APPENDIX X

Summary of Treatability Studies
Reported in the Feasibility Study (2000)

APPENDIX X
SUMMARY OF TREATABILITY AND PILOT STUDIES PERFORMED PRIOR TO PILOT STUDY NO. 3

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SUMMARY OF TREATABILITY AND PILOT STUDIES REPORTED IN THE FEASIBILITY STUDY (2000)

X.1 Introduction

Table X-1 shows a summary of the treatability and pilot studies performed as part of the initial FS (Environ, 2000) effort. On March 30, 1998, QST Environmental Inc. (Fountain Valley, California) completed a Treatability Study Workplan (TSW) that was approved by the DTSC. A copy of this TSW is included in Enclosure A in Volume II of the initial FS report (J&W Engineering, 1998; Environ, 2000). The following two treatability studies were conducted by QST, in conjunction with vendors, to treat the different waste materials in the current and former lagoons at the Site:

- *Ex situ* Stabilization for the affected soils and drilling muds from Lagoons 1 through 5, the former lagoons, pits (excluding Pit F), and perimeter berm. Two different stabilization methodologies were tested.
- *Ex situ* Solvent Extraction for the tarry liquid waste from Lagoons 1 and 2.

As shown in **Table X-1**, the stabilization treatability studies were performed by two different companies: Environmental Recycling, LLC (ER) of Prairieville, Louisiana, and Global Solutions, Inc. (Global) of Signal Hill, California. These companies used different stabilization methodologies. ER tested various mix designs with Lagoons 1 and 2 (semisolid) waste and Lagoon 4 (more solid) wastes, along with aggregate/stabilizer materials that were on hand at the Site, and an emulsion to produce a recycled commercial product such as asphalt stabilized base (ASB), engineered backfill, and/or embankment material. Global Solutions tested two separate mix batches with several different stabilizing agents (e.g., Portland cement, cement kiln dust, and lime) on Lagoons 3 and 4 and former lagoon area wastes. For the solvent extraction study, ER performed this testing together with NW Technologies (NW Tech) of Houston, Texas.

J&W Engineering, Ltd. (J&W) of Desoto, Texas, performed quality assurance and quality control (QA/QC) and documentation services during the stabilization and solvent treatability studies performed by ER and NW Tech on the solid and/or liquid wastes from Lagoons 1, 2, and 4. J&W's *Final Report, ASCON Treatability Study Report, Stabilization and Ex situ Solvent Extraction Technologies* was included in Enclosure A of Volume II of the initial FS report (J&W Engineering, 1998; Environ, 2000). QST performed oversight and documentation for the stabilization treatability study by Global. Global/QST's final *Treatability Study Report, Stabilization of Wastes* (Global/QST, 1998) was included in Enclosure B of Volume II of the initial FS report (Environ, 2000).

The main findings of the ER/J&W's (Sections X.2.1 and X.2.2) and Global/QST's (Section X.2.3) studies are summarized below.

X.2 Summary and Findings of Treatability Studies Performed Prior to Pilot Study No. 3

X.2.1 *Ex situ* Asphalt Recycling Treatability Study

ER performed its treatability study for an *ex situ*, onsite stabilization technology that uses an asphaltic emulsion, crushed concrete, and proprietary additives/agents to stabilize mobile COPCs within a waste matrix (identified as *Ex situ* Asphalt Recycling). The resulting treated material is

not considered a waste as it has been recycled into a commercial product that may be used as an effective substitute for conventional commercial products. The leachability testing results of the COPCs are considered to be protective of residential groundwater/drinking water quality. Specific design mixes of proprietary agents and additives can be introduced to meet various performance specifications of the stabilized product's end use. This technology has been used at various Superfund and industrial sites to treat soil and sludges containing petroleum hydrocarbons, VOCs, SVOCs, and metals. The structural character of the stabilized material from the ER process allows it to be used for a wide variety of uses.

J&W (J&W, 1998) reported the results of the *Ex situ* Asphalt Recycling treatability studies performed on the Site's semi-solid material (Lagoons 1 and 2), more solid material (Lagoon 4), and the tarry material (Lagoon 2). As documented by J&W, during March through May 1998, ER performed a stabilization treatability study on five mix designs of these semi-solid and solid materials. These mix ratios were intended to mimic likely onsite conditions as impacted Site materials were mixed with aggregate/stabilizers and an emulsion.

The initial Site waste characterization screening, observations, and analytical data did not identify any waste characteristics that were incompatible with ER's stabilization process of generating an ASB commercial product from the waste materials. Initial screening/observations performed during the treatability study indicated favorable results for all five mix designs, and the resultant laboratory analytical data confirmed their success. Based on field observations, the mix designs did not produce any swelling or volume increase greater than the added components. The best mix design that passed all the chemical and geotechnical analysis requirements of the treatability study Data Quality Objectives (DQOs) was 40% affected solid/semisolid material from the Site, 58% aggregate/stabilizers (available at the Site), and 2% emulsion. It should be noted that in the subsequent pilot testing that was conducted in 1999, different mix designs and additives were used, as discussed in Section X.3.2.

Comparing the analytical results for the best mix design before and after treatment, before treatment results included total petroleum hydrocarbon concentrations of 3,520 ppm in the C_6-C_{10} hydrocarbon range and 22,700 ppm in the C_{10}-C_{28} hydrocarbon range. After treatment, when analyzed for leachability, these concentrations were less than 5 ppm.

In general, for all mix designs, the leachable concentrations of VOCs, SVOCs, and metals in the final product were substantially less than the original total concentrations. In the best mix design, many of these compounds were reduced to non-detectable concentrations in the leachate collected from the final product.

