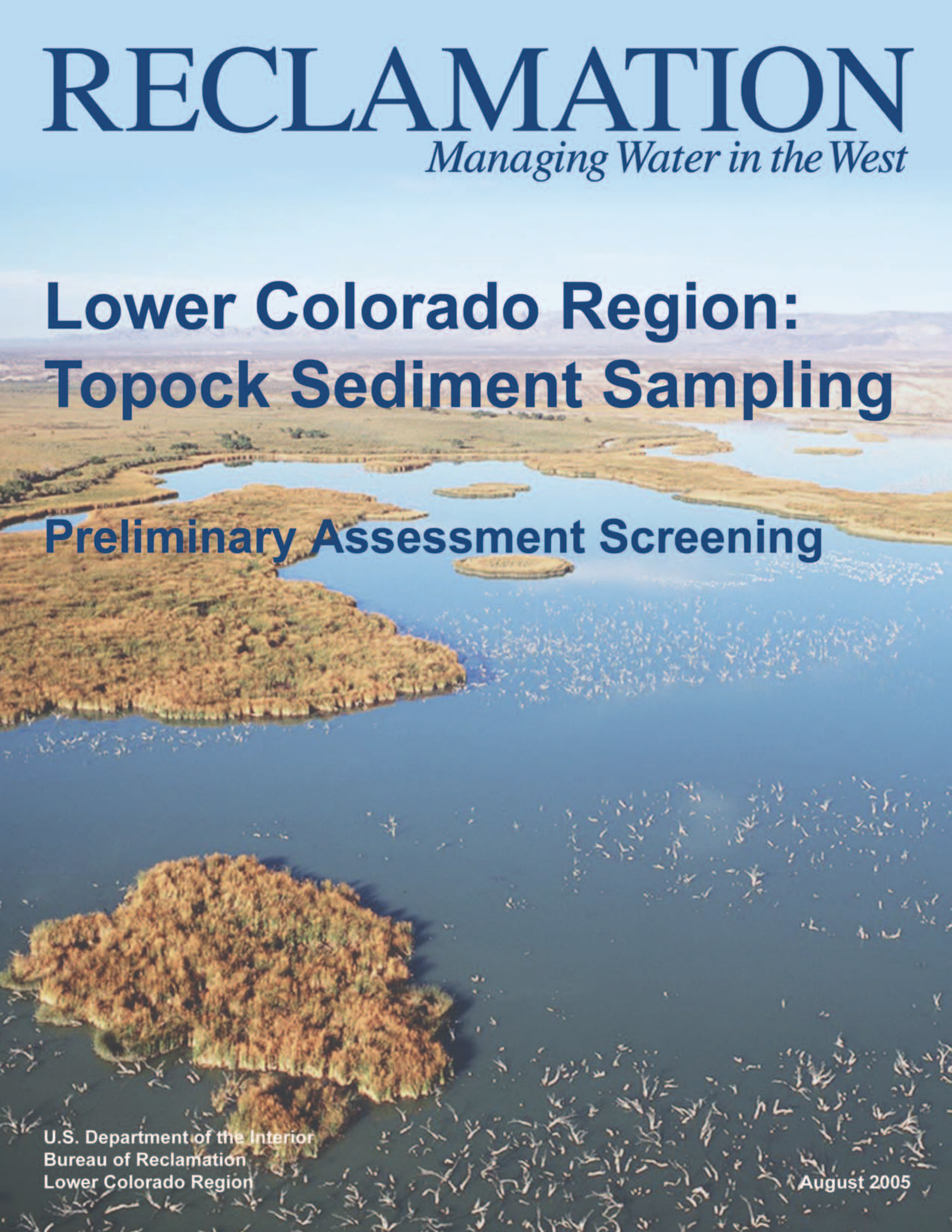
# RECLAMATION
*Managing Water in the West*

# Lower Colorado Region: Topock Sediment Sampling

## Preliminary Assessment Screening



U.S. Department of the Interior
Bureau of Reclamation
Lower Colorado Region

August 2005

## Mission Statements

The mission of the U.S. Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

# Lower Colorado Region: Sediment Sampling

## Preliminary Assessment Screening

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# 1. Introduction

The U.S. Department of the Interior, Bureau of Reclamation, Lower Colorado River Region has been engaged in natural resource trustee activities regarding a natural gas compressor station operated by Pacific Gas and Electric Company (PG&E). PG&E's Topock Natural Gas Compressor Station is located adjacent to the Colorado River, about 1 mile southwest of Topock, Arizona, in San Bernardino County, California. PG&E has been the sole owner of the facility since it began operating in 1951. The land occupied by the facility itself, along with associated rights-of-way, was leased by PG&E from the U.S. Department of the Interior, Bureau of Land Management (BLM) from 1949 until 1964 when the State of California acquired the land from BLM. PG&E later purchased these lands from California in 1965. The PG&E site is surrounded by public lands owned and operated by the U.S. Department of the Interior (Department).

# 2. Site History and Background

The Pacific Gas and Electric Topock Compressor Facility (PG&E facility) is located about 10 miles east of Needles, CA along the Colorado River (see **Figure 1**). This site has been managed since 1996 under an Administrative Order Consent (AOC) agreement pursuant to the Resource Conservation Recovery Act (RCRA) by the State of California, Department of Toxic Substances Control (DTSC). This AOC stems from the existence of known contamination of groundwater and suspected contamination of sediments and soils by hexavalent chromium and other toxic compounds. A plume of contaminated groundwater has been detected under public lands, and other contamination may have been released from the PG&E facility, as reported in the PG&E 2001 and 2004 Draft RFI Reports (Ecology and Environment Inc., 2001 and 2004).

Between 1951 and 1985, PG&E used a chromium-based additive in the cooling towers of the Topock Compressor Station. During the 1950s and 1960s, the untreated cooling tower water, which contained hexavalent chromium and other heavy metals, was discharged into Bat Cave Wash, a normally dry streambed that flows north into the Colorado River within ½ mile of the site. There are no records available on the volume of wastewater discharged from the PG&E facility to either Bat Cave Wash or injection wells from 1951 to 1972, however, PG&E estimates that the volume of wastewater generated by the facility from 1951 to 1969 was approximately 6 million gallons per year with a total chromium concentration of 10 parts per million (ppm).

By 1970, PG&E had begun wastewater treatment to convert the hexavalent chromium to trivalent chromium, and discharged the treated product into injection wells located near Bat Cave Wash. Between May 1970 and December 1973, PG&E estimates that approximately 29.4 million gallons of treated wastewater with an average chromium concentration of less than 1 ppm was injected into Well PG&E-8. Treated wastewater was later routed to single-lined evaporation ponds located on the Havasu National Wildlife Refuge. In 1989, four new Class II evaporation ponds were placed into operation on BLM-managed lands.

Studies to date indicate that Federal land managed by the United States Fish and Wildlife Service (Service), BLM, and Reclamation, has been adversely affected by PG&E's activities. Known contaminants of concern (COC) include: hexavalent chromium ($Cr^{+6}$), trivalent chromium ($Cr^{+3}$), copper, and nickel; others are suspected, such as mercury, PCBs, volatile organic compounds, and other metals, although the site has not been fully characterized. Specific (known) or threatened (suspected) contamination includes:

- Groundwater: Known - supporting ecosystem and groundwater-surface water interface
- Sediments: Suspected - supporting ecosystem
- Soils: Known - supporting ecosystem

# 3. Sampling Schedule

Sediment sampling focused on the Colorado River and was conducted from October 9-12, 2001. Travel commenced on October 9 with some sample collection reconnaissance, sampling, and trial runs. Work continued through most of the day on October 12 and commenced with a late afternoon return.

Two teams worked simultaneously and each team collected one sample category at a time to reduce time spent transferring equipment between or among teams; this activity ultimately reduced the potential for introduced variance caused by altering personnel/team formation. Sampling activity was conducted early in the week to allow for immediate shipment and analysis and to increase the quality of processed results, especially if hexavalent chromium ($Cr^{+6}$ or CrVI) was detected. At depth samples were taken at 4-6 feet below ground surface, unless otherwise indicated. Quality analysis and quality control (QA/QC) measures were stressed to preserve the quality of samples (see QA/QC guidance in **Appendix C**).

# 4. General Sampling Equipment

The following summary establishes a basic overview of the sampling efforts required to obtain the supporting data for suspected injuries to Reclamation trust resources. Two teams, made of six people each, acquired samples on October 9-12, 2001. The table below lists the general sampling equipment used.

Table 1. General Sampling Equipment

| Sampling Equipment | | Quantity |
|---|---|---|
| 1 | Boat transportation, fuel and cans, and personal flotation devices | 2 |
| 2 | Vehicle transportation | 3 - 4 |
| 3 | Whirl-Pak® bags for soil and sediment | 300 |
| 4 | 2 liter wide-mouth jars (kept clean) | 50 |
| 5 | Shipping containers (coolers for some), tape, shipping labels, lab authorization, ice, blue ice, and trash bags or other waterproof bags for container protection | |
| 6 | Custody forms/seals | |
| 7 | Power auger (gas/electric), gas cans/generator/inverter, coring bits and extensions, or other sludge/soil core sampler with extensions | |
| 8 | Soil sampling pans and spoons, shovels, and hammer/sledge | |
| 9 | Decon equipment to clean equipment between samples, alconox, and Hydrolab (with conductivity probe and 50-100' line and tether rope) | |
| 11 | Kemmerer water sampler, nitric acid, and water sample bottles (1L) | |
| 12 | Incremental wood borer/corer and tall wide mouth sample bottles for core samples | |
| 13 | Ice chests for food drinks sample collections | |
| 14 | Global Positioning System (GPS) units (one per team), cameras, data sheets, field notebooks, markers, tape, aluminum foil, cell phone/radios, and spotlight/flashlight | 2 |

# 5. General Sampling Strategy

Samples were taken of the sediments and in accordance with specific plans found elsewhere in this document.

