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HEBRON INDUSTRIAL DISCHARGES STUDY

TASK 4: INTEGRATION REPORT

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List of Acronyms

AFD	Agence Francaise de Development
ARIJ	Applied Research Institute Jerusalem
B&V	Black & Veatch
"Cake"	Dehydrated Stonecutting Waste
CAD	Computer Aided Design (Autodesk AutoCAD)
CAPEX	Capital Expenditures
CEC	Consulting Engineering Center
DAF	Dissolved Air Flotation
Deloitte	Deloitte Consulting LLP
EPA	Environmental Protection Agency
EU	European Union
EUR	Euro
FoE-ME	Friends of the Earth-Middle East
GIS	Geographic Information System (ERSI ArcGIS)
GPOBA	Global Partnership Output Based Aid
HIDS	Hebron Industrial Discharge Study
HWE	House of Water and Environment
HCCI	Hebron Chamber of Commerce
HRWWTP	Hebron Regional Wastewater Treatment Plant
ICA	Israeli Civil Administration
INP II	Infrastructure Needs Program Phase II
IX	Ion Exchange
JOD	Jordanian Dinar
JSC	Joint Service Council for Solid Waste Management
KfW	German Development Bank
MAC	Maximum Allowable Concentration
MBR	Membrane Biological Reactor
MEnA	Ministry of Environmental Affairs
MoLG	Ministry of Local Government
MoNE	Ministry of National Economy
MH	manhole
MM	million
NIS	New Israeli Shekel (English)
OMW	olive mill wastewater
OPEX	Operating Expenditures
PAC	Powdered Activated Carbon
PCBS	Palestinian Central Bureau of Statistics
PG	Palestinian Government
PMO	Program Management Office
PPP	Public – Private Partnership
PPU	Palestine Polytechnic University
PWA	Palestinian Water Authority
RO	Reverse Osmosis
RZEE	Roberto Zimmerman Environmental Engineering
"Slurry"	Liquefied Stonecutting Waste
SWM	Solid Waste Management
USAID	United States Agency for International Development
USD	United States Dollar
USG	United States Government
USM	Union of Stone & Marble
WB	World Bank
W+B	Witteveen + Bos
WBG	West Bank/Gaza
WHO	World Health Organization
WRB3	Water Resources Program Phase III
WW	wastewater
WWTP	Wastewater Treatment Plant

1.0 Executive Summary

1.1 Background and Objectives

The Hebron Industrial Discharge Study (HIDS) aims to identify the sources and types of potentially harmful industrial wastewater discharges that could find their way from the 2,200 industries in Hebron area into the planned Hebron Regional Wastewater Treatment Plant (HRWWTP). The study proposes measures, both technical and institutional, that could be undertaken to mitigate these potentially harmful impacts to the plant.

The study was conducted from April to June, 2013. Activities included a review of existing industrial wastewater data and studies on industrial wastewater in Hebron from the year 1999 to the present; location and identification of 152 representative industries of concern in the Hebron area from a total population of 2,200 factories; door to door field surveys of these industries; extensive stakeholder consultation; and the formulation of conclusions and recommendations on industrial wastewater handling in Hebron. The study did not undertake a review of design of the proposed HRWWTP, or its design basis.

1.2 Data and Study Review

A review of the relevant parts of the original HRWWTP Feasibility Study by CH2MHill (1999-2005) and the Updated HRWWTP Feasibility Study by Witteveen+Bos and the Consulting Engineering Center (2012-2013) indicate that the current design of the HRWWTP aims to serve the domestic wastewater from the City of Hebron and the industrial discharges from within the city limits. The discharges from the Industrial Zone in Hebron, home to the majority of the Industries of Concern, would not be handled by the HRWWTP, on the assumption that these discharges would be diverted through a bypass sewer and treated elsewhere.

1.3 Field Data Collection and Review

Based on directory documents from the Hebron Chamber of Commerce and Industry (HCCI) and location/GIS information from the Hebron Municipality, 2,200 factories were checked and categorized in accordance with the Palestinian Central Bureau of Statistics (PCBS) International Standard Industrial Classification system. The 350 factories most relevant to the study were further validated for location and industrial category, and this list was further refined to a sample of 152 to be surveyed in the sectors of concern such as metals, pharmaceuticals/detergents, slaughterhouses, building materials, food, tanneries and so on. Stonecutting was excluded since this important sector had been thoroughly examined in the past year, and the results were available to the study. Most of the heavy industries are located within the Hebron Industrial Zone, straddling areas designated as H1 and H2.

In addition to the 152 field surveys, the HIDS team reviewed the operation of relevant facilities in other locations in the West Bank that could prove instructive in the design and operation of an Industrial Wastewater Management Program for Hebron. The Ramallah Municipal Slaughterhouse demonstrated good practice in service to the business community on a non-profit basis, health regulations enforcement and community outreach. The Bethlehem stone-cutting community have, through their 100% membership of the Union of Stone and Marble, put in place an effective solid waste transport disposal system that dramatically reduces the discharge of stone slurry into the sewerage system. The regulatory systems with respect to wastewater in Ramallah and Al-Bireh are good examples for Hebron in terms of operational efficiency. The Joint Service Council Waste Management program for Hebron and Bethlehem is a system that could be expanded for industrial wastewater management, including finding ways to ensure sustainability over the longer term.

1.4 Industries of Concern and Solutions

Major industries of concern and the solutions to their liquid waste are listed in the table below.

Table: Industries of Concern Summary

Industry	Concern Pollutant	Technical Solution	Sewer Disposal	Implementation Concern
Dairies	O&G / BOD	Grease Traps	Yes	Technical solutions available, but who will pay
Olive Mills	Phenols	**Haulage or Central Treatment**	**Yes***	No onsite technical solution; limited financial resources
Slaughter House	O&G / BOD	Grease Traps; Solids Separation	Yes	Technical solutions available, but who will pay
Stone & Other Building Mat	TSS	**Haulage to dewatering facility or wet disposal**	**No**	Technical solution available, but limited commitment
Tahina	BOD / Chloride	Sewer Acceptance	Yes	Design impact, but no viable options exist
Tanneries	Chrome / Chloride	**Plant Rehabilitation**	**Yes**	Technical solution in-place, but without chrome recovery

*Note: *Based on further confirmation of phenol concentrations and HRWWTP acceptable loadings*

Slaughterhouses, Dairies, Tahina, and Other Foods: Because the characteristics of the discharge from these activities resemble domestic wastewater but at a higher concentration, this waste can be incorporated into the HRWWTP design and operation planning. Suitable grease and solids separation elements should be installed in the factories, and the resulting solid waste disposed/ managed appropriately.

Tanneries: The existing but currently inoperable tanneries pre-treatment plant in Hebron could, once refurbished, reduce the chromium levels in the tanneries' waste to levels that would be acceptable to the HRWWTP. The economic driver of this from the perspective of the tanneries would be recovery and reuse of the chromium. This is only practically possible by using Sulphuric Acid in the process, a substance controlled by the Israeli Authorities and currently prohibited to Palestinian industries. Arrangements to allow this will greatly enhance the ability of the industries to manage their waste streams.

Stone Cutting and Building Materials: Following the Israeli Civil Administration (ICA) threat to close the Hebron Industrial Zone if no action was taken to prevent stone and marble slurry from reaching the Shoket WWTP, USAID supported an emergency response project to eliminate sewer disposal through transport of the waste to approved disposal sites. The consensus amongst all stakeholders is that a closed-loop pre-treatment system is the solution, where wastewater is recovered for re-use, and the solids are disposed of properly. The key to success is enforcement of zero discharge to the sewer, and practical solid waste transport and disposal arrangements in place.

Olive Mills: The waste from Olive Mills, although complex and potentially damaging to the biological processes in the HRWWTP, is seasonal in nature and not significant in volume. The current levels can be tolerated by the planned HRWWTP, but any increase in activity would need to be monitored closely, and separate treatment arrangements made.

1.5 Wastewater Volume Considerations

The HIDS team estimates a wastewater flow rate for the City of Hebron of 12,243 m^3 per day in 2013. If pre-treated flows from the Industrial Zone were added to this (excluding stone and marble), this would add about 10% in a hydraulic load, but the pollutant load could accelerate the plant reaching its current capacity earlier than designed.

1.6 Legal and Regulatory Considerations

The Municipality of Hebron is at the heart of the regulatory environment, with the Governorate, Ministry of Local Government, Ministry of Environmental Affairs and PWA, amongst others. Many standards and processes are still in the process of being developed and/or enacted with respect to wastewater collection and treatment. Areas for development include updating fees and penalties, operational enforcement, service provision and monitoring procedures. The situation is made more complex by access restrictions within the city to Area H2.

1.7 Proposed Solutions and Next Steps

Tannery, Stone and Marble, and Olive Mill wastes are of most concern with respect to HRWWTP sustainability.

Tanneries: the existing per-treatment plant should be assessed, rehabilitated and made operational. If chrome recovery is possible (through the use of Sulphuric Acid or other means) the self-funded sustainability of the operation can be assured by this. If not, longer term arrangements will need to be driven by enforcement actions.

Stone and Marble: The currently USAID supported haulage and disposal system for stone and marble waste will need to be transitioned to a local entity, together with public awareness efforts on the benefits currently accruing from this program.

Olive Mill Wastes: these require close monitoring to see if levels of toxic substances are rising to levels that cannot be handles by the HRWWTP.

All of the solutions require institutional sustainability. The industrial wastewater management structure requires an enforceable regulatory environment, buy-in by public and private institutions, both public and private investment resources, and a dedicated and independently funded Project Management Office (PMO) that carries out a strategic plan.

The steps required to carry out these solutions include:

Improving Operator Readiness: Form, fund, and train a dedicated unit within the municipality.

Strengthening Enforcement Practices: Adoption and implementation of effective procedures.

Improving data levels: increase sampling frequency and improve the waste management plan.

Engaging external partners for key actions: With a view to improving access into H2 for Palestinian police to escort Municipal civil servants for routine inspection and enforcement of regulatory violations, and allowing access to the required chemicals for chromium recovery.

Introducing PPP contracts: On a pilot basis one or two areas such as the solid waste transport and disposal system for stone and marble waste could be set up on a PPP basis.

Increasing Public Awareness: Design and implementation of a sustained public awareness program in cooperation with relevant local authorities and stakeholders.

2.0 Project Background

Over 2,200 factories operate within the Hebron Governorate representing 15 different industries. Of this amount, 1,400 exist within Hebron City alone and roughly 40% produce some form of wastewater which is disposed into the municipal sewer network. As a result, one key issue regarding the future success of the planned Hebron Regional Wastewater Treatment Plant (HRWWTP) is in limiting these industrial discharges from reaching the domestic sewer network. For this reason, an updated understanding of the industrial area and various types of effluent produced, along with the industrial waste regulations and mitigation measures, is necessary in establishing the framework for monitoring and controlling these discharges to help ensure the future success of the HRWWTP.

Working with international donors and local stakeholders involved with the project, USAID offered support towards updating these industrial waste streams with the primary goal of categorizing the key "Industries of Concern" which would severely impact the HRWWTP operations. Over the past decade, international donors have been regularly involved with various projects to address the industrial discharge issues from Hebron industries, including:

- 2002 – Primary treatment station for treating tannery discharges (USAID)
- 2003 – Individual filter press units for recycling stone industry discharges (USAID)
- 2005 – Trunk sewer line to handle factory waste (USAID)
- 2008 – Central processing facility for recycling stone industry discharges (EU)
- 2012 – Emergency disposal of stone industry waste (USAID)
- 2012 – Industrial sector competitiveness and strengthening (USAID)
- *On Hold* – Central processing plant expansion and sewer bypass

Regarding the proposed project, PWA suggested a plan aimed at preventing the disposal of stone cutting slurry waste into the sewage network which included two main components:

(i) Construction of new trunk line beginning upstream of the area, circumventing the factories and terminating south of the Industrial Zone entrance
(ii) Municipality expansion to increase plant capacity for higher waste volumes

Aside from the recent experience and field knowledge gained from working on the *Emergency Disposal of Industrial Stone Cutting Waste Project*, there are many other industries within Hebron which produce some form of wastewater including: tanneries, dairies, slaughterhouses, textiles, metallurgical and metal finishing, and commercial vehicle maintenance shops. The presence of such industries and resulting toxic or heavy metals requires a preliminary examination with proposed solutions to minimize negative impact on the proposed HRWWTP.

The objective of this study was to examine the anticipated effects of not collecting, treating, or properly disposing of industrial wastewater and suggest solutions for mitigating its impacts on the area's long-term waste management strategy through the following tasks:

(1) Identify and categorize existing sources of wastewater
(2) Determine the associated risks with the wastewater
(3) Develop options to address industrial discharges and minimize impact on HRWWTP

(4) Examine the legal and institutional framework which would assist the Hebron Municipality in future efforts towards ensuring industry compliance with local and national regulations

The study served to assist the HRWWTP implementing parties and provide the baseline for a successful municipal sewage network without disruption due to industrial discharges. These tasks were completed through a review of the available documentation and data compiled from earlier studies, gathering updated field data through surveys, and performing a GAP analysis and collecting missing information.

3.0 Data Collection and Analysis

3.1 Review of Previous Studies

Considerable efforts have been focused on the Palestinian wastewater sector, and in particular, the inception – design – construction of the HRWWTP. These previous studies are pertinent to the Hebron Industrial Discharge Study's task of analyzing industrial wastewater impacts.

3.1.1 Original HRWWTP Feasibility Study

Under the USAID West Bank Water Resources Program Phase III (WRB3), CH2MHILL conducted numerous studies, as listed below, between 1999 and 2005. The reports identified the critical need in Hebron for a wastewater facility in order to reduce water supply contamination, environmental impacts from raw waste, and health risks from public exposure. The most relevant references to this study assessment were found in Tasks 6, 10, and 17 which contain explicit details outlining industrial wastewater characteristics. Task reports provided by USAID for review in this study include:

- Task 6 – Hebron Wastewater Monitoring Program, 2000
- Task 8 – Stormwater, Domestic Wastewater, and Industrial Wastewater Master Plan, 2001
- Task 9 – Hebron Governorate Wastewater Treatment Feasibility Study and Addendums, 2002
- Task 10 –Hebron Industrial Wastewater Control and Pretreatment Feasibility Study, 2002
- Task 12A – Hebron Regional Wastewater Treatment Facilities Feasibility Study, 2005
- Task 12B – Addendum to the Detailed Feasibility Study of the Hebron Regional Wastewater Treatment Plant Reclaimed Wastewater and Residuals Management, 2005
- Task 12B – Hebron Regional Wastewater Treatment Facilities Environmental Assessment Supplemental, 2005
- Task 17 – Environmental Assessment for Stormwater, Domestic Wastewater, and Industrial Wastewater Master Plan for Hebron and Feasibility Analysis, 2003
- Task 22 – Detailed Feasibility Study of Reclaimed Wastewater and Residuals Management for the Hebron Regional Wastewater Treatment Plant, 2003
- Task 22 – Demonstration Projects (Reclaimed Wastewater Reuse and Biosolids Composting & Reuse) in support of Detailed Feasibility Study of Reclaimed Wastewater and Residuals Management for the Hebron Regional Wastewater Treatment Plant), 2003
- Task 25 – "Stone Cutting Industry – Demonstration Projects for Treatment" Project Completion Report, 2003

3.1.2 Updated HRWWTP Feasibility Study

Co-funded by Agence Francaise de Development (AFD), European Union (EU), and World Bank (WB), Witteveen + Bos Consulting Engineers (W+B) and Consulting Engineering Center (CEC) are working on "*Module 1 – Update of the Feasibility Study for the Hebron Governorate Regional Wastewater Management Project*". There are two main objectives of this project – to allow for the construction of the HRWWTP as deemed feasible through the updated review and to determine the preferred agriculture reuse option. Within the context of this study's objectives, relevant information came from Deliverables 1, 1A, and 1B which contain specific details on estimated hydraulic flows, pollutant loads, and measured data for Hebron City.

Deliverable reports provided by CEC for review include:

- Deliverable 1 – Review of Feasibility Studies and Key Design Parameters and Outline of the HRWWTP and Effluent and Biosolids Reuse Facilities, 2012
- Deliverable 1A – Measurement of Wastewater Flows and Loads, 2012
- Deliverable 1B – Baseline and Projections of Future Wastewater Flows and Loads, 2012
- Deliverable 2A – Basis of Design Report, 2012
- Deliverable 2D – Project and Work Packages, 2012
- Deliverable 2E – Project Economic and Financial Evaluation, 2012
- Peer Review of Wastewater Treatment Process, Conceptual Design, and Cost Estimates for the proposed Hebron WWTP, 2013

Found within Deliverable 1 under *Operational Concept*, "The plant would serve around 85% of the population of Hebron (180,000 people), but would not serve the industrial area of Hebron and the surrounding neighborhoods, which generates up to 10% of the wastewater flow. This is to avoid the wastewater from the marble-cutting industry, which contains very fine inorganic saw-dust, would disturb the treatment process."

Furthermore, Deliverable 1A states "The baseline loads are obtained by multiplying the projected connected population with the per capita wastewater loading rates and applying an additional 10% to preliminarily account for industrial discharges within the city limits."

This point is further highlighted in Deliverable 1A's Appendix I, *Per Capita Wastewater Load Considerations*, "The planned regional wastewater treatment plant of Hebron will receive wastewater primarily from domestic areas, as all industrial facilities in the industrial zone of Hebron will be disconnected from the municipal sewage network and diverted elsewhere. Therefore, the characteristics of the Hebron wastewater are expected to be similar to the typical characteristics of domestic wastewater in other West Bank projects." Although these sources pointed at removing the troublesome elements from the flowstream to the HRWWTP, they were silent on recommending what should be done with those wastewater streams.

These statements were later clarified, and confirmed, during a meeting with CEC/W+B on May 27th. The designers operated under the assumption that industrial contributions originating within the city limits were to be included in the design calculations, but that the Industrial Zone would be excluded from the HRWWTP. This assumption was based on the PWA's planned project to reconstruct sewer lines passing through the Industrial Zone. The primary objective of

PWA's project is to replace and upsize old piping to prepare for the expected hydraulic increase from the community. A secondary objective was to reroute the old alignment southwest of the existing location in order to prevent the stone & marble factories from illegally disposing their wastewater into the sewer network.

However, it should be noted that the plans included reconnecting all factories and residents to the new piping, so it remains unclear how this would eliminate disposal of industrial wastewater from the factories if they remain connected. This is a major discrepancy that was discussed at the first stakeholder meeting on May 29th, to clarify the intent of the PWA's sewer construction plans and address the design assumption of elimination of the entire Industrial Zone from the municipal sewer network through disconnection and "bypassing" the industries.

3.1.3 Other Relevant References

In addition to the HRWWTP documents noted above, multiple other documents were referenced during this study. These documents generally fell into one of three categories – technical references for specialized industrial concerns, wastewater references for this specific region, or institutional references for general wastewater management.

Other relevant references include:

- Environmental Profiles for the West Bank: Hebron District (ARIJ, 1995)
- Analysis of Waste Management Policies in Palestine (USAID, 2005)
- Prospects for Efficient Wastewater Management & Water Reuse in Palestine (EU, 2005)
- Current Status of Industrial Sector in Palestine (USAID, 2009)
- Regional Overview of Wastewater Management and Reuse in Eastern Mediterranean Region (WHO, 2005)
- Analysis of Industrial Survey for Ramallah, Beitunia, & Birzeit Areas (HWE, 2009)
- Wastewater Treatment Manuals: Primary, Secondary, & Tertiary Treatment (EPA, 1997)
- Industrial Waste Treatment Handbook (Woodard & Curran, 2001)
- Industrial Wastewater Treatment (National University of Singapore, 2006)
- State of Wastewater Management in Arab Countries: Hashemite Kingdom of Jordan Country Report (Arab Water Council, 2011)
- Evaluation of Pilot-Scale Plate-and-Frame Filter Press for Dewatering Fine Coal Refuse and Silica Sand (Pennsylvania State University, 2009)
- Understanding and Analyzing the Current Israeli Wastewater Practices for Trans-boundary Wastewater management from Palestine (HWE, 2012)
- West Bank and Gaza Wastewater Treatment and Reuse Policy Note (WB, 2004)
- Palestinian Stone & Marble Cluster Competitiveness Assessment Report (USAID, 2006)

3.2 Field Data Collection

3.2.1 Industry Data and Selection Process

As outlined under *Project Background*, the availability of existing data was critical to the assessment given the compressed schedule. It would have been impossible to determine the industries of concern if existing databases were not readily available. Initial meetings were held with the Hebron Municipality, Hebron Chamber of Commerce (HCCI), and Palestinian Central Bureau of Statistics (PCBS) to obtain their references for compilation and use in meeting the study objectives. The most significant documents provided by each agency were:

- HCCI – Industrial Craftsmanship Directory, Hebron Governorate (XLS)
- PCBS – International Standard Industrial Classification, Version 4 – ISIC v4 (PDF)
- Municipality – Multiple files containing relevant area information – e.g. sewer network, industry locations, political designations, elevations & contours (CAD/GIS)

First, location and industry category filters were applied to sort the HCCI Industrial Craftsmanship Directory and begin grouping factories by relevant classifications. For example, factories inside the Governorate, but outside Hebron City/Industrial Zone, were excluded from the listing. Next, the ISICv4 was used to categorize each industry by their corresponding class and sub-class codes. Industry were already identified (by type) within the Directory but these categorizations were unorganized and referenced many different names, spellings, descriptions so the ISICv4 was used to standardize the classification.

Since over 560 industries representing 15 categories were initially identified using the above screens, an "Industries of Concern" selection process was developed (Appendix A) to further refine the listing of proposed industries for field surveying. The flow diagram illustrates the procedure for identifying, verifying, and removing factories from the proposed listing. Through the iterations seen in the Appendix, each step eliminated several industries from the listing until the final question of "Would remaining industries impact the HRWTP?"; resulting in 350 factories (10 categories) to further investigation through the field surveys. The primary purpose of quantifying concern industries was exactly this, to pinpoint those which could severely impact the HRWWTP operations.

After narrowing the listing from 2,200 to 350 factories, the Municipality GIS files were used to geo-locate the industries and plan the field surveys. However, issues were identified within both the HCCI and Municipality sources. Mainly, the HCCI listing did not match the provided Municipality maps, meaning that the exact locations were not known. Before the survey teams were dispersed into the field, phone calls were made to each Industry of Concern factory using the contact information provided in the HCCI listing to determine the specific location. This information, along with the survey team's local knowledge, allowed the Discharge Team to update the Municipality GIS maps with the missing factories or corrected locations; these positions were then reconfirmed in the field. An overall map of industries within Hebron City is provided in Appendix B. As seen in the map, the densest concentration of industries which were specifically identified as potential HRWWTP concerns are located within, or just north, of the Hebron Industrial Zone. This determination reaffirms stakeholders' understanding of the area and the relative significance of the Industrial Zone with regards to the proposed HRWWTP.

3.2.2 Hebron Factory Field Surveys

As a major component of the data collection effort, a door-to-door survey of 152 factories from Hebron City and the Industrial Zone was completed. To secure reliable responses, the Discharge Team conducted a pre-survey training to enact various scenarios which could arise. Primarily, the focus was on soliciting accurate information in a conversational manner, as is the cultural custom, as opposed to a more interrogating question/answer sequence. Surveyors inquired about production inputs, processes, and output, as well as existing and proposed technical and institutional wastewater solutions from factory owners and operators via a 16-question survey (See 0 for Survey Procedure and Appendix D for Survey Questionnaire).

Data collected were separated by type of industry, with the following industries covered by the Discharge Team: Metals, Pharmaceuticals/Detergents, Slaughterhouses, Precious Metals, Ceramics, Paper/Carton, Plastics, Industrial Materials, Olive Mill, Car Washing, Dairy, Other Food (i.e. Tahina, Beverages, and Snacks), Fabrics/Upholstery, Glass and Mirror, Wood, Dry Cleaning, Tanneries, Hospitals, and Building Materials. Stone and Marble factories were not included within the survey even though they represent a major industry of concern. The reason for this was the previous data which was collected during the earlier emergency project. Table 1 below shows the breakdown by industry category of the 152 factories surveyed. Roughly 55% of the factories utilize the Municipality services as their sole water source, but 84% have only a sewer connection for disposal (i.e. no septic tanks) and 75% admitted to disposing wastes through the sewer system. Unfortunately only 14% implement either pretreatment or reuse practices within their factory. 0Appendix E includes a complete listing of the survey results.

Table 1: Summary of Surveyed Industries

Industry	Factories Surveyed
Metals	10
Pharmaceuticals / Detergents	4
Slaughterhouse	39
Precious Metals	5
Ceramics	12
Paper / Carton	3
Plastic	3
Industrial Materials	3
Olive Mill	2
Car Washing	3
Dairy	6
Other Food	11
Fabrics / Upholstery	8
Glass / Mirror	6
Wood	5
Dry Cleaning	4
Tanneries*	1
Hospitals	3
Building Materials	24
TOTAL	**152**

Note: Tanneries are in a condensed cluster and businesses are owned by one family. As such, the owners indicated that one factory survey was sufficient, and the data could be applied to each of their respective facilities.

Stonecutting factories were not surveyed, as substantial data had been gathered over the past year during the *Emergency Disposal of Industrial Stone Cutting Waste Project*. The collective information between the current and previous industrial projects provided a representative sample of the wastewater characteristics from local industries and allowed the Discharge Team to develop a comprehensive record of their industrial discharges and impacts on the sewage network and planned HRWWTP.

This survey brought multiple benefits for the Discharge Team and HRWWTP project. First, the survey data allowed the Discharge Team to estimate the discharge flows and loads both inside the Industrial Zone and Hebron City. This in turn allowed for an estimation of potential impacts to the HRWWTP relative to the design parameters. Second, survey data validated which industries were truly Industries of Concern from the original selection process and produce problematic industrial discharges.

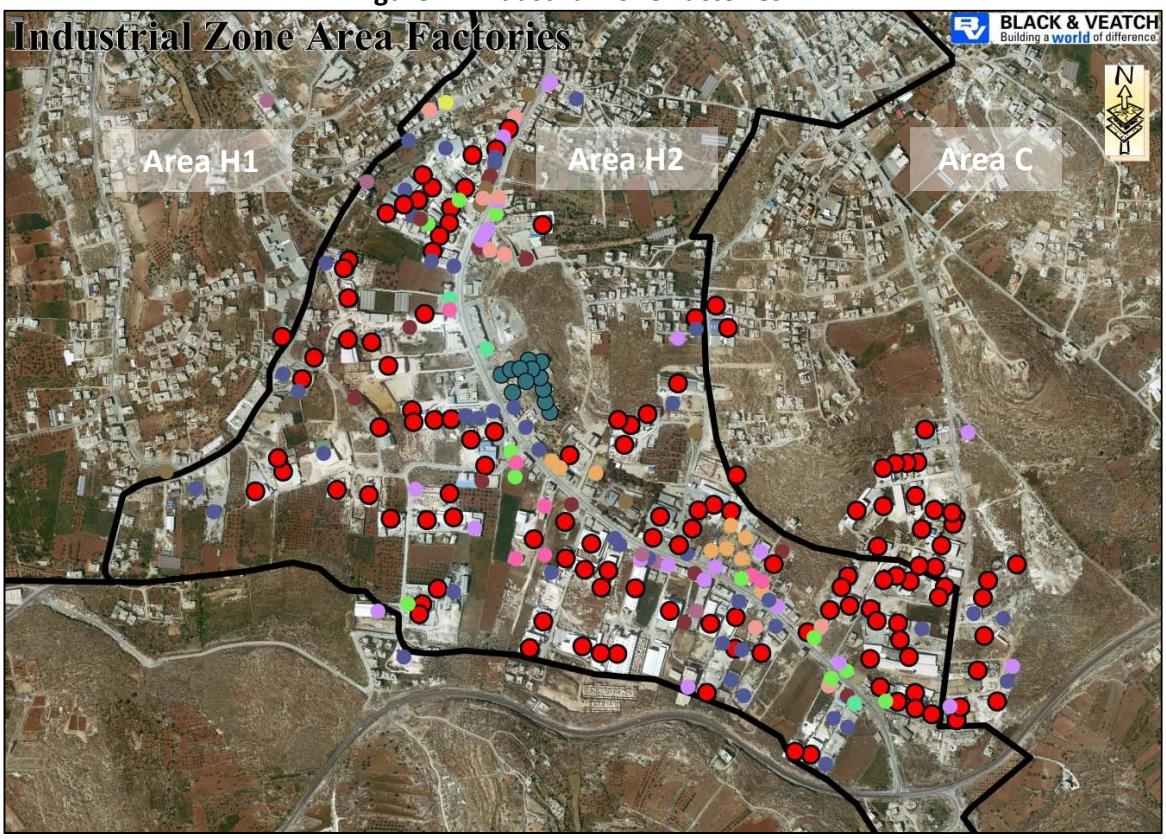
Third, the physical presence of the Discharge Team within the business community, directly interacting with factory owners, had the fringe benefit of providing public awareness for governmental and donor commitment to the HRWWTP project, emphasizing the significance and impact of unregulated industrial discharge into the municipal sewer system. Finally, several questions asked in the surveys revealed local context to industrial wastewater management, highlighting topics such as: general project awareness, perception of governmental effectiveness, and industry responsibilities in waste management – all critical factors concerning solution implementation and long-term sustainability.

3.2.3 Industrial Zone Directory

Southeast of Hebron City, the loosely-designated Hebron Industrial Zone represents the largest and densest concentration of "heavy" industries like stone & marble, metal finishing, building materials, equipment manufacturing, and tanneries. The zone straddles Hebron's special designation areas H1 and H2 along with a small portion in Area C (i.e. Sarsouriya Street). A total of 278 factories are located within the area plus an estimated 5,000 residents.

According to CEC/W+B as noted earlier, an assumption of the HRWWTP design was that the Industrial Zone would be disconnected from the sewer network to eliminate any contribution of high TSS wastewater, mainly from the stone and marble industries, which would severely impact HRWWTP operations. However, stone and marble factories only account for 130 out of the 278 total factories. As a result, the Discharge Team decided a complete geo-location of all 278 factories within the Industrial Zone was important for estimating the potentials flows and loads from this area. Figure 1 below illustrates the main result from this exercise, indicating stone & marble factories are the predominant presence (shown as red dots); Appendix F contains the detailed map with respective color legend for the indicated industries.

Figure 1: Industrial Zone Factories



3.2.4 Industrial Zone Sampling Event

In preparing the HRWWTP design, two major wastewater sampling and monitoring campaigns were conducted – first in 1999/2000 under CH2MHILL and the other in 2012 under CEC/W+B. Both programs utilized the technical services of the Roberto Zimmerman Environmental Engineering ("RZEE") company. During the early stages of this study, the Discharge Team decided that updated sampling results would be beneficial if time and circumstances allowed, since it was not included in the project's SOW. The updated results would be used to more accurately quantify the Industrial Zone wastewater characteristics since previous measurements from this area focused more on the northern sections of the area and not the individual branches and their respective waste streams.

The purpose of the proposed sampling event was to achieve the following objectives:

- Characterization of wastewater flows in existing sewers through physical sampling and measurement to collect such information as flow rate, physical characteristics, and chemical characteristics over a 24+ hour period in order to capture both typical and non-typical events of industrial discharge as seen in the figure below.

- Characterization of wastewater discharges from individual establishments through grab samples to collect such information as flow rate, physical characteristics, and chemical characteristics from several factories representing different industries.

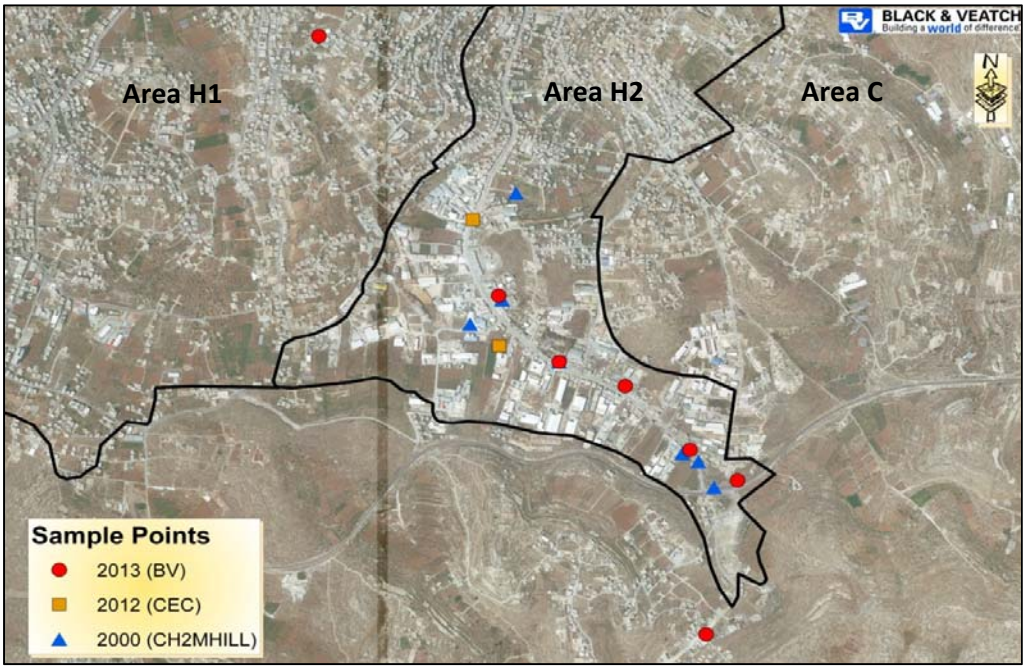
- Characterization of wastewater discharges specifically from one tannery establishment through grab samples to collect such information as flow rate, physical characteristics, and chemical characteristics

Figure 2: Sampling Schedule

Sampling Intervals - proposed	Wednesday																		Thursday																		
Options	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Sample + Flow Observation																																					
East		1						2								3												4								4
New East			1						2								3													4						4
Outfall				1						2								3													4					4
Sampling: No Flow Observation																																					
Tannery				1					2																				3				4			4
Slaughter	1																							2													2
Tahena			1																									2									2
Dairy		1																									2										2
																																					22
Analysis - Code																																					
Suite - deduct ICP	1	1	2					1	1							1	1							1			1	1		1							12
Suite - with ICP (metals)		1		2					1	1								1										1	1		1		1				10
																																					22

The Discharge Team selected points within the Industrial Zone to complement the previous sampling measurements as seen in Figure 2 below. Three points on the sewer network, identified as "East", "New East", and "Outfall", were selected for flow measurements and sampling at regular intervals. Four specific industries from the Industries of Concern listing – Tannery, Slaughterhouse, Tahina, and Dairy – were selected for grab samples at peak discharge times for analyzing their respective physical and chemical characteristics.

Figure 3: Industrial Zone Sampling Points



The planned campaign totaled 22 samples for laboratory testing, which would be analyzed by the Palestine Polytechnic University (PPU) in Hebron against the 22 physical and chemical parameters listed in Table 2 below. Anticipating results that would allow for the Discharge Team to more accurately calculate flows and loads from the Industrial Zone using current data and additionally would serve as verification of earlier estimates provided by factory owners during the completed field surveys.

Table 2: Sampling Test Parameters

BOD, Total	Alkalinity	NO_3
BOD, Soluble	EC	P, Total
COD	ICP (8 metals)	P, Ortho
TDS	Cr forms	Fat, Oil and Grease
TSS	Sulfate	Imhoff SS: 15, 30, 45, 60'
pH	Chloride	Surfactants (MBAS)
TVSS	TKN	
$CaCO_3$	NH_3	

However, analytical results received from PPU were anomalous and unsuitable for incorporation into the study's results. Given the time constraints, the Discharge Team decided to complete the remainder of the assessment based on available data from the CHM2HILL and CEC sampling campaigns. The compressed delivery schedule did not allow ample time to perform another round of sampling and analysis. As discussed in greater detail within the Recommendations Section, it is suggested a more robust measurement campaign be undertaken to acquire the necessary information from the Industrial Zone along with cataloging the physical and chemical characteristics for all identified Industries of Concern in a database tool for ongoing use by the HRWWTP designers and eventual operators.

3.2.5 Comparative Case Studies

The Discharge Team conducted meetings with similar industries and institutions in neighboring cities to serve as a basis of comparison and possibly models of success. Over 35 meetings were held throughout this study (Appendix G), many of which focused on learning about the institutional aspects of the existing industry management mechanisms inside different governmental agencies. Key findings from four specific meetings are summarized below, each highlighting aspects of successful waste management which could be applied to the HRWWTP.

3.2.5.1 Ramallah Municipal Slaughterhouse

The Discharge Team met with operators of the Ramallah Municipal Slaughterhouse for comparison with the Hebron Municipal Slaughterhouse; results indicated a significantly more sophisticated wastewater management system in the Ramallah, which could act as a model for the future renovations and planned replacement of the Hebron Slaughterhouse.

Rehabilitated in 2010, the Ramallah Slaughterhouse serves Ramallah, Beitonia, and Al-Bireh processing cows and sheep as chickens are slaughtered separately at private facilities in Birzeit. The amount of water consumed daily is similar to Hebron, at 15 m^3. Table 3 indicates the

design capacity, actual quantities, and comparison to Hebron quantities. As seen, Ramallah slaughters much less than Hebron; explained as the cultural difference between the two areas. Therefore, it would make sense for Hebron to have a facility which operates at similar, or better, standards to that visited in Ramallah.

Table 3: Monthly Slaughterhouse Quantities

Livestock	Ramallah Capacity	Ramallah Actual	Hebron Actual
Sheep	4,000	40-50	600
Cow	1,000	20	250
Camel	*Unknown*	0	4-5

**Note: All quantities are monthly*

Facility Cleanliness and Sanitation: The Ramallah facility has significantly better sanitation practices than Hebron, where three waste types are separated into different tanks for discharge:

- Blood which is collected in special wells after solids separation. This treatment requires passing through eight sieves with remaining blood collected in containers and then transported to a dumpsite by tanks. Approximately 10 m^3 daily with 1m^3 as water through this process.
- Water mixed with detergent dumped directly into the sewer system.
- Solid waste, at 10 m^3/day, is collected in a special container, and then dumped at a dumpsite (same as blood, but in different containers).

At the Hebron Slaughterhouse, waste is only divided between solid and liquid (blood and water) with the mixture of water, blood, and detergent going directly into the sewer network. Consequently, the plant operations can be addressed technically with filters to separate the large discharge quantities of blood and offal from the Hebron Slaughterhouse prior to disposal in the municipal sewer network.

Service to the Business Community: The purpose of municipal slaughterhouses is to ensure all meat is slaughtered to the same standard of hygiene through a centralized location, then sending the meat to retail shops across the city. Resulting from the low quality conditions as seen at the Hebron Slaughterhouse and the perceived lower quality of meat, many retail shops slaughter their own meat illegally onsite. Conversely, in Ramallah, there are no other slaughterhouses for meats, with 70 retail workshops who sell meat. The Ramallah Slaughterhouse is nonprofit; retail locations pay 40 NIS for sheep and 120 NIS for cow; meat is delivered to the retail workshops by designated trucks.

Health Regulations Enforcement: The Ramallah slaughterhouse encourages facility usage through public awareness campaigns, quality services, easily accessible location, and very hygienic conditions. Regulations are implemented as designed (Local Councils Law, Slaughterhouse Legal System), followed up with enforcement of non-compliance incidents and continual monitoring of the retail shops by the Municipality. For first time offenders, all slaughtered meat is confiscated. For second offenses, all meat whether slaughtered or not is confiscated. And for third violations, the real shop is closed permanently. It is also worth mentioning that the confiscated meat is donated to orphanages and charities within the area.

