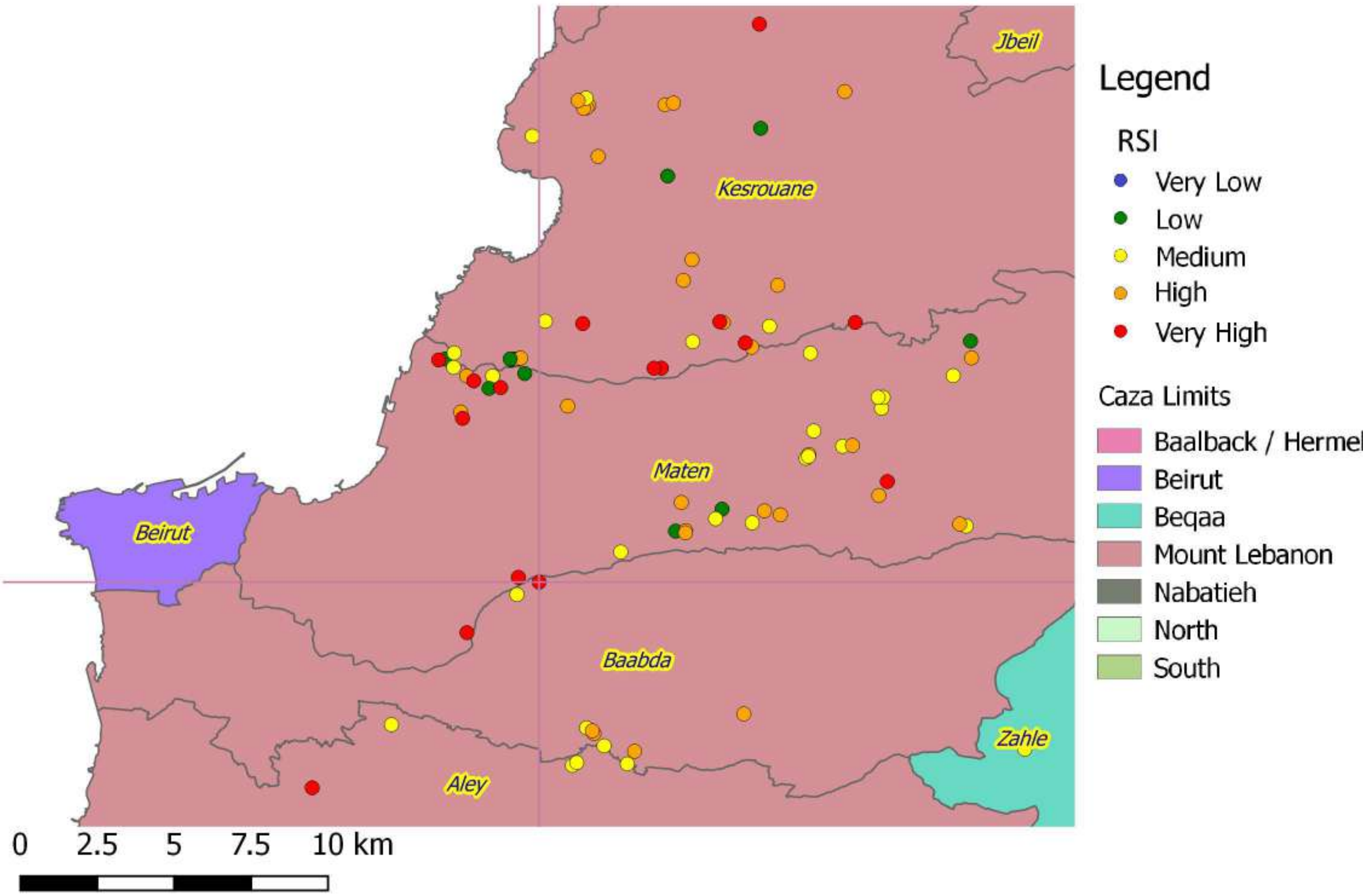
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	20,000	4.0	80,000
2.2-Manual segregation of waste into different recyclable materials	m^3	600	3.0	1,800
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	19,000	4.0	76,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	7,600	8.0	60,800
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	15,000.0	15,000
TOTAL COST (USD)				**243,600**
AVERAGE COST per unit Volume (USD/m^3)				**12.180**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	80	20.0	1,600
Fine sand	m^3	4,750	2.5	11,875
Coarse sand	m^3	7,600	1.5	11,400
Aggregates	m^3	3,800	6.0	22,800
Steel	t	76	100.0	7,600
TOTAL Revenues (USD)				**55,275**
AVERAGE Revenues per unit volume (USD/m^3)				**2.764**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: K5- Ras El Maten-2n

Location of dumpsite (WGS-1984):

X: 35.64 m

Y: 33.87 m

Z: 111.0 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Ras El Maten

Distance to urban areas: 880.0 m

Dump status: Operational

Estimated volume: 150000.0 m3

Area: 15000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 10

Risk Sensitivity Index Score: 22.5

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

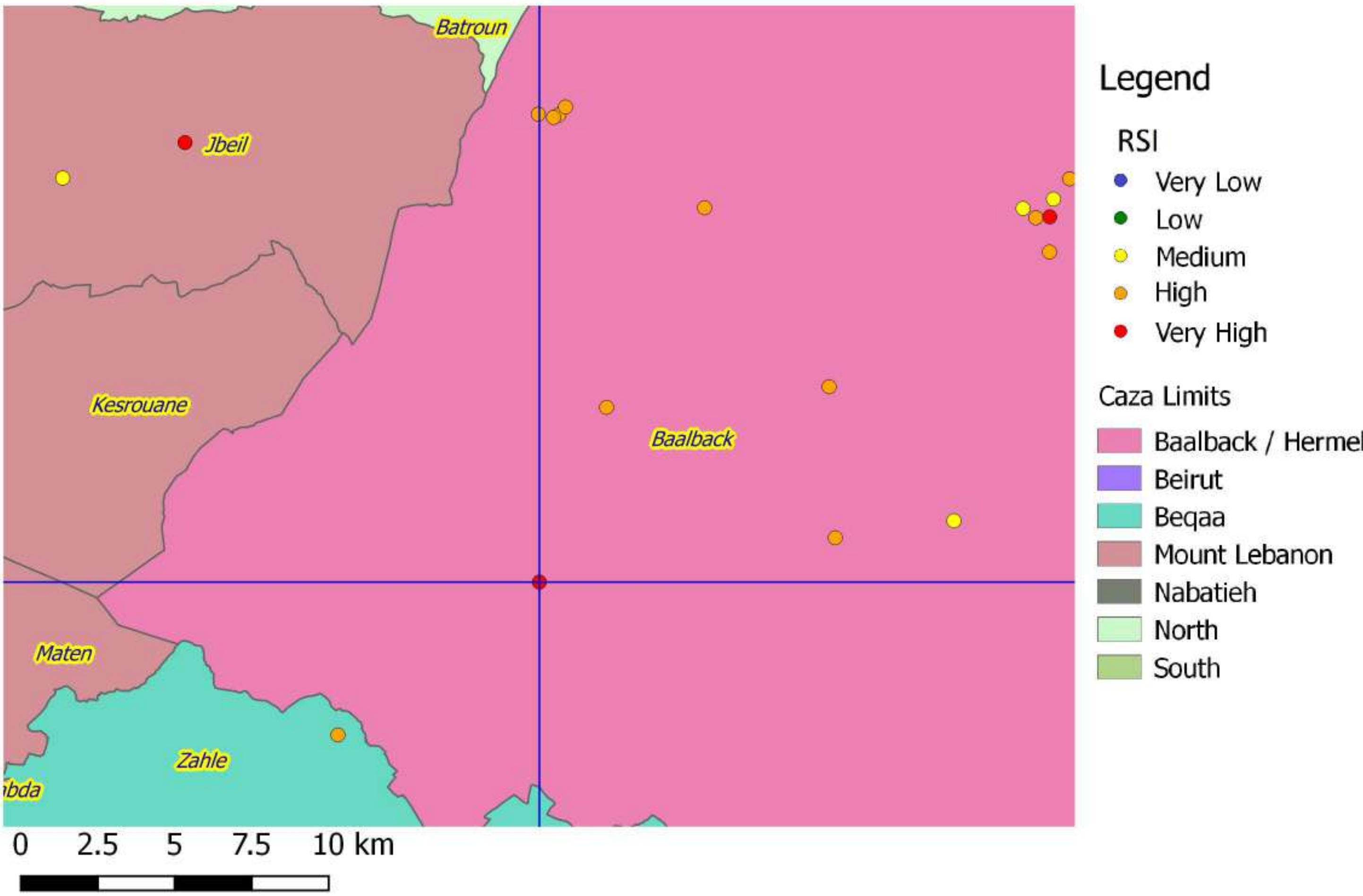
1- Site Name and Location	**K5-Ras El Maten-2n**	
X	35.637	
Y	33.870	
Z	111	m
Mohafaza	Mount Lebanon	
Caza	Maten	
Town	Ras El Maten	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	245.0	m
Status	Operational	
3- Estimated Volume	150,000	m^3
Area	15,000	m^2
Height	10.0	m
Visibility	Y	
4- Priority Ranking for Rehabilitation	**10**	
Risk Sensitivity Index Score	23.53	out of 36.000
5- Preferred Rehabilitation Option	Achieve intended use (build a new road)	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of rubble using the necessary machinery for the purpose of grading and compacting the waste in the dump. c- Stabilize slopes and cover dump and side slope with sand and plant with trees	
7- Responsibility	Municipality of Ras El Maten	
8- Legal requirements	Enforce legislation and ban open dumping of rubble.	
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works c-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection of treatment and sorting activities.	
11 - Estimated cost (USD)	147,000	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	0.980	USD/m^3
12- Possible sources of financing	Municipality Budget	

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and all necessary work needed to assess conditions of the dump.	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of rubble within the dump for the purpose of grading and compaction	m^3	15,000	2.0	30,000
2.2-Manual segregation of waste and removal of any recyclable or bulky materials	unit	1	2,000.0	2,000
2.3- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	7,500	2.0	15,000
2.4-Adding a layer of agricultural top soil on side slopes (50 cm thickness)	m^3	7,500	10.0	75,000
2.5- Planting trees	unit	250	20.0	5,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	10,000.0	10,000
TOTAL COST (USD)				**147,000**
AVERAGE COST per unit Volume (USD/m^3)				**0.980**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L8-Chmestar-01

Location of dumpsite (WGS-1984):

X: 36.03 m

Y: 33.95 m

Z: 1093.52 m

Mohafaza: Beqaa

Caza: Baalback

Town: Chmestar

Distance to urban areas: 100.0 m

Dump status: Operational

Estimated volume: 10000.0 m3

Area: 2000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 11

Risk Sensitivity Index Score: 22.15

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L8-Chmestar-01**
X	36.034
Y	33.955
Z	1093.52 m
Mohafaza	Beqaa
Caza	Baalback
Town	Chmestar
2- Type of Dump	Dump in roadside cliff or steep slope
Distance to Urban areas	9.24178791 m
Status	Operational
3- Estimated Volume	10,000 m^3
Area	2,000 m^2
Height	5 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**11**
Risk Sensitivity Index Score	22.15 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher.
7- Responsibility	Municipality of Chmestar
8- Legal requirements	Enforce legislation and ban open dumping of rubble.
9- Monitoring requirements	a- Control dust during earth moving and sorting works b-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection
11 - Estimated cost (USD)	127,300 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.730 USD/m^3
Potential revenues	27,238 USD
13- Possible sources of financing	Municipality Budget

COST ESTIMATE

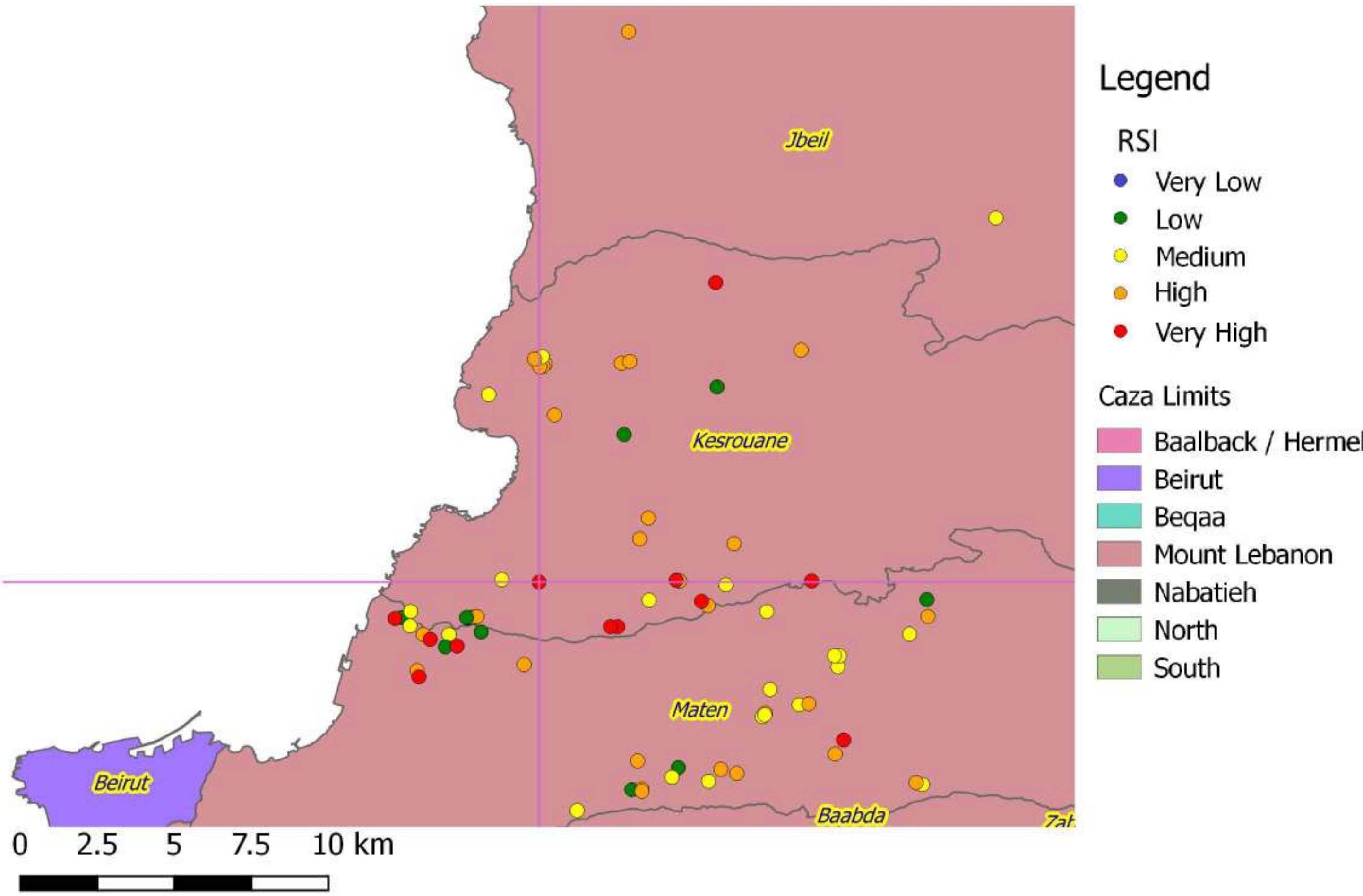
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	4,000.0	4,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	4,000.0	4,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	10,000	4.0	40,000
2.2-Manual segregation of waste into different recyclable materials	m^3	300	3.0	900
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	9,500	4.0	38,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	3,800	8.0	30,400
2.5- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m2	1,000	2.0	2,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	8,000.0	8,000
TOTAL COST (USD)				**127,300**
AVERAGE COST per unit Volume (USD/m^3)				**12.730**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	20	20.0	400
Fine sand	m^3	2,375	2.5	5,938
Coarse sand	m^3	3,800	1.5	5,700
Aggregates	m^3	1,900	6.0	11,400
Steel	t	38	100.0	3,800
TOTAL Revenues (USD)				**27,238**
AVERAGE Revenues per unit volume (USD/m^3)				**2.724**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L5-Aain Er-Rihane-3

Location of dumpsite (WGS-1984):

X: 35.65 m

Y: 33.96 m

Z: 497.63 m

Mohafaza: Mount Lebanon

Caza: Kesrouane

Town: Aain Er-Rihane

Distance to urban areas: 0.0 m

Dump status: Non-operational

Estimated volume: 100000.0 m3

Area: 50000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 12

Risk Sensitivity Index Score: 22.08

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L5-Aain Er-Rihane-3**
X	35.652
Y	33.961
Z	497.63 m
Mohafaza	Mount Lebanon
Caza	Kesrouane
Town	Ain Er Rihane
2- Type of Dump	Dump in roadside cliff or steep slope
Distance to Urban areas	0.00 m
Status	Non-operational
3- Estimated Volume	100,000 m^3
Area	50,000 m^2
Height	2 m
Visibility	N
4- Priority Ranking for Rehabilitation	**12**
Risk Sensitivity Index Score	22.08 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Ain Er Rihane
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	1,175,000 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	11.750 USD/m^3
Potential revenues	276,375 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

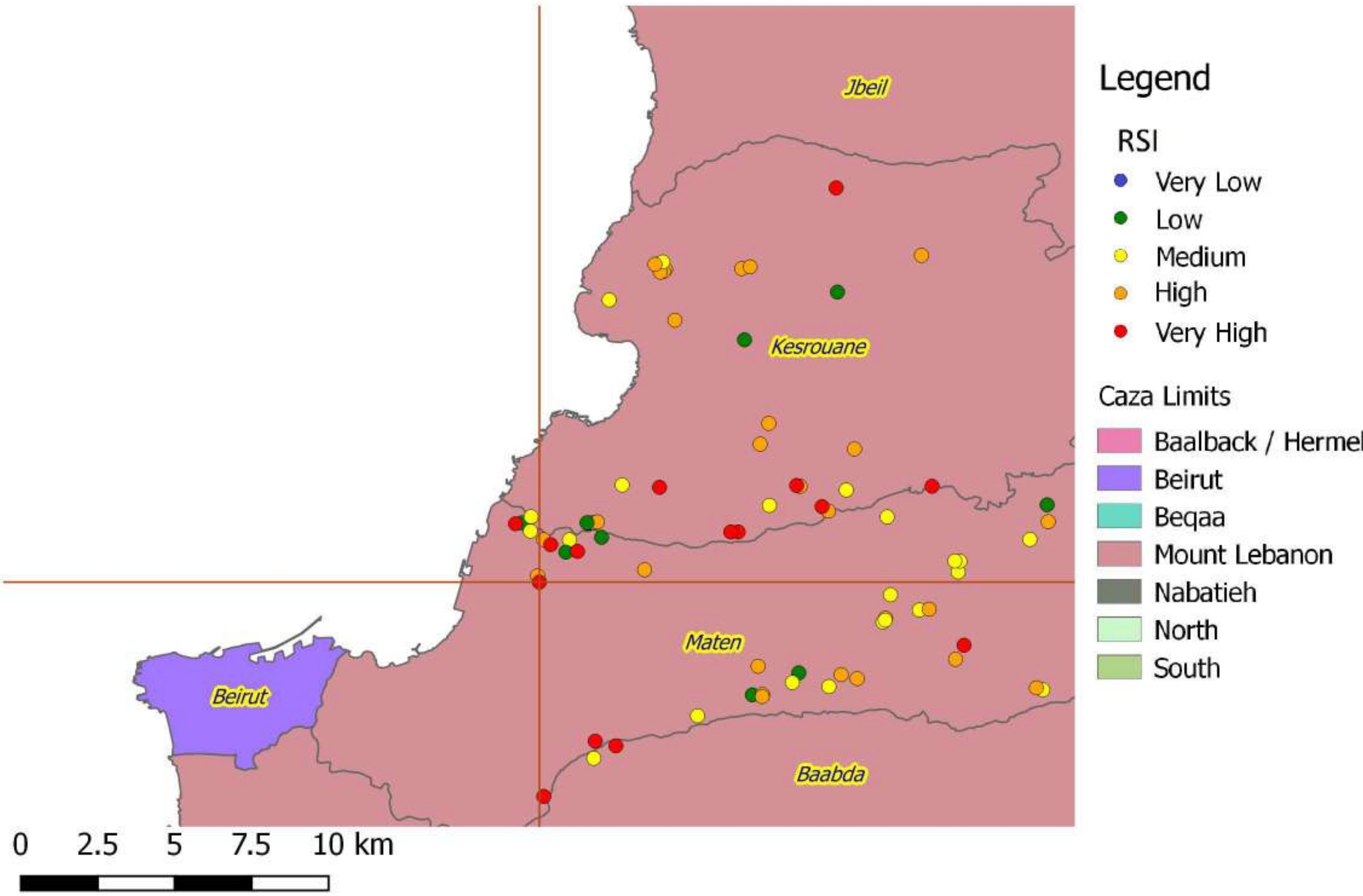
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	10,000.0	10,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump	LS	1	12,000.0	12,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	100,000	4.0	400,000
2.2-Manual segregation of waste into different recyclable materials	m^3	3,000	3.0	9,000
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	95,000	4.0	380,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	38,000	8.0	304,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	60,000.0	60,000
TOTAL COST (USD)				**1,175,000**
AVERAGE COST per unit Volume (USD/m^3)				**11.750**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	400	20.0	8,000
Fine sand	m^3	23,750	2.5	59,375
Coarse sand	m^3	38,000	1.5	57,000
Aggregates	m^3	19,000	6.0	114,000
Steel	t	380	100.0	38,000
TOTAL Revenues (USD)				**276,375**
AVERAGE Revenues per unit volume (USD/m^3)				**2.764**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L4-Mtayleb-1