## 5.1 River Sediments

### Sampling Rationale (Approach and Sampling Methodologies)

This protocol discusses standard sampling techniques used by environmental scientists for the PG&E/Lower Colorado River investigation to collect sediment for contaminant analysis. This protocol primarily addresses ravine and river backwater systems that are easily accessible and do not require elaborate equipment to collect sediments.

Chromium was suspected of entering the Colorado River from historic releases in Bat Cave Wash, migration of the groundwater plume, and other sources, as documented in the Resource Conservation and Recovery Act Facility Investigation and subsequent reports. It was further expected that contaminated sediment still remains in the river between Bat Cave Wash and Lake Havasu.

Reclamation is concerned that contaminated sediment found during dredging operations will require special disposal, and that additional operational costs will be incurred. Sediment samples are also useful in assessing exposures to biota. Sediment provides habitat and feeding substrate for numerous biota. Some biota are known to ingest sediment which allows for accumulation of sediment bound contaminants. Contaminated sediment can serve as a pathway to injury in the food chain.

All sediment samples were analyzed for total chromium. The standard operating procedure for sediment collection, handling, and analysis can be found in **Appendix C**.

Tests for total chromium (Cr) instead of $Cr^{+6}$ was accomplished for two reasons. First, and most important, $Cr^{+6}$ readily changes to $Cr^{+3}$ when oxidized and back again in a reducing environment. An equilibrium is reached that is dependant on many variables such as the presence of decomposing organic material and the oxygenation of surrounding water. In a dredging operation, the Reclamation trust resource (sediments) would be further disturbed, dramatically changing these conditions. Granted $Cr^{+6}$, with a preliminary remediation goal of 30 ppm, is much more toxic than $Cr^{+3}$ at 100,000 ppm[1]. A much more effective measure of toxicity is total Cr because of the disturbance necessary for dredging. With the many factors that affect this red/ox equilibrium it is almost impossible to arrive at a significant number that relates meaningfully to disposal of contaminated dredging spoils by focusing on speciation. On the other hand, sampling for total Cr will indicate if levels are above background in the Topock area, and if so, may indicate a point source or diffuse entry point to the river. The threshold effect level (TEL) for Service trust resources is considerably lower than the Environmental Protection Agency human exposure standard of 210 ppm requiring remediation. It has been shown that a TEL of 37.3 ppm can be detrimental to biota regardless of speciation.[2]

Second, sampling is greatly simplified. If there is no concern about the ratio of $Cr^{+3}$ to $Cr^{+6}$, then refrigeration and preservation methods are not required. Sample life increases from, at most, one week to as long as six months. Lab methods for determining $Cr^{+6}$ are time consuming, tedious, and expensive compared to total Cr. This allows for more useful data to be collected in a shorter period of time at less expense.

In keeping with the objective to detect and quantify total chromium, the locations most likely to contain elevated levels are sediments along the river bed and banks. During the 1983 and '93 floods of the Colorado River, much of the sediment along it was redistributed, especially in confined areas such as Topock Gorge. However, examination of aerial photographs before and after these events indicated areas relatively untouched by the increased flows and other areas where sediment was redeposited. We theorized that the higher flows would have also redeposited some of the sediment on the river banks above the river's current working elevation.

## 5.2 Sampling Approach

Sediment samples were collected for the sediment dwelling invertebrate toxicity tests and chromium speciation/acid-volatile sulfide tests, to be conducted by the United States Geographical Survey, Columbia Lab. Samples were preserved on wet ice and were immediately shipped. Each site was initially screened using a conductivity meter to detect potential upwelling zones (indicative of possible

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[1]Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems, Arch, Environ. Contaim. Toxicol. 39, 20-31 (2000) MacDonald, Ingersoll, and Berger.

[2] EPA Region 9 Preliminary Remediation Goals (PRG) Tables (November 22, 2000) Region 9 Office: 75 Hawthorne St., San Francisco, Calif., 94105 (http://www.epa.gov/region09/waste/sfund/prg/s1_02.htm).

groundwater/surface water interface following the Hanford/Columbia River methods). If significant conductivity levels were detected, then that particular area was selected as a site replicate; otherwise, the sites were systematically sampled. If significant conductivity values were detected, a Kemerer water sampler was used to obtain water samples in the vicinity. These water samples were tested for chromium speciation and acid-volatile sulfides. Four (4) liter samples of sediment were collected for each replicate. The sample bottles were filled carefully to the brim, allowing no air space, and with minimal mixing/disturbance (ladling rather than pouring where possible). Samples were immediately placed on wet ice for preservation and shipment. Shipment occurred the same day samples were collected, and destination arrival time was required to be less than 24 hours.

## 5.3 Sample Site Selection

Sediment samples were taken from reference sites upstream, from potentially contaminated areas in the river (two samples), and from dredge spoils (2/3) on the Arizona (AZ) side (The number of samples taken are listed in parentheses, with the number of depth-sub samples, for individual cores, listed after the slash).

Dredge spoils (4/3) were sampled on the AZ side beginning immediately across the river from the Bat Cave Wash tributary and down river towards the Topock Marina entrance. The Bat Cave Wash tributary was also sampled at depth (2/3). On the California (CA) side, dredge spoils were sampled at depth (3/3) at the interface with the conglomerate outcrop near MW-20; depth to water was sampled if possible. Avocet Beach is a dredge spoil site on the CA side (first bend of the river after the Topock gas pipelines) that was sampled at depth (8/3).

River and backwater sediment was sampled in the Blankenship Bend (Bend) area. On the CA side, a sediment deposition area (2/3) was identified between a small island prior (upriver) to the first turn in the Bend. On the AZ side, the large sandbar (2/3) adjacent to the cliff face (on the river proper) was another major deposition zone. An additional deposition zone was located in a backwater, nestled deeply, and far east along the wall of the above mentioned cliff face; the deposition area (2/3) was found where an obscure river channel empties into this backwater (**Figure 2**).

Two large backwaters on the CA side, approximately one mile upriver of the delta, were sampled for sediment at depth (2/3). The majority of sampling effort was applied to the delta. We attempted to sample at 20 locations in the delta to be representative (20/3). Delta samples were selected based on stability and predictability of sediment deposition (the delta experiences dramatic changes through bed load transportation and deposition).

The most predictable location for continued deposition can be found immediately down river from the delta, where the river empties into Lake Havasu. A sample grid was developed (see **Figure 2**) to systematically sample this depositional area. Ten (10) sediment grab samples were collected using a Ponar or Eckman dredge. The sampling design is depicted on the attached sample location map (**Figure 2**).

## 5.4 Sampling Equipment

The following equipment was used to obtain environmental samples from the respective media/matrix.

Table 2. Parameter/Matrix

| Parameter/Matrix | Sampling Equipment | Fabrication | Dedicated | Decontamination Procedure |
|---|---|---|---|---|
| Total Cr/riverbed sediment surface | Ponar Sampler | Stainless Steel | No | 1. Physical removal<br>2. Non-phosphate detergent was (Alconox)<br>3. Pesticide-grade acetone rinse ***[not required here]***<br>4. Distilled/deionized water rinse<br>5. Organic-free water rinse ***[not required here]***<br>6. Air dry |
| Total Cr/riverbed sediment at depth | Butterfly Valve Core Auger (2") | Stainless Steel | No | |
| Total Cr/riverbank sediment surface | Bucket Auger (var. size) | Stainless Steel | No | |
| Total Cr/riverbank sediment at depth | Core Auger (2") | Stainless Steel | No | |

## 5.5 Sampling Standard Operating Procedures

### Sediment, Soil and Sludge Sampling

Collection of samples from near-surface soil was accomplished with spades, shovels, and scoops. Surface debris was removed to the required depth with this equipment, then a stainless steel or plastic scoop was used to collect the sample. This method was used in most soil types but is limited to sampling near surface areas. Since stainless steel has chromium as a constituent, plastic was the preferred material for sampling.

River sediment was sampled with a Ponar dredge, and dredge spoils were taken using the auger/core equipment. Samples were placed in Whirl-Paks® or chemically clean sample collection jars. Samples were stored and shipped without preservation/ice. Sampling at depth was accomplished with augers and thin-walled tube samplers. This system consisted of a gas powered hollow-stem auger, a hand bucket auger, a series of extensions, a "T" handle, and a core tube sampler. The hand auger was used to bore a hole to desired sampling depth for the first sample at that location, and was then withdrawn. This was to avoid contamination of the soil surface from the exhaust of the gas powered auger. The auger tip was then replaced with a tube core sampler, lowered down the bore hole, and the sample tube was driven into the soil at the completion depth. The core was then withdrawn, and the Butyrate sample tube was removed from the core sampler. The sample was collected from the plastic tube by avoiding any material that had come in contact with stainless steel such as soil from the center of the sample tube leading end or along the center line.