As discussed in Section 8, *Ex situ* Asphalt Recycling was rejected during the preliminary screening of process options based on effectiveness and implementability criteria. Although the asphalt stabilized product generally met performance objectives with respect to process efficiency, contaminant levels and geotechnical properties, the process required addition of 60% amendment to 40% waste. Strong odors were also associated with the treated product. Unless suitable offsite use of this product could be identified, which is unlikely given the Site history and contaminants present in the wastes, the addition of amendment that results in a significant increase in the waste volume represents an unacceptable consequence of this approach. In addition, the unknown level of air emissions generated during implementation of the mixing process was considered a fatal flaw.

X.2.2 *Ex situ* Solvent Extraction Treatability Study

ER and NW Tech performed a treatability study for an *ex situ*, onsite solvent extraction technology that uses a biosurfactant/solvent to mix with the Site's tarry sludges and sediments from Lagoons 1 and 2 to extract and concentrate petroleum hydrocarbons. The technology is carried out with a hot water extraction process coupled with various surfactants and physical

processes to decrease the viscosity of the oils and extract oils from sludges and sediments during final separation. The extracted concentrated oils are subsequently collected for commercial reuse or appropriate offsite disposal. Depending on characterization data, the recovered oil may be delivered to a refinery, recycler, or fuel blender. The washed solids may then be characterized for reuse onsite, or further stabilization/recycling or disposal offsite. The process is designed as a self-contained system with internal recycling of the leaching solutions. Additional details on the results of the *Ex situ* Solvent Extraction process are described below.

J&W documented ER's second phase of the treatability study program, the *ex situ* solvent extraction treatability study, which was performed by NW Tech in May 1998 at its facility in Houston, Texas. Two different biosurtactant/solvents were screened, Biosolve® and Nature's Way "HS." The Biosolve initial screening failed and it was dropped from further consideration. Utilizing the "HS" biosurfactant/solvent, three separate runs (or mix designs) were developed for treatability testing (two from the tarry material from Lagoon 2 and one from the semi-solid material from Lagoon 1). The initial screening, observations, and characterization data of these materials prior to *Ex situ* Solvent Extraction treatability study commencement did not identify any waste characteristics that inhibited the extraction process.

The extraction process included a hot water and biosurfactant/solvent wash to decrease viscosity, increase pumpability, and to promote oil separation for potential recovery of oil. Initial screening/observations performed during this treatability study indicated favorable oil/water separation and increased pumpability for the two runs of the tarry material. The results of the run of the semi-solid material failed, and the sample was precluded from confirmatory analyses. The best mix design that passed all the analysis requirements of the treatability study DQOs was recirculated with a Magnetic Frequency Component, which favorably decreased the product's viscosity and exhibited superior separation qualities.

X.2.3 Stabilization Treatability Study

Global, with assistance from QST, conducted a stabilization treatability study on wastes collected from the Ascon Landfill Site. Global developed a stabilization/fixation technology that has been used on wastes similar to those found at the Site. This process has been used on material ranging from low-level hydrocarbon contaminated soils to tank bottom sludges consisting of hydrocarbon saturated solids from refineries and oilfield production facilities.

The process can be either completed in a pugmill mixer where contaminated soil and sludges are mixed with the chemical reagents and additives (e.g., Portland cement) or on the ground surface using an excavator or mixer where waste is handled in 12-inch lifts and are blended with the appropriate chemical reagents and additives. The resulting end product has soil-like properties and can be used as a recycled product.

Global's process uses proprietary chemical agents and additives to stabilize mobile constituents of concern within a waste matrix. The proprietary additives are mixed in varying percentages with water and impacted Site materials (for these tests, specifically impacted soil from the former lagoon areas and hydrocarbon wastes from Lagoons 3 and 4). The goal of the tests was to produce various mixes which would result in a recyclable material that could be used as described above and be environmentally acceptable. To accomplish this goal, Global/QST completed the tests in two batches. The results of the first batch would be used to design/adjust the mix ratios of wastes to soil to additives for the second batch.

Prior to treatment, samples of the waste materials from Lagoons 3 and 4 and soils samples from the former lagoon areas were collected in 5 gallon sample buckets for laboratory analysis for TRPH by EPA 418.1, TPH with carbon chain identification by EPA 8015M, Title 22 metals using EPA 6010/7400, VOCs using EPA 8260, and SVOCs using EPA 8270. The results from the initial waste characterization are presented in Section 3.1 of the QST Treatability Study Report

(Global/QST, 1998; Environ, 2000). A summary of the TPH results is provided in this report. Levels of VOCs and SVOCs were in the low ppm range and metals were present well below TTLC levels. The TPH results for the pre-treatment wastes were 3,400 mg/kg for Lagoon 3[1], 22,000 mg/kg for Lagoon 4, and 490 mg/kg for the soils. To prepare for testing, the Lagoon 3 and 4 materials were blended in equal proportions and soil was added to the mix at 10% to 40% by weight, along with 7% to 10% additive (e.g., Portland cement). The estimated average TPH concentration for the blended mix for this testing was 9,000 mg/kg.

After treatment, three mixes (out of 9 submitted from Batch 2[2] –that exhibited the best geotechnical properties (Marshall Stability and Compression) were sampled for chemical analysis. (All mixes from Batch 1 failed geotechnical pre-screening due to being soft and easily pancaked.) These chemical analyses included TCLP-Title 22 metals, TCLP-VOCs, TCLP-SVOCs, and TCLP-TPH (modified for diesel). The results of these post-treatment characterizations are reported in Section 3.4 of the QST Treatability Study Report. The TCLP-TPH extraction results for the three samples ranged from 15 to 58 mg/l. All TCLP-VOC, and TCLP-SVOC concentrations were reported below the method detection limits and below the regulatory limits.