Location of dumpsite (WGS-1984):

X: 35.61 m

Y: 33.93 m

Z: 151.6 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Mtayleb

Distance to urban areas: 10.0 m

Dump status: Operational

Estimated volume: 4500.0 m3

Area: 4500.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 13

Risk Sensitivity Index Score: 21.82

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L4-Mtayleb-1**
X	35.610
Y	33.928
Z	151.60 m
Mohafaza	Mount Lebanon
Caza	Maten
Town	Mtayleb
2- Type of Dump	Elaborated hill or pile
Distance to Urban areas	0.00 m
Status	Operational
3- Estimated Volume	4,500 m^3
Area	4,500 m^2
Height	1 m
Visibility	N
4- Priority Ranking for Rehabilitation	**13**
Risk Sensitivity Index Score	21.82 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 2: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Mtayleb
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	57,185 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.708 USD/m^3
Potential revenues	12,437 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

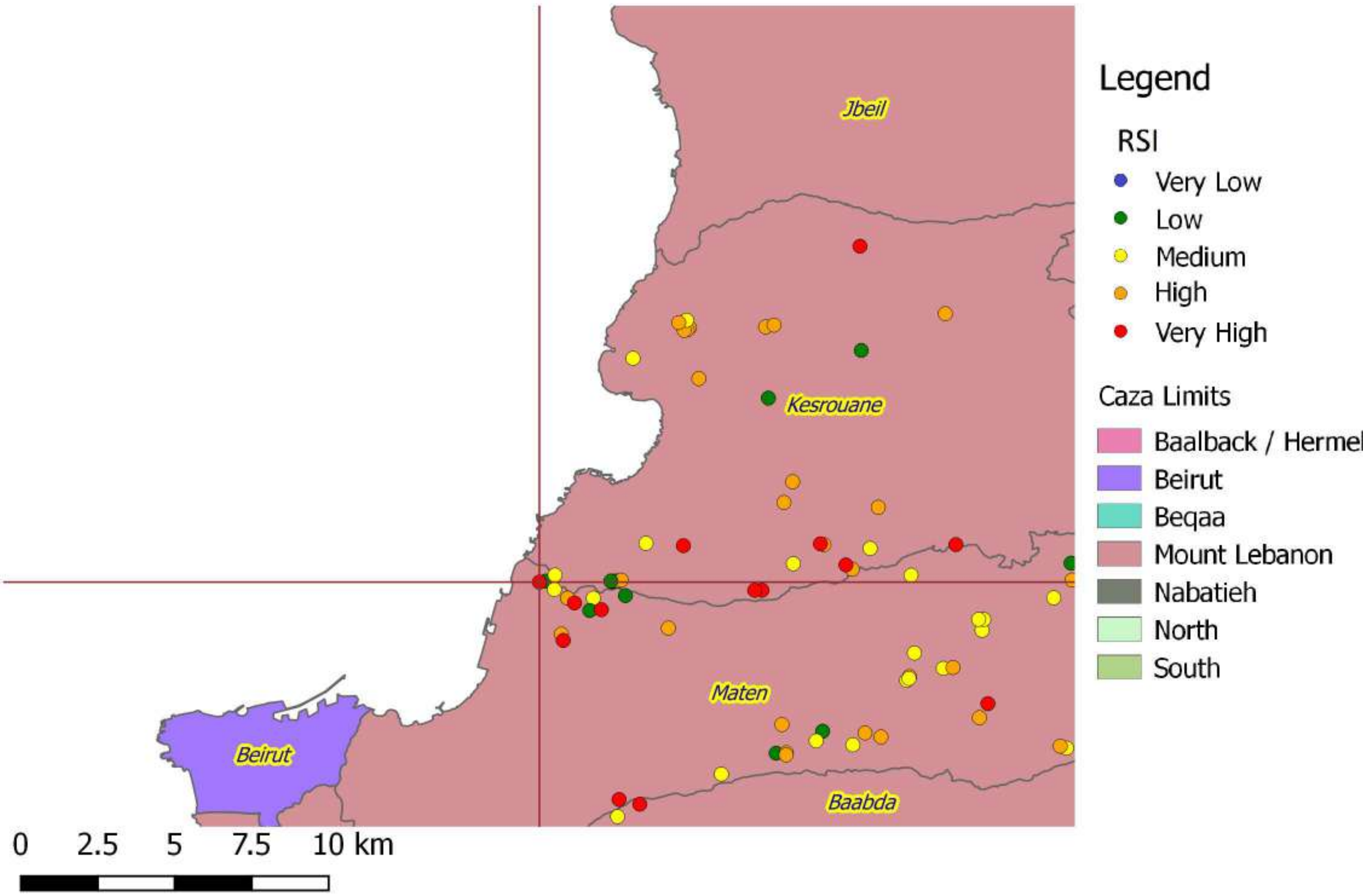
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	4,500	4.0	18,000
2.2-Manual segregation of waste into different recyclable materials	m^3	135	3.0	405
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	4,275	4.0	17,100
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	1,710	8.0	13,680
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	4,000.0	4,000
TOTAL COST (USD)				**57,185**
AVERAGE COST per unit Volume (USD/m^3)				**12.708**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	18	20.0	360
Fine sand	m^3	1,069	2.5	2,672
Coarse sand	m^3	1,710	1.5	2,565
Aggregates	m^3	855	6.0	5,130
Steel	t	17	100.0	1,710
TOTAL Revenues (USD)				**12,437**
AVERAGE Revenues per unit volume (USD/m^3)				**2.764**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L4-Zouk Al Khrab-6n

Location of dumpsite (WGS-1984):

X: 35.6 m

Y: 33.95 m

Z: 95.46 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Zouk Al Khrab

Distance to urban areas: 500.0 m

Dump status: Operational

Estimated volume: 5000.0 m3

Area: 5000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 14

Risk Sensitivity Index Score: 21.74

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L4-Zouk Al Khrab-6n**
X	35.601
Y	33.948
Z	95.46 m
Mohafaza	Mount Lebanon
Caza	Maten
Town	Zouk Al Khrab
2- Type of Dump	Elaborated hill or pile
Distance to Urban areas	6.270225048 m
Status	Operational
3- Estimated Volume	5,000 m^3
Area	5,000 m^2
Height	1 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**14**
Risk Sensitivity Index Score	21.74 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 2: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Zouk El Khrab
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	64,650 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.930 USD/m^3
Potential revenues	13,619 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

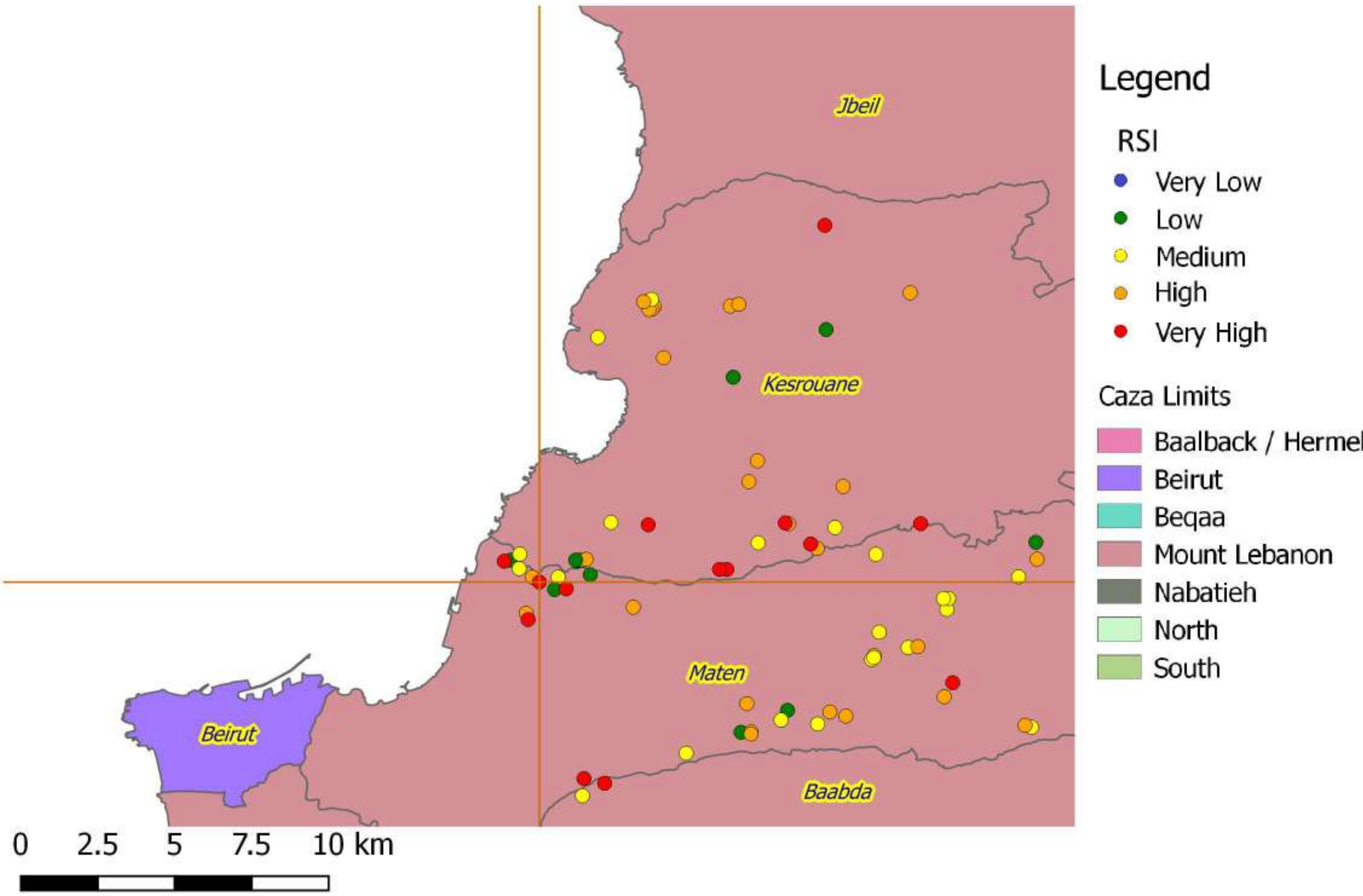
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	3,000.0	3,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	5,000	4.0	20,000
2.2-Manual segregation of waste into different recyclable materials	m^3	150	3.0	450
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	4,750	4.0	19,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	1,900	8.0	15,200
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	4,000.0	4,000
TOTAL COST (USD)				**64,650**
AVERAGE COST per unit Volume (USD/m^3)				**12.930**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	10	20.0	200
Fine sand	m^3	1,188	2.5	2,969
Coarse sand	m^3	1,900	1.5	2,850
Aggregates	m^3	950	6.0	5,700
Steel	t	19	100.0	1,900
TOTAL Revenues (USD)				**13,619**
AVERAGE Revenues per unit volume (USD/m^3)				**2.724**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L4-Zouk Al Khrab-5

Distance to urban areas: 200.0 m

Location of dumpsite (WGS-1984):

Dump status: Operational

X: 35.61 m

Estimated volume: 5000.0 m3

Y: 33.94 m

Area: 2500.0 m2

Z: 143.84 m

Visibility: Y

Mohafaza: Mount Lebanon

Priority Ranking for Rehabilitation: 15

Caza: Maten

Risk Sensitivity Index Score: 21.49

Town: Zouk Al Khrab

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L4-Zouk Al Khrab-5**
X	35.614
Y	33.941
Z	143.84 m
Mohafaza	Mount Lebanon
Caza	Maten
Town	Zouk Al Khrab
2- Type of Dump	Dumps in used-up surface quarry
Distance to Urban areas	57.75 m
Status	Operational
3- Estimated Volume	5,000 m^3
Area	2,500 m^2
Height	2 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**15**
Risk Sensitivity Index Score	21.49 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 2: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Zouk El Khrab
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	65,650 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	13.130 USD/m^3
Potential revenues	13,619 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

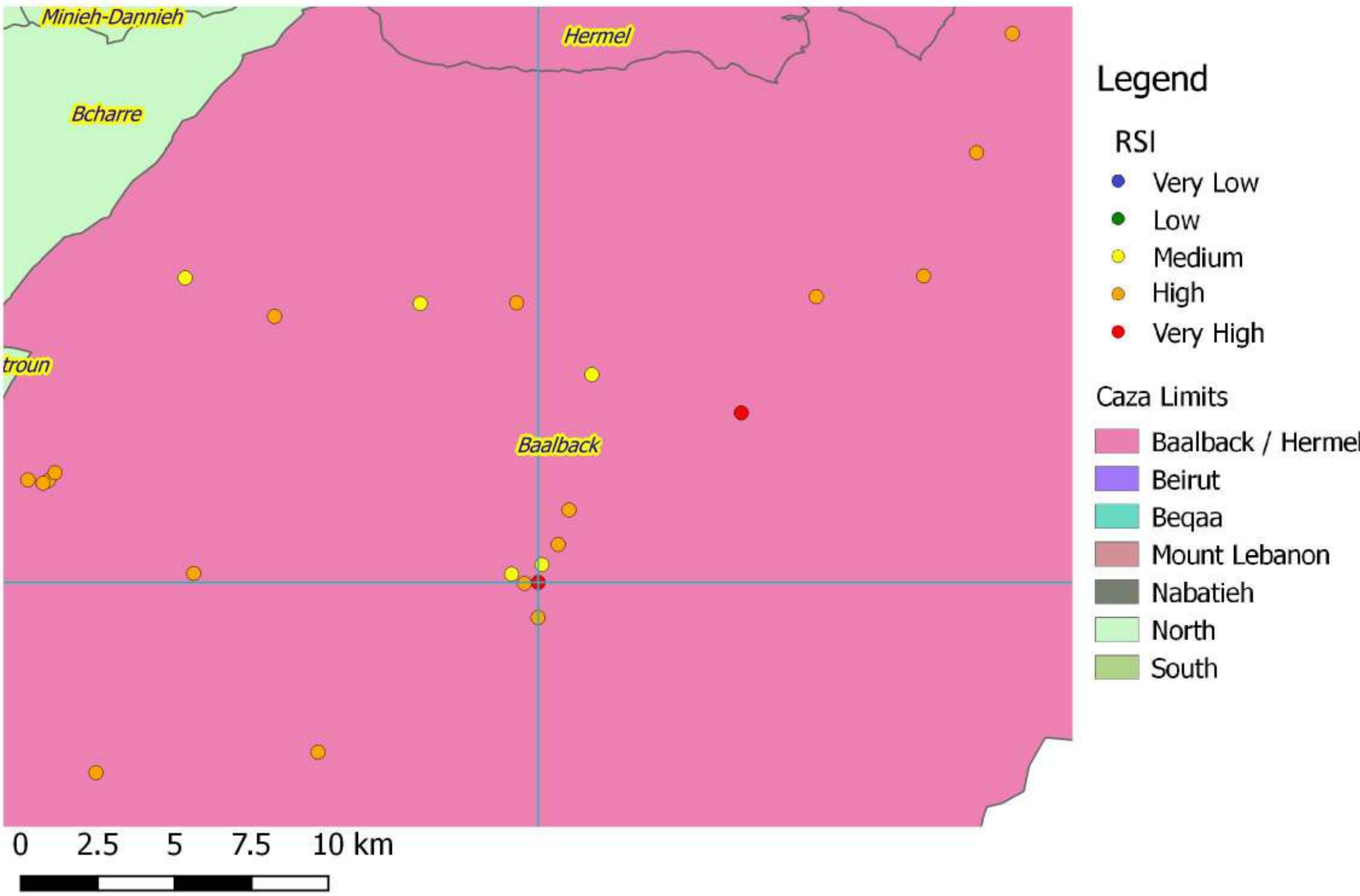
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	3,000.0	3,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	3,000.0	3,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	5,000	4.0	20,000
2.2-Manual segregation of waste into different recyclable materials	m^3	150	3.0	450
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	4,750	4.0	19,000
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher.	m^3	1,900	8.0	15,200
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	5,000.0	5,000
TOTAL COST (USD)				**65,650**
AVERAGE COST per unit Volume (USD/m^3)				**13.130**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	10	20.0	200
Fine sand	m^3	1,188	2.5	2,969
Coarse sand	m^3	1,900	1.5	2,850
Aggregates	m^3	950	6.0	5,700
Steel	t	19	100.0	1,900
TOTAL Revenues (USD)				**13,619**
AVERAGE Revenues per unit volume (USD/m^3)				**2.724**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: M9-Maqne-07n

Location of dumpsite (WGS-1984):

X: 36.21 m

Y: 34.08 m

Z: 1069.54 m

Mohafaza: Beqaa

Caza: Baalback

Town: Maqne

Distance to urban areas: 150.0 m

Dump status: Operational

Estimated volume: 12500.0 m3

Area: 5000.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 16

Risk Sensitivity Index Score: 21.39

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**M9-Maqne-07n**
X	36.213
Y	34.083
Z	1069.54 m
Mohafaza	Beqaa
Caza	Baalback
Town	Maqne
2- Type of Dump	Dump in valley or seasonal water channels
Distance to Urban areas	241 m
Status	Operational
3- Estimated Volume	12,500 m^3
Area	5,000 m^2
Height	2.5 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**16**
Risk Sensitivity Index Score	21.39 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Maqne
8- Legal requirements	Enforce legislation and ban open dumping of rubble.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works c-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of treatment and sorting activities.
11 - Estimated cost (USD)	155,625 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.450 USD/m^3
Potential revenues	34,047 USD
12- Possible sources of financing	Municipality Budget