Once the depth of sampling rendered the hand auger useless, it was necessary to use the power auger. Due to possible chromium presence as a wear metal in the exhaust of the power auger's gas engine, samples taken at one foot or less were taken exclusively with the hand auger. Once the desired depth had been reached, sampling continued as on surface samples. If possible, a series of consecutive cores were sampled to give a complete soil column, or the power auger was used to drill down to the desired depth for sampling. The sample tube was then driven to its sampling depth through the bottom of the hollow stem augur and the core extracted.

All sampling tools and tubes were cleaned in the field using the above discussed method. Each Butyrate sample tube was used for one sample only and a red cap was placed on the trailing end. Dedicated sample tools were impractical because of the large number of soil samples required. Therefore, sample tools were cleaned in the field using the decontamination procedure previously discussed and, if left unattended, were wrapped in aluminum foil until needed. Any doubt of the sampling tool's state of readiness resulted in decontamination before use.

## 5.6 Sample Handling and Shipment

Each of the sample Whirl-Paks® were sealed and labeled according to the following protocol. Pak openings were secured with custody seals. Each sample was labeled with all required information including site name, sample number, time, date of collection, and analysis requested. Sealed paks were placed on wet ice in plastic coolers for transportation.

Unless hand carried to the lab, all sample documents were affixed to the underside of each cooler lid. The lids were sealed and affixed on at least two sides with custody seals so that any sign of tampering was easily visible.

## 5.7 Schedule of Activities

Table 3. Activities Work Schedule

| Activity | Start Date | End Date |
|---|---|---|
| Sediment Sampling | 10/09/2001 | 10/12/2001 |

# 6. References

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# Appendix A

## Procedures for the Decontamination of Field and Laboratory Equipment

### I. General

Equipment used to collect, mix, process, or store any potentially contaminated samples should be decontaminated prior to use and between samples by using the procedure given under “Procedure” below.

Personal protective equipment (PPE) worn in the field may also require decontamination. Refer to “Safety” below for proper handling of potentially contaminated PPE.

### II. Equipment

Decontamination kits will be kept in the laboratory and in field vehicles, and will consist of the following:

- Alconox and water wash bottle
- Tap water rinse bottle
- Distilled water rinse bottle
- Ten percent nitric acid rinse bottle
- Brush or sponge
- Bottles to contain decontamination wastes (segregated by chemical content)
- Protective gloves and eye wear
- Acetone rinse bottle (only needed for organic contaminants samples)

### III. Procedure

1. Scrub field equipment with phosphate free soap (Alconox) and water wash.
2. Rinse with tap water (or with acetone for organic contaminants samples).
3. Rinse with distilled water.
4. Rinse with 10 percent acid solution (such as nitric acid).
5. Final and thorough rinse with DI water.

# Appendix B

## Sample Documentation

All sample documents will be completed legibly in permanent ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error. Examples of forms to use for sample documentation are included in Attachment 2.

### Field Logbook

The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following:

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, including site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Identification and description of samples and locations
9. Subcontractor information and names of onsite personnel
10. Date and time of sample collections, along with chain-of-custody information
11. Records of photographs
12. Site sketches

### Sample Labels

Sample labels will clearly identify the particular sample and should include the following:

1. Site name and number
2. Time and date sample was taken
3. Sample preservation
4. Analysis requested
5. Sample location

Sample labels will be securely affixed to the sample container.  Tie-on labels can be used if properly secured.

## Chain-of-Custody Record

A chain-of-custody record will be maintained from the time the sample is taken to its final deposition.  Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed.  When samples (or groups of samples) are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal.

The chain-of-custody record should include (at minimum) the following:

1. Sample identification number
2. Sample information
3. Sample location
4. Sample date
5. Name(s) and signature(s) of sampler(s)
6. Signature(s) of any individual(s) with control over samples

## Custody Seals

Custody seals demonstrate that a sample container has not been tampered with or opened.

The individual in possession of the sample(s) will sign and date the seal and affix it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sampling packaging, will be noted in the field logbook.

# Appendix C

## Quality Assurance Project Plan

### 1.1 Project Organization and Responsibilities

This section briefly discusses project roles and responsibilities. The principal staff positions are project manager and health and safety officer (HSO).

The project manager will provide overall direction and management of the project team, including the delegation of work, and will be held responsible for the successful completion of the project. This includes the responsibilities for both quality assurance and quality control. In addition, the project manager will be responsible for ensuring that the project, including all sampling, laboratory analysis, data processing, and data quality review is conducted in strict accordance with the site project plans. The project manager will have overall responsibility for the successful, timely, and cost-effective completion of the field investigation and all deliverables. He/she will be responsible for establishing technical and quality control programs and task assignments for the project. In addition, he/she will be responsible for reviewing and approving all documentation and final reports. Furthermore, he/she will be responsible for the day-to-day management of the staff assigned to the project.

The HSO will be responsible for the review and approval of the Health and Safety Plan (HSP) and will oversee the activities of the Site Health and Safety Office throughout the duration of the field sampling activities. The HSO will ensure full compliance with all Bureau of Land Management, U.S. Environmental Protection Agency (EPA), and Occupational Safety and Health Administration medical and safety regulations established in the HSP.

### 1.2 Quality Assurance and Quality Control Samples

Quality Assurance and Quality Control (QA/QC) samples will be collected in accordance with the EPA guidelines (*OSWER Directive 9360.4-01, "QA/QC for Removal Actions"*). QC replicate, duplicate, and blank samples will be analyzed by laboratories, and are intended to identify and diagnose problems related to sampling and analysis. QC field blank samples will also be collected during the sampling activities. Laboratories will be responsible for providing the regular, QA, and QC analytical work for the sampling activities.

Rinsate blanks will be collected by pouring volatile-free reagent water (ASTM Type II) into/through/over clean (decontaminated) sampling equipment used in the collection of investigative samples, and then dispensed into prepared sample bottles. The sample containers will be selected at random, in accordance with the type of chemical analytical test to be conducted. Analyses of rinsate blanks are used to assess the efficiency of equipment decontamination procedures in preventing cross-contamination between samples. The rinsate blanks are analyzed for the same parameters as the investigative samples.

## 1.3 Sample Collection, Handling, and Identification Protocols

The project manager or his/her designee is responsible for ensuring that all chain-of-custody and quality control procedures are followed. It is the responsibility of field personnel to understand and follow the chain of custody procedures relative to their assigned tasks. The field sampler is, therefore, personally responsible for the care and custody of the samples collected until they are properly transferred.

To help maintain security, a minimum number of persons will be involved in sample collection and handling. Field records will be completed at the time the sample is collected; that is, the field logbook and the chain-of-custody forms will be signed or initialed, and will include the date and time collected. All original data collected in accountable documents such as field logbooks and chain-of-custody forms will be written in indelible, waterproof ink and will be legible. These documents will not be destroyed, even if they contain inaccuracies that require a replacement document. If an error is made in an accountable document, corrections will be made by crossing a line through the error and entering the correct information above, below, or in the margin next to the error. The erroneous information will not be obliterated. The error will be corrected by the person who made the entry, if possible, and initialed and dated. Field records and sample identification tags may contain the following information:

- Project number
- Relevant comments (odor, color, texture, etc.)
- Unique sample (field) identification number
- Date and time of sample collection, including site conditions/weather
- Source of sample (including name, location, and sample type)
- Preservatives used
- Analysis required
- Name(s) and signature(s) of collectors
- Field data (pH, DO, etc.), to include field equipment identification
- Serial numbers on seals and transportation cases

All samples will be collected in laboratory grade containers. Samples will be stored and shipped in a cooler on ice (4°C) as a general preservation method. The following summarizes the sample packing and transportation protocol:

- Use waterproof ice chests or coolers only.

- After filling out the pertinent information on the sample label and tag, put the sample in the bottle or vials, and screw-on the lid.
- Put in additional inert packing material to partially cover sample bottles (more than half-way). Place bags of ice around, among, and on top of sample bottles.
- Fill cooler with cushioning material and tape the drain shut.
- Put paperwork (chain-of-custody record) in a waterproof plastic bag, and tape it with masking tape to the inside lid of the cooler.
- Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.
- Attach completed shipping label to top of the cooler.
- Affix custody seals on front right and back left of cooler. Cover seals with clear tape.

## 1.4 Transfer of Custody and Shipment

Chain-of-custody forms will be prepared in the field for each sample set or other piece of physical evidence to ensure the sample integrity from collection through analysis. Individual sample bottles will be labeled to prevent misidentification. Once a sample bottle is filled, a sample seal will be applied across the cap and down the side of the sample bottle to provide visible indication as to whether the bottle has been opened between the time of sampling and the time of analysis. The chain-of-custody documentation will be enclosed in each sample shipping container, so as to be readily available upon arrival of the samples at the analytical laboratory. Once the shipping containers are closed, container seals will be fixed in such a way as to positively indicate if the container has been opened in transit.

When transferring the possession of the samples, the transferee must sign and record the date and time on the chain-of-custody form. Custody transfers, if made to a sample custodian in the field, account for each individual sample, although samples may be transferred as a group. The field custodian or field inspector if a custodian has not been assigned, is responsible for properly packaging and dispatching samples to the appropriate laboratory for analysis. This responsibility includes filling out, dating, and signing the appropriate portion of the chain-of-custody form.