A review of the total metal results on the pre-treatment samples showed that only lead in the sample from Lagoon 3 exceeded either ten times the STLC or twenty times the TCLP threshold values. The post treatment lead leachability results were reported as non-detect (at a detection limit of 0.16 mg/l), which is thirty times below the hazardous waste level of 5.0 mg/l. All the metal solubility results were exceptionally low when compared to regulatory limits. Virtually all TCLP results were at or below detection limits for the Title 22 metals.

Based on the results of the treatability study and past actual field application of its technology, Global believed that this stabilization process could be taken directly from the treatability test phase to full-scale operations without any additional field testing. However, as odor and VOC emissions may be a concern during full-scale operations, (based on VOC and odor emissions observed during prior handling and during mixing/curing for stabilization), Global/QST (1998) recommended that a full-scale pilot project be conducted to determine if the odor, volatile vapor impacts, and mitigation measures of the process could be designed and implemented.

Based on the results of the treatability tests, Global and QST presented the following conclusions:

- Three different mix designs (waste plus additives) produced a recycled product meeting acceptable compression, strength, and environmental criteria.

- The recyclable product can be produced with a mixture of 70% by weight waste (lagoon material) and 30% by weight onsite collected soil, then blended with additives (7% to 10% by weight) using either the land application or pug mill mixing processes.

- VOC readings observed during the mixing and curing stages of the stabilization treatment process indicate that VOCs may be a concern during full-scale remedial action.

Based on the conclusions of the treatability study, Global/QST made the following recommendations:

- Prior to full-scale implementation, design and complete a pilot scale study using field equipment at the Site to collect information and data that would be used for final

[1] TRPH by 418.1 results for the same sample were 47,000 ppm, likely due to the 418.1 detecting carbon chains greater than C40.
[2] Batch mix designs varied the percentages of lagoon waste, with weight percentages of impacted soil and additives.

design of the stabilization remedial system. This pilot scale study should focus on odor and VOC emissions during the excavation as well as the treatment, and curing processes.
- The pilot scale study should be used to develop full-scale design and process cost estimates.
- Various mix designs resulting in acceptable products in sufficient quantities should be prepared to assist in evaluating the marketability of the recycled product.

Pilot studies for *ex situ* waste stabilization and field emissions testing are discussed below.

X.3 Field Pilot Testing

Based on the promising results of the treatability studies performed on the Site wastes, as described above, two field pilot tests were performed to further evaluate the feasibility of full-scale implementation of two remedial technologies:

- *Ex situ* Solvent Extraction, and
- *Ex situ* Stabilization – with a focus on emissions/odors.

These technologies/process options were retained following a preliminary screening described in Section 7 of the initial FS report. This section describes the field pilot testing procedures and provides summaries of the results. **Table X-1** presents a summary of the treatability studies and pilot tests conducted.

The objectives of the pilot tests were to simulate full-scale remedial activities. Pilot Test No. 1, which was conducted in March 1999, was designed to simulate full-scale waste excavation and handling and field solvent extraction while evaluating the associated emissions. Pilot Test No. 2, which was conducted in October 1999, was designed to simulate full-scale stabilization. The scopes of work for the two tests were as follows:

- Pilot Test No 1 - Conduct waste excavation, handling, and mixing from current Lagoons 2, 3, and 4 and solvent extraction of liquid wastes from Lagoon 2 while performing emissions testing.

- Pilot Test No. 2 - Utilize a surface mixing stabilization process with wastes excavated from Lagoons 3 and 4, a Former Lagoon Area, and impacted Site soils with various additives to generate and test a reusable product from five mix designs. Conduct simultaneous emissions testing.

J&W prepared work plans that described the procedures to be implemented during each of the two pilot tests. These work plans were approved by DTSC.

Global was selected to implement the construction aspects of the two pilot tests. J&W was selected to perform the regulatory negotiations, engineering, air monitoring, QA/QC, and documentation services during the pilot tests. J&W's *ASCON Field Emissions Testing Program* report (Pilot Test No. 1) was included as Enclosure C of Volume II of the initial FS report (J&W, 1999a; Environ, 2000), and J&W's *Stabilization Pilot Testing Program* report (Pilot Test No. 2) was included as Enclosure D of Volume II of the initial FS report (J&W, 1999b; Environ, 2000). The implemented procedures and main results presented in these reports are summarized in the following sections.

X.3.1 Pilot Test No. 1 - Field Solvent Extraction and Emissions Testing

Pilot Test No. 1 was performed by Global for excavation and materials handling and Industrial Innovations, Inc (3i) of Stockton, California, for solvent extraction and was documented by J&W. The pilot test was designed to evaluate excavation, waste handling, waste mixing, and *Ex situ* Solvent Extraction testing in the presence of a thorough air monitoring/sampling program. The objectives of the Field Solvent Extraction and Emissions Testing Program are listed in Section 2.2 of the Pilot Test No. 1 report (J&W, 1999a; Environ, 2000) and include those summarized below:

- Evaluate potential odors and air emissions during performance of these treatment technologies to aid in the design of emission control techniques to be used during full-scale implementation of Site remedial actions.

- Evaluate Site-specific material handling issues to aid in the design of the selected soil remediation alternatives.

- Demonstrate and evaluate pilot-scale performance of waste treatment techniques selected for treatment of Site waste materials.

- Evaluate the characteristics of the recovered oil and other products from the *Ex situ* Solvent Extraction process.