Ministry of Health (MoH) is responsible for inspections inside the municipal slaughterhouse. Regulation and enforcement of the slaughterhouse system in Ramallah is done in coordination with the Municipality, Ministry of Health (MoH), Ministry of Agriculture (MoA), Veterinary Department, General Safety Committee, and Customs Department.

The Hebron Municipality does have plans to rehabilitate, and eventually replace, the current slaughterhouse to a standard similar to Ramallah, but no firm plans for funding or construction exist as of yet. The quality of Ramallah's facility and operations, sophisticated wastewater management to protect the municipal sewer lines from excessive (i.e. problematic) slaughterhouse discharge, and effective awareness, regulation and enforcement practices sets Ramallah as a model for improvements to the Hebron system.

3.2.5.2 Bethlehem Stonecutting

The Discharge Team met with the Union of Stone & Marble (USM) Bethlehem branch and factory owners as a source of comparison to the stonecutting industry in Hebron, which has a significantly more functional waste management and regulatory system that could serve as a model for improvements to the Hebron industries.

A haulage system exists in Bethlehem similar to the proposed plans for Hebron (i.e. Emergency Project Transition Plan), with the notable difference that factory owners take ownership of the haulage in Bethlehem, while in Hebron the current system is imposed and regulated through international donor support with plans for eventual municipal regulation after June 30th.

Treatment and Haulage: In Bethlehem, almost all factories are connected directly to settling pools that, when dry, is sent to old quarries in Beit Fajar. A few of the stonecutting factories use filter presses (private purchase and donor-funded), where cake is then sent to quarries by owner trucks. Factories without filter presses transport slurry in tankers, either factory-owned or through the contractor, to the Wadi Al-Nar dumpsite.

Although factories are directly connected to the municipal system, nobody uses the sewer as a disposal method. Most factories choose to transport their cake and slurry, paying for haulage and disposal at 350 NIS/trip. For those that use their own vehicles, the payment for disposal is about 70-100 NIS/trip. This indicates a strong cultural mindset and sense of professional responsibility among factory owners, unlike the individual self-focus that exists within Hebron.

Regulation and Enforcement: There are explicit rules and payment fees regulated by the water and sewage authority, which functions independently from the municipality to prevent illegal disposal, but – according to sources – rarely encounters violations due to the waste management practices in place which have become culturally embedded. Thus, no government entity is currently needed for constant enforcement; though under the current framework this role would technically fall under the purview of the Municipality and water and sewage authority). There is a general safety committee for vocational safety of workers and another labor union for stonecutting factories that contains members from USM Workers Syndicate, and Ministry of Labor, but this entity does not perform any inspection for illegal disposal.

Interestingly, the percentage of USM-registered factories in Bethlehem is 100%, significantly more than the 30% in Hebron. Additionally, USM has not implemented any disposal-type

regulations as owners show commitment to proper waste management without force. The one incident that occurred in the past year was when a small amount of slurry was dumped into sewer system during a heavy rain, and the Municipality came directly to resolve the issue. In addition, factory owners in Bethlehem consider USM as the official and only legal representative body, so the USM facilitates all official transactions with all relevant government bodies.

With a rooted culture in compliance among stonecutting factory owners, a reliable waste transport with high collection rates, 100% USM membership, and reactive government entities presents Bethlehem as a model of relative success compared to the industry in Hebron. Through further investigation in understanding the mechanisms that have propelled Bethlehem's industry to this level of success, options for improvement of Hebron's system may materialize.

3.2.5.1 Ramallah and Al-Bireh Municipality

The Discharge Team met with officials from Ramallah and Al-Bireh to provide a source of comparison to the interactive relationship between municipalities and industries. Though the industrial landscape differ vastly from that of Hebron, the organization and responsiveness of the Ramallah and Al-Bireh government entities on wastewater treatment and industry compliance, particularly after the construction of the WWTP, which serves as another interesting case study for Hebron to draw lessons from.

Wastewater Treatment (Ramallah): here is a proposed WWTP at Ein Jeliot northwest of Ramallah, to be funded by the German Development Bank (KfW). In order to support this and other treatment projects, Ramallah is adopting a zero tolerance policy towards industrial discharges into the sewer system. This may be easier to implement in Ramallah given the considerably smaller industrial presence. Furthermore, Ramallah's focus, according to its master plan, is on business, finance, retail, entertainment, and tourism. These focuses along with the considerable land costs make it difficult for space-intensive businesses (i.e. factories) to make Ramallah their operating base.

Another wastewater project proposed in Al-Tireh, funded by the Municipality of Ramallah, and contracted to GE-Osmonics will utilize a Membrane Biological Reactor (MBR) technology to reduce the plant's footprint while still processing high-quality effluent. The practicality of this high-tech system will be dependent on the city of Ramallah actively working on securing a level of influent quality which is acceptable for the WWTP processes. This is an important lesson learned for Hebron, showing that technical solutions by private industry are possible, but only when the municipality takes responsibility for regulating the use of the public sewers, thus delivering a predictable wastewater to the treatment plant.

Industrial Regulation and Enforcement (Ramallah): In order to ensure industry compliance and investment protection, Ramallah places effort in implementing existing laws, understanding the implications of uncontrolled discharges. Currently (June 2013), a municipal chemical engineer is completing a survey of factories to assess risks and discharges (similar to this project's focus). Ramallah is now implementing annual licensing of non-domestic sources, with annual renewal contingent upon compliance with either zero discharge or satisfactory pretreatment.

For example, an aluminum/ painting plant will not be allowed sewer discharge next year, unless properly pretreated, along with several food and beverage industries. For pharmaceutical factories, each individual waste stream has its own characteristics and requires specific pretreatment measures to be implemented. For that reason, wastewater from pharmaceutical factories cannot be combined with other waste streams (i.e. dilution) for later treatment; should enforcement fail, the Municipality will involve the police, or as needed, the military.

Currently no revenue-generating schemes are planned for treated effluent reuse. The project's finances do not take this into account and it is assumed the high-quality effluent will enhance the quantity and quality in the Ein Kinya stream, helping those farmers. Perhaps if conditions change and enough value exists downstream, revenue options will be considered, in the future.

Industrial Regulations and Fees (Al-Bireh): Similar to Ramallah, limited industries exist within Al-Bireh when compared to Hebron. The Al-Bireh "Industrial Zone" houses small workshops, one dairy factory, some lubricant factories, one pharmaceutical factory, one small stonecutting factory, one galvanizing factory, and an aluminum painting factory. Each has their own pretreatment procedure on site, or is not connected with the municipal sewer system, instead using individual septic tanks. Slurry from the stonecutting factory is picked up and disposed in a nearby landfill every two days.

Like Bethlehem, Al-Bireh has a water service department that functions separately from the municipality, and serves as the main regulatory and enforcement mechanism for water and wastewater in the city. Regulations for the water service council are set by the municipal council, with the department's responsibilities including fee collection (for provision of water, wastewater, and maintenance), and connecting to the sewage system. Connection fees are paid once, while sewer maintenance fees are paid as a part of the water bill and levied at approximately 30% of water consumption. As a result of difficulties in collecting the sewage fees, it was incorporated into a unified bill with water, increasing compliance significantly.

PWA intends on establishing four water service departments similar to the one in Al-Bireh Municipality all over the West Bank (North, Middle, South, and Gaza).

Al-Bireh WWTP Enforcement: Operational since 2001, the Al-Bireh WWTP serves 100% of Al-Bireh and 30% of Ramallah, including Ramallah Hospital. As a result, Al-Bireh has a highly organized and responsive regulatory system to protect the plant asset. There are imposed fees for violators, and in the case of payment default the case is handled by the police. As a result of the WWTP, regulations require factories to establish an onsite pretreatment unit in order to receive the Municipality operation license.

The governmental inspection department appears effective and mainly initiates inspections based on received complaints. Once a complaint is filed, the inspector visits the violation site and writes a report, in conjunction with the Ministry of Environmental Affairs (MEnA). A notice letter is also sent to the factory requesting the remedy of the stated violation and to pay the penalty (severity based on how hazardous the violation is), or face imprisonment. As a result of consistent enforcement and positive public awareness from the municipality and police, especially in regards to fee payment, there is a high rate of voluntary compliance from the community at over 80%, with zero wastewater violations reaching the court system.

Despite both Ramallah and Al-Bireh housing fewer industries than Hebron, the organization, coordination, responsiveness, and efficiency of their public awareness, institutional and regulatory systems in addressing wastewater management issues has allowed for high compliance rates in payment, pretreatment, and discharge practices – necessary prerequisites for establishing any WWTP.

3.2.5.2 Joint Service Council Solid Waste Management

The Hebron and Bethlehem Joint Service Council's (JSC) solid waste management program provides another successful example that can serve as a comparative model for successes and challenges in costs and operations of the planned stonecutting haulage program in Hebron.

The JSC is a collective body tasked with managing the solid waste of Hebron and Bethlehem to supplement and/or replace the municipality's responsibility to provide this service. Established in 2007 under Local Government Law of the Palestinian Government and empowered by the Ministry of Local Government (MoLG) to provide Solid Waste Management (SWM) services for Hebron and Bethlehem. JSC's work with solid waste management is currently under funding by the World Bank, with an incremental decrease in funding from the donor for the 5-year span of the project in order to enable a proper transition to the local government.

Waste Management Service Provision: Originally, the JSC and Hebron Municipality worked together to provide solid waste management services. Waste was picked up by the municipality from individual houses and shops, brought to a transfer station, and then JSC would transport from the transport station to a disposal site. Any pickup from buildings and street cleaning was the responsibility of the municipality. Due to the Municipality's lacking capacity however, full waste management operations are under conversion to the sole responsibility of JSC, to be completed by 2014.

Operations are executed by the JSC, which then bills the Municipality for these services. The Municipality should then collect funds through waste collection payments from the community. With the transition of waste management operations, the JSC was able to utilize less labor and equipment to serve more communities, and more efficiently, than the Municipality, rendering JSC's operation costs less than costs under the Municipality. The decrease in costs also increases the probability of meeting cost recovery goals.

Service Fees and Payments: Regarding collection fees paid by the community in Hebron, waste management service is paid annually. In other municipalities there is a prepaid process, allowing for a much higher collection rate. In addition, payment for Hebron households is a yearly bill that averages only 10-12 NIS/month based on household size, which is not an effective collection process. Converting the yearly bill to a monthly payment may increase collection rate, but this change has yet to be enacted.

Each municipality has its own fee system, with about 50% cost recovery at best; the rest is cost subsidy. Hebron's cost recovery system is relatively worst in the region, largely because over half of its customers are unregistered, which makes cost collection very difficult. Recently, the Municipality service boundaries were extended to almost double the original population size. None of these households were registered post-expansion, so no payments have been collected from these households. While other municipalities have waste management fees tied to prepaid

electricity meters, only about 10-15% of Hebron's population is serviced through prepaid meters. For the areas without prepaid meters, the collection rate averages only 22-25%.

There is a proposal to expand prepaid meter services, but the proposal is currently stalled due to the election of a new government. Additionally, the cities of Hebron are working with Witteveen + Bos to prepare cost calculation, tariff, and fee setup guidelines. Also, Global Partnership Output Based Aid (GPOBA) is an $8MM project committed to JSC for improving solid waste service and fee collection. JSC is currently using the funding as an incentive-based approach towards compliance. Under the structure, if government bodies comply with their payments and the management/regulatory framework set forth by JSC, then they can receive portions of the funding. For example, with the new sanitary landfill in Al-Minya (after closure of Yatta Dumpsite), transportation costs will be higher but if municipalities remain compliant and dispose at the new landfill, they can receive money to subsidize transportation costs.

Compliance Monitoring and Evaluation: JSC collection of service payments from the Municipalities is over 85%. The compliance rate is not at 100% due to the sanitary landfill not opened yet, so there is still use of unregulated dumpsites. The payment is set at 100 NIS/ton as a fixed tariff to the Municipality for dumping services, including the 16 NIS entry fee at the Yatta dumpsite gate. Monthly payments are due two weeks after the end of each month. In the case that a municipality does not pay, JSC will stop collection to the area. The same penalty is levied if a municipality uses its own trucks to dump at the dumpsites, instead of JSC's. If the Municipality cannot pay the fees for dumping and collection, they need to open their own dumpsite. This option is never taken, as opening up another dumpsite is work intensive and costly.

There are metrics monitored by JSC to measure level of service in municipality and coverage of service. 95% of local communities are covered by primary collection service, with collection rate/frequency measured daily. Commitment to pay by the Municipality for primary collection services and Yatta use is also measured. There is daily registration at the Yatta dumpsite to monitor dumping, so if there is a drop in waste volumes from usual levels then JSC knows there is probably dumping elsewhere, and can investigate. JSC takes responsibility to transport municipal inspectors to sites of illegal dumping for documentation of violation. An incentive-based approach is taken in dealing with the ministries and municipalities. For example, the JSC will inform the municipalities of locations where illegal dumping is found, and then will not provide them with waste disposal containers if the issue is not remedied.

Additional regulatory specifications for enforcement are required to update the current solid waste penalty system, but are already in process through the pending approval of a new solid waste bylaw. A national strategy on public awareness for waste issues and environmental issues in general was drafted with World Bank funding, but this strategy still requires implementation.

Funding Sustainability: JSC is now seeking private sector participation for the operation and maintenance of the soon-to-be-operational Al-Minya Landfill and two transfer stations, the long haul transport of waste between the transfer stations and the Landfill; and possibly implementation of recycling activities. This model for solid waste management would enhance the financial sustainability of the already improved waste operations post-JSC takeover. JSC's solid waste management system serves as an interesting case in the interaction between donors, the local government, a third party entity managing operations, and the private sector

in order to create a functional system of waste management pickup, payment, and dumping. The system would be improved with additions to the regulatory and institutional framework to formalize JSC's role in this system, yet the current system already provides a compelling template for the foundations of a successful haulage program.

Despite the fact that solid waste haulage presents more flexibility in disposal options, that municipalities are the primary customers, and the reuse issue is not a concern compared to stonecutting waste – many of the mechanisms set forth by JSC's program could become key components to ensuring sustainability of a stonecutting haulage program.

3.3 Industries of Concern

From the primary Industries of Concern identified through the field surveys and data collection, the Discharge Team concluded the Stone & Marble, Tanneries, and Olive Mills (respectively from greatest to lowest impact) represented the most critical industries which would prevent the HRWWTP from operating. The possible technical solutions, acceptable for sewer disposal and implementation concerns are summarized in the Table 4 below.

These statements represent a snapshot in time, based on current conditions, which could change in the future. Therefore, it has been suggested and recommended that the donors, designers, or local entities maintain an Industrial Database of regularly updated information so that the HRWWTP operators can evaluate the industrial landscape and determine if, and when, other industries might become a more relevant concern. An existing example of this is the Olive Mill industry, which poses no threat currently, but may so in the future given the proposed HRWWTP expansion and as discussed in greater detail below.

Table 4: Industries of Concern Summary

Industry	Concern Pollutant	Technical Solution	Sewer Disposal	Implementation Concern
Dairies	O&G / BOD	Grease Traps	Yes	Technical solutions available, but who will pay
Olive Mills	Phenols	**Haulage or Central Treatment**	**Yes***	No onsite technical solution; limited financial resources
Slaughter House	O&G / BOD	Grease Traps; Solids Separation	Yes	Technical solutions available, but who will pay
Stone & Other Building Mat	TSS	**Haulage to dewatering facility or wet disposal**	**No**	Technical solution available, but limited commitment
Tahina	BOD / Chloride	Sewer Acceptance	Yes	Design impact, but no viable options exist
Tanneries	Chrome / Chloride	**Plant Rehabilitation**	**Yes**	Technical solution in-place, but without chrome recovery

*Note: *Based on further confirmation of phenol concentrations and HRWWTP acceptable loadings*

3.3.1 Slaughterhouses, Dairies, Tahina, & Other Foods

Characterized by high BOD, O&G, and TKN levels, the food industry presents a unique case for the HRWWTP, where the risks are a moderate, but manageable, concern. Representing a smaller portion of the total hydraulic load, the industry's organic concentrations and peak hour loads are substantially higher than domestic wastewater. At the same time, these characteristics more closely resemble that of domestic wastewater and so therefore can be incorporated into the HRWWTP design and operation planning.

3.3.1.1 Dairies

A total of six (6) dairies were identified and surveyed within the Municipal boundaries during this assessment. Distributed throughout Hebron City, the dairies are all located above the Industrial Zone and connected to the sewer network. Thus, the effect of these sources was captured in the estimated loadings reported in *Deliverable 1B: Baseline and Projections of Future Wastewater Flows and Loads* (CEC/W+B, June 2012). Generating between 525-550 m^3 of wastewater daily, dairy industries represent roughly 5% of the existing daily flow from Hebron City (12,000 m^3) and should be considered as a significant contributor to the hydraulic load.

The multiple dairy processing plants tend to discharge in a continuous manner or in small batches and are unlikely to present a shock loading to the plant.

Characterized by high organics from proteins, fats, and lactose, dairies also contain high concentrations of solids and pH variability. During the field survey, only one factory was identified with a pretreatment grease trap. This factory was one of the smaller ones, with most of the largest factories in the area disposing untreated wastewater directly into the network.

Encouraging all facilities to install pretreatment measures would benefit all aspects of the HRWWTP – collection, treatment, and disposal. However, as noted before, these industrial wastewaters are already accounted for in the design basis and do not pose any new threat to the system operations.

It should be noted that removing the solid wastes from the liquid stream transfers them to the solid waste management stream, where it would need to be addressed. Without a mandated disposal process or an industrial/commercial reuse for these materials, it is likely they will re-emerge in the sewer system as part of the liquid waste stream.

3.3.1.1 Slaughterhouses

A total of 76 slaughterhouses were identified and 39 surveyed within the municipal boundaries during this assessment while the actual number is assumed to be much larger as there are many smaller workshops and slaughtering at individual homes, still the majority of slaughter operations occur at the surveyed facilities which are the largest facilities in the area.

Most slaughterhouses are located inside Hebron City, with the only major Industrial Zone facility being the Hebron Municipal Slaughterhouse. Hydraulically, slaughterhouses contribute less than 1% to the system flow. Of that, the municipal facility accounts for approximately 20% of the industry's total wastewater production. As such, most of the potential impacts from these operations are already included within the design basis. Furthermore, proposed plans exist to

refurbish, and eventually replace, the existing Municipal Slaughterhouse with the intent of improving the level of operations to a standard closer to what was observed in Ramallah.

Potential discharge of fecal matter (poultry), hair (sheep, cattle, camel), feathers (poultry), entrails (all), hide fragments (all), etc. would introduce high BOD and TSS loads into the system along with increased O&G levels. These gross solids should be separated at the source and managed as solid wastes. All slaughterhouses should be required to provide grease traps to remove the floatable O&G. This fraction is most likely to cause obstructions in the collection system and burden grease removal at the HRWWTP.

Plans for the new regional slaughterhouse will likely prevent any near-term pretreatment actions from occurring. Without a well-defined schedule for the creation of such a facility and the linked decommissioning of existing slaughterhouses, it can only be assumed the present configuration will continue for the foreseeable future. While it might have been acceptable practice to discharge uncontrolled grease to the sewer for open discharge, the provision of any WWTP requires appropriate source controls, with removal of floating grease as the minimum entry level for such controls.

It should be noted that removing the solid wastes from the liquid stream transfers them to the solid waste management stream, where it would need to be addressed. Without a mandated disposal process or an industrial/commercial reuse for these materials, it is likely they will re-emerge in the sewer system as part of the liquid waste stream.

3.3.1.2 Tahina Production

A total of six (6) tahina factories were identified and surveyed within the municipal boundaries during this assessment. Distributed throughout Hebron City, only two (2) factories are located within the Industrial Zone. Based on sesame consumption, the two factories inside the Industrial Zone constitute about 30% of the total tahina wastewater production. Similar to the other industries, the majority of the discharges are captured within the W+B design basis. Averaging 15m^3/day, tahina is hydraulically insignificant at 0.1% of the system flow.

Tahina wastes contain high levels of oxygen-demanding wastes, much of that in the form of oils (natural aspect of sesame) and very large amounts of salt. Very high doses of salt are used as part of the process to remove the hulls from the seeds; this salt waste is sent directly into the sewer. High levels of salinity can interfere with the biological processes used in conventional wastewater treatment. Salinity is not removed by conventional wastewater treatment and passes through to the plant effluent where salts can interfere with irrigation reuse in two ways: alteration of the soil's physical structure and harmful effects to salt intolerant vegetation.

Pretreatment at the source is difficult, as desalination requires deep technical knowledge and complex technologies. A more appropriate intervention would be source control or process modification. First, would need to verify waste solids are kept separate and not flushed into the sewer. Even still, the primary issue surrounds the salts. Alternative technologies have been discussed during this assessment, specifically a mechanical system currently being tested in Nablus, but results are unproven and application to Hebron is not foreseen in the near future.

Since most of the tahina industry is accounted for in the design basis, existing conditions should be manageable within the HRWWTP. Should the industry change in character from marginal (0.1% flow) to a more significant contributor, the situation would need to be revisited and this conclusion verified. It is possible that at some point in the future, the tahina wastewater will need to be kept out of the system in its entirety, either from a HRWWTP protection or wastewater reuse point of a view.

Removing sesame hulls from the liquid stream transfers them to the solid waste management stream. Some factories currently sell this waste material as livestock feed, and so opportunities exist which would promote the separation of the solid waste without being too burdensome on the individual factory owners. Should desalination pretreatment measures occur, the nature of the concentrated brine is unknown. Perhaps it could be reused in the industrial process (de-hulling). Since the likelihood of salinity reduction is nil, there is little incentive to understand the potential benefits of the brine waste. Should it become necessary to separate these high-salt wastewaters from the collection system, there are low-technology approaches that might be employed, such as remotely- located evaporation basins.

3.3.2 Tanneries

3.3.2.1 Process Optimization

Multiple sources refer to various process improvement measures as a means of reducing hazardous discharges from existing tanneries. Though these process improvements can indeed increase the absorption of chrome in leather, documentation showing the resulting tannery effluent would contain 5 mg/l or less of chrome is not currently available. While implementing such practices should be encouraged as industry standards, there appears to be limited alternatives for reducing the tannery wastewater chrome concentration by 95% or more, outside of the design and operation of the dedicated treatment unit.

Most recently, an independent consultant with support from Friends of the Earth Middle East (FoE-ME) shared experiences with adjusting pH and temperature in order to achieve significantly higher levels of chrome absorption. Results of experimentation with tanneries in Saudi Arabia and Indonesia indicated that raising the pH to 4.0 through a chrome fixing bath between 41 and 43 °C could leads to increased chrome exhaustion. Hebron tanneries should consider implementing these techniques to increase chrome absorption as one measure towards decreasing the wastewater content. If this process cannot be shown to reduce chrome concentrations to within the range of 5 – 50 mg/l, then an “end of pipe” pretreatment (i.e. the dedicated pretreatment unit) will still be required prior to disposal into the sewer network.

3.3.2.1 Wastewater Characteristics

Table 5 contains data from the CH2MHILL (2000) sampling of Hebron tanneries and technical, international articles (2007 and 2011) for comparison. Both of the referenced sources provided ranges of concentrations, classified as either “weak” or “strong” tannery waste.

It appears the 2007 refers to data from a review of practices in Pakistan completed in 1998. The 2011 reference listed data from ten tannery studies from 1999 to 2009; the geographical location of these tanneries was not stated.

Table 5: Typical Tannery Concentrations

Parameter	Hebron Data	International Data[1] 2011		International Data[2] 2007	
Parameter	**USAID[3]**	**Weak**	**Strong**	**Weak**	**Strong**
Total BOD	2350			840	18,620
Soluble BOD	860				
COD	4800			1320	54,000
TSS	4900			220	1620
VTSS	3740				
TDS	19,000	6,810	36,800		
NH_3-N	330	33	335		
TKN	300	144	370	236	358
Chlorides	7130				
Sulfides	24.3	35	440	800	6,480
Alkalinity	498				
Oil & Grease	50.9				
Total Phenols	1.45				
Total Chromium	483	11	95	41	133

Note: All values expressed in mg/L

From the above, we may see that the local tannery discharge fits within the expected ranges for: BOD, COD, TDS, and TKN. However, other parameters vary considerable. For example:

- TSS is roughly 4x the mean value (4,800 vs. 920)
- NH_3 (ammonia) nitrogen is equal to the "strong" max (330 vs. 335)
- TKN tends towards the high-end of the "strong" range (330 vs. 358/370)
- Sulfides are below the lowest "weak" value (24.3 vs. 35)
- Chromium is 4x the mean "strong" value (483 vs. 114)

These comparisons are presented for the purpose of evaluating treatment technologies and their performance on the normal mix of tannery wastewaters. Thus, the unusually high values for Cr and TSS associated with the Hebron tanneries might mean that industry-standard processes will not achieve the same results as experienced elsewhere.

The concerning pollutant is the chromium forms, with sulfur forms and salinity as secondary concerns as they can impact the conveyance, treatment, and disposal of these wastewaters. In the following discussion, a value of 500 mg/l of chromium was provided as the total daily amount disposed by the Hebron tanneries cluster.

[1] G. Durai and M. Rajasimman, 2011. Biological Treatment of Tannery Wastewater - A Review.*Journal of Environmental Science andTechnology, 4: 1-17.*
2 Biological Treatment of Tannery Wastewater Using Activated Sludge Technology; Haydar, Azis, and Ahmad; Pak. J. Engg. & Appl. Sci. Vol July 2007.
3Hebron Wastewater Monitoring Program, Task 6 – Final Report, Vol. 1, June 2000.Sect. IV- Pg. 25 /39.

It is recommended that pretreatment be applied to tannery wastewaters to reduce chrome concentrations before discharge to municipal sewers. Influent concentrations of 1.5 – 2.0 mg/l are recommended upper limits which do not inhibit activated sludge processes. Two cases are considered which both achieve acceptable levels that the HRWWTP could properly treat:

- 90% reduction (50 mg/l) – results in an estimated 0.8 mg/l influent
- 99% reduction (5 mg/l) – results in an estimated <0.1 mg/l influent

3.3.2.1 Chrome Removal and Recovery

From 2002 to 2006, a wastewater pretreatment facility serviced the Hebron tanneries cluster. A shared discharge network existed which sent wastewaters directly to the pretreatment unit. It was regarded as a successful system, in that meaningful amounts of chromium were recovered for reuse, reducing the factories' costs. Figure 4 below represents the existing pretreatment system, and also is an industry standard for chrome recovery: slow precipitation using magnesium oxide, settling of the suspension, decantation of the supernatant, and acidification of the precipitate to liberate chromium for reuse as a tanning process input. Sulfuric acid is required for this recovery step. Israel has banned the import of sulfuric acid into the West Bank, so this facility has been idle since 2006. The need to challenge the mindset that sulfuric acid is the only possible reagent is discussed in Section 5.1.2.

Figure 4: Existing System Schematic

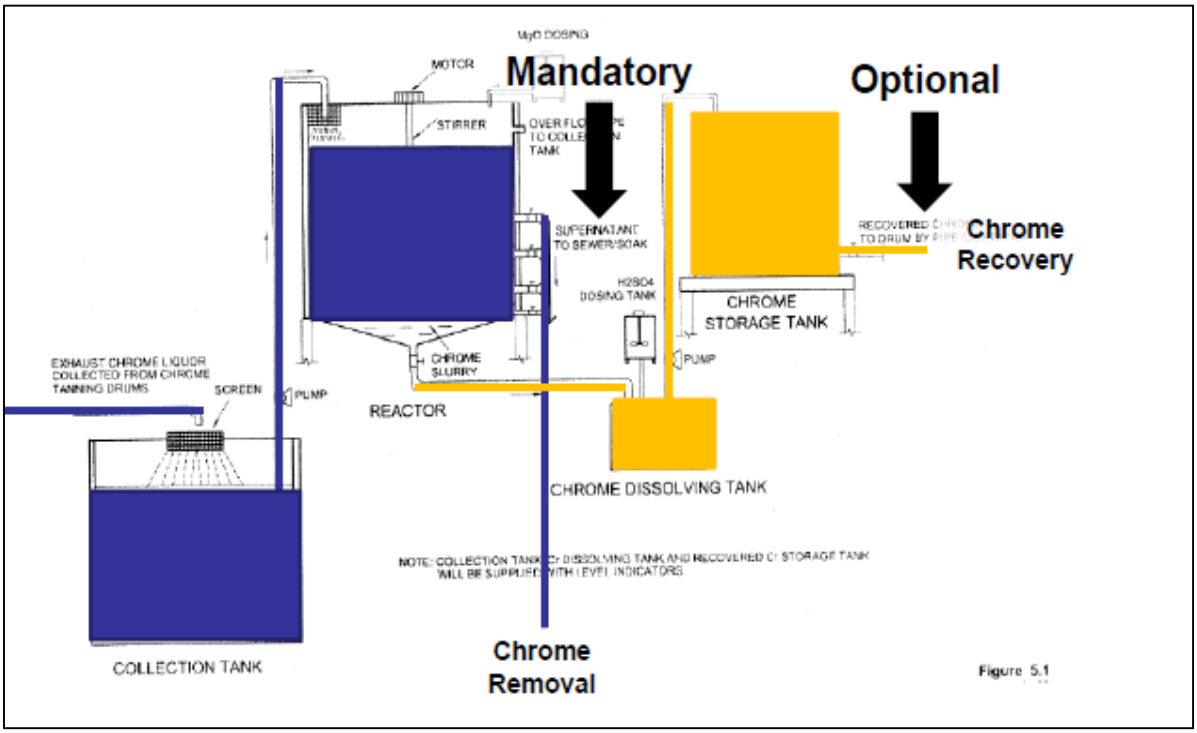


Figure 5: Existing System Photograph

The adjacent Figure 5 photograph was taken in May 2013. It shows the pretreatment unit that appears to be intact in terms of inventory. Peripherals, such as electrical panels, controls, and instrumentation need replacement. One can expect that motors, valves and pumps might need repair or replacement. It appears that after a tear-down, clean-out and refurbishment, the unit could become functional again.

Note that in the above paragraph and shown in Figure 4, the topics of effluent treatment and beneficial chrome recovery is discussed, as if they are inherently linked; this is erroneous and has led to the assumption that sulfuric acid is relevant to the treatment of tannery wastes.

The following discussions will review the separate issues of:

- Chrome reduction of tannery effluents and
- Beneficial recovery of chromium for reuse in the tanning processes.

3.3.2.2 Chrome Removal: Existing Treatment Facility

Influent / effluent performance data from 2002 to 2006 were not obtained. Multiple inquiries were made, so although it is demonstrated that some chrome was recovered, the quality of the wastewater discharged to the sewer is not documented.

The existing facility is similar to common industry norms, as described in:

- *Introduction to treatment of tannery effluents*[4] pg. 11, Fig. 4 shows a flowsheet that is similar to the existing unit in Hebron. Interestingly, this facility is labeled "Chrome Recovery Plant", which discharges into pretreatment processes prior to discharge to a municipal sewer.
- *Chrome Management in the Tanyard* [5]describes a similar flow sheet (Fig. 19, pg 24) that precipitates with magnesium oxide, as is the case for the existing unit in Hebron. For such systems, chrome concentrations in the supernatant are about 5 mg/l (pg. 25/64). This suggests that a chrome recovery plant, similar to the current unit, could be designed, constructed and operated to achieve 5 mg/l discharges. So, by inference, the existing treatment might be capable of treating chrome to about 5 mg/l. No data was found to confirm whether or not the existing unit operated at such performance levels.

Coincidentally, discharging 5 mg/l of chrome to the municipal sewer conservatively protects the proposed HRWWTP, from a process-interference point of view. The proposed 2013 PWA/ MOLG Industrial Wastewater Connection Bylaws also specifies 5 mg/l as the upper limit for chrome concentrations in wastewaters discharged to a municipal sewer.

[4]"Introduction to treatment of tannery effluents" UN Industrial Development Organization, Vienna 2011.
[5]"Chrome Management in the Tanyard". UN Industrial Development Organization (UNIDO), 9AUG2000. US/RAS/92/120/11-51. Prep. By Ludvik&Buljan.

A critical operational consideration is that factory owners are supportive of reinstating the existing pretreatment unit because they benefitted directly from the recovered chromium-enriched sludge. The reverse of this situation is likely to be true. That is, in the absence of providing a tangible benefit (i.e. chrome-enriched sludge) to the tanneries, the operation of the treatment plant would become a burden with no inherent benefit, so the capital and operational expenditures (CAPEX and OPEX) would need to be sustained by some party other than the tanneries, or imposed through an as-yet undefined force of local law.

So, the technical remedy appears readily available. Confirming this would require operating data from 2002–2006 and an engineering review of the current discharge characteristics of the tanneries to evaluate process effectiveness under current, and projected, loads.

Even without such information, a modest capital budget (estimated at $30,000-$50,000) could revitalize the existing pretreatment unit and resume operation after six years of deterioration and disuse. Several site visits in May 2013 create the impression that most, if not all elements are in place, but as noted earlier, it is expected auxiliary components will need to be repaired or replaced (i.e. electrical gear, instrumentation, valves, pumps, etc.). Another capital expenditure could be connection costs to replace the existing lines which connected the tanneries to the pretreatment unit as it is unlikely these old, abandoned lines are still functional. However, these costs are minor compared to the costs of new, alternate facilities.

A further consideration depends on a pretreatment only intent, without recovery of chrome, is that this sludge will change from a process input, going back into the tanneries' into a waste form (heavy-metal sludge) for which there is likely no established residuals management pathway. As such, questions such as whether or not a storage tank also needs to be constructed or if there is a local recycler (West Bank or Israel) who can process the sludge.

These types of questions are common to all the technical interventions in review. If the HRWWTP collection, treatment and disposal processes are protected by keeping certain wastewaters out, where do they go? Every liquid remedy triggers a solid problem. During the Discharge Study, these cross-media transfers were identified and with some credible options, but remained outside of the scope's purpose (i.e. protecting the HRWWTP). However, rarely will remedies be implementable through purely technical solutions. Moving from listing options to integrating all the liquid/solid tradeoffs can only happen if done under the authority of an agency that can cause an overall optimization, not just the optimization of solid waste management or that of the liquid side interests.

A positive aspect of running the existing WWTP without chrome recovery is that the process introduces yet more salinity to a wastewater already high in dissolved materials. As discussed at the Stakeholder Meetings, these salts may not impact the HRWWTP operations directly, passing through the system, but may cause concern for the agricultural irrigation, which is another major component of the effluent reuse. Despite the potentially adverse effects of this treatment byproduct, it remains recommended to rehabilitate the existing pretreatment plant and make strides toward negotiating the import of sulfuric acid in order to financially incentivize the tannery factories to pretreat their waste to levels acceptable for sewer disposal.

Adding sulfuric acid would increase the existing TDS (2000 data) from the unusually high concentration of 19,000 mg/l to something even greater. At an estimated 200 m^3/day of tannery wastewater compared to the total 13,000 m^3/day, there is a mixing ratio of about 65:1. Thus tanneries' could add about 300 mg/l of TDS to the influent salinity at the HRWWTP. A minor mitigation is that discharges occur in batches (4-8 per day). Given the twelve tanneries, this translates to about 60 events/day of 2-3 m^3 each. The discharge period (beginning at 8AM and ending at 4PM) matches the peak domestic wastewater flow periods, providing maximum dilution effects. This matching with peak municipal flows would attenuate the apparent TDS increase to less than the calculated 300 mg/l. The purpose of this discussion is not to present the TDS as irrelevant, but rather to say it is a problem that may not need an immediate solution, while chromium forms must be intercepted now in order to protect the HRWWTP.

3.3.2.1 Chrome Removal: Alternative Processes

Since the existing facility can likely achieve significant removals of chromium as outlined in Appendix H we have de-emphasized alternative treatment technologies. However, a brief overview is provided on chrome recovery within the following discussions.

Physical-Chemical Processes: *No advantages over existing plant*

- *Powdered Activated Carbon (PAC).* Listed as a secondary, polishing step since the PAC bed needs to be protected from solids, oil and grease. High removals of chrome are expected, and it has advantage of not adding more TDS. It is expected the chrome would be bound into the PAC and not recoverable in practical terms. This is potentially a useful option for treatment, should the existing process be found to be inadequate.
- *Dissolved Air Flotation (DAF).* One negative is that DAF is better for continuous flows, while tanneries are batch processes. Also, the tannery track record for DAF is not well documented, although this is a well-established technology in sludge processing for wastewater treatment in the beneficiation of metallic ores. It seems credible that with the correct conditioning steps, a mineral beneficiation "float" could work that would be chrome-enriched. Not recommended for further evaluation.
- *Alternatives to MgO*. Calcium hydroxide was used as a coagulant material for chromium precipitation and plain sedimentation was applied for reducing COD, BOD_5, and TSS. The results demonstrate 98.8% removal of chromium, 31% removal of COD, 25.8% removal of BOD_5, and 51.2% removal of TSS. No information was found on the recovery of chrome and reuse by tanneries, or properties of the sludge for proper disposal. Potentially useful technology since "minor variation" of the existing treatment facility.
- Chemically-enhanced primary treatment. Similar to existing tanneries treatment plant, but using alum as the coagulant. 98% removals of chrome, turbidity, TSS, and a 50 – 60% reduction in COD. Expected chrome recovery uses acidification; if this requires sulfuric acid, this would not be a remedy to the current problem. Potentially useful.
- Oxidation of chrome with Hydrogen Peroxide, Sodium Hypochlorite or Calcium Hypochlorite. Oxidizes Cr^{+3} to chromate, but the concern is this may include a recovery step using H2SO4, so this approach might gain nothing. Not recommended.
- Solvent-extraction variants of above flow sheets. No advantage identified.

Biological Treatment: *None Recommended*

Biological treatment can achieve high levels of chrome removals in lab-scale tests, with specialized organisms and media. Increased chromium, sulfates and salinity inhibit the application of standard biological treatment processes. Also, recovery of chrome for reuse is not demonstrated[6]. Technology does not appear sufficient.

Electrical Processes: *None Recommended*

- *Solvent Extraction/Electro-winning*. Not demonstrated at plant-scale and also uses H_2SO_4 for chrome recovery so no advantage exists over the existing process.
- *Electrolysis.* Chrome removal does not adequately meet the 90% removal to achieve the required influent levels (only ranges between 50-60% removed). In addition, the electrical requirements are quite high (i.e. costly) making this option not viable.
- *Electro-Coagulation*. Only pilot-scale systems exist and high removals of chrome are not demonstrated. Also, the electrical demands would be too high, similar to above.

Ion- exchange resins (IX): *None Recommended*

Extensive pretreatment required so that the IX is only exposed to a soluble fraction of tannery wastewater. Pilot-scale work establishes credibility, but no plant-scale data was found. The main drawback is that since this exchanges one salt (metal) for another (sodium, etc.), this process would add TDS which impact HRWWTP effluent characteristics and potential reuse.

Membrane technology: *None Recommended*

Use of reverse osmosis (RO) has been reported at demonstration levels, but not in general use. High-tech, elaborate pretreatment are usually needed to remove residual elements, and correspondingly, capital costs are the highest of all options. Technically, it is the best option, as all metals and salts are rejected from the membrane resulting in concentrated liquor from which other processes could extract chrome for reuse. This would yield the best effluent quality, and could either produce finished high-quality water for reuse, or a lesser quality water fit for discharge. Not recommended for further inquiry under present circumstances.

3.3.2.1 Chrome Removal: Recommended Process

Consider the case where the recovery of chrome is useful. The first option to consider is revitalizing the existing pretreatment unit as the preferable means of interception and treatment of the tannery wastewater. In order for this to happen:

- The existing chrome recovery step (i.e. use of sulfuric acid) could be made possible through intervention of national or international agencies to change the Israeli policy of denying access for sulfuric acid.
- Another approach to solving the importation issue is a third-party operator, possibly a bonded contractor could be constituted to receive and manage controlled substances.
- Alternatives to sulfuric acid as a means of acidification of the sludge for chrome recovery might be identified, yet significant energies have already been expended without strong,

[7] *Biological Treatment of Tannery Wastewater – A Review*

conclusive results. It is recommended that a final determination be made as to whether H_2SO_4 is uniquely capable of recovering chromium or there are acceptable alternatives.