COST ESTIMATE

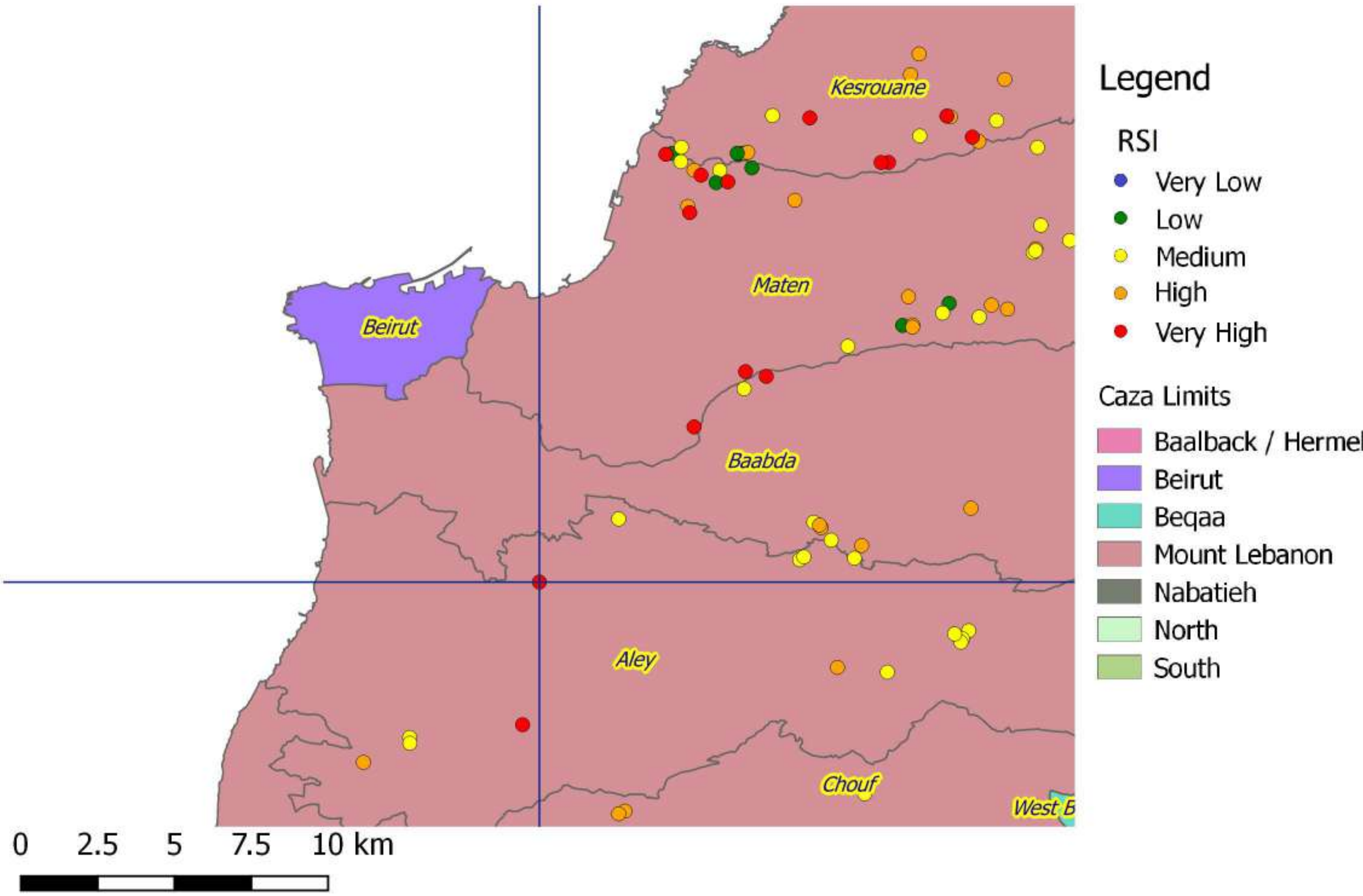
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	12,500	4.0	50,000
2.2-Manual segregation of waste into different recyclable materials	m^3	375	3.0	1,125
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	11,875	4.0	47,500
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	4,750	8.0	38,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	9,000.0	9,000
TOTAL COST (USD)				**155,625**
AVERAGE COST per unit Volume (USD/m^3)				**12.450**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	25	20.0	500
Fine sand	m^3	2,969	2.5	7,422
Coarse sand	m^3	4,750	1.5	7,125
Aggregates	m^3	2,375	6.0	14,250
Steel	t	48	100.0	4,750
TOTAL Revenues (USD)				**34,047**
AVERAGE Revenues per unit volume (USD/m^3)				**2.724**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: J4-Aaytat-0	Distance to urban areas: 800.0 m
Location of dumpsite (WGS-1984):	Dump status: Operational
X: 35.56 m	Estimated volume: 40000.0 m3
Y: 33.8 m	Area: 4000.0 m2
Z: 582.91 m	Visibility: Y
Mohafaza: Mount Lebanon	Priority Ranking for Rehabilitation: 17
Caza: Aley	Risk Sensitivity Index Score: 21.39
Town: Aaytat	Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

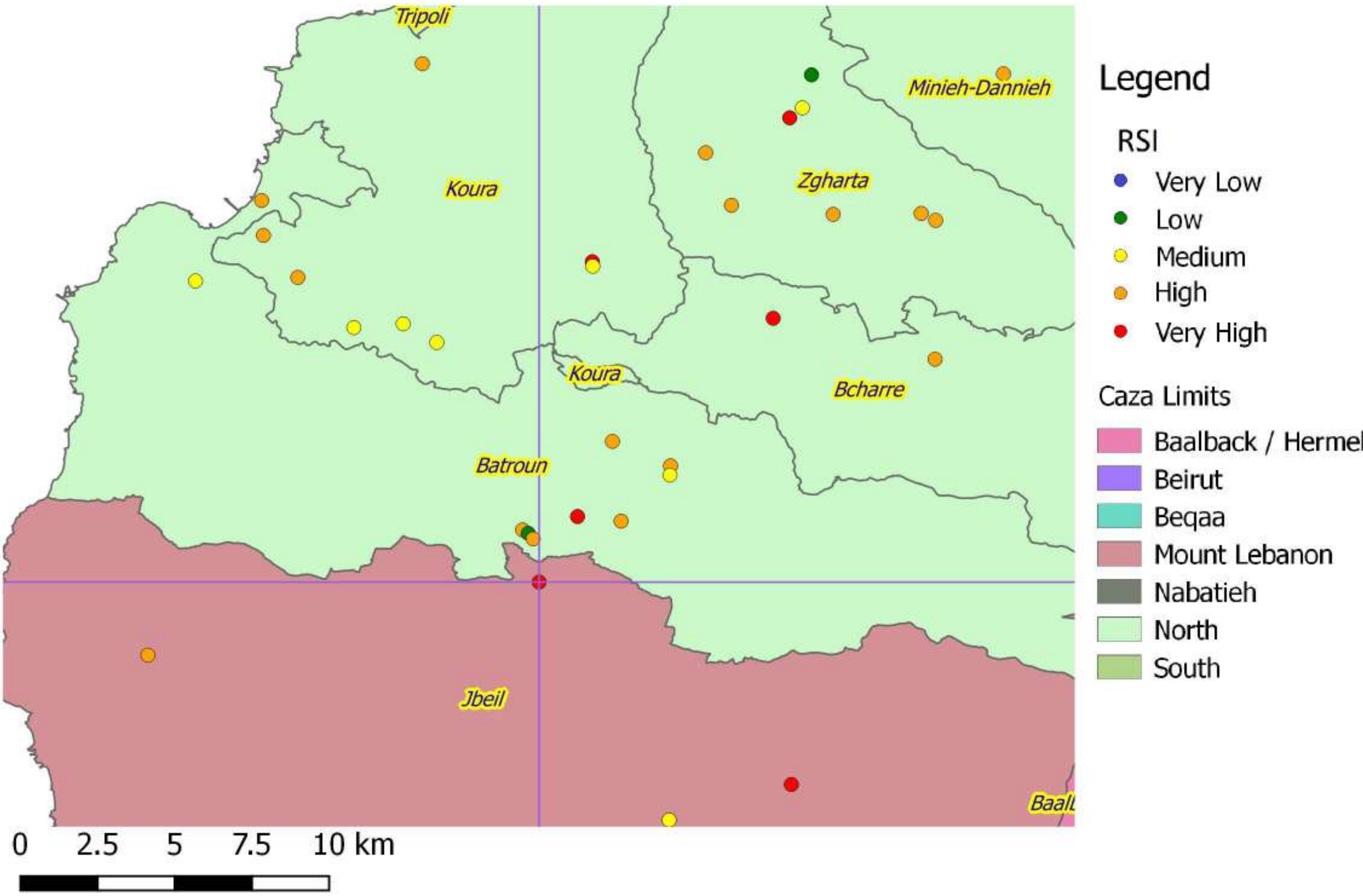
1- Site Name and Location	**J4-Aaytat-0**
X	35.557
Y	33.798
Z	582.91 m
Mohafaza	Mount Lebanon
Caza	Aley
Town	Aaytat
2- Type of Dump	Dump in roadside cliff or steep slope
Distance to Urban areas	80.91 m
Status	Operational
3- Estimated Volume	40,000 m^3
Area	4,000 m^2
Height	10 m
Visibility	N
4- Priority Ranking for Rehabilitation	**17**
Risk Sensitivity Index Score	21.39 out of 36.000
5- Preferred Reahbilitation Option	Achieve intended use (expand the land)
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of rubble using the necessary machinery for the purpose of grading and compacting the waste in the dump. c- Stabilize slopes and cover dump and side slope with sand and plant with trees
7- Responsibility	Municipality of Aaytat
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a- Control dust during earth moving and sorting works b-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection
11 - Estimated cost (USD)	77,600 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	1.940 USD/m^3
13- Possible sources of financing	Municipality Budget

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	7,000.0	7,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and all necessary work needed to assess conditions of the dump.	LS	1	8,000.0	8,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of rubble within the dump for the purpose of grading and compaction	m^3	4,000	2.0	8,000
2.2-Manual segregation of waste and removal of any recyclable or bulky materials	unit	1	600.0	600
2.3- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	2,000	2.0	4,000
2.4-Adding a layer of agricultural top soil on side slopes (50 cm thickness)	m^3	4,000	10.0	40,000
2.5- Planting trees	unit	100	20.0	2,000
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	8,000.0	8,000
TOTAL COST (USD)				**77,600**
AVERAGE COST per unit Volume (USD/m^3)				**1.940**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: O6-Tartej-0n

Location of dumpsite (WGS-1984):

X: 35.82 m

Y: 34.18 m

Z: 1107.94 m

Mohafaza: Mount Lebanon

Caza: Jbeil

Town: Tartej

Distance to urban areas: 50.0 m

Dump status: Operational

Estimated volume: 1800.0 m3

Area: 1200.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 18

Risk Sensitivity Index Score: 21.37

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

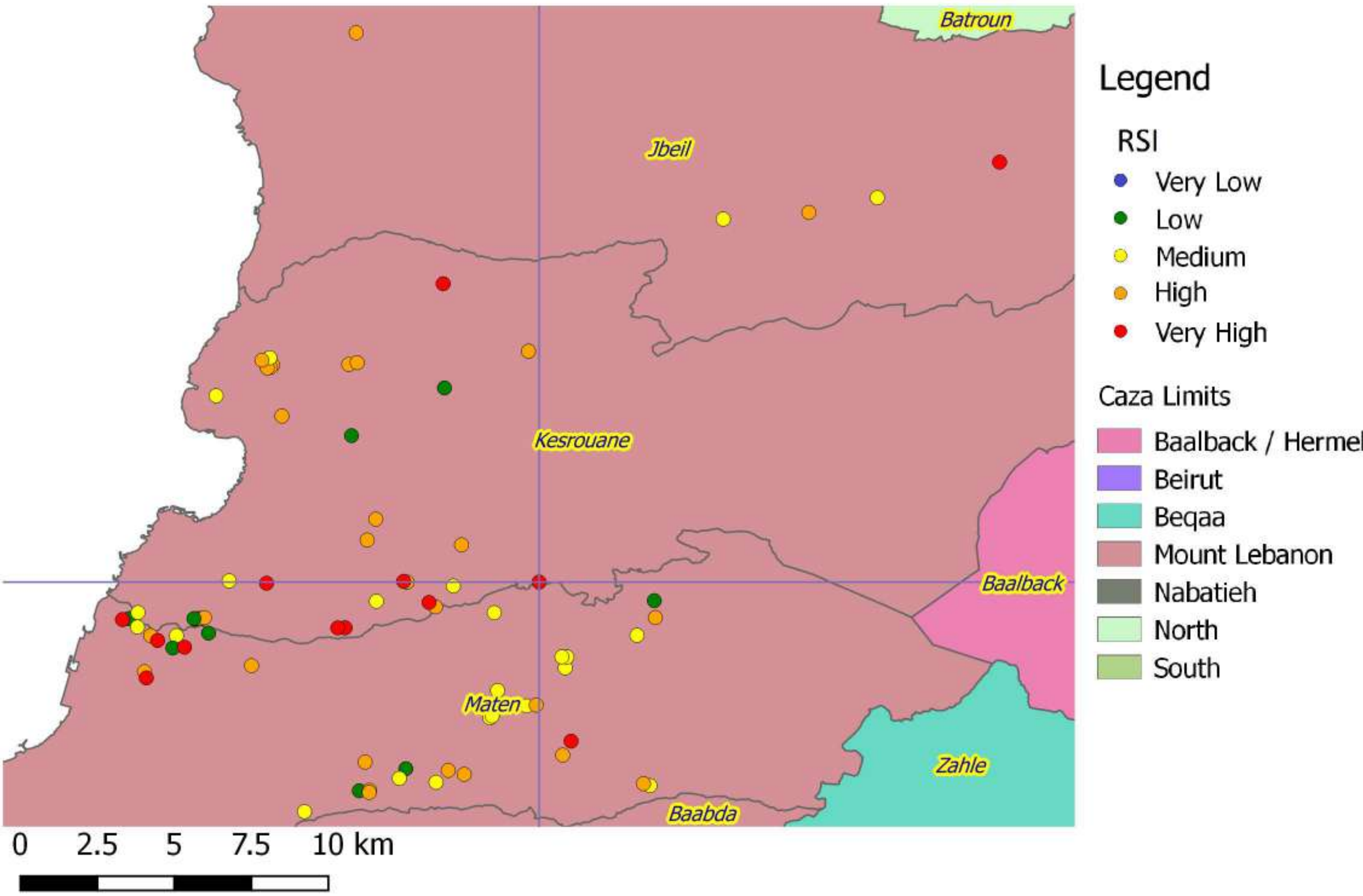
1- Site Name and Location	**O6-Tartej-0n**	
X	35.821	
Y	34.180	
Z	1107.94	m
Mohafaza	Mount Lebanon	
Caza	Jbeil	
Town	Tartej	
2- Type of Dump	Elaborated hill or pile	
Distance to Urban areas	8.6278162	m
Status	Operational	
3- Estimated Volume	1,800	m^3
Area	1,200	m^2
Height	2	m
Visibility	Y	
4- Priority Ranking for Rehabilitation	**18**	
Risk Sensitivity Index Score	21.37	out of 36.000
5- Preferred Reahbilitation Option	Achieve intended use (transform to a garden)	
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of rubble using the necessary machinery for the purpose of grading and compacting the waste in the dump. c- Stabilize slopes and cover dump and side slope with sand and plant with trees	
7- Responsibility	Municipality of Tartej	
8- Legal requirements	Enforce legislation and ban open dumping.	
9- Monitoring requirements	a- Control dust during earth moving and sorting works b-Monitor Health and Safety of operators	
10 - Operation and maintenance requirements	Continuous control and inspection	
11 - Estimated cost (USD)	22,800	USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.667	USD/m^3
13- Possible sources of financing	Municipality Budget	

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	2,000.0	2,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and all necessary work needed to assess conditions of the dump.	LS	1	2,000.0	2,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of rubble within the dump for the purpose of grading and compaction	m^3	1,200	2.0	2,400
2.2-Manual segregation of waste and removal of any recyclable or bulky materials	unit	1	600.0	600
2.3- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	600	2.0	1,200
2.4-Adding a layer of agricultural top soil on side slopes (50 cm thickness)	m^3	1,200	10.0	12,000
2.5- Planting trees	unit	30	20.0	600
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	2,000.0	2,000
TOTAL COST (USD)				**22,800**
AVERAGE COST per unit Volume (USD/m^3)				**12.667**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: L5- KfarTay- 1n

Location of dumpsite (WGS-1984):

X: 35.75 m

Y: 33.96 m

Z: 1027.0 m

Mohafaza: Mount Lebanon

Caza: Maten

Town: Kfar Tay

Distance to urban areas: 950.0 m

Dump status: Non-Operational

Estimated volume: 58800.0 m3

Area: 8400.0 m2

Visibility: Y

Priority Ranking for Rehabilitation: 19

Risk Sensitivity Index Score: 21.34

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**L5-KfarTay-1n**
X	35.748
Y	33.962
Z	1027.00 m
Mohafaza	Mount Lebanon
Caza	Maten
Town	KfarTay
2- Type of Dump	
Distance to Urban areas	200.0 m
Status	Non-operational
3- Estimated Volume	58,800 m^3
Area	8,400 m^2
Height	7.0 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**19**
Risk Sensitivity Index Score	21.34 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of KfarTay
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of sorting and treatment activities.
11 - Estimated cost (USD)	686,084 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	11.668 USD/m^3
Potential revenues	151,337 USD
12- Possible sources of financing	Municipality budget/National Budget

COST ESTIMATE

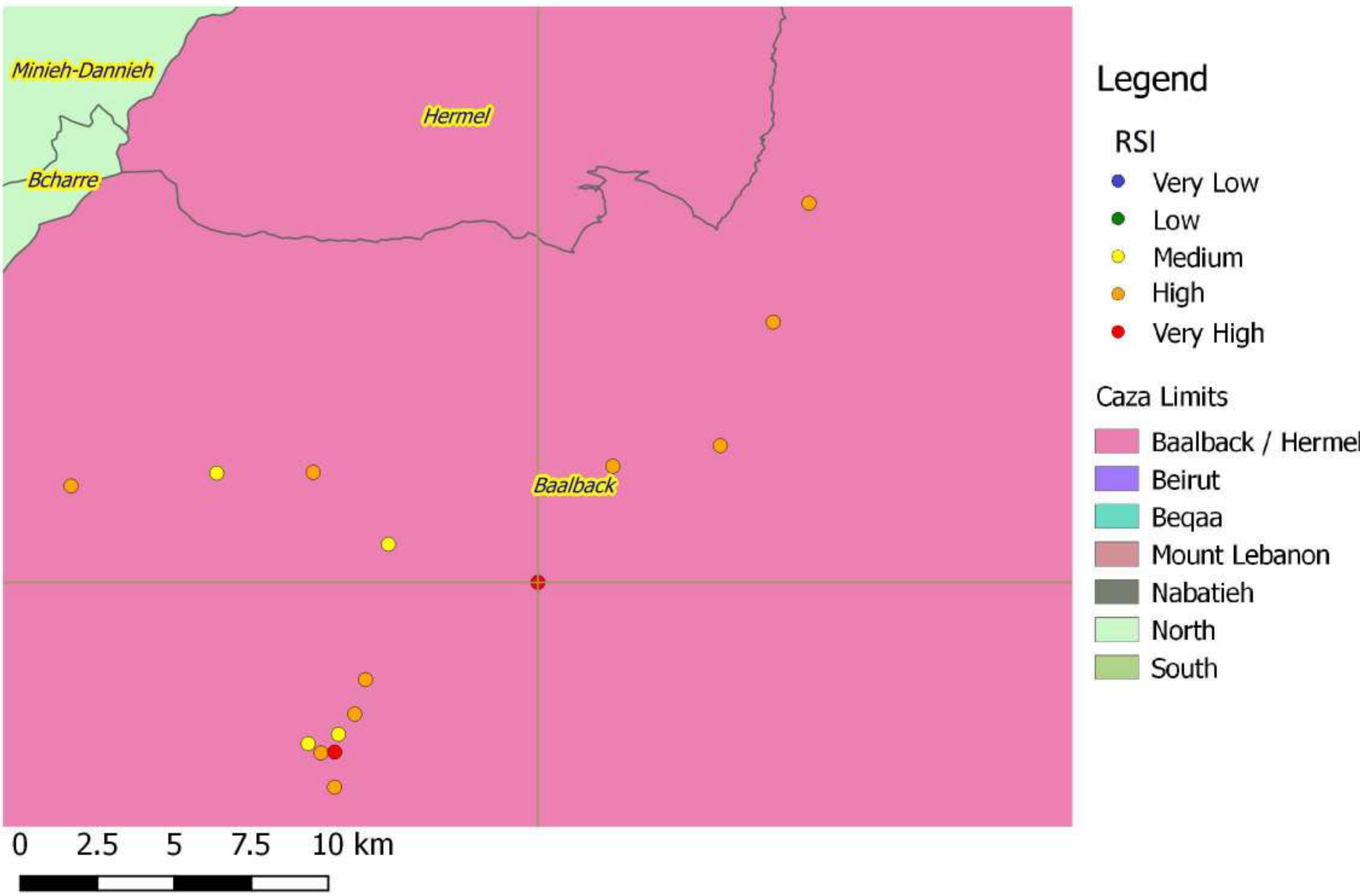
Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	5,000.0	5,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	5,000.0	5,000
2. Earth Movement Works				
2.1 - Excavate part of the waste dump for the purpose of treatment/sorting and earth movement	m^3	58,800	4.0	235,200
2.2-Manual segregation of waste into different recyclable materials	m^3	1,764	3.0	5,292
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	55,860	4.0	223,440
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	22,344	8.0	178,752
2.5- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m^2	4,200	2.0	8,400
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	25,000.0	25,000
TOTAL COST (USD)				**686,084**
AVERAGE COST per unit Volume (USD/m^3)				**11.668**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	235	20.0	4,704
Fine sand	m^3	13,965	2.5	34,913
Coarse sand	m^3	22,344	1.5	33,516
Aggregates	m^3	11,172	6.0	67,032
Steel	t	112	100.0	11,172
TOTAL Revenues (USD)				**151,337**
AVERAGE Revenues per unit volume (USD/m^3)				**2.574**

Rehabilitation Report

Updated Master Plan for the closure and rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon



Template Form for Construction and Demolition Waste Dumps

Name of dumpsite: N10-Rasm Al Hadath-00n

Distance to urban areas: 150.0 m

Location of dumpsite (WGS-1984):

Dump status: Operational

X: 36.28 m

Estimated volume: 10500.0 m3

Y: 34.14 m

Area: 3000.0 m2

Z: 976.04 m

Visibility: Y

Mohafaza: Beqaa

Priority Ranking for Rehabilitation: 20

Caza: Baalback

Risk Sensitivity Index Score: 21.3

Town: Rasm Al Hadath

Estimated rehabilitation cost: Refer to appendix E

Recommended Rehabilitation Option: Refer to appendix E for further details.