X.3.1.1 Excavation and Material Handling Procedures

J&W's main Site preparation activities included the following:

- Erection of the Site work zones [(Support Zone (SZ), Contamination Reduction Zone (CRZ), and Exclusion Zone (EZ)] and signs.
- Erection and baseline monitoring of onsite weather station.
- Erection of Site personnel decontamination areas, soil laydown areas, and viewing areas.
- Selection of 24 onsite air monitoring locations and air sampling locations (see **Figure 9-1** in Appendix A).
- Calibration of all field monitoring and air sampling equipment.
- Preparation and completion of the required onsite documentation forms.

The purpose of the excavation process at each of three excavation areas located in the former lagoon areas near Lagoons 2, 3, and 4, shown on **Figure 9-1** in Appendix A, was to simulate material handling and mixing procedures as they would be implemented during full-scale remedial efforts. These three specific excavation areas were selected to be representative of the three distinct waste types found at the Site. In addition, air samples were strategically located and collected to evaluate the air emissions associated with each excavation activity (see **Figure 9-1** in Appendix A and Section 5.3 in the Pilot Test No. 1 report). The excavation process, as implemented during Pilot Test No.1, is described below:

- Each soils laydown Area was lined with a 20-mil flexible membrane liner (FML), a soil berm was erected around the area for runoff control, and a barrier fence was erected for personnel security.
- Approximately 20 cubic yards of representative drilling muds and affected soils were excavated (from each of the three excavation areas in turn) and placed onto the lined laydown area, spread out and mixed.
- Global mixed the drilling muds and soils to simulate the actual material handling processes.

- Global sprayed the vapor suppressing USEPA-approved dust control agent (Simple Green) onto the excavated area and the soils laydown area to control any fugitive dust and to evaluate Simple Green's vapor suppressant capabilities.

- J&W performed air monitoring and/or sampling directly downwind to document the comparative air emission levels. Refer to **Tables 9-1** and **9-2** in the initial FS report (Appendix A) for air monitoring and sampling results, respectively.

X.3.1.2 *Ex Situ* Solvent Extraction Testing Procedures

In order to evaluate the ability to separate and extract usable oil from the tarry liquid wastes contained within Lagoons 1 and 2 at the Site, J&W contracted with 3i to perform the *Ex situ* Solvent Extraction testing during Pilot Test No. 1. These procedures were conducted simultaneously with the air-monitored/sampled excavation and materials handling/mixing procedures to closely simulate full-scale remedial actions and generate data regarding the associated VOC air emissions.

The purpose of the *Ex situ* Solvent Extraction process was to evaluate how effectively, efficiently, and successfully 3i could extract representative samples of tarry liquid wastes from Lagoon 1 and 2 and separate the tarry liquid waste into water, sediment, and reusable oil. **Figure 11-3** in the initial FS report (Appendix A) shows a process diagram of the 3i solvent extraction system.

The *Ex situ* Solvent Extraction process employed by J&W utilized a series of patented mechanical and mobile process systems for sludge treatment. J&W used the SuperMacs, Sludge Bug, and Phaser 600 system from 3i for the solvent extraction test.

The *Ex situ* Solvent Extraction process, as implemented during Pilot Test No. 1, is described below:

- The front tank of the SuperMacs unit was filled to a specific level (2,700 gallons) with the selected liquefier (water). Nature's Way (bioremediating cleaner) was added at a rate of 1% (or 27 gallons) per minute. Then this solution was preheated using the heat exchanger set to a preset temperature (160°F).

- A sump was excavated adjacent to Lagoon 2 and properly prepared to accommodate the Sludge Bug, a pumping device.

- Sludge (initially sampled and characterized) in an area of Lagoon 2 adjacent to the edge was collected using an excavating machine and deposited inside the sump.

- The sludge collection process then began. The operator maneuvered the Sludge Bug to collect the sludge. Hot water was injected into the Sludge Bug progressive cavity pump at a pressure of approximately 100 pounds per square inch of mercury (psi Hg) by the SuperMacs pressure wash pump, and the diluted sludge was then pumped via hose to the SuperMacs.

- The diluted sludge was "scalped" through a vibro-mechanical separator fitted with a 0.5-inch orifice screen. Rocks, wood, and other large debris were then removed from the influent and deposited into a container.

- The diluted-scalped sludge was pumped into the SuperMacs front tank for initial oil and solid separation and then transferred to the Phaser 600 to separate the solid, liquid, and oily phases by centrifugal action. Periodically, centrate samples (oil and

water with some sediment) were collected for further analysis [see **Table 9-3** in Appendix A].

Prior to, during, and upon completion of the field emissions testing, J&W performed a round of air monitoring at the 24 site monitoring points (**Table 9-1**, Appendix A).

X.3.1.3 Data Validation Procedures for Pilot Test No. 1 DQOs

In order to evaluate the performance and validation of the field emissions pilot test, J&W implemented an analytical data management program to ensure the defensibility and application of the pilot test results through the use of Data Quality Objectives (DQOs). The DQOs are qualitative and quantitative statements and goals specifying the quality of the data required to justify decisions concerning remedy implementation. The DQOs were established as minimum treatment objectives for this Site-specific pilot test and took into consideration the following, in accordance with Standard Operating Procedures (SOPs) from USEPA (1992):

- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability

Based upon these general DQO objectives, certain Site and project-specific DQOs were developed and approved by DTSC for the field emissions pilot test, including:

- The selected analytical testing methods must incorporate all the COPCs likely to be present during the pilot test.

- Onsite weather conditions must be within acceptable ranges (i.e. no rain, no elevated wind speeds, representative temperatures, etc.) and be periodically monitored during the testing procedures for potential field sampling/monitoring adjustments.

- Onsite noise levels must be monitored during the tenting procedures and maintained below 85 decibels (db) within the Site work zones (unless hearing protection worn as in the EZ) and 65 db on the Site perimeter (in accordance with local noise ordinances).