- FoE-ME's independent tannery consultant provided guidance on process optimization to reduce chrome discharge; however, definitive guidance on chrome recovery without the use of sulfuric acid is not yet available.
- As noted earlier, the existing unit (if refurbished) has a high probability of reducing chromium concentrations in the tannery effluent from 500 mg/l to levels that will protect the proposed HRWWTP.

  Case A (90% Removal). Results in a cluster discharge of 50 mg/l, corresponding to 0.8 mg/l of chrome delivered to the HRWWTP. This would conservatively protect the activated sludge process planned, since the process is not inhibited by concentrations less than 2 mg/l (higher concentrations inhibit the metabolic processes of the biomass).

  Case B (99% Removal). Results in a cluster discharge of 5 mg/l, corresponding to <0.1 mg/l of chrome delivered to the HRWWTP.

Even if the existing tannery treatment plant cannot achieve the 5 mg/l that the literature suggests, there is a much greater degree of confidence that it could treat to the 50 mg/l levels and protect the proposed HRWWTP from chrome interference. As indicated above, other technologies exist but either does not meet the required treatment standards (i.e. 90%) or are not practical in the context of this environment (i.e. complex technology, high capital/operating costs). Therefore, the most readily available solution is to refurbish the existing treatment plant. Once rehabilitated, the plant can operate in the absence of sulfuric acid. This however creates a difficult enforcement situation whereby owners have no incentive to operate the plant (due to the lack of recovery of valuable chrome) and can continue under the unregulated status quo due to the limited authoritative presence inside the Industrial Zone. If an import structure can be negotiated with the Israelis, the factories will have an incentive to operate – at their own cost – the plant in order to recover the chrome as was done prior to the imposed restrictions of this chemical. It is noted that the Israeli Civil Administration (ICA) has indicated there is "no hope" in reversing the banned import policy given its security concern as a potential "dual use" substance. Despite the apparent finality of the above opinion, it is worthwhile for international interests (donors, sovereign states, other parties) to attempt to alter this stalemate, if process experts assert that there is no substitute for sulfuric acid.

3.3.3 Stone Cutting & Building Materials

3.3.3.1 Industry Background

Mined from nearby quarries, stone is sent to factories for cutting into rough blocks using metal saw blades with diamond tips, then sent for polishing and finishing using brushes and abrasives. Limestone and dolomite are the primary rocks mined, so waste material is relatively inert. Previous studies characterized slurry by high compositions of calcium carbonate and magnesium, with traces of iron, molybdenum, chrome, nickel, and arsenic from the diamond tip

saw blades[7]. In addition, other trace elements may be present, depending on the machinery and technique used. If adhesives are used to fix the abrasives then traces of cobalt may be present.

The majority of the process is done under wet conditions to cool the machinery. As water goes through the process, it mixes with fine solids, creating "slurry". Many factories collect the slurry in settling pools or silos for water reuse and a few have the capability to dewater the slurry, extracting greater quantities of water for reuse. Depending on the waste material, the slurry and cake is either disposed on-site, at the Central Slurry Processing Plant, on agricultural land, on open areas, designated disposal sites, or in the municipal main sewer line[8].

According to local sources, factories used to transport the slurry at their own cost to Yatta Dumpsite prior to the 2nd Intifada. During this time, the entrance to the Industrial Zone was closed, forcing the factories to devise a creative method for waste disposal – through the sewer network. Afterward, this method became habit and factories continued to use the sewer despite the lifted restrictions. Likely, it could be attributed to the realization that costs for transporting were much higher, and less convenient, than simply dumping down the sewer.

Another peculiarity is the haulers themselves. Even for factories who've resumed hiring drivers for waste haulage, the factories are often unaware of the waste's final destination. These drivers would leave factories only to visit the nearest manhole in order to dispose of the waste and move to the next customer. There are even accounts of drivers stopping in the middle of the road and accessing a manhole to discharge their load. From a business perspective, these actions are not unreasonable – as drivers limit distances traveled, it reduces fuel costs, which represents the greatest cost, and increase turnover thereby visiting more factories per day.

Despite the personal gain for factories and drivers, this method creates an undue burden on the Municipality, who spends an estimated 800,000 – 1,000,000 NIS annually to clean the network as a result of the sediment buildup and subsequent network blockage. Local residents within the Industrial Zone have even stated that it was not uncommon for their domestic connections to become plugged and a slurry-municipal mixture to actually overflow into their homes.

3.3.3.1 USAID Emergency Project

Following the recent Israeli Civil Administration (ICA) threat to close the Industrial Zone if no action was taken to prevent stone & marble slurry from reaching the Shoket WWTP, USAID offered support through haulage of this industrial wastewater. An emergency response project was established to eliminate illegal disposal into the municipal network and temporarily transport the waste material from over 150 factories within Hebron and the surrounding downstream areas to an approved disposal site for a period from July 2012 to June 2013.

[7] Annita, C., A. Tunesi, V. Barberini, L. Galimberti & A. Cavallo, 2005, *Chemical and Mineralogical Characterization of Cutting process Sludge Process*, *Exploration of sludge from stone working, Synthesis of the research*.
[8] Solid Waste Management (Council), 2012, *Sedimentation Structure for Waste Water from Stone Cutting Industry.*

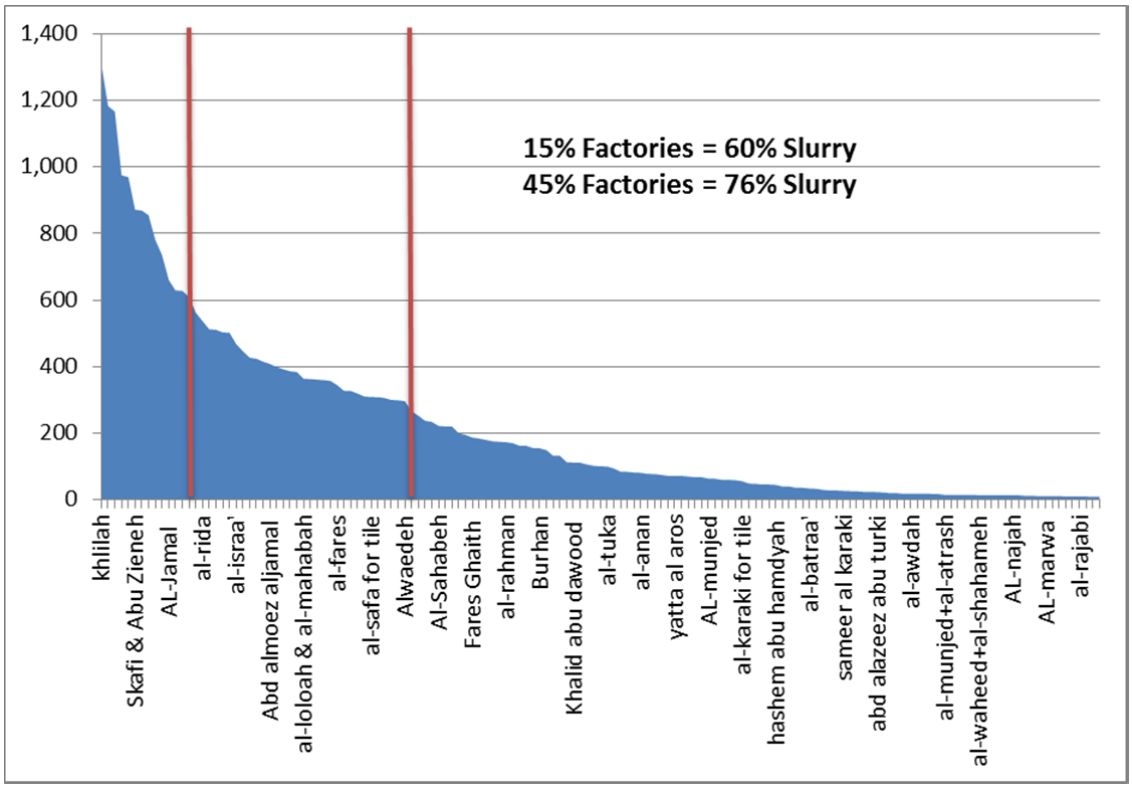
Table 6: Waste Volumes Transported by Month

Waste Type	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Grand Total
Slurry	10,868	7,731	9,426	8,752	9,434	10,218	8,294	8,520	9,519	9,912	9,823	102,497
Cake	6,386	7,107	6,501	8,979	8,404	7,098	3,979	3,623	4,134	5,768	8,137	70,116
Grand Total	**17,253**	**14,838**	**15,927**	**17,731**	**17,838**	**17,316**	**12,273**	**12,143**	**13,653**	**15,680**	**17,960**	**172,612**

Over the project period, an average of 9,500 m^3 (slurry) was collected monthly. Outside of Ramadan, production remained consistent varying between 8,500 – 10,500 m^3 as seen the in Table 6 above. All waste was either hauled to the Yatta Dumpsite to dry in temporary settling pools or to an abandoned quarry in Sa'er. The most notable aspect of individual factory production is that the industry almost mimics an exponential decay, whereby the top 15% largest factories contribute 60% of all slurry volumes, yet expanding this analysis to the top 45% highest-producing factories only translates into 76% as shown in Figure 6.

The importance of this relates to Pareto's principle, whereby 80% of the problem can be attributed to 20% of the offenders. These factories became key targets for compliance, haulage buy-in, and project support during the Emergency Project as most of the smaller factories would follow the lead of these larger factories – indicating that social and cultural influences could play a significant role in moving an unregulated industry towards compliance, especially in the absence of any formal inspection or enforcement.

Figure 6: Factories by Volume Production



The first step in preventing disposal into the sewer network was closing access points. Within the first two months of the project, a total of 45 illegal connections were closed at individual factories and 50 manholes sealed through coordination with the Municipality. While conscious efforts were made, and with significant headway, to reverse this prescribed "habit" as noted above, the general culture still has a long way to go. The unregulated disposal of slurry into the sewer network remains the greatest threat to the planned HRWWTP operations.

USAID emphasized its support for this Emergency Project was supplementary and in conjunction with efforts by local stakeholders to prevent the risk of closure through immediate action. Ultimately, the continued operations would be the responsibility of local stakeholders and so efforts were made to transition from a donor-supported haulage and disposal program to a sustainable, locally-operated solution. In an effort to maintain the successes achieved thus far, USAID has planned a phased, draw-down of staff in order to provide overlap with the existing team, allowing them to transfer knowledge and skills to the local counterparts.

3.3.3.1 Industrial Process & Pretreatment Options

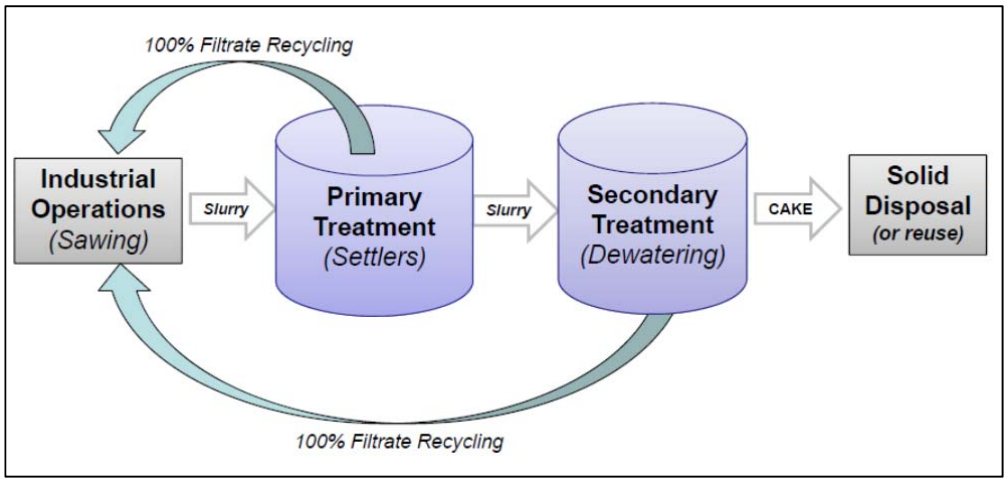
Simplifying the industrial process, there are four main components – Input (Slurry), Primary Treatment, Secondary Treatment, and Output (Cake). As indicated through the CH2MHILL Demonstration Projects (Appendix I), there are various technologies for solid/water separation. Each of these technologies has a corresponding initial capital cost, ease of user operation, maintenance cost, and return on investment (as measured by m^3 of reclaimed water).

Within this report's context, "primary treatment" refers to settlement by chemical (coagulants), mechanical (flocculation), or natural (gravity) means. These technologies are usually low capital cost, easy for users to operate, low running costs, and high yield – meaning the unit cost (NIS/m^3) of recovered water makes these technologies attractive to factory owners, as evidenced by their presence within the Industrial Zone. There are an estimated 32 settling pools and 79 settling silos currently under operation.

"Secondary treatment" refers to the next level of separation, which must take a thicker slurry mixture, as the byproduct from primary treatment, and apply considerable forces to extract additional water quantities. The resulting byproduct from secondary treatment is typically a solid cake containing 20% or less of water. The more common technologies include centrifugal systems (high velocity) and filtration systems (high pressure). These technologies are the opposite of primary treatment and are characterized by high capital costs, difficult for users and requiring technical knowledge, higher running costs, and low yield. The only secondary treatment technology observed within the Industrial Zone is the plate & frame filter press, where 25 exist, and of this amount, only 16 are currently operational.

Regardless of the exact system chosen, the purpose of these primary and secondary treatment technologies is to create a "closed loop" within the industrial process – whereby no liquid waste requires disposal as seen in Figure 7 below. Though the recovered water still contains small amount of fines (i.e. silt size), the filtrate is acceptable for reuse in wet sawing operations.

Figure 7: Closed Loop Process Diagram



It is critical to understand the importance of maintaining a "closed loop" system and eliminating any disposal of slurry wastewater into the sewer. As noted above, and illustrated in Appendix J, even secondary treatment systems like plate & frame filter presses are only capable of capturing particles larger than 50 microns under ideal conditions – anything smaller will pass through the system and become part of the filtrate. Academic studies have shown that filtrates can contain anywhere from 3-5% solids. Over time, buildup of this grit will take up volume in the process tank and accelerate wear on plant equipment.

Donors have initiated other projects aimed at introducing treatment measures and waste reuse to the Industrial Zone. Though there have been positive efforts towards promoting this closed loop system, increasing reuse of a scarce resource, and ideally updating operations to reflect current international industry practices, the implementation of these treatment measures generally fall short of the expected outcomes. For example, ten (10) plate & frame filter presses were installed at individual factories in 2002. Of those, four (4) are no longer operated. When asked why, all factories responded the "cost of maintenance" which averaged 1,500 NIS/moth.

Constructed in 2008, the Central Processing Plant ("Hagar") provided a pilot centralized dewatering system for the entire Industrial Zone. Noted in the Hagar *Post-Project Evaluation Report* and observed during the Emergency Project, the plant operates at 50% capacity on average due to a variety of reasons (repairs or maintenance, electricity shutdowns, staffing issues). At this efficiency, the plant can only roughly 15,000 m^3 of the slurry generated annually.

Another program is currently underway to procure 22 new "plate & frame" filter presses and repair nine (9) existing machines. As shown in Appendix K, approximately 50% of the monthly slurry produced should be eliminated through this program once all units are online. Depending on the operating efficiency of these systems, between 5,500 and 7,000 m^3 of slurry will remain and require further treatment or disposal.

The operational inefficiencies observed within the current framework suggest that future mechanisms may only function at 60 – 90% of the design capacity, even with 100% coverage (i.e. systems at all factories). For this reason, establishing a sustainable haulage and disposal program is essential in supporting any dewatering or reuse schemes as the foundation in the

stone treatment hierarchy (i.e. Haulage-Dewatering-Reuse, from simplest to most complex). Until a point where proper haulage becomes the basis of waste management, it is unlikely other, more advanced, schemes will realize their full potential.

3.3.3.1 Industrial Process & Pretreatment Options

Successful examples of proper haulage and disposal exist in Bethlehem and surrounding areas downstream of the Industrial Zone. Downstream factories are located in remote areas which force them to develop self-sufficient means of dealing with their liquid waste where, on the other hand, many factories in the Industrial Zone are directly situated above the sewer network. The most common method for waste management downstream is drying the liquid material in a special pool or open land, and then periodically excavating the cake once dried.

Furthermore, Bethlehem provides an interesting comparison given its similar size with roughly 186 factories between Bet Fajar (139), Al-Duha (42), and Al-Khader (5). Approximately 30% have filter presses with the largest concentrations in Al-Duha and Al-Khader, 40/45 and 3/5 respectively. The remaining slurry waste is either dried on adjacent lands for transported via contractor at 350 NIS/truck – almost double the proposed 200 NIS/truck for the Industrial Zone Transition Plan through the Hebron Municipality's local contractor.

Al-Duha and Al-Khader both have sewer systems, but no factories dispose of their waste via the sewer due to a stronger authority presence, and most importantly, a culture of compliance among the factory owners. It was indicated that tough rules from the water and sewage authority prevented factories from illegal disposal, and over time, it became part of the culture.

3.3.3.1 Industry Barriers

The cultural and political external influences of Hebron cannot be ignored as they play a major role in the actions of the stone & marble industry. With over 90% of the factories located inside the Industrial Zone, designated as H2, monitoring and enforcement of the area presents a real challenge to local authorities. While international interventions could be planned to allow for greater access to this specific area in order to better monitor and regulate the Industrial Zone, other indirect actions as noted below can be taken to achieve the same results.

Although the local authorities and regulatory framework do not carry much weight inside the Industrial Zone, cultural perceptions and financial incentives are strong drivers. Since the "technical" solution is already available (i.e. proper haulage & disposal), the difficultly resides in structuring this solution in a way that motivates factories towards compliance. As suggested within the Recommendations Section of this report and as provided through the Emergency Project Transition Plan, the continued support of the Hebron Municipality in successfully launching and maintaining a haulage and disposal program will assist in shifting the current culture of sewer disposal, more similar to Bethlehem or even the Industrial Zone pre-Intifada. Beyond the physical haulage and disposal, it is extremely important to undertake efforts which address the cultural aspect of the industry, such as through public awareness campaigns, strong penalties for offenders, and incentives for those in compliance. This, in conjunction with a strengthened Municipality as outlined in the *Recommendations Section*, will help to ensure that the illegal disposal does not resume in the future.

3.3.4 Olive Mills

Most industrial activities around Hebron may be dispassionately analyzed as for-profit enterprises, amenable to financial "bottom-line" incentives and disincentives. By contrast, the entire olive business (from land to tree to harvest to pressing) is emblematic of the traditional life of the region, and in particular of the West Bank. The olive grove and its ability to "pay its way" generation after generation have been and continue to be an important part of personal and communal identity.

Regrettably, the wastewater discharged from olive presses presents a mix of characteristics that can create problems for direct discharge to the municipal sewer system. These characteristics are described in detail in the following sections, but include:

- Extremely high organic strength and solids loads,
- Low biodegradability,
- Organic acids,
- Naturally-occurring substances (e.g., phenolic compounds, pectins, and tannins) which at high doses are toxic to the microorganisms in domestic wastewater treatment plants.

Given the nature of these wastes, the applicable treatment mechanisms require complex processes. The CAPEX and OPEX for such works are beyond the capability of small, artisanal enterprises such as these olive mills. Low-technology approaches (i.e. settling tank, filter, etc.) would provide no measurable treatment.

In the following discussion, the case is made that on an interim basis, the three olive mills now connected to the sewer system may not pose a major threat to the HRWWTP. For long-term planning, protection of the HRWWTP could be assured by disconnecting these mills from the sewer system. This would require the trucking of olive mill waste (OMW) to a separate liquid treatment facility. This independent OMW treatment plant could either provide pretreatment, with compliant discharges sent to the municipal sewers, or an entirely offline system with the product water made available for industrial/agricultural reuse, or simply discharged.

3.3.4.1 Process Optimization

Multiple sources of information exist that refer to means of altering olive press operations in ways that would reduce the discharge of harmful substances in the produced wastewaters. These mostly require changing press equipment to more modern technologies. Given that the olive pressing operations in Hebron are low-budget facilities, it is unlikely anything more than minimal changes would take place in the foreseeable future. The following analysis is based on the expectation that in the near term, olive mills to operate more or less as in the past.

3.3.4.1 Wastewater Characteristics

Data shown as "West Bank OMW" in Table 7 below is from a study of twenty olive mills in the Nablus – Tulkarem area (2003 – 2004). The "Galilee OMW" data was obtained from different olive mills in the area (2004), but no statement was made on how many mills were included. In the absence of information to the contrary, the Discharge Team assumed the nature of processes used in Hebron would be similar to that characterized in the noted cases. On that basis, 10,000 mg/l was selected as a higher phenols estimate for calculating Hebron OMW.

Table 7: Typical Olive Mill Concentrations

Characteristics	Traditional (low– tech) Processes (1990) [9]		West Bank OMW (2004)[10]	Galilee OMW (2004)[11]
Parameters	**Weak**	**Strong**		
pH	5.0	4.5	4.5	5
Total Solids	120,000	120,000	2,700	
VSS	105,000	105,000	2,500	500
TSS	15,000	15,000		
COD	120,000	130,000	65,000 *	163,500
BOD	90,000	100,000	40,000 to 200,000 *	27,500 **
Polyphenols	10,000	24,000	2,500	6,800
Oil	3,000	100,000	6,300	

Note: All values expressed in mg/L
** and **: See footnotes for further details*

3.3.4.1 Hydraulic Impacts (Collection and Treatment)

The report, *Management of Olive Mills Wastes in the Palestinian Territories*[12], quantifies the production of OMW at 1,000 m^3/yr for the average mill. If the pressing extends for three months, there are roughly 80 working days (i.e. 13 weeks at 6 days/week), translating into 13 m^3/ day. The Hebron Discharge surveys identified three olive presses connected to the municipal sewer, so estimated total OMW flow to the sewer is approximately 39 m^3/day. With a dilution ratio of 333:1 (13,000 m^3: 39 m^3), OWM constitutes only 0.3% of plant influent.

3.3.4.1 HRWWTP Process Inhibition

The presence of phenols in wastewater at high concentrations can degrade treatment operations by inhibiting the desired aerobic biological processes. Process inhibition is noted at plant influent concentrations of 50 mg/l [13]. USAID work in 2001[14] cites USEPA Maximum Allowable Concentrations (MAC) of 10 mg/l. Recognizing that the label "phenol" includes a

[9] "Pretreatment of Olive Oil Mill Wastewater", HuseyinEvcil, September 2005. Dokuz Eylul University. Based on Sengül F. (1991); "Waste Characteristics and Treatment of Industrial Wastewaters", Izmir, Turkey.
[10] "Management of Olive Mill Wastes in the Palestinian Territories" A paper by Shaheen and Karim, based on their publication "Management of Olive- Mills Wastewater in Palestine"; Hafez Shaheen & Riyad Abdel Karim, An-Najah National University, Nablus, Palestine. 2007
[11] "Reducing the Environmental Impact of Olive Mill Wastewater in Jordan, Palestine and Israel",BasheerSobhi, SabbahIsam, Yazbek Ahmad and Haj Jacob, SaleebaAhlam, R&D Center, Galilee Society, Shefa-Amr, Israel.
[12] "Management of Olive Mill Wastes in the Palestinian Territories" A paper by Shaheen and Karim, based on their publication "Management of Olive- Mills Wastewater in Palestine"; Hafez Shaheen&Riyad Abdel Karim, An-Najah National University, Nablus, Palestine. 2007
[13] "USEPA Wastewater Treatment Manuals: Primary, Secondary and Tertiary", (citation needed), Table 11.1
[14] West Bank Integrated Water Resources Program Ph. III, Task 8, "Stormwater, Domestic Wastewater, and Industrial Wastewater Master Plan for Hebron" July 2001, Volume 1, Final Report. Table 5-2.
* Note that COD = 65,000 is not consistent with BOD > 65,000. These values are from different parts of the report, suggesting that the COD = 65,000 is a low- range value, compatible with BOD = 40,000 mg/l.
** Note that this BOD is unusually low relative to COD = 163,500. The measurement of high BOD values is problematic under the best of circumstances. The presence of inhibitory substances (phenols, tannins) might be partly responsible for anomalies.

variety of forms with varying toxicities, these numbers are taken as representing an approximate range of inhibitory levels, not as certain control points.

From the above, an estimated phenol loads in the influent to the HRWWTP is roughly 30 mg/l based on the 10,000 mg/l concentration and 333:1 dilution ration, suggesting – but not proving conclusively – that OWM discharge to the municipal sewer may not interfere with HRWWTP processes in the near term. This observation is based on reasonable assumptions, which need to be confirmed through sampling and further data analysis.

Since the pressing season is roughly October – December, this study was unable to perform any characterization of the discharge from the three olive mills connected to the Hebron sewer system. In order to minimize uncertainty about the impacts of these mills, it is recommended that a wastewater sampling be conducted during the pressing season. Sampling should characterize the discharged waters from these presses, as well as the aggregated wastewater flows from a sampling point south of Highway 60. This would either confirm or challenge the observation that the olive press wastewaters might be unimportant in the near term.

3.3.4.2 Anticipated Future Concerns

The above analysis has found due to the fact that only a few of the region's olive presses are connected to the sewer system, thus effects upon the HRWWTP are likely to be imperceptible. Thus, while the "do nothing" option is likely to be valid in the early years of WWTP operations, it is not likely to be valid in perpetuity. The situation is subject to several variables:

- Actual concentrations of phenols in the mills' effluents are higher than those cited in the literature. This could lead to process interference at the proposed HRWWTP.
- Toxicity of the actual phenol forms is greater than found in the literature. The biological phenols and polyphenols found in OMW may not have the same inhibitory properties as a pure phenol product from a refinery. Thus, the toxic interference concentrations found in the literature (10 – 50 mg/l) might overstate or understate actual bio-toxicity.
- Sewer system is extended to include more or all of the twenty olive presses in the region. This would increase the OMW impacts upon the HRWWTP notably.

Since these scenarios lead to the need to manage OMW actively, each should be explored. It would be prudent to accept that, in the future, the HRWWTP will need to be protected from the effects of OMW. As is the case with other protective interventions, this can take the form of either pretreatment for discharge to the sewer or complete separation from the sewer system.

3.3.4.3 Recommended Sampling and Analysis

As guidance for these decisions, a sampling program should be conducted during the middle of the olive pressing campaign. Sampling locations recommended are:

- Discharges from each of the three olive presses, proposing two from each mill on non-consecutive days. *Purpose: Characterize sources*
- Collect samples from the outfall manhole approximately 1 km south of Route 60. *Purpose: Characterize blended Hebron sewer discharge*

- Sample from Wadi As-Sammen downstream from the above manhole. Point should be above the proposed HRWWTP and above any apparent inflows from communities or industrial / OMW discharge into the wadi. *Purpose: Check on transformations in transit*

Analytical suites: Capture the usual wastewater treatment parameters, plus a characterization of forms of phenols, as there may be differences in toxicity between an analytical-grade phenol and a naturally-occurring phenol, potentially complicated with organics.

Test Program to Characterize Existing Wastewater

1) Confirm discharge characteristics of Hebron OMW.
2) Calculate the predicted phenol mg/l at downstream points in the collection system, assuming phenol is a conservative substance that can be predicted on mixing ratios.
3) Measure actual phenol concentrations of the combined wastewater as it leaves Hebron to compare with the values predicted above. The phenols may interact with other wastewater constituents in ways that reduce the values predicted by the blending ratios.
4) Measure actual phenol concentrations downstream. The purpose is to better predict the phenol concentrations that may enter the HRWWTP in the "do nothing" case.
5) Toxic interference check by dilution; a low-technology screen for presence or absence of inhibitory substances in combined wastewater can be done by running BOD tests at successive dilutions. If changes are noticed as the sample is diluted, this can indicate the presence of biological inhibitors. Yields no information on the nature of the inhibition, and would only show there are one or more substances suppressing biological activity.

Test Program to Identify and Quantify Bio-toxicity

Maximum concentrations of phenol found in standard references may (or may not) provide useful guidance to assess process interference with the WWTP. In order to establish a higher level of confidence, it might be wise to commission a bio-toxicity study of the actual OMW. This would best be done in conjunction with the above – mentioned Wastewater Characterization test program. Such a test program would use representative quantities of combined OMW mixed in appropriate proportions with actual Hebron wastewater. This program could lead to the rational establishment of phenol concentrations that are protective of the wastewater treatment process. In the absence of actual bio-testing, one is at risk of selecting concentrations from the literature that are either overly demanding or fail to be protective.

3.3.4.4 Treatment and Pretreatment

Technologies to treat OMW are capital-intensive and incompatible with distributed small-scale pretreatment at individual mills. The olive mills connected to the sewer system are, by definition, in urban settings so onsite wastewater management options that might be available in rural areas where large tracts of land might allow an individual mill to manage its own wastewaters, are unavailable. Rural olive mills needing a stand-alone system could apply:

> *"System consisting of an initial phased separation tank followed by an extensive overflow treatment system (treatment lagoons/ponds, terrestrial disposal etc.). The sludge may undergo biological treatment or be dehydrated and disposed of at waste disposal sites."*[15]

From the above, it may be seen that even if land were plentiful and inexpensive, the costs for such a self-sufficient system are excessive for any small operations. Thus, the only practicable intervention is to truck these wastewaters to a central OMW treatment facility. If this facility were designed to receive the wastewaters from all olive mills in the region, the required capacity would be approximately 300 m^3/day to allow for peak, and not average, days.

At a pre-design level, inquiries could be made into cost tradeoffs between treatment rates that match daily delivery rates vs. construction of storage basins / tanks that would allow the treatment system to run at a lower rate over longer time periods.

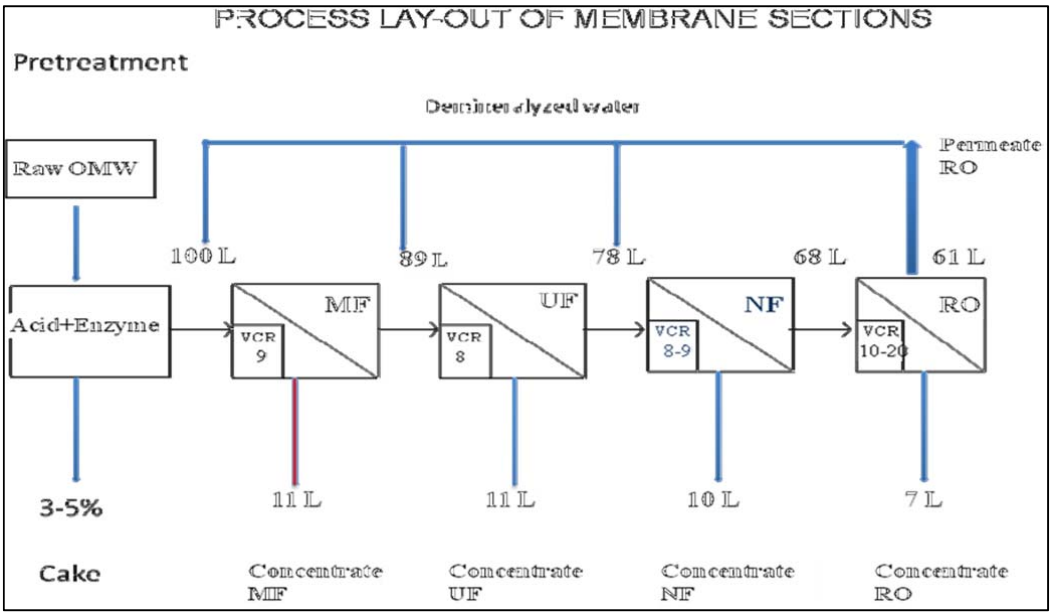
Many technologies exist, but most involve the addition of chemicals and the creation of large quantities of waste sludge, which present disposal problems. Although polyphenols can be considered an environmental problem, they belong to a very important category of antioxidant, phytochemical compounds that are useful for the pharmaceutical and cosmetic industry.

The treatment technology best suited to the extraction and recovery of marketable byproducts from OMW is membrane filtration[16]. Using a progression of finer filter stages [microfiltration (MF), ultrafiltration (UF), Nano filtration (NF) and reverse osmosis (RO)] the quality of the product water (i.e. permeate) is progressively upgraded while creating a succession of side-streams of reject byproducts, all of which are either benign or have marketable value. A simple design schematic detailing this process is shown in Figure 8 below.

[15] University of the Aegean, INNOVATIVE OLIVE MILL WASTE MANAGEMENT SYSTEMS Workshop on November 1, 2002 in Mytilene
http://www.aegean.gr/environment/eda/naias/news_workshop.htm

[16] http://www.srcosmos.gr/srcosmos/showpub.aspx?aa=14356 "New Olive Mill Wastewater Process to Eliminate Environmental Load and to Recover Several fine Chemicals and Poliphenols and Purified Water" M.PIZZICHINI, C.RUSSO, D.PIZZICHINI*, M. VITAGLIANO*ENEA, Department of Biotechnology, Agro-industry and Health; Casaccia Research Centre, Rome, Italy*GENELAB s.r.l. via Roma 31, PalazzoloAcreide, Siracusa, Italy

Figure 8: OMW Membrane Filtration Schematic



Beginning with phenol concentrations of 4,660 mg/l, the product water contains 12 mg/l. CODs are reduced from 130,000 to 90 mg/l. Thus, the product water is a marketable asset, with a potential to provide an income stream to offset part of the capital and O&M costs for treatment.

This source further states:

- MF/UF retentate can be used in the food industry as an additive for bread, pizza, etc.
- NF concentrate contains purified polyphenols . used as a food integrator.
- RO concentrate contains 52 to 70% of the hydroxytyrosol present in the raw OMW.
- All concentrate fractions, including UF, are requested in the food industries and in the nutraceutical sector.
- The purified water, representing the highest volume fraction, shows a COD level of 100 ppm O_2, having the characteristics of potable water.

Thus, the membrane technologies offer prospects of converting 100% of the OMW into marketable components.

Costs for such systems were referenced[17] from 2012, as follows at 10m^3/ hr:

- Initial Capital Cost – €2,000,000
- Annual Operation Cost – €1,000,000

[17] "New techniques in olive mill wastewater treatment (OMW)"
European Commission FP7-Regions-2009-1 STInno project (245405).
Arvaniti, E. C.17,2, Zaglis, D.P.1,2, Papadakis, V.G.3 &Paraskeva, C.A. 1,2

Note that the estimated generation rate for three olive mills in Hebron is only 39 m^3/ day so a feasible design for a regional OMW plant would be 18 mills, at 13 m^3/ day or 10,000 l/hr. It is coincidental that the estimated flow rate matches the facility described in the referenced report.

Offsetting income streams are:

- "Nutritious fraction" – €250,000/yr (2,500 T/yr @ €100/T UF concentrate)
- "Toxic fraction" (herbicide) – €3,750,000/yr (7,500 T/yr @ €500/T RO concentrate)
- Product water – Local Market Value (40,000 T/ yr)

This report does not assert markets for these products exist in Hebron, so the above is not presented as proof that OMW treatment can be financially self-sustaining. The above is a discussion case to challenge the mindset that pollution control is a massive outflow of capital and operation money and labor. By creating a shared treatment facility, it is possible to protect the HRWWTP in a manner that is likely to be less expensive to the community than would be the case for technologies that convert contaminants from the liquid to a semi-solid form.

3.3.5 Previously Unidentified Industries

As a result of the survey effort, industries that were not previously identified as significant sources of industrial discharge were identified.

3.3.5.1 Hospitals

As a result of the Joint Service Council's Medical Waste Law, hospitals have separate containers and discharge practices for blood, medicine and medical instruments, and offal. Water mixed with cleaning and sanitation materials (chlorine, detergents, soaps, industrial salts) is discharged into the sewer, along with x-ray developing solution. As stated in other examples in this Report, materials like silver should not be discharged. The fact that this material has marketplace value should facilitate separation from the liquid wastes stream.

3.3.5.1 Dry Cleaning

Water mixed with detergents and particulate from soiled garments is discharged into the sewer. The main chemical used in dry cleaning, Perchloroethylene, at a range of 6 – 350 kg/year (depending on whether the business has a pretreatment system), is also discharged into the sewer system as a viscous sludge once a year after multiple reuse cycles. The impact of this chemical comes not from its potential impact on the HRWWTP, but the fact that it is a carcinogen and could pose serious health and safety concerns, particularly given the intended reuse of waste. With the significant impact of any potential wastewater leakage of PCE into local water supply, investigations should be made into means of recovery of PCE at the point of use.

3.3.5.2 Olive Mills

Mill wastewater contains high concentrations of substances (principally phenols and tannins) that can inhibit treatment by conventional processes. However, since the hydraulic contribution of these wastewater sources is about 0.3% of total plant flow, it is likely that the presence of the three small olive mills within Hebron would not impact either the design or operation of the HRWWTP. The pressing, and therefore discharge, season is roughly from October to December.

4.0 Industrial Wastewater Assessment for Hebron

4.1 Estimated Impacts of Industrial Wastewater

Coupling the technical industry data with the completed field survey results, a risk matrix was generated (shown below and included as Appendix L) to illustrate the different risks within each industry and their impact on the HRWWTP system. The HRWWTP system has six phases, or stages, at which the pollutant could negatively affect the system. These were separated into: Collection, Hydraulic Load, Organic Load, Plant Process, Irrigation Reuse, and Health/Safety.

Figure 9: Industrial Pollutant Risk Matrix

Risk Details		Impact Categories / Risk Factor					
Industry	Risk Description	Collection	Hydraulic Load	Organic Load	Plant Process	Irrigation Reuse	Health / Safety
Olive Mills	Phenols	0.15	0.07	0.21	0.81	0.15	0.03
Tannery	Chromium	0.05	0.21	0.21	0.81	0.21	0.07
Tannery	TSS	0.15	0.21	0.35	0.63	0.09	0.03
Stone & Build Mat.	solids - fine	0.15	0.21	0.21	0.63	0.09	0.03
Tannery	Phenols	0.15	0.21	0.21	0.63	0.15	0.03
Olive Mills	TSS	0.15	0.07	0.63	0.45	0.09	0.03
Dairy	TKN	0.15	0.21	0.49	0.45	0.09	0.03
Dairy	TSS	0.15	0.21	0.49	0.45	0.09	0.03
Slaughterhouse	TKN	0.05	0.21	0.35	0.45	0.09	0.03
Tannery	TKN	0.05	0.21	0.35	0.45	0.09	0.03
Tannery	Sulfur forms	0.25	0.21	0.35	0.45	0.15	0.07
Metals Finishing	CN (cyanides)	0.05	0.07	0.21	0.45	0.15	0.07
Tahina	TSS	0.15	0.21	0.21	0.45	0.09	0.03
Tannery	Salts, TDS	0.05	0.21	0.21	0.45	0.21	0.03
Tahina	Salts	0.15	0.21	0.07	0.45	0.21	0.03
Dairy	Oil & Grease	0.25	0.21	0.63	0.27	0.09	0.03
Dairy	BOD, COD	0.05	0.21	0.63	0.27	0.09	0.03
Olive Mills	BOD, COD	0.15	0.07	0.63	0.27	0.09	0.03
Slaughterhouse	Blood	0.15	0.21	0.63	0.27	0.09	0.05
Slaughterhouse	Oil & Grease	0.25	0.21	0.49	0.27	0.09	0.03
Tahina	BOD, COD	0.05	0.21	0.49	0.27	0.09	0.03
Tannery	BOD, COD	0.05	0.21	0.49	0.27	0.09	0.03
Tahina	Oil & Grease	0.15	0.21	0.35	0.27	0.09	0.03
Vehicle Washing	Petroleum Byproducts	0.15	0.21	0.35	0.27	0.09	0.05
Vehicle Washing	Oil & Grease	0.25	0.21	0.35	0.27	0.09	0.03
Vehicle Washing	Solvents	0.05	0.21	0.35	0.27	0.09	0.05
Dry Cleaning	Perchlorethylene	0.05	0.07	0.21	0.27	0.15	0.09
Hospitals	Detergents	0.05	0.07	0.21	0.27	0.09	0.03
Metals Finishing	pH	0.15	0.07	0.21	0.27	0.09	0.07
Stone & Build Mat.	solids- heavy	0.35	0.21	0.21	0.27	0.03	0.03
Stone & Build Mat.	soluble, near soluble	0.05	0.21	0.21	0.27	0.09	0.01
Tannery	pH	0.25	0.21	0.21	0.27	0.09	0.07
Vehicle Washing	Detergents	0.05	0.21	0.21	0.27	0.09	0.03

In terms of this assessment's objective, the primary concerns are the Hydraulic Load, Organic Load, and Plant Process as severe impacts here could render the plant inoperable. As such, these were given the highest impact factor, as seen in Table 8 below. It is not to say that the other values translate to "unimportance". Irrigation Reuse and Health/Safety are things the donors and designers are very aware of and concerned about; it simply means that these aspects would not directly affect the plant's operations.