1- Site Name and Location	**N10-Rasm Al Hadath-00n**
X	36.285
Y	34.143
Z	976.04 m
Mohafaza	Beqaa
Caza	Baalback
Town	Rasm Al Hadath
2- Type of Dump	Elaborated hill or pile
Distance to Urban areas	156 m
Status	Operational
3- Estimated Volume	10,500 m^3
Area	3,000 m^2
Height	3.5 m
Visibility	Y
4- Priority Ranking for Rehabilitation	**20**
Risk Sensitivity Index Score	21.30 out of 36.000
5- Preferred Rehabilitation Option	Priority Group 1: Sort, crush and recycle
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the volume of the dump and recovering secondary construction material such as aggregates and fines. c-Manual segregation of waste for the recovery of recyclable materials if any, such as steel, plastics, wood, etc. d-Mechanical segragation of waste using a heavy duty rotating trommel screen into different size of fines, grains and stones. e-Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concreteshould also be recovered by means of a magnet installed on the mobile crusher
7- Responsibility	Municipality of Rasm El Hadath
8- Legal requirements	Enforce legislation and ban open dumping of rubble.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Control dust during earth moving works c-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of treatment and sorting activities.
11 - Estimated cost (USD)	129,765 USD
Average rehabilitation/closure cost (USD per m^3 of waste)	12.359 USD/m^3
Potential revenues	28,599 USD
12- Possible sources of financing	Municipality Budget

COST ESTIMATE

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	3,000.0	3,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	4,000.0	4,000
2. Earth Movement Works				
2.1 - Excavate the waste dump for the purpose of treatment/sorting and earth movement	m^3	10,500	4.0	42,000
2.2-Manual segregation of waste into different recyclable materials	m^3	315	3.0	945
2.3-Mechanical segregation of waste using a rotating trommel screen to separate rubbles into fine sand and stones	m^3	9,975	4.0	39,900
2.4- Crushing of stones, rocks and concrete blocks using a mobile crusher unit to transform them into different sizes of aggregates and fines. Steel present in concrete should also be recovered by means of a magnet installed on the mobile crusher	m^3	3,990	8.0	31,920
3. Control and Monitoring				
3.1- Supervision of works, Control and Monitoring	LS	1	8,000.0	8,000
TOTAL COST (USD)				**129,765**
AVERAGE COST per unit Volume (USD/m^3)				**12.359**

Potential Revenues

Description	Unit	Quantity	Unit price (USD)	Total price (USD)
Recyclables materials such as Plastics, wood, glass, etc	t	21	20.0	420
Fine sand	m^3	2,494	2.5	6,234
Coarse sand	m^3	3,990	1.5	5,985
Aggregates	m^3	1,995	6.0	11,970
Steel	t	40	100.0	3,990
TOTAL Revenues (USD)				**28,599**
AVERAGE Revenues per unit volume (USD/m^3)				**2.724**

APPENDIX F – UPDATED MASTER PLAN PRESENTATION

Updated Master Plan for the Closure and Rehabilitation of Uncontrolled Dumpsites throughout the Country of Lebanon

June 2017

Republic of Lebanon
Ministry of Environment

ELARD

Agenda

Updated Master Plan

- Objectives
- Survey Methodology
- Survey Limitations
- Survey Results and Analysis
- Prioritization Model and Results
- Rehabilitation Decision Tool, Results and Cost

Environmental Assessment of Dumpsites

- Objectives
- EA Methodology
- Pilot Test
- EA Recommendations

Cost Assessment of Dumpsites

- Background and Objectives
- Methodological Process
- Assumptions
- Dataset
- CAOD Main Findings and Conclusions

Brief

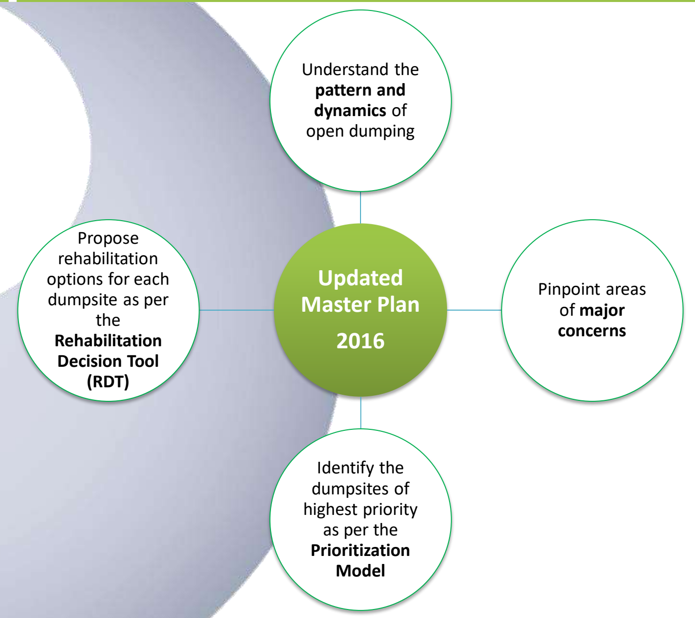
Two major events required the update of 2011 Master Plan.

2011 Syrian Conflict

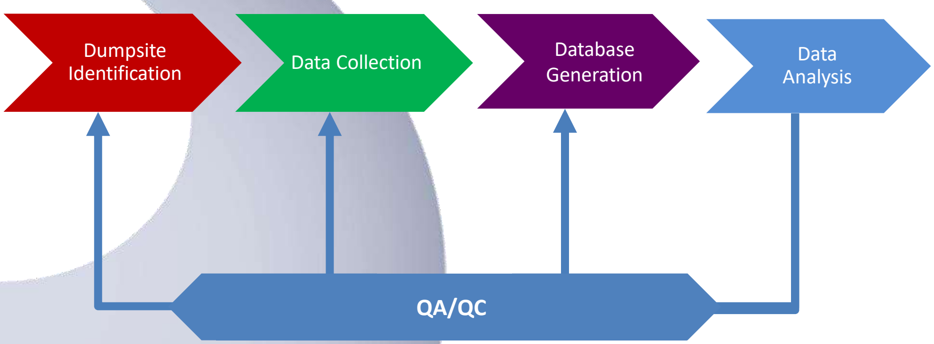
2015 Solid Waste Collection and Disposal Crisis

Timeline of Events

Objectives



Survey Methodology



Municipal Solid Waste (MSW) Dumpsite: a dumpsite containing over 85% of Municipal Solid Waste. This might include, in addition to MSW, Hospital Waste, Construction and Demolition Waste, Industrial Waste, etc.

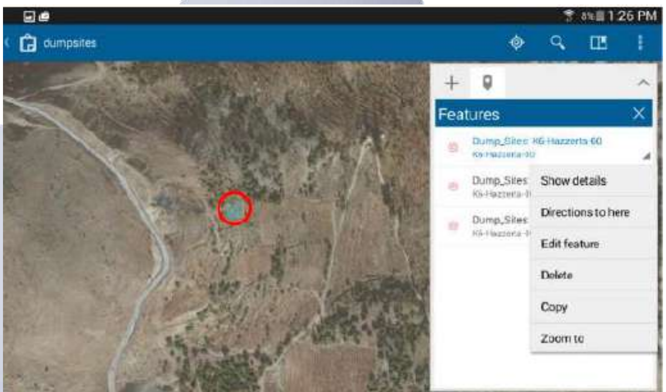
Construction and Demolition Waste (CDW) Dumpsite: a dumpsite containing over 85% of Construction and Demolition Waste. These include rubble, green waste, construction and demolition debris, etc.

Survey Methodology

Dumpsite Identification

QA/QC

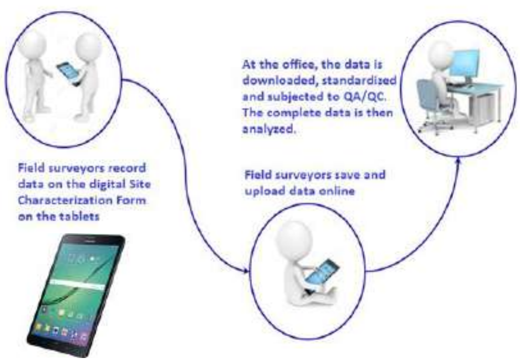
- 2011 Survey
- Municipality Officials
- Other informants
- MoE



Survey Methodology

Data collection

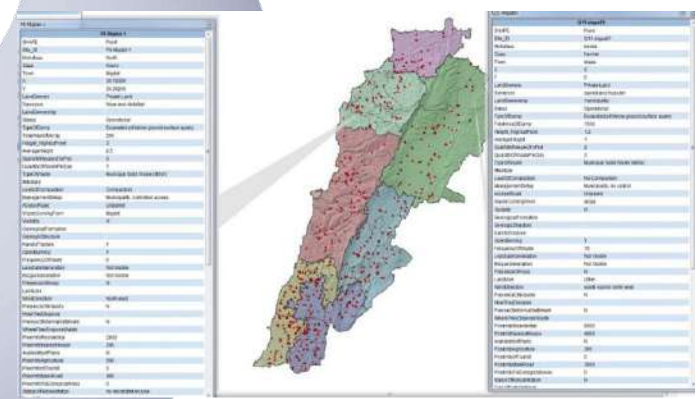
QA/QC



Survey Methodology

Database Generation

QA/QC

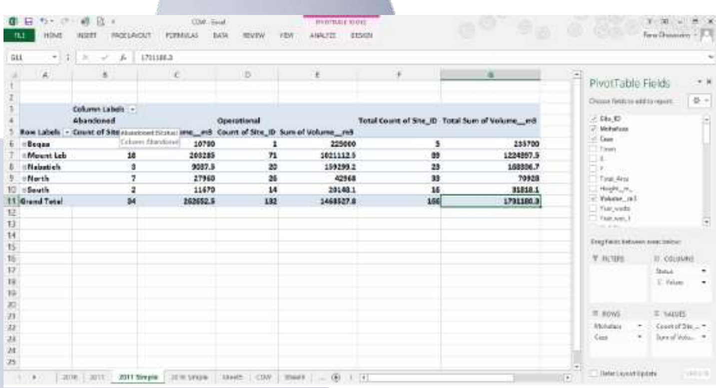


Survey Methodology

- Statistical Analysis
- Software Analysis

Data Analysis

QA/QC



Survey Limitations

Five main challenges were encountered during the data collection phase:

- **Nature** of the sector
- **Definitions** of dumpsites
- **Volumes** estimations
- **Accessibility**
- **Municipality**-related setbacks

Survey Results and Analysis

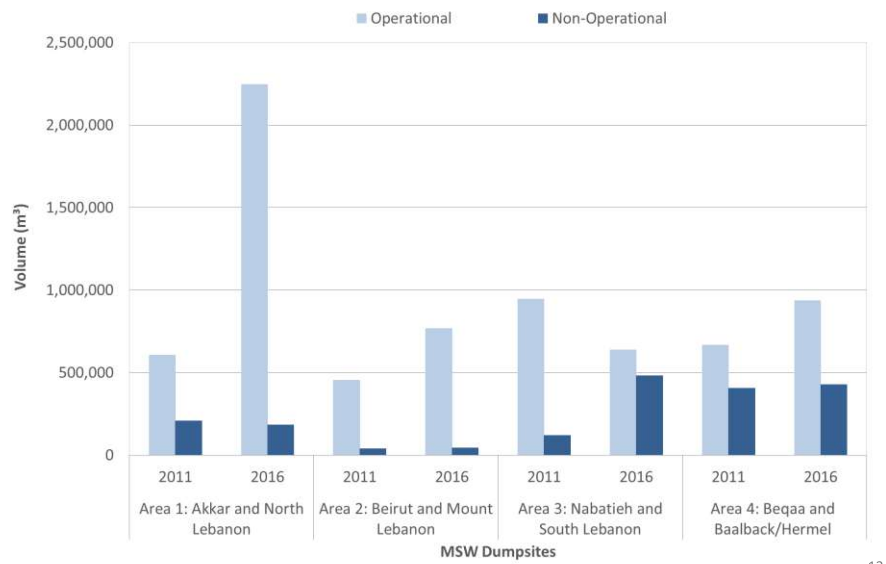
		Operational		Non-Operational		Inaccessible		Grand Total	
		#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
All of Lebanon									
MSW	***2011***	382	2,675,548	122	774,523	-	-	**504**	**3,450,073**
	2016	341	4,588,218	263	1,135,603	13	19,486	**617**	**5,743,307**
CDW	***2011***	132	1,468,528	34	262,653	-	-	**166**	**1,731,181**
	2016	178	964,223	145	1,181,313	1	15,000	**324**	**2,160,536**

Increase **Decrease**

670 identified dumpsites in 2011 survey

941 identified dumpsites in 2016 survey

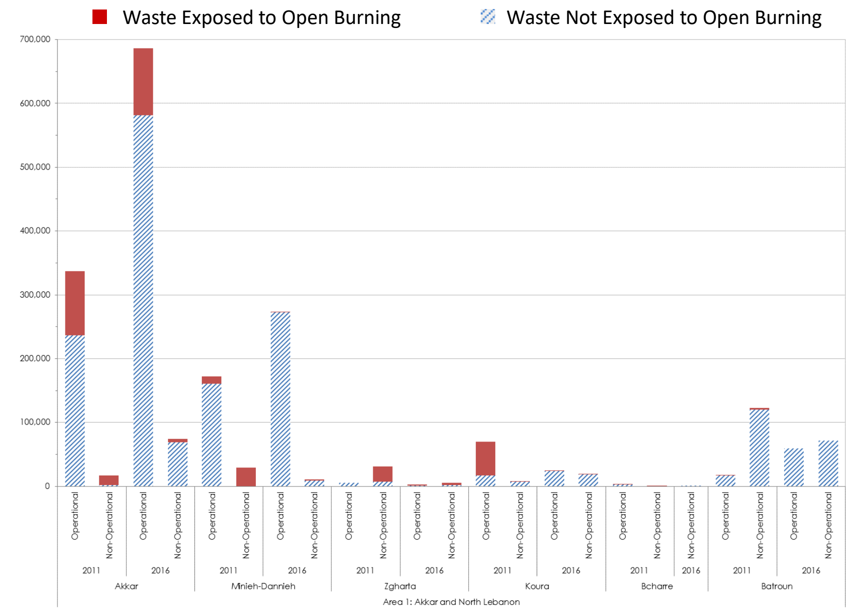
Survey Results and Analysis – MSW



Survey Results and Analysis – Area 1 MSW

		Operational		Non-Operational		Inaccessible		Grand Total	
		#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
Area 1: Akkar and North Lebanon									
2011		**61**	**606,007**	**25**	**208,088**			**86**	**814,095**
2016		**38**	**2,246,797**	**46**	**182,29576568**	**3**	**5,280**	**87**	**2,434,372**
Akkar	*2011*	22	337,300	9	16,620	-	-	**31**	**353,920**
+116.3%	*2016*	19	686,575	15	73,885	2	5,220	**36**	**765,680**
Minieh-Dannieh	*2011*	7	171,750	5	29,060	-	-	**12**	**200,810**
+41.6%	*2016*	5	273,572	6	10,800	1	60	**12**	**284,432**
Tripoli	*2011*	-	-	-	-	-	-	-	-
	2016	1	1,200,000	-	-	-	-	**1**	**1,200,000**
Zgharta	*2011*	5	5,767	6	31,428	-	-	**11**	**37,195**
-78.3%	*2016*	2	2,450	9	5,600	-	-	**11**	**8,050**
Koura	*2011*	17	69,920	2	7,680	-	-	**19**	**77,600**
-43.4%	*2016*	8	25,200	8	18,750	-	-	**17**	**43,950**
Bcharre	*2011*	4	3,920	1	300	-	-	**5**	**4,220**
-70.1%	*2016*	-	-	5	1,260	-	-	**5**	**1,260**
Batroun	*2011*	6	17,350	2	123,000	-	-	**8**	**140,350**
-6.7%	*2016*	3	59,000	2	72,000	-	-	**5**	**131,000**

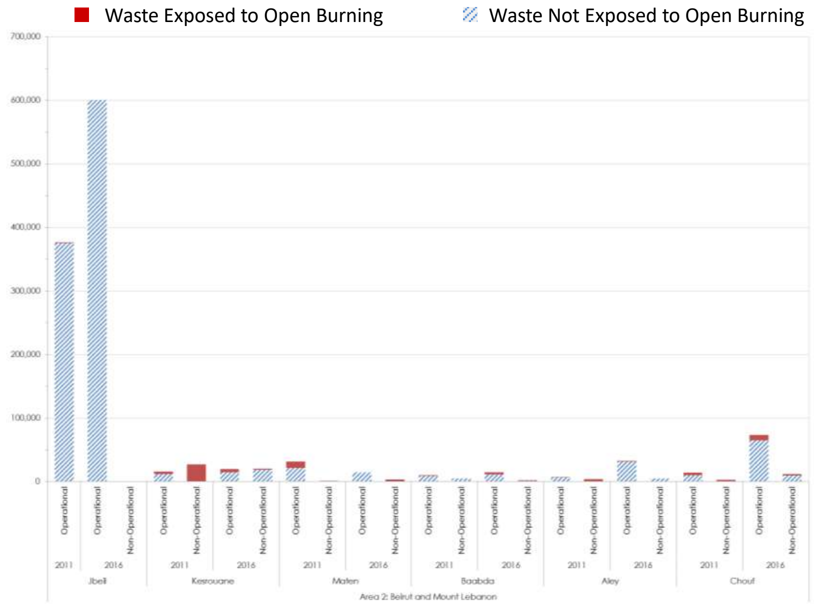
Survey Results and Analysis – Area 1 MSW