- Onsite light levels must be periodically monitored and maintained above 3 foot-candles (FC) at all times during testing procedures.

- Continuous air monitoring must be performed during the testing procedures at each work face, along the Site perimeter and at the 24 site monitoring points to document compliance with the DTSC-approved real-time action levels.

- Periodic air samples must be collected and analyzed at an approved State-certified laboratory for the parameters of concern in accordance with the DTSC-approved air sampling plan.

- Representative solvent extraction samples must be collected and analyzed prior to and during the solvent extraction testing procedures to document compliance with the SCAQMD permit and to obtain a successful extraction process.

- The analytical data generated from the air sampling must be in compliance with regulatory action and exposure levels approved for the Site and within recommended QA/QC analytical testing limits.

X.3.1.4 Summary of Results of Field Solvent Extraction and Emissions Testing

Based on the findings and results of the field activities and laboratory analyses associated with the field emissions testing pilot study performed in March 1999, as described above, J&W presented the following conclusions:

- The pilot test procedures were implemented in accordance with the Ascon Field Emissions Testing Work and Health and Safety Plan, as amended and approved by DTSC.

- All of the COPCs established in the baseline health risk assessment for the Site (ESE, 1997b) were analyzed.

- The weather data were within all SCAQMD permit requirements.

- Onsite noise levels were below the regulatory guidelines for each area of the Site.

- Onsite light levels were above the DTSC regulatory lower limit for onsite working conditions.

- Continuous air monitoring was performed at each work face, along the perimeter and periodically at the 24 site monitoring points, and at no time were the DTSC-approved air monitoring action levels exceeded.

- Fourteen air samples were collected and analyzed. The resultant data generated were compared to the DTSC-approved actual COPC analytical action levels (if available), Agency for Toxic Substance and Disease Registry (ATSDR) Minimal Risk Levels (MRLs, if available), and/or the PRGs exposure levels (which are allowable ambient air lifetime exposure concentrations). The comparison of these most conservative action/exposure concentrations to the resultant field emissions testing data showed that no onsite worker was exposed or offsite release generated above these exposure levels.

- Representative solvent extraction influent and effluent samples were collected and analyzed and no emissions were generated during the process in excess of the various SCAQMD operating permits.

- Based on the results that were obtained, excavation and onsite handling of the various lagoon wastes were feasible from both a physical and community safety point of view.

- The *Ex situ* Solvent Extraction system did achieve successful separation of the sludge into water, oil, and sediment. However, the separated waste streams required additional effort to yield a cleaner separated product. The water exhibited elevated concentrations of petroleum because it was continuously recirculated during the pilot test. Cleaner water is anticipated during full-scale remediation with further processing, centrifuging, and additional onsite treatment (e.g., settling tank). Likewise, the sediment would likely be further cleaned and utilized in the onsite stabilization process during full-scale remediation. The characteristics of the

separated oil had a high dissolved water content and it appears that, without further processing, resale is unlikely.

J&W recommended that modification of the 3i Solvent Extraction Process to generate more fully separated process products should be more fully investigated.

As discussed in Section 8 of the RFS, *Ex situ* Solvent Extraction was rejected during the preliminary screening of process options based on effectiveness and implementability criteria. Although the results of the *Ex situ* Solvent Extraction treatability and pilot studies appeared promising from the standpoint of increasing product pumpability and achieving phase separation without appearing to generate significant emissions, several major drawbacks to the process were uncovered during testing. The most significant technical issue, as described above, was the cross contamination of the separated water and sediment phases, which reduced the BTU value of the recovered product and resulted in contaminant concentrations in the water similar to the waste oil (meaning the water could require subsequent treatment).

X.3.2 Pilot Test No. 2 -- Field Stabilization Testing

Pilot Test No. 2 was also performed by Global and documented by J&W. The pilot test was designed to evaluate the various Site wastes that could be excavated and stabilized using a surface mixing stabilization process (rather than a more costly and material-handling, intensive pug mill process), to produce a reusable product (engineered backfill) without the emission of elevated VOC concentrations. The feasibility of application of surface mixing during Pilot Test 2 was based on the low levels of VOC and odor emissions observed during Pilot Test No. 1.

The purpose of the stabilization pilot study was to mimic material excavation, handling, and mixing procedures as they would be implemented during full-scale remedial efforts. The DTSC-approved air sampling scheme was designed to evaluate potential air emissions associated with the surface mixing stabilization technology. To evaluate the impact to native surface soil conditions caused by the pilot study activities, a soil sampling scheme was implemented with five-point composited samples (see **Table 9-6** in Appendix A). The overall project objectives of the field stabilization pilot test are listed in Section 2.2 of the Pilot Test No. 2 report (Appendix A) and are summarized below:

- Evaluate through appropriate air monitoring if the additives used for stabilization, when mixed with lagoon or former lagoon area wastes and impacted Site soils, generate VOCs that reach concentrations of concern.
- If VOCs are generated above levels of concern, demonstrate that these VOCs can be promptly mitigated through the use of various vapor-suppressing products to concentrations lower than the established DTSC Action Levels (ALs) (see **Tables 9-1** and **9-2** in Appendix A).
- Evaluate if quality structural fill material can be produced by stabilizing lagoon wastes without the addition of significant soil or aggregate (crushed concrete).
- Evaluate other various stabilization mix designs using varying quantities of impacted soil, aggregate (from offsite concrete source), and stabilization additives to obtain physical/chemical data useful to potential end users of the generated stabilized soil.
- Evaluate the effectiveness and feasibility of conducting stabilization mixing within a bermed pad on the ground (surface mixing) instead of using a pugmill. Ground mixing is expected to have far fewer logistical limitations relative to pugmill mixing.