Table 8: Category Risk Factor

Impact Category	Risk Factor
Collection	0.5
Hydraulic Load	0.7
Organic Load	0.7
Plant Process	0.9
Irrigation Reuse	0.3
Health/Safety	0.1

With that said, there are other areas which the donors and designers should further investigate, like Collection, since there are other potentially adverse impacts to the system, but not the plant. For example, certain industrial chemicals (especially sulfur forms) can erode concrete pipes and the buildup of solids within the pipes could cause disruptions to the expected daily flows.

Following the designation of risk factors for each category, individual pollutants were ranked on a scale from Very Low to Very High, with Very Low represented as "0.1" and Very High represented as "0.9". These designations were based on the available technical and understanding of the pollutants on the wastewater treatment process. The resulting heat map of the risk matrix (shown above) indicates which industries and corresponding pollutants would present the highest risks for the HRWWTP.

4.1.1 Hebron City Flows and Loads

4.1.1.1 Hydraulic Loads

A key input to the W+B design basis is the wastewater flow quantification, reported by Roberto Zimmerman Environmental Engineering, which was based on investigations performed between May 6- 12, 2012. The sampling program was conducted on two manholes that capture wastewater flows from segments of the collection system; both were located above the Industrial Zone with the intent of characterizing the residential portions of the service area; however, except for stonecutting and tanneries, the majority of the non-residential wastewater generators are distributed throughout the service area. Thus, the data gathered may best be understood as representing a mixed domestic/industrial wastewater.

These data and interpretations are captured in:

- Deliverable 1a – Measurement of Wastewater Flows and Loads
- Deliverable 1b – Baseline and projections of future wastewater flows and loads

The data gathered verifies the locations were well-selected, as the TSS data were in the range characteristic of domestic wastewater. The sampling points are shown in Section 2.2.4 as orange squares, labeled "2012 CEC". The northern point was identified as "Location 1, Main Sewer"; the southern as "Location 2, Side Sewer". The campaign measured flow at both manholes for seven days and collected wastewater samples from only Location 1.

The estimated daily average flows for this test are:

- Location 1 – 8,443 m^3/ day
- Location 2 – 2,217 m^3/ day
- Total – 10,660 m^3/ day

Deliverable 1a estimates that Location 1 captures 65% of the domestic wastewater. This report confirmed that the neighborhoods served by Location 2 capture roughly 35% of the residences in the sewage network boundaries, in agreement with Deliverable 1a. Deliverable 1a cites 155,482 persons as the connected load. Thus, Location 1 includes 100,000 persons and 55,000 for Location 2. From this the calculation follows:

- Location 1 – 84 m^3/ 1000 persons (84 l/ cap- daily)
- Location 2 – 43 m^3/1000 persons (43 l/cap- daily)

Since the composition of each tributary area is not demonstrably different, there appears to be a discrepancy in the flow determinations. The hydrograph for Location 1 has a normal sinusoidal shape and a peaking factor (i.e. peak/average) of 2.3, which is reasonable for a mid-sized city. Examination of the hydrographs for Location 2 shows multiple periods (20 – 50 minutes) of zero flow between 2AM and 6AM. It is not possible for the wastewater flow from 55,000 people to go to zero for an instant, much less for 30 minutes. The peaking factor from these data calculates as 4.5, which would be characteristic of a very small community (say, 100 people). This indicates that the flow data from Location 2 could be invalid, but further exploration was outside the scope of this study; discussions provided herein are meant to serve as points of interest for the donor community to follow up with the respective parties. The below provides a comparison of the estimates calculated and measured for Location 2:

- Deliverable 1a: Using the 65/35 sewer-separation weighting, flow is 4,456m^3/day
- Discharge Study: Estimated credible flows from this sub-basin, based on a population of 55,000 at 64 l/cap-day results in 3,520 m^3/day. A minor industrial presence contributes an estimated 300 m^3/ day for a total flow of 3,820 m3/ day.

Above values indicated above are much higher than the reported 2,217 m^3/ day for Location 2. As a result, the Discharge Team decided to use 3,800 m^3/ day which adds about 1,600 m^3/day to the estimated total flow (i.e. L1 + L2 = 8,443 + 3,800 = 12,243 m^3/ day vs. 10,660 m^3/day).

Deliverable 1b (Table 6) shows a Scenario 1 projected WW flow rate of 12,264 m^3/ day for Year 2015, which is identical to the above estimate of 12,243 m^3/ day for Year 2013. The projected 2027 flow rate is 26,308 m^3/ day. From this it can be concluded that the worst-case scenario is design loads might be reached two years earlier than planned. This is not seen as invalidating the planned design case and nor its planned construction timeline.

4.1.1.2 Organic Loads

Based on review of CEC/W+B design deliverables and follow-up discussions, the organic loads (expressed as pollution per population equivalent) proposed for Hebron City, as seen in the adjacent Table 9, represent a municipal waste – or mixture of both domestic and industrial wastes. According to the designers, these assumptions were later confirmed during the 2012 sampling campaign conducted and also verified against other WWTP design standards.

Table 9: Design Loading Rates

Item	Unit	Concentration
COD	gpcd	140
BOD	gpcd	60
TSS	gpcd	70
TN	gpcd	11.7
TP	gpcd	2.2

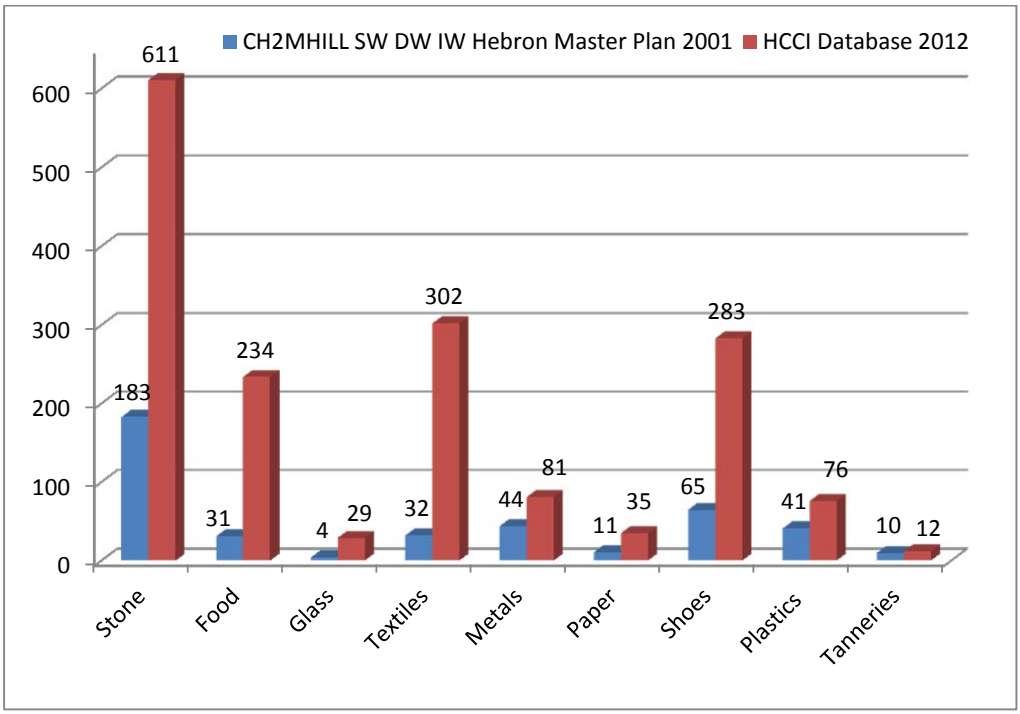
Two concerns remain regarding the classification of industries. First, the Industrial Zone does not formally adhere to the term – meaning many industries exist outside of this area. The decision for location is based primarily on land – whether the space is already available and family-owned or what the unit cost of purchasing the land is (NIS/dunnum) and how much the intended factory owner can allocate to this purchase. Without a more formal arrangement controlled by local authorities, it is impossible to assume where new factories will emerge given

the decision is almost entirely financial, and therefore the potential impact of new factories can only be examined on a case-by-case basis.

Second, the industrial reference was the 2001 Hebron Master Plan, which listed only 438 industries while the current HCCI Craftsmanship Directory identifies 2,226. As seen in Table 10 below – the industrial growth varies, with some categories seeing no growth (i.e. tanneries), expected growth (i.e. in line with population), and great expansion (i.e. stone). As discussed earlier, the organic loads for industries are highly variable, often differing by several magnitudes in some categories (e.g. BOD for slaughterhouses versus stone & marble). For this reason, a more complete estimation of the potential loads would be appropriate if based on industry-specific concentrations. This would further verify that the industries within Hebron City are sufficiently covered within the plant's design.

Impacts to the future plant are unknown for any new industries which may come online inside Hebron City. Generally, it can be said that the design capacity of the HRWWTP would be reached sooner if no pretreatment requirements are required by the local authorities.

Figure 10: Industry Comparison from 2001 – 2012



4.1.2 Industrial Zone Flows and Loads

As outlined in Section 3.2.3, a catalog of the Industrial Zone was necessary to estimate the flows and loads from this region, which is currently excluded from the HRWWTP design. Utilizing existing sources, 278 factories representing 15 industries were identified and 5,000 residents were estimated. These values were cross-checked against the team's field surveys, GIS ground-truthing, and available PCBS census data.

4.1.2.1 Hydraulic Loads

Calculated from the field surveys conducted, estimated wastewater volumes totaled roughly 1,400 m^3 daily for the Industrial Zone. Of this amount, 70% can be attributed to four industries: Building Materials, Car Maintenance/Washing, Stone & Marble Cutting, and Tanneries. The remaining 400 m^3, or 30%, corresponds to 20% residential and 10% industrial contributions. Several industries indicated zero industrial wastewater, yet provided surveyors with their domestic waste productions so it could be reasoned the remaining 30% is characterized principally by domestic wastewater volumes. To conclude, the hydraulic impact of the Industrial Zone equates to 7% of the design average daily flow (15,249 m^3) assuming all factories and residents, except the Stone & Marble industry (~ 400m^3), are connected to the network and contribute approximately 1,000 m^3 of wastewater daily.

4.1.2.2 Organic Loads

Industry concentrations were based on available information, both locally completed studies and general industry best practices. The resulting calculation, seen in Table 10 below, illustrates loading impacts on the HRWWTP if including the Industrial Zone within the current design. Again, all factories and residents were included, except for the Stone & Marble industry based on their designation as a major "industry of concern" as discussed in further detail herein.

Table 10: Industrial Zone Pollutant Loading Estimate

Industrial Zone	Total Factories	WW Per Factory	WW Total	Estimated Loads (kg/d)				
Industry Types	*No.*	*m^3/d*	*m^3/d*	*BOD*	*COD*	*TSS*	*TDS*	*TKN*
Building Mat	44	5.78	254.3	---	12.7	946.0	---	---
Car Wash	11	12.67	139.3	14.0	30.1	10.9	59.0	1.0
Ceramics	9	0.36	3.2	0.8	1.3	---	22.0	---
Food	8	5.58	44.6	35.7	62.5	98.2	56.7	---
Glass	1	1.22	1.2	---	0.2	0.0	---	---
Industrial Equip	13	0.38	4.9	0.0	---	1.0	10.7	0.2
Metal	24	0.19	4.6	0.0	---	1.8	20.0	0.4
Paper	1	0.28	0.3	0.1	0.7	0.5	0.6	---
Plastics	3	5.58	16.7	3.0	19.2	13.7	16.6	---
Shoes	2	0.00	0.0	---	---	---	---	---
Slaughterhouse	7	2.38	16.7	41.6	97.4	21.1	62.9	9.5
Stone Cutting	130	2.75	358.0	---	35.8	2,663.7	---	---
Tanning	12	17.50	210.0	370.9	722.4	831.6	1,785.0	63.0
Textiles	4	0.00	0.0	---	---	---	---	---
Wood	9	0.01	0.1	---	---	---	---	---
Residential	5,000	0.06	320.0	300.0	700.0	300.0	---	58.5
TOTAL				**766**	**1,682**	**4,889**	**2,033**	**133**

If these loads are directly included with the projected Hebron City estimates, it will shift the future design from the proposed 2070 to the 2030 scenario. As noted earlier, it doesn't mean that these loads will prevent the HRWWTP from operating as designed, just that the design capacity will be reached sooner than initially planned, unless measures are taken by the local authorities to address the pretreatment and disposal of these wastewater streams.

4.1.3 Health and Safety Impacts

While many of the industries in Hebron do not present an immediate concern to the functionality of the HRWWTP, the chemicals used in the production and cleaning processes of some industries have environmental and public health implications. The most notable being perchloroethylene (PERC), the major chemical used for dry cleaning. The concern is that the once yearly dumping of this chemical is a sizeable addition of a carcinogenic chemical to the waste stream. Perchloroethylene can also be a common soil contaminant, and because of its mobility in groundwater, its toxicity at low levels, and its density (which causes it to sink below the water table), cleanup activities are extremely difficult if leakage occurs. PERC can contribute to the formation of photochemical smog when it reacts with other volatile organic carbon substances in air. These reactions tend to eliminate PERC before it reaches the upper atmosphere in amounts sufficient to damage the ozone layer.

Additional chemicals of concern found in industries in Hebron are:

- Sulfuric Acid (H_2SO_4): Can cause severe skin burns, dry, red, cracked skin (dermatitis), blurred vision, and eye damage. The chemical can also harm the respiratory system, and is associated with cancer of the larynx and lung cancer, with severe exposure causing death. Environmentally, sulfuric acid will travel along the air currents until it is deposited as wet acid deposition (acid rain, acid fog), and has moderate chronic (long-term) toxicity to aquatic life. It is very corrosive and would badly burn plants, birds or land animals exposed, and larger quantities may lower pH for extended periods of time.

- Hydrogen Sulfide (H2S) gas. This gas is generated in wastewater collection systems (sewers) in settings where sulfur forms are present in oxygen- depleted aqueous solutions. High S concentrations from industrial discharges provide the needed sulfur. High BOD wastewaters provide the needed oxygen starved (reducing) environment, and warm wastewater temperatures enhance the reaction rate. All of these factors are present in the Hebron collection system, so it is reasonable to expect that H2S would be present in the atmosphere in the sewers and manholes. Occupational exposure to H2S is a major risk to personnel working in confined spaces (manholes). H2S is lethal at doses that can be found in manholes.

- Nitric Acid (HNO_3): Concentrated forms and its vapors are highly corrosive to the eyes, skin, and mucous membranes, respiratory irritation, and fatal if ingested. Dilute solutions cause mild skin irritation and hardening of the epidermis, staining the skin yellow and producing deep painful burns. Environmentally, as a waste by-product of nitric acid production, oxides of nitrogen (NO_x) are very harmful to the environment and they can also aggravate the effects of climate change.

- Caustic Soda (sodium hydroxide (NaOH)): Alkalis such as this may gradually penetrate the deep tissues unless the adhered alkali is completely removed. In particular if the eyes are exposed to an alkali, since eye tissue is rapidly affected causing a lowering or loss of vision. Even a dilute solution can affect the tissue of the skin if it repeatedly comes into contact with the skin, which may cause dermatitis or chronic eczema. The inhalation of caustic soda dust or mist causes various degrees of injury in the respiratory tract. Environmentally, sodium hydroxide can readily react with water vapor in the air and produce aerosol or mists which are very corrosive. Concentrated aerosol compounds (silica, asbestos and etc.) may result in a number of diseases such as silicosis and black lung.

- Hydrochloric Acid (HCl): Corrosive to the eyes, skin, and mucous membranes. Acute inhalation exposure may cause coughing, hoarseness, inflammation and ulceration of the respiratory tract, chest pain, and pulmonary edema, corrosion of the mucous membranes, esophagus, and stomach. Dermal contact may produce severe burns, ulceration, and scarring. Chronic occupational exposure to hydrochloric acid has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion. Environmentally, hydrochloric acid forms a component of acid rain. It also contributes to the processes that cause photochemical smog.

- Polyethylene ($C_2H_4NH_2$): A suspected human carcinogen, or cancer-causing agent. When these bags come in direct contact with food, as in packaging, chemicals within the bag can leach out into the food and contaminate it. Environmentally, without special treatment it is not readily biodegradable, and thus accumulates.

- Phosphoric Acid (H_3PO_4): Corrosive to the skin and eyes. Contact can cause pain, redness, burns, and blistering. Permanent scarring and blindness can result. A severe exposure can cause death. Can burn the lips, tongue, throat and stomach upon ingestion. Environmentally, phosphoric acid entering the environment can acidify soils and waters.

- Oxonia (Hydrogen Peroxide 27.5%, Peroxyacetic Acid 5.8%): Cause irreversible eye damage and skin burns, and harmful if swallowed. Environmentally, the chemical is toxic to birds, fish, and aquatic invertebrates.

- Ammonia (NH_3): Affects human and animal health both as a gas and as a particulate. The particulate form of ammonia has broader implications for the general public, whereas the gaseous form is a localized concern for the health of animals and exposed workers. When in fine particulate (PM2.5) form, ammonium particles pose a risk to human health. Such small diameter particles are able to be respired and travel deep into lung tissue to the alveoli causing a variety of respiratory ailments such as bronchitis and asthma. Environmentally, both gaseous and particulate ammonia contribute to eutrophication of surface waters, soil acidification, fertilization of vegetation, changes in ecosystems, and smog and decreased visibility in cities and pristine areas.

Table 11: Chemicals by Industry

Chemical	Industry
Sulfuric Acid	Food Products, Dairy, Precious metals
Nitric Acid	Precious metals
Caustic Soda	Food Products, Dairy, Hospitals, Precious Metals, Dry Cleaning, Olive Mills
Hydrochloric Acid	Tanneries
Polyethylene	Plastic
Phosphoric Acid	Dairy (for cleaning)
Perchloroethylene	Dry Cleaning
Oxonia	Dairy (for cleaning stainless steel)
Ammonia	Tanneries

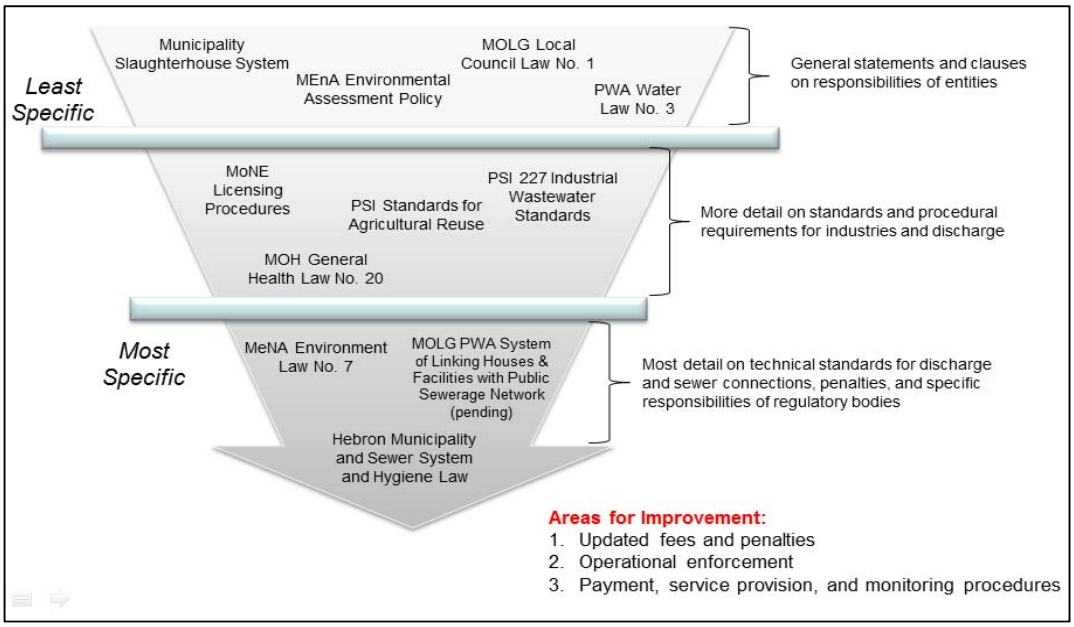
4.2 Legal and Regulatory Environment

4.2.1 Relevant Industrial Regulations

The regulatory framework for managing industrial wastewater is in place, with significant emphasis on the role of the Municipality in the creation of regulation, payment and enforcement mechanisms for wastewater discharge. Key regulations include Palestinian Standards Institute standards for industrial wastewater and agricultural reuse, and the 1986 municipal sewer system and hygiene control law (derived from 1955 Jordanian law). See Appendix M for a catalogue of all relevant regulations, and Appendix N for further details on articles and clauses relevant to wastewater management within these regulations.

Despite the existence of regulations that address wastewater, the regulatory framework lacks specificity on the municipal level in enforcement and violation procedures, and does not reflect the current economic, political, and commercial environment in the existing penal code. Regulations such as the PWA and MOLG bylaw, still pending approval, are critical for setting the foundation for actual application of sewage connection, payment, and discharge management policies. Figure 11 below presents the regulations in order of specificity, and highlights areas for improvement in the regulatory environment:

Figure 11: Hierarchy of Wastewater Regulations



4.2.2 Relevant Institutional Structures

The main relevant institutional bodies to the management of industrial wastewater are the Hebron Municipality, Hebron Governorate, Ministry of Local Government, Ministry of Environmental Affairs, PWA, Ministry of Health, Ministry of National Economy, industry unions, and Hebron Chamber of Commerce. See Appendix O for a matrix of regulations, sorted by institutions associated with the creation or implementation of the regulation.

4.2.3 Local Implementation Effectiveness

The regulatory framework places the Municipality at the forefront of institutional and operational management of the wastewater sector, with "cradle to grave" responsibility for the management of industrial wastewater due to their duties as the local service provider. Thus, the logical conclusion would be for the Municipality to develop and primarily enact a monitoring and enforcement plan, with support from the police, governorate, and ministries in creating points of access and intervention when violations do occur.

On the other hand, the Hebron Municipality faces many challenges in fulfilling their obligations as service-provider and regulator, most importantly:

- Geographically serving a mixed use residential and industrial area,
- Complex political environment due to H1 versus H2 designations, and
- Current lack of capacity to dedicate specific resources to accounting, fee collection, monitoring and inspection, and provision of services.

Thus, an intensive reform of municipal capacity and operations, or a technical operations committee or outside party will likely need to be created for consistent management and regulation of industrial wastewater discharge, especially from the most problematic industries

such as stonecutting. The JSC model for solid waste management serves as an especially salient case study in the success of haulage operations when a body outside the municipality provides operational support to municipal regulatory efforts.

5.0 Proposed Solutions and Mitigation Measures

5.1 Recommendations for HRWWTP Sustainability

5.1.1 No Action Impacts

This section highlights the available tools and approaches to achieve the desired technical results for proceeding with the HRWWTP as outlined throughout the report. It is important to reiterate that, at present, the Stone & Marble, Tannery, and Olive Mills are the most critical industries of concern, with the potential to immobilize plant operations. Therefore, stakeholders must understand that taking "no action" ensures damage to the HRWWTP and obviously not recommended. Under the current conditions, the acceptance of other industry wastes into the municipal sewer system shouldn't pose any immediate risks, but must be monitored and tracked in order to determine the time when these other waste streams become a concern and must be addressed to continue protecting the HRWWTP.

5.1.2 Recommendation #1: Tanneries Pretreatment Rehabilitation

Based on the discussion in Section 3.3.2, stakeholders should make a final determination as to whether acids other than sulfuric can serve to recover chromium from the process sludge. If no practical substitutes for sulfuric acid exist, then it should be decided if it will or will not be available to allow for chrome recovery as this will then lead to whether the existing plant will operate as pretreatment only or if can recover chrome for factory reuse.

If it is decided that the plant will only serve as a pretreatment facility, the stakeholders must determine the responsibility for rehabilitating the facility and how to enforce the operation of the pretreatment in perpetuity. In addition, the responsibility for OPEX needs to be identified (i.e. tannery factories) along with the physical operation of the pretreatment plant. If it is decided that chrome recovery is a critical aspect to the functionality, and sustainable operation of the plant, then an entity or structured must be identified

Regarding rehabilitation, a professional assessment of the existing system must be made, along with calculating the likely effluent quality in order to advise with recommendations on optimal reagents, doses, and operations. Then, another professional assessment of the physical condition of the existing treatment system in order to identify work needed to restore to functionality. Afterward, perform the needed repairs and upgrades to the facility followed by startup and commissioning of the refurbished unit.

The regulatory entity (currently undetermined) must have the technical capacity and authority to frequently observe operations, take samples, and analyze for compliance. Decisions on which mechanisms will be used for control, such as an annual sewer access permit, to verify compliant operations; clear effluent limits (e.g., Total Cr < 50 mg/l) must be defined to define compliance. These options must be clearly indicated to the industry – pretreatment compliance or exclusion from the municipal sewer system.

Stakeholders must first decide which route to pursue – rehabilitation with chrome recovery or without. This H_2SO_4 lynch pin dictates any subsequent efforts as it leads down two very different paths; institutional considerations are discussed in more detail later within the report.

5.1.3 Recommendation #2: Stone & Marble Local Haulage Program

As earlier noted in Section 3.3.3, USAID is pursuing a "transition plan" following the 1-yr of provided haulage and disposal through their *Emergency Disposal of Industrial Stone Cutting Waste Project*. This transition will focus on assisting the Municipality with sustaining a locally operated and maintained haulage/disposal program. Since efforts started July 1st, results of this are currently unknown but HRWWTP stakeholders have requested a status report in early August in order to evaluate how the program is managing.

Though great strides have been made in switching from illegal disposal to more regulated practices, this process is not yet embedded within the industrial culture and therefore requires vigilant monitoring of the progress. These institutional efforts, like public awareness campaigns, are discussed in greater detail below.

Technically, no "new" solutions exist beyond what is already known. As outlined earlier, the technologies used to separate the liquid and solid waste streams are designed as a closed loop system whereby no liquid wastes are disposed as all filtrate is reused within the industrial process. Until a point when other pretreatment, reuse, or resale options become financially and practically viable options – emphasis on cultural adjustments through public awareness campaigns remain one of the strongest tools for changing the industry practices.

5.1.4 Recommendation #3: Olive Mill Monitoring

Highlighted within Section 3.3.4, actual characteristics of OMW from Hebron olive presses now connected to the municipal sewer is unknown, although they are likely to be similar to mills in Nablus, Tulkarm and Galilee for which there is published data. This data shows high levels of phenols, which appear to present a risk of inhibiting biological processes at the proposed HRWWTP. Resolving this matter requires obtaining actual samples of OMW as any final decision for the industry should not be made on loose estimates. This could be conducted during mid-season (November 2013), when processing would be at its highest.

A multi-day campaign has been proposed to characterize this wastewater, especially the COD, TSS, and most importantly, phenol levels. Propose multi-day test program to characterize the OMW, especially COD, TSS and phenol levels. During this campaign, samples of municipal wastewater at several locations should also be collected to identity whether phenol substances are conserved (i.e. diminished through dilution) or reactive (i.e. diminished through chemical interactions from materials existing within the municipal wastewater). Finally, bio-toxicity testing is proposed, using Hebron OMW and general wastewater samples to characterize the actual concentrations at which the local OMW could be inhibitory with the proposed treatment processes. This would serve as a future preventative measure, to serve the stakeholders and plant operators for when the rest of the Hebron Governorate comes online to the HRWWTP.

5.2 Recommendations for Institutional Sustainability

Any recommendations made on a technical level rely heavily for their efficacy on the existence of a defined and operating institutional framework that has the consent of all participating stakeholders. The effective industrial wastewater and solid waste management examples given

in Ramallah, Bethlehem, and Hebron (JSC) all provide guidance as to what is needed for industrial wastewater management in Hebron.

The key elements of any sustainable industrial wastewater management structure include:

- Solid legal foundation and enforceable regulatory environment,
- Public and private institutions incentivized to act towards the financial, economic and social goals of wastewater management,
- Investment resources available to manage public assets,
- Programmatic entity to manage feedback and the activities of various stakeholders,
- Strategic plan with clarity on achieving complex objectives, allowing for adjustment over time as circumstances change.

As demonstrated over the years since the HRWWTP's inception, bringing these five elements to fruition remains a difficult challenge. Each element is detailed further below, and includes recommendations to achieve them. The resulting program emphasizes the Municipality reform necessary to achieve a functional and sustainable utility in preparation of the HRWWTP.

5.2.1 Solid Legal Foundation and Enforceable Regulatory Environment

As indicated earlier the current legal regime lacks specificity and requires the adoption of suitable procedures and penalties for Hebron Municipality. Even if these responsibilities were delegated to another party, such as the JSC, the delegation of tasks needs to be drafted and officially adopted by all agreeing parties. These procedures should be based on best practices, and drafted in consultation with the community to which they will apply. In order to implement these adopted procedures successfully, compliance standards must: be clear and easy to follow, modify or officially replace regulations already in existence, incorporate successfully applied procedures elsewhere in the West Bank (i.e. combined utility bills linking water and electricity supply or pre-prepayment mechanisms).

It is imperative that any proposed procedures and penalties conform to the technical solutions described in the preceding sections, allowing for transition periods as new operations and technologies emerge, "grace periods" for industry adaptation to new procedures, alternative dispute resolution mechanisms, and management of support services such as industrial waste haulage and disposal.

5.2.2 Public and Private Institutions

Hebron Municipality is the core of any utility sector initiative. Presently, the Municipality is institutionally challenged in this mission, but several opportunities exist to improve effectiveness in managing industrial wastewater, including:

- Adjusting the existing structure through improved technical capacities, organizational restructuring, financial accounting mechanisms, and more formal operational management to improve the functions surrounding wastewater management in anticipation of the increased regulatory and operational burdens from the HRWWTP.

- Delegating the function to a third party, similar to JSC solid waste arrangement, while outsourcing the operation of the HRWWTP to a third party. One advantage could be the inclusion of performance indicators directly linked to payments, incentivizing both sides to perform their respective functions.

Another public institution for consideration will be the PWA, given its national role as regulator of water resources and wastewater management. To support the planned HRWWTP, it may be necessary for PWA to become involved with negotiating the following agreements:

- Discharge standards into open wadis
- Access for authorized enforcement officers into area H2 as required to carry out water and wastewater enforcement activities,
- Arrangements for the establishment and operation of a trusted supplier/user arrangement for the supervised delivery and use of banned chemicals (i.e. sulfuric acid) to implement the technical solutions described above.

The Hebron Chamber of Commerce and Industry, Union of Stone and Marble, and other relevant industry groupings would also indirectly benefit from Municipality strengthening from such activities as awareness campaigns aimed at improving compliance amongst members. Similar awareness campaigns could also be utilized to reach potential wastewater service providers on matters such as wastewater management, HRWWTP operations, or waste haulage and disposal

5.2.3 Public Investment Resources

Current institutional arrangements for managing industrial wastewater in Hebron from pre-treatment right through to final treatment make a 100% commercially viable option unlikely even after several years of WWTP operation. Regulation and enforcement activities have their costs also. A portion of expenditures will always be attributable to general communal maintenance of the public environment or payment for economic benefit derived from industrial activity. It is important that, aside from the initial public capital investments made (with donor assistance), the ongoing operating costs of the services are funded well into the future to allow the sector proper growth to where it can be separated into a commercial entity and a public entity. This could involve establishing a separate wastewater fund managed solely for this purpose, but may require public, in some cases, donor resources initially until a time when it could transition over to financial independence as revenues from the sector grow.

5.2.4 Management Entity

Implementation of the strategic plan outlined below, in conjunction with the needs described above, will require a management entity to operate as the Program Management office (PMO) for this effort, and would need to be initially funded for the first few years. This could be at the Municipality or other suitable institution such as the Governorate.

5.2.5 Strategic Plan

All of the technical, regulatory, and institutional elements of the wastewater management program will have to be aligned in a Strategic Plan that clearly identifies goals, milestones, activities, and responsibilities. This document will provide the roadmap for all participants and

stakeholders to achieve the wastewater management program. The Strategic Plan would most benefit if drafted by the owner of the plan, whichever agency is appointed. In order for the Strategic Plan to be drafted the following steps should be taken:

- Detailed review of operational readiness for all potential stakeholders in the wastewater management program, and design of a system to address the weaknesses identified
- Establishment of baseline wastewater composition through a robust sampling campaign, enabling more rigorous HRWWTP load forecasting and monitoring
- Investigation of contract forms and contractual arrangements that could be exercised to allocate responsibilities between the parties, both public and private, potentially involving pilot PPP-type structures

5.3 Recommended Next Steps

Taking everything discussed thus far into account, the recommended next steps detailed below provide the potential structure for successfully managing the industrial wastewater concerns in preparation of the planned HRWWTP construction and operation.

5.3.1 Improve Operator Readiness

Any technical solution to the industrial wastewater situation also necessitates a combination of regulatory, institutional, contractual and operational activities. Since the Municipality currently is responsible for wastewater management and will be again after the completion of the constructor's operating period per the intended contract (i.e. 3 years following construction), the required actions to prepare the Municipality to successfully operate the HRWWTP include:

- Proper funding and organization of a dedicated department within the Municipality to be responsible for wastewater management. Irrespective of what activities are outsourced, if any, oversight functions and final responsibility for the operation of the system remain with the Municipality.
- Personnel training in all areas of system management – operation, maintenance, upstream monitoring, discharge compliance, industry enforcement, financial accountability, and public awareness.

5.3.2 Strengthen Enforcement Practices

The technical recommendations in this report are clear – zero discharge of stonecutting waste and establishing a reliable haulage program, pretreatment of tannery waste for eventual sewer disposal, monitoring and potential (future) pretreatment of olive mill waste, and significantly improved enforcement practices of industry discharges. While the existing regulatory environment provides the structure for enforcement, the clarity of how to implement such regulations requires the development and adoption of explicit procedures.

5.3.3 HRWWTP Industrial Database

Building on the efforts of this study and previous sampling campaigns, there is an opportunity to keep the data updated on an ongoing basis for the effective monitoring and management the

HRWWTP. This will help to prolong the design life of the plant as appropriate maintenance and enforcement actions are taken. It will also provide the Municipality with a basis on which to enter into future agreements. Activities needed include:

- Prepare a sampling plan for industrial wastewater from each represented industry, including olive mills, that takes into account the location, likely composition, and seasonality of the potential waste streams.
- Prepare a future monitoring plan for industries of concern to assist the Municipality in wastewater management and control.
- Generate a compiled of a database given all available resources for wastewater flow management by the Municipality and HRWWTP operators.

5.3.4 External Partner Engagement

Management of the wastewater situation requires increased reliability and predictability in activities that are not solely within the control of Palestinian authorities. Two areas where an agreement with Israeli counterparts would greatly improve the service standards achieved:

- Enhanced protocol for access by the Municipality enforcement agents into area H2 (i.e. Industrial Zone) for the purpose of industrial wastewater management.
- Design and implement a trusted supplier/operator mechanism to allow sulfuric acid and other required chemicals to be used in the pretreatment of wastes from tanneries and any other applicable industries.

5.3.5 Contract/Structure Reform

Some form of Public-Private Partnership (PPP) will be required to deliver parts or all of the elements within the industrial wastewater management program. Possible candidates include: slurry waste disposal, central pretreatment plant operation for tanneries and other industry groupings, monitoring of influent waste streams, and even operation of the HRWWTP following the initial operation period (i.e. first 3 years after construction). Activities needed include:

- Review activities required to run the industrial wastewater program and identify candidates for outsourcing or other forms of PPP based on capacity of the public sector, commercial viability, legal viability, risk, and best practice.
- Select one or two pilot PPPs as starting points to review the legal/contractual requirements, and draft a legal and contractual workplan for these transactions.
- Test the commercial viability of the pilot transactions and estimate the level of public support needed over the timeframe of the partnerships.
- Transaction plan for implementation by the relevant parties.

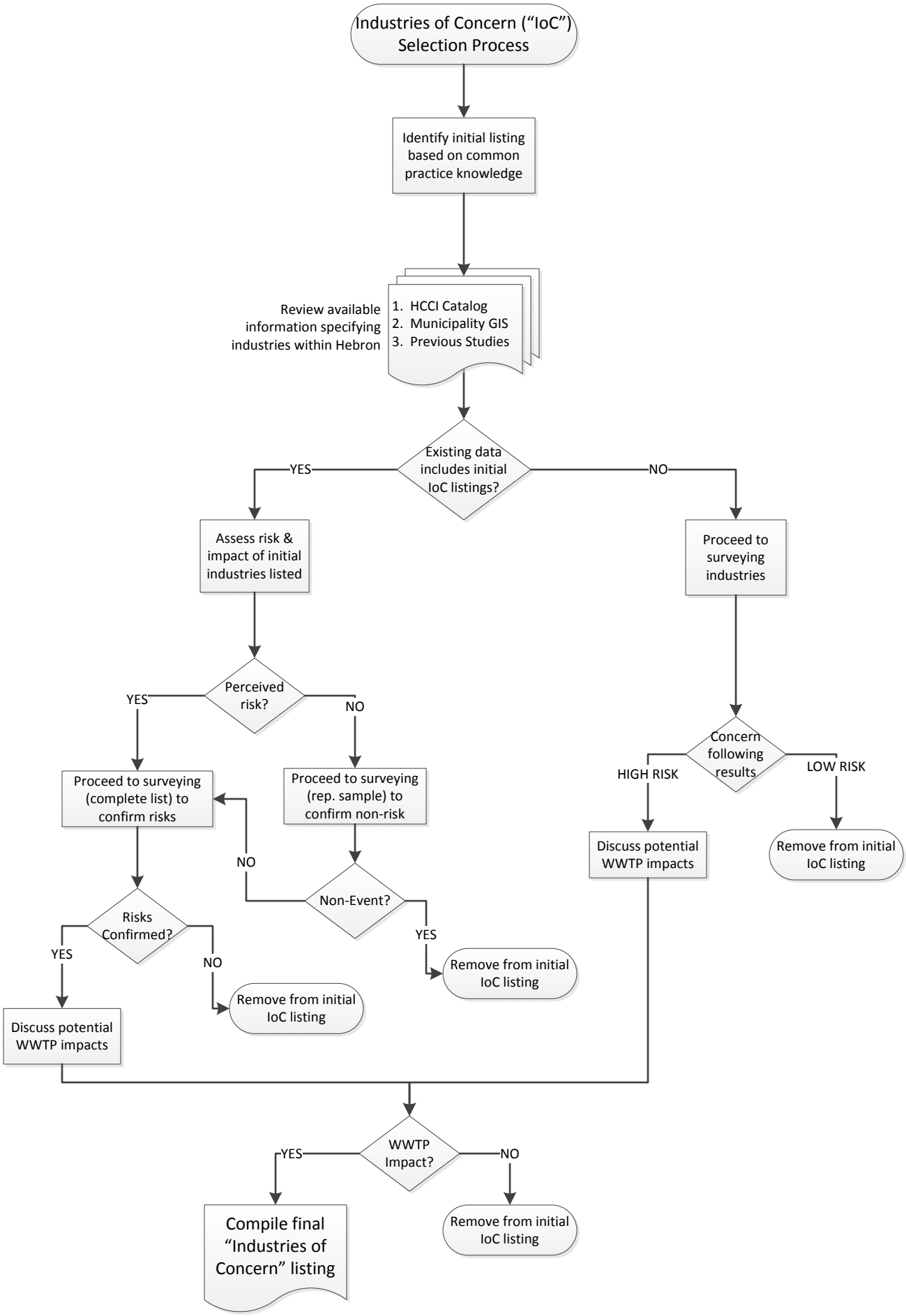
5.3.6 Increased Public Awareness

Meetings conducted with local authorities revealed a sincere willingness to address and correct the industrial wastewater problems which beleaguer the Hebron Municipality. Another key factor for any future success of an industrial wastewater management program will be public

buy-in to the program objectives and the perception that the Municipality's actions are benefitting the community. Activities needed include:

- Design a public awareness campaign to coincide with commitments being made by Palestinian authorities, Hebron Municipality, and the international donor community on wastewater management in Hebron.
- Periodic, and ongoing, announcement of awareness activities (according to the designed plan) to maintain continual public presence throughout the duration of the wastewater management program to prepare for the eventual transition to the Municipality.