Survey Results and Analysis – Area 2 MSW

		Operational		Non-Operational		Inaccessible		Grand Total	
		#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
Area 2: Beirut and Mount Lebanon									
2011		**43**	**453,976**	**16**	**39,175**	**-**	**-**	**59**	**493,151**
2016		**80**	**767,846**	**50**	**43,885**	**2**	**2,400**	**132**	**814,131**
Jbeil	*2011*	3	376,100	-	-	-	-	**3**	**376,100**
+59.6%	*2016*	1	600,000	1	0	1	400	**3**	**600,400**
Kesrouane	*2011*	9	15,555	10	26,725	-	-	**19**	**42,280**
-0.5%	*2016*	4	19,750	13	20,300	1	2,000	**18**	**42,050**
Maten	*2011*	11	31,620	1	1,000	-	-	**12**	**32,620**
-40.8%	*2016*	4	14,560	12	4,750	-	-	**16**	**19,310**
Baabda	*2011*	7	10,026	1	5,000	-	-	**8**	**15,026**
+11%	*2016*	9	14,470	7	2,210	-	-	**16**	**16,680**
Aley	*2011*	5	6,550	1	4,000	-	-	**6**	**10,550**
+381.4%	*2016*	27	45,691	3	5,100	-	-	**30**	**50,791**
Chouf	*2011*	8	14,125	3	2,450	-	-	**11**	**16,575**
+412.2%	*2016*	35	73,375	14	11,525	-	-	**49**	**84,900**

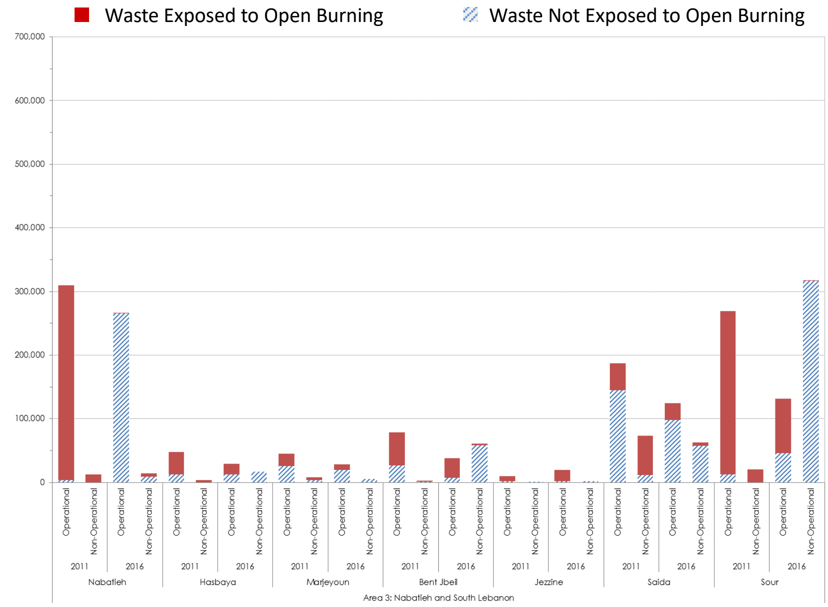
Survey Results and Analysis – Area 2 MSW



Survey Results and Analysis – Area 3 MSW

		Operational		Non-Operational		Inaccessible		Grand Total	
		#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
Area 3: Nabatieh and South Lebanon									
2011		**168**	**947,002**	**52**	**120,955**	-	-	**220**	**1,067,957**
2016		**127**	**637,590**	**110**	**480,498**	**1**	**41**	**238**	**1,118,129**
Nabatieh	*2011*	13	309,437	17	12,768	-	-	**30**	**322,205**
-13.1%	*2016*	8	265,500	23	14,649	-	-	**31**	**280,149**
Hasbaya	*2011*	19	48,009	3	3,455	-	-	**22**	**51,464**
-10.7%	*2016*	16	29,165	8	16,780	-	-	**24**	**45,945**
Marjeyoun	*2011*	22	44,980	3	8,069	-	-	**25**	**53,049**
-36.6%	*2016*	20	28,545	7	5,090	-	-	**27**	**33,635**
Bent Jbeil	*2011*	31	78,828	6	2,808	-	-	**37**	**81,636**
+22.2%	*2016*	20	38,460	23	61,335	-	-	**43**	**99,795**
Jezzine	*2011*	15	9,936	1	35	-	-	**16**	**9,971**
+119.9%	*2016*	10	19,910	5	1,977	1	41	**16**	**21,928**
Saida	*2011*	33	186,925	6	73,292	-	-	**39**	**260,217**
-28%	*2016*	20	124,500	22	62,734	-	-	**42**	**187,234**
Sour	*2011*	35	268,887	16	20,528	-	-	**51**	**289,415**
+55.2%	*2016*	33	131,510	22	317,933	-	-	**55**	**449,443**

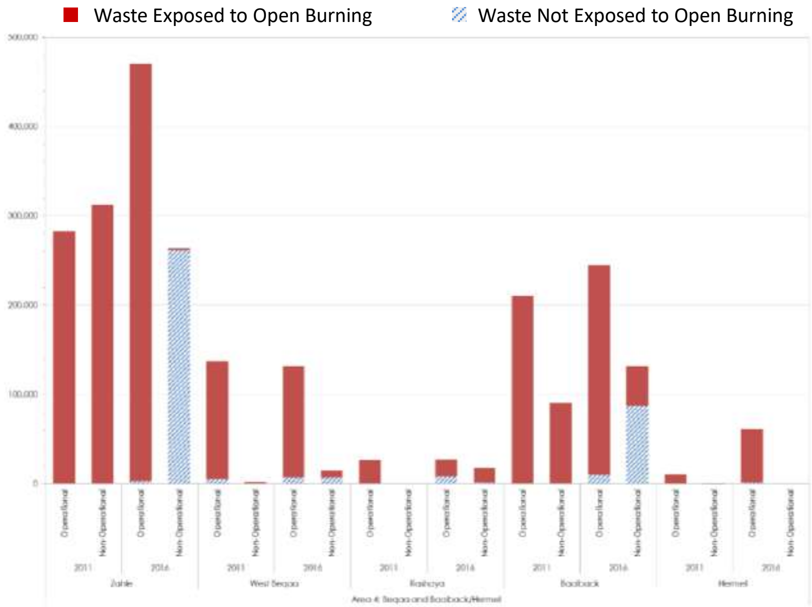
Survey Results and Analysis – Area 3 MSW



Survey Results and Analysis – Area 4 MSW

		Operational		Non-Operational		Inaccessible		Grand Total	
		#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
Area 4: Beqaa and Baalback/Hermel									
2011		**110**	**668,565**	**29**	**406,305**	**-**	**-**	**139**	**1,074,870**
2016		**96**	**935,985**	**57**	**428,925**	**7**	**11,765**	**160**	**1,376,675**
Zahle	*2011*	5	283,000	13	312,480	-	-	**18**	**595,480**
+23.3%	*2016*	7	470,500	10	263,750	-	-	**17**	**734,250**
West Beqaa	*2011*	25	137,350	2	2,100	-	-	**27**	**139,450**
+7.6%	*2016*	24	131,990	8	15,400	1	2,625	**33**	**150,015**
Rashaya	*2011*	29	26,695	3	325	-	-	**32**	**27,020**
+77.3%	*2016*	23	27,180	11	17,605	5	3,140	**39**	**47,925**
Hermel	*2011*	4	10,600	1	600	-	-	**5**	**11,200**
+500.4%	*2016*	3	61,250	1	0	1	6,000	**5**	**67,250**
Baalback	*2011*	47	210,920	10	90,800	-	-	**57**	**301,720**
+25%	*2016*	39	245,065	27	132,170	-	-	**66**	**377,235**

Survey Results and Analysis – Area 4 MSW



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Prioritization Model - MSW

10 attributes were selected for MSW dumpsites

- Volume of waste at site (m^3)
- Geology
- Hydrology
- Distance to urban areas (m)
- Quantity of waste currently dumped at site (t/d)
- Presence of alternatives
- Open burning of waste
- Visibility
- Depth of filling of waste (m)
- Duration of exposure (years)

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Prioritization Model - MSW

Attribute		Weighing Factor	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
Volume of waste at site (m^3)		10	<10,000	10,000-50,000	50,000-100,000	>100,000
Geology	Lithology (70%)	9	Considerable to high clay content	Clay contents and jointing systems	Secondary porosity, different forms of karstification and presence of some marl intercalations	Secondary porosity (cracks and joints) of carbonate rock, plus high karstification
	Faults and lineaments density (segment/km^2) (30%)		<10	10-15	15-20	> 20
Hydrology	Distance to drainage line (m) (80%)	8	>200	200-100	100-50	<50
	Distance to springs (m) (20%)		>200	200-150	150-100	<100
Distance to urban areas (m)		7	>1,000	1,000- 500	250-500	<250
Quantity of waste currently dumped at site (t/d)		6	<10	10-50	50-100	>100
Presence of alternatives		5	No alternatives	Working on alternative solution and funding	Alternative under construction	Alternative operational
Open burning of waste		4	Burned		Not burned	
Visibility		3	Not visible		Visible	
Depth of filling of waste (m)		2	<1	1-5	5-10	>10
Duration of dumpsite exposure (year)		1	<10	10-20	20-30	>30

Prioritization Model – RSI calculation

The RSI was calculated for each dumpsite by adding all attributes, after multiplying each sensitivity grade (class) by its respective weight according to the following equation:

$$RSI = \sum_{n=1}^{n} W_i S_i$$

Where:

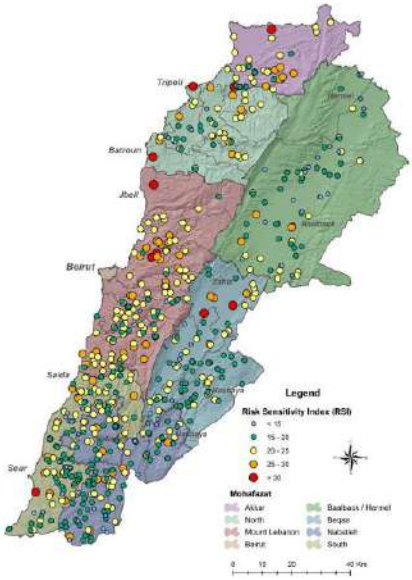
RSI: Risk Sensitivity Index variable ranging from Minimum 10 to Maximum 41

Wi: is the weightage of the ith variable ranging from 1-10

Si: Sensitive index of the ith variable ranging from 0 -1

Prioritization Model – MSW Results

RSI Range	Number of Dumps
> 30	10
25 - 30	69
20 -25	245
15 - 20	248
< 15	45
Total	**617**



Prioritization Model – MSW Results

Rank	Dumpsite ID	Caza	RSI Score
1	R6-Tripoli-0	Tripoli	40.73
2	N5-Hbaline-0	Jbeil	40.31
3	R7-Adweh-0	Minieh-Dannieh	34.76
4	P5-Batroun-0	Batroun	34.59
5	T9-Srar-0	Akkar	34.27
6	J6-Qabb Elias-00	Zahle	32.50
7	C1-Deir Qanoun El-Aain-01	Sour	31.42
8	L5-Balloune-3	Kesrouane	30.32
9	L5-Beit Chabab-1n	Maten	30.20
10	J7-Barr Elias-00	Zahle	30.15
11	R9-Fnaydek-0	Akkar	29.83
12	F2-Sarafand-01	Saida	29.64
13	G4-Jezzine-00	Jezzine	29.03
14	D2-Abbasiyeh-03	Sour	28.96
15	M9-Baalback-02	Baalback	28.90
16	R9-Mishmesh-0	Akkar	28.39
17	G2-Ghaziye-00	Saida	28.35
18	E3-Kfour En-Nabatieh-00	Nabatieh	28.13
19	G2-Saida-1n	Saida	28.08
20	R7-Kfar Chellane-0	Minieh-Dannieh	28.05

Prioritization Model – Sensitivity Analysis

Original Version	
Attribute	**Weight Factor**
Total Quantity	**10**
Geology	9
Hydrology	8
Distance to urban areas	7
Quantity dumped (t/d)	6
Alternatives	5
Open burning	4
Visibility	3
Filling depth	2
Exposure time	1

Test Version	
Attribute	**Weight Factor**
Total Quantity	**10**
Geology	8
Hydrology	9
Distance to urban areas	5
Quantity dumped (t/d)	4
Alternatives	2
Open burning	7
Visibility	3
Filling depth	6
Exposure time	1

Prioritization Model – Sensitivity Analysis

Original Version		
Rank	**Dumpsite ID**	**RSI Score**
1	R6-Tripoli-0	40.73
2	N5-Hbaline-0	40.31
3	R7-Adweh-0	34.76
4	P5-Batroun-0	34.59
5	T9-Srar-0	34.27
6	J6-Qabb Elias-00	32.50
7	C1-Deir Qanoun El-Aain-01	31.42
8	L5-Balloune-3	30.32
9	L5-Beit Chabab-1n	30.20
10	J7-Barr Elias-00	30.15
11	R9-Fnaydek-0	29.83
12	F2-Sarafand-01	29.64
13	G4-Jezzine-00	29.03
14	D2-Abbasiyeh-03	28.96
15	M9-Baalback-02	28.90
16	R9-Mishmesh-0	28.39
17	G2-Ghaziye-00	28.35
18	E3-Kfour En-Nabatieh-00	28.13
19	G2-Saida-1n	28.08
20	R7-Kfar Chellane-0	28.05

Test Version			
Rank	**Dumpsite ID**	**RSI Score**	**Original Version Rank**
1	N5-Hbaline-0	42.10	2
2	R6-Tripoli-0	40.98	1
3	T9-Srar-0	35.77	5
4	R7-Adweh-0	34.57	3
5	P5-Batroun-0	34.18	4
6	C1-Deir Qanoun El-Aain-01	34.17	7
7	J6-Qabb Elias-00	31.73	6
8	L5-Beit Chabab-1n	30.54	9
9	G2-Ghaziye-00	30.31	17
10	L5-Balloune-3	30.23	8
11	R9-Fnaydek-0	30.07	11
12	R9-Beit Ayyoub- 1	29.90	21
13	P5-Hamat-1	29.73	25
14	F2-Sarafand-01	29.33	12
15	J7-Barr Elias-00	29.32	10
16	G4-Jezzine-00	28.77	13
17	G2-Saida-1n	28.49	19
18	Q8-Bqaa Sifreen-0	28.26	26
19	R7-Kfar Chellane-0	28.33	20
20	R9-Mishmesh-0	28.00	16

Rehabilitation Decision Tool - MSW

7 remedial measures were considered for MSW dumps.

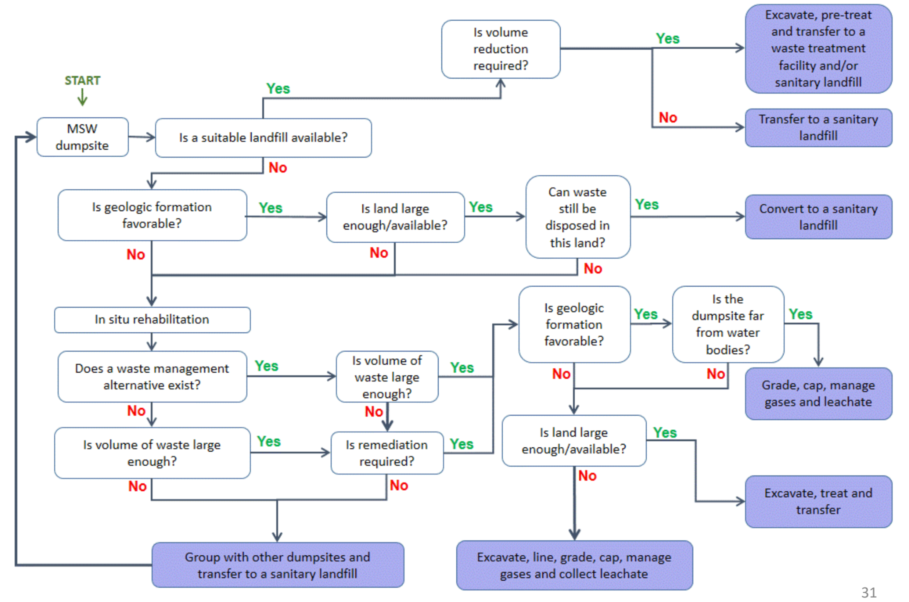
- Excavate, pre-treat and transfer to a waste treatment facility and/or sanitary landfill
- Transfer to a sanitary landfill
- Convert to a sanitary landfill
- Grade, cap, manage gases and leachate
- Excavate, treat and transfer
- Excavate, line, grade, cap, manage gases and collect leachate
- Group with other dumpsites and transfer to a sanitary landfill

Rehabilitation Decision Tool - MSW

Question	Reference Attribute*	Criteria** for Yes	Criteria** for No
Is a suitable landfill available?	-	Suitable landfill available nearby	Suitable landfill not available nearby
Is volume reduction required?	-	M_T_Qty > 0.85: Size with respect to allocated plot >50%	M_T_Qty < 0.85: Size with respect to allocated plot < 50%
Is land large enough?	-	Size with respect to allocated plot >50%	Size with respect to allocated plot <50%
Is geologic formation favorable?	Geology	M geology < 0.25	M geology >0.25
Can waste still be disposed of in this land?	Distance to Urban Areas; Visibility	M_Dist_Urb <0.35; and M_visibility <0.25	M_Dist_Urb >0.35; and M_visibility >0.25
Does a WM alternative exist?	Presence of Alternatives	M_pres alt > 0.5	M_pres alt < 0.5
Is volume of waste large enough?	Volume; Quantity	M_Volume > 0.5 or M_quantity >0.5	M_Volume <0.5 or M_quantity<0.5
Is geologic formation favorable?	Geology	M_geology < 0.25	M_geology > 0.25
Is dumpsite far from water bodies?	Hydrology	M_hydrology < 0.5	M_hydrology > 0.5
Is remediation required?	Volume; Quantity	M_volume >0.2 M_quantity >0.2	M_volume <0.2 and M_quantity <0.2

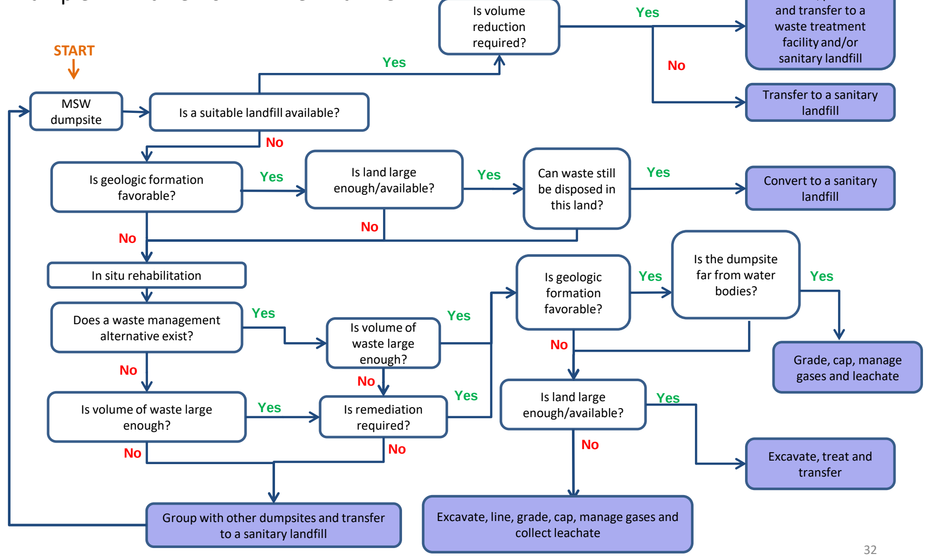
**refer to Attribute Table*
***refer to Sensitivity Grade results*