X.3.2.1 Surface Mixing Stabilization Testing Procedures

J&W's main Site preparation activities included the following:

- Posting of work zones and signs,
- Construction of an onsite weather station,
- Preparation and posting of Site personnel decontamination areas, material handling/staging/mixing/lay down areas, and viewing areas,
- Selection of air sampling locations (see **Figure 9-2**, Appendix A),
- Collection of pre-remedial action baseline light, noise, weather, and air monitoring data,
- Calibration of field monitoring and air sampling equipment,
- Performing pre-pilot study soil sampling in the operational areas designated at the Site (Waste Stockpile Staging Area, Material Surface Mixing Area, and Product Stockpile Staging Area), and
- Preparation and completion of the required onsite documentation forms.

Each morning J&W implemented the air monitoring and sampling plan. The fresh excavation areas, the operational areas, and the Site perimeter were monitored on a continuous basis to document if the DTSC-approved action levels were exceeded (see **Table 9-4**, Appendix A).

On each given day, only the material needed for the individual mix design was excavated and processed in order for air sampling efforts to reflect emissions potentially generated from Site materials from the specific mix design. A long-reach excavator was used to remove sufficient amounts of materials from Lagoon 4 (El), Lagoon 3 (E2), and a former lagoon area (E3) west of Lagoon 3 throughout the week (see **Figure 9-2**, Appendix A).

From the Waste Stockpile Area, specified amounts of each material were loaded by a front-end loader into dump trucks and transported to the Surface Mixing Area located adjacent to and west of the Waste Stockpile Area (**Figure 9-2**, Appendix A). The bulk of the mix materials (Lagoon 3 and 4 materials, former lagoon area materials, soils, and gravel) were uniformly spread to an approximate 12-inch depth using a bulldozer. When prescribed by the Mix Design, a dry Portland cement powder or a special dry mix [30% Portland cement + 70% cement kiln dust (PCKD)] was applied by a specialized J.A. James Construction Company hooded spreader truck. Once these mix design components were placed in the Mixing Area and distributed evenly, J.A. James Construction Company utilized a hooded CAT Reclaimer/Pulverizer to thoroughly mix the materials. Approximately 200 cubic yards (cy) of each of Mix Designs Nos. 1, 2, and 4 (see **Table X-A** below for design components) and approximately 100 cy of each of Mix Designs Nos. 3 and 5 were produced during the stabilization pilot study. The production volume was reduced because of equipment cost/scheduling constraints and the need to conform to the SCAQMD permit requirements. Five mix designs were evaluated which consisted of the materials listed in **Table X-A**, as follows:

Table X-A. Stabilization Pilot Test Mix Designs

Mix Design No.	Lagoon 3 Waste (cy)	Lagoon 4 Waste (cy)	Former Lagoon Area Waste (cy)	Site Soils (cy)	Gravel (cy)	Portland Cement (cy)	PCKD (cy)	Total Mix Volume
1	-	176	-	-	-	24	-	200
2	-	70	80	20	20	-	10	200
3	35	-	35	10	15	-	5	100
4	-	80	80	20	-	-	20	200
5	40	-	40	10	-	-	10	100
Total	75	326	235	60	35	24	45	800

After several passes through the material by the Reclaimer/Pulverizer and the addition of water (rarely necessary due to the very moist nature of excavated wastes), each mix design was

allowed to cure undisturbed for 2 hours in the Mixing Area, then loaded and transported via dump trucks to segregated stockpiles south of the Mixing Area. To evaluate the effectiveness of the stabilization process, the following sampling scheme was implemented (these sampling locations are shown on **Figure 9-2**, Appendix A, and the data are summarized in **Table 9-6**, Appendix A):

- Collection of representative samples of the three different types of Site waste materials (Lagoons 3 and 4 materials, former lagoon area materials, and Site soils) used as bases for the five mix designs for laboratory analysis for TRPH, TPH-CCID, TCLP-TPH-G, TCLP-TPH, TCLP VOCs, TCLP SVOCs, TCLP RCRA Metals, and moisture content.
- Collection of representative samples of each mix design products after the initial 2-hour curing time, and laboratory analysis for the same chemical parameters as for the pre-treatment samples along with physical testing parameters.
- Physical testing of the five mix designs after 8 days of curing time in the physical laboratory. Physical testing analyses included optimum moisture content, maximum dry density, expansion index, Marshall Stability, unconfined compressive strength, and shear strength.

X.3.2.2 Generated Product Handling Procedures

To evaluate the quality and reuse/resale value of the products generated during the stabilization pilot test, each of the five mix designs were allowed to cure, and then the products were cored and analyzed for various chemical and physical properties (see **Table 9-6**, Appendix A). Upon completion of the surface mixing and initial curing, approximately 30 to 40 cy of each stabilized mix were transported separately via dump trucks to a final laydown area east of Lagoons 1 and 2 (see **Figure 9-2**, Appendix A). Each stabilized mix was spread out in an approximately 8-inch lift and compacted by a rubber-tired backhoe. The stabilized mixes were laid down next to one another for visual and physical comparison over time.

Upon completion of the stabilization pilot testing, the following procedures were implemented:

- All affected soils placed and mixed in the Surface Mixing Area were backfilled into the lagoons, and each Excavation Area and Stockpiling Area (which was not covered by remaining product) was backfilled and restored as near as possible to its original condition.
- The excavation and mixing equipment was decontaminated (along with the excavator) in the Equipment Decontamination Area (**Figure 9-2**, Appendix A).
- All unused mix design component residuals generated during the stabilization testing process were deposited back into their respective locations.