Appendix A Industries of Concern Selection Process


Industries of Concern ("IoC") Selection Process
Identify initial listing based on common practice knowledge
Review available information specifying industries within Hebron
1. HCCI Catalog
2. Municipality GIS
3. Previous Studies
Existing data includes initial IoC listings?
YES
NO
Assess risk & impact of initial industries listed
Proceed to surveying industries
Perceived risk?
YES
NO
Proceed to surveying (complete list) to confirm risks
Proceed to surveying (rep. sample) to confirm non-risk
Concern following results
HIGH RISK
LOW RISK
Discuss potential WWTP impacts
Remove from initial IoC listing
NO
Non-Event?
YES
Remove from initial IoC listing
Risks Confirmed?
YES
NO
Remove from initial IoC listing
Discuss potential WWTP impacts
WWTP Impact?
YES
NO
Compile final "Industries of Concern" listing
Remove from initial IoC listing

Appendix B Hebron City Industries Map

Factories Of Hebron City

BLACK & VEATCH
Building a world of difference.

N

Surveyed Factories

- Building Materials
- Cars Maintenance
- Ceramics
- Dry Clean
- Food
- Glass
- Hospital
- Industrial Equip
- Metal
- Paper
- Pharmaceutical
- Plastics
- Precious Metals
- Shoes
- Slaughterhouse
- Stone Cutting
- Tanning
- Textiles
- Wood

Meters

0 500 1,000 2,000 3,000 4,000

Appendix C Field Survey Procedure

Survey Procedure

Suggested Daily Survey Procedure Stages:

1. Before field survey stage
2. During field survey stage
3. After field survey stage

❖ Before Field Survey Stage:

1) Telephone Outreach
    a. The industry list will be split among the team, based on the assigned zones for field visits
        i. Individuals will be responsible for making calls to their portion of the list
        ii. Questions to ask the factory owners (or site manager):
            1. Introduce yourself, and give the owner a brief introduction of project and survey
            2. Where are the factories located exactly? Confirm the address we have in the excel file, and also add in the specific location on the street
            3. Confirm other contact details to make sure excel file is accurate
            4. Find out the respondent's name and add to excel file
            5. Ask if it would be possible to stop by the factory for 20 minutes during the allotted time period for their zone during our field visits to ask a few more questions, and note on answer sheet what the appointment time is
2) Make sure to pre-fill the questionnaire answer sheet with any information gathered during the phone conversation and on the excel file
3) Every day in the morning there will be a short meeting for the team for the following goals:
    a. Every team must receive a daily list of factories to visit with excess of two or three in case of emergency or the owner is not ready for meeting or ignores the appointment
    b. Discuss with the team the day plan and tasks for everyone
    c. Print out the questionnaires according to the planned number of daily visits for each team with excess of two or three in case of mistakes occurring in filling stage

Note: keep in mind that majority of factories do not start work till 9 AM (possibly earlier depending on industry), so any meeting with the manager or owner can't be before this time.

❖ During Field Survey Stage:

This stage will include the procedures for communication and collecting data:

1. **Communication procedure :**
   - Make sure that there is a previous call done before the visit to meet the manager or owner of the factory, and confirm time of appointment.
   - Introduce the team and talk generally about the project and what are the collected data will used for
     - Use the hebron municipality advertisement as the script for how to describe the project (see advertisement document for Arabic version):

In order to estimate the current and future wastewater treatment needs of the city of Hebron, Hebron Municipality with the full support of the Hebron Chamber of Commerce & Industry is facilitating a survey of industrial water users in the coming weeks. The results of the survey will be used as inputs to the design of a new wastewater treatment plant planned to be developed for the city of Hebron.

Surveyors will be making contact with all industrial water users between May 8th 2013 and June 15th 2013 to ask a few simple questions on the existing and expected composition and volume of their industrial wastewater. Please cooperate with the surveyors when contacted.

   - Try to make the data provider feel that this project will serve his/her business and the general public community (long-term HRWWTP)
   - Try not to ask any critical questions about the policy of your company, personal information, taxes, etc.
   - Communicate with the data provider in a way reflects your and company's respect to him.
   - Try to take data for your questionnaire not in ask and answer way, but through general conversation with data provider, so he/she will corporate without feeling that his/her company is under investigation. However, make sure to have clear answers to the questions on the questionnaire, asking the priority questions first.
   - Try to be flexible if any technical problems occur

2. **Data collecting stage:**
   - As you ask the questions, if the factory owner is willing to give you a general tour of the factory, note any observations of manufacturing

processes and waste production and discharge. Make sure to inquire with the factory owner if you have any observations you want to validate, but make sure to ask with sensitivity

- The main data points we want to gather **are Quantity and Frequency of Water, Wastewater, Materials Balance in their industrial processes**. Make this the priority.

❖ After Field Survey Stage:

This stage takes place in the office after doing the field survey to do the following tasks:

- One team scheduled to visit less factories by one or two than the others in order to return to the office and make calls with the factories to have a visit appointment for the next day preferred.(This team is cycled by the next week)
- This team must print out a copy of factories lists ready to the visit in the next day, with feedback from the field teams in order to adjust if some factories require a visit the next day
- Each team needs to enter the answers gathered during the survey process into the excel template
- If there are any problems that occurred during the survey it can be discussed with the team at the end of the day, to adjust strategy for the next day

Appendix D Field Survey Questionnaire

Contact Information

Confirm HCCI data, Industry Classification / Get info on survey respondent / Add GIS identification

Owner Name: _____

Telephone: _____

GIS Block: _____
GIS Zone: _____
GIS Factory: _____

1) Production Process

a. What is the nature of your business (i.e. what product the business produces?)

b. What is the process of production?

c. What are the byproducts (solid and liquid), and quantity of leftover waste?

2) Raw Material Input (Quantity / Frequency)

a. What are the raw materials you use for your business?

Raw Materials used: _____

_____

_____

b. How often and how much do you receive these raw materials to your business, or how much do you use these materials (for example, x kilo/day or month) on a daily or monthly basis? (They can also answer the question by, for example, "we produce x shoes per day with x amount of materials")

3) Water Input (Quantity / Frequency)

a. How much water do you use, and how often, for your business (example: m^3/week or month)?

b. What is your source of water (example: public, private well; purchased tank), and when (or how much, i.e. one $10m^3$ tanker/week) water to you receive?

4) Wastewater

a. How much wastewater do you dispose of after production (by quantity and frequency, for example x m^3/week or month)

b. How do you get rid of/discharge the wastewater?

   i. Is the factory connected to the sewer system or not? (if not, how do you discharge of the waste?)

   ii. Do you treat any of the wastewater before dumping? If yes, how, and at what quantity and frequency?

   iii. Do you reuse any of the wastewater? If yes, how, and at what quantity and frequency?

   iv. What is the dumping process for all your byproducts (solid or liquid)?
      1. Where (Important: Focus on waste going down the drain!)

      2. Quantity

3. How often (continuous or batch flow)

5) Institutional Relations

a. What government entities impact your operations the most?

b. Which is the EASIEST to work with (i.e. licenses, regulations, support)?

c. Which is the HARDEST to work with (i.e. licenses, regulations, support)?

6) Solution for Wastewater Treatment

a. What are your thoughts on how to resolve the issue of treating industrial wastewater (i.e. technically, politically, or financially)?

7) Sampling

a. If we have time to come back, can we take a sample?

8) Field Observations:

_____

_____

_____

_____

Field Inspector Name: _____ Date: _____

Appendix E Field Survey Compiled Results

INDUSTRY	GIS ID	COMPANY NAME	APPOINTMENT DAY / TIME DD/MM/YY	LOCATION SPECIFIC	1A. BUSINESS DESCRIPTION	1B. PROCESS DESCRIPTION	1C. BYPRODUCTS DESCRIPTION	2A. RAW MATERIALS DESCRIPTION	2B. RAW MATERIALS (Qty & Freq)	3A. WATER USE (m3 / month)	3B. WATER SOURCE (Qty & Freq)
Building Material	Z4/B8/#88	Al-Safaa Floor Tile Factory	27/5 at 01:20pm	industrial zone	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	60 m^3/month(small stone)- 15 ton/month(cement)	60	tanks
Building Material	Z/B/#90	Al-Tawfiq Floor Tile Factory	27/5 at 02:25pm	industrial zone, main st	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	10 ton/month (small stone)- 4 ton/month (white cement)- 5 ton/month (black cement) - 40 m^3/month (sediment)	60	municipality+tanks
Building Material	Z/B/#87	Khalilah Marble and Stone Company	27/5 at 12:50pm	industrial zone	stone lathing	cut the raw stone to finall design.	slurry	stones / water	400 m^3 / month	1200	tanks
Building Material	Z/B/#89	Al-Khudary Floor Tile Factory	27/5 at 02:00pm	al-sahlah st . Ibrahim mosque	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	10 ton/month (small stone)- 3 ton/month (white cement)- 3 ton/month (black cement) - 40 m^3/month (sediment)	50	municipality
Building Material	Z/B/#86	Abu Hammad Floor Tile Factory	27/5 at 12:20pm	industrial zone	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	50 ton/week (small stone)- 15 ton/week (white cement)- 20 ton/week (black cement) - 225 m^3/month (sediment)	30	tanks
Building Material	Z / B /#80	Al-Itihad Floor Tile Factory	27/5 at 10:00am	industrial zone	Concrete Tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	15 ton/month (white cement)- 20 ton/month(black cement)- 120m^3/month (fine sedimment)- 50 m^3/month (Equars)- 80 m^3/month (small stone)	180	tanks
Building Material	Z4 / B5 / #78	Al-Watan Floor Tile Company	26/5 at 02:20pm	industrial zone .	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	20 ton/month (small stone) - 12 ton/month (white cement) - 15 ton/month (black cement) - 60m^3/month (sediment) .	100	tanks
Building Material	Z/B/#85	Al- Salam Floor Tiles and Bricks Factory	27/5 at 12:10pm	industrial zone	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	18 m^3/week (small stone)- 1.5 ton/day (cement) - 180m^3 /week (sediment)	60	tanks
Building Material	Z4 / B7 / #81	Sunnukrot Floor Tile Factory	27/5 at 10:10am	industrial zone, main st.	Concrete Tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	24 m^3/week (small stone)- 500 ton/week (white cement)- 500 ton/week (black cement)	50	municipality+tanks
Building Material	Z / B / #70	Al-Karaki Floor Tile Factory	25/5 at 3:40pm	Industrial zone .	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	17 ton/ month (small stone) -10 ton/ month (cement) .	35	municipality
Building Material	Z4 / B7 / #74	Al-Sheikh Floor Tile Factory	26/5 at 11:15am	industrial zone . Beside the municipality slughterhouse .	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	15m^3 / month (small stone) - 3 ton / month (cement)	30	tanks
Building Material	Z4 / B7 / #76	Amazona for Crushing Workshop	26/5 at 12:40pm	industrial zone . Beit oula station	crushed stones	put the raw material in crush machine to covert the stone from big size to small size .	sludge	crushed stones / stockpiles / water	12000 ton /month	300	tanks
Building Material	Z4/B7/#83	Al-Batraa Bricks and Stones Company	27/5 at 10:50am	industial zone, beside alameer for ready concrete	stone lathing	cut the raw stone to finall design.	sludge	stones	100 m^3/month	80	tanks
Building Material	Z / B / #73	Nizam Abu Eisheh Bricks Factory	26/5 at 10:45am	industrial zone . Beside alnahda factory.	concrete bricks	mix the raw material in mixer then put the mixture in machine then the mixture put in templates then Compressed it then watered the brick to be more solidity	slurry	cement / sand / small stone / water	300m^3 /month (small stone) - 80m^3 /month (sand) - 15ton / month (concrete)	20	tanks
Building Material	Z / B / #69	Al-Walaa Bricks Factory	25/5 at 3:20pm	Industrial zone . Alsadah	concrete bricks	mix the raw material in mixer then put the mixture in machine then the mixture put in templates then Compressed it then watered the brick to be more solidity	slurry	cement / sand / small stone / water	15 ton/ day (small stone) - 6 ton / day (sand) - 3 ton / day (cement)	14	tanks
Building Material	Z4 / B5 / #79	Khalil Al-Rahman Floor Tiles	26/5 at 02:45pm	industrial zone .	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	5 ton/month (small stone) - 1 ton/month (white cement) - 2 ton/month (black cement) - 10ton/year(sediment) .	40	well
Building Material	Z4 / B5 / #68	Al-Arabi Floor Tiles Factory	25/5 at 1:45pm	al-sahlah st . Ibrahim mosque	concrete tiles	mix the raw material in mixer then Put the mixture into templates then Compressed it then watered the tile 2 or 3 time.	slurry	very small stone (italy+local) / white+ black cement /fine sediment / water .	6 ton/ month (small stone) -1 ton/ month (cement) .	10	municipality
Building Material	Z4 / B7 / #71	Bayt Al-Maqdes Workshop	26/5 at 9:10am	Industrial zone . Beside aljamal mattress	stone lathing	cut the raw stone to finall design.	slurry	stones / granite .	20 m^3 / month	10	tanks
Building Material	Z4 / B7 / #72	Abu Seif Bricks Factory	26/5 at 9:30am	industrial zone . Opposite of sunkrott for tile	concrete bricks	mix the raw material in mixer then put the mixture in machine then the mixture put in templates then Compressed it then watered the brick to be more solidity	slurry	cement / sand / small stone / water	120 ton / month (small stone) - 10 ton/ month (cement) - 50 ton/ month (sand)	6	tanks
Building Material	Z4 / B5 / #77	Tatbeer Marble and Granite Company	26/5 at 01:05pm	industrial zone . At al-mo'amnen mosque in al-sahlah st .	stone lathing	cut the raw stone to finall design.		stone	9 ton / day .	30	municipality
Building Material	Z4/B7/#84	Zalloum Construction Company	27/5 at 11:05am	industrial zone	Ready - Made concrete	determined the quantity of contents by computer and mix it in mixer. And the remaining dirts collected in special pool .	slurry	small stone, sand, cement, chemical material, water	1800 ton/week (small stone)- 450 ton/week (cement)-1000 ton/week (sand)-500 liter/week(ch.material)	6000	tanks
Building Material	Z4/B7/#82	Al-Ameer Properities and Investment Company	27/5 at 10:30am	industrial zone, alandalus gas station	Ready - Made concrete	determined the quantity of contents by computer and mix it in mixer. And the remaining dirts collected in special pool .	slurry	small stone, sand, cement, chemical material, water	10000 ton/month (small stone)- 2000 ton/month (cement)-4000 ton/month (sand)-15000 liter/month(ch.material)	3600	tanks
Building Material	Z4/B8/#91	Abu Hammad Floor Tile Factory	27/5 at 02:35pm	industrial zone, sarsoria st	crushed stones	put the raw material in crush machine to covert the stone from big size to small size .	sludge	stockpile / water / stone	12000 ton /month	10	tanks
Building Material	Z4 / B4 / #75	Basent Exhibition	26/5 at 12:20pm	industrial zone . Alshalah st , at al-saheb junction	Gypsum	cut the raw material to finall desige .		gypsum board / iron support /bolts	800 board / month	10	tanks
CAR WASHING	3299	Al-Iqtisad Lubricant	5/23/2013	alsalam-street	car washing+ Lubrication	washing (with water+detergents)+ lubrication+ ghanging oil	solar+greace+engine oil+	engine oil+ water + detergents+ houmer	have no idea	600	municipality+well
CAR WASHING	1599	al-okhowa for industrial oils and car washing	5/23/2013	abu-kteela	lubricant+ car maintenance + oil changing	washing (with water+detergents)+ lubrication+ ghanging oil	solar+greace+engine oil+	engine oil+ water + detergents+ houmer	have no idea	300	municipality+well
CAR WASHING	4721	Al-Andalus lubricant and car washing	5/20/2013	industrial area- opoosite to tannaries	car washing+ Lubrication	washing (with water+detergents)+ lubrication (greace 1 kg\truck)+ washing with water	solar+greace+engine oil+	water+ detergents (soap mixed with water until they boils in addition to colours)+ solar+oils(engine oil+hydrolic oil "68,10,32"+greace+houmer"clorox car care"	houmer 220L/6months soap 230 L/6months solar 5L/month	240	municipality+well+tanks
CERAMICS	Z2/B1/#48	Alsalam for ceramic and pottery	20/5 at 01:15 pm	Ras eljora , opposite cocacola factory	pottery and ceramic work and class work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.then coloured the shape and spraying class mixture then byt it in oven for second time . And the class in bring small pieces and but it in oven and take the finall shape		clay , colour, oxides, liquid glass (Sodium silicate), car oil water.	1 ton / day for all material	12.8	municipality

INDUSTRY	GIS ID	COMPANY NAME	APPOINTMENT DAY / TIME DD/MM/YY	LOCATION SPECIFIC	1A. BUSINESS DESCRIPTION	1B. PROCESS DESCRIPTION	1C. BYPRODUCTS DESCRIPTION	2A. RAW MATERIALS DESCRIPTION	2B. RAW MATERIALS (Qty & Freq)	3A. WATER USE (m3 / month)	3B. WATER SOURCE (Qty & Freq)
CERAMICS	Z4/B7/#41	Al-Fakhouri Pottery Company	19/5 at 2:45 pm	Industrial zone, near to hebron muni. Slaughter house	pottery work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.		clay , soil, salt, water.	12 ton / day (for all material)	450	tanks
CERAMICS	Z4/B7/# 42	Al-Fakhouri Hand-Made Potery Workshop	19/5 at 3:00 pm	Industrial zone, near to hebron muni. Slaughter house	pottery and ceramic work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.		spanish + italian clay , water.	3 ton / week (clay)	4.3	municipality
CERAMICS	Z4/B7/#40	Hajj Rateb Pottery Workshop	19/5 at 2:30 pm	Industrial zone, near to hebron muni. Slaughter house	pottery work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.		Red & yellow soil , sand, salt ,water .	200 m^3 / day for all material	128.6	tanks
CERAMICS	Z4/B7/#45	Khalil Al-Rahman Pottery Factory	19/5 at 3:45 pm	Industrial zone, near to hebron muni. Slaughter house	pottery work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.		clay , soil, salt, water.	50 m^3 /month for all material	150	municipality
CERAMICS	Z/4/B7/#44	Mohammad Rabee Al-Fakhoury Pottery Factory	19/5 at 3:30 pm	Industrial zone, near to hebron muni. Slaughter house	pottery work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.		clay , soil, salt, water.	50 m^3 /year for all material	100	tanks
CERAMICS	Z2/B1/#49	Holy Land Ceramics Workshop	20/5 at 01:30 pm	Ras eljora , beside cocacola factory	pottery and ceramic work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.then coloured the shape and spraying class mixture then byt it in oven for second time .		clay , colour, oxides, liquid glass (Sodium silicate) water.	clay 22 ton/4 month, class 1650 k/ 4 month, colour 110 k/ 4month	20	municipality
CERAMICS	Z4/B7/#43	Al-Khalil Pottery Factory	19/5 at 3:15 pm	Industrial zone, near to hebron muni. Slaughter house	pottery work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.		soil, salt, water, clay	200 m^3 / year for all material	10	tanks
CERAMICS	Z2/B1/#47	Al-OkhowwahPottery	20/5 at 12:45 pm	Ras eljora , opposite zaid station	pottery and ceramic work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.then coloured the shape and spraying class mixture then byt it in oven for second time .		clay , colour, oxides, liquid glass (Sodium silicate) water.	3 ton / month for all material	5	municipality
CERAMICS	Z2/B4/#50	Al-Tamimi Faience Pottery Company	20/5 at 02:15 pm	AL-harass, beside alqudsi super market	pottery and ceramic work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.then coloured the shape and spraying class mixture then byt it in oven for second time .		clay , colour, oxides, liquid glass (Sodium silicate) water.	22 ton / month (for all material)	5	municipality
CERAMICS	Z2/B4/#51	Artistic Pottery Workshop	20/5 at 02:45 pm	Wadi al-qate'a beside Qafishe factory for carton	pottery work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.		clay , colour, oxides, liquid glass (Sodium silicate) water.	4 ton / month (for all material)	1.5	municipality
CERAMICS	Z2/B4/#46	Al-Fareed Pottery Workshop	20/5 at 12:10 pm	Wadi al-qate'a beside al-jibrini dairy	pottery work	Mix all the raw material in mixer and add water to it , then take the mixture to formation stage ,finally burn it in oven.then coloured the shape and spraying class mixture then byt it in oven for second time .		clay , colour, oxides, liquid glass (Sodium silicate) water.	2 ton / month for all material	1	tanks
CHEMICALS	2,1,81	Hassouneh Trade and Indusrial Company	May 13,Monday 10:00 A.M	Hebron City - Alrameh	Pharmaceutical	Mixing chemical substances in specific percentage to produce detergents		Chemical substances,Water	7000Kg/Month	38	Municipality
CHEMICALS	3,3,87	Agricultural Indstry Company	May 22,Wednesday 10:30A.M	Hebron City - Al-Adel	Pharmaceutical	Heating the oils and adding chemical materials for four days in concentration 12% and PH=8-9 ,cutting,peeling,pressing		oils(artificial olives oil),artificial salt,coastic soda,water	1.5 ton Coastic soda for manfacturing and another 200-300Kg for cleaning/month,400Kg artificial salt/month	17.5	Municipality
CHEMICALS	393	Ashour Chemical detergents Company	13-5-2013	Hebron City - Dhahyat Albaladyyeh	chemical detergents	mixing+ filling		sulfonic acid+ soduim laurith sulfate+ caustic soda NaOH ,foam activator ABC, coca media, Hcl, preservation materials+cetric acid+ isoprobanol+ coulors	basic raw materials 6-7 tons/mon	152	municipality+well
CHEMICALS	393	ashour for chemical detergents	13-5-2013	Wadi Al-Hareyeh beside PPU-B	chemical detergents	mixing+ filling		sulfonic acid+ soduim laurith sulfate+ caustic soda NaOH ,foam activator ABC, coca media, Hcl, preservation materials+cetric acid+ isoprobanol+ coulors	basic raw materials 6-7 tons/mon	152	municipality+well
DAIRY	1,8,1	Al-Junaidi Dairy and Food Products Co. Ltd,	May12, Sunday 01:00 P.M	Al Salam Street	1-Dairy products, 2-Tahena,3-Salads	1-(Raw milk, pasteurization, homogenization, packag, store), 2-(Sesame, washing, soak in water with added alittle salt, roasting, grinding), 3-(washing vegetables, cutting, cooking, addition, packaging).	Sulfuric acid, Costic Soda,and water from cheese,labana contains whey protien	Milk,stabilizers, powder milk, glatin, salt, enzaymes, vegetable, sesame, preservatives, cocoa	Milk-80,000 L daily, Vegetables-25 ton daily, Sesame-4,5 ton daily	9750	tanks
DAIRY	2,4,7	Al-Jibrini Dairy and Food Products Company	May13, Monday 10:00 A.M	Alsaheeb	1-Dairy products, 2-Salads, 3-White Chesses	1-(Raw milk, pasteurization, homogenization, packag, store), 2-(washing vegetables, cutting, cooking, addition, packaging).2-(washing vegetables, cutting, cooking, addition, packaging).	Sulfuric acid, Costic Soda,and water from cheese,labana contains whey protien	Milk, Suger, Cocoa, Flavor, stabilizers, powder milk, glatin, salt, enzaymes, vegetable, preservatives	Milk 40Ton daily, vegetable 5Ton daily	4500	tanks
DAIRY	3,8,1	Al-Safi Dairy and Food Products Company	May14, Tusday 09:00 P.M	Esaa-Dwerban	1-Dairy products, 2-Salads	1--(Raw milk, pasteurization, homogenization, packag, store), 2-(washing vegetables, cutting, cooking, addition, packaging)	Sulfuric acid, Costic Soda,and water from cheese,labana contains whey protien	Milk,stabilizers, powder milk, glatin, salt, enzaymes, vegetable, preservatives	Milk 6Ton daily, Vegetable 500Kg daily	600	municipality+tanks
DAIRY	4,4,3	Al-Diaa Dairy Company	May13, Monday 11:00 P.M	Alsaheeb Junction	Dairy products	Milk, pasteurization, homogenization, packaging, cooling, stored	Sulfuric acid, Costic Soda,and water from cheese,labana contains whey protien	Milk, preservatives, stabilizers, powder milk, glatin, salt, enzaymes	Milk-110Ton monthly, Stabilizers 700kg monthly	540	municipality
DAIRY	3,3,1	AL-Natsheh Dairy	May14, Tusday 11:10 A.M	Ein Arab	1-Labana, 2-Yogurt	1-Milk(pasteurization, homogenization), added starter culture(micro organisms), heating, filling in cheese cloth, straining, packaging, 2-Milk, added starter culture(micro organisms), packaging.	Sulfuric acid, Costic Soda,and water from cheese,labana contains whey protien	Milk,stabilizers, glatin, salt, enzaymes, preservatives	200Kg of Milk daily	15	municipality
DAIRY	1,8,9	Eid Mujahed Dairy	May14, Tusday 10:40 A.M	Essa	1-Labana, 2-Yogurt	1-Milk(pasteurization, homogenization), added starter culture(micro organisms), heating, filling in cheese cloth, straining, packaging, 2-Milk, added starter culture(micro organisms), packaging.	Sulfuric acid, Costic Soda,and water from cheese,labana contains whey protien	Milk,stabilizers, glatin, salt, enzaymes, preservatives	500Kg of Milk daily	10	municipality
DRY CLEANING	3,5,1	Prince Dry Clean	22-5-2013/01:00P.M	Al-Hawooz	Washing, Ironing and Dry Cleaning	Dry Clean by using machins based on perchloroethylene, Washing based on water and normal detargent(chlor, wash soap,Fragrant laundering)	perchloroethylene, detargent,liquid chlor concentration 11%, oxgen, Industrial salt, powder contain{chlor, catalyst, costic soda}, wash soap,Fragrant laundering)	Water, perchloroethylene, detargent(liquid chlor concentration 11%, oxgen, Industrial salt, powder contain{chlor, catalyst, costic soda},wash soap,Fragrant launderin	Not given	390	municipality
DRY CLEANING	2,1,70	Al-Gad Dry Clean	21-5-2013/03:15P.M	Al-Rameh	Washing, Ironing and Dry Cleaning	Dry Clean by using machins based on perchloroethylene, Washing based on water and detargent(liquid chlor concentration 11%, oxgen, Industrial salt, powder contain{chlor, catalyst, costic soda}, wash soap,Fragrant laundering)	perchloroethylene, detargent,liquid chlor concentration 11%, oxgen, Industrial salt, powder contain{chlor, catalyst, costic soda}, wash soap,Fragrant laundering)	Water, perchloroethylene, detargent(liquid chlor concentration 11%, oxgen, Industrial salt, powder contain{chlor, catalyst, costic soda},wash soap,Fragrant launderin	Industrial salt 300kg/month, perchloroethylene 320kg per year, powder 200kg/month, liquid chlor 300l/month, oxgen 200kg/month	300	municipality+tanks
DRY CLEANING	3,3,99	Hebron Dray Clean	20-5-2013/01:30P.M	Dwar Al-Manara	Washing, Ironing and Dry Cleaning	Dry Clean by using machins based on perchloroethylene(about 300kg per year), Washing based on water and soap and other detergent materials (LDL,EAL, powder chlore, Benzen, Catalyst, Bova)	perchloroethylene, detargent,liquid chlor concentration 11%, oxgen, Industrial salt, powder contain{chlor, catalyst, costic soda}, wash soap,Fragrant laundering)	Water, perchloroethylene, LDL,EAL, powder chlore, Benzen, Catalyst, Bova.	perchloro ethylene 300kg per year	90	municipality
DRY CLEANING	2,7,82	Al-Nozha Dry Clean	21-5-2013/02:30P.M	Ein Sara	Washing, Ironing and Dry Cleaning	Dry Clean by using machins based on perchloroethylene, Washing based on water and normal detargent(chlor, wash soap,Fragrant laundering)	perchloroethylene, detargent,liquid chlor concentration 11%, oxgen, Industrial salt, powder contain{chlor, catalyst, costic soda}, wash soap,Fragrant laundering)	Water, perchloroethylene, chlore, wash soap,Fragrant launderin	perchloroethylene 320kg per year	60	municipality

INDUSTRY	GIS ID	COMPANY NAME	APPOINTMENT DAY / TIME DD/MM/YY	LOCATION SPECIFIC	1A. BUSINESS DESCRIPTION	1B. PROCESS DESCRIPTION	1C. BYPRODUCTS DESCRIPTION	2A. RAW MATERIALS DESCRIPTION	2B. RAW MATERIALS (Qty & Freq)	3A. WATER USE (m3 / month)	3B. WATER SOURCE (Qty & Freq)
FABRICS	Z4/B4/#52	Al-Deek Al-Zahabi Company	21/5 at 12:05	industrial zone at alsaheb junction	textile and fabrics	take the raw material and then make the design for it then cut it and sewing it to finall design		cotton, plaster , yarrn, wool	2 ton / week	50	municipality
FABRICS	Z2/B7/#59	Nabeel company for shoes	22/5 at 12:30 pm	Nimra, Abu Al-halawe junction.	women and men shoe factory	make the design then sewing and tensile in machine, after that injection shoes land and finishing phase, finally, tanning phase in special machine		leather, lindeum, tanning material, EVA(used in bottom of shoes, spray material, pu(polyreleatan:it chimical material which is liquid but when it dumped converte to solid, DMF, detergent material.	Pu:20 ton /month, EVA:2ton /month, Mithalen:750 k /month, leather: 10,000feet/month, Lindeum:10,000feet /month	50	municipality
FABRICS	Z3/B3/#60	Tosetti for shoes	22/5 at 01:00 pm	Al-Salam st	women and men shoe factory	make the design then sewing and tensile in machine, after that injection shoes land and finishing phase		Leather, lago, polythiren(convert to solid rubber), spong, yarn.	Leathe: 10000 feet/month, polythiren: 20 ton/month	40	municipality
FABRICS	Z4/B7/#58	Al-Jamal Mattress	22/5 at 11:50 pm	Industrial zone, opposite Al-fakhori ceramic	Mattress production	Mix the raw material by machine to make sponge.		Petroleum products, poluim(liquid material)	5 ton / year	30	municipality
FABRICS	Z4/B4/#57	Abu Mayyaleh Pavilions and Tents Stores	21/5 at 02:10	industrial zone at alsaheb junction	pavilions, tent	cut the raw material for the finall shape		Cuadr , tent , leather	10 ton / 6 month	3	municipality
FABRICS	Z4/B5/#54	Raafat Ajlouni Workshop	21/5 at 12:31	Al-Sahle St., Near Al-mohtaseb hospital	women shoe manufactory	make the design then cut the raw material for this design then collect all shoe part ..		leather, lago, linoleum, heel, caoutchoue, spray material, insoles	leather3000m/month, lindeum500m/month, caoutchoue500/month, heel # 500, insoles # 500	3	municipality
FABRICS	Z4/B5/#55	Al-Anwar Shoes Workshop	21/5 at 01:15	Al-Sahle St., Near Al-mohtaseb hospital	women shoe manufactory	make the design then cut the raw material for this design then collect all shoe part ..		leather, lago, linoleum, heel, caoutchoue, spray material, insoles	leather3000m/month, lindeum500m/month, caoutchoue500/month, heel # 500, insoles # 501	2	municipality
FABRICS	Z4/B4/#53	Al-Rasheed Furniture Exhibition	21/5 at 12:30	industrial zone at alsaheb junction	curtain and carpet	make the design for the fabrics and sewing it then show it for sale .		fabrics (with ready colour) ,carpet , yarn	700m/ year	2	municipality
GLASS & MIRROR	Z3/B1/#63	Al-Shweiky brothers for Glass	22/5 at 03:00 pm	Essa, beside Al-wala' mosque	glass, mirror	cut the glass then drilling and punching it and securite glass and put it in oven.		glass , mirror, sand	$1000m^2$ /month , Sand:$2m^3$ /year	90	well
GLASS & MIRROR	Z4/B5/#56	Ashour Glass Stores	21/5 at 02:45pm	industrial zone beside ashour for food	P	cut the glass and stimulated and perforation		glass , mirror		30	municipality
GLASS & MIRROR	Z3/B3/#61	Al-shweiky for glass	22/5 at 01:45 pm	bear al-saba' st. near al-shafee mosque	glass and mirror	cut the glass then drilling and punching the glass and decorat it		glass, mirror, ceruim	1200 m^2 /month	5	municipality
GLASS & MIRROR	Z4/B5/#56	Ashour Glass Stores	21/5 at 02:45pm	industrial zone beside ashour for food	P	cut the glass and stimulated and perforation		glass , mirror		30	municipality
GLASS & MIRROR		Abu Sneineh Crystal for Glass and Mirrors Company		al-haras - zughaier department						5.5	municipality
GLASS & MIRROR		Zalloum Glass and Mirrors Company		Esaa						5	municipality
GLASS & MIRROR		Ghulmeh Glass Works Stores		ras aljora - entrance of city						2	municipality
GLASS & MIRROR		AL-Noor Frames Workshop		Ein sara -beside almohtaseb chamber						1	municipality
GLASS & MIRROR	Z3/B3/#61	Al-shweiky for glass	22/5 at 01:45 pm	bear al-saba' st. near al-shafee mosque	glass and mirror	cut the glass then drilling and punching the glass and decorat it		glass, mirror, ceruim	1200 m^2 /month	5	municipality
GLASS & MIRROR	Z3/B1/#63	Al-Shweiky brothers for Glass	22/5 at 03:00 pm	Essa, beside Al-wala' mosque	glass, mirror	cut the glass then drilling and punching it and securite glass and put it in oven.		glass , mirror, sand	$1000m^2$ /month , Sand:$2m^3$ /year	90	well
HOSPITALS	2,1,99	Al-Mezan Hospital	23-5-2013/11:40A.M	Al-Ramah	Medical Services		detergents	Materials for cleaning(chlor concentration 2.5-3%, floor soap, hand soap, flash, liquid soap for shaining floor, ditol)	No details about quantities	1050	municipality
HOSPITALS	1,2,10	Al-Ahle Hospital	23-5-2013/10:00A.M	Ber Al-Mahjar	Medical Services		(soap-ecoforce, ecobio to remove blood, oxgen, ,Fragrant launderin, Industrial salt,detergents)	Washing Section(soap-ecoforce, ecobio to remove blood, oxgen, ,Fragrant launderin, Industrial salt), materials for cleaning(chlor concentration 2.5-3%, floor soap, hand soap, flash, liquid soap for shaining floor, ditol)	(soap-ecoforce75-100kg/month, ecobio50kg/month, oxgen36l/week, Fragrant launderin130l/month, Industrial salt20kg/2week, chlor 400l/month, floor soap 130l/month, hand soap30-40l/month, flash 60l/month, liquid soap for shaining floor 4-5l/month, ditol 48l/month	4500	municipality
HOSPITALS	4,1,99	Alia Hospital	21-5-2013/11:30A.M	Alia hospital location, city center	Medical Services		Detergents,ethanediol " C2H6O2", disinfector, grills and oxgen.	Materials for cleaning(Chlorine+ Detergents(floor soap, hand soap,...)+ acid+ Flash+ dettol+ethanediol " C2H6O2"), Washing Section(catalyst, chlor, disinfector, • Blood spots are cleaned with cold water, chlor or chlor grills and oxgen.	• Chlorine is bought with 11% concentration then diluted to 0.05 % about 100 L/day is used + detergents used are (soap Aviv with 12 L/day) + acid (6 L/day) +flash (6 L/day) • Water 10 m3/day for each department .	1590	municipality
INDUSTRIAL MATERIALS	195	Al-Misk Industrial Machinery Company	16-5-2013/ 11AM	sibta square- opposite to nour eldeen neirokh company+ alnour press	lathing and manufacturing stone cutting equipment	solid (iron dust)+liquid (0.5 m3/mon renewing the cooling water mixed with cooling oil)		raw iron+ paints+cooling oil	according to work	17.5	municipality+well
INDUSTRIAL MATERIALS	251	Eagle flex Company	19-5-2013 / 1:30 PM	qezoun -	iron and stone cutting disks manufacturing (feber)	fine raw materials oxides+ mixing with bounding materials "liquids or powder"+machines and ovens for cutting and forming+		white aluminum oxides (Al2O3)+ blacks sillicon carbide+brown aluminum oxide	according to work	30	municipality+well
INDUSTRIAL MATERIALS	4720	Asia for manfacturing stone instruments	20-5-2013/ 12:00 PM	industrial area-alfahs- near to naji shawar and sons company	lathing and manufacturing stone cutting equipment	raw steal+ cutting+ forming+manfacturing		steal+bronze+motors and gears for engine	1.5-2 ton steal monthly+ 20% or more solid waste	2	tanks+well
METALS		Al-Sharabati Lathing	13-5-2013	industrial area- opposite to abu mazin resturant	maintenance + block frames	scaling + manufacturing on machine+ forming		iron (different thickness)	200 Kg/Mon	0.5	municipality+well
METALS		Metal casting, rolling and pressing	13-5-2013	Abu -Roman/ behind abdalhai shaheen school	metal cating	melting - forming	lubrication oil	aluminum , copper	CU- 300 Kg/Mon AL- 100 Kg/Mon	0.5	municipality+well
METALS		Diamond Partnership Lathing	13-5-2013	Abu -Roman/ beside PPU abu romman	maintenance + lathing machines parts	scaling+ cutting+ lathing on machine+ (water+ cooling oil for cooling the machine)		iron+ aluminum+ plastic + cooling oil (AHD380)	300 Kg/Mon sometimes the customer buy the raw materials	0.55	municipality+well
METALS		Neiroukh Solar Heaters Factory	13-5-2013	wadi alharriyah- beside PPU- A	glass solar heaters+ electric biolers	electric biolers(metal structuring+weilding+ final gathering) glass solar heaters(pipes cutting+ weilding+ final gathering)		(gelvanic + black) iron plates, (gelvanic+ black) pipes, isolating materials(polytian)	200 tons/mon for iron+ 80 ton/mon pipes+ 20 ton/mon isolating materials	50	municipality+well
METALS		Abdulrahman Natsheh Lathing	13-5-2013	Dwerban- opposite to Paltel store	lathing equipment parts	lathing on machine		iron + cooling oil	refuse to give	4-Jan	municipality+well
METALS		Al-Nahdha Metal Ornament Workshop	13-5-2013	industrial area- opposite to al-ameer concrete factory	metal ornament	cutting- forming- ornament		iron (different thickness)	_____	4	tanks+well
METALS		Al-Jubeh Metal Ornament and Forming	13-5-2013	wadi alharriya-opposite to Neirokh Factory	metal ornament and forming	scaling + ornamnent forming+ doors manufacturing		iron	refuse to give	1.5	tanks+well
METALS		Al-Natsheh Lathing	13-5-2013	issa- aljawaher hall- hajar school	lathing + door hinges	scaling+ cutting+ lathing on machine+ (water+ cooling oil for cooling the machine)		iron + cooling oil	100 Kg/Mon	0.5	municipality+well
METALS		Al-Arabiyah Modern Lathing	13-5-2013	wadi alharriya- next to Neirokh Factory	renewal and cleaning cars mortors	scaling + air based cleaning/ cleaning by machine(kerosen based)	kerosen+ oil	kerosen+ soap+ oil	1 L/Mon for each	1.9	municipality+well