Rehabilitation Decision Tool - MSW



Rehabilitation Decision Tool - MSW

Example: R7-Adweh-0 in Minieh-Dannieh



Rehabilitation Decision Tool – MSW Results

Rank	Dumpsite ID	Caza	Proposed Rehabilitation Plan
1	R6-Tripoli-0	Tripoli	Grade, cap, manage gases and leachate
2	N5-Hbaline-0	Jbeil	Option 1 - Grade, cap, manage gases and leachate
			Option 2 - Convert to a sanitary landfill
3	R7-Adweh-0	Minieh-Dannieh	Grade, cap, manage gases and leachate
4	P5-Batroun-0	Batroun	Excavate, line, grade, cap, manage gases and collect leachate
5	T9-Srar-0	Akkar	Convert to a sanitary landfill
6	J6-Qabb Elias-00	Zahle	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Transfer to a sanitary landfill
7	C1-Deir Qanoun El-Aain-01	Sour	Convert to a sanitary landfill
8	L5-Balloune-3	Kesrouane	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
9	L5-Beit Chabab-1n	Maten	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
10	J7-Barr Elias-00	Zahle	Option 1: Excavate, treat and transfer
			Option 2: Grade, cap, manage gases and leachate

Rehabilitation Decision Tool – MSW Results

Rank	Dumpsite ID	Caza	Proposed Rehabilitation Plan
11	R9-Fnaydek-0	Akkar	Excavate, line, grade, cap, manage gases and collect leachate
12	F2-Sarafand-01	Saida	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
13	G4-Jezzine-00	Jezzine	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
14	D2-Abbasiyeh-03	Sour	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
15	M9-Baalback-02	Baalback	Excavate, line, grade, cap, manage gases and collect leachate
16	R9-Mishmesh-0	Akkar	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill
17	G2-Ghaziye-00	Saida	Excavate, line, grade, cap, manage gases and collect leachate
18	E3-Kfour En-Nabatieh-00	Nabatieh	Excavate, line, grade, cap, manage gases and collect leachate
19	G2-Saida-1n	Saida	Grade, cap, manage gases and leachate
20	R7-Kfar Chellane-0	Minieh-Dannieh	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate
			Option 2 - Group with other dumpsites and transfer to a sanitary landfill

Rehabilitation Cost – MSW

Rank	Dumpsite ID	Proposed Rehabilitation Plan	Cost (USD)
1	R6-Tripoli-0	Grade, cap, manage gases and leachate	6,557,287
2	N5-Hbaline-0	Option 1 - Grade, cap, manage gases and leachate	2,931,075
		Option 2 - Convert to a sanitary landfill	6,946,524
3	R7-Adweh-0	Grade, cap, manage gases and leachate	1,612,762
4	P5-Batroun-0	Excavate, line, grade, cap, manage gases and collect leachate	1,039,300
5	T9-Srar-0	Convert to a sanitary landfill	6,732,524
6	J6-Qabb Elias-00	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	2,163,875
		Option 2 - Transfer to a sanitary landfill	1,613,750
7	C1-Deir Qanoun El-Aain-01	Convert to a sanitary landfill	4,748,516
8	L5-Balloune-3	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	336,500
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	164,500
9	L5-Beit Chabab-1n	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	240,250
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	176,500
10	J7-Barr Elias-00	Option 1: Excavate, treat and transfer	3,758,262
		Option 2: Grade, cap, manage gases and leachate	1,765,675

Rehabilitation Cost – MSW

Rank	Dumpsite ID	Proposed Rehabilitation Plan	Cost (USD)
11	R9-Fnaydek-0	Excavate, line, grade, cap, manage gases and collect leachate	895,875
12	F2-Sarafand-01	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	443,625
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	375,250
13	G4-Jezzine-00	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	334,750
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	193,000
14	D2-Abbasiyeh-03	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	435,000
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	398,750
15	M9-Baalback-02	Excavate, line, grade, cap, manage gases and collect leachate	1,147,000
16	R9-Mishmesh-0	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	150,250
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	74,500
17	G2-Ghaziye-00	Excavate, line, grade, cap, manage gases and collect leachate	457,200
18	E3-Kfour En-Nabatieh-00	Excavate, line, grade, cap, manage gases and collect leachate	678,750
19	G2-Saida-1n	Grade, cap, manage gases and leachate	359,250
20	R7-Kfar Chellane-0	Option 1 - Excavate, line, grade, cap, manage gases and collect leachate	225,310
		Option 2 - Group with other dumpsites and transfer to a sanitary landfill	133,375
		Cost Range: 32,130,590 - 39,187,061	

Rehabilitation Costing Example – MSW

1- Site Name and Location	**R7-Adweh-0**
X	35.988
Y	34.451
Z	215 m
Mohafaza	North
Caza	El Minieh
Town	Adweh
2- Type of Dump	Dump in Valley or seasonal water channel
Distance to Urban areas	131 m
Open Burning	No
3- Estimated Volume	255,372 m3
Area	21,281 m2
Height	12 m
Quantity of waste currently dumped	150 t/d
Waste coming from	Most of the villages of Minieh, Koura and Diniyeh
4- Priority Ranking for Rehabilitation	**3**
Risk Sensitivity Index Score	34.762 out of 55
5- Preferred Rehabilitation Option	Grade, Cap, manage gases and leachate
6- Technical Requirements	a-Assess site conditions and conduct preliminary studies to determine actual volumes and characteristics of wastes and of the dump. b- Conduct earth movement of old waste using the necessary machinery for the purpose of reducing the surface area of the dump, grading, compaction and sabilization of waste within the dump (surface slope 2 to 4 %) and for stabilization of side slopes to a vertical to horizontal ratio less than 1:3. c-Install a capping system to prevent gas migration and divert rain from entering the waste dump. The cap should be composed of a 30 cm gravel drainage layer followed by 50 cm of well compacted clay layer and a 30 cm fine protective layer of soil. A geotextile protective membrane should be installed between the drainage and clay layers. d-Active harnessing of gases from the dumpsite by drilling the necessary number of gas wells (minimum 1 gas well for each 10000 m3 of waste) and installing silica-based gravel inside gas wells, gas collection pipes (perforated and non perforated HDPE pipes), headers and subheaders (HDPE pipes), grouts and plugs, and the appropriate blower and gas flaring unit. e- Construction of peripheral drainage channels to control leachate generation and diverting rain away from the dumpsite. Concrete channels can be constructed along the periphery of the dumpsite. Leachate and diverted rain water should be collected in an appropriately sized leachate collection tank, pit or pond supplied with the necessry pumping system.

Rehabilitation Costing Example – MSW (Cont'd)

7- Responsibility	Union of Municipalities of El Minieh / Municipality of Adweh
8- Legal requirements	Enforce legislation and ban open dumping.
9- Monitoring requirements	a-Assign experienced personnel to supervise closure activities. b- Monitor gas quantity and quality c- Monitor and control leachate generation d- Control dust during earth moving works e-Monitor Health and Safety of operators
10 - Operation and maintenance requirements	Continuous control and inspection of cap, flaring unit, blowers, leachate generation and management
11 - Estimated cost ($) Average rehabilitation/closure cost ($ per m3 of waste)	1,612,762 $ 6.315 $/m3
12- Possible sources of financing	National Budget or donor agencies

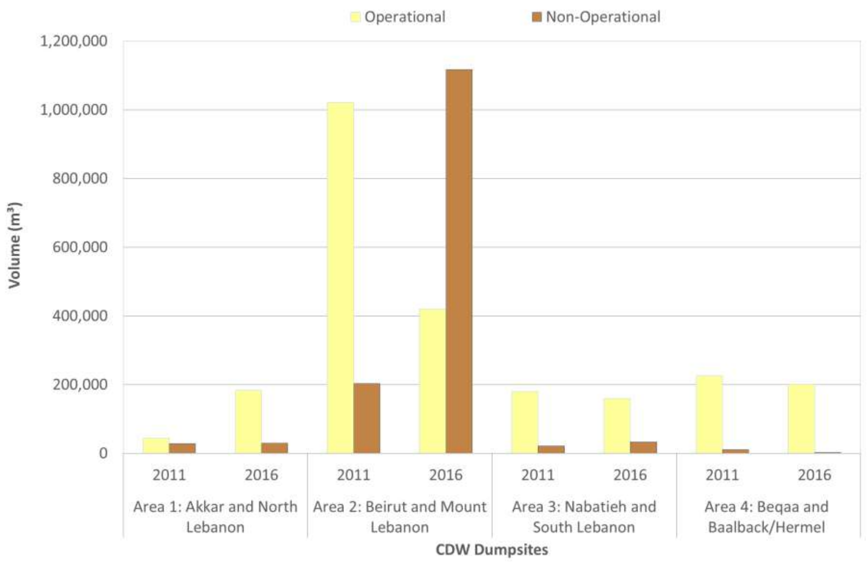
COST ESTIMATE

Description	Unit	Quantity	Unit price (US$)	Total price (US$)
1. Preparatory Works				
1.1 - Mobilization and Demobilization: Mobilization to the site and demobilization after completion of all the required tasks including machineries and equipment needed for the completiion of the works.	LS	1	15,000.0	15,000
1.2 - Site Assessment: including visual inspection, topographic survey, initial assessment study and research, sampling, waste characterization, shop drawings, as built drawings and all necessary work needed to assess conditions of the dump.	LS	1	30,000.0	30,000
2. Earth Movement Works				
2.1 - Surface preparation and re-shaping: including movement of waste within the dump for the purpose of grading, compaction and stabilization of waste (old and new waste coming from nearby dumps, if any)	m3	89,380	4.0	357,521
2.2- Slope stabilization: including grading of the surface of the fill to about 2 - 4% and the side slopes to a vertical to horizontal ratio less than 1:3.	m2	21,281	2.0	42,562
3. Capping Works				
3.1 - Supply and install a well compacted low permeability clay liner (50 cm thickness)	m3	12,769	14.0	178,760
3.2 - Supply and install a gravel drainage layer (30 cm thickness)	m3	7,661	40.0	306,446
3.3 - Supply and install fine protective layer of soil (30 cm thickness)	m3	7,661	15.0	114,917
3.4 -Supply and install a geotextile protective membrane between the clay liner and the gravel drainage layer	m2	25,537	4.0	102,149

Rehabilitation Costing Example – MSW (Cont'd)

4. Gas Management Works				
4.1 -Drilling of gas wells: The drilling should be done using an auger (preferably a hollow stem Auger type). The diameter of all boreholes is fixed to 90 cm while the depth vary according to depth of waste. The Radius of influence of gas wells to vary between 15 and 20 m.	lm	306	125.0	38,306
4.2 - Supply and install gravel (silica-based) inside gas wells: - The gravel size should vary between 5 mm and 5 cm. Preferablygravel should be of basiltic nature, otherwise it should be properly and extensively washed before usage.	m3	195	50.0	9,730
4.3 - Supply and install HDPE Pipes in gas wells (slotted and non slotted) complete including all accessories. Pipes thickness to be 5 mm minimum.	Lm	306	130.0	39,838
4.4 -Supply and install connection headers including main venting header and sub venting header, complete including all accessories. Pipes to be made of 150 to 200 mm HDPE. Accessories include T-junction, 90 degrees curves,m enlarger, reducer, caps, monitoring ports, gate valves, flexible hose, etc.	Lm	966	140.0	135,256
4.5 - Supply and install blower and flaring unit: including flare, blowers, connections, fittings, and accessories. Minimum flow to be 40 m3/hr	unit	1	75,000.0	75,000
4.6- Supply and install soil backfill material, Bentonite clay and grout forsealing the gas wells, complete including all accessories	unit	26	50.0	1,277
5. Leachate Management Works				
5.1 - Construction of a concrete leachate collection pit. Volume 40 m3 complete including pumping system	unit	1	30,000.0	30,000
5.2 - Construction of concrete peripheral drainage channels to collect leachate and divert rain away from the dump. Drainage channel to be 80 cm x 80 cm x 80 cm min.	lm	800	45.0	36,000
5.3 - Cut off walls	lm	500	100.0	50,000
6. Control and Monitoring				
6.1 - Control and Monitoring of works	LS	1	50,000.0	50,000
TOTAL COST ($)				**1,612,762**
AVERAGE COST (S/m3)				**6.315**

Survey Results and Analysis – CDW



Survey Results and Analysis – Area 1 CDW

		Operational		Non-Operational		Grand Total	
		#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
Area 1: Akkar and North Lebanon							
2011		**26**	**42,968**	**7**	**27,960**	**33**	**70,928**
2016		**29**	**183,160**	**18**	**29,006**	**47**	**212,166**
Akkar	*2011*	8	15,600	1	270	**9**	**15,870**
+67.4%	*2016*	8	20,420	4	6,150	**12**	**26,570**
Minieh-Dannieh	*2011*	1	200	-	-	**1**	**200**
+20,450%	*2016*	3	41,100	-	-	**3**	**41,100**
Tripoli	*2011*	-	-	-	-	-	-
	2016	-	-	-	-	-	-
Zgharta	*2011*	4	3,525	3	16,640	**7**	**20,165**
+58%	*2016*	4	24,900	5	6,950	**9**	**31,850**
Koura	*2011*	8	14,763	-	-	**8**	**14,763**
+477.8%	*2016*	6	73,300	5	12,006	**11**	**85,306**
Bcharre	*2011*	1	400	1	2,250	**2**	**2,650**
+13.2%	*2016*	1	1,200	2	1,800	**3**	**3,000**
Batroun	*2011*	4	8,480	2	8,800	**6**	**17,280**
+40.9%	*2016*	7	22,240	2	2,100	**9**	**24,340**

Survey Results and Analysis – Area 2 CDW

		Operational		Non-Operational		Inaccessible		Grand Total	
		#	Volume (m³)	#	Volume (m³)	#	Volume (m³)	#	Volume (m³)
Area 2: Beirut and Mount Lebanon									
2011		**71**	**1,021,113**	**18**	**203,285**	**-**	**-**	**89**	**1,224,398**
2016		**35**	**419,880**	**88**	**1,116,910**	**1**	**15,000**	**124**	**1,551,790**
Jbeil	*2011*	1	3,000	-	-	-	-	**1**	**3,000**
+233%	*2016*	4	9,000	2	1,000	-	-	**6**	**10,000**
Kesrouane	*2011*	25	151,190	5	118,900	-	-	**30**	**270,090**
+13.7%	*2016*	8	87,930	27	204,195	1	15,000	**36**	**307,125**
Maten	*2011*	22	181,460	8	45,735	-	-	**30**	**227,195**
+123%	*2016*	13	265,650	30	241,015	-	-	**43**	**506,665**
Baabda	*2011*	4	21,300	1	14,000	-	-	**5**	**35,300**
+6.9%	*2016*	3	2,450	6	35,300	-	-	**9**	**37,750**
Aley	*2011*	7	55,405	2	21,200	-	-	**9**	**76,605**
+9.8%	*2016*	3	42,650	11	41,450	-	-	**14**	**84,100**
Chouf	*2011*	12	608,758	2	3,450	-	-	**14**	**612,208**
-1%	*2016*	4	12,200	12	593,950	-	-	**16**	**606,150**

Survey Results and Analysis – Area 3 CDW

		Operational		Non-Operational		Grand Total	
		#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
Area 3: Nabatieh and South Lebanon							
2011		**34**	**179,447**	**5**	**20,708**	**39**	**200,155**
2016		**69**	**159,933**	**35**	**32,897**	**104**	**192,830**
Nabatieh	*2011*	5	14,552	-	-	**5**	**14,552**
+84.3%	*2016*	15	24,313	4	4,700	**19**	**29,013**
Hasbaya	*2011*	3	114,082	-	-	**3**	**114,082**
-56.8%	*2016*	4	42,500	2	6,750	**6**	**49,250**
Marjeyoun	*2011*	6	18,855	-	-	**6**	**18,855**
+33.2%	*2016*	10	16,925	5	8,200	**15**	**25,125**
Bent Jbeil	*2011*	6	11,810	3	9,038	**9**	**20,848**
+84.5%	*2016*	19	38,475	4	0	**23**	**38,475**
Jezzine	*2011*	3	6,897	-	-	**3**	**6,897**
-50.7%	*2016*	1	2,400	2	1,000	**3**	**3,400**
Saida	*2011*	3	7,374	-	-	**3**	**7,374**
+160.4%	*2016*	10	13,400	3	5,800	**13**	**19,200**
Sour	*2011*	8	5,877	2	11,670	**10**	**17,547**
+60.8%	*2016*	10	21,920	15	6,447	**25**	**28,367**

Survey Results and Analysis – CDW Area 4

		Operational		Non-Operational		Grand Total	
		#	Volume (m^3)	#	Volume (m^3)	#	Volume (m^3)
Area 4: Beqaa and Baalback/Hermel							
2011		**1**	**225,000**	**4**	**10,700**	**5**	**235,700**
2016		**45**	**201,250**	**4**	**2,500**	**49**	**203,750**
Zahle	*2011*	-	-	3	3,700	**3**	**3,700**
+1,085%	*2016*	12	43,750	1	100	**13**	**43,850**
West Beqaa	*2011*	-	-	1	7,000	**1**	**7,000**
+20%	*2016*	1	7,500	2	900	**3**	**8,400**
Rashaya	*2011*	-	-	-	-	**-**	**-**
+100%	*2016*	5	9,700	-	-	**5**	**9,700**
Hermel	*2011*	-	-	-	-	**-**	**-**
+100%	*2016*	-	-	1	1,500	**1**	**1,500**
Baalback	*2011*	1	225,000	-	-	**1**	**225,000**
-37.6%	*2016*	27	140,300	-	-	**27**	**140,300**

Prioritization Model - CDW

8 attributes were selected for CDW dumpsites

- Volume of waste at site (m^3)
- Visibility
- Hydrology
- Distance to urban areas (m)
- Presence of alternatives/ intended use
- Status
- Geology
- Duration of exposure (years)

Prioritization Model - CDW

Attribute		Weighing Factor	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
Volume of waste at site (m^3)		8	<3,000	3,000-10,000	10,000-50,000	>50,000
Visibility		7	Not visible		Visible	
Hydrology	Distance to drainage line (80%)	6	>200	200-100	100-50	<50
	Distance to springs (20%)		>200	200-150	150-100	<100
Distance to urban areas		5	>1,000	1000-500	250-500	<250
Presence of alternatives/intended use		4	No alternatives/ no plans	Working on alternative solution and funding	Alternative under construction	Alternative operational
Status (Non Operational/Operational)		3	Removed	Covered	Non operational	Operational
Geology	Lithology (70%)	2	Considerable to high clay content	Clay contents and jointing systems	Secondary porosity, different forms of karstification and presence of some marl intercalations	Secondary porosity (cracks and joints) of carbonate rock, plus high karstification
	Faults & lineaments density (segment/km^2) (30%)		<10	10-15	15-20	>20
Duration of dumpsite exposure (year)		1	<10	10-20	20-30	>30

Prioritization Model – RSI calculation

The RSI was calculated for each dumpsite by adding all attributes, after multiplying each sensitivity grade (class) by its respective weight according to the following equation:

$$RSI = \sum_{n=1}^{n} W_i \, S_i$$

Where:

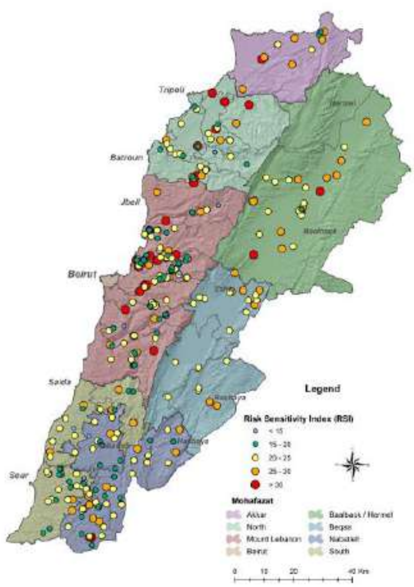
RSI: Risk Sensitivity Index variable ranging from Minimum 10 to Maximum 41

Wi: is the weightage of the ith variable ranging from 1-10

Si: Sensitive index of the ith variable ranging from 0 -1

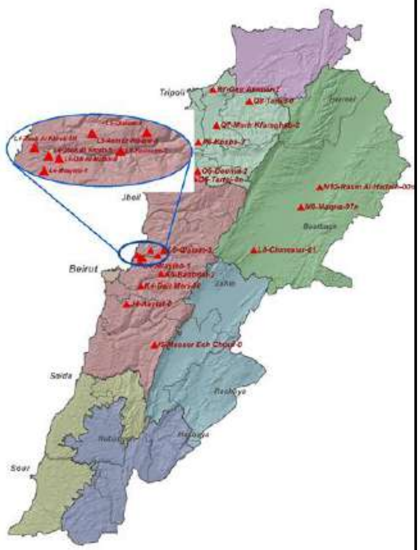
Prioritization Model – CDW Results

RSI Range	Number of Dumps
> 20	29
18 - 20	69
14 -18	143
10 -14	75
< 10	8
Total	**324**



Prioritization Model – CDW Results

Rank	Dumpsite ID	Caza	RSI Score
1	Q7-Morh Kfarsghab-2	Zgharta	23.53
2	R7-Deir Ammar-2	Minieh-Dannieh	23.53
3	K5 - Broummana -1n	Maten	23.48
4	K4-Beit Meri-00	Maten	23.21
5	P6-Kosba-2	Koura	23.19
6	L5-Balloune-2	Kesrouane	23.16
7	L5-Qlaiaat-3	Kesrouane	22.85
8	I5-Maaser Ech Chouf-0	Chouf	22.59
9	L4-Dik Al-Mahdi-0	Maten	22.51
10	K5- Ras El Maten-2n	Maten	22.50
11	L8-Chmestar-01	Baalback	22.15
12	L5-Aain Er-Rihane-3	Kesrouane	22.08
13	L4-Mtayleb-1	Maten	21.82
14	L4-Zouk Al Khrab-6n	Maten	21.74
15	L4-Zouk Al Khrab-5	Maten	21.49
16	M9-Maqne-07n	Baalback	21.39
17	J4-Aaytat-0	Aley	21.39
18	O6-Tartej-0n	Jbeil	21.37
19	L5- KfarTay- 1n	Maten	21.34
20	N10-Rasm Al Hadath-00n	Baalback	21.30



Rehabilitation Decision Tool - CDW

4 remedial measures were considered for CDW dumps.

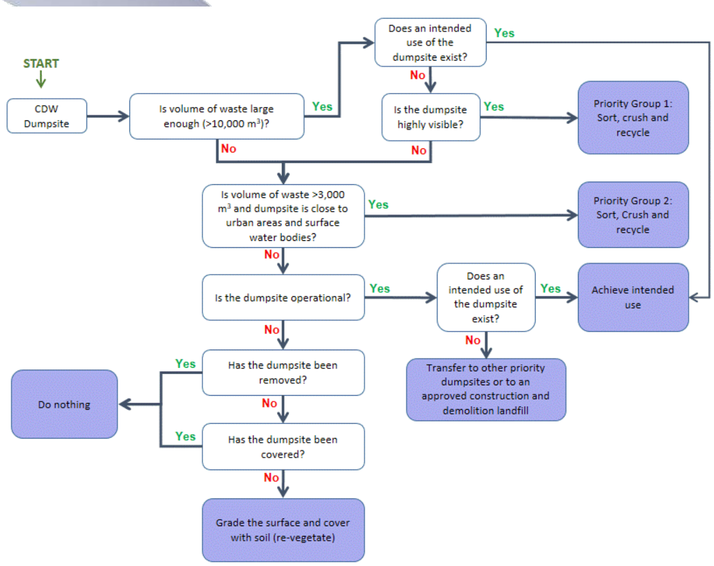
- Sort, crush and recycle
- Transfer to other priority dumps or to an approved construction and demolition landfill
- Grade the surface and cover with soil (re-vegetate)
- Achieve intended use

Rehabilitation Decision Tool - CDW

Question	Reference Attribute*	Criteria** for Yes	Criteria** for No
Does an intended use of the dumpsite exist?	Presence of Alternatives	M_pres_alt >=0.5	M_pres_alt <=0.5
Is volume of waste large enough?	Volume	V>=10,000 m^3	V<=10,000 m^3
Is the dumpsite highly visible?	Visibility	M_Value for visibility >=0.5	M_Value for visibility <=0.5
Is volume of waste >3,000 m^3 and dumpsite is close to urban areas and surface water bodies?	Volume	3,000m^3 <= V <=10,000 m^3	V<3,000 m^3
	Distance to Urban Areas	M_dist _urban >=0.5	M_dist _urban <= 0.5
	Distance to Water Bodies	M_Hydrology>=0.5	M_Hydrology<=0.5
Is the dumpsite operational?	Status	Operational	Non-operational
Has it been removed?	Status	Non-operational	Non-operational
	Subcategory	Removed	Not removed
Has it been covered?	Status	Non-operational	Non-operational
	Subcategory	Covered	Not Covered

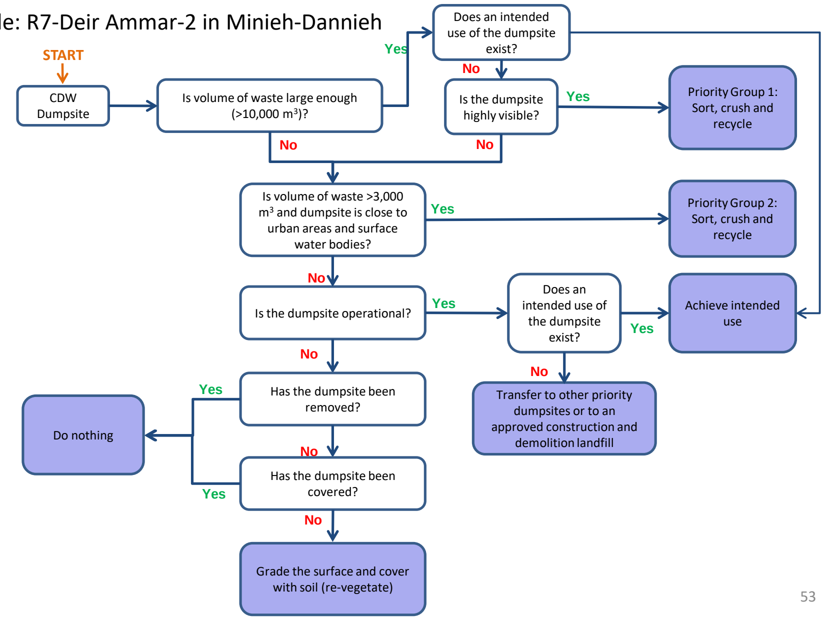
**refer to Attribute Table*
*** refer to Sensitivity Grade results*

Rehabilitation Decision Tool - CDW



Rehabilitation Decision Tool - CDW

Example: R7-Deir Ammar-2 in Minieh-Dannieh



Rehabilitation Decision Tool – CDW Results

Rank	Dumpsite ID	Caza	Rehabilitation
1	Q7-Morh Kfarsghab-2	Zgharta	Achieve intended use (build a church)
2	R7-Deir Ammar-2	Minieh-Dannieh	Priority Group 1: Sort, crush and recycle
3	K5 - Broummana -1n	Maten	Priority Group 1: Sort, crush and recycle
4	K4-Beit Meri-00	Maten	Priority Group 1: Sort, crush and recycle
5	P6-Kosba-2	Koura	Achieve intended use (establish a parking)
6	L5-Balloune-2	Kesrouane	Priority Group 1: Sort, crush and recycle
7	L5-Qlaiaat-3	Kesrouane	Priority Group 1: Sort, crush and recycle
8	I5-Maaser Ech Chouf-0	Chouf	Priority Group 2: Sort, crush and recycle
9	L4-Dik Al-Mahdi-0	Maten	Priority Group 1: Sort, crush and recycle
10	K5- Ras El Maten-2n	Maten	Achieve intended use (build a new road)
11	L8-Chmestar-01	Baalback	Priority Group 1: Sort, crush and recycle
12	L5-Aain Er-Rihane-3	Kesrouane	Priority Group 1: Sort, crush and recycle
13	L4-Mtayleb-1	Maten	Priority Group 2: Sort, crush and recycle
14	L4-Zouk Al Khrab-6n	Maten	Priority Group 2: Sort, crush and recycle
15	L4-Zouk Al Khrab-5	Maten	Priority Group 2: Sort, crush and recycle
16	M9-Maqne-07n	Baalback	Priority Group 1: Sort, crush and recycle
17	J4-Aaytat-0	Aley	Achieve intended use (expand the land)
18	O6-Tartej-0n	Jbeil	Achieve intended use (transform to a garden)
19	L5- KfarTay- 1n	Maten	Priority Group 1: Sort, crush and recycle
20	N10-Rasm Al Hadath-00n	Baalback	Priority Group 1: Sort, crush and recycle

Rehabilitation Cost – CDW

Rank	Dumpsite ID	Proposed Rehabilitation Plan	Cost (USD)
1	Q7-Morh Kfarsghab-2	Achieve intended use (build a church)	40,267
2	R7-Deir Ammar-2	Priority Group 1: Sort, crush and recycle	422,550
3	K5 - Broummana -1n	Priority Group 1: Sort, crush and recycle	839,960
4	K4-Beit Meri-00	Priority Group 1: Sort, crush and recycle	939,750
5	P6-Kosba-2	Achieve intended use (establish a parking)	109,433
6	L5-Balloune-2	Priority Group 1: Sort, crush and recycle	362,900
7	L5-Qlaiaat-3	Priority Group 1: Sort, crush and recycle	553,850
8	I5-Maaser Ech Chouf-0	Priority Group 2: Sort, crush and recycle	102,440
9	L4-Dik Al-Mahdi-0	Priority Group 1: Sort, crush and recycle	243,600
10	K5- Ras El Maten-2n	Achieve intended use (build a new road)	147,000
11	L8-Chmestar-01	Priority Group 1: Sort, crush and recycle	127,300
12	L5-Aain Er-Rihane-3	Priority Group 1: Sort, crush and recycle	1,175,000
13	L4-Mtayleb-1	Priority Group 2: Sort, crush and recycle	57,185
14	L4-Zouk Al Khrab-6n	Priority Group 2: Sort, crush and recycle	64,650
15	L4-Zouk Al Khrab-5	Priority Group 2: Sort, crush and recycle	65,650
16	M9-Maqne-07n	Priority Group 1: Sort, crush and recycle	155,625
17	J4-Aaytat-0	Achieve intended use (expand the land)	77,600
18	O6-Tartej-0n	Achieve intended use (transform to a garden)	22,800
19	L5- KfarTay- 1n	Priority Group 1: Sort, crush and recycle	686,084
20	N10-Rasm Al Hadath-00n	Priority Group 1: Sort, crush and recycle	129,765
		Total	**6,323,409**

Rehabilitation Cost

Preliminary Cost of Rehabilitation of MSW Dumpsites	USD $
Average Total for Top 20	35,658,825
Total for remaining dumpsites	24,549,610
Total	**60,208,435**

Preliminary Cost of Rehabilitation of CDW Dumpsites	USD $
Top 20	6,323,409
Total for remaining dumpsites	7,455,018
Total	**13,778,427**

The total estimated Cost of Rehabilitation for MSW and CDW Dumpsites amounts to **USD 74 million**

Agenda

Updated Master Plan

- Objectives
- Survey Methodology
- Survey Limitations
- Survey Results and Analysis
- Prioritization Model and Results
- Rehabilitation Decision Tool, Results and Cost

Environmental Assessment of Dumpsites

- Objectives
- EA Methodology
- Pilot Test
- EA Recommendations

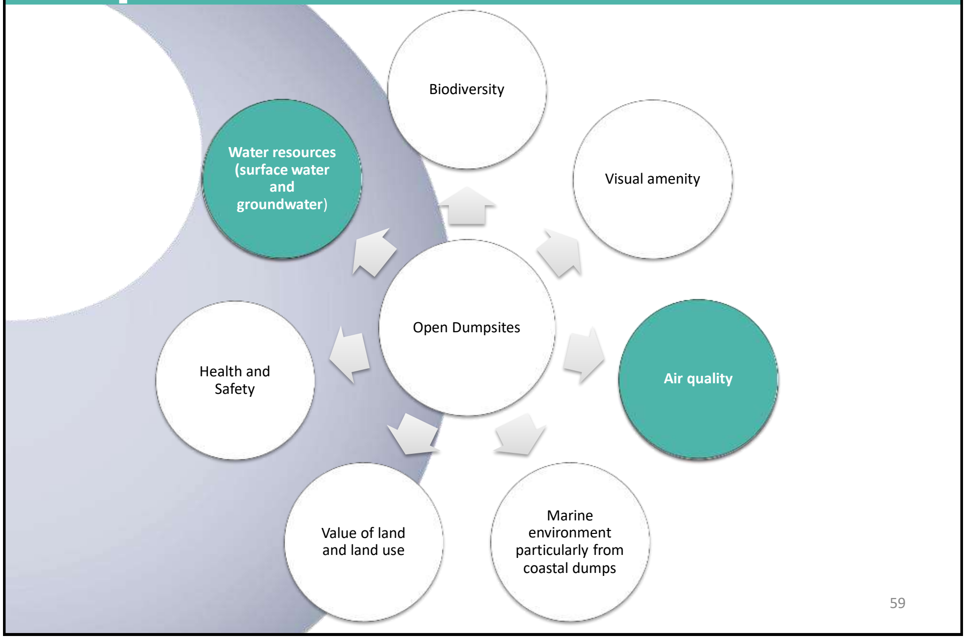
Cost Assessment of Dumpsites

- Background and Objectives
- Methodological Process
- Assumptions
- Dataset
- CAOD Main Findings and Conclusions

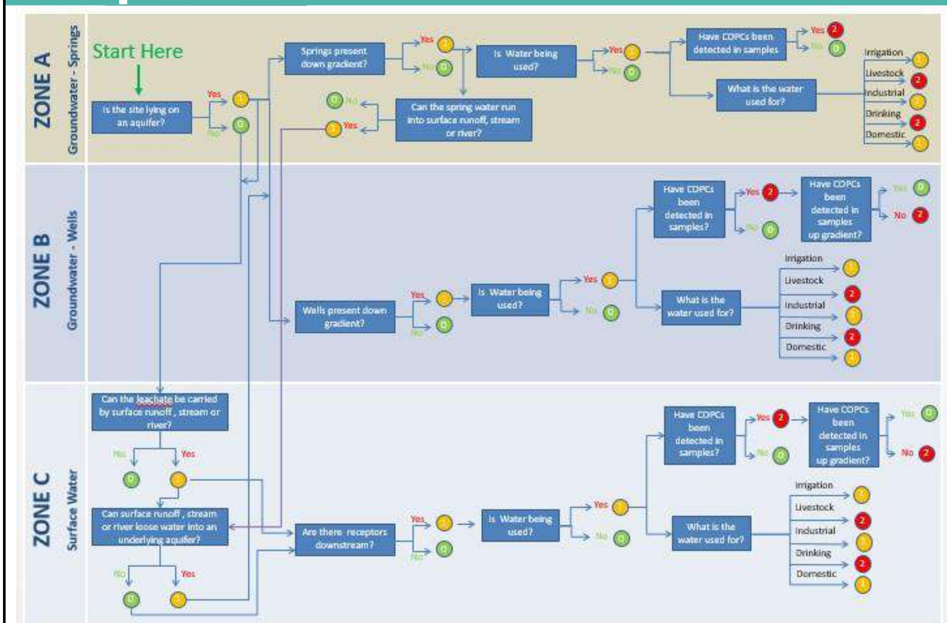
Objective

The Environmental Assessment (EA) methodology proposes an easy, hands-on tool that can be used to directly and independently assess the environmental impacts of uncontrolled dumps in Lebanon.

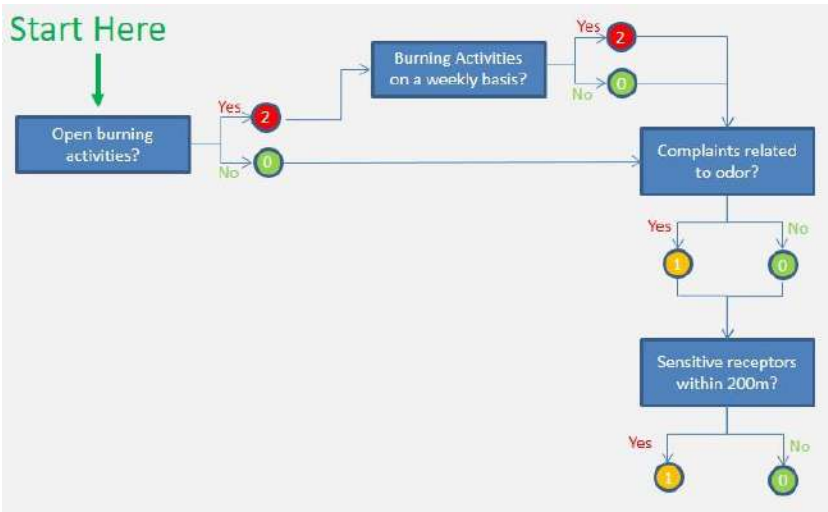
EA Methodology – Identification of Potential Impacts



EA Methodology – Potential Impacts on Water Resources



EA Methodology – Potential Impacts on Air Quality



EA Methodology – Impact Significance Levels and Recommendations

Total Score Per Zone	Impact Significance
0-2	Low
3-5	Moderate
≥ 6	High

Recommendations
Corrective measures
Dumpsite rehabilitation
Dumpsite rehabilitation

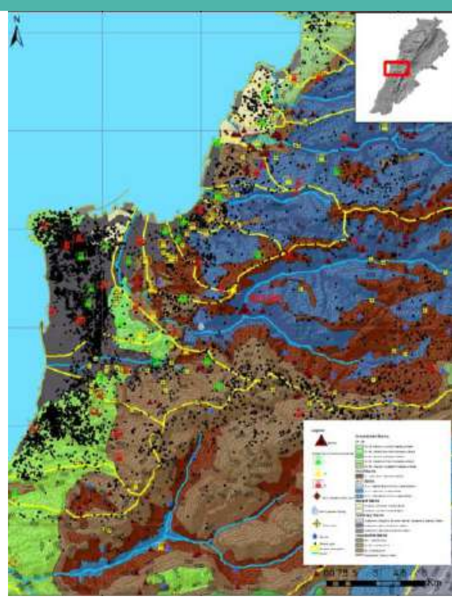
EA Methodology – Impact Significance Levels and Recommendations

Receptor	Recommendations
Water Resources	• Eliminate the source of the pollution, primarily through closure and rehabilitation of the dumpsite.
Air Quality	• Forbid open burning practices; • Apply soil cover to prevent odor emissions and reduce their dispersion; • Install a gas collection and flaring system.