All packages sent to the laboratory are accompanied by the chain-of-custody record and other pertinent forms. Copies of these forms are to be retained by the originating office (either carbon or photo copy). Mailed packages will be registered with return receipt requested. If packages are sent by common carrier, receipts, such as airbills, are retained as part of the permanent chain-of-custody documentation. Airbill numbers should be recorded in the logbook as well as the chain-of-custody documents serial numbers. Samples to be shipped will be packed so as not to break, and the package so sealed that any evidence of tampering is obvious. Sample shipment will comply with Department of Transportation requirements (49 CFR).

## 1.5 Laboratory Chain-Of-Custody

The laboratory chain-of-custody is presented in the following sections.

Laboratory chain-of-custody is initiated as samples are received and signed for by the sample custodian. Documentation of sample location continues as samples are signed in and out of the central storage facility for analysis using the Sample Control Record. After analysis, extracts and any remaining samples are held in the central storage area under custody until disposal. Prior to disposal of the samples, tags and other identification are removed from the containers and placed in the project file.

## 1.6 Duties and Responsibilities of the Sample Custodian

This information has been partially covered in the previous section. Duties and responsibilities of the sample custodian shall include the following: receiving samples; inspecting sample shipping containers for presence/absence and condition of custody seals, locks, "evidence tape," container breakage, and/or container integrity; and recording condition of both shipping containers and sample containers (bottles, jars, cans, etc.) in appropriate logbooks. This also includes recording whether the samples were cool upon arrival if required; signing appropriate documents shipped with samples (i.e., airbills, chain-of-custody forms, traffic reports, etc.); verifying and recording agreement or non-agreement of information on sample documents (i.e. sample tags, chain-of-custody records, traffic reports, airbills, etc.) in appropriate logbooks or on appropriate forms. If there is non-agreement, recording the problems, contacting the client for direction, and notifying appropriate laboratory personnel; initiating the paperwork for sample analyses on appropriate laboratory documents; marking or labeling samples with laboratory sample numbers, and cross-referencing laboratory numbers to client identifications and sample tags, as appropriate; placing samples, sample extracts, and spent samples into appropriate storage and/or secure areas; controlling access to samples in storage and assuring that standard operating procedures are followed when samples are removed from and returned to storage; assuring that sample tags are removed from the sample containers and included in the appropriate file if applicable; monitoring storage conditions for proper refrigeration temperature and prevention of cross-contamination; returning shipping containers to the proper sampling teams; and preparing and shipping sampling kits including shipping containers, sample bottles, preservatives, labels, chain-of-custody forms and sampling instructions to clients who request them.

## 1.7 Sample Receipt

Sample shipments are received at each laboratory by the designated sample custodian. Shipping information is recorded in the incoming logbook and the paperwork filed chronologically. The shipping containers are then inspected and opened by the sample custodian, who records the condition and custody information on a sample log-in sheet, as he/she unpacks the coolers.

Chain-of-custody of a sample ensures that the sample is traceable from field collection through laboratory receipt, preparation, analysis and disposal. The primary chain-of-custody documents which may be used to locate a sample at any point in time are as follows:

- Chain-of-Custody form from the field describing the origin and transportation of a sample
- Laboratory sample receipt log and supporting log-in records, documenting acceptance of a sample by laboratories
- Laboratories sample control forms, documenting the analyst who has custody and the reason for removal of a sample from storage

## 1.8 Analytical Procedures

Analytical procedures will conform to EPA methods for the parameters to be analyzed and the sample matrix. Any proposed alternate methods of analysis will be approved by the EPA and the project manager prior to use.

## 1.9 Quality Assurance/Quality Control Objectives for Measurement Data

The accuracy or bias of an analytical method can be represented as the mean of the percent recovery of the analytes of interest from a given matrix. The quality of data can be assessed through the comparison of individual data values, expressed as percent recovery, to quality control limits. Quality control limits are calculated from data derived from the analysis of standard matrix quality control samples, solvent (non-matrix) quality control samples, or surrogate analytes in field samples.

Laboratories maintain quality control charts which track both the accuracy and precision of sample analyses. These charts and laboratory generated control limits are updated, at a minimum, annually. The spiking analytes used to generate the charting data are determined by method requirements.

## 1.10 Data Reduction, Validation, and Reporting

Data reduction and initial review of the analytical results are performed by the analyst. The analyst then prepares a hard copy of the data report, which along with the associated raw data is forwarded to the laboratory manager or his/her designee.

The laboratory manager performs a routine review of the data package for data acceptability. This review must include a verification of the accuracy and completeness of the following items: sample accountability; analytical report; quality control analyses; chain of custody information; instrument raw data; standards information; preparation information; notes or flags concerning special client requests and telephone records; and invoicing information.

Data may also be reported as ‘flagged' to provide information to the client concerning the analytical system. Flags applied to analytical data are defined on the analytical report. The following flags may be applied as data qualifiers:

**ND** Compound analyzed for but not detected
**U** The compound is at a level under the Practical Quantitation Limit
**B** The compound is found in the associated blank as well as the sample
***** Denotes any situation which may require further information be supplied to the client
(A brief explanation will accompany this flag)

The quality control section routinely reviews and monitors quality control data, formatted on quality control charts. Reports and data packages may also undergo quality assurance review as either the standard final data review prior to the release of the report, or during an internal audit session.

Method blank results are reviewed on a continuing basis to assure lack of laboratory contamination. Analysts, peer reviewers, managers, and QC are responsible for this review. If contamination is noted, immediate response following the corrective action procedure is initiated.

### 1.11 Quality Assurance Performance and System Audits

As a participant in numerous certification programs and various contracts requiring approval, laboratories are frequently subjected to rigorous performance evaluations and on-site inspections by regulatory agencies and commercial clients. The laboratories’ Quality Assurance Staff performs internal audits of the laboratory as well. The audits ensure that all laboratory systems, including sample control, analytical procedures, data generation, and documentation meet contractual requirements and comply with good laboratory practice standards.

### 1.12 Corrective Action

When a non-conformance has been characterized, and the cause satisfactorily determined, a plan of corrective action must be devised and implemented with the purpose of eliminating, or at least severely restricting, the chance for recurrence of the non-conformance. Non-conformances that are essentially the result of random error (also referred to statistically, in some cases, as blunder) may not be amenable to specific corrective action. They must nevertheless be documented. Analytical and control data, when compared with control limit criteria, must be evaluated in the context of the entire method and associated data, including instrument performance, laboratory procedures, sample matrix effects, analyst performance, etc.

# Appendix D

## Sampling GPS Grid Coordinates

```
NP,WP001,MARK001   ,UTM/UPS ,11S,730056,3845045,NAR ,9,463.5,WGD,,ft,,
NP,WP002,MARK002   ,UTM/UPS ,11S,729928,3845347,NAR ,4,461.2,WGD,,ft,,
NP,WP003,MARK003   ,UTM/UPS ,11S,729760,3845534,NAR ,5,460.5,WGD,,ft,,
NP,WP004,MARK004   ,UTM/UPS ,11S,729513,3845704,NAR ,7,450.4,WGD,,ft,,
NP,WP005,MARK005   ,UTM/UPS ,11S,729137,3845918,NAR ,4,456.0,WGD,,ft,,
NP,WP006,MARK006   ,UTM/UPS ,11S,725881,3848451,NAR ,4,434.4,WGD,,ft,,
NP,WP007,MARK007   ,UTM/UPS ,11S,724672,3849383,NAR ,4,425.4,WGD,,ft,,
NP,WP008,MARK008   ,UTM/UPS ,11S,723980,3849926,NAR ,10,441.6,WGD,,ft,,
NP,WP009,MARK009   ,UTM/UPS ,11S,724065,3849836,NAR  ,4,434.3,WGD,,ft,,
NP,WP010,MARK010   ,UTM/UPS ,11S,723386,3850733,NAR  ,5,430.1,WGD,,ft,,
NP,WP011,MARK011   ,UTM/UPS ,11S,739949,3823005,NAR  ,4,448.7,WGD,,ft,,
NP,WP012,MARK012   ,UTM/UPS ,11S,740103,3823013,NAR  ,4,451.3,WGD,,ft,,
NP,WP013,MARK013   ,UTM/UPS ,11S,740249,3822993,NAR  ,4,455.0,WGD,,ft,,
NP,WP014,MARK014   ,UTM/UPS ,11S,740567,3823140,NAR  ,4,450.4,WGD,,ft,,
NP,WP015,MARK015   ,UTM/UPS ,11S,740900,3823232,NAR  ,6,469.3,WGD,,ft,,
NP,WP016,MARK016   ,UTM/UPS ,11S,741194,3823222,NAR  ,5,448.7,WGD,,ft,,
NP,WP017,MARK017   ,UTM/UPS ,11S,741033,3823611,NAR  ,6,431.3,WGD,,ft,,
NP,WP018,MARK018   ,UTM/UPS ,11S,740872,3823542,NAR  ,4,448.8,WGD,,ft,,
NP,WP019,MARK019   ,UTM/UPS ,11S,740692,3823450,NAR  ,4,441.1,WGD,,ft,,
NP,WP020,MARK020   ,UTM/UPS ,11S,740373,3823333,NAR  ,4,445.4,WGD,,ft,,
NP,WP021,MARK021   ,UTM/UPS ,11S,739979,3823211,NAR  ,4,449.6,WGD,,ft,,
NP,WP022,MARK022   ,UTM/UPS ,11S,740072,3823581,NAR  ,5,522.2,WGD,,ft,,
NP,WP023,MARK023   ,UTM/UPS ,11S,740068,3823582,NAR  ,6,439.3,WGD,,ft,,
NP,WP024,MARK024   ,UTM/UPS ,11S,740329,3823626,NAR  ,6,448.7,WGD,,ft,,
NP,WP025,MARK025   ,UTM/UPS ,11S,740289,3824122,NAR  ,4,453.8,WGD,,ft,,
NP,WP026,MARK026   ,UTM/UPS ,11S,740156,3824700,NAR  ,4,445.9,WGD,,ft,,
NP,WP027,MARK027   ,UTM/UPS ,11S,739927,3824835,NAR  ,4,418.3,WGD,,ft,,
NP,WP028,MARK028   ,UTM/UPS ,11S,739836,3824950,NAR  ,4,435.6,WGD,,ft,,
NP,WP029,MARK029   ,UTM/UPS ,11S,739745,3824835,NAR  ,5,450.3,WGD,,ft,,
NP,WP030,MARK030   ,UTM/UPS ,11S,730388,3845135,NAR  ,6,431.9,WGD,,ft,,
NP,WP031,MARK031   ,UTM/UPS ,11S,730288,3844780,NAR  ,7,421.0,WGD,,ft,,
NP,WP032,MARK032   ,UTM/UPS ,11S,729488,3845360,NAR  ,7,451.3,WGD,,ft,,
NP,WP033,MARK033   ,UTM/UPS ,11S,729540,3845379,NAR  ,5,432.7,WGD,,ft,,
NP,WP034,MARK034   ,UTM/UPS ,11S,729729,3845235,NAR  ,7,451.5,WGD,,ft,,
NP,WP035,MARK035   ,UTM/UPS ,11S,729913,3844853,NAR  ,8,453.1,WGD,,ft,,
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NP,WP036,MARK036   ,UTM/UPS ,11S,730050,3844357,NAR  ,5,438.4,WGD,,ft,,
NP,WP037,MARK037   ,UTM/UPS ,11S,731703,3842963,NAR  ,6,445.8,WGD,,ft,,
NP,WP038,MARK038   ,UTM/UPS ,11S,731878,3842671,NAR  ,6,416.0,WGD,,ft,,
NP,WP039,MARK039   ,UTM/UPS ,11S,731780,3843896,NAR  ,4,433.8,WGD,,ft,,
```