X.3.2.3 Data Validation Procedures for Pilot Test No. 2 DQOs

In order to evaluate the performance and validation of the stabilization pilot test, J&W implemented an analytical data management program similar to that utilized during Pilot Test No. 1. This program was designed to ensure the defensibility and application of the stabilization pilot test results through the use of Site-specific DQOs. The DQOs were based upon the general DQOs stated above in Section X.3.1.3 and established as minimum treatment objectives for this Site-specific pilot test in accordance with SOPs from USEPA (1992).

Based on a review of the known COPCs at the Site identified during the RI (ESE, 1997), the findings of J&W's treatability study performed in May 1998, the results of Pilot Test No. 1, and the desired results of the stabilization pilot testing study, the following Site-specific DQOs were established to consider this pilot study a success:

- Onsite Health & Safety Assessment - Air monitoring and sampling for evaluation of worker safety during the pilot test and future worker's safety during full-scale remediation (see **Tables 9-1** and **9-2** in Appendix A for pilot testing ALs),
- Evaluation of community safety during the pilot test with consideration given to full-scale remediation,
- Evaluation of the effectiveness of various mitigative measures to reduce VOC emissions during the pilot test,
- The achievement of various specific treatment goals for the stabilized product generated by various mix designs tested in terms of physical and chemical performance criteria such as:

    - TCLP VOCs (≤Toxicity Characteristic [TC] Values and ≤Ascon-derived and DTSC-approved ALs and Exposure levels [ELs]) described in **Table 9-2**, Appendix A.
    - TCLP SVOCs (≤TC Values and ≤ALs/ELs).
    - TCLP metals (≤TC Values and ≤ALs/ELs).
    - TCLP TPH (<1,000 ppm).
    - Optimum moisture content (12% to 30%).
    - Maximum dry density (85 to 120 pounds per cubic foot [pcf]).
    - Marshall Stability (> 750 lbs.)
    - Unconfined compressive strength (> 35 psi).

- Analytical detection limits should be lower than the treatment goals or performance criteria; and
- Resultant QA/QC and project data should be within quantification limits and be legally and scientifically defensible.

X.3.2.4 Summary of Results of Stabilization Testing

Based on the findings and results of the field activities and laboratory analyses associated with the stabilization testing pilot study performed in October 1999, as described above, J&W presented the following conclusions:

- The pilot test procedures were implemented in accordance with the Ascon Stabilization Pilot Testing Work and Health and Safety Plan, as amended and approved by DTSC.
- The pilot test schedule was adhered to and all field work related to the stabilization testing procedures was completed in four days.
- All of the DQOs were evaluated against the resultant pilot study data with the following conclusions:

    - All of the COPCs were analyzed, and the analytical method detection limits were lower than all action levels, treatment goals, and performance criteria.

    - The weather data were within all SCAQMD permit requirements.

    - Onsite noise levels were below the regulatory guidelines for each area of the Site. Onsite light levels were above the DTSC regulatory lower limit for onsite working conditions.

    - Continuous air monitoring was performed in each work area, stockpile area, along the perimeter and periodically at the 24 Site monitoring points, and at no time were the DTSC-approved air monitoring ALs exceeded.

- Thirty-seven air samples were collected and analyzed. The resultant data generated were compared to the DTSC-approved actual COPC analytical action levels (if available), ATSDR MRLs (if available), and/or the PRG exposure levels. The comparison of these most conservative action/exposure concentrations to the resultant stabilization pilot testing data showed that no onsite worker was exposed or offsite release generated above these conservative and approved exposure levels.

- The generated stabilized product from the five mix designs passed all the chemical and physical DQO evaluation criteria.

- The QA/QC program instituted and implemented during the stabilization pilot study included procedures for appropriate sampling practices and evaluation of sampling and laboratory handling/analytical methods integrity.

- Based on an overall evaluation of the project compared to the established DQOs, the stabilization pilot study was highly successful and met and exceeded all project goals and requirements.

J&W recommended that information and analytical data associated with the five passing mix designs be supplied to vendors of choice to develop a market for the Ascon stabilized soil for reuse as an engineered backfill.