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METALS		Al-Qawasmeh Lathing	13-5-2013	industrial area- next to al-ameer concrete factory							
OLIVE MILL	Out of Zones	Al-Amal Presses	May14, Tusday 09:45 A.M	Industrial Zone	Olive Oil	Washing olive, remove leaf, cracking olive by using hot water, mixing olive, then go to turbine to separates peat of olive, then produces oil and peat	Peat, leaf, carpentry	Olive	400Ton\Season	450	municipality
OLIVE MILL	Alamaneh olive press	jameel abuhadeed (brother's owner)	industrial area- opposite to alandalus gas station	olive press	cleaning the olive (water is only used in this process and gone to the sewage system)+ grinding (water is added to facilitaite the process with small percentage)+ mixing (hot water with temperature of 50-60 C)+ seperation(it depends on centrifuges to separate dried olive seeds and the other is water mixed with impured oil)	solid (olive leaves + olive seeds) liquid(impured oil mixed with water+ washing water)	Peat, leaf, carpentry	according to olive season	cleaning(40 L/ton) + grinding (50 L/ton)+ mixing(hot water 40L/ton)	tanks	municipality+tanks
OTHER FOOD ITEMS	4,7,99	Alamaneh Olive Press	19-5-2013 / 12:30 PM	industrial area- opposite to alandalus gas station	olive press	cleaning the olive (water is only used in this process and gone to the sewage system)+ grinding (water is added to facilitaite the process with small percentage)+ mixing (hot water with temperature of 50-60 C)+ seperation(it depends on centrifuges to separate dried olive seeds and the other is water mixed with impured oil)	Peat, leaf, carpentry	water+ olive	according to olive season	cleaning(40 L/ton) + grinding (50 L/ton)+ mixing(hot water 40L/ton)	tanks
OTHER FOOD ITEMS	3,2,2	Al-Shareef Food Production and Trade Company	May13, Monday 12:10 A.M	Essa	1-Western Dessert(Cake, Mafen), 2-Bakery products, 3-concentrated juice	1-Miixing Materials,		Sugar, Cocoa, Margarin, Sesame, Packing powder, Oils, Eggs,	Suger 80Ton\year, Oils 80Ton\year,	45	municipality+tanks
OTHER FOOD ITEMS	Out of Zones	Al-Sharawi Food Industries	21-5-2013/ 02:00P.M	Hebron-Bet Kahel	Chips	using special machine to with added a little oil to blow up the raw material.		Corn, Oils, Peant, Salt	Not given	225	municipality
OTHER FOOD ITEMS	2,2,8	Ribhi A. Al-Kurd and Partners Ice Cream Company	May16, Thersday 10:25 A.M	Al Rameeh	1-Ice Cream 2-Jelly 3-Ras Abd			Milk, Suger, Margarin, Flavors, Egg		750	municipality
OTHER FOOD ITEMS	1,2,5	Al-Batraa Food Products and Invesment Company	May13, Monday 01:00 P.M	At the intrance of Beet Kahel besaid petropal Factory	1-Ice cream, 2-Ras Abd, 3-Juice	Receipt raw materials, invistigate it, then to production preperation hall, after that mix it, disinfection, pasteurization, cooling, forming, packaging, store		Milk, Cocoa, Suger, Oils, Butter, stabilizers, preservatives, Flavors	Milk 10Ton daily	540	municipality
OTHER FOOD ITEMS	4,7,5	Naji Shawar and Sons Company	May16, Thersday 09:00 A.M	Industrial Zone	1-Tahena, 2-Sesame, 3-Sesame Oil,	1-(Sesame, washing, soak in water with added alittle salt, roasting, grinding), 2-Sesame, washing,drying, roasting	Sesame peel	Sesame, Salt,	1.5Ton Sesame, 130Kg Salt	210	tanks
OTHER FOOD ITEMS	4,1,3	Al-Zaro for Food Trading	May16, Thersday 10:00 A.M	Karantena	1- Tahena, 2-Sesame	1-(Sesame, washing, soak in water with added alittle salt, roasting, grinding), 2-Sesame, washing,drying, roasting, pakaging, 3-Sesame, grinding, extract oil		Sesame, Salt	5Ton of Sesame monthly	180	municipality
OTHER FOOD ITEMS	3,5,4	Al-Qasrawi Trade and Industry Company	May14, Tusday 01:00 P.M	Abu-Roman	1-Chips, 2-Juice	1-Potato, fried, packaging, store. 2-Flavors added to pasteurized water, packag, store	oil	Potato,flour, oils, flavors	Potato 15-20Ton daily	450	municipality
OTHER FOOD ITEMS	4,1,3	Fayez Shawar Company		Karantena	1-Tahena, 2-Sesame, 3-Sesame Oi	1-(Sesame, washing, soak in water with added alittle salt, roasting, grinding), 2-Sesame, washing,drying, roasting, pakaging, 3-Sesame, grinding, extract oil	Sesame peel	Sesame, Salt,	0.75Ton Sesame, 65Kg Salt	105	municipality
OTHER FOOD ITEMS	3,3,2	Shawar Mill	May13, Monday 09:00 P.M	Karn Altoor	1-Tahena, 2-Sesame Oil	1-(Sesame, washing, soak in water with added alittle salt, roasting, grinding), 2-Sesame, grinding, extract oil	Sesame peel	Sesame, Salt	Sesame-500Kg daily	30	spring
OTHER FOOD ITEMS	2,7,6	Tahboub Ice Cream and Refreshments (Caramello)	May13, Monday 11:40 A.M	Ein Sara	1-ice cream, 2-Juice	1-Milk, Butter, Starch, Sugar, Flavor mixing together and then refrigerate, 2-Make a fresh juice		Milk, Butter, Starch, Sugar, Flavor, Fruits	1500kg monthly	5	municipality
OTHER FOOD ITEMS	4,1,4	Shawar Halva Factory	May15, Wensday 11:00 A.M	Alshallale Street	Halawe	Tahena, added glucose, suger, Lemon salt and erq alhalawa and then mixing to gother on heat		Tahena, cocoa, suger,glucose, erq alhalawa, Lemon salt	1Ton Suger daily, 1Ton glucose daily, 1Ton Tahena daily	3	municipality
PAPER	161	Paper Industries Company Ltd	15-5-2013/ 11 AM	hebron university- schools junction- opposite to king khaled school	notebook + box files manufacturing	raw paper roll+ cutting and forming +linning+ printing+covering(water base-nylon)		raw paper+ cartoon+ powder ink+ gelvanic steel(spring)+plastic paltes or rolls+coulors(panton)	666 ton/mon paper 20.000 A3 cartoon per year 400 kg/year Ink	32	municipality+well
PAPER	211	Al-Kazem Industry and Investment Company	15-5-2013/ 10 AM	Alrameh superb - next to alherbawe factory	cartoon , paper cups+ aluminum paltes	cartoon or aluminum farmes- forming- mixing		cartoon+ aluminum	15 ton/mon cartoon 5 ton/mon aluminum	12	municipality+well
PAPER	381	Al-Ittihad Packaging Company	15-5-2013/ 12 pm	altahreer junction- opposite alfardous hall	cartoon , paper cups+ paper bags	printing using concentrated ink mixed with water+ cutting+ forming		raw paper+raw cartoon+ Ink+ colors	refuse to give	22.5	municipality+well
PLASTIC	229	royal industrial and trade company	16-5-2013 / 1 PM	alrameh superp	sanitary pipes+water tanks+fireplace+furniture + house equipment	plastic raw materials+ injection+ forming		PVC(polyvenile cloride) powder + PP (piopropleen)+polyethelen+wood+paints+ LLDB	350 ton/mon PVC+(250-300) ton/mon PP+(150-160) ton/mon polyethelen+ (70-80) ton/mon coulors	750	municipality+well+tanks
PLASTIC	116	Zamzam plastic company	16-5-2013 / 12 PM	interence of beetkahel- next to pertubal company	plastic bags manufacturing	extrader+cuttin and forming+additions(printing)		LBBE+HDBE+LLBE+CaCo3+coulors+liquid concentrated ink.	750 ton/mon(main raw materials)	70	municipality+well
PLASTIC	382	Al-Ittihad Lazer cassette	15-5-2013/ 12 pm	altahreer junction- opposite alfardous hall	CD manufactiring	plastic grains+ casting+ data transfer from computer		plastic grains (polycarbonate)	refuse to give	4	municipality+well
PRECIOUS METALS	2,7,7	Lamasat Al-Sharq Jewelry Workshop	May 12,Sunday 02:00 P.M	Abu Al-Halawa Junction	Gold	Gold bars is converted by melting at 750 c to get the product	Nitric Acid, Costic Soda,Sulphric Acid	Candles,sulphric acid,Costric soda		1.5	municipality
PRECIOUS METALS	out of zones	Al-Mustaqbal Jewelry Workshop	May 14,Tuesday 11:45 A.M	Hebron City - Singer	Gold	Gold bar is converted by melting then drag,and finally forming	Nitric Acid, Costic Soda,Sulphric Acid	Gold,silver,copper,candle,water,gypsumHCL,,sulphric acid,coastic soda(powder)nitric soda1/3+water 2/3	Nitric acid 1L/Month Sulphric Acid 1L/Month Coastic Soda 4 Kg/Year	20	
PRECIOUS METALS	2,4,30	Al-Qawasmeh Jewelry Company	May 15,Wednesday 03:00 P.M	Hebron City - Alharas	Gold	Melting,Drag and rolling,Casting by using Candle,Chemical Acids for finishing	Nitric Acid, Costic Soda,Sulphric Acid	Candles,sulphric acid,Costric soda to melt Aluminum,Gold,Gypsum,Copper,Cadium, Andium	Costic Soda 10 Kg monthly,Costic Soda 10-12 Kg monthly ,Sulphric Acid 2 L monthly,Nitric Acid 2L/month and if it uses for copper emptying Copper it uses 1 Kg Nitric Acid for every 1 Kg Copper and this quantity is different according the work,10 ton Gypsum for all Hebron,HCL 2L monthly,and all of this substances go to sewer	5	municipality
PRECIOUS METALS	2,1,40	Iyad Imran Al-Saeed Company	May 13,Monday 10:30 A.M	Hebron City - Ras Aljourah	Gold	melting the gold then forming the metal from stage to 10 stages	Nitric Acid, Costic Soda,Sulphric Acid	Candle,Sulphric Acid,boric Acid Substance	15Kg/Year	2	municipality
PRECIOUS METALS	2,1,77	Imad Jewelry Workshop	May 13,Monday 11:00 A.M	Hebron City - Ras Aljourah	Gold	Gold bar is converted by melting then drag,and finally forming	Nitric Acid, Costic Soda,Sulphric Acid	Candle,Sulphric Acid,boric Acid Substance to melt gold	2Kg/Year	1	municipality
SLAUGHTERHOUSES	Z1/B8/#32	Hijazi Shawar Slaughterhouse	Thurs- 16\5	Aljalade square	Chicken Slaughter House	kill in site	Water mixed with blood+detergent	Chicken + detergent (soap + clour + fire water)	500 chicken/ day	52.5	municipality+tanks
SLAUGHTERHOUSES	Z2/B4/#18	Al-Esra' Slaughterhouse	Mon- 13\5	namera -at left of end monolite st	Chicken Slaughter House	kill in site		Chicken + Detergent		4.3	municipality

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SLAUGHTERHOUSES	Z3/B3/#26	Al-Bayed Slaughterhouse	Mon- 13\5	AL-hawouz 1 , opposite lebanon hall	Slaughter House	kill in his special SH and muni SH and al-qasrawe SH		sheep + cow + chicken + detergent	10sheep / week(special SH) & 2 sheep/ week (muni SH) & 2cow/week & 30 chicken / day	38.6	municipality
SLAUGHTERHOUSES	Z4/B1/#17	Al-Raed Slaughterhouse	Mon- 13\5	Bab al-zaweih,beginig of al-hemoni st	Chicken Slaughter House	kill in al-qasrawi S.H and AL-natsheh and abu sneneh SH		Chicken + Detergent		1.5	municipality
SLAUGHTERHOUSES	Z1/B9/#15	Al-natsheh alzeraeye	Mon- 13\5	al-salam st opposite of taj mahal sweet	Slaughter House	kill in site	Water mixed with blood+detergent	Chicken + Detergent	1200 chicken / day	22.5	municipality
SLAUGHTERHOUSES	Z4/B7/#27	Hebron Muni. Slaughterhouse	Thurs- 16\5	Industrial zone- near to Alanan company	Slaughter House	Kill in site	Water mixed with blood+detergent	sheep + cow + camel + detergent.	250 cow/ month & 600 sheep/ month & 4-5 camel/ month.	450	municipality
SLAUGHTERHOUSES	Z3/B8/#34	Al-Basha Slaughterhouse	Sat- 18\5	industrial zone -Central hebron market for vegetables	Chicken Slaughter House	kill in site	Water mixed with blood+detergent	Chicken + detergent (soap)	2200 chicken/ day	390	municipality
SLAUGHTERHOUSES	Z4/B7/#28	Abu- sneneh Slaughterhouse	Thurs- 16\5	Industrial zone- near to Abu-lafe company for stone	Chicken Slaughter House	kill in site	Water mixed with blood+detergent	Chicken + Detergent(phonic + soap)	1500-2000 chicken/ day	300	municipality+tanks
SLAUGHTERHOUSES	Z3/B5/#30	Al-Qasrawi Slaughterhouse	Thurs- 16\5	Abu-ruman mountain	Chicken Slaughter House	kill in site		Chicken + detergent (soap + clour)	1000 chicken/ day , and 12 turkey/ month	300	tanks
SLAUGHTERHOUSES	Z2/B1/#38	palestine Slaughterhouse	Sat- 18/5	Ras Al-jora	Slaughter House	kill in site	Water mixed with blood+detergent	Sheep + cow+Detergent (soap)	5 sheep/day, 1cow/day	150	municipality
SLAUGHTERHOUSES	Z4/B7/#29	Wisam Slaughterhouse	Thurs- 16\5	Industrial zone - beside zalloum company for concrete.	Chicken Slaughter House	kill in site		Chicken + detergent (dettol,soap,phonic)	500 chicken/ day	130	municipality+tanks
SLAUGHTERHOUSES	Z2/B1/#37	Al-Qasrawi Slaughterhouse	Sat- 18/5	Ras Al-jora	Slaughter House	kill in site	Water mixed with blood+detergent	Sheep + Detergent (clour +soap).	10 sheep / week	120	municipality
SLAUGHTERHOUSES	Z3/B8/#33	Beit Almaqdes Slaughterhouse	Thurs- 16\5	industrial zone-Central hebron market for vegetables	Slaughter House	kill in site	Water mixed with blood+detergent	sheep + cow + camel + detergent(soap).	10 sheep/day, 1cow/day	60	municipality
SLAUGHTERHOUSES	Z3\ B3\ #1	Abu Al-Noor Zahdah Slaughterhouse	Sun - 12\5	Bear Al-saba'a st. , Beside Al-Shafee Mosque	Slaughter House	kill in the Municipality S.H & Kill in the site for 5-6 time/month	Water mixed with blood+detergent	Sheep + Cow +Detergent	3 cow/month & 10 cheap / 20day	40	municipality+well
SLAUGHTERHOUSES	Z4/B1/#5	Al-Yazuri Slaughterhouse	Sun - 12\5	Bab Alzawieh - Alomyan St.	Chicken Slaughter House	kill in the site		Chicken + Detergent	100 Chicken /day	36	municipality
SLAUGHTERHOUSES	Z3/B8/#21	Al-Arz Slaughterhouse	Mon- 13\5	al- tahreer squre, beside of al-ekhlas SH	Chicken Slaughter House	kill in abu-sneneh SH & Al-natshe SH		Chicken + Detergent		30	municipality
SLAUGHTERHOUSES	Z2/B4/#39	Alqala'a al-wardeye Slaughterhouse	Sat- 18/5	AL-haras . Beside friends cafee	Slaughter House	kill in site	Water mixed with blood+detergent	Sheep + cow+ camel +Detergent	10 sheep/week, 1cow/week and 1 camel / week	30	municipality
SLAUGHTERHOUSES	Z1/B5/#31	Dofish Slaughterhouse	Thurs- 16\5	Abu-Ktela	Chicken Slaughter House	kill in site	Water mixed with blood+detergent+feather	Chicken + detergent (soap + clour)	150 chicken/ day	30	municipality+tanks
SLAUGHTERHOUSES	Z2/B1/#36	Shahrazad Slaughterhouse	Sat- 18/5	Ras Al-jora	Slaughter House	kill in site and in special SH in daert elser	Water mixed with blood+detergent	Sheep + Cow + Detergent (dettol +soap).	5 sheep/day, 1cow/week and 50 chicken/ day	30	municipality
SLAUGHTERHOUSES	Z3/B5/#24	Shaheen SH	Mon- 13\5	AL- HAwouz 2,near zahde company for leather opposite al-bayed company	Slaughter House	kill in his special SH for cow and sheep . Chicen from shawar SH		sheep + cow + chicken + detergent	20 sheep / week& 20 chicken / day & cow/ week	20	municipality
SLAUGHTERHOUSES	Z3/B5/#22	Al-Dmeiri Slaughterhouse	Mon- 13\5	AL-hawouz 2, oppositeof gernata school and omnia hall	Chicken Slaughter House	kill in al-qasrawe SH		Chicken + Detergent		16	municipality
SLAUGHTERHOUSES	Z1/B9/#12	Al-Deek Al-Romi Slaughterhouse	Mon- 13\5	al-salam ST.main St beside al-ansar station for oil	Chicken Slaughter House	kill in AL-qasrawi S.H and AL-natsheh		Chicken + Detergent	41 chicken / day	22.5	municipality
SLAUGHTERHOUSES	Z3/B8/#19	Al-Tahreer Slaughterhouse	Mon- 13\5	al- tahreer squre	Slaughter House	kill in site and hebron muni SH		sheep+cow +detergent		10	municipality
SLAUGHTERHOUSES	Z3/B2/#25	Al-Madeenah Al-Munawwarah Slaughterhouse	Mon- 13\5	AL-hawouz 1, befor 80 m from taffic signal	Slaughter House	kill in special SH that is in opposite of his shop and kill in hebron muni SH		sheep +cow + detergent	10 sheep/week (his SH) and 15 sheep/ week (muni SH)	8	municipality
SLAUGHTERHOUSES	Z3/B3/ #3	AL-Bashaer S.H	Sun - 12\5	bear Al-saba'a st. , Near Mecca Gas station	Slaughter House	Kill in the Muni.SH & Kill Camel in the site	Water mixed with blood+detergent	Camel + Sheep + Cow + Detergent	1Camel / 5days & 1Cow/ 4days	6	municipality
SLAUGHTERHOUSES	Z3/B5/#23	Al-Naseem Slaughterhouse	Mon- 13\5	AL- hawouz 2, beside hamza mosque	Chicken Slaughter House	get it from distributors		Chicken + Detergent		6	municipality
SLAUGHTERHOUSES	Z1/B9/#13	Al-natsheh Slaughterhouse	Mon- 13\5	Al-salam S.T beside Al-deek alromi SH	Chicken Slaughter House	kill in abu-sneneh SH		Chicken + Detergent	50 chicken /day	6	municipality
SLAUGHTERHOUSES	Z3\B3\ #2	Zakaria Dofish S.H	Sun - 12\5	Bear Al-saba'a st. , Beside Al-Shafee Mosque	Slaughter House	Kill in the Municipality S.H		Sheep + Cow + Detergent	2 sheep / week	6	municipality
SLAUGHTERHOUSES	Z4/B1/#6	Al-Ahram Slaughterhouse	Sun - 12\5	Bab Alzawieh -Beside Bab Alzawieh Mosque	Slaughter House	Kill in the Muni. SH		Sheep + Cow +Detergent	3sheep/week & 1cow/week	5	municipality
SLAUGHTERHOUSES	Z2/B1/#35	Al-Za'tare Slaughterhouse	Thurs- 16\5	Qayzoon St. ras eljoura circle	Slaughter House	kill in muni. SH		Sheep + Cow + Detergent (normal).	8 sheep / week	5	municipality
SLAUGHTERHOUSES	Z4/B1/#4	Khaleel Al-Rahman Slaughterhouse	Sun - 12\5	Bab Alzawieh -Beside Bab Alzawieh Mosque	Slaughter House	Kill in the Muni.SH		Cow + Sheep +Detergent	1sheep / 1days & 1Cow/ 3days	5	municipality
SLAUGHTERHOUSES	Z4/B1/#11	Zahrat Al-Mada'en Slaughterhouse	Mon- 13\5	Wadi altofah -al-adel St	Chicken Slaughter House	Kill in Abo-sneneh SH		Chicken + Detergent	40 chicken / day	4	municipality
SLAUGHTERHOUSES	Z3/B3/#7	Ala' El-Deen Slaughterhouse	Sun - 12\5	Al-Salam St , opposite of Al-Helal hospital.	Chicken Slaughter House	Kill in Abo-sneneh SH		Chicken + Detergent	100 Chicken /day	4	municipality
SLAUGHTERHOUSES	Z3/B8/#20	Al-Ekhlas Slaughterhouse	Mon- 13\5	al- tahreer squre, opposite of al-tahreer SH	Slaughter House	kill in the muni SH		Sheep + detergent		2	municipality
SLAUGHTERHOUSES	Z4/B1/#16	Al-Najah Slaughterhouse	Mon- 13\5	Bab al-zaweih, beside hamada coffee	Slaughter House	Kill in the Muni. SH		sheep+cow +detergent		2	municipality
SLAUGHTERHOUSES	Z3/B3/#14	zahdeh	Mon- 13\5	Al-'adel St.,Health Directorate Circle Downtown, Hebron	Slaughter House	Kill in the Muni. SH		Sheep +Detergent	1 sheep / day	2	municipality
SLAUGHTERHOUSES	Z1/B9/#8	Al-Amanah Slaughterhouse	Sun - 12\5	Qarn Al-Thor ,Opposite Abdullah Mosque	Slaughter House	Kill in the site & kill in Muni. SH	Water mixed with blood+detergent	Sheep +Detergent	10 sheep/week in site & 4sheep/week in Muni. SH	30	municipality
SLAUGHTERHOUSES	Z4/B5/#9	Al-Shahd Slaughterhouse	Sun - 12\5	Al-Sahle St., Near Al-mohtaseb hospital	Chicken Slaughter House	Kill in Abo-sneneh SH		Chicken + Detergent	100 Chicken /day	30	municipality
SLAUGHTERHOUSES	Z3/B3/#10	Al-Natsheh Slaughterhouse	Mon- 13\5	Al-Salam St , Sebta Sq.	Slaughter House	Kill in the Muni. SH & they use Al-Qasrawe SH		Chicken + Cow + Sheep + Detergent	20 Chicken /day & 4 sheep / 3 week	3	municipality
TANNERY	4,7,9	Al-Waleed for leather tanning	May 19,Sunday 10:00A.M	Hebron City-Industrial Zone	Tannery	**SEE TANNERY MEETING NOTES**	Salt ,Chrome,HCl,Formic acid (CH2O2),Sodium sulfide (Na2S),Ammonium sulfide,Lime			525	municipality+tanks
WOOD	Z4/B1/#63	Khalil- Alrahman Trade and Industry	23/5 at 12:30pm	bear al-saba' st. Beside old friends association	Wood industry	Cut the raw material and punched it to take final design		Wood, glue, lago	wood:25 board/ month, glue: 1m^3 /month	2	municipality
WOOD	Z4/B8/#65	Abu Tareq Abu Husein Furniture Carpentry	23/5 at 01:20pm	industrial zone beside aljamal mattress	Wood industry	Cut the raw material then collect the part to final design		Wood, glue, lago	wood: 40 board /month (each board: 10-15 kilo)	4.3	municipality
WOOD	Z4/B1/#67	Firas company	23/5 at 12:40pm	bear al-saba' st. Beside old friends association	Wood industry	Cut the raw material and punched it to take finall design		Wood, glue, lago	wood: 20 board /month (each board: 10-15 kilo)	1.5	municipality
WOOD	Z4/B4/#66	Bisan company	23/5 at 01:45pm	industrial zone at al-saheb junction	Wood industry	cut the raw material to final design		Wood, glue, lago	wood: 40 board /month (each board: 10-15 kilo)	1	municipality
WOOD	Z4/B8/#64	Khalil- Alrahman	23/5 at 01:00pm	industrial zone beside aljamal mattress	Wood industry	cut the raw material to final design		tree wood (firewood)	tree wood : 20 ton /month	1	municipality

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Building Material	Z4/B8/#88	Al-Safaa Floor Tile Factory	1200	septic tanks	No	No	Tanks	HCCI	technically	big size .
Building Material	Z/B/#90	Al-Tawfiq Floor Tile Factory	900	public sewage system	No	Yes	Pools	HCCI	technically	moderate size . High risk
Building Material	Z/B/#87	Khalilah Marble and Stone Company	720	public sewage system	No	No	Tanks	HCCI / ministry of economy	technically	big size .
Building Material	Z/B/#89	Al-Khudary Floor Tile Factory	600	septic tanks	No	No	Private Land	HCCI	technically	
Building Material	Z/B/#86	Abu Hammad Floor Tile Factory	450	public sewage system	No	Yes	Pools	HCCI	technically	Moderate size .
Building Material	Z / B /#80	Al-Itihad Floor Tile Factory	90	septic tanks	No	Yes	Tanks	No any relation	technically (suggest to use filtter)	Moderate size, high risk
Building Material	Z4 / B5 / #78	Al-Watan Floor Tile Company	50	septic tanks	No	No	Tanks	No any relation	technically (filtter)	Big size , high risk .
Building Material	Z/B/#85	Al- Salam Floor Tiles and Bricks Factory	30	public sewage system	No	Yes	Pools	HCCI	technically	Big size
Building Material	Z4 / B7 / #81	Sunnukrot Floor Tile Factory	30	public sewage system	No	Yes	Tanks	No any relation	technically	Moderate size, high risk
Building Material	Z / B / #70	Al-Karaki Floor Tile Factory	20	public sewage system	No	No	Pools	No any relation	technically (filtter)	big size , use the stone cutting project but if it stoped will dumped slurry in sewerge
Building Material	Z4 / B7 / #74	Al-Sheikh Floor Tile Factory	15	public sewage system	No	Yes	Tanks	No any relation	technically (filtter)	moderate size . High risk
Building Material	Z4 / B7 / #76	Amazona for Crushing Workshop	10	septic tanks	No	No	Private Land	No any relation	technically (filtter)	big size , moderate size .
Building Material	Z4/B7/#83	Al-Batraa Bricks and Stones Company	10	public sewage system	No	Yes		HCCI, muni.	technically	Big size
Building Material	Z / B / #73	Nizam Abu Eisheh Bricks Factory	10	public sewage system	No	No	Pools	HCCI	technically (filtter)	moderate size . Moderate risk
Building Material	Z / B / #69	Al-Walaa Bricks Factory	7	septic tanks	No	No	Pools	No any relation	technically (filtter)	big size . With no connect with sewerge.
Building Material	Z4 / B5 / #79	Khalil Al-Rahman Floor Tiles	5	septic tanks	No	No	Tanks	No any relation	technically (filtter)	small size , moderate risk
Building Material	Z4 / B5 / #68	Al-Arabi Floor Tiles Factory	5	public sewage system	No	No	Pools	No any relation	technically (filtter)	moderate size, need treatment for it waste
Building Material	Z4 / B7 / #71	Bayt Al-Maqdes Workshop	5	public sewage system	No	No	Private Land	HCCI	technically (filtter)	moderate size, need treatment for it waste
Building Material	Z4 / B7 / #72	Abu Seif Bricks Factory	4	public sewage system	No	No	Pools	No any relation	technically (filtter)	moderate size.
Building Material	Z4 / B5 / #77	Tatbeer Marble and Granite Company	0.5	public sewage system	No	No	Private Land	HCCI	technically (filtter)	moderate size , he said he can reuse the slurry of stone to make type of granite .
Building Material	Z4/B7/#84	Zalloum Construction Company	0	public sewage system	Yes	Yes	Pools	HCCI, Muni.ministry of econnomy	technically	Big size
Building Material	Z4/B7/#82	Al-Ameer Properities and Investment Company	0	septic tanks	Yes	Yes	Private Land	HCCI, Muni.ministry of econnomy	technically	Big size.
Building Material	Z4/B8/#91	Abu Hammad Floor Tile Factory	0	public sewage system	No	No		No any relation	technically	big size , moderate size .
Building Material	Z4 / B4 / #75	Basent Exhibition	0	septic tanks	No	No		No any relation	No need	small size , low risk
CAR WASHING	3299	Al-Iqtisad Lubricant	600	public sewage system	Yes	No	public sewage system	Civil Defense	if there is a possibility for the car washing to reuse the treated water it has to be distilled	clorox contains HCL and used for shining cars according to customers demand+ solid waste cars are not washed in this place and there a special municipal one for them.
CAR WASHING	1599	al-okhowa for industrial oils and car washing	300	public sewage system	Yes	No	public sewage system	Civil Defense		clorox contains HCL and used for shining cars according to customers demand+ solid waste cars are not washed in this place and there a special municipal one for them.
CAR WASHING	4721	Al-Andalus lubricant and car washing	240	public sewage system	Yes	No	public sewage system	Civil Defense	Continuous and frequent cooperation with stakeholders+ the treatment plant staff should work 20-24 hours a day in order to achieve the wanted progress.	we meet the manager not the owner + the waste water in the mentioned wells are with high percentage of oil and greace it is covered but we took a look on it + the lubricant is not working now but work season is about 8 months spring and summer and 4 winter months the work is not as much as other months +the hydrolic oil only added in the hydrolic containers+ clorox contains HCL and used for shining cars according to customers demand+ solid waste cars are not washed in this place and there a special municipal one for them.
CERAMICS	Z2/B1/#48	Alsalam for ceramic and pottery	8.6	septic tanks	No	No	public sewage system	HCCI , muni	technically	big size . Enviromental pollution, moderate risk.

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CERAMICS	Z4/B7/#41	Al-Fakhouri Pottery Company	120	septic tanks	No	Yes	public sewage system	Muni.	technically, and need Filter press	Moderate size, high environmental pollution
CERAMICS	Z4/B7/# 42	Al-Fakhouri Hand-Made Potery Workshop	0	public sewage system	No	No	public sewage system	No Relation .	No need.	Moderate size, high environmental pollution
CERAMICS	Z4/B7/#40	Hajj Rateb Pottery Workshop	0	public sewage system	No	Yes	public sewage system	No Relation .	No need.	Moderate size, high environmental pollution by burning the pottery work after take final shape.
CERAMICS	Z4/B7/#45	Khalil Al-Rahman Pottery Factory	0	public sewage system	No	No	public sewage system	No Relation .	No need.	Moderate size, high environmental pollution
CERAMICS	Z/4/B7/#44	Mohammad Rabee Al-Fakhoury Pottery Factory	0	public sewage system	No	No	public sewage system	HCCI	No need.	Moderate size, high environmental pollution .
CERAMICS	Z2/B1/#49	Holy Land Ceramics Workshop	0	public sewage system	No	No	public sewage system	Ministry of tourisim, muni , HCCI , ministry of economy	technically	big size . Enviromental pollution, low risk.
CERAMICS	Z4/B7/#43	Al-Khalil Pottery Factory	0	public sewage system	No	No	public sewage system	No Relation .	No need.	Moderate size
CERAMICS	Z2/B1/#47	Al-OkhowwahPottery	0	public sewage system	No	No	public sewage system	HCCI	No need.	moderate size, low risk.
CERAMICS	Z2/B4/#50	Al-Tamimi Faience Pottery Company	0	public sewage system	No	No	public sewage system	HCCI , muni	No need.	moderate size, low risk
CERAMICS	Z2/B4/#51	Artistic Pottery Workshop	0	public sewage system	No	No	public sewage system	No Relation .	No need.	moderate size, low risk
CERAMICS	Z2/B4/#46	Al-Fareed Pottery Workshop	0	public sewage system	No	No	public sewage system	No Relation .	No need.	moderate size, low risk.
CHEMICALS	2,1,81	Hassouneh Trade and Indusrial Company	2.4	public sewage system	No	No	public sewage system	Municipal sewer system	Municipal sewer system	Municipal sewer system
CHEMICALS	3,3,87	Agricultural Indstry Company	10	public sewage system	No	No	public sewage system	MoNE,HCCI,Hebron Municipality	Technoligical Solution	
CHEMICALS	393	Ashour Chemical detergents Company	3.5	septic tanks	No	No	septic tanks	Taxes Department- Ministry of Fainance+ PSI+ MNE+HCCI	sceintifical updates+ use for treated water for hebron only	the whole area is not connected to the public sewage system and based on the septic tanks
CHEMICALS	393	ashour for chemical detergents	3.5	septic tanks	No	No	septic tanks	Taxes Department- Ministry of Fainance+ PSI+ MNE+HCCI	sceintifical updates+ use for treated water for hebron only	the whole area is not connected to the public sewage system and based on the septic tanks
DAIRY	1,8,1	Al-Junaidi Dairy and Food Products Co. Ltd,	6600	public sewage system	No	No	public sewage system	MoNE	Technically and Financially	
DAIRY	2,4,7	Al-Jibrini Dairy and Food Products Company	4200	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically, Politically and Financially	
DAIRY	3,8,1	Al-Safi Dairy and Food Products Company	690	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically and Politically	
DAIRY	4,4,3	Al-Diaa Dairy Company	600	public sewage system	Yes	No	public sewage system	MoNE, Ministry of Health	Technically, Politically and Financially	
DAIRY	3,3,1	AL-Natsheh Dairy	15	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Politically	
DAIRY	1,8,9	Eid Mujahed Dairy	10	public sewage system	No	No	public sewage system	Ministry of Health	Politically	
DRY CLEANING	3,5,1	Prince Dry Clean	390	public sewage system	No	No	public sewage system		Politically	This dry cleaning shops do a pretreatment for perchloroethelene , with a net final disposal 5 to 6 kg instead of 320 kg
DRY CLEANING	2,1,70	Al-Gad Dry Clean	300	public sewage system	No	No	public sewage system	Hebron Municipality	Politically	This dry cleaning shops do a pretreatment for perchloroethelene , with a net final disposal 5 to 6 kg instead of 320 kg, and this dry clean washing for Al-mezan and Al-hilal hospitals.
DRY CLEANING	3,3,99	Hebron Dray Clean	90	public sewage system	No	No	public sewage system	MoNE	it should be a qualified researchers and advanced sceintific studies based on experimental approeach specifically on waste water classification+ waste water dumping process should be regulated and inspected by MOH	about (perchloroethelene) dumped in the sewage system some dry cleaning shops do a pretreatment for it , with a net final disposal 5 kg instead of 300 kg
DRY CLEANING	2,7,82	Al-Nozha Dry Clean	60	public sewage system	No	No	public sewage system	Hebron Municipality	Politically	This dry cleaning shops do a pretreatment for perchloroethelene , with a net final disposal 5 to 6 kg instead of 320 kg

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FABRICS	Z4/B4/#52	Al-Deek Al-Zahabi Company	0	public sewage system	No	No	public sewage system	no any relation	No need	big size, no risk , and all the textile manufactory has no tanninig in site .
FABRICS	Z2/B7/#59	Nabeel company for shoes	0	public sewage system	No	No	public sewage system	HCCI, Muni	No need	Big size, low risk, dry industry, the tanning is done in special machine without liquid waste.
FABRICS	Z3/B3/#60	Tosetti for shoes	0	public sewage system	No	No	public sewage system	HCCI, Muni	No need	moderate size, no risk
FABRICS	Z4/B7/#58	Al-Jamal Mattress	0	public sewage system	No	No	public sewage system	HCCI, Muni	No need	The owner reject make tour in factory.
FABRICS	Z4/B4/#57	Abu Mayyaleh Pavilions and Tents Stores	0	public sewage system	No	No	public sewage system	HCCI	No need	moderate size, no risk
FABRICS	Z4/B5/#54	Raafat Ajlouni Workshop	0	public sewage system	No	No	public sewage system	HCCI	No need	moderae size , no risk
FABRICS	Z4/B5/#55	Al-Anwar Shoes Workshop	0	public sewage system	No	No	public sewage system	HCCI	No need	moderae size , no risk
FABRICS	Z4/B4/#53	Al-Rasheed Furniture Exhibition	0	public sewage system	No	No	public sewage system	HCCI	No need	moderae size , no risk
GLASS & MIRROR	Z3/B1/#63	Al-Shweiky brothers for Glass	90	septic tanks	No	Yes	septic tanks	no any relation	No need	Big size, water for punching change daily
GLASS & MIRROR	Z4/B5/#56	Ashour Glass Stores	15	public sewage system	No	No	public sewage system	HCCI	technicall	moderae size , moderate risk .
GLASS & MIRROR	Z3/B3/#61	Al-shweiky for glass	5	public sewage system	No	No	public sewage system	HCCI, Muni	technicall	Moderate size, moderate risk
GLASS & MIRROR	Z4/B5/#56	Ashour Glass Stores	15	public sewage system	No	No	public sewage system	HCCI	technicall	moderae size , moderate risk .
GLASS & MIRROR		Abu Sneineh Crystal for Glass and Mirrors Company	5.5	public sewage system	No	No	public sewage system			
GLASS & MIRROR		Zalloum Glass and Mirrors Company	5	public sewage system	No	No	public sewage system			
GLASS & MIRROR		Ghulmeh Glass Works Stores	2	public sewage system	No	No	public sewage system			
GLASS & MIRROR		AL-Noor Frames Workshop	1	public sewage system	No	No	public sewage system			
GLASS & MIRROR	Z3/B3/#61	Al-shweiky for glass	5	public sewage system	No	No	public sewage system	HCCI, Muni	technicall	Moderate size, moderate risk
GLASS & MIRROR	Z3/B1/#63	Al-Shweiky brothers for Glass	90	septic tanks	No	Yes	septic tanks	no any relation	No need	Big size, water for punching change daily
HOSPITALS	2,1,99	Al-Mezan Hospital	1050	public sewage system	No	No	public sewage system	Ministry of Health		For washing there is agreement with Al-Gad Dry Clean.
HOSPITALS	1,2,10	Al-Ahle Hospital	4140	public sewage system	No	No	public sewage system	Ministry of Health		
HOSPITALS	4,1,99	Alia Hospital	1290	public sewage system	No	No	public sewage system	Ministry of Health		
INDUSTRIAL MATERIALS	195	Al-Misk Industrial Machinery Company	12.5	septic tank+ public sewage system	No	No	septic tank+ public sewage system	taxes+income tax+HCCI+ministry of industry and tarde +municipality +metal engineering industries union	there is a need for a central treatment plant+ it should be special containers for each type of industry	the cooling oil mixed with water is renewed every month+ manufactured machines are washed inside the factory using (water +tinner)
INDUSTRIAL MATERIALS	251	Eagle flex Company	20	septic tank+ public sewage system	No	No	septic tank+ public sewage system	metal engineering industrial union (MEIU)+Ministry of Finance+MNE+HCCI	there is national need for such a project to use the tread water for agricultural use also in order to save the environment+ he suggested the problem of public sewage system absence in some areas	Mr.joulani is the head of MEIU so he said that water is not involved in metal industries in general and he suggest list of metal factories who are helpful for the project
INDUSTRIAL MATERIALS	4720	Asia for manfacturing stone instruments	1.5	septic tanks	No	No	septic tanks	HCCI+ Taxes+ MONE	the matter needs a financial solution	no risks because no disposing for chemical materials and no usage for chemicals
METALS		Al-Sharabati Lathing	0.25	public sewage system	No	No	public sewage system	no	crucial need for a central plant	
METALS		Metal casting, rolling and pressing	0.25	septic tanks	No	Yes	septic tanks	Taxes Department- Ministry of Finance	central plant	
METALS		Diamond Partnership Lathing	0.05	public sewage system	No	Yes	public sewage system	Taxes Department- Ministry of Fainance	rehibitation for waste water equipments used currently+ central plant for the whole city.	filtration process followed is by filtering the water mixed with the oil and cooling oil and iron dust to use the remaining dissolved materials as a fertilizer
METALS		Neiroukh Solar Heaters Factory	50	public sewage system	No	No	public sewage system	MNE+HCCI	central treatment plant+ filter in each factory+ public awareness	they used to use acid before but now instead of it sand is used
METALS		Abdulrahman Natsheh Lathing	3	public sewage system	No	No	public sewage system	HCCI+ ministry of fainance+ ministry of national economy+ municipality	no idea	the whole area is not connected to the public sewage system and based on the septic tanks
METALS		Al-Nahdha Metal Ornament Workshop	2.5	public sewage system	No	No	public sewage system	Hebron chamber of commerce and industry	no idea	
METALS		Al-Jubeh Metal Ornament and Forming	1	public sewage system	No	No	public sewage system	municipality+ industries union+ HCCI	no idea	there is a septic tank and they have no idea if the workshop connected to it or not
METALS		Al-Natsheh Lathing	0.25	public sewage system	No	No	public sewage system	Taxes Department- Ministry of Fainance	no idea	for cooling the machine water+ cooling oil is cycled inside till water vaporate during operation , water is renewd once a month
METALS		Al-Arabiyah Modern Lathing	0.1	public sewage system	No	No	public sewage system	Taxes Department- Ministry of Fainance	no idea	