# Appendix E

## Sediment Sampling Log

### 10/10/01 Topock Area Sediment Sampling Log

Hank Kaplan
Dennis Watt

Equipment - 1 Wildco® Sediment Sampler
1 x 1 ft Core Sampler w/ 2 x 1 ft extensions
1 Slide Hammer
1 Hand Auger (5 ft) / 2 x 5 ft extensions
1 Ponar Dredge
1 PLGR GPS Unit #39
Whirl-Pak®
Sharpies
Decontamination supplies (Alconox®, 3 in. diameter Brush…)
Styrofoam Sample Cooler
Log / administrative supplies and forms
(Custody forms, Labels, Tamper Tape…)

All sampling equipment decontaminated at start of day before proceeding. Sampling for 10/10/01 is on the up river end of sample area.

Sample numbering is by site and depth taken. Letters at the end of some sample numbers denote duplicates - "A" denotes Whirl-Pak® container, B" denotes EPA certified Qor-Pak®. These samples were sent to an independent lab[3]. Letters that might be confused for numbers (I, O) were not used.

| Sample# | Depth | Equip | GPS[4] | Time[5] |
|---|---|---|---|---|
| A-0-1 | 0-1 ft | Core | Mark 001 | 10:30 |
| A-1-2 | 1-2 ft | Hand Auger | Mark 001 | 10:37 |

[3] - Olson Bio-Chemistry Labs SDSU Box 2170, ASC 133, Brookings, South Dakota, 57007-1217

[4] - NP, WP001, MARK001, UTM/UPS, 11S, 730056, 3845045, NAR, 9, 463.5, WGD, , ft,

[5] Note: Military time used throughout. All error on GPS is +/- 20 ft or less unless otherwise noted.

Wind from North gusting up to 20 mph. Stopped sampling at 2 feet because of sand sluffing.

Decon Hand Auger: 10:45
Arrive Site B: 10:53

| Sample# | Depth | Equip | GPS[6] | Time |
|---|---|---|---|---|
| B-0-1 | 0-1 ft | Hand Auger | Mark 002 | 10:57 |
| B-1-2 | 1-2 ft | Hand Auger | Mark 002 | 10:59 |

Wind from North gusting up to 20 mph. Stopped sampling at 2 feet because of sand sluffing.

Arrive Site C: 11:06
Decon Hand Auger: 11:08

| Sample# | Depth | Equip | GPS[7] | Time |
|---|---|---|---|---|
| C-0-1 | 0-1 ft | Hand Auger | Mark 003 | 11:14 |
| C-1-2 | 1-2 ft | Hand Auger | Mark 003 | 11:23 |
| C-2-3 | 2-3 ft | Hand Auger | Mark 003 | 11:25 |

Wind from North gusting up to 20 mph. Stopped sampling because of sand sluffing.

Decon Hand Auger: 11:27
Arrive Site D: 11:32

| Sample# | Depth | Equip | GPS[8] (+/- 22 ft) | Time |
|---|---|---|---|---|
| D-0-1 | 0-1 ft | Hand Auger | Mark 004 | 11:34 |
| D-1-2 | 1-2 ft | Hand Auger | Mark 004 | 11:36 |

Wind from North gusting up to 15 mph. Stopped sampling because of sand sluffing.

[6] NP, WP002, MARK002, UTM/UPS, 11S, 729928, 3845347, NAR, 4, 461.2, WGD, , ft, ,
[7] NP, WP003, MARK003, UTM/UPS, 11S, 729760, 3845534, NAR, 5, 460.5, WGD, , ft, ,
[8] NP, WP004, MARK004, UTM/UPS, 11S, 729513, 3845704, NAR, 7, 450.4, WGD, , ft, ,

Arrive Site E: 11:48
Decon Hand Auger: 11:50

| Sample# | Depth | Equip | GPS[9] | Time |
| --- | --- | --- | --- | --- |
| E-0-1 | 0-1 ft | Hand Auger | Mark 005 | 11:52 |
| E-1-2 | 1-2 ft | Hand Auger | Mark 005 | 11:59 |
| E-2-3 | 2-3 ft | Hand Auger | Mark 005 | 12:01 |
| E-3-4 | 3-4 ft | Hand Auger | Mark 005 | 12:03 |
| E-4-5 | 4-5 ft | Hand Auger | Mark 005 | 12:05 |
| E-5-6 | 5-6 ft | Hand Auger | Mark 005 | 12:11 |
| E-5-6A | 5-6 ft | Hand Auger | Mark 005 | 12:11 |
| E-6-7 | 6-7 ft | Hand Auger | Mark 005 | 12:18 |
| E-7-8 | 7-8 ft | Hand Auger | Mark 005 | 12:19 |
| E-8-9 | 8-9 ft | Hand Auger | Mark 005 | 12:22 |
| E-9-10 | 9-10 ft | Hand Auger | Mark 005 | 12:24 |

Wind from North gusting up to 15 mph. Optimal moisture content and soil composition allowed deeper augering. Hole stood open. Wet sand at 9-10 ft indicated water table.

Decon Hand Auger: 12:30
Lunch: 12:30
Arrive Site F: 13:56

| Sample# | Depth | Equip | GPS[10] | Time |
| --- | --- | --- | --- | --- |
| F-0-1 | 0-1 ft | Hand Auger | Mark 006 | 13:58 |
| F-1-2 | 1-2 ft | Hand Auger | Mark 006 | 14:00 |

Wind from North gusting up to 20 mph. Stopped sampling because of sand sluffing.

9 NP, WP005, MARK005, UTM/UPS, 11S, 729137, 3845918, NAR, 4, 456.0, WGD, , ft, ,
10 NP, WP006, MARK006, UTM/UPS, 11S, 725881, 3848451, NAR, 4, 434.4, WGD, , ft, ,

Arrive Site G: 14:18
Decon Hand Auger: 14:19

| Sample# | Depth | Equip | GPS[11] | Time |
|---|---|---|---|---|
| G-0-1 | 0-1 ft | Hand Auger | Mark 007 | 14:23 |
| G-1-2 | 1-2 ft | Hand Auger | Mark 007 | 14:26 |
| G-2-3 | 2-3 ft | Hand Auger | Mark 007 | 14:28 |
| G-3-4 | 3-4 ft | Hand Auger | Mark 007 | 14:29 |

Wind from North gusting up to 20 mph. Stopped sampling because of sand sluffing.
Decon Hand Auger: 14:37
Arrive Site H: 14:45

| Sample# | Depth | Equip | GPS | Time |
|---|---|---|---|---|
| H-0-1** | 0-1 ft | Ponar | Mark 008[12] | 14:50 |
| H-0-2 | 1-2 ft | Ponar | Mark 009[13] | 15:03 |

Wind from North gusting up to 20 mph.
**Sampler failed to obtain any sediment material on first effort.