Table X-1
Summary of Previous Treatability and Pilot Studies
Ascon Landfill Site

Report	Technology Tested/Date	Media Tested	Volume Tested	Treatability Study - Specific DQOs	Test Implementation Contractor	QA/QC and Documentation Contractor	Comments
J&W Engineering, LTD. *Final Report ASCON Treatability Study Report Stabilization and Ex situ Solvent Extraction Technologies* May 29, 1998	•*Ex situ* Asphalt Recycling and soil/muds stabilization (March - May, 1998)	•Lagoon #1 and #2 - Semi-Solid Waste (SS) •Lagoon #4 - More-Solid Waste (MS)	•Four 5 gallon buckets	•Efficacy Verification Testing (EVT) Toxicity Characteristic Leaching Potential (TCLP) Testing of each constituent in a mix design must be below the Medium Specific Concentration Level ([MSCL] based on Maximum Contaminant Levels (MCLS) as defined under USEPA's Safe Drinking Water Act as amended by various State Risk Reduction Rules into the current MSCL's) •Moisture Content below 10% for each final EVT mix •EVT Density of at least 85 lbs pcf •EVT Average Marshall Stability of at least 2,000 lbs •EVT Estimated Compressive Strength of at least 35 lbs psi	Environmental Recycling, LLC (ER)	J&W Engineering	•Five mixes were tested, each was a combination of Ascon Impacted Material (AIM), Aggregate/ Stabilizers (A/S), and an Emulsion •When buckets were opened strong to very strong hydrocarbon odors were observed •Best mix design was 40% (Mixture of SS and MS materials), 58% A/S, 2% emulsion (waste was allowed to dry extensively prior to mixing)
J&W Engineering, LTD. *Final Report ASCON Treatability Study Report Stabilization and Ex situ Solvent Extraction Technologies* May 29, 1998	•*Ex situ* Solvent Extraction (May 1998)	•Lagoon #1 - Semi-Solid Material •Lagoon #2 - Mud Tar or "Taffy" Materials	•Two 1-gallon cans •Two 5-gallon buckets	•A minimum hot water bath of 140-180 degrees F must be utilized •A mixing time for ingredients of less than 10 minutes must be obtained •A separation time of less than 30 minutes must be obtained •A pumping rate of a minimum of 3 gpm should be utilized	ER/NW Technologies	J&W Engineering and Environmental Recycling, LLC	•Three mixes were tested - Mix A1T - 74.4% water, 24.8% AIM, 0.8% NaturesWay - Mix A2T - 74.4% water, 24.8% AIM, 0.8% NaturesWay - Mix A3T - 74.6% water, 24.9% AIM, 0.5% NaturesWay •All mixes heated to 140 to 180 degree F, water decanted off, and waste allowed to separate •Analysis performed on A1T water, oil and sediment •Analysis performed on A2T water and oil •No analysis on A3T, due to no separation •A1T and A2T successful at separation and increasing flowability of materials •Based on analytical results, separation did occur and viscosity was reduced, however the sediment fraction was nonexistent and a predominantly "heavier-than-water" oil occurred. Minor amounts of the VOCs, SVOCs, and Metals transfer from the oil to the water
QST Environmental *Treatability Study Report Stabilization of Wastes* June 24, 1998	•*Ex situ* stabilization of wastes	•Lagoon #3 waste •Lagoon #4 waste •4-8 soil samples, (soils from 4-8 ft bgs in Former Lagoon Area [FLA])	•Four 5-gallon buckets of each of the three materials	•Test greater than 50 psi for Unconfined Compressive Strength •Test greater than 900 psi for the Marshall Stability Test •Test non-detect or below statutory limits for TCLP on Metals, VOCs, SVOCs, and TPH	Global Solutions	QST	•Two separate mix batches were created •21 mixes in first batch, all mixtures failed geotechnical preliminary screening •17 mixes in second batch, 9 mixes pass preliminary geotechnical screening and sent for further geotechnical analysis •Best 3 of geo-tech results sent for chemical analysis •Best mix 70% lagoon waste mixed with 30%w of 4-8 soils (FLA) and then blended with 7-10% additive (e.g., Portland, PCKD, etc.) •"However, as determined during this study, odor and VOC emissions may be a major concern during full scale operations."

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Summary of Previous Treatability and Pilot Studies
Ascon Landfill Site

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J&W Engineering, LTD. *ASCON Stabilization Pilot Testing Program* December 15, 1999	•*Ex situ* stabilization of wastes, surface mixing	•326 cys of Lagoon 4 edge material •75 cys of Lagoon 3 edge material •235 cys of Former Lagoon Material	•636 cys of waste •60 cys of site soil •35 cys of gravel •24 cy of Portland •45 cys of PCKD	•Treated product must not yield a TCLP TPH-G concentration greater than 1000 ppm (or 1,000,000 ppb or ug/l) •Treated product must not yield TCLP VOCs, TCLP SVOCs, or TCLP Metals concentrations greater than published USEPA TCLP regulations •Treated product must yield greater values than various physical characteristics parameters such as: - Maximum Dry Density of 85-120 lbs pcf - Marshall Stability of greater than or equal to 750 lbs - Unconfined Compressive Strength of greater than or equal to 35 lbs psi.	Global Solutions	J&W Engineering	•Wastes excavated from edge of Lagoon #3, #4 and west of Lagoon #3 in Former Lagoon Area •Wastes placed in stockpile area •Wastes moved in specific amounts to surface mixing area •Five mixes made: 1) 176 cy L-4, 24 cy Portland Cement = 200 cys total 2) 70 cy L-4, 20 cy site soils, 80 cys FLA, 20 cys Gravel, 10 cys PCKD = 200 cys total 3) 35 cy L-3, 10 cy site soils, 35 cys FLA, 15 cys Gravel, 5 cys PCKD = 100 cys total 4) 80 cys L-4, 20 cys site soils, 80 cys FLA, 20 cys PCKD = 200 cys total 5) 40 cys L-3, 10 cys site soils, 40 cys FLA, 10 cys PCKD = 100 cys total •Mixture cures for 2 hours and then is loaded and hauled to mix product stockpiles •Mixture cures for 8 days •Metals Tested for in mix end products were just the following 8 metals (Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium and Silver) •Results show only Barium from range of 565 ug/l to 2610 ug/l
J&W Engineering, LTD. *ASCON Field Emissions Testing Program* May 6, 1999	•Measure emissions during excavation/material handling of various wastes •Ex-situ solvent extraction - hot waster washing and solvent extraction process and to measure emissions during this process	•Materials at the edges of Lagoons #2, #3, and #4 (20 cys each) •Lagoon #2 liquids put through hot water wash and solvent extraction process	•Approximately 60 cys of soil •Unknown amount of liquid from Lagoon 2	•To determine what if any emissions would require mitigation during soil mixing activities •To determine effectiveness of 3i Solvent Extraction Process	Global Solutions	J&W Engineering	•All noise levels below regulatory guidelines •Continuous air monitoring demonstrated at no time were the DTSC-approved air monitoring Action Levels exceeded •No onsite worker was exposed or off-site release generated above any regulatory levels •"Simply, based on the results, excavation and onsite handling of the various Lagoon wastes is feasible form both a physical and community safety point of view." •Solvent Extraction System did achieve successful separation, however, waste streams appear to still require additional onsite treatment and/or separation process modifications. Resultant oils appear to suggest that resale is unlikely, however pickup and reuse at no cost to the overall remediation should be explored.