INDUSTRY	GIS ID	COMPANY NAME	4A. WASTEWATER (m3/month)	4Bi. SEWER OR OTHER?	4Bii. ANY PRE-TREATMENT?	4Biii. ANY REUSE?	4Biv. DISPOSAL PROCESS (Qty & Loc)	5. GOVERNMENT IMPACTS / RELATIONSHIPS	6. SOLUTION FOR WW TREATMENT	8. FIELD OBSERVATIONS
METALS		Al-Qawasmeh Lathing					public sewage system			the owner said he is not the wanted person but indeed he is , he refuse to give us any information.
OLIVE MILL	Out of Zones	Al-Amal Presses	450	public sewage system	No	No	public sewage system	Ministry of Health	Financially	The WW resulting from this process is very dangerous, so if we added on the plants, the plants will die
OLIVE MILL	Alamaneh olive press	jameel abuhadeed (brother's owner)		public sewage system	No	No	public sewage system	he proposed a problem which is the institional relations are not organized well and there is an obvious conflict between them	yes	
OTHER FOOD ITEMS	4,7,99	Alamaneh Olive Press	cleaning (water is renewd according to the waste in olive)+ 40-45% from the total amount pressed is gone directly as water mixed with impured oil to the sewage system.	public sewage system	No	No	public sewage system	minstry of agriculture+ MOH+MNE	he proposed a problem which is the institional relations are not organized well and there is an obvious conflict between them	30 % olive seeds+40-45% (water mixed with the impured oil+ 25% pure oil.+about the regulations for food industry from MOH he said that he doesn't know anything about it and so all olive mills owners and there is no regular inspection from any ministry also there was a union called (Agricultural Cooperative Association) but it is not working now
OTHER FOOD ITEMS	3,2,2	Al-Shareef Food Production and Trade Company	22.5	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Politically	
OTHER FOOD ITEMS	Out of Zones	Al-Sharawi Food Industries	225	septic tanks	No	No	septic tanks	Ministry of Health	Financially	
OTHER FOOD ITEMS	2,2,8	Ribhi A. Al-Kurd and Partners Ice Cream Company	630	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically and Financially	Extreme conservative about information he gives us
OTHER FOOD ITEMS	1,2,5	Al-Batraa Food Products and Invesment Company	450	septic tanks	No	No	septic tanks	Ministry of Industre and Trad	Technically and Politically	
OTHER FOOD ITEMS	4,7,5	Naji Shawar and Sons Company	210	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Politically	
OTHER FOOD ITEMS	4,1,3	Al-Zaro for Food Trading	180	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically	This company not included in HCCI list
OTHER FOOD ITEMS	3,5,4	Al-Qasrawi Trade and Industry Company	150	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically, Politically and Financially	
OTHER FOOD ITEMS	4,1,3	Fayez Shawar Company	105	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically, Politically and Financially	This company not included in HCCI list
OTHER FOOD ITEMS	3,3,2	Shawar Mill	30	public sewage system	No	No	public sewage system	MoNE	Technically, Politically and Financially	The WW resulting from this process is very dangerous, so if we added on the plants, the plants will die, because the concentration of salt is high
OTHER FOOD ITEMS	2,7,6	Tahboub Ice Cream and Refreshments (Caramello)	3	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically	
OTHER FOOD ITEMS	4,1,4	Shawar Halva Factory	3	public sewage system	No	No	public sewage system	MoNE, Ministry of Health	Technically, Politically and Financially	
PAPER	161	Paper Industries Company Ltd	10.08	septic tank+ public sewage system	Yes	No	septic tank+ public sewage system	MNE	need for a qualified industrial area+ seperation between domestic waste water lines and industials+ each industrial zone should have its own treatment plant	for cooling the machines water+ air+ alcohol "IPA"+ oils are used. The cooling process depend on cycling water inside the machine+ water based covering is for protecting the customer and environment from ink+ each machine has its own filter+ there is a washing machine for ink
PAPER	211	Al-Kazem Industry and Investment Company	1.5	public sewage system	No	No	public sewage system	HCCI+ ministry of fainance(taxes department)+ministry of industry	there is a need for central treatment plant+ reuse for agriculture	solid waste sold weekly
PAPER	381	Al-Ittihad Packaging Company	14	public sewage system	No	No	public sewage system	MNE+HCCI+ taxes	good project + central plant concerning about people's benefits	MNE regulations limited the use of cartoon paper and support plastic even MOH+MENA recommend paper using
PLASTIC	229	royal industrial and trade company	450	public sewage system	No	No	public sewage system	MNE+PSI+National security+Municipalty+Taxes	transportation of the treated water by pipes better than pumping	inside the factory there is a private car washing center (70 cars are washed)(water+detergents+solar+tinner) foor cooling chillers is used
PLASTIC	116	Zamzam plastic company	50	septic tanks	No	No	septic tanks	HCCI+plastic industry union+MNE+businessmen union+ ministry of fianance	global issue	inside the factory there is a private car washing center (7 trucks+12 cars washed once per week) (water+detergents+solar+tinner) foor cooling chiller is used- the factory owner has about 5 other factories with his brothers working on nylon bags and plastic
PLASTIC	382	Al-Ittihad Lazer cassette	2	public sewage system	No	No	public sewage system	MNE+HCCI+ taxes	good project + central plant concerning about people's benefits	cooling machine depends on chiller (water cycle inside the factory)
PRECIOUS METALS	2,7,7	Lamasat Al-Sharq Jewelry Workshop	1.5	public sewage system	No	No	public sewage system	MoNE,MoF		
PRECIOUS METALS	out of zones	Al-Mustaqbal Jewelry Workshop	20	septic tanks	No	No	public sewage system	MoNE,union of prec.metals	Political,financially,and technoligical Solution	Filteration Machine for all water that used in workshop
PRECIOUS METALS	2,4,30	Al-Qawasmeh Jewelry Company	5	public sewage system	No	No	public sewage system	MoNE	Political Solution	Use alternative substance from Italy instead of Sulphric Acid in some stages of manfacturing to decrease usage of this but this material not uses by all factories/and usage of filter for Fumes rising
PRECIOUS METALS	2,1,40	Iyad Imran Al-Saeed Company	1.5	public sewage system	No	No	public sewage system	MoNE,MoF	financially,and technoligical Solution	
PRECIOUS METALS	2,1,77	Imad Jewelry Workshop	1	public sewage system	No	No	public sewage system	MoNE,MoF	Political,and financially Solution	
SLAUGHTERHOUSES	Z1/B8/#32	Hijazi Shawar Slaughterhouse	52.5	public sewage system	No	No	septic tanks	Muni.	technically	Moderate size, moderate risk.
SLAUGHTERHOUSES	Z2/B4/#18	Al-Esra' Slaughterhouse	4.3	public sewage system	No	No	public sewage system	muni and national economy	technically	Small Size , moderate risk , they are trying to reuse the waste water for agriculture

INDUSTRY	GIS ID	COMPANY NAME	4A. WASTEWATER (m3/month)	4Bi. SEWER OR OTHER?	4Bii. ANY PRE-TREATMENT?	4Biii. ANY REUSE?	4Biv. DISPOSAL PROCESS (Qty & Loc)	5. GOVERNMENT IMPACTS / RELATIONSHIPS	6. SOLUTION FOR WW TREATMENT	8. FIELD OBSERVATIONS
SLAUGHTERHOUSES	Z3/B3/#26	Al-Bayed Slaughterhouse	34.3	public sewage system	No	No	public sewage system	ministry of health and national economy and muni	technically	moderate size and moderate risk
SLAUGHTERHOUSES	Z4/B1/#17	Al-Raed Slaughterhouse	1.5	public sewage system	No	No	public sewage system	muni and national economy	technically (no need)	Small Size , no risk , Normal Detergent
SLAUGHTERHOUSES	Z1/B9/#15	Al-natsheh alzeraeye	450	public sewage system	No	No	public sewage system	No Relationships	financially	Big SH / high risk
SLAUGHTERHOUSES	Z4/B7/#27	Hebron Muni. Slaughterhouse	450	public sewage system	No	No	public sewage system	Muni.	technically	The biggest SH in the hebron, and Unhealthy.
SLAUGHTERHOUSES	Z3/B8/#34	Al-Basha Slaughterhouse	390	public sewage system	No	No	public sewage system	Muni.	technically and financially	Big size , high risk.
SLAUGHTERHOUSES	Z4/B7/#28	Abu- sneneh Slaughterhouse	300	public sewage system	No	No	public sewage system	ministry of health and national economy and muni	technically	big size, they kill outside then enter SH and it contain 2 entrance.
SLAUGHTERHOUSES	Z3/B5/#30	Al-Qasrawi Slaughterhouse	300	public sewage system	No	No	public sewage system	ministry of health and Muni.	technically	small size , high risk
SLAUGHTERHOUSES	Z2/B1/#38	palestine Slaughterhouse	150	public sewage system	No	No	public sewage system	Muni.	technically	moderate size , moderate risk.
SLAUGHTERHOUSES	Z4/B7/#29	Wisam Slaughterhouse	150	public sewage system	No	No	public sewage system	HCCI and MNE and Muni.	technically	Moderate size, high risk.
SLAUGHTERHOUSES	Z2/B1/#37	Al-Qasrawi Slaughterhouse	120	public sewage system	No	No	public sewage system	Muni.	technically	small size , moderate risk.
SLAUGHTERHOUSES	Z3/B8/#33	Beit Almaqdes Slaughterhouse	60	public sewage system	No	No	public sewage system	Muni.	technically	Big size , moderate risk.
SLAUGHTERHOUSES	Z3\ B3\ #1	Abu Al-Noor Zahdah Slaughterhouse	40	public sewage system	No	No	public sewage system	Muni. & MNE	No	Moderate Size , Kill in some season
SLAUGHTERHOUSES	Z4/B1/#5	Al-Yazuri Slaughterhouse	36	public sewage system	No	No	public sewage system	Muni.	No	Small Siza,& there are 4 SH in this site
SLAUGHTERHOUSES	Z3/B8/#21	Al-Arz Slaughterhouse	30	public sewage system	No	No	public sewage system	Muni. & MNE	technically	Small size and zero risk
SLAUGHTERHOUSES	Z2/B4/#39	Alqala'a al-wardeye Slaughterhouse	30	public sewage system	No	No	public sewage system	Muni.	technically	big size , moderate risk.
SLAUGHTERHOUSES	Z1/B5/#31	Dofish Slaughterhouse	30	public sewage system	No	No	public sewage system	ministry of health and Muni.	technically	Moderate size, high risk.
SLAUGHTERHOUSES	Z2/B1/#36	Shahrazad Slaughterhouse	30	public sewage system	No	No	public sewage system	Muni.	technically	moderate size , moderate risk .
SLAUGHTERHOUSES	Z3/B5/#24	Shaheen SH	20	public sewage system	No	No	public sewage system	Muni and ministry of health	technically	moderate size and moderate risk
SLAUGHTERHOUSES	Z3/B5/#22	Al-Dmeiri Slaughterhouse	16	public sewage system	No	No	public sewage system	Muni and ministry of health	technically	Small size and zero risk
SLAUGHTERHOUSES	Z1/B9/#12	Al-Deek Al-Romi Slaughterhouse	15	public sewage system	No	No	public sewage system	Muni.	No	small size ,no risk Waste ,no kill
SLAUGHTERHOUSES	Z3/B8/#19	Al-Tahreer Slaughterhouse	10	public sewage system	No	No	public sewage system	muni and national economy	technically	moderate size and moderate risk
SLAUGHTERHOUSES	Z3/B2/#25	Al-Madeenah Al-Munawwarah Slaughterhouse	8	public sewage system	No	No	public sewage system	ministry of health and national economy	technically	moderate size and moderate risk
SLAUGHTERHOUSES	Z3/B3/ #3	AL-Bashaer S.H	6	public sewage system	No	No	public sewage system	Muni. & MNE	No	Small Size , Moderate product & risk
SLAUGHTERHOUSES	Z3/B5/#23	Al-Naseem Slaughterhouse	6	public sewage system	No	No	public sewage system	Muni and ministry of health	technically	Small size and zero risk
SLAUGHTERHOUSES	Z1/B9/#13	Al-natsheh Slaughterhouse	6	public sewage system	No	No	public sewage system	Muni.	technical	
SLAUGHTERHOUSES	Z3\B3\ #2	Zakaria Dofish S.H	6	public sewage system	No	No	public sewage system	Muni. & MNE	No	Moderate Size , no kill in site ,no risk
SLAUGHTERHOUSES	Z4/B1/#6	Al-Ahram Slaughterhouse	5	public sewage system	No	No	public sewage system	Muni. & MNE	No	No
SLAUGHTERHOUSES	Z2/B1/#35	Al-Za'tare Slaughterhouse	5	public sewage system	No	No	public sewage system	Muni.	technically	moderate size , low risk .
SLAUGHTERHOUSES	Z4/B1/#4	Khaleel Al-Rahman Slaughterhouse	5	public sewage system	No	No	public sewage system	No Relationships	No	Small Size ,No risk Waste
SLAUGHTERHOUSES	Z4/B1/#11	Zahrat Al-Mada'en Slaughterhouse	4	public sewage system	No	No	public sewage system	No Relationships	No	small size, zero risk
SLAUGHTERHOUSES	Z3/B3/#7	Ala' El-Deen Slaughterhouse	4	public sewage system	No	No	public sewage system	Muni. & MNE	No	Small Size , no risk
SLAUGHTERHOUSES	Z3/B8/#20	Al-Ekhlas Slaughterhouse	2	public sewage system	No	No	public sewage system	No Relationships	technically	Small size and zero risk
SLAUGHTERHOUSES	Z4/B1/#16	Al-Najah Slaughterhouse	2	public sewage system	No	No	public sewage system	Muni and ministry of health	technically	moderate size , low risk
SLAUGHTERHOUSES	Z3/B3/#14	zahdeh	2	public sewage system	No	No	public sewage system	Muni.	technically (no need)	small size, low risk
SLAUGHTERHOUSES	Z1/B9/#8	Al-Amanah Slaughterhouse	1	public sewage system	No	No	public sewage system	Muni.	No	Moderate Size & risk
SLAUGHTERHOUSES	Z4/B5/#9	Al-Shahd Slaughterhouse	1	public sewage system	No	No	public sewage system	No Relationships	No	Small Size , no risk , Normal Detergent
SLAUGHTERHOUSES	Z3/B3/#10	Al-Natsheh Slaughterhouse	1	public sewage system	No	No	public sewage system	Muni. & MNE	No	No
TANNERY	4,7,9	Al-Waleed for leather tanning	525	public sewage system	No	No	public sewage system	MoNE,HCCI,,Federation of lathing	Political Solution	
WOOD	Z4/B1/#63	Khalil- Alrahman Trade and Industry	2	public sewage system	No	No	public sewage system	no any relation	No need	Moderate size, no risk
WOOD	Z4/B8/#65	Abu Tareq Abu Husein Furniture Carpentry	0	public sewage system	No	No	public sewage system	no any relation	No need	No risk, dry industry
WOOD	Z4/B1/#67	Firas company	0	public sewage system	No	No	public sewage system	no any relation	No need	No risk, dry industry
WOOD	Z4/B4/#66	Bisan company	0	public sewage system	No	No	public sewage system	no any relation	No need	No risk, dry industry
WOOD	Z4/B8/#64	Khalil- Alrahman	0	public sewage system	No	No	public sewage system	Muni.	No need	Moderate size, no risk

Appendix F Industrial Zone Industries Map

Industrial Zone Area Factories

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Surveyed Factories

- Building Materials
- Cars Maintenance
- Ceramics
- Dry Clean
- Food
- Glass
- Hospital
- Industrial Equip
- Metal
- Paper
- Pharmaceutical
- Plastics
- Precious Metals
- Shoes
- Slaughterhouse
- Stone Cutting
- Tanning
- Textiles
- Wood

Appendix G Discharge Study Meeting Log

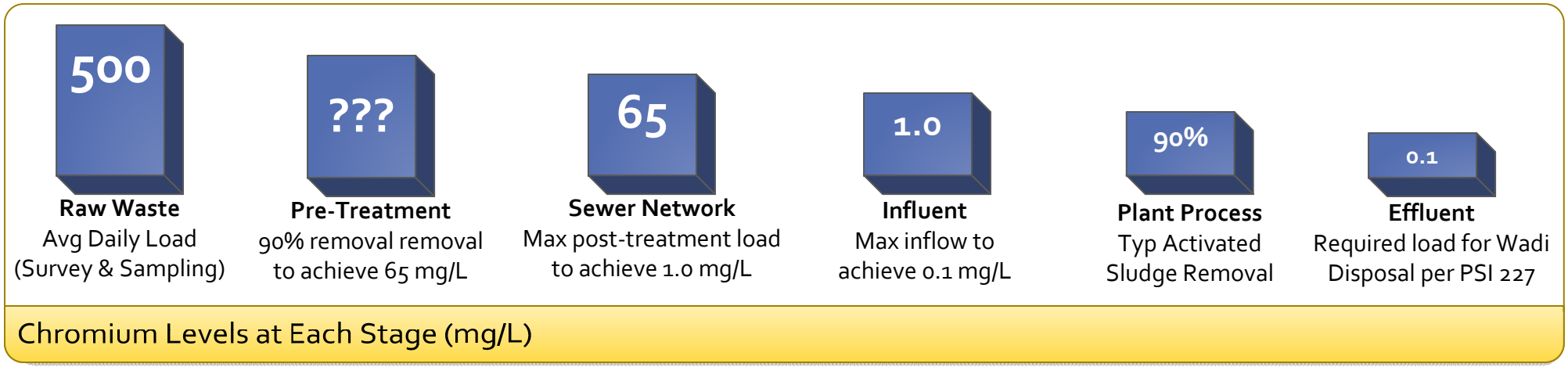
Summary of Project Meetings

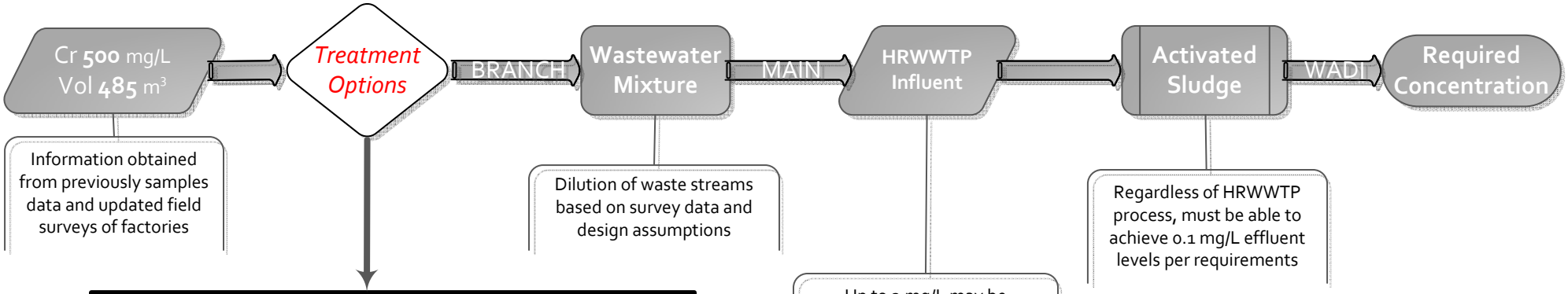
Meeting Type	Meeting Date	Meeting Contact	Meeting Organization	Meeting Description
Industry	(23 April)	Various	FOEME site visit	Meeting with (FOEME) at the Tanneries within the Hebron Industrial Zone to meet the independent expert on Tanneries
Industry	(24 April)	Various	FOEME meeting (Bethlehem)	Meeting with Friends of the Earth Middle East (FOEME) at their Bethlehem office to discuss data sharing with regards to tanneries and stone cutting industries
Industry	(28 April)	Various	(HCCI)	Meet with Hebron Chamber of Commerce & Industry (HCCI) to discuss their "Industrial & Craftsmanship Directory" of Hebron Governorate completed in 2012 and request their cooperation in providing us with this information (excel only, no GIS) to assist our project
Industry	(05 May)	Tawfiq Nassar	(PCBS)	Meeting with Palestinian Central Bureau of Statistics, Hebron office (PCBS) to request the details from their surveys of industrial factories within Hebron and generally discuss the Bureau's survey collection and data methodology
Industry	(05 May)	Various	Hebron Municipality	Meeting with Hebron Municipality to request electronic soft copies of the road and sewer network and to discuss the regulatory abilities of the Municipality to control industrial waste
Institutional	(06 May)	Islam Abu Ziad	(MoLG)	Meeting with Ministry of Local Government (MoLG) to discuss regulatory framework for wastewater regulation and enforcement
Institutional	(06 May)	Yasir AbuShanab, Nidal AlKatbeh, Ahmed Abu Thaher	(MEnA)	Meeting with Ministry of Environmental Affairs (MEnA) to discuss role of Ministry in oversight and regulation of environmental standards for wastewater treatment and discharge
Institutional	(06 May)	Adel Yassine	(PWA)	Meeting with Palestinian Water Authority (PWA) to discuss wastewater treatment and reuse needs in Hebron as aligned with SOW, and the role of PWA in the process
Technical	(08 May)	Belal Amous	Birzeit University	Meeting with Birzeit University to review testing facilities and understand capabilities to select partner for performing 24-hr sampling event
Administrative	(08 May)	Various	USAID	Meeting with USAID to provide project update
Industry	(09 May)	Dr. Wafaa Hasan	PPU	Meeting with Palestine Polytechnic University review testing facilities and understand capabilities to select partner for performing 24-hr sampling event
Industry	(09 May)	Various	(HCCI)	Meeting with key industry representatives at Hebron Chamber of Commerce & Industry (HCCI) to introduce them to the project and request their support for the upcoming field survey
Institutional	(09 May)	Ludo Prins, Russell Abrahms	World Bank's Water Sector and (TPAT)	Meeting with the World Bank's Water Sector and Capacity Development Technical Planning and Advisory Team (TPAT) to discuss the wastewater sector, restructuring plan, tariff management, policies and regulation, future vision, and required support
Institutional	(15 May)	Adel Yassine, Marwan AlAkhdar	Hebron Municipality and PWA	Meeting with Hebron Municipality and PWA to discuss the Industrial Zone Bypass Project
Technical	(16 May)	Dr. Wafaa Hasan	PPU	Meeting with Palestine Polytechnic University finalize agreement in order to start sampling by Tuesday, May 21st
Industry	(18 May)	Tariq Abu Alfeilat	Union of Leather and Shoes	To gather information regarding leather and shoes manufacture in Hebron
Industry	(19 May)	Amer, Aatif, Hatem Zaatarie	Tanneries	To talk in general about the project and have full idea about tannery manufacture in Hebron, and it's wastewater composition
Institutional	(21 May)	Zuhair Isead	Hebron Municipality legal adviser	Met with Mr. Zuhair Isead (Hebron Municipality legal adviser) to discuss the legal issues related to wastewater management in Hebron
Industry	(21 May)	Asma Qawasmeh	Alia Hospital	To investigate water usage and waste water and its composition in the hospital in general, especially clothes washing, cleaning, restaurants, or any activity involving water
Industry	(22 May)	Najeh Ghayyada	Eng. Najeh Ghayyada	Meeting with Eng. Najeh Ghayyada (Hebron University Dept of Nutrition & Food Technology) to validate the Industries of Concern within the Food Industry
Institutional	(23 May)	Yasser Dweik	Yasser Dweik (JSC)	Meeting with Yasser Dewik (Joint Service Council) to discuss the waste management operations and current waste management projects ongoing with Hebron Municipality
Institutional	(25 May).	Hashem Qawasmeh, Marwan AlAkhdar	Hebron Municipality	Meeting with Municipality to discuss preliminary regulatory environment for sewage and wastewater in preparation of the upcoming legal advisors roundtable, also discussed stonecutting enforcement
Institutional	(26 May)	Marwan AlAkhdar, Amjad Obeidu	Other Donor Projects	To gather information on proposed or executed projects related to waste water in Hebron and a brief description for each one; also to get a list of donors for those projects.
Institutional	(27 May).	Adel Yassine	Adel Yassin (PWA)	Meeting with Adel Yassin (PWA) to discuss the bypass project, connection bylaw, and general industrial zone concerns from the PWA perspective – namely tanneries, stone cutting, and slaughterhouses
Technical	(27 May).	Majid Hamouda, Peter Hermans, Johan Lijftogt	CEC and W+B	Meeting with CEC and W+B to discuss the design assumptions, standard assumptions, and TOR preconditions for the HRWWTP. Discussed in detail the basis of design and possible need to update the criteria according to new information from this study

Institutional	(27 May).	Various	Legal Advisors Roundtable	To bring together the key legal advisors from relevant ministries and the Municipality of Hebron to discuss regulations, enforcement, and policy regarding penalties related to the treatment and dumping of industrial waste from industries within Hebron (both the Industrial Zone and the City)
Administrative	(29 May).	Various	1st Stakeholder Jacir Palace	Held 1st Stakeholder Meeting at Jacir Palace in Bethlehem to discuss the study progress, findings, and next steps. Attendees included: AFD, World Bank, USAID, PWA, Hebron Municipality, Ministry of Environmental Affairs, and Ministry of National Economy
Industry	(03 Jun).	Ashraf Morar	Ramallah Municipal Slaughterhouse	Visit the Ramallah Municipal Slaughterhouse as comparative case study to the Hebron Municipal Slaughterhouse with regards to both technical operation / performance and institutional management / regulation
Industry	(10 Jun)	Various	Union of Stone & Marble (USM) Bethlehem	Met with Union of Stone & Marble (USM) to discuss performance of industries in Nablus and Bethlehem then arrange a visit to Bethlehem branch (Tue, 6/10) with local authorities to better understand the management and regulation of the waste as a comparative case study to Hebron.
Institutional	(12 Jun)	Yasser Dweik	Solid Waste Management with Yasser Dweik	With the success of the solid waste management program, would like to investigate the operations and management of solid waste that could be applied to slurry haulage.
Institutional	(13 Jun)	Musa Jweid, Lamya Hamayel	Al-Bireh Municipality	To gather information on what is happening on the ground in Al-Bireh, especially as related to regulations and WWTP
Technical	(13 Jun)	Khaled Ghazal	Ramallah Municipality and WWTP - meeting	To gather information on waste water treatment plants in Ramallah and regulation and enforcement that applied in municipality
Technical	(13 Jun)	Mahmoud Abed	Al-Bireh WWTP meeting	To gather information about WWTP in Al-Bireh to know all sections of it and its work mechanism and the plant effeciency is evaluated and the studies hepled in establishing it .
Administrative	(13 June)	Various	USAID pre-Stakeholder session meeting	Discuss findings and recommendations to be presented on 19 June Stakeholder Meeting
Institutional	(15 June)	Yasser Dweik	Solid Waste Management with Yasser Dweik	Follow on meeting to previous solid waste management meeting to discuss operations and institutional process and visit Al-menya sanitary landfill
Administrative	(19 June)	Various	2nd stakeholder meeting - Jacir Palace	Discuss data findings and recommendations to be integrated into final report

Appendix H Chromium Removal Flow Balance

Chromium Waste Flow Balance Diagram

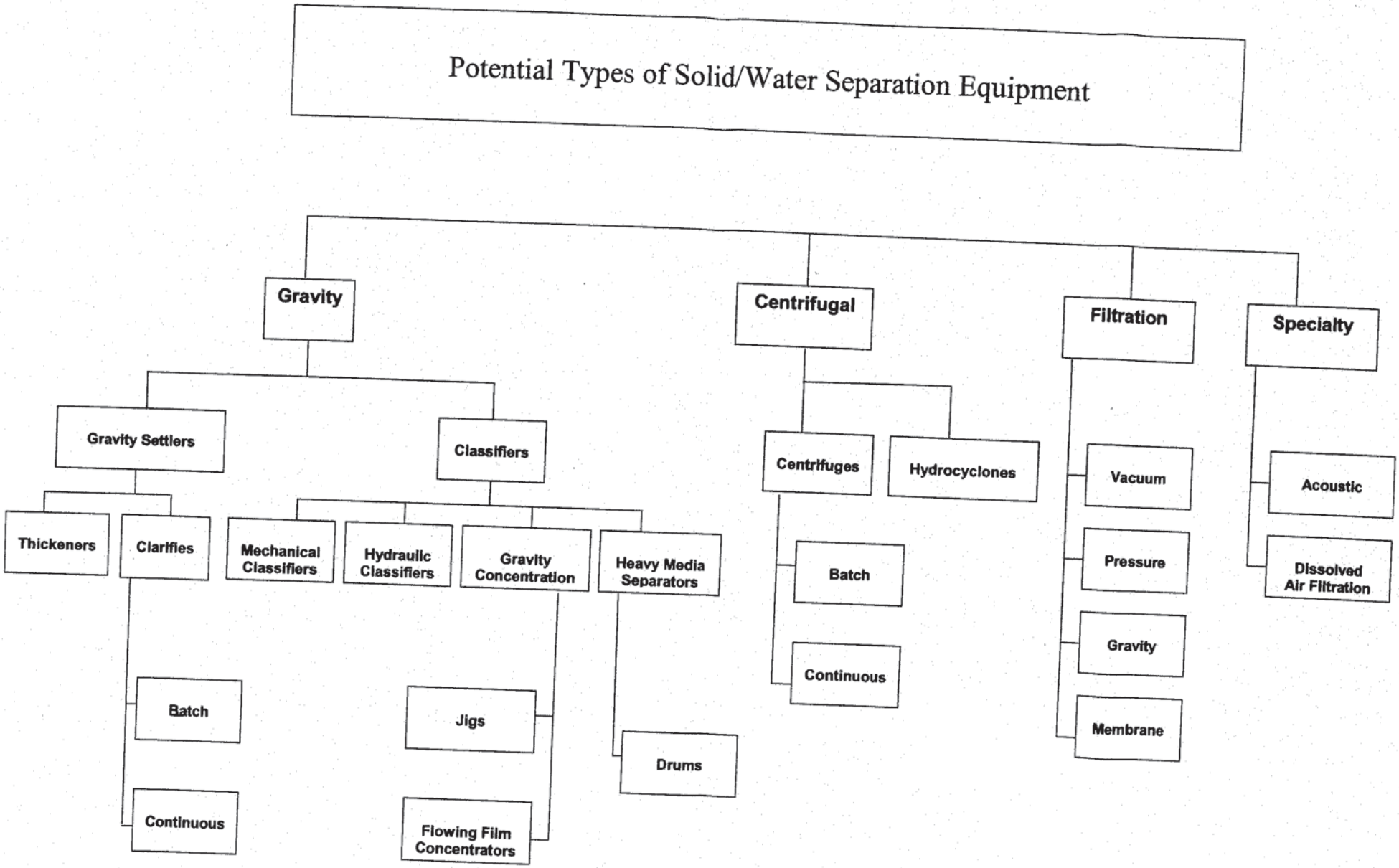




Technology	Cr Removal	Issues	Option?
Existing (MgO)	99%	H2SO4	Yes (Mod)
Phys / Chem	99%	---	Yes
Biological	40%	Low Removal	No
Electrical	60%	Low Removal	No
Ion Exchange	99%	HI OPEX	No
Membrane	99%	HI CAPEX	No

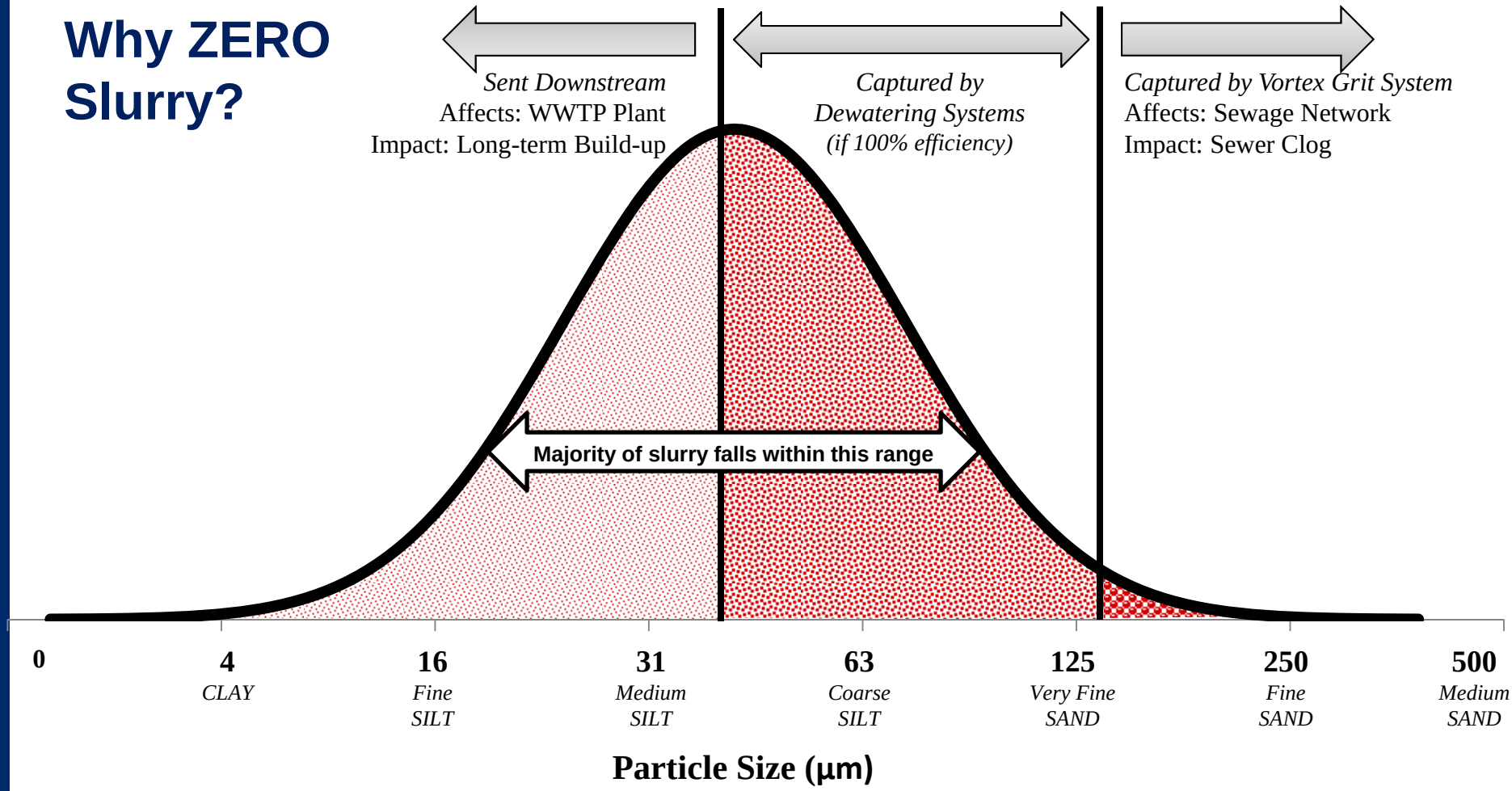
Appendix IStone Slurry Pretreatment Technologies

Figure 4.1 Typical Technologies in Industrial Solid/Water Separation.



Appendix JStone Slurry Particle Distribution

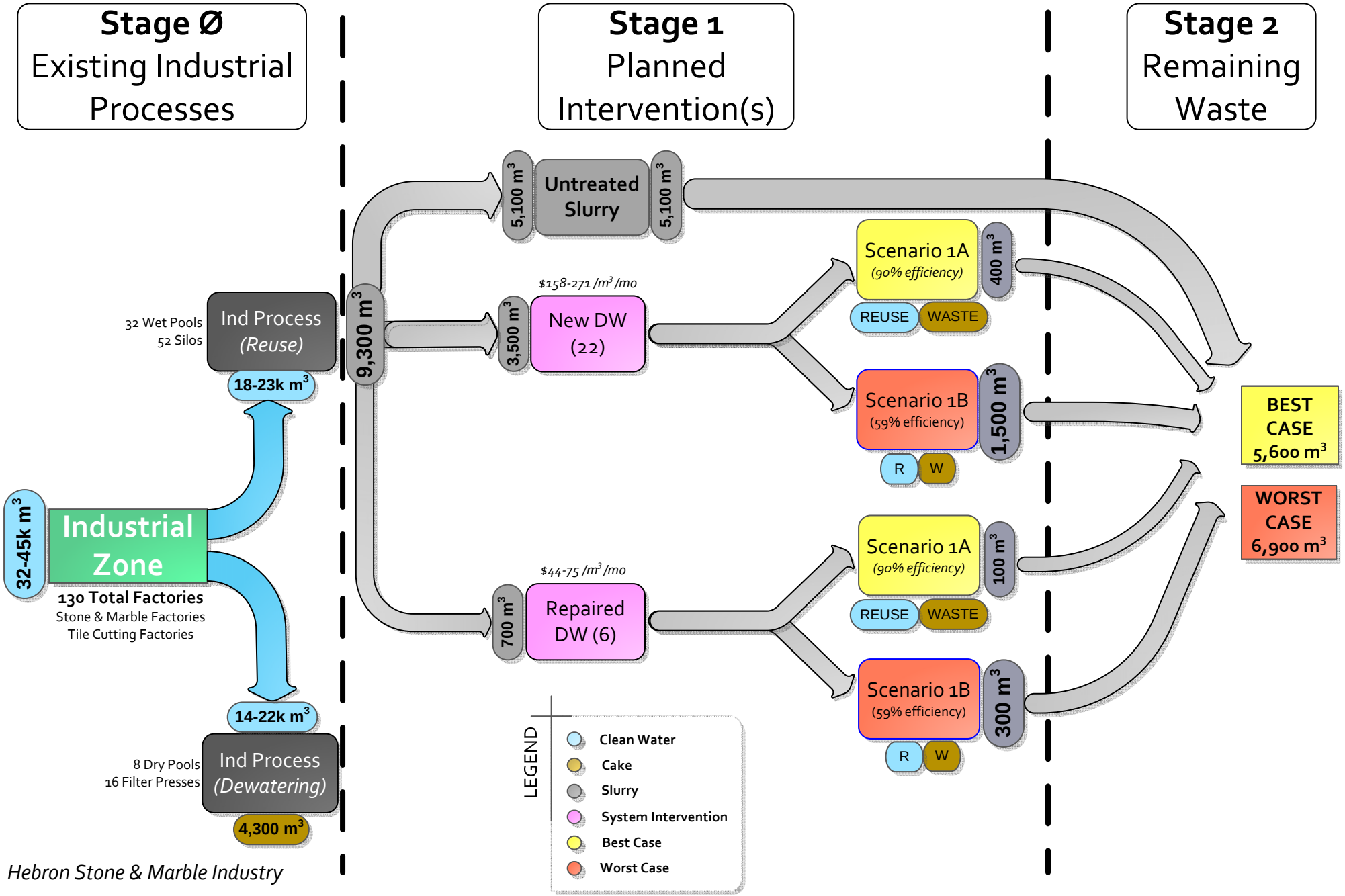
Why ZERO Slurry?