Decon Ponar: 15:17
Arrive Site J: 15:17

| Sample# | Depth | Equip | GPS[14] | Time |
|---|---|---|---|---|
| J-0-1 | 0-1 ft | Ponar | Mark 010 | 15:18 |

Wind from North gusting up to 20 mph. Boat drifted with motor upwind as sample was taken

[11] NP, WP007, MARK007, UTM/UPS, 11S, 724672, 3849383, NAR, 4, 425.4, WGD, , ft, ,

[12] NP, WP008, MARK008, UTM/UPS, 11S, 723980, 3849926, NAR, 10, 441.6, WGD, , ft, ,

[13] NP, WP009, MARK009, UTM/UPS, 11S, 724065, 3849836, NAR, 4, 434.3, WGD, , ft, ,

[14] NP, WP010, MARK010, UTM/UPS, 11S, 723386, 3850733, NAR, 5, 430.1, WGD, , ft, ,

## 10/11/01 Topock Area Sediment Sampling Log

Hank Kaplan
Tim Spillane

Equipment -
- 1 Wildco Sediment Sampler
- 1 x 1 ft Finger Core Sampler*** w/ 2 x 1 ft extensions
- Slide-hammer
- 1 Hand Auger (5 ft) / 2 x 5 ft extensions
- 1 Ponar Dredge
- 1 PLGR GPS Unit #39
- Whirl-Paks®
- Sharpies
- Decontamination supplies (Alconox, 3 in. diameter Brush…)
- Styrofoam Sample Cooler
- Log / administrative supplies and forms
- (Custody forms, Labels, Tamper Tape…)

All sampling equipment decontaminated at start of day before proceeding. Sampling for 10/11/01 is on the Lake Havasu delta and proceeding upriver.

***Original core sampler was modified with "finger" insert from the Wildco Sampler. The advantage was to allow use of slide hammer and auger handle in softer and looser sediments. Valve at upper end of Wildco Sampler was simulated by covering exhaust hole of core sampler with fingers upon extraction of core. Sampler still used 1 foot sections of plastic (2" dia. Butyrate) inserts to avoid stainless steel casing and sample was retrieved by use of a smaller diameter (1-1/4") Butyrate to avoid sample coming in contact with stainless steel bit. Dubbed the "Finger Core Sampler."

Arrive Site K: 10:45

| Sample# | Depth | Equip | GPS[15] | Time |
|---|---|---|---|---|
| K-0-1 | Surface | Ponar | Mark 011 | 10:47 |

Wind from North calm to 2-3 mph.

[15] NP, WP011, MARK011, UTM/UPS, 11S, 739949, 3823005, NAR, 4, 448.7, WGD, , ft, ,

Arrive Site L: 10:55
Ponar decon: 10:55 (accomplished in-transit)

| **Sample#** | **Depth** | **Equip** | **GPS**[16] | **Time** |
|---|---|---|---|---|
| L-0-1 | Surface | Ponar | Mark 012 | 11:02 |

Wind from North calm to 2-3 mph.

Arrive Site M: 11:11
Ponar decon: 11:11

| **Sample#** | **Depth** | **Equip** | **GPS**[17] | **Time** |
|---|---|---|---|---|
| M-0-1 | Surface | Ponar | Mark 013 | 11:15 |

Wind from North calm to 2-3 mph.

Arrive Site N: 11:22
Ponar decon: 11:22

| **Sample#** | **Depth** | **Equip** | **GPS**[18] | **Time** |
|---|---|---|---|---|
| N-0-1 | Surface | Ponar | Mark 014 | 11:24 |

Wind from North calm to 2-3 mph.

Arrive Site P: 11:30
Ponar decon: 11:30

| **Sample#** | **Depth** | **Equip** | **GPS**[19] | **Time** |
|---|---|---|---|---|
| P-0-1 | Surface | Ponar | Mark 015 | 11:34 |

Wind from North calm to 2-3 mph.

[16] NP, WP012, MARK012, UTM/UPS, 11S, 740103, 3823013, NAR, 4, 451.3, WGD, , ft, ,
[17] NP, WP013, MARK013, UTM/UPS, 11S, 740249, 3822993, NAR, 4, 455.0, WGD, , ft, ,
[18] NP, WP014, MARK014, UTM/UPS, 11S, 740567, 3823140, NAR, 4, 450.4, WGD, , ft, ,
[19] NP, WP015, MARK015, UTM/UPS, 11S, 740900, 3823232, NAR, 6, 469.3, WGD, , ft, ,

Arrive Site Q: 11:40
Ponar decon: 11:40

| Sample# | Depth | Equip | GPS[20] | Time |
|---|---|---|---|---|
| Q-0-1 | Surface | Ponar | Mark 016 | 11:44 |
| Q-0-1A | Surface | Ponar | Mark 016 | 11:45 |

Wind from North calm to 2-3 mph.

**Start of new transect**

Arrive Site R: 11:50
Ponar decon: 11:50

| Sample# | Depth | Equip | GPS[21] | Time |
|---|---|---|---|---|
| R-0-1 | Surface | Ponar | Mark 017 | 11:53 |
| R-0-1B | Surface | Ponar | Mark 017 | 11:54 |

Wind from North calm to 2-3 mph. Use of Qor-Pack sample container for duplicate.

Arrive Site S: 11:59
Ponar decon: 11:59

| Sample# | Depth | Equip | GPS[22] | Time |
|---|---|---|---|---|
| S-0-1 | Surface | Ponar | Mark 018 | 12:02 |

Wind from North calm to 2-3 mph.

[20] NP, WP016, MARK016, UTM/UPS, 11S, 741194, 3823222, NAR, 5, 448.7, WGD, , ft, ,
[21] NP, WP017, MARK017, UTM/UPS, 11S, 741033, 3823611, NAR, 6, 431.3, WGD, , ft, ,
[22] NP, WP018, MARK018, UTM/UPS, 11S, 740872, 3823542, NAR, 4, 448.8, WGD, , ft, ,

Arrive Site T: 12:07
Ponar decon: 12:07

| Sample# | Depth | Equip | GPS[23] | Time |
|---|---|---|---|---|
| T-0-1 | Surface | Ponar | Mark 019 | 12:10 |

Wind from North calm to 2-3 mph.

Arrive Site U: 12:16
Ponar decon: 12:16

| Sample# | Depth | Equip | GPS[24] | Time |
|---|---|---|---|---|
| U-0-1 | Surface | Ponar | Mark 020 | 12:18 |

Wind from North calm to 2-3 mph.

Arrive Site V: 12:23
Ponar decon: 12:23

| Sample# | Depth | Equip | GPS[25] | Time |
|---|---|---|---|---|
| V-0-1 | Surface | Ponar | Mark 021 | 12:25 |

Wind from North calm to 2-3 mph.

Lunch
Arrive Site W: 13:30
Ponar decon: 13:30

| Sample# | Depth | Equip | GPS[26] | Time |
|---|---|---|---|---|
| W-0-1 | 0-1 | Hand Auger | Mark 022 | 13:48 |

Wind from North calm to 2-3 mph.

[23] NP, WP019, MARK019, UTM/UPS, 11S, 740692, 3823450, NAR, 4, 441.1, WGD, , ft, ,
[24] NP, WP020, MARK020, UTM/UPS, 11S, 740373, 3823333, NAR, 4, 445.4, WGD, , ft, ,
[25] NP, WP021, MARK021, UTM/UPS, 11S, 739979, 3823211, NAR, 4, 449.6, WGD, , ft, ,
[26] NP, WP022, MARK022, UTM/UPS, 11S, 740072, 3823581, NAR, 5, 522.2, WGD, , ft, ,

Arrive Site X: 13:55
Ponar decon: 13:55

| Sample# | Depth | Equip | GPS[27] | Time |
|---|---|---|---|---|
| X-0-1 | Surface | Ponar | Mark 023 | 13:58 |

Wind from North calm to 2-3 mph.

Arrive Site Y: 14:08
Ponar decon: 14:08

| Sample# | Depth | Equip | GPS[28] | Time |
|---|---|---|---|---|
| Y-0-1 | Surface | Ponar | Mark 024 | 14:11 |

Wind from North calm to 2-3 mph.

Arrive Site Z: 14:16
Ponar decon: 14:16

| Sample# | Depth | Equip | GPS[29] | Time |
|---|---|---|---|---|
| Z-0-1 | Surface | Ponar | Mark 025 | 14:21 |
| Z-0-1B | Surface | Ponar | Mark 025 | 14:21 |

Wind from North calm to 2-3 mph.

Arrive Site AA: 14:26
Ponar decon: 14:26

| Sample# | Depth | Equip | GPS[30] | Time |
|---|---|---|---|---|
| AA-0-1 | Surface | Ponar | Mark 026 | 15:00 |

Wind from North calm to 2-3 mph.

[27] NP, WP023, MARK023, UTM/UPS, 11S, 740068, 3823582, NAR, 6, 439.3, WGD, , ft, ,
[28] NP, WP024, MARK024, UTM/UPS, 11S, 740329, 3823626, NAR, 6, 448.7, WGD, , ft, ,
[29] NP, WP025, MARK025, UTM/UPS, 11S, 740289, 3824122, NAR, 4, 453.8, WGD, , ft, ,
[30] NP, WP026, MARK026, UTM/UPS, 11S, 740156, 3824700, NAR, 4, 445.9, WGD, , ft, ,

Arrive Site AB: 15:16
Finger Core decon: 15:16

| Sample# | Depth | Equip | GPS[31] | Time |
|---|---|---|---|---|
| AB-0-1 | 0-1 | Finger Core | Mark 027 | 15:21 |

Wind from North calm to 2-3 mph.