Pilot Test – Site Selection

The **Beit Meri** dumpsite in Maten caza (Site ID: K4) was chosen to test the EA methodology based on the following:

- Its location in a basin within Mount Lebanon
- Limited presence of other sources of pollution to better establish the linkage between pollution levels and the presence of the dumpsite.

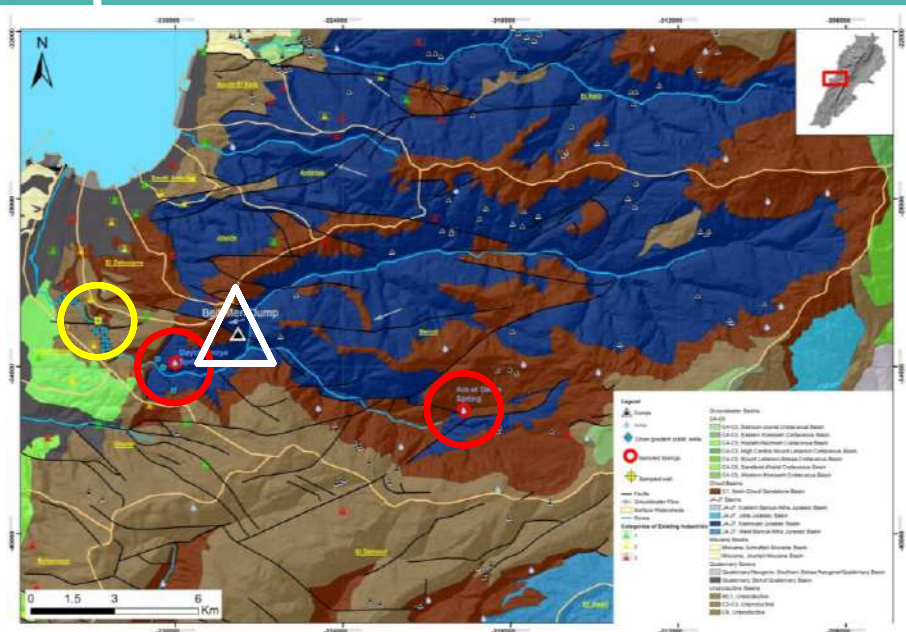


Pilot Test – Site Description

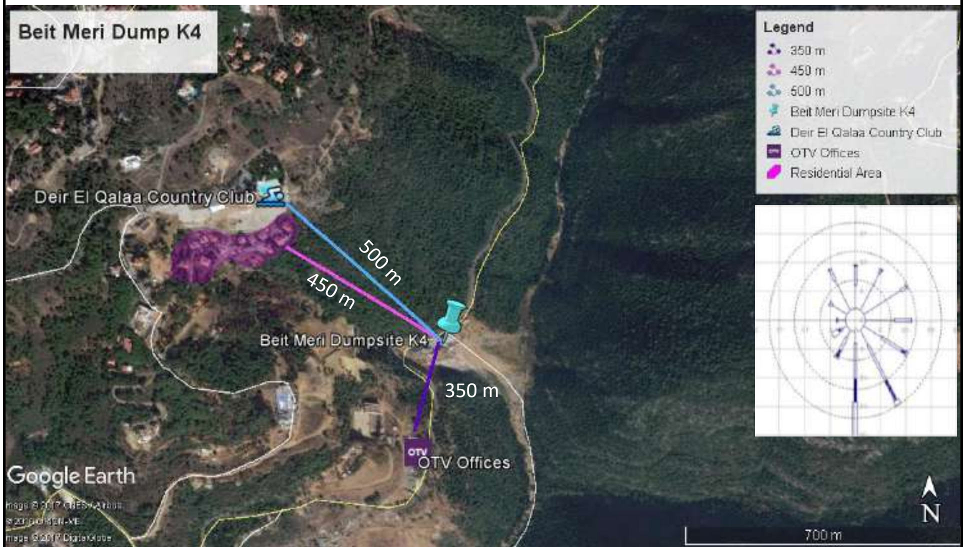
Beit Meri dumpsite (Site ID: K4)

- Dumpsite Characteristics
  - Operational since 1970
  - Area: 30,000 m^2
  - Height: 2.5 m
  - Volume: 75,000 m^3
- Location Features
  - Kesrouane Jurassic Basin
  - Valley, seasonal water channels
  - 10 m off the main road
- Practices
  - CDW dumpsite but during the solid waste crisis MSW was being disposed
  - No open burning

Pilot Test – Water Quality Baseline Conditions



Pilot Test – Air Quality Baseline Conditions



Pilot Test – Air Quality Baseline Conditions

- Air Emissions
  - Beit Meri dumpsite: operational since 1970
  - No studies for this region dating prior to this time
- Wind Direction
  - Predominant wind direction: from the South and South-West
- Sensitive Receptors
  - No sensitive receptors to the North or North-East
  - Receptors to the South: OTV studios
  - Receptors to the North-West: Residential area and Deir El Qalaa Country Club

Pilot Test – Water Quality Sampling

- 3 sampling locations
  - Ain El Delbe spring, up gradient from the dumpsite
  - Daychounieh spring, down gradient from the dumpsite
  - Daychounieh well, down gradient from the dumpsite
- Sampling on Jan 31st, 2017
- Industrial Research Institute (Lebanese University): Total and Fecal Coliform analysis
- Eurofins Analytico (Netherlands): Analysis of all other parameters

Pilot Test – Water Quality Sampling Results

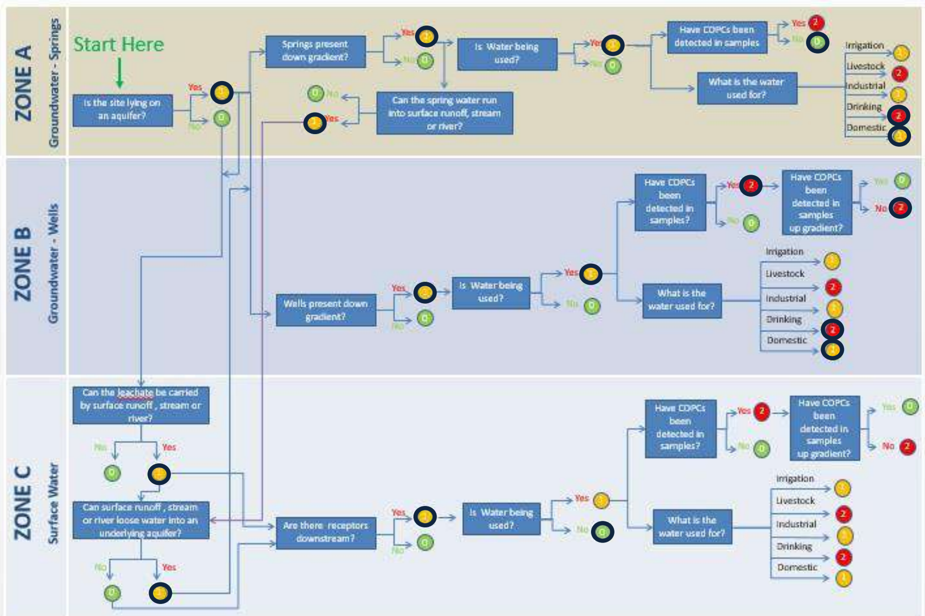
Parameter	Unit	WHO Guidelines	EPA Standards	Lebanese Standards	Ain El Delbe Spring (Up gradient)	Daychouniyeh Welll (Down gradient)	Daychouniyeh Spring (Down gradient)
Benzene	µg/L	10	5	0	<0.10	1.1	0.88
Fecal Coliforms	CFU/ 250mL	0	5.0%	0	190	21	200
Total Coliforms	CFU/ 100mL	0	5.0%	0	240	15	190
Cobalt	µg/L	-		-	<1.0	2.2	<1.0
Copper	µg/L	2,000	1,300	1,000	<3.0	6.1	<3.0
Nickel	µg/L	70		20	<2.0	4.8	<2.0
Vanadium	µg/L	-		-	<2.0	5.7	<2.0
Zinc	µg/L	NA		5,000	<5.0	29	<5.0

Pilot Test – Water Quality Results Interpretation

Indication of potential contamination:

- Dumpsite located along the same surface stream reaching the Daychounieh Spring within the rocks forming the same aquifer basin
- Distance between sampled points and dumpsite has likely enhanced dilution of contaminants down gradient during the wet season
- Leachate with heavy contamination loads may have been already washed and leached at the beginning of winter

Pilot Test – Water Quality Methodology Application

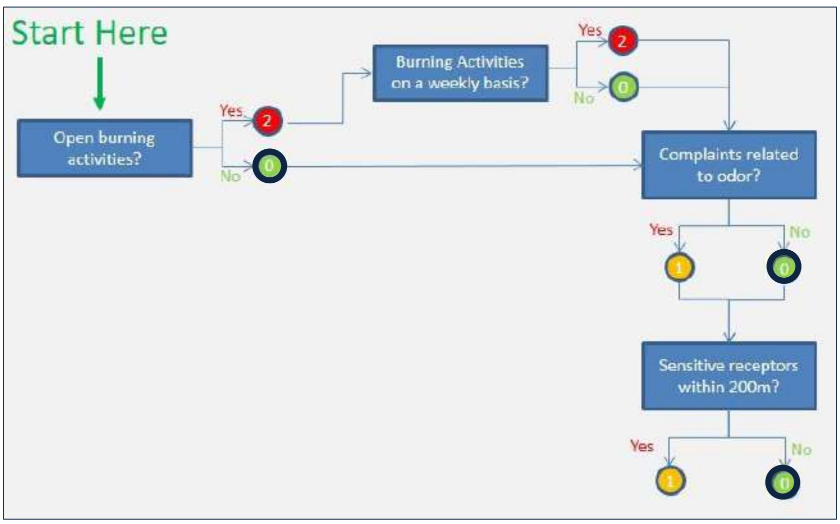


Pilot Test– Water Quality Methodology Application Results

Zone	Total Score	Impact Significance
A – Groundwater - Springs	8	High
B – Groundwater - Wells	9	High
C – Surface Water	3	Moderate

Dumpsite Rehabilitation

Pilot Test – Air Quality Methodology Application



Pilot Test – Air Quality Methodology Application Results

Air Quality

Total Score	Impact Significance
0	Low

Do nothing

EA Methodology Recommendations

Key Points to Consider

- Selection of adequate water sampling points
- Sampling to be carried out during the dry season
- Identification of back-up sampling points
- Coordination with the relevant water establishment
- The nature of these subsurface water conduits/pathways can be extremely complicated.
- Consultation with qualified experts (hydrogeologist) during implementation

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Environmental Assessment of Dumpsites
- Objectives
- Methodology
- Pilot Test
- EA Recommendations

Cost Assessment of Dumpsites
- Background and Objectives
- Methodological Process
- Assumptions
- Dataset
- CAOD Main Findings and Conclusions

Background and Objectives

Five Main Studies on the Cost of Environmental Degradation and Benefit Assessment tackling Municipal, and Construction and Demolition Waste

- World Bank (2004) with USD 10 million equiv. to 0.05% of GDP in 2000
- World Bank (2007) with USD 100 million equiv. to 0.5% in 2006
- World Bank (2011) with USD 19 million equiv. to 0.09% in 2005
- GiZ SWEEP-Net (2014) with USD 140 million in Beirut & Mount Lebanon equiv. to 0.4% in 2012
- EC BA (2011) with € 212 million equiv. to 0.4% in 2020

Objectives

To calculate the cost of environmental degradation associated with municipal solid waste (MSW) and construction and demolition waste (CDW) accumulated in active (or operational) and passive (or non-operational, not rehabilitated) dumps in Lebanon

Methodological Process

Three main categories

- The opportunity loss in terms of forgone recyclables, compost and brick priced at market value, and the averted land value in terms of better landfills
- The depreciation of the value of land only
- The environmental degradation *per se* in terms of untreated leachate generated from dumped waste that would contaminate soils as well as underground and surface water resources, forgone methane capture and forgone energy generation

Other *bads* that are not captured in the analysis:

- Burden of health in case of waste burning;
- Loss of amenities in dumpsite areas; and
- Contamination of underground water.

Methodological Process

The tourism figures did not seem to be affected by the dumpsites per se but rather by the Waste Crisis of July 2015.

Lebanon Entries by Nationality Aggregates, 2009-2016, in million

Nationality	2009	2010	2011	2012	2013	2014	2015	2016	±% 2016/2009
Lebanese	2.9	3.3	2.5	2.2	2.3	2.6	2.6	2.2	-3%
Syrian	3.4	4.0	3.9	4.1	4.5	3.6	2.0	1.8	-9%
Other Arabs	0.9	1.0	0.7	0.6	0.6	0.6	0.5	0.7	-7%
Other Nationalities	1.1	1.3	1.1	0.9	0.9	0.9	0.0	1.2	-29%
Total	**8.2**	**9.7**	**8.2**	**7.9**	**8.2**	**7.6**	**5.1**	**5.9**	**-7%**

Source: CAS website: <www.cas.gov.lb>.

Methodological Assumptions

Several assumptions were made to carry out the analysis, notably:

- Volume is equally annualized and actualized (3%) over the dumps' lifetime;
- Waste category follows Environment Memo 8/1 (2015), Srour et al. (2013) and Market value derived from MoE-EU StREG (2016) but residual waste to be landfilled is assigned –USD13/ton;
- Averted land area due to compacting is valued;
- Meta-analysis hedonic pricing use average land values by Governorate;
- Leachate underground water contamination was not considered; and
- Forgone Energy production and methane capture is calculated starting 1997.

CAOD – Dataset

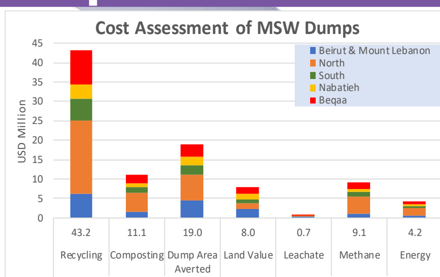
Item	Volume	Area	Active[1]	Passive[2]	Inaccessible	Total	Rehabilitated	
							Covered	Removed
	m^3	m^2	#	#	#	#	#	#
MSW	**5,327,048**	**1,114,320**	**341**	**118**	**13**	**472**	**43**	**102**
ML	796,686	167,010	80	19	2	101	7	24
North	2,427,772	278,761	38	28	3	69	3	15
South	620,116	113,539	63	16	1	80	9	24
Nabatieh	399,194	121,950	64	29	0	93	10	22
Beqaa	1,083,280	433,060	96	26	7	129	14	17
CDW	**1,442,539**	**559,218**	**178**	**92**	**1**	**271**	**21**	**32**
ML	836,420	314,080	35	53	1	89	18	17
North	210,666	67,238	29	13	0	42	1	4
South	49,840	23,300	21	13	0	34	2	5
Nabatieh	141,863		48	9	0	57	0	6
Beqaa	203,750		45	4	0	49	0	0
Grand Total	**6,769,587**	**1,673,538**	**519**	**210**	**14**	**743**	**64**	**134**

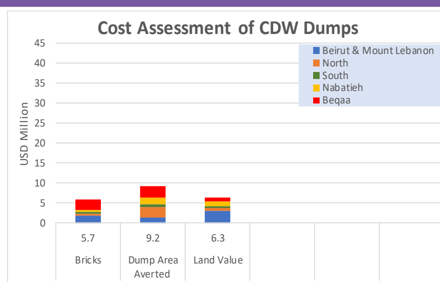
[1] Operational
[2] Non-operational and not rehabilitated

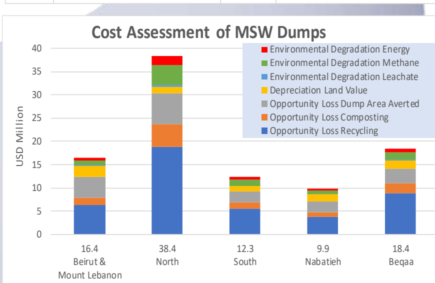
Aggregate Results: USD 117 Million

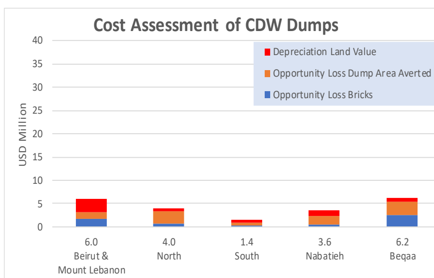
Category / Governorate	Opportunity Loss				Depreciation	Environmental Degradation			Total
	Forgone Recycling	Forgone Composting	Forgone Bricks	Dumpsite Area Averted	Land Value	Untreated Leachate	Forgone Methane Capture	Forgone Energy Generated	
	US$ Million								
MSW	**43.21**	**11.08**	**0.00**	**19.02**	**8.01**	**0.74**	**9.06**	**4.19**	**95.31**
BML	6.28	1.61	-	4.51	2.21	0.25	1.04	0.49	16.39
North	18.87	4.84	-	6.68	1.4	0.25	4.34	2	38.38
South	5.5	1.41	-	2.38	1.09	0.07	1.26	0.58	12.29
Nabatieh	3.79	0.97	-	2.27	1.6	0.05	0.81	0.37	9.86
Beqaa	8.77	2.25	-	3.18	1.71	0.12	1.61	0.75	18.39
CDW	**0.00**	**0.00**	**5.74**	**9.25**	**6.32**	**0.00**	**0.00**	**0.00**	**21.31**
BML	-	-	1.68	1.39	2.95	-	-	-	6.02
North	-	-	0.71	2.58	0.74	-	-	-	4.03
South	-	-	0.29	0.58	0.57	-	-	-	1.44
Nabatieh	-	-	0.54	1.83	1.22	-	-	-	3.59
Beqaa	-	-	2.52	2.87	0.84	-	-	-	6.23
Grand Total	**43.21**	**11.08**	**5.74**	**28.27**	**14.33**	**0.74**	**9.06**	**4.19**	**116.62**
Lower Bound	34.57	8.86	4.59	22.62	11.46	0.59	7.25	3.35	93.30
Upper Bound	51.85	13.30	6.89	33.92	17.20	0.89	10.87	5.03	139.94

Aggregate Results by Governorate & Category: US$ 117 M









Main Findings & Conclusions

The MSW and CDW CAOD amounts to about **USD 117 million** in 2016 (range: USD 93 million to 140 million to account for uncertainty).

If dumps are presently rehabilitated, the following benefits could accrue:

- Up to USD 49 million could partially be recovered in terms of recyclables and bricks reconstitution
- Up to USD 43 million in terms of land appreciation
- About USD25 million cannot be recouped as they are missed opportunities that could not be re-actualized.

Main Findings & Conclusions

CAOD by Governorate

1. North ~ USD 42
2. Beqaa ~ USD 22 million
3. Mount Lebanon ~ USD 22 million
4. South ~ USD 14 million
5. Nabatieh ~ USD 13 million

The CAOD results are attributed to the fact that these Governorates have the largest aggregated dumpsite areas and the largest aggregated dumpsite volumes.

CAOD by Dumpsite Type

There is no doubt that the urgency lies with the MSW dumpsites as they are inflicting a significantly higher opportunity loss, land depreciation and environmental degradation than CDW dumpsites.

Mainly recycling, land clearing and land appreciation will accrue with the rehabilitation of CDW dumps as most other calculated benefits were forgone or difficult to bear fruits with the passage of time.

Main Findings & Conclusions

The CAOD amounts to **USD 117 million** of which about USD 43 million in terms of land price appreciation around dumps and possibly some high-value recyclables could accrue today in case dumps are rehabilitated.

While the value of compostable material is definitely lost (USD 11 million) and the forgone value of recyclables remains uncertain, the environmental degradation of USD 14 million is associated with missed opportunities in the past for not properly managing MSW and CDW dumpsites from day one before they originated in the first place.

THANK YOU