Based on Udden-Wentworth Grain Size Classification

Appendix K Stone Slurry Flow Balance

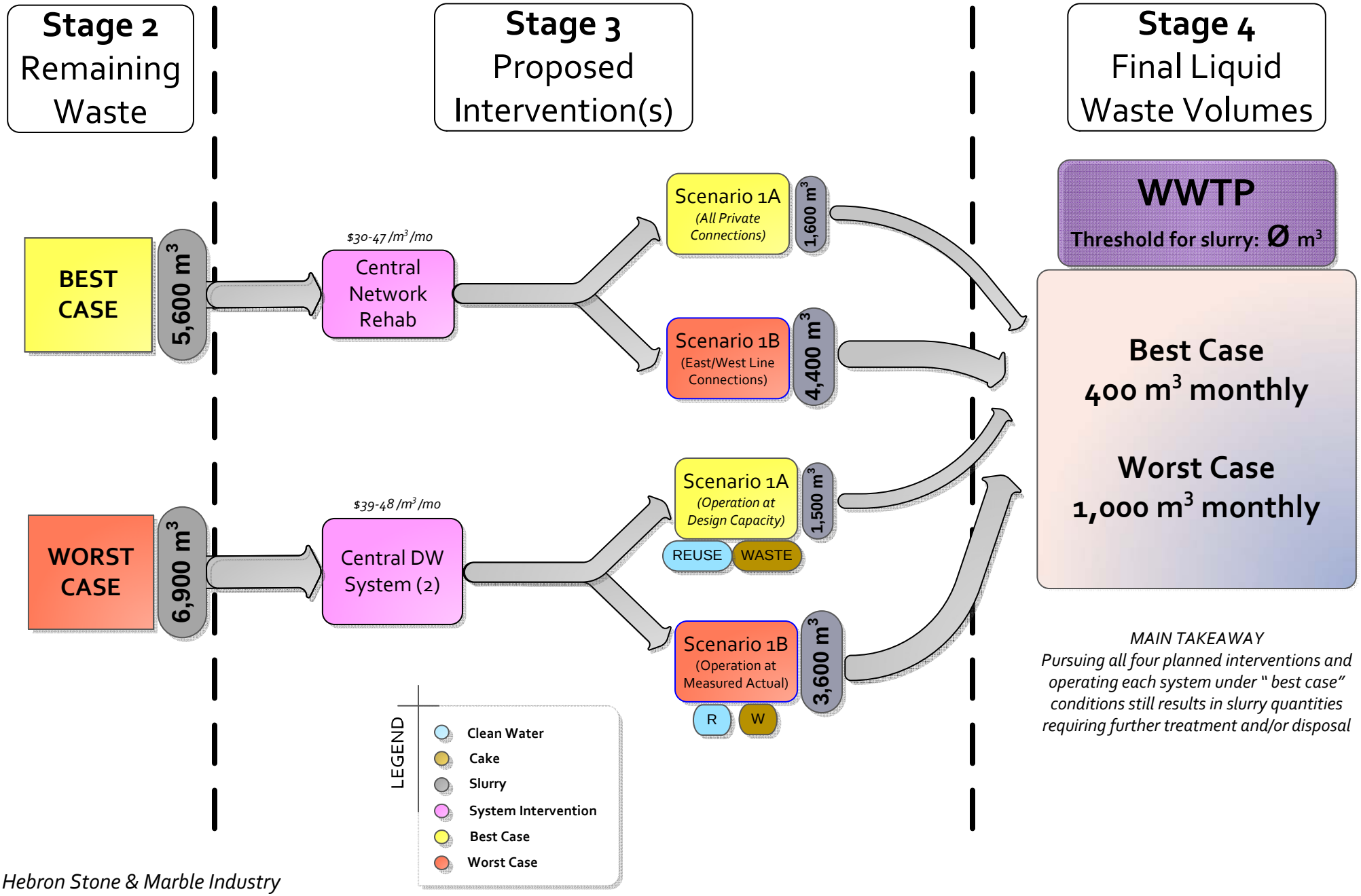
"Slurry" Waste Flow Balance Diagram



Hebron Stone & Marble Industry

Industrial Discharge Study Project

"Slurry" Waste Flow Balance Diagram



Appendix L Industrial Waste Risk / Impact Matrix

Industrial Wastewater Risk and Impact Matrix

Risk Details		Impact Categories / Risk Factor					
Industry	Risk Description	Collection	Hydraulic Load	Organic Load	Plant Process	Irrigation Reuse	Health / Safety
Olive Mills	Phenols	0.15	0.07	0.21	0.81	0.15	0.03
Tannery	Chromium	0.05	0.21	0.21	0.81	0.21	0.07
Tannery	TSS	0.15	0.21	0.35	0.63	0.09	0.03
Stone & Build Mat.	solids - fine	0.15	0.21	0.21	0.63	0.09	0.03
Tannery	Phenols	0.15	0.21	0.21	0.63	0.15	0.03
Olive Mills	TSS	0.15	0.07	0.63	0.45	0.09	0.03
Dairy	TKN	0.15	0.21	0.49	0.45	0.09	0.03
Dairy	TSS	0.15	0.21	0.49	0.45	0.09	0.03
Slaughterhouse	TKN	0.05	0.21	0.35	0.45	0.09	0.03
Tannery	TKN	0.05	0.21	0.35	0.45	0.09	0.03
Tannery	Sulfur forms	0.25	0.21	0.35	0.45	0.15	0.07
Metals Finishing	CN (cyanides)	0.05	0.07	0.21	0.45	0.15	0.07
Tahina	TSS	0.15	0.21	0.21	0.45	0.09	0.03
Tannery	Salts, TDS	0.05	0.21	0.21	0.45	0.21	0.03
Tahina	Salts	0.15	0.21	0.07	0.45	0.21	0.03
Dairy	Oil & Grease	0.25	0.21	0.63	0.27	0.09	0.03
Dairy	BOD, COD	0.05	0.21	0.63	0.27	0.09	0.03
Olive Mills	BOD, COD	0.15	0.07	0.63	0.27	0.09	0.03
Slaughterhouse	Blood	0.15	0.21	0.63	0.27	0.09	0.05
Slaughterhouse	Oil & Grease	0.25	0.21	0.49	0.27	0.09	0.03
Tahina	BOD, COD	0.05	0.21	0.49	0.27	0.09	0.03
Tannery	BOD, COD	0.05	0.21	0.49	0.27	0.09	0.03
Tahina	Oil & Grease	0.15	0.21	0.35	0.27	0.09	0.03
Vehicle Washing	Petroleum Byproducts	0.15	0.21	0.35	0.27	0.09	0.05
Vehicle Washing	Oil & Grease	0.25	0.21	0.35	0.27	0.09	0.03
Vehicle Washing	Solvents	0.05	0.21	0.35	0.27	0.09	0.05
Dry Cleaning	Perchlorethylene	0.05	0.07	0.21	0.27	0.15	0.09
Hospitals	Detergents	0.05	0.07	0.21	0.27	0.09	0.03
Metals Finishing	pH	0.15	0.07	0.21	0.27	0.09	0.07
Stone & Build Mat.	solids- heavy	0.35	0.21	0.21	0.27	0.03	0.03
Stone & Build Mat.	soluble, near soluble	0.05	0.21	0.21	0.27	0.09	0.01
Tannery	pH	0.25	0.21	0.21	0.27	0.09	0.07
Vehicle Washing	Detergents	0.05	0.21	0.21	0.27	0.09	0.03

Appendix M Regulatory Catalogue

Hebron Discharge Table of Relevant Wastewater Regulations

Institution	Law Title	Year	Description	Notes	Hard / Soft
Ministry of Local Government MOLG	Local council law No.1	1997	This law regulates the Palestinian Local Council. It is Palestinian Law. It includes the local council's role in different fields, and gives them their own authorities which facilitate their work and duties as best as possible. Also this law explains the relationship between the local councils and MOLG and MOLG role toward the local councils. This law explains that wastewater and sewage systems are the local council's responsibility, as they are the provider of services.	**See Article Detail List for further description*	Hard & soft copy \ Arabic
Hebron Municipality	Sewerage system and Hygiene control Law No.3, Issued according to Article (41), Law No.9	1986 (Updated from year 1955)	This system is concerned with the restriction on all kinds of institutes in relation to the process of discharging water into the public sewerage network **Violation sanctions:** the system gives the local councils the tasks and duties, responsibilities and authorities, to be used against who violate the system.	Derived from Jordan municipality law. Though old, still Hebron uses. **See Article Detail List for further description*	Hard copy \ Arabic Digital copy retyped by the team Translated to English
Hebron Municipality	Municipalities' law article 26 –sewerage and general health system	1986 (Updated from year 1955)	This article states the fees imposed by municipality for connection to sewage line: • 25 JD for connection request • 1 JD for each square meter of the building floors according to the license of the constructed building • 20 JD fees upon every residential building and 10 JD legal fees for every commercial store. • 50 JD connection fees for every commercial store with area of 42 m^2 and one JD for each additional one m^2. Item 2 article 28 is not applied on this case • 50 JD fees are collected from lubrications, car washing, factories and stone cutting factories, and 3 JD contribution fees on each square meter.	Connection fees are paid once.	Hard copy \ Arabic Translated to English
Hebron Municipality and PWA	Memorandum of understanding between PWA and Hebron Municipality on the remnants of the stone saws in Hebron	2013	MOU between PWA and Hebron Municipality on the remnants of the stone saws in Hebron, presented solutions to the following: 1. Create new bypass conveyor lines beyond the industrial area, so prevent future stone saws from reaching others with these new lines, cutting saws links and existing factories, which are linked illegally. 2. Treatment plant expansion which was established a year ago with funding and support from the EU, where it is expanded and increase its current capacity from which to address all remnants of stone saws.	Copy received not yet signed **See Article Detail list for further description*	Soft and hard copy\ Arabic and English
Ministry of Health	General Health Law No.20	2004	This law gives the MOH duties and its functions according to article 2 from this law. • Article 33 states no license should be given to any industrial		Hard & soft copy \ Arabic

MOH			building without approval from MOH. • Law forbids practicing any craft that has a negative influence on general health and environmental health except with approval from MOH. One of the functions given to MOH is determining "health hazard" which threatens the general and environmental health. • Article 40 states that everyone has to maintain and protect the environment and not cause any type of "health hazard" and anyone who causes this should remove the harm. • Article 41: the specialist employee in MOH sends a warning letter to the person causing the harm in order to remove the harm that occurred within a time scale determined according to the level of harm caused. • Article 42: MOH in coordination with stakeholders should discharge, transfer, store or treat the hazardous waste, also waste water collection; treatment, reuse or discharge should be in a healthy manner. • Article 78 : talks about the role of MOH inspectors as the law gives them the procedure for inspection as they are allowed to notice the crimes according to this law and write the official signed reports of the incident • Article 88: penalties on violators: if any the harm done by the violator caused death or a big financial loss, the penalty would be prison. In case of repeated offense the penalty will be doubled.		
Palestinian Water Authority PWA	Water law No.3	2002	Aims at developing and increasing capacity of water resource management, improving quality and protecting from pollution. The law states the foundation of a water authority and describes its jobs, tasks and roles.		Hard & soft copy \ Arabic
Ministry of Local Government, PWA	Regulations project for linking houses and industries to public sewerage	2013	This legislation is still under study and it has not approved in any of the local councils yet. This legislation is concerned with all relevant issues related to linking houses and industry with the public sewerage network, including the condition imposed on these connection owners and the qualification of the waste water discharged from them. The owners that violate the conditions will not be licensed to be linked with the public network. This legislation is also concerned with the functions of the local councils and their departments and branches. According to the legislation, the head of the local council authority is in charge of punishing the ones who violate the regulations.	Still need approval **See Article Detail List for further description*	Soft and hardcopy \ Arabic Translated to English

Hebron Discharge Table of Relevant Wastewater Regulations

Ministry of Environmental Affairs	Law No.7 concerning environment	1999	The law aims at the following: 1. Protect the environment from all forms and different shapes of pollution 2. Protect the public health and social welfare 3. Introduce the basis of environment protection in the economic and social development plans and encourage durable development of the bio-sources so as to observe the rights of the coming generations 4. Maintain biological diversification, protect the areas with environmental sensitivity and improve the areas which have experienced damage from the environment aspect 5. Encourage the compilation and publication of the various environmental information and enhance the public consciousness of the environment issues.	Chapter three in this law is talking about the water environment and waste water discharge from article No.28 to article No.30 **See Article Detail List for further description*	Hard & soft copy \ Arabic & English
Ministry of Environmental Affairs	Referential condition to evaluate the environmental effects	1999	The specific conditions to evaluate the environmental effects can be applied on any project and can be presented as an application form by its owner to be approval environmentally. The environmental effect is evaluated with respect to the general guidelines of the environment evaluation process issued by EQA Evaluation includes the following : 1. Air Quality 2. Surface water and its kind 3. Soil and natural forests 4. Water resources 5. Wildlife 6. Transportation 7. Infrastructure 8. Landscape 9. Labor service 10. Hygiene 11. Sewage and industrial water 12. Solid and liquid waste 13. Noise	Authority of Environment Quality became Ministry of Environmental Affairs	Hard copy \ Arabic
Ministry of Environmental Affairs	Palestinian Environmental Assessment Policy		This is an outline of environmental assessment framework and procedures for proposed project plans and existing projects		Hard & soft copy \ English

Hebron Discharge Table of Relevant Wastewater Regulations

Ministry of Environmental Affairs	Decision of the council of Ministers No.25	2010	The decision was based on the recommendation of the chairman of the EQA to regulate the environmental approvals for new and existing masonry and marble saws, and tile and ready-made concrete factories in accordance with the provisions of this bylaw and the provisions stipulated in the Environmental Assessment Policy.		Hard and soft copy \ English and Arabic
Palestinian Standard Institution	Recycled Industrial Waste Water Standards, PS1 227	2010	This is the recent standard in PSI, and it is specified to limiting the conditions requirements and restrictions imposed on the discharges of industrial facilities or its treatment plants to the valleys or surface water or for reusing it in irrigation.		Hard copy \ Arabic Translated to English
Palestinian Standard Institution	Treated water for agricultural use standards	2012	This mandatory regulations aims to: • Setting basics for using the treated waste water for agriculture in a way that does not cause harm to humans, animals and plants • Guarantee that this treated water will not cause any harm upon environment elements (soil, water and air) The appendix for those regulations details treated water classifications. Concerned ministries are MOA and PWA		Soft and hard copy \ Arabic Translated to English
Ministry of National Economics	Industrial Licensing Procedures	2010	This guide is concerned with the industry procedures of how to obtain licenses and its approval cycle through the official departments. The guide presents shows the cycle of the procedures to be followed.	*See Article Detail List for further description*	Hard copy \ Arabic
Ministry of National Economics	Industrial permission procedures		Supposed to outline licensing and permission procedure, but it was a repetition of some items already shown in the MONE bylaw	Still needs approval from the cabinet	Hard copy \ English & Arabic
Ministry of National Economics	Law No. 10 concerning industry	2011	This law outlined the current powers and authorities to MONE, and explains the basics related to issuing the licenses for industrial facilities and explains the cases of confiscation of the licenses	MONE laws from original Ministry of Industry	Hard and soft copy \ Arabic
Hebron Municipality	Slaughter Houses System	1956	This system is a Jordanian system and still used in Hebron Municipality, it is related to organizing the slaughter houses in the city and its work and licensing. It states foundation of municipal slaughter house its duties and authorities and setting the penal system for anyone violates the slaughter houses system	*See Article Detail List for further description*	Hard copy \ Arabic
Joint Service Council JSC	Medical waste Legal System	**2012**	Distinguishes between solid and liquid wastes and ways of discharging, managing remote areas (storing, collecting transmitting) This law states that medical waste water should be separated from domestic waste water and it is forbidden to discharge it randomly. This law imposes treatment of medical waste water before discharging in the medical sewer network	*See Article Detail List for further description*	Hard copy \ Arabic

Hebron Discharge Table of Relevant Wastewater Regulations

			This law gives the inspectors duties and functions according to article 56 from this law also it states the MOH authorities and duties toward medical waste management (the same for MENA 's inspectors and local councils and their inspectors). The penalty procedure for this law referred to related laws and applied in ministries and local councils.		
Joint Service council	Solid waste Legal System	**2012**	This legislation is under study and it is not yet signed by ministers' council. It is specialized in solid waste only.	Still needs approval	Hard copy \ Arabic
Ministry of Agriculture	Agriculture law No.2	**2003**	This law talks about everything related to agriculture and does not specify any items related to waste water specifically		Hard soft copy \ Arabic
Ministry of Industry	Law No.1 1999 natural resources	**1999**	This law talks about establishing and forming " General Admin of Natural Resources " in Ministry of Industry and determining its functions and duties but nothing mentioned about waste water	Now MONE	Hard and soft copy \ English and Arabic
Ministry of Industry	Law No.10 regarding Industrial Estates and Industrial Free Zones	**1998**	Forming and establishing "Palestinian Industrial Estates and Free Zones Authority" PIEFZA and determining its functions and duties , and organizing everything related to the industrial zones functions	Now MONE	Hard and soft copy \ English and Arabic

Appendix N Relevant Regulatory Articles

Regulatory Details Related to Wastewater and Sewerage

Licensing and Industrial Developing Procedure (MoNE) 2010

A. Issuing License for Constructing Industrial Facility:
   Service requirements:
   - Industrial license application
   - Stakeholders approvals needed for license issuance (MENA, MOLG, Municipality and other related)
   - Required documents :
     - Survey map certified from licensed surveyor
     - Copy of ID
     - Copy of trader registration
     - Copy of company registration
     - Possession or rent document for the place
     - Primary feasibility study
     - 100 NIS for the factory

B. Operating license for industrial facility :
   The beneficiaries from this license are the same which have the construction license either for new or constructed factory or had a construction license before
   Service requirements:
   - Handwritten application for operating license
   - Required documents
     - Pledge not to run the factory before getting the operating license
     - Field visit report to the facility and its readiness to work
     - Building license
     - 100 NIS fees

C. Renewing operating license
   The beneficiaries are those which had the operating license and it is expired.
   Service requirements:
   - Renewing operating license application
   - Required documents:
     - Field visit report
     - 100 NIS fees

Medical Waste Management System (Joint Service Council) 2012

A. Chapter Ten: Article (68) – Violators Penalty :

Who violates this legal system and regulations should be penalized according to related scheduled penalties in the law.

B. Article (69) : Canceling or Confiscation the Environmental Approval

MENA is allowed to confiscate or cancel the environmental approval in accordance to rules of this system if the owner did any kind of violation of the environmental approval conditions

Slaughterhouses Legal System (Municipality) 1956

A. Article (3) from this legal system states that each municipal or village council or camp with population more than three thousands must establish a public slaughter house

B. Article (8) from this system states that it is not allowed to slaughter the animals outside of the public slaughter. It is forbidden to set meat for sale unless it is stamped by the official seal.

C. Article (34)from this states in paragraph two that the governmental veterinarian has the authority to enter the butcher to verify the expiration date for meat and sacrifice

D. Article (35) from this system states that it is allowed for every municipal and village council to set what regulations it finds suitable for managing public slaughter comprehensively and in organized way and it should be coupled with director of veterinary's approval.

Local Council Law(MoLG) Law no.1 year 1997

A. Article (2) from this law states that MOLG set the general policy for scheduled local councils work and supervision on their functions and specializations .MOLG supervises on budget and financial, administrative and legal monitoring also the procedures related to forming those councils.

B. Article (3) from this law states that the local council has its own legal character and financial independence and identifies its functions and authorities referring to the law.

Environmental Law No.7 (MEnA) 1999

A. Part three: Aquatic Environment
   a. Article (28): The Ministry shall , in cooperation with the competent authorities , determine the quality standards and characteristics of the drinkable waters .

   b. Article (29) : The Ministry shall formulate , in coordination with the competent authorities , the standards and criteria necessary for the method of compiling treating , re-use or dispose of the waste water and rain water is a sound manner which is consistent with the reservation of the environment and public health
   c. Article (30): it shall be prohibited for any individual to dispose of any solid, liquid or other material except in accordance with the conditions and standards determined by the competent authorities.
B. Part four : Penalties
   a. Article (68): whoever violates the provisions of article thirty of this law shall be penalized by financial fine of 200 JD and not exceeding one 1,000 dinars or the equivalent thereto in the currency in legal circulation currency and imprisonment for a period of not less than one month and not exceeding six month or by one of these two penalties.

Sewage Law No.3 (Municipality) 1986

(Sewerage legal system and health inspection in Hebron city issued in accordance to article 41 from municipality's' law for year 1955)

A. Article (2): it is forbidden for anyone to discharge liquid wastes or polluted water to any natural stream or any uncovered place in the municipality region before filtering and getting a written consent from the municipal council.

B. Article (34) : mayor authority is to commission property's owner to remove the health harms
1. The mayor has the right to assign a property owner that hasany of the health harms on their property to remove that in accordance to official note in a determined period in the note
2. If anyone ignores the official note in accordance to the regulations the mayor has the right in case of necessityto commission the health employee in the city to remove the harm and the cost is on the owner who was informed about the official’s note containing the imposed fees
3. If the property which contains harm is owned by multiple owners it is sufficient to inform one of them with the official note

C. Article (36) : Health Harm Monitoring

The municipality engineer and in charged health employee in the city or any municipality's sheriff "if he authorized in by written order" to inspect any facility in the municipality region or suspect there is any kind of health harm also he has the right to enter

any facility between 8 am and 5 pm after explained note of which land and building in company with assistants or workers and to dig land in any place they feel suitable without any damage and if there is health harm the owner should obey the inspection.

D. Article (15) : it is forbidden for anyone to discharge any disposal or analytical complex to natural stream and also it is forbidden for him allow this to happen

E. Article (19) : it is forbidden for anyone to discharge or allow to discharge any kind of following liquid wastes:
- Petroleum materials or derivatives like benzene, solar, oil and fuel oil etc or any liquid, gas or solid materials either it is separate or mixed with other materials with amounts may harm or impedes the filtration process or may cause harm to human, animal or plants or any public harm
- The council has the right to give the license for allowance of these things mentioned in previous paragraph

F. Article (20) : if it is shown for the council that the liquids and wastes or matters discharged to the public sewer contains any of the aforementioned materials it is allowed for the council to :
- Forbid discharging those liquids or materials to the public stream
- Assign the owner to have a primary filtration suitable for separating the harmful substances before discharging to the sewer system or making any amendment in concentration percentage and this according to the regulations and standards assigned from the council or the engineer depending on the circumstances
- Assign the owner to pay additional money to the municipality covers the cost paid by the municipality for filtration process because of discharging those substances to the sewer.

G. Article (21): if the owner assigned to do primary filtration for the liquid wastes especially the industrial special equipment for this technology should be established according to the approved standards by the council and to guarantee it is working efficiently and continuously and do the regular maintenance.

H. Article (24): the council has the right to commission entering to the private and public properties for inspection or monitoring the private sewerage network and verifying that is it matching with this system regulations, with the inspector carrying his own ID.

I. Article (26) : regarding the fees imposed on industrial factory owners who have been licensed before

J. Article (35) : Penalties

Who violates this system regulations is penalized with 20-50 JD or arrest for a month, or both, and removing the violation and health hazard.

Regulations Project for Linking Houses and Facilities to Public Sewerage (MoLG, PWA)No( ) year 2013

A. Article (3) : from the law states that " those regulations are applied to anyone benefits from the water and sewerage services inside and outside the local councils borders"

B. Article (15): about discharging the commercial and industrial waste water
- It is forbidden to discharge the waste water commercial, industrial and polluted and unpolluted agricultural to the sewer system except after treating and getting hand-written approval from services provider (water, sewerage) according to the regulations in appendix no.1 for this system
- It is forbidden for anyone to discharge or allow to discharge any radioactive substances or any kind of industrial isotopes to the public sewer system
- It is forbidden to anyone to discharge or allow to discharge the waste water from drugs factories and polluted disposals from hospitals and other analytical samples to public sewer system except after treatment and getting the permission from stakeholders

Regulatory Details Related to Wastewater and Sewerage

- It is forbidden for anyone to discharge or allow to discharge waste water and waste oil from olive mills to the public sewer system and the owners should make the production procedure follow the regulations mentioned in appendix no 1 from this system
- It is forbidden for anyone to discharge or allow to discharge waste water from commercial kitchens, restaurants and food factories and hotel to the public sewer system except after establishing fats trap and after getting hand written approval from services provider (water, sewage) with commitment to maintain the fat trap
- It is forbidden for anyone to discharge or allow to discharge the waste water from lubrications and car washings to the public sewer except after establishing oil trap unit after getting hand-written approval from the services provider with commitment to regular maintenance
- It is forbidden for anyone to discharge or allow to discharge waste water and settling matters from stone cutting factories and industrial building materials to the public sewer or streams or any open place and the service provider (water, sewerage) has to offer specified locations for drying or disposing the stone cutting deposits
- It is forbidden to dilute the pollutants in industrial waste water by mixing with the fresh or drinkable water to have the mentioned concentrations in the regulations in appendix no 1 from this system

C. Article (11) : industrial facilities sewer connections licenses

1) Trade and industrial facilities having current license should apply to connect its sewer system with the public one and this application contains the following details:
    a. Trade and industrial processes that followed and which produce waste water
    b. Used and resulting chemicals in this process
    c. Amount of water used and its source and how much goes out after industrial process
    d. Physical, chemical and biological characteristics for waste water intended to be connected to the public sewer system
    e. Technical details for the mechanical, chemical and biological processes for primary treatment unit "if it is available" which designed by submitted side
    f. Waste water containers capacity and locations which must be used in case of necessity
    g. Any information the service provider find it necessary in studying the sewer connection application

D. Article (14): " the service provider (water, sewerage) collect the capitalcost for establishing the public sewage system"

E. Article (17) : additional fees for operation and maintenance

1) Additional fees to the basic prepaid ones has to be collected by the service provider, in case of exceeding the maximum COD concentration allowed in the waste water discharged to the public sewer (1500 mg\L) which is for covering the additional cost for the services provider
2) The additional fees for covering the treatment cost is determined according to a payment formula the service provider submits in matching with the rule " the polluter pays"
3) The service provider handles issuing the requirements related to additional fees for factories and facilities that connected to the public sewer
4) The mean value of COD concentration for calculating the additional fees for covering the treatment cost regularly (every three months) is conditional on the taken samples, which should not be less than one sample monthly if it is possible

F. Article (19) : inspection and administrative monitoring for connecting facilities with the public sewer

1) The service provider is responsible for inspection and administrative monitoring in the local council borders, outside the local council borders it is services provider, MOLG and stakeholders' responsibility
2) The service provider and stakeholders exchange information related to harms from waste water management
3) Inspectors and employees have a right to ask for any information in the industrial facilities regularly also they have the right to adjust the violations and everything related to waste water and waste water regulations
4) Service provider and inspection and monitoring in coordination with the stakeholder have the right to test the waste water quality for samples taken from the discharge point for the facility
5) All tests, measurements and analysis in accordance with waste water characteristics regulations relating to the newest PSI messages, and the practical scientific analytical ways in the reference "standard method for examination of water and waste water"
6) Germ, physical, chemical and biological tests as mentioned in previous paragraph

7) Allowance to take waste water samples coming out of factories or treated waste water according to MOH ,environmental quality authority demands and coordination with service provider within the borders

G. Article (20) : suspending or cutting off the approval for facilities connection with public sewer

Service provider has the right to suspend or cut off the approval to connect every facility to the public sewer system in a period finds it suitable and \or setting the civilian and penal responsibility for the violators in the following cases:

1) Violation system regulations or any conditions the service provider put when the approval is given
2) Preventing the employees and inspectors in service provider to do their work
3) Non-compliance to any conditions or requirements the service provider sees it is necessary for sewer system maintenance and it is his work to evaluate those conditions
4) Defaulting of fees payment upon the institution or the industrial facility

H. Article (21) : Penalties

Without prejudice to any more severe penalty imposed by any other legislation, whoever violates the provisions of this Regulation or instructions issued under the penalties prescribed under the provisions of the Water Law No. 3 of 2002 and the Local councils law No. 1 of 1997 and the Environmental Law No. 7 of 1999

I. Article (22) : General Regulations

It is prohibited for any person to discharge any liquid waste or contaminated or normal water sources or natural stream or to the valleys or to anywhere exposed, only after treatment and took the written consent of the provider of water services and sanitation to discharge it

J. Article (23) : Cancellation

All that contradict with the regulations of this system will be cancelled

Appendix no.1 (MoLG PWA 2013)

Instructions for drainage commercial and industrial wastewater into the public sewer network

Article 1

It is prevented to discharge wastewater contaminated commercial, industrial and non-polluted to the public sewer network unless pretreated and obtain the written consent of the provider of water services and sanitation, according to these instructions

Article 2

It is prohibited for any person to cause or allow the discharge of waste water and the following to the public sewer network:

1. Any solid or liquid material quantities or sizes, or of biological, chemical or physical characteristics can lead to obstruction of flow in the public sewer lines, or cause damage to public health or lead to hardship or harm to the public sewer network or personnel or interfere with maintenance work and operation of the treatment plants or with the treatment process in it or could produce waste water threaten general health and general safety
   For example, but not limited to:
   Ash and residues burning coal, sand and mud, straw and sawdust, metal, glass, porcelain and tar and feathers, wood and plastic waste, blood and guts of animals and animal manure, hair and paper dishes and containers of various kinds, fat and grease and oils, acids, and carbon and mineral salts, steam and hot gases and dyes, pesticides and effluents from olive presses, Dairy, and the blood of animals resulting from slaughterhouses
2. Any solid, liquid or gaseous materials contain toxic substances or metal elements or heavy metals can be according to the opinion of a service provider of water and sanitation to harm or interfere with the treatment process or can form as single or as a result of its interaction with other waste threat to human, animal orplant
3. Any material that could lead to:
   1) Inability to treat during the treatment process

   2) Forming materials can be deposited or freeze or become sticky between zero temperatures -40 ° C
   3) Obstruction final use of water such as causing high concentration of dissolved salts such as liquid waste resulting from the tahini contemporary and jeans sinks
4. Any wastewater out of the facility with pH less than 5.0 and over 9.5
5. Liquid waste resulting from the stone cutting tiles and marble factories, brick and cement mixers and any liquid residues in which concentration of suspended solids more than 50 mg\L and specific weight more than 1.5 g\cm3
6. Any liquid or vapor over the temperature of 65 Celsius and if proven for service provider of water and sanitation that these fluids or fumes with varying less temperature can damage the drainage system or cause other damage has the right to prevent disbursement
7. Wastewater containing oil and grease, and animal and vegetable fats or wax emulsion at a concentration of more than 100 mg\L
8. Any wastewater or cyanide-containing materials or compounds at a concentration may produce 2 mg\L estimated as cyanide
9. Any waste water or substances contain phenol with concentration over than 10 mg\L estimated as phenol or with concentration over than 100 mg\L estimated as phenol free of halogens
10. Any waste water or substances containing sulfide compounds with concentration over than 2 mg\L estimated as hydrogen sulfide
11. Any waste water or substances containing chlorinated organic solvents

Decision of the Council of Ministers No. (25) of 2010

Concerning the Ecosystem Conditions for Masonry and Marble Saws, and Tile and Ready-Made Concrete Factories

In fact, the whole decision articles (1-26) are relevant

Memorandum of Understanding between the Water Authority and the municipality of Hebron on the remnants of the stone saws in Hebron

First Party: PWA
Second Party: Hebron Municipality

Following complaints repeated Israeli from the dumping of waste saws stone "Asthma" concentrated in the industrial area of sewer lines General city of Hebron, which flows toward the Green Line, where it is processed in a purification plant Huckat inside the Green Line and the Israeli authorities withhold large sums of money from the account of the Palestinian National Authority and its threat deduct additional amounts in excess of 30 million shekels pretext of the expansion of the existing treatment plant and increase efficiency to cope with the deterioration of the quality of wastewater flowing from the city of Hebron, which contain a high percentage of impurities and dissolved substances outstanding. Has the crews of technical water authority and the municipality of Hebron to study the appropriate solutions that were considered at the moment is the best solution to reduce the size of the damage and reduce these negative effects of this phenomenon, which directly affect the sewer system of public and reduce the efficiency and impact in the treatment system proposed in the future of the city of Hebron and its environs. Was represented solutions to the following matters:

1. Create new bypass conveyor lines beyond the industrial area, so prevent future stone saws from the Forensic Wasl others with these new lines, cutting saws links and existing factories, which have been linked to illegal ways.

2. Grout treatment plant expansion which was established a year ago with funding and support from the European Union, where it is expanded and increase its current capacity from which to address all remnants of stone saws.

To ensure success in achieving the objectives of this project which is vital to stop the dumping of waste stone saws in the

mainstream and properly processed and the preservation of the environment and the provision of public funds therefore it was decided to work

• abide by the Water Authority to provide the necessary financial support and address all the official bodies to fund this project according to the estimated cost of the project which has been prepared by the Mayor of Hebron and of 2.8 million euros (have been addressed and the Palestinian Ministry of Finance and get the amount required by the proposed Hebron Municipality worth 2.8 million euros)

• abide by the Water Authority in coordination with the Israeli side to facilitate the transfer of materials and equipment necessary to carry out the project, and get the necessary permits and procedures, especially in the H2 area

• Parties commit themselves to full coordination with all relevant parties direct industry stone to facilitate the implementation of the project and its success and maintain continuity, These are the parties with official institutions (Environmental Quality Authority, Ministry of National Economy, Ministry of Local Government and Hebron), in addition to the Union saws stone and quarry owners and the owners factories.

• The Parties undertake to coordinate the work of the technical designs and engineering plans required and preparation of tender documents duly and specifications.

• Hebron Municipality is committed to maintaining the components of the project after the completion of the implementation and therefore:

- Encourage the quarry owners to use the treatment plant to get rid of the remnants of saws

- The application of the necessary measures to prevent seepage tanks from the dumping of waste in public sewer manholes

- Regular monitoring on the stone saws to make sure mechanism of waste and residues to make sure there are no illegal connections to the new sewer lines

- Regular maintenance of the treatment plant to ensure the continuation of its work efficiently to cover the needs of all stone factories and ensure sustainability of the operational and financial aspects, and to increase working hours

- Coordination with the security agencies to enforce the law and punish offenders

• ask the Hebron municipality, taking into account the existing obstacles

- Industrial Zone is located in the region classified H2 that fall within the Israeli security control
- Outside the boundaries of the municipality of Hebron and throughout Egypt torrent sewage runoff, there are many points that are dumping and unloading of cargo, including saws asthma wind areas.

First Party	Second Party
PWA	Hebron Municipality

Appendix O Institution / Regulation Matrix

Wastewater Hebron Discharge Regulations by Relevant Government Body

PWA	JSC	PSI	MOH	MOA	MENA	MONE	MOLG + HM
PSI treated waste water reuse standards for agriculture 2012 (standards set by PSI then adopted by PWA and MOA as they are the relevant governmental councils)	JSC medical waste management system 2012 (Law is set by JSC but relevant to MOH)	PSI treated waste water reuse standards for agriculture 2012 (Standard is set by PSI)	MOH general health legal system no.20 year 2004 (Law set for determining MOH functions and authorities)	PSI treated waste water reuse for agriculture 2012 (standards set by PSI then adopted by PWA and MOA as they are the relevant governmental councils)	MEnA Referential condition to evaluate the environmental effects 1999 (Law set by MENA and used by the ministry)	MoNE Procedures at licensing departments and industry development 2010 (Procedures set by MoNE for industrial facilities licensing)	MoLG Local councils law No.1 1997 (Law is set by MoLG for determining the duties and functions of MoLG in reference to its relationship between MoLG and local councils, e.g. Hebron Municipality)
Water law no.3 2002 (Determine PWA functions and duties)	JSC solid waste management proposal 2012 (Law is set by JSC and relevant to MOLG and municipalities as they are the stakeholder governmental councils)	PSI treated industrial waste water standards 2010 (Standard set by PSI , they are general standards can be used by all councils concerning industrial waste water)	JSC medical waste management system 2012 (Law is set by JSC but relevant to MOH)		MEnA Law No.7 concerning environment 1999 (Law is set by MENA for general regulations related to environment in Palestine)	MoNE Law no.10 -1998 regarding to industrial estates and industrial fee zones (this law is set by Ministry of Industry but it is now converted to MONE so MONE is applying it)	Hebron Municipality Slaughter Houses System 1956 (Law set by Hebron municipality for determining the general system and procedures related to slaughterhouses in the municipality's region)
MoLG PWA Regulations project for linking houses and industries to public sewerage 2013 (Law proposed by special committee under supervision of MOLG and					MEnA Decision of the council of ministers No.25 – 2010 (set and applied by MENA)	MoNE Law no.1 – 1999 concerning natural resources (this law is set by Ministry of Industry but it is now converted to MONE so MONE is applying it)	MoLG PWA Regulations project for linking houses and industries to public sewerage 2013 (Law proposed by special committee under supervision of MOLG and PWA to be general system for all

PWA to be general system for all local councils And helping them in managing everything related to waste water and sewer system)							local councils And helping them in managing everything related to waste water and sewer system)
Hebron Municipality and PWA Memorandum of understanding between PWA and Hebron Municipality of the remnants of the stone saws in Hebron 2013					MEnA Environmental assessment policy (set and applied by MENA)	MoNE Law no.10 concerning industry 2011 (this law is set by Ministry of Industry but it is now converted to MONE so MONE is applying it)	Hebron Municipality Sewerage system and the Hygiene control in Hebron 1986 (Law is obtained from Jordanian municipalities law and adopted by Hebron Municipality for managing everything related to waste water and sewer system in municipality region – original version from 1955)
						Regulations proposal for industrial permission procedures (set and applied by MONE)	Hebron Municipality and PWA Memorandum of understanding between PWA and Hebron Municipality of the remnants of the stone saws in Hebron 2013