Finger Core decon: 15:24
Arrive Site AC: 15:30

| Sample# | Depth | Equip | GPS[32]* | Time |
|---|---|---|---|---|
| AC-0-1 | 0-1 | Finger Core | Mark 028 | 15:35 |

Wind from North calm to 2-3 mph.

Finger Core decon: 15:38
Arrive Site AD: 15:42

| Sample# | Depth | Equip | GPS[33] | Time |
|---|---|---|---|---|
| AD-0-1 | 0-1 | Finger Core | Mark 029 | 15:59 |

Wind from North calm to 2-3 mph.

[31] *NP, WP027, MARK027, UTM/UPS, 11S, 739927, 3824835, NAR, 4, 418.3, WGD, , ft, ,
[32] NP, WP028, MARK028, UTM/UPS, 11S, 739836, 3824950, NAR, 4, 435.6, WGD, , ft, ,
[33] NP, WP029, MARK029, UTM/UPS, 11S, 739745, 3824835, NAR, 5, 450.3, WGD, , ft, ,

## 10/12/01 Topock Area Sediment Sampling Log

Hank Kaplan
Tim Spillane

Equipment - 1 Wildco Sediment Sampler
1 x 1 ft Finger Core Sampler w/ 2 x 1 ft extensions
Slide-hammer
1 Hand Auger (5 ft) / 2 x 5 ft extensions
1 Ponar Dredge
1 PLGR GPS Unit #39
Whirl-Paks®
Sharpies
Decontamination supplies (Alconox, 3 in. diameter Brush…)
Styrofoam Sample Cooler
Log / administrative supplies and forms
(Custody forms, Labels, Tamper Tape…)

All sampling equipment decontaminated at start of day. Sampling for 10/12/01 is from Golden Shores Marina and proceeding downriver.

Arrive Site AE: 08:57

| Sample# | Depth | Equip | GPS[34] | Time |
|---|---|---|---|---|
| AE-1-2 | 1-2 | Finger Core | Mark 030 | 08:59 |

Wind from South at 25-30 mph.

Finger Core decon: 09:27
Arrive Site AF: 09:30

| Sample# | Depth | Equip | GPS[35] (+/- 23ft) | Time |
|---|---|---|---|---|
| AF-0-1 | 0-1 | Finger Core | Mark 031 | 09:35 |
| AF-1-2 | 1-2 | Finger Core | Mark 031 | 09:34 |

[34] NP, WP030, MARK030, UTM/UPS, 11S, 730388, 3845135, NAR, 6, 431.9, WGD, , ft, ,
[35] NP, WP031, MARK031, UTM/UPS, 11S, 730288, 3844780, NAR, 7, 421.0, WGD, , ft, ,

| | | | | |
|---|---|---|---|---|
| AF-2-3 | 2-3 | Finger Core | Mark 031 | 09:33 |

Wind from South at 25-30 mph.

Finger Core decon: 09:43
Arrive Site AG: 10:22

| **Sample#** | **Depth** | **Equip** | **GPS**[36] (+/- 21ft) | **Time** |
|---|---|---|---|---|
| AG-0-0 | Surface | Finger Core | Mark 032 | 10:25 |
| AG-0-1 | 0-1 | Finger Core | Mark 032 | 10:27 |
| AG-1-2 | 1-2 | Finger Core | Mark 032 | 10:26 |

Wind from South at 25-30 mph.

Finger Core decon: 10:58
Arrive Site AH: 11:05

| **Sample#** | **Depth** | **Equip** | **GPS**[37] | **Time** |
|---|---|---|---|---|
| AH-0-0 | Surface | Finger Core | Mark 033 | 11:08 |
| AH-0-1 | 0-1 | Finger Core | Mark 033 | 11:08 |
| AH-1-2 | 1-2 | Finger Core | Mark 033 | 11:08 |

Wind from South at 25-30 mph.

Hand Auger decon: 11:32
Arrive Site AJ: 11:32

| **Sample#** | **Depth** | **Equip** | **GPS**[38] (+/- 23ft) | **Time** |
|---|---|---|---|---|
| AJ-0-0 | Surface | Hand Auger | Mark 034 | 11:34 |

[36] NP, WP032, MARK032, UTM/UPS, 11S, 729488, 3845360, NAR, 7, 451.3, WGD, , ft, ,
[37] NP, WP033, MARK033, UTM/UPS, 11S, 729540, 3845379, NAR, 5, 432.7, WGD, , ft, ,
[38] NP, WP034, MARK034, UTM/UPS, 11S, 729729, 3845235, NAR, 7, 451.5, WGD, , ft, ,

| | | | | |
|---|---|---|---|---|
| AJ-0-1 | 0-1 | Hand Auger | Mark 034 | 11:34 |

Wind from South at 25-30 mph.

Finger Core decon: 12:23
Arrive Site AK: 12:33

| **Sample#** | **Depth** | **Equip** | **GPS**[39] | **Time** |
|---|---|---|---|---|
| AK-0-0 | Surface | Finger Core | Mark 035 | 12:35 |
| AK-0-1 | 0-1 | Finger Core | Mark 035 | 12:35 |
| AK-1-2 | 1-2 | Finger Core | Mark 035 | 12:35 |
| AK-2-3 | 2-3 | Finger Core | Mark 035 | 12:35 |

Wind from South at 25-30 mph.

Finger Core decon: 12:48
Arrive Site AL: 13:00

| **Sample#** | **Depth** | **Equip** | **GPS**[40] | **Time** |
|---|---|---|---|---|
| AL-0-0 | Surface | Finger Core | Mark 036 | 13:07 |
| AL-0-1 | 0-1 | Finger Core | Mark 036 | 13:07 |
| AL-1-2 | 1-2 | Finger Core | Mark 036 | 13:07 |
| AL-2-3 | 2-3 | Finger Core | Mark 036 | 13:07 |

Wind from South at 25-30 mph.

[39] NP, WP035, MARK035, UTM/UPS, 11S, 729913, 3844853, NAR, 8, 453.1, WGD, , ft, ,
[40] NP, WP036, MARK036, UTM/UPS, 11S, 730050, 3844357, NAR, 5, 438.4, WGD, , ft, ,

Finger Core decon: 13:20
Arrive Site AM: 13:40

| **Sample#** | **Depth** | **Equip** | **GPS**[41] | **Time** |
|---|---|---|---|---|
| AM-0-0 | Surface | Finger Core | Mark 037 | 13:42 |
| AM-0-1 | 0-1 | Finger Core | Mark 037 | 13:42 |
| AM-1-2 | 1-2 | Finger Core | Mark 037 | 13:42 |
| AM-2-3 | 2-3 | Finger Core | Mark 037 | 13:42 |

Wind from South at 25-30 mph.

Finger Core decon: 13:55
Arrive Site AN: 14:00

| **Sample#** | **Depth** | **Equip** | **GPS**[42] | **Time** |
|---|---|---|---|---|
| AN-0-0 | Surface | Finger Core | Mark 038 | 14:06 |
| AN-0-1 | 0-1 | Finger Core | Mark 038 | 14:06 |
| AN-1-2 | 1-2 | Finger Core | Mark 038 | 14:06 |
| AN-2-3 | 2-3 | Finger Core | Mark 038 | 14:06 |

Wind from South at 25-30 mph.

[41] NP, WP037, MARK037, UTM/UPS, 11S, 731703, 3842963, NAR, 6, 445.8, WGD, , ft, ,
[42] NP, WP038, MARK038, UTM/UPS, 11S, 731878, 3842671, NAR, 6, 416.0, WGD, , ft, ,

Finger Core decon: 14:17
Arrive Site AP: 14:30

| Sample# | Depth | Equip | GPS[43] | Time |
|---|---|---|---|---|
| AP-0-0 | Surface | Finger Core | Mark 039 | 14:33 |
| AP-0-0B | Surface | Finger Core | Mark 039 | 14:33 |
| AP-0-1 | 0-1 | Finger Core | Mark 039 | 14:33 |
| AP-1-2 | 1-2 | Finger Core | Mark 039 | 14:33 |
| AP-2-3 | 2-3 | Finger Core | Mark 039 | 14:33 |
| AP-2-3B | 2-3 | Finger Core | Mark 039 | 14:33 |

Wind from South at 25-30 mph.

[43] NP, WP039, MARK039, UTM/UPS, 11S, 731780, 3843896, NAR, 4, 433.8, WGD, , ft, ,

# Appendix F

## Sediment Sampling Results

**Topock Sediments Chromium Received 10/15/2001**

| Lab Number | Date Sampled | Sample Description | Concentration in mg/kg |
|---|---|---|---|
| 1-2366 | 10/10/01 | A-0-1 | 12.39 |
| 1-2367 | 10/10/01 | A-1-2 | 4.90 |
| 1-2368 | 10/10/01 | B-0-1 | 1.73 |
| 1-2369 | 10/10/01 | B-1-2 | 1.16 |
| 1-2370 | 10/10/01 | C-0-1 | 15.97 |
| 1-2371 | 10/10/01 | C-1-2 | 0.86 |
| 1-2372 | 10/10/01 | D-0-1 | 2.08 |
| 1-2373 | 10/10/01 | D-1-2 | 1.11 |
| 1-2374 | 10/10/01 | E-0-1 | 5.95 |
| 1-2375 | 10/10/01 | E-1-2 | 5.68 |
| 1-2376 | 10/10/01 | E-2-3 | 1.03 |
| 1-2377 | 10/10/01 | E-3-4 | 0.84 |
| 1-2378 | 10/10/01 | E-4-5 | 1.00 |
| 1-2379 | 10/10/01 | E-5-6 | 1.21 |
| 1-2380 | 10/10/01 | E-6-7 | 1.05 |
| 1-2381 | 10/10/01 | E-7-8 | 0.87 |
| 1-2382 | 10/10/01 | E-8-9 | 0.99 |
| 1-2383 | 10/10/01 | E-9-10 | 0.95 |
| 1-2384 | 10/10/01 | F-0-1 | 0.79 |
| 1-2385 | 10/10/01 | F-1-2 | 2.03 |
| 1-2386 | 10/10/01 | G-0-1 | 1.12 |
| 1-2387 | 10/10/01 | G-1-2 | 0.78 |
| 1-2388 | 10/10/01 | G-2-3 | 0.90 |
| 1-2389 | 10/10/01 | H-0-1 | 1.10 |
| 1-2390 | 10/10/01 | J-0-1 | 0.78 |
| 1-2391 | 10/11/01 | K-0-1 | 4.47 |
| 1-2392 | 10/11/01 | L-0-1 | 5.30 |
| 1-2393 | 10/11/01 | M-0-1 | 3.36 |
| 1-2394 | 10/11/01 | N-0-1 | 5.33 |
| 1-2395 | 10/11/01 | P-0-1 | 3.14 |

| | | | |
|---|---|---|---|
| 1-2396 | 10/11/01 | Q-0-1 | 4.05 |
| 1-2397 | 10/11/01 | R-0-1 | 1.74 |
| 1-2398 | 10/11/01 | S-0-1 | 2.96 |
| 1-2399 | 10/11/01 | T-0-1 | 2.71 |
| 1-2400 | 10/11/01 | U-0-1 | 1.13 |
| 1-2401 | 10/11/01 | V-0-1 | 1.64 |
| 1-2402 | 10/11/01 | W-0-1 | 0.47 |
| 1-2403 | 10/11/01 | X-0-1 | 0.72 |
| 1-2404 | 10/11/01 | Y-0-1 | 0.44 |
| 1-2405 | 10/11/01 | Z-0-1 | 0.41 |
| 1-2406 | 10/11/01 | AA-0-1 | 3.90 |
| 1-2407 | 10/11/01 | AB-0-1 | 0.87 |
| 1-2408 | 10/11/01 | AC-0-1 | 0.78 |
| 1-2409 | 10/12/01 | AE-0-2 | 0.86 |
| 1-2410 | 10/12/01 | AF-0-0 | 0.75 |
| 1-2411 | 10/12/01 | AF-0-1 | 1.55 |
| 1-2412 | 10/12/01 | AF-1-2 | 0.59 |
| 1-2413 | 10/12/01 | AF-2-3 | 1.15 |
| 1-2414 | 10/12/01 | AG-0-0 | 20.29 |
| 1-2415 | 10/12/01 | AG-0-1 | 24.47 |
| 1-2416 | 10/12/01 | AG-1-2 | 14.12 |
| 1-2417 | 10/12/01 | AH-0-0 | 1.92 |
| 1-2418 | 10/12/01 | AH-0-1 | 1.42 |
| 1-2419 | 10/12/01 | AH-1-2 | 2.22 |
| 1-2420 | 10/12/01 | AJ-0-0 | 0.55 |
| 1-2421 | 10/12/01 | AJ-0-1 | 0.84 |
| 1-2422 | 10/12/01 | AK-0-0 | 0.87 |
| 1-2423 | 10/12/01 | AK-0-1 | 0.70 |
| 1-2424 | 10/12/01 | AK-1-2 | 0.96 |
| 1-2425 | 10/12/01 | AK-2-3 | 1.20 |
| 1-2426 | 10/12/01 | AL-0-0 | 1.30 |
| 1-2427 | 10/12/01 | AL-0-1 | 0.71 |
| 1-2428 | 10/12/01 | AL-1-2 | 1.43 |
| 1-2429 | 10/12/01 | AL-2-3 | 0.85 |
| 1-2430 | 10/12/01 | AM-0-0 | 0.98 |
| 1-2431 | 10/12/01 | AM-0-1 | 0.70 |
| 1-2432 | 10/12/01 | AM-1-2 | 0.65 |
| 1-2433 | 10/12/01 | AM-2-3 | 1.08 |
| 1-2434 | 10/12/01 | AN-0-0 | 1.41 |
| 1-2435 | 10/12/01 | AN-0-1 | 1.28 |
| 1-2436 | 10/12/01 | AN-1-2 | 29.05 |
| 1-2437 | 10/12/01 | AN-2-3 | 1.83 |
| 1-2438 | 10/12/01 | AO-0-1 | 1.26 |
| 1-2439 | 10/12/01 | AP-0-0 | 1.09 |
| 1-2440 | 10/12/01 | AP-0-1 | 0.94 |
| 1-2441 | 10/12/01 | AP-1-2 | 1.45 |
| 1-2442 | 10/12/01 | AP-2-3 | 2.83 |

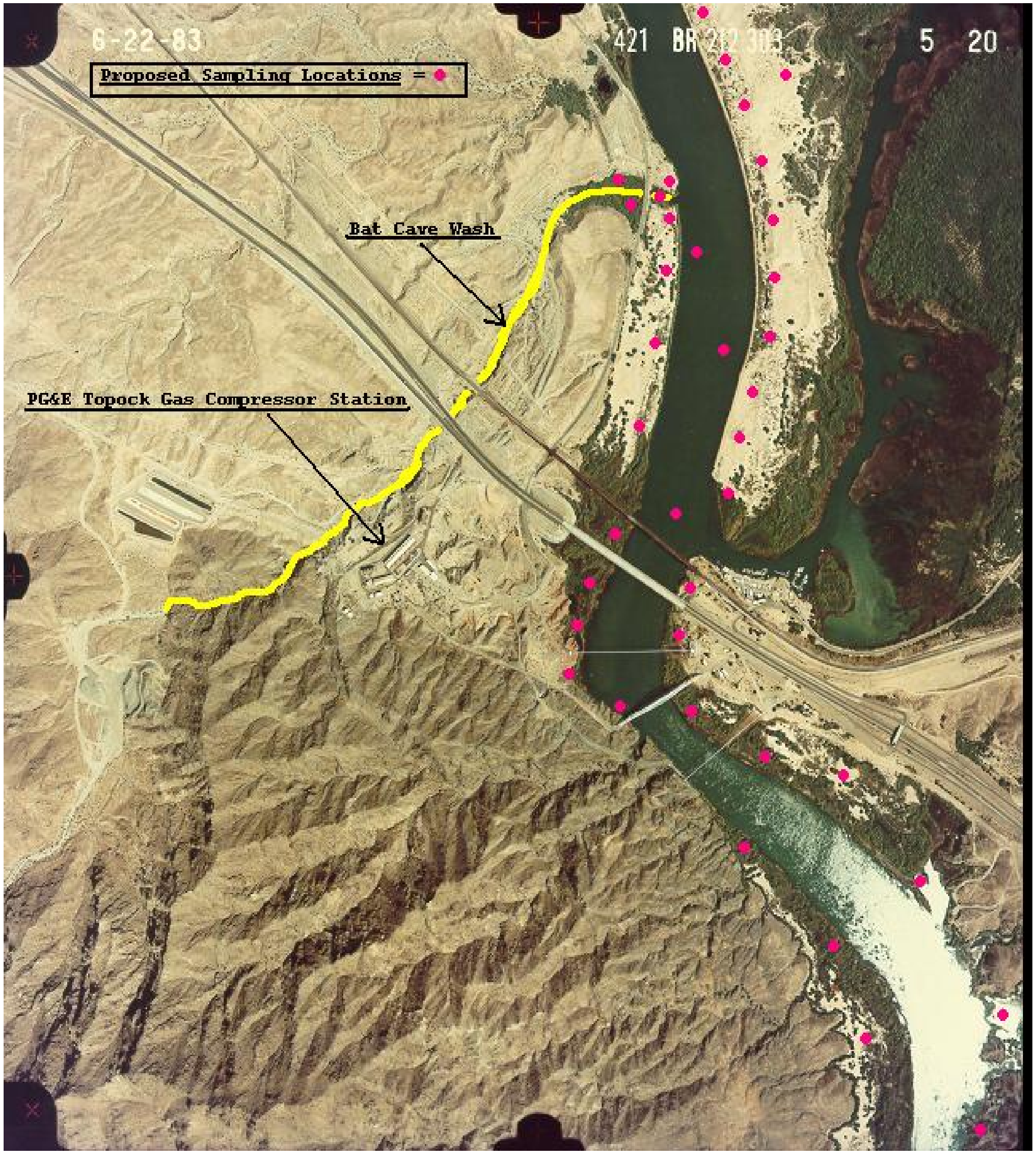


***Figure 1***
Proposed Sampling Locations

***Figure 2***
Sampling Locations
(Map shows actual